

Standard Review Projects and AB 1082/1083 Pilots

Evaluation Year 2024 (Year 4)

Third-Party Evaluation Report
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Prepared for
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(on behalf of Pacific Gas & Electric,
San Diego Gas & Electric, and Liberty Utilities)
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Acronym List

Acronym	Definition
AB	Assembly Bill
AC	Alternating current
ACF	Advanced Clean Fleets
ACT	Advanced Clean Trucks
ADA	Americans with Disabilities Act
AFDC	Alternative Fuels Data Center
AHJ	Authority Having Jurisdiction
AL	Advice Letter
AMI	Advanced metering infrastructure
ARCHES	Alliance for Renewable Clean Hydrogen Energy Systems
AR5	IPCC's published fifth assessment report
BAU	Business-as-usual
BEV	Battery electric vehicle
BTM	Behind-the-meter
CAISO	California Independent System Operator
CARB	California Air Resources Board
CBG	Census block group
CBO	Community-based organization
CCS	Combined charging system
CEC	California Energy Commission
CFI	Charging and Fueling Infrastructure
CH ₄	Methane
CNG	Compressed natural gas
CO	Carbon monoxide
COBRA	CO-Benefits Risk Assessment Health Impacts Screening and Mapping tool
CO ₂	Carbon dioxide
CPUC	California Public Utilities Commission
CTA	California Trucking Association
CVRP	Clean Vehicle Rebate Project
CVUSD	Cajon Valley Union School District
DAC	Disadvantaged Community
DC	Direct current
DCFC	Direct current fast charger
DGE	Diesel gallons equivalent
DMV	Department of Motor Vehicles
DOE	U.S. Department of Energy
DPR	Department of Parks and Recreation
ELRP	Emergency Load Reduction Program
EMFAC	Emissions Factors
EPA	U.S. Environmental Protection Agency
eTRU	Electric transportation refrigeration unit
EV	Electric vehicle
EV-HP	Electric vehicle high-power
EVSE	Electric vehicle supply equipment
EVSP	Electric vehicle service provider

Acronym	Definition
EY	Evaluation Year
FCEV	Fuel cell electric vehicle
GGE	Gasoline gallons equivalent
GHG	Greenhouse gas, here including CO ₂ , CH ₄ , and N ₂ O
GSE	Ground Support Equipment
GVWR	Gross vehicle weight rating
GWP	Global Warming Potentials
HVIP	Hybrid and Zero Emission Truck and Bus Voucher Incentive Project
ICE	Internal combustion engine
ICT	Innovative Clean Transit
IOU	Investor-owned utility
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
IV-2SLS	Instrumental variable two-stage least squares
kW	Kilowatt
kWh	Kilowatt-hour
L1	Level 1
L2	Level 2
LCFS	Low Carbon Fuel Standard
LDV	Light-duty vehicle
LMI	Low- and moderate-income
MDHD	Medium- and heavy-duty
ME&O	Marketing, education, and outreach
MPA	Master participation agreement
MW	Megawatt
MWh	Megawatt-hour
MT	Metric ton
NEVI	National Electric Vehicle Infrastructure
N ₂ O	Nitrous oxide
NH ₃	Ammonia
NO _x	Oxides of nitrogen
NSP	Network service provider
NTG	Net-to-gross
OEM	Original equipment manufacturer
OIR	Order Instituting Rulemaking
OLS	Ordinary least squares
ORION	Off-Road Inventory Online
PAC	Program Advisory Committee
PAI	Program Attribution Index
PAO	Public Advocates Office
PG&E	Pacific Gas & Electric Company
PHEV	Plug-in hybrid electric vehicle
PM	Particulate matter
PTD	Program-to-Date
PYDFF	Power Your Drive for Fleets
RFID	Radio frequency identification
ROG	Reactive organic gases

Acronym	Definition
SB	Senate Bill
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SO ₂	Sulfur dioxide
SO _x	Oxides of sulfur
SRP	Standard Review Projects
TCM	Truck Choice Model
TCO	Total cost of ownership
TE	Transportation electrification
TEAS	Transportation Electrification Advisory Services
TEPM	Transportation Electrification Project Management
TEC	The Energy Coalition
TOU	Time-of-use
TRU	Transportation refrigeration unit
TTM	To-the-meter
VAP	Vehicle acquisition plan
V2G	Vehicle-to-grid
VGI	Vehicle-grid integration
VIO	Vehicles in operation
VMT	Vehicle miles traveled
VSL	Value of statistical lives
ZEB	Zero-emission bus
ZEV	Zero-emission vehicle

1. Executive Summary

This report summarizes findings and lessons learned from an independent evaluation of 12 active programs to build electric vehicle (EV) charging infrastructure for light-, medium-, and heavy-duty vehicles, administered by four California Utilities. These programs were authorized under California Public Utilities Commission (CPUC) decisions in 2018 and 2019 and support goals in Senate Bill (SB) 350 Clean Energy and Pollution Reduction Act of 2015 and Assembly Bills (AB) 1082 and 1083. This report builds on last year’s Evaluation Year (EY) 2023 report¹ with new findings and lessons learned for EY2024. Last year’s report was the final report on the Vehicle-To-Grid (V2G) Pilot and the Liberty EV Bus Infrastructure programs.

Table 1 summarizes the 12 active transportation electrification programs and their authorized budgets.

Table 1. Summary of Utility Programs

Utility	Program	Description	Budget
Southern California Edison (SCE)	Charge Ready Transport	Public and private fleet medium- and heavy-duty (MDHD) make-ready and customer infrastructure.	\$342.6M
	Schools Pilot	Direct installation of and incentives for make-ready infrastructure and chargers at K–12 schools, community colleges, and universities.	\$9.9M
	Parks Pilot	Direct installation of and incentives for make-ready infrastructure and chargers at public parks and beaches.	\$9.9M
Pacific Gas & Electric (PG&E)	EV Fleet	Public and private fleet MDHD make-ready and customer infrastructure.	\$236.3M
	Schools Pilot	Direct installation of and incentives for make-ready infrastructure and chargers at K–12 schools, community colleges, and universities.	\$5.8M
	Parks Pilot	Direct installation of and incentives for make-ready infrastructure and chargers at public parks and beaches.	\$5.5M
	EV Fast Charge	Installation of Utility-owned direct current fast charging (DCFC) chargers.	\$22.4M
San Diego Gas & Electric (SDG&E)	Power Your Drive for Fleets	Public and private fleet MDHD make-ready and customer infrastructure.	\$107.4M
	Schools Pilot	Direct installation of and incentives for make-ready infrastructure and chargers at K–12 schools, community colleges, and universities.	\$9.9M
	Parks Pilot	Direct installation of make-ready infrastructure and chargers at public parks and beaches.	\$8.8M
Liberty Utilities	Schools Pilot	Direct installation of and incentives for make-ready infrastructure and chargers at K–12 schools, community colleges, and universities.	\$3.9M
	Parks Pilot	Direct installation of and incentives for make-ready infrastructure and chargers at public parks and beaches.	\$0.78M

¹ For EY2023 impacts, please see: Cadmus, Energetics, et al. (2024). *Standard Review Projects and AB 1082/1083 Pilots: Evaluation Year 2023 (Year 3)*. <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/sb-350-te/srp-ab10821083-2023-evaluation-report102024.pdf>

1.1. Terminology

Throughout this report, the Evaluation Team uses several technical terms:

- **Site.** A single geographic location at which a Utility customer has installed charging ports as part of one of the 12 Utility programs.²
- **Charging Station.** A site with one or more EV charging ports.
- **EY2024 Sites.** Sites activated in calendar year 2024.
- **Program-to-Date (PTD) Sites.** Sites activated in the program from inception through the end of 2024.
- **2024 Actual.** Impacts in calendar year 2024 from PTD sites.
- **PTD Actual.** Impacts in all years from PTD sites.
- **10-Year Projection.** Projected impacts from PTD sites through 10 years of equipment life.
- **Electric Vehicle Supply Equipment (EVSE).** A charger with one or more ports.
- **Ports.** The connectors that can concurrently charge vehicles from a single EVSE.
- **Light-duty vehicles (LDVs).** Class 1 and Class 2a vehicles. Gross vehicle weight rating (GVWR) up to 8,500 lbs.
- **Medium-duty vehicles.** Class 2b through Class 6 vehicles. GVWR between 8,501 lbs. and 26,000 lbs.
- **Heavy-duty vehicles.** Class 7 and Class 8 vehicles. GVWR over 26,001 lbs.

This evaluation uses the following conventions to describe the status of sites as they advance toward activation and use:

- **Utility Construction Completed:** Sites where the Utility has completed its part of the installation. This could be to-the-meter (TTM), behind-the-meter (BTM), or a turnkey installation.
- **Activated:** Sites with charging stations installed and available for use.
- **Operational:** Sites for which advanced metering infrastructure (AMI) and/or electric vehicle service provider (EVSP) energy usage data have been received from the Utility or EVSP.
- **Closed Out:** Sites for which financial documentation has been finalized by the Utility and incentives for the installed chargers have been paid.³

Table 2 summarizes site counts denoted in this evaluation for EY2024 and the program to date. EY2024 sites, shown in white columns, include sites that reached a given site status (such as Activated) between January 1, 2024, and December 31, 2024. PTD sites, shown in gray columns, include all sites since the launch of the program that reached a given site status as of December 31, 2024.

² Utilities sometimes refer to a site as a “project.”

³ At some closed out sites, the Utilities still plan to pay incentives for future chargers.

Table 2. Site Counts for EY2024 Sites and PTD Sites

Utility	Program	Utility Construction Completed		Activated		Operational		Closed Out	
		EY2024	PTD	EY2024	PTD	EY2024	PTD	EY2024	PTD
SCE	Charge Ready Transport	34	99	31	86	32	86	26	55
	Schools	4	25	1	22	4	21	18	19
	Parks	0	0	0	0	0	0	0	0
PG&E	EV Fleet	42	115	46	108	43	103	39	91
	Schools	1	12	1	12	1	12	4	11
	Parks	0	0	0	0	0	0	0	0
	EV Fast Charge	12	32	11	29	11	29	11	22
SDG&E	PYDFF	3	26	4	25	4	25	11	23
	Schools	4	19	4	19	4	19	13	17
	Parks	2	11	2	11	2	11	3	11
Liberty	Schools	0	1	1	1	0	0	0	0
Utilities	Parks	0	0	0	0	0	0	0	0
Total		102	340	101	313	102	307	125	249

Counts in Table 2 are not additive between the four site statuses (Utility Construction Completed, Activated, Operational, and Closed Out). In general, the site count in the Closed Out column is a subset of sites in the Operational column, which is a subset of sites in the Activated column, which is a subset of sites in the Utility Construction Completed column. Since program inception to the end of 2024, the four MDHD programs have had the most sites reach Utility Construction Completed (240), followed by the Schools Pilots (57), PG&E EV Fast Charge (32), and the Parks Pilots (11).

1.2. Findings

This section summarizes program findings. For simplicity, programs are grouped into two program bundles based on similarities in program design:

- **MDHD Bundle:** PG&E EV Fleet, SCE Charge Ready Transport, and SDG&E PYDFF
- **Public Charging Bundle:** Liberty Schools and Parks, PG&E EV Fast Charge, PG&E Schools and Parks, SCE Schools and Parks, and SDG&E Schools and Parks

Table 3 summarizes the program impacts by bundle for EY2024.

Table 3. Program Impacts by Bundle

Impact Parameter	MDHD Bundle		Public Charging Bundle	
	EY2024	PTD	EY2024	PTD
Population of Activated Sites in EY2024 (#)	81	219	19	93
Ports Installed in Analyzed Sites (#)	1,590	3,540	145	660
EVs Supported (#) ^a	1,925	4,635	N/A	N/A
Electric Energy Consumption (MWh)	36,348	87,807	3,826	6,672
Petroleum Displacement (diesel gallons equivalent [DGE])	2,861,568	7,365,589	259,628	525,511
Greenhouse Gas (GHG) Emission Reduction (metric tons [MT] GHG) ^b	22,397	58,839	2,222	4,135
Oxides of Nitrogen (NO _x) Reduction (kg)	15,709	47,572	N/A	N/A
Particulate Matter (PM ₁₀) Reduction (kg)	159	614	12	21
Particulate Matter (PM _{2.5}) Reduction (kg)	148	571	11	20
Reactive Organic Gases (ROG) Reduction (kg)	1,055	4,435	152	342
Carbon Monoxide (CO) Reduction (kg)	112,575	401,124	5,691	11,710

^a The team derived the EVs supported value for MDHD programs from applicants' vehicle acquisition plan (VAP). This value represents the maximum number of vehicles expected to be supported by the charging infrastructure.

^b GHGs include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) multiplied by their respective Global Warming Potential (GWP) as defined by the Intergovernmental Panel on Climate Change (IPCC) published fifth assessment (AR5). See *Appendix B* for more details).

1.3. Lessons Learned

Preliminary lessons learned supported by findings are provided below by bundle. These lessons and findings were derived from a limited number of program participants across most but not all market sectors. Additional insights will be gained as more sites are completed in the coming years.

1.3.1. Medium-Duty Heavy-Duty Bundle

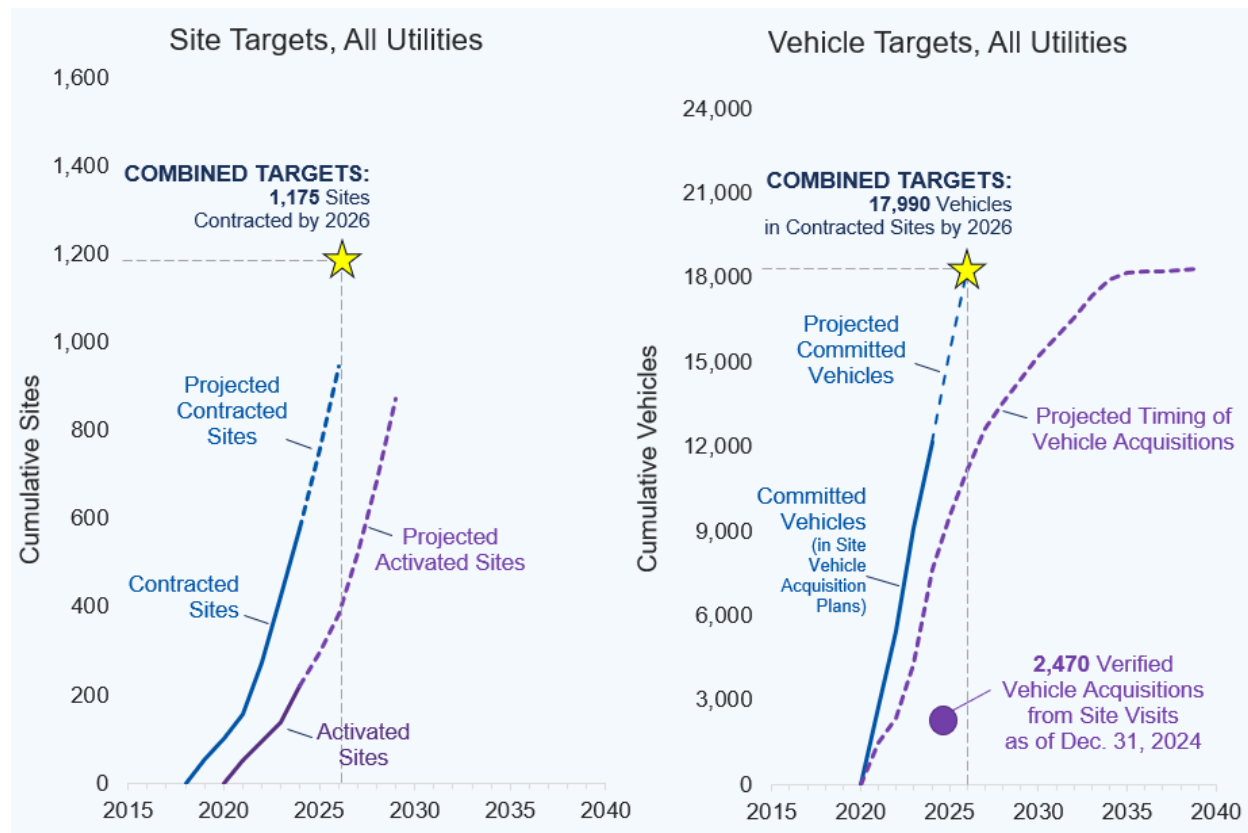
LESSON 1. MDHD programs are having a meaningful impact on EV and charger deployments. However, program participation has been lower than expected in two of the three programs.

2024 saw the highest number of sites activated across program years, with 81 sites and 1,590 charging ports with the ability to support a planned 1,925 EVs. This brings PTD totals across all Utility MDHD programs to 219 activated sites, with a total of 3,540 charging ports that can support 4,635 vehicles on customer vehicle acquisition plans (VAPs). When all programs are aggregated, the Evaluation Team expects that the Utilities will meet the *combined vehicle* targets (17,990 vehicles) by 2026 but fall short of the *combined site* targets (1,175 sites) (Figure 1). Since the inception of the Utility programs, the average size of the sites has increased for all Utilities (in terms of the number of vehicles in the VAPs). This trend supports the vehicle targets but undermines the site targets.

In 2024, SCE activated 31 new sites with 579 charging ports to support 742 vehicles based on customer VAPs in the Charge Ready Transport program, bringing the total activated PTD sites to 86, with 1,609 charging ports to support 1,950 vehicles. This meets 17% of the program goal of 500 sites and 23% of

the goal of 8,490 vehicles supported. A total of 222 contracts have been signed in the program to date, including for activated sites, to support 4,824 vehicles, which would meet 44% of the program’s site goal and 57% of its goal for vehicles supported.

Figure 1. Utility Program Progress Toward Site and Vehicle Targets



In 2024, PG&E activated 46 new sites with 968 charging ports to support 1,092 vehicles based on customer VAPs in the EV Fleet program, bringing totals to 108 activated sites with 1,628 charging ports to support 2,006 vehicles PTD. This meets 29% of the program goal of 375 sites and 31% of the goal of 6,500 vehicles supported. A total of 318 contracts have been signed in the program to date to support 6,547 vehicles, which would meet 85% of the program’s site goal and all of its vehicles supported goal.

In 2024, SDG&E activated four new sites with 43 charging ports to support 91 vehicles based on customer VAPs in the PYDFF program, bringing totals to 25 activated sites with 303 charging ports to support 679 vehicles. This meets 8% of the program goal of 300 sites and 23% of the goal of 3,000 vehicles supported. A total of 45 contracts have been signed in the program to date to support 1,018 vehicles, which would meet 15% of the program’s site goal and 34% of its vehicles supported goal.

Recommendation 1.1: As described above, program participation has lagged expectations across two of the three MDHD programs. The *Barriers to MDHD Vehicle Electrification* section of this evaluation describes a number of factors that may constrain the electric MDHD market—most notably the financial cost and risk posed to fleets when electrifying. To continue advancing MDHD electrification, the Evaluation Team recommends the State of California maintain and/or

strengthen the set of incentives currently offered for MDHD fleets. In particular, we show (in the *Truck Choice Model*) the importance of BTM incentives, which are currently set to expire in 2026 with the sunset of these MDHD programs but could be part of the State's Funding Cycle 1.

LESSON 2. Utility spending in DACs exceeds targets across all programs; however, overall spending in MDHD programs remains low, and only one of three Utilities is currently on pace to meet its site and vehicle goals

In total the three Utilities have spent \$149 million of an approved budget of \$686 million, or approximately 22%, across programs to date. However, these totals represent spending on only financially closed-out sites and do not include funding that has been reserved for contracted sites. Currently, all Utilities are exceeding their DAC goals across MDHD programs.

SCE spent \$19.6 million on closed-out sites in 2024, bringing total program spending to \$54.4 million out of an approved budget of \$342.6 million, which represents 16% of total funds. In the program to date, 71% of Charge Ready Transport program spending has been on sites in DACs, exceeding the 40% program target. For both EY2024 and the program to date, nearly 70% of sites, charging ports, and vehicles are located in DACs.

PG&E spent \$20.7 million of the EV Fleet program budget on closed-out sites in 2024, bringing total spending to \$70.2 million out of the approved program budget of \$236.3 million, or 30% of available funding. In the program to date, 45% of the EV Fleet program spending has been on sites in DACs, exceeding the 25% program target. In both EY2024 and the program to date, more than 40% of sites, charging ports, and vehicles are located in DACs. PG&E has reported that outside of the budget dedicated to the transit bus market sector, the EV Fleet program is expected to be fully subscribed by end of 2025.

SDG&E spent \$8.6 million of the PYDFF program budget on closed-out sites in 2024, bringing total spending to \$24.5 million out of the approved budget of \$107.4 million, or 23% of available funding. In the program to date, 46% of the PYDFF program spending has been on sites in DACs, exceeding the 30% program target. In both EY2024 and the program to date, more than 40% of sites, charging ports, and vehicles are located in DACs. This was the first year that SDG&E met its DAC goals due to the change of DAC definition in Advice Letter (AL) 4436-E, which was approved in August 2024, allowing the use of the service territory definition instead of the statewide definition.

Recommendation 2.1: If MDHD programs are not yet fully subscribed and funding remains by the scheduled program end date, the Evaluation Team recommends extending the existing programs in the absence of FC1-BTM support. Because changing program requirements will require regulatory support, the Evaluation Team recommends that the Utilities request changes in structure that will allow some flexibility for use of unspent funding.

Recommendation 2.2: Utility-reported spending is still relatively low compared to approved program budgets. This is mainly due to Utilities reporting on financially closed out sites rather than on all sites in the program pipelines. It would be beneficial for the Utilities to share the committed spending for projects not yet financially closed out—even if these are estimates.

Greater transparency and timeliness of actual spending data promotes public trust in the Utility programs and potentially allows for a more engaged set of stakeholders within California and elsewhere.

Recommendation 2.3: SCE and SDG&E have started proactively tracking activated sites' progress toward fulfilling their VAPs to ensure that program participants are meeting their obligations as a response to the EY2023 recommendation. Ensuring that VAPs are fulfilled would contribute to improved program performance with respect to energy consumption, petroleum displacement, emissions reductions, and health impacts. The Evaluation Team recommends that PG&E undertake a similar process in EY2025.

LESSON 3. Installed capacity and overall consumption for MDHD sites increased significantly, and peak demand represents a small portion of installed charging capacity.

Installed capacity grew by over 82 MW in 2024 across all Utility MDHD programs, bringing PTD total installed charging capacity to nearly 165 MW. Total energy consumption also grew significantly, with over 56 MWh consumed in 2024, accounting for 64% of PTD consumption (nearly 88 MWh).

Peak demand in 2024 was 28 MW, or approximately 17% of total charging capacity, indicating that sites have significant opportunity to increase utilization. Peak demand is defined as the highest combined demand across all sites during a single 15-minute interval, rather than as the combined peak demand of each individual site throughout the year. It is not expected that all sites will reach peak demand concurrently.

There is currently no indication of stranded assets or oversized infrastructure for MDHD program sites. Several factors are attributed to low peak demand in comparison to installed capacity, including gradual delivery of vehicles based on customer VAPs, vehicle reliability, fleet integration timeline, and adoption of load management, which may reduce overall capacity requirements in the original site design. The Evaluation Team will continue to assess these indicators in future evaluation years as additional vehicles are delivered to program sites and fleet operations mature.

LESSON 4. Most fleet operators have not implemented load management, resulting in higher electricity costs.

Across all Utility MDHD programs, only 45 of the 219 activated sites (21%) exhibited use of load management. Across these programs, as much as 40% of charging consumption shows enough flexibility to be shifted to lower cost time periods. The school bus market sector has the greatest flexibility, with 49% of charging sessions overlapping with the highest cost time of 4 p.m. to 9 p.m. The greatest flexibility across all market sectors by utility is for medium-duty vehicles in PG&E territory, with 59% of energy able to be shifted to lower cost time periods. While electricity rates vary among Utilities, the

Significant Opportunity for Savings

Across all MDHD programs, the Evaluation Team estimates that all sites combined could save more than \$3 million annually, representing a 28% cost reduction, and a 10% reduction in GHG emissions by shifting consumption to off-peak periods.

average of monthly billing costs is approximately \$0.36/kWh across all three programs, and monthly billing costs for sites using load management range from \$0.16/kWh to \$0.33/kWh. Estimated potential yearly savings from implementation of load management range from \$3,500 for low energy consumption sites to \$442,000 for the highest energy consumption site.

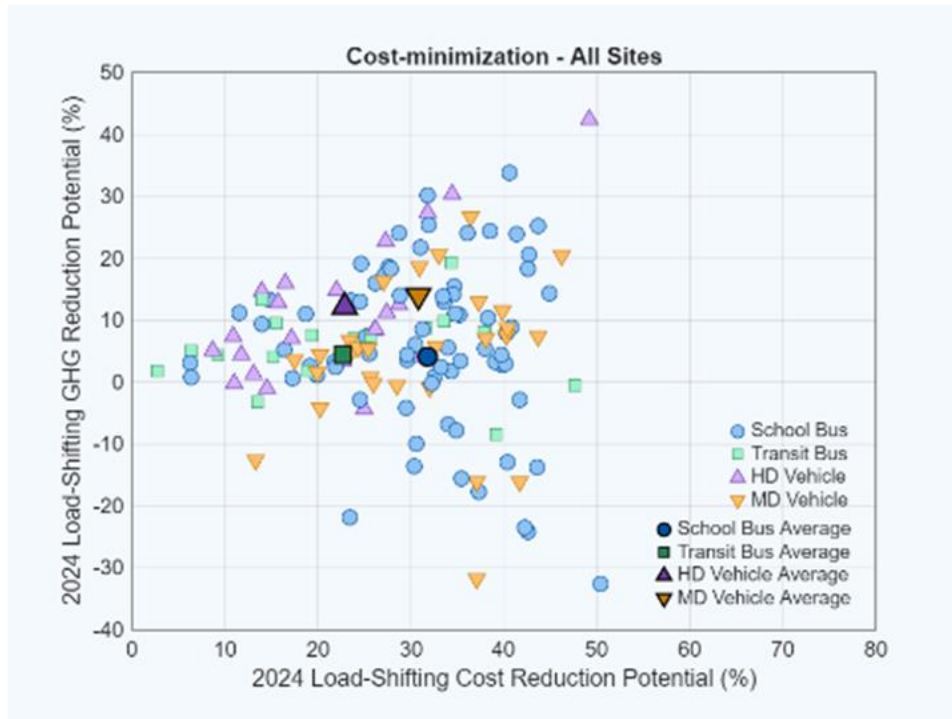
Not all NSPs offer load management capability, and not all fleet operators have direct access to their utility bills to understand time-of-use (TOU) cost impacts. During site visits the Evaluation Team observed that most operators' expected costs differed from their actual costs. These customers expected that charging would occur during off-peak periods to leverage TOU rates. However, charging behavior did not align with this expectation due to several factors, including staff education and awareness, staff availability, and technology constraints.

Recommendation 4.1: Customers face challenges with implementing load management due to EVSE technology limitations, NSP functionality barriers, vehicle battery management system technical barriers, and in some cases a combination of each. Utilities should consider mandating that all new EVSE technology included in the approved product list be capable of performing basic load management services, such as rules-based charging.⁴ Utilities should also consider requiring all NSPs to offer load management capabilities to allow fleet operators to implement more cost-effective charging behavior. The Evaluation Team found that some NSPs offer load management capabilities, but these capabilities often come at an extra cost. The Evaluation Team does not recommend mandating fleet operators to purchase these more costly solutions.

Recommendation 4.2: Site visits have shown that many fleet operators remain unaware of their energy use and charging costs, despite these data being available on monthly utility bills and through most EVSPs. Often a site host's administrative office receives utility bills but does not share relevant energy and cost information with fleet operators. Utilities should be proactive about holding annual technical assistance sessions with managers of fleets that have charging flexibility and potential to achieve substantial energy savings. These technical assistance sessions—ideally held in person—could help connect the fleet manager with the office that pays the electricity bills to give fleet managers a better understanding of the impacts of TOU rates on operational costs. The Evaluation Team has identified the savings potential associated with adoption of load management at activated sites, as presented in Figure 2.

⁴ Rules-based charging refers to a charging strategy that utilizes predefined rules or algorithms to determine when and how to charge a device or system

Figure 2. Results of Available Annual Improvements When Modeling Utility Costs by Market Sector

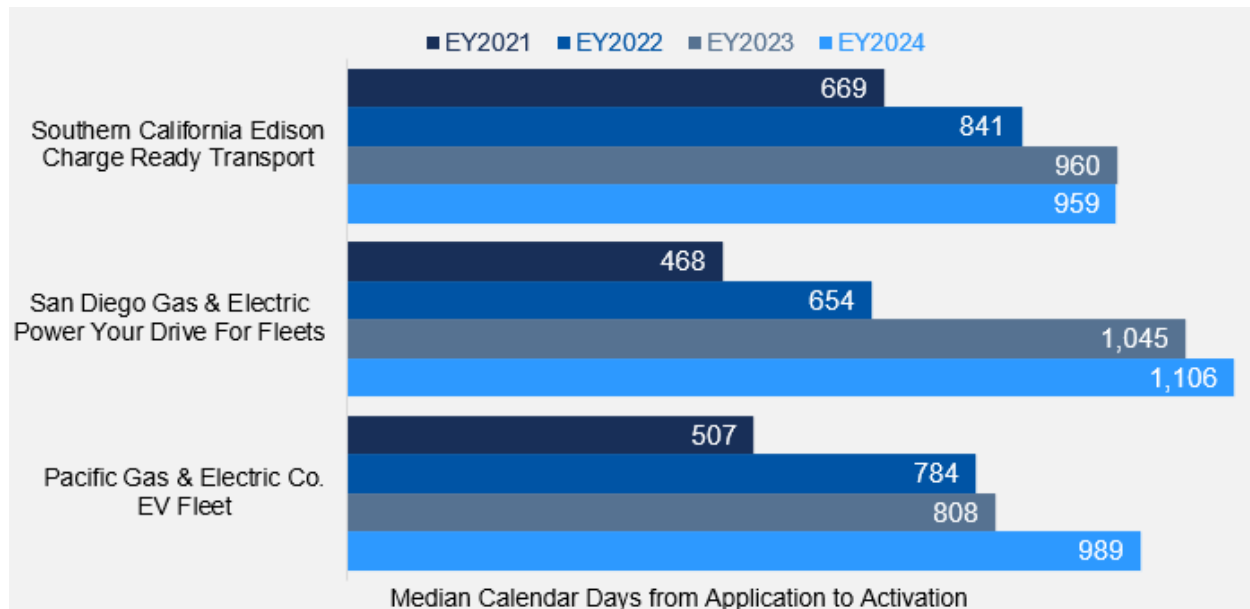


LESSON LEARNED 5. Site activation timelines continue to increase as larger sites become operational.

The time period from application to activation was over 950 days for each of the three Utility programs in 2024, with the highest at 1,106 days (SDG&E) and the lowest at 959 days (SCE), as shown in Figure 3. As in previous years, the Design and Permitting phase was the longest phase across programs, with a median length exceeding one year. In 2024 PG&E responded to phase delays by requiring customers to secure a design contractor before contract signing. For the SCE Charge Ready Transport program, over 50% of sites were heavy-duty vehicle sites, which added nearly 40 MW of capacity this year. Large, complex projects such as MDHD sites inherently take longer than small sites to complete, and therefore these sites become activated in later program evaluation years. Accordingly, the long activation times of the larger, more complex sites increase overall activation timelines. We acknowledge that this will remain a characteristic of program performance throughout the evaluation period.

To address this issue, in 2024 the Evaluation Team examined the activation timeline of sites based upon application year, rather than activation year, to better examine trends across programs and determine if timelines may be getting shorter year over year. However, the Evaluation Team was unable to identify any specific trends that would allow us to make this assessment based on available data. In Fall 2024 the Commission adopted new energization targets and increased data reporting requirements. In its 2025 evaluation activities, the Team will continue to review project timelines based upon application year, in addition to activation year, to determine if trends can be more accurately examined as more sites come online.

Figure 3. Median Calendar Days from Application to Activation



LESSON 6. The average installed capacity per site for the three MDHD programs increased in 2024, resulting in a higher average cost per site and a lower average cost per kilowatt.

For the SCE Charge Ready Transport program, the average installed capacity per site for PTD sites through 2024 was 758 kW, which is a 77% increase from 429 kW for PTD sites through 2023. This increase in capacity led to an increase in the average cost per site for TTM and BTM of 41% from \$304,057 to \$430,204. For the PG&E EV Fleet program, the average installed capacity per site for PTD sites through 2024 was 766 kW, which was a 46% increase from 526 kW for PTD sites through 2023. The average cost per site for TTM and BTM increased by 21% from \$272,995 to \$331,005 for the PG&E EV Fleet program. For the SDG&E PYDFF program, the average installed capacity per site for PTD sites through 2024 was 383 kW, which was an 8% increase from 353 kW for PTD sites through 2023 PTD, while the average cost per site for TTM and BTM increased by 38% from \$331,122 to \$455,777. As the cost per site increases, the cost per kilowatt and the cost per vehicle decreases.

Utility spending per vehicle and per kilowatt capacity installed varied among Utility programs. SCE spending on TTM and BTM was \$36,450 per vehicle and \$1,158/kW of charging capacity installed for PTD sites through 2024, compared to costs for PTD sites through 2023 of \$41,395 per vehicle and \$1,250/kW installed. PG&E spending on TTM and BTM was \$24,931 per vehicle and \$1,508/kW of charging capacity installed for PTD sites through 2024, which is less than costs of \$25,636 per vehicle and \$1,588/kW for PTD sites through 2023. SDG&E spending on infrastructure was \$24,262 per vehicle and \$2,135/kW of charging capacity installed for PTD sites through 2024, which is similar to costs for PTD sites through 2023 of \$24,648 per vehicle, and an increase from \$1,528/kW.

There is a strong relationship between the installed capacity of a site and the cost per kilowatt of the site as shown in Figure 4, with larger sites in general having a lower cost per kilowatt than smaller sites. With the increase in the average installed capacity per site in EY2024 discussed above, the evaluation

team examined an additional analysis that looked at the weighted average cost compared to the simple average cost. A weighted average assigns different levels of importance to data points, often providing more accuracy than a simple average where all data points are equally weighted. In this case, the Evaluation Team weighted the sites by their installed kilowatts.

Figure 4. TTM and BTM Cost versus Installed Site Capacity

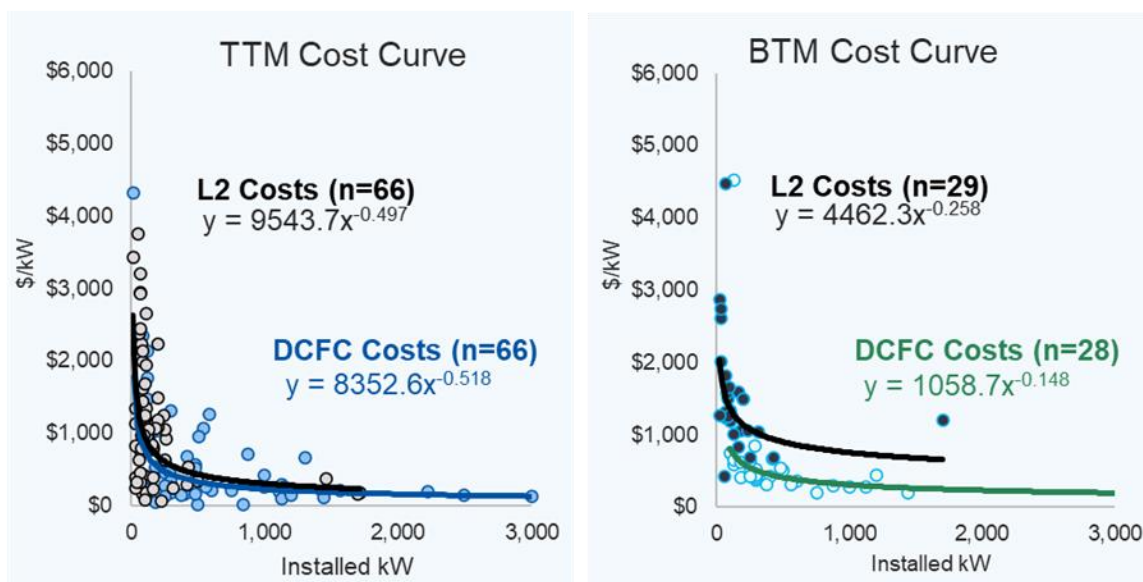


Table 4 provides both the simple average and the weighted average costs for the three Utility MDHD programs for PTD sites through 2024. Across the three MDHD programs, PTD sites through 2024 had an average cost per site of \$385,421 for TTM and BTM, compared to the weighted average cost of \$849,572. For the cost per site per kilowatt across the same MDHD programs, PTD sites through 2024 had an average cost of \$1,476/kW for TTM and BTM compared to the weighted average cost of \$546/kW. This shows that when weighting by the installed capacity of the site, the weighted average cost is higher and the weighted average cost per kilowatt is lower than when using a simple average; this is consistent with Figure 4, which shows a lower cost per kilowatt for larger sites.

Table 4. MDHD Site Costs Weighted Average Comparison to Simple Average

Utility Program	TTM + BTM Site Cost 2024 PTD		TTM + BTM Site Cost per kW 2024 PTD	
	Simple Average	Weighted Average	Simple Average	Weighted Average
SCE Charge Ready Transport	\$430,204	\$1,062,994	\$1,158/kW	\$567/kW
PG&E EV Fleet	\$331,005	\$712,354	\$1,508/kW	\$432/kW
SDG&E PYDFF	\$455,777	\$733,556	\$2,135/kW	\$1,189/kW
All MDHD Programs	\$385,421	\$849,572	\$1,476/kW	\$546/kW

LESSON 7. Market share for transit buses, electric transportation refrigeration units (eTRUs), and delivery vehicles (a subsector of the medium-duty vehicle market sector) is projected to increase to 54%, 52%, and 48% respectively by 2035 according to Delphi panels conducted for

EY2024; however, the panels forecasted that both transit bus and delivery vehicle market share will fall short of CARBs Innovative Clean Transit (ICT) and ACT sales requirements.

The EY2022 evaluation included a Delphi panel forecast for both the transit bus market sector and the medium-duty vehicle subsector of delivery vehicles, while 2024 is the first year a Delphi panel provided a forecast for eTRUs. The transit bus market sector is forecasted to reach a lower market share over the forecast horizon than the 2022 panel predicted and is expected to fall below CARB's ICT sales requirements, while the delivery vehicle market sector is also forecasted to reach a lower market share than the previous forecast and fall short of the ACT sales requirements. For the transit bus market sector, experts cited supply chain challenges around manufacturing and reliability as reasons why electric transit buses would not meet ICT regulations. For the delivery vehicle market sector, most panelists anticipate that uncertainty around policy and funding will slow adoption in the near term, but that improving economics will accelerate growth in the 2030s—at which point infrastructure will become the primary constraint. For the eTRU market sector, five of the six panelists cited the unclear status of California regulations and federal policy as major factors influencing their projections, with high capital costs and technology immaturity impacting early adoption, especially for small fleets.

LESSON 8. Utility MDHD program sites continue to displace petroleum, reduce GHG and local emissions, and achieve health impacts.

Combined, the sites have displaced more than seven million gallons of petroleum PTD. Specifically, the SCE Charge Ready Transport sites account for over four million gallons, PG&E EV Fleets sites for over two and half million gallons; and SDG&E PYFF sites for over half a million gallons. In addition, the PTD sites across the programs collectively reduced nearly 59,000 MT of GHG emissions. These sites all contributed to lowering local emissions, with CO impacts being the most prominent, achieving a reduction of more than 400,000 kg to date. Overall, between 14% and 32% of the health benefits from PTD sites are in DACs, and the total monetized health benefits from sites range from approximately \$6.1 million to \$8.1 million for all MDHD programs.

1.3.2. Public Charging Bundle

All Public Charging Programs

LESSON 1. The Schools and Parks Pilots sites and the EV Fast Charge program sites continue to displace petroleum, reduce GHG and local emissions, and achieve health impacts overall and within DACs.

Combined, the School and Parks Pilots PTD sites have displaced more than 525,000 gallons of petroleum, with between 40% and 69% of the impact occurring within DACs. Specifically, the SCE Schools Pilot sites account for 33,737 gallons; PG&E Schools Pilot sites for 18,434 gallons; PG&E EV Fast Charge sites for 339,865 gallons; and SDG&E Schools and Parks sites for 133,475 gallons. In addition, the PTD sites across the pilots collectively reduced GHG emissions by over 4,000 MT. These sites also contributed to lowering local emissions, with CO impacts being the most prominent with a reduction of over 11,500 kg to date. Finally, the sites accounted for between 15% and 26% of the health benefits in

DACs with a total monetized health benefits range from \$2,969 (PG&E Schools) to \$69,047 (PG&E EV Fast Charge).

LESSON 2. The Schools and Parks Pilots sites and the EV Fast Charge program sites continue to promote regional EV adoption.

The SDG&E Schools and Parks Pilots, SCE and PG&E Schools Pilot, and PG&E EV Fast Charge program contributed to EV adoption in households neighboring the infrastructure. SDG&E's investments in the Schools and Parks Pilots' public charging infrastructure had an economically meaningful impact on EV ownership, leading to an estimated increase of 100 EVs for the Schools Pilot and 22 EVs for the Parks Pilot to date. As in past years, the impact of the SDG&E Schools Pilot was greater than the impact of the SDG&E Parks Pilot, as more charging facilities have been installed in schools than in parks. The SCE and PG&E Schools Pilots may have also contributed to EV adoption in households neighboring the infrastructure with 56 EVs for SCE and 24 EVs for PG&E to date. The PG&E EV Fast Charge program also continued to positively influence EV adoption in households neighboring the infrastructure relative to baseline registrations with 40 EVs to date.

LESSON 3. Although higher-than-expected site costs and delays continue to be a challenge for the Schools and Parks Pilots and the EV Fast Charge program, committed staff have worked diligently to mitigate these costs.

All of the Schools and Parks Pilots and PG&E's EV Fast Charge program began during the COVID-19 pandemic, which had unprecedented economic impacts across nearly every market. These changes were so significant that the estimates the Utilities developed for Decision 19-11-017 (which mandated the Schools and Parks Pilots at their determined funding levels) and Decision 18-05-040 (which mandated the EV Fast Charge at its determined funding level) did not reflect the actual costs for implementation. In addition to costs, the Utilities experienced site delay challenges over the last several years. For example, SCE encountered long lead times for school site permitting and repairs and dealt with infrastructure vandalism. PG&E experienced school site delays related to design consideration such as ADA requirements. In addition, SDG&E Parks and Schools staff noted inconsistent permitting costs; a rise in inspection costs; and EVSP staff turnover that led to delays in commissioning, maintenance, or other services for sites over the pilot period. Furthermore, PG&E EV Fast Charge experienced permitting delays as well as delays from site specification requirements such as bollards and back-up batteries. In response to increased costs associated with these challenges, staff across the Schools and Parks Pilots and the EV Fast Charge program has continued to make adjustments to the program design, processes, and conduct ongoing budgetary reviews, focusing on the latter two in 2024.

- **Program Processes:** In 2024, SCE Schools Pilot staff focused on improving communication with the schools and EVSE providers as more schools transitioned to maintenance for their operational sites.
- **Budgetary Reviews:** In 2024, SCE program staff used actual site cost data to improve forecasts for all Standard Review Projects (SRP) programs. In 2023, PG&E EV Fast Charge staff had determined through a budget exploration that about five more sites could be built, which were secured in 2024. Also, starting in 2023 and continuing into 2024, PG&E Schools Pilot staff

identified several key strategies as effective for keeping school site costs low, including pre-desktop reviews, regular reviews of actual costs, and open communication during construction.

Parks Pilot

LESSON 1. Although cross-jurisdiction coordination was a significant challenge in previous years, the deep commitment all Utility staff have maintained for the Parks Pilot is beginning to show positive results.

The plan for the Parks Pilot in 2021 was for all Utilities to enter into a collective participation agreement with the DPR. However, in 2022, the Utilities separated their efforts and began pursuing independent agreements with the DPR. Though the discussions generally went well, the process of coordinating with site-specific and state-level staff paired with DPR staff turnover led to minor delays throughout the site planning and implementation process. In 2023, SCE was able to secure the first eight site-specific addendum agreements for the Parks Pilot, and SDG&E continued to capitalize on the inclusion of local parks as part of the Pilot design. In 2024, SDG&E and PG&E successfully signed the MPA paving the way for site identification. Building on its earlier success, SCE secured the final site addendum and focused on improving communication with district level staff by engaging in conversations about other electrification interests, such as fast charging. Liberty remains hopeful for a signed MPA with State DPR staff in 2025.

1.4. Structure of Report

The evaluation report is organized into the following sections:

- **Chapter 1.** Executive Summary
- **Chapter 2.** Introduction
- **Chapter 3.** Statewide Findings
- **Chapter 4.** SCE Programs: Charge Ready Transport, Schools and Parks Pilots
- **Chapter 5.** PG&E Programs: EV Fleet, Schools and Parks Pilots, EV Fast Charge
- **Chapter 6.** SDG&E Programs: PYDFF, Schools and Parks Pilots
- **Chapter 7.** Liberty Utilities Programs: Schools and Parks Pilots
- **Appendix A.** Deep Dives
- **Appendix B.** Methodology
- **Appendix C.** Data Collection Instruments

Each of the program-specific sections in Chapter 4 to Chapter 7 contain the same three sections:

- **Overview:** Describes the evaluation objectives, logic model, theory of program impacts, and research questions.
- **Findings:** Details results from the program materials review, market research, in-depth interviews, surveys, analyses, or other methods.
- **Lessons Learned:** Varies, as appropriate, according to the needs of each evaluation bundle.

2. Introduction

In support of the transportation electrification goals of the SB 350 Clean Energy and Pollution Reduction Act of 2015 and ABs 1082 and 1083, the CPUC issued decisions in 2018 and 2019 authorizing investment in 12 Utility programs designed to spur adoption of LDV and MDHD vehicle electrification among fleets and households. The programs support both TTM and BTM EV charging infrastructure, along with EVSE. Programs cover 100% of the TTM cost and vary in their level of support for BTM and EVSE. Approximately 90% of the funding for these 12 programs is for MDHD EVs as shown in Table 5.

Table 5. Summary of Utility Programs

Utility	Program	Description	Decision	Public Charging Budget	MDHD Budget
SCE	Charge Ready Transport	\$342.6M for TTM and some or all of the BTM infrastructure up to the charging station for MDHD fleets. Additional rebates for charging stations are available for certain fleets.	18-05-040		\$342.6M
	Schools Pilot	\$9.9M for installation of approximately 250 Level 1 (L1) and Level 2 (L2) charging ports at 40 K–12 schools.	19-11-017	\$9.9M	
	Parks Pilot	\$9.9M for installation of approximately 120 L2 charging stations, 10 DCFC charging ports, and an optional 15 mobile stations across 27 state parks and beaches.	19-11-017	\$9.9M	
Total SCE Approved Budget				\$19.8M	\$342.6M
Percentage of Total SCE Approved Budget				5%	95%
PG&E	EV Fleet	\$236.3M for TTM and some or all BTM infrastructure up to the charging station for MDHD fleets. Additional rebates for charging stations are available for certain fleets.	18-05-040		\$236.3M
	Schools Pilot	\$5.8M for installation of four or six L2 charging ports at 22 schools.	19-11-017	\$5.8M	
	Parks Pilot	\$5.5M for installation of L2 and DCFC charging ports at state parks and beaches.	19-11-017	\$5.5M	
	EV Fast Charge	\$22.4M for make-ready infrastructure of 30-40 DCFC sites and rebates for EVSE.	18-05-040	\$22.4M	
Total PG&E Approved Budget				\$33.7M	\$236.3M
Percentage of Total PG&E Approved Budget				12%	88%
SDG&E	PYDFF	\$107.4M for TTM and some or all BTM infrastructure up to the charging station for MDHD fleets. Additional rebates for charging stations are available for certain fleets.	19-08-026		\$107.4M
	Schools Pilot	\$9.9M for installation of and incentives for installing 184 L2 and 12 DCFC charging ports at 30 educational institutions.	19-11-017	\$9.9M	
	Parks Pilot	\$8.8M for installation of 74 light-duty public charging ports in 12 state parks and beaches within SDG&E's service territory and 66 light-duty public charging ports at 10 city and county park sites.	19-11-017	\$8.8M	
Total SDG&E Approved Budget				\$18.7	\$107.4M
Percentage of Total SDG&E Approved Budget				15%	85%

Utility	Program	Description	Decision	Public Charging Budget	MDHD Budget
Liberty	Schools Pilot	\$3.9M for up to 56 L2 and DCFC charging ports at 17 schools.	19-11-017	\$3.9M	
	Parks Pilot	\$0.8M for five dual-pedestal EVSE at three sites.	19-11-017	\$0.8M	
Total Liberty Approved Budget				\$4.7M	\$0
Percentage of Total Liberty Approved Budget				100%	0%
Total Approved Budget				\$76.9M	\$686.3M
Percentage of Total Approved Budget				10%	90%

2.1. Evaluation Framework

Per the originating CPUC decisions,⁵ this evaluation has three overarching objectives (Figure 5).

Figure 5. Evaluation Objectives



To fulfill these objectives, the Evaluation Team conducted a variety of data collection and analysis activities for the LDV and MDHD programs, summarized in Table 6. Descriptions of the methodologies for these activities are in *Appendix B*.

Table 6. Data Collection and Analysis Activities

Type	Activity	Public Charging	MDHD
Data Collection	Program Data and Materials	✓	✓
	AMI/EVSP Data	✓	✓
	Site Visits	✓	✓
	Site Cost Data	✓	✓
	Monthly Customer Bills	✓	✓
	Market Data ^a	✓	✓
	Interviews	✓	✓
	Surveys		✓
	Delphi Panels		✓

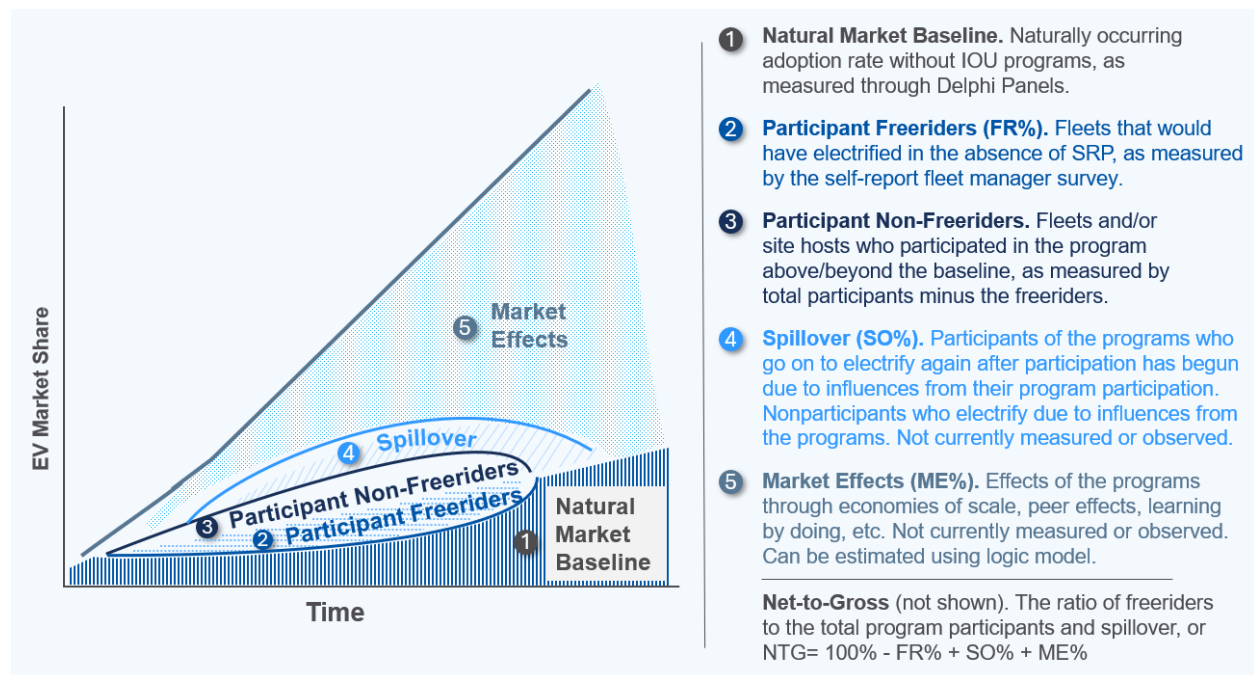
⁵ CPUC Decision 18-05-040. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M215/K783/215783846.PDF>; Decision 19-11-017 <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M319/K823/319823155.PDF>; Decision 19-08-026 <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M311/K550/311550050.PDF>

Data Analysis	EV Adoption Regression	✓	
	Grid Impacts	✓	✓
	Counterfactual Development	✓	✓
	Petroleum Displacement	✓	✓
	GHG and Criteria Pollutant	✓	✓
	Health Impacts	✓	✓
	Total Cost of Ownership	✓	✓
	Site Visit Findings	✓	✓
	Co-Benefits and Co-Costs		✓
	Interviews/Survey Findings	✓	✓
	Market Effects		✓

^a Includes Vehicles in Operation in California

Figure 6 is a conceptual diagram of the impact of the Utilities' programs on the broader transformation of the EV market. Figure 6 aligns with other market transformation work in California.⁶

Figure 6. Conceptual Diagram Showing Program Impacts on EV Market



The bottom shaded area (#1) is the naturally occurring baseline adoption curve. This is the adoption that would occur in the absence of the programs and includes program participant freeriders (#2) and others not associated with the programs. Participant non-freeriders (#3) add to this naturally occurring baseline adoption. Areas #2 and #3 sum to all participants of the Utility programs.

The spillover area (#4) represents program participants who go on to build more stations or install more ports following their participation in the program. Finally, the programs spur broader effects through

⁶ For example, see CPUC (2023) California Market Transformation Evaluation Framework, Draft Version 2.0, August 2023.

increased learning, economies of scale, and peer effects which result in more EV's and EV charging infrastructure installed across the State of California and elsewhere (#5). This is referred to as market effects.

For MDHD programs, the Evaluation Team measures the natural market baseline (#1) through Delphi panels for individual market sectors. We estimate freeridership and spillover using a fleet manager survey which asks respondents about intentions. These responses are converted to a net-to-gross (NTG) ratio. In our final Evaluation report in 2027, we will use the NTG ratio to convert all gross impacts into net impacts. For public charging programs, we do not estimate freeridership or spillover and do not calculate the NTG ratio. Rather, we estimate the impact of each charging station on nearby household EV adoption through a two-stage instrumental variable regression.

2.2. Light-Duty Market Landscape in California

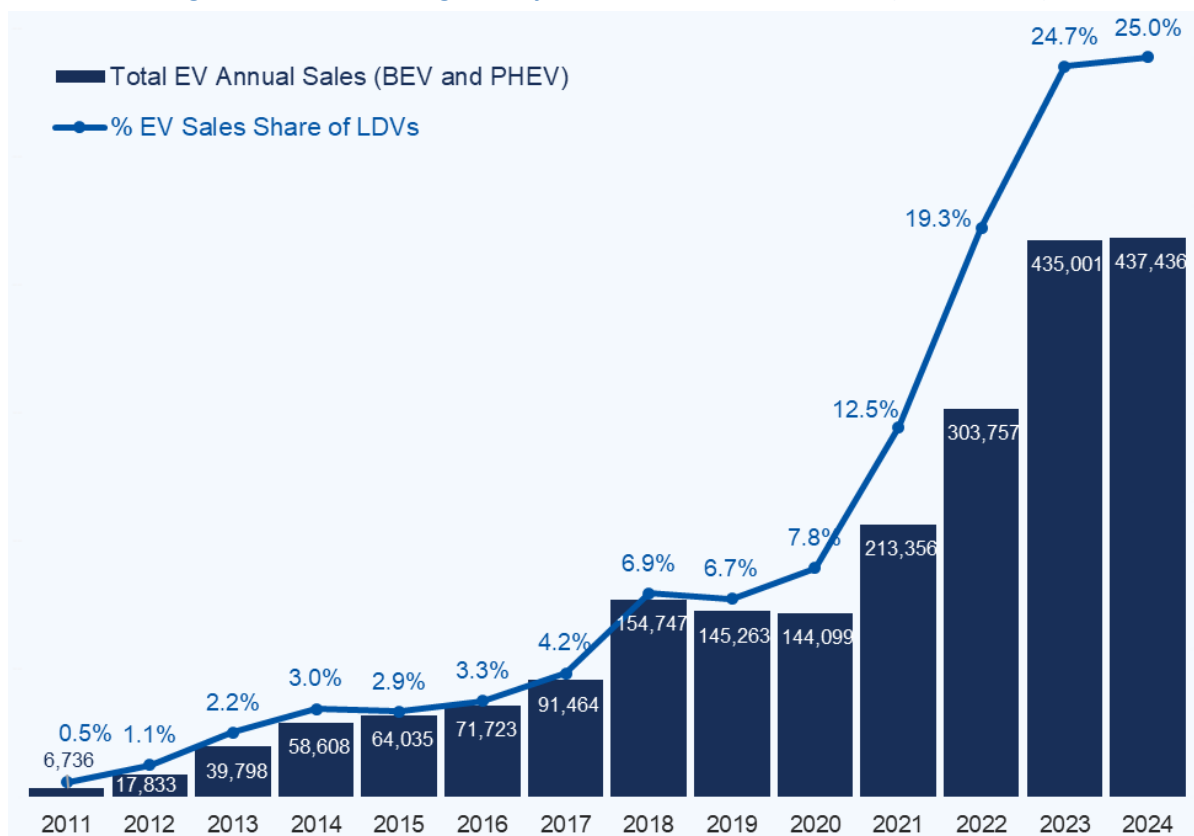
This section summarizes the market landscape in 2024 for the public charging programs, including Schools and Parks Pilots and PG&E's EV Fast Charge program. Vehicles of interest include Class 1–Class 2b vehicles, such as passenger sedans, small cargo vans, compact pickup trucks, small SUVs, minivans, standard pickup trucks, and SUVs primarily driven by households. Note, some Class 2b vehicles are used in fleets and are therefore counted as MDHD vehicle in Section 1.3.

2.2.1. Light-Duty Sales

Figure 7 shows the growth of annual sales of light-duty EVs in California, including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).⁷ The bars represent annual sales, and the line represents annual sales share.

⁷ The figure shows household EVs. For Class 2b, the Evaluation Team assumes that 50% of Ford F-150 Lightning Extended Range and GMC Silverado's are in fleets and are therefore excluded from this graph but included in similar graphs in the MDHD Section 1.3. Additionally, cargo vans are assumed to be a part of MDHD fleets rather than household EVs.

Figure 7. 2011–2024 Light-Duty EV Sales Share in California (Class 1–2b ^a)



Source: Figure derived from California Energy Commission (2025). California Energy Commission Zero Emission Vehicle and Infrastructure Statistics. Data last updated 01/31/2025. Retrieved 4/30/2025 from <http://www.energy.ca.gov/zevstats>.

^a Class 2b includes 10,423 vehicles classified as fleet vehicles.

California saw a leveling off of EV sales shares in 2024. Light-duty EVs account for one in four (25.0%) of all new LDV sales in 2024, with BEVs accounting for 21.4% of LDV sales and PHEVs accounting for 3.7% compared to 21.1% and 3.6% in 2023.⁸ Across the entire United States, the proportion of LDV EV sales share for new registrations increased from 7.8% in 2023 to 8.1% in 2024.⁹

2.2.2. Light-Duty Models

Table 7 shows the top 10 light-duty EVs sold in California in 2024, which account for 59% of the LDV EV market. Tesla Model Y was the sales leader, with 29% of the LDV EV market, while 124 models capture the bottom 41% of the market.

⁸ California Energy Commission. Last updated January 31, 2025. “New ZEV Sales in California.” <https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/new-zev-sales>

⁹ Cox Automotive, January 15, 2025. “Electric Vehicle Sales Jump Higher in Q4, Pushing U.S. Sales to a Record 1.3 Million.” <https://www.coxautoinc.com/market-insights/q4-2024-ev-sales/>

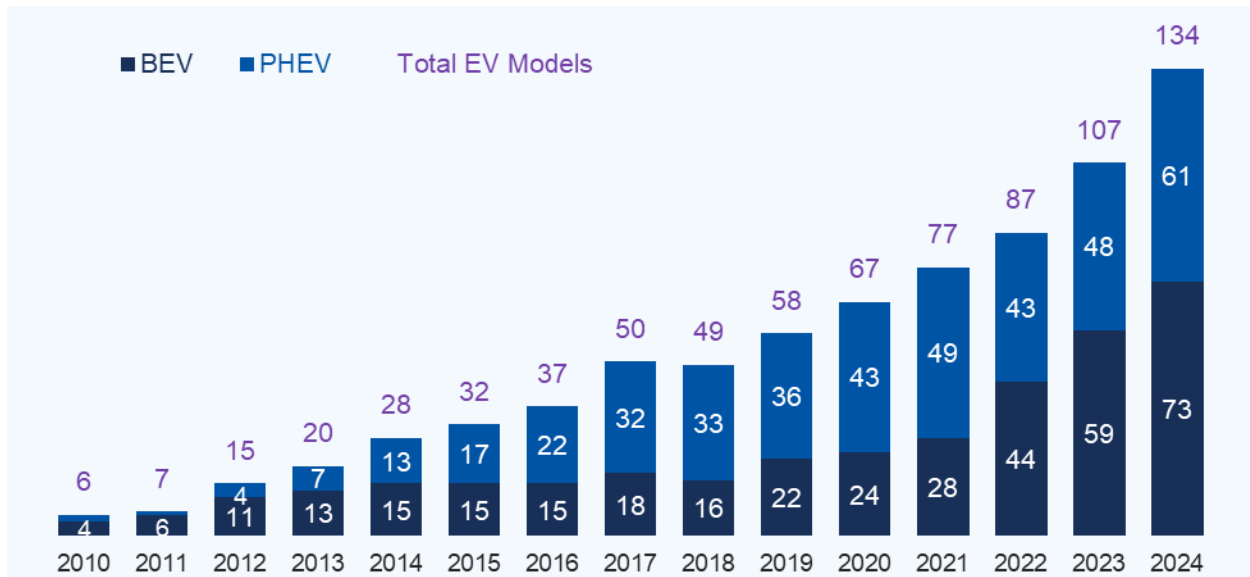
Table 7. Top 10 EVs in California, 2024 LDV Sales (Class 1–2b^a)

Rank	Make	Model	Type	2024 Light-Duty EV Sales	% of 2024 Light-Duty EV Sales
1	Tesla	Model Y	BEV	127,567	29%
2	Tesla	Model 3	BEV	52,882	12%
3	Hyundai	IONIQ 5	BEV	17,028	4%
4	Ford	Mustang Mach-E	BEV	10,140	2%
5	Tesla	Cybertruck	BEV	9,411	2%
6	Rivian	R1S	BEV	8,819	2%
7	Toyota	RAV4 Prime	PHEV	8,680	2%
8	BMW	i4	BEV	8,386	2%
9	Jeep	Wrangler	PHEV	8,123	2%
10	Tesla	Model X	BEV	8,012	2%
Remaining 124 Makes/Models				178,389	41%
Total				437,436	100%

^a Class 2b includes 10,423 vehicles classified as fleet vehicles.

Figure 8 shows the number of unique zero-emission vehicle (ZEV) models offered in the 2024 California LDV market. In 2024, the California market had 134 unique models of light-duty EVs (BEVs and PHEVs), 27 more than in the previous year. The market maintained the trend from 2023 of a shift toward BEV offerings (relative to PHEV offerings) with 54% of the available EV models being BEVs.

Figure 8. Unique Light-Duty EV Models for Sale in California (Class 1–2b^a)



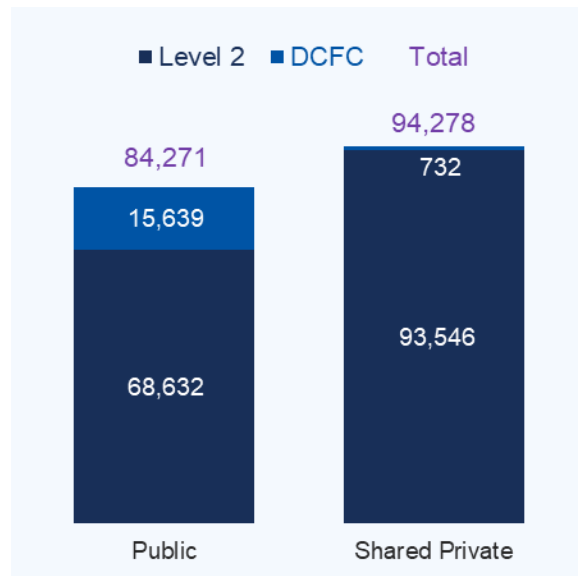
Source: Figure derived from California Energy Commission (2025). California Energy Commission Zero Emission Vehicle and Infrastructure Statistics. Data last updated 01/31/2025. Retrieved 02/26/2025 from <http://www.energy.ca.gov/zevstats>.

^a Class 2b includes 10,423 vehicles classified as fleet vehicles.

2.2.3. Charging Infrastructure Deployment

According to the California Energy Commission (CEC) ZEV Dashboard, there are over 178,500 L2 and DCFC EV chargers¹⁰ for LDVs in California to date, last updated on March 6, 2025, as can be seen in Figure 9. This includes 84,271 public chargers (68,632 L2 and 15,639 DCFC) and 94,278 shared private chargers (93,546 L2 and 732 DCFC). The CEC derives these numbers from multiple sources, including lists of public and shared private chargers by the Alternative Fuels Data Center (AFDC), PlugShare, and CEC surveys.

Figure 9. LDV Chargers in California



¹⁰ The CEC defines the number of chargers as the number of vehicles that can charge concurrently. For example, an L2 charger with two connectors that can charge two vehicles concurrently is counted as two chargers. The U.S. Department of Energy refers to this as a “port.”

2.3. MDHD Market Landscape in California

This section summarizes the market landscape in 2024 for electric MDHD vehicles. The three MDHD programs in this evaluation support charging infrastructure for a wide range of vehicle types and use cases, including both on-road and off-road vehicles. Table 8 provides an overview of the vehicle types used throughout the report—referred to as “market sectors” hereafter.

Table 8. Overview of Market Sectors

Category	Market Sector	Description
On-Road	Medium-Duty Vehicle	Class 2 ^a –6 vehicles (including large panel vans, heavy-duty pickup trucks, straight trucks, step vans, small dump trucks, medium straight trucks, large maintenance trucks, and large step vans)
	Heavy-Duty Vehicle	Class 7–8 vehicles (including coach buses, large straight trucks, 2-Axle tractors, large straight trucks, tractors, and refuse trucks)
	School Bus	Class 4–8 school buses (including Type A, Type B, Type C, and Type D)
	Transit Bus	Class 7–8 buses (including standard buses, articulated buses, over-the-road buses, and double-decker buses for passenger transport)
Off-Road	Forklift	Off-road vehicle with a pronged device in front for lifting and carrying heavy loads
	Airport Ground Support Equipment (GSE)	Equipment used to service aircraft between flights (e.g., refueler, tugs/tractors, potable water trucks)
	Port Cargo Truck	Also known as a terminal tractor, off-road, low speed, to load, unload, move, and store cargo within seaports and terminals
	Transportation Refrigeration Unit (TRU)	Alternative to diesel refrigeration system, where the compressor is driven by an electric motor
	Truck Stop Electrification	High power fast charging at truck stops enabling longer distance travel

^a MDHD programs are eligible for on-road vehicles with a gross vehicle weight exceeding 6,000 pounds (Class 2–8), including Class 2b cargo vans and light-medium trucks intended for fleet usage. Class 2 is included in the medium-duty SRP market sectors, which differs from the EPA’s GVWR classification of Class 2 as LDVs.

MDHD Programs by the Numbers

As of December 31, 2024, participating fleets in the Utility programs accounted for...

- **1,973** Class 3 to 8, on-road vehicles verified by the Evaluation Team during site visits, accounting for **64%*** of California’s statewide total
- **497** off-road vehicles verified by the Evaluation Team during site visits
- **3,614** ports verified by the Evaluation Team during site visits

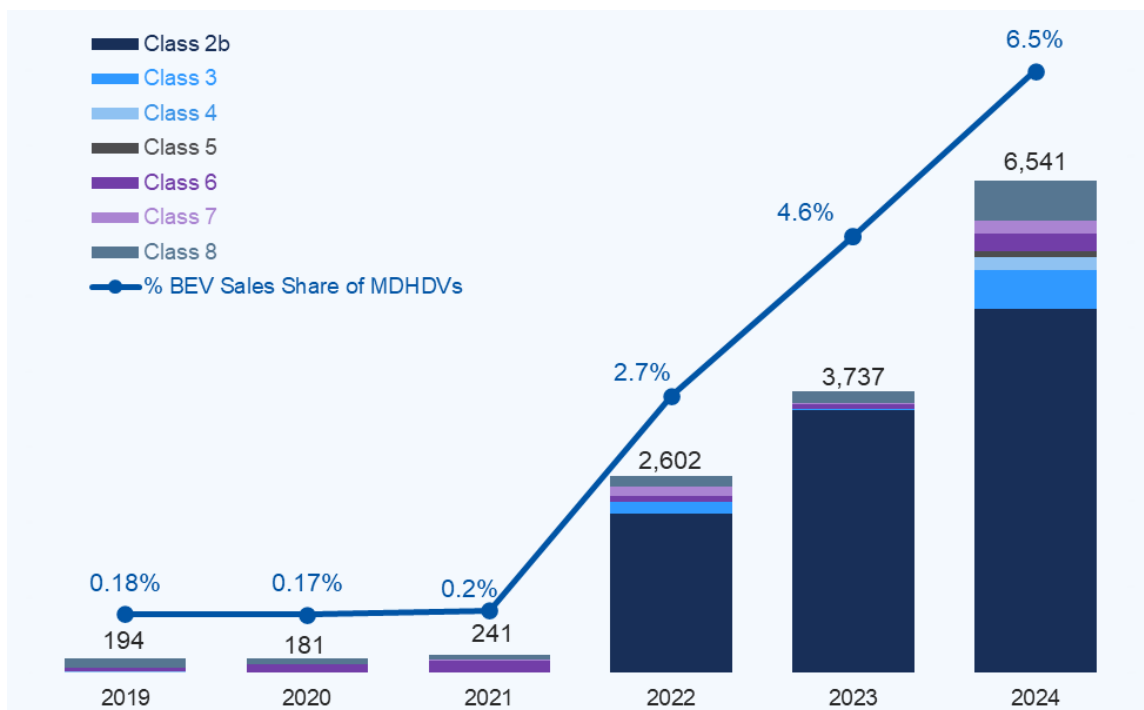
*Calculated by dividing the number of vehicles seen on site by the Evaluation Team by the total number of Class 3 to 8 EVs in California at the end of 2024 per data from Atlas Public Policy. The 64% is likely an underestimate since some site visits occurred in previous years. Also, the Evaluation Team was not able to get a count of vehicles at approximately 10% of the sites visited. The calculation does not include approximately 400 off-road vehicles verified by the Evaluation Team.

2.3.1. Medium-Duty and Heavy-Duty Vehicle Sales

Figure 10 shows the growth of MDHD on-road fleet EVs in California from 2019 to 2024. Due to limited data availability, off-road MDHD vehicles are not shown. From 2019 to 2024, a total of 13,496 Class 2b to 8 MDHD fleet EVs were sold in California. Over the past six years, the BEV sales percentage for the MDHD fleet Class 2b to 8 market has increased from 0.18% in 2019 to 6.5% in 2024. Notably, nearly half (48%) of the cumulative sales occurred in 2024 alone, reflecting a significant recent market acceleration, unlike the LDV markets' stagnation since 2023. Of the 13,496 MDHD fleet vehicles, 10,423 are Class 2b vehicles and 3,073 are Class 3–8 vehicles.¹¹

In 2024, 6,541 Class 2b to 8 MDHD BEVs were sold to fleets in California, up from 3,737 in 2023. This reflects an increase of 2,804 vehicles, or a nearly doubling of sales within a single year (approximately 75% year-over-year increase). Among 2024 MDHD BEV sales, the largest share came from Class 2b, which accounted for 73.9%. The remaining shares were distributed across Class 8 (8.2%), Class 3 (7.9%), Class 6 (3.6%), Class 7 (2.7%), Class 4 (2.4%), and Class 5 (1.3%). When considering BEV sales as a percentage of the total 2024 market (including internal combustion engine [ICE] vehicles), BEVs made up 1.6% of Class 3 sales, 3.6% of Class 4, 1.2% of Class 5, 4.0% of Class 6, 9.7% of Class 7, and 4.8% of Class 8 sales.

Figure 10. 2019–2024 On-Road, MDHD Fleet BEV Sales in California (Class 2b^a–8)



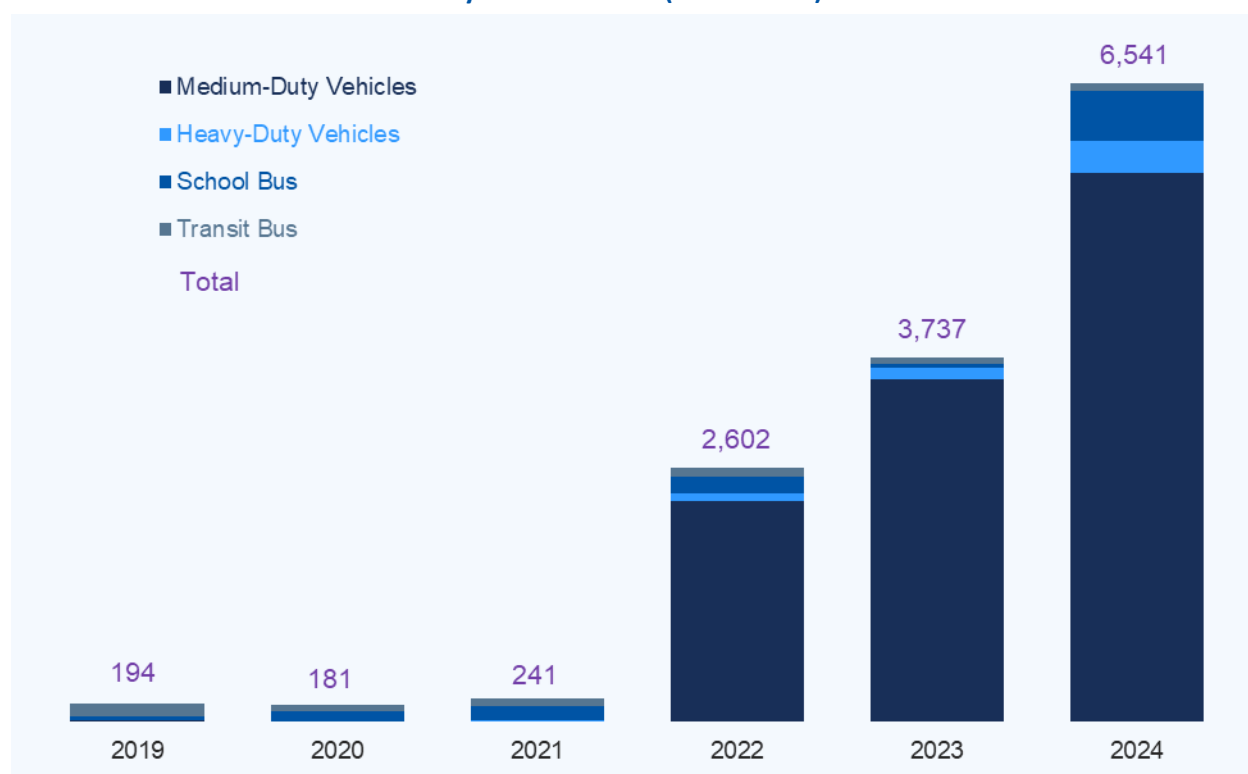
Source: Atlas Public Policy

^a Class 2b includes 10,423 vehicles classified as fleet vehicles

¹¹ Based on Atlas Public Policy; the Evaluation Team assumes that 50% of Ford F-150 Lightning Extended Range and Chevrolet Silverados are commercial fleet vehicles, while excluding Class 2b and 3 Rivian R1T, Rivian R1S, Cadillac Escalade IQ, Hummer EV, Sierra EV, and Tesla Cybertruck as these are considered personal vehicles.

Figure 11 shows the annual sales of MDHD BEVs in California from 2019 to 2024, segmented by market sector.¹² In 2024, medium-duty vehicles represented the largest share of the on-road market sectors, followed by school buses, heavy-duty vehicles, and then transit buses. Over the past six years, most of the sales growth has occurred in the medium-duty vehicle market sector, driven largely by Class 2b cargo vans and pickup trucks. Since 2022, the medium-duty vehicle market sector has added 11,409 BEVs to California’s roads and has experienced consistent yearly growth, including a 60.3% increase from 2023 to 2024. While the heavy-duty vehicle, school bus, and transit bus market sectors have recorded lower total sales volume, they have exhibited higher relative growth. From 2023 to 2024, school bus sales increased 9.3-fold, heavy duty-vehicle sales nearly doubled, and transit bus sales increased by 10.8%.

Figure 11. 2019-2024 On-Road, MDHDs Fleet BEV Registrations in California, by Market Sector (Class 2b^a–8)



Source: Atlas Public Policy

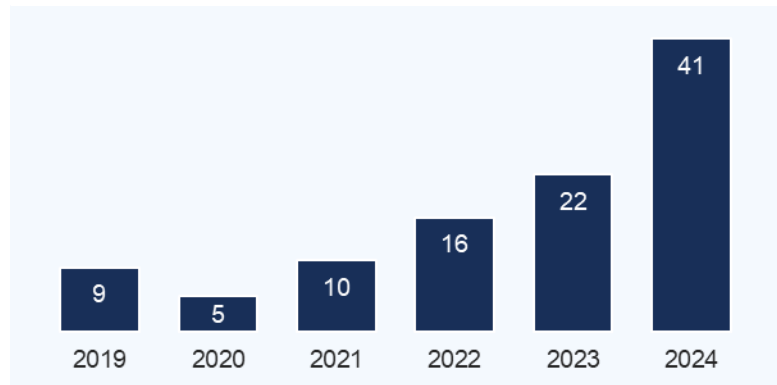
^a Class 2b includes 10,423 vehicles classified as fleet vehicles

¹² The Evaluation Team categorizes Class 2b fleet vehicles as medium-duty vehicles.

2.3.2. MDHD Models

Figure 12 depicts the number of distinct models in California's 2024 MDHD market. In 2024, California had 41 unique models of MDHD BEVs, which is 19 more than in 2023. Within the market sectors in 2024, the heavy-duty vehicles offered 11 unique models, medium-duty vehicles offered 20 unique models, school buses offered five unique models, and transit bus offered five unique models.

Figure 12. 2019-2024 Unique MDHD BEVs Models for Sale in California (Class 2b^a-8)



Source: Atlas Public Policy

^a Class 2b includes 10,423 vehicles classified as fleet vehicles

Table 9 exhibits Class 2b to 8 fleet MDHDs sold in California in 2024 by make/model. The data presented below excludes registrations of vehicles for personal use. Table 9 maintains the trend shown in Figure 10, for 2024, in which the medium-duty market sector accounts for the largest number of registered commercial MDHD Class 2b to 8 vehicles in California, followed by school buses, heavy-duty vehicles, and then transit buses.

Table 9. Commercial Class 2b ^a through Class 8 MDHD EVs Sales by Make/Model in 2024 in California

Make	Model	Class	Market Sector	2024 Sales
Battle Motors	LNT	Class 6	Medium-Duty	1
Blue Bird	All American/All Canadian	Class 6	School Bus	146
BrightDrop (GM)	ZEVO 600	Class 2b/3	Medium-Duty	332
	ZEVO 400	Class 3	Medium-Duty	48
BYD	Electric Bus	Class 8	Transit Bus	4
	School Bus	Class 8	School Bus	60
Cenntro	Logistar-400	Class 4	Medium-Duty	157
Chevrolet	Silverado EV	Class 2b/3	Medium-Duty	950
Ford	E-Transit	Class 2b	Medium-Duty	858
	F-150 Lightning (Ext. Range)	Class 2b	Medium-Duty	2,577
Freightliner	B2 106	Class 7/8	School Bus	20
	eCascadia 116	Class 8	Heavy-Duty	91
	EM2 106	Class 7/8	Medium-Duty	25
	MT50E	Class 7	Medium-Duty	24
Gillig	Low Floor Bus	Class 7	Transit Bus	26
IC Corporation	CE School Bus	Class 7/8	School Bus	271
International	EMV	Class 7/8	Medium-Duty	22
Isuzu	NRR	Class 5	Medium-Duty	18
Karsan	Jest	Class 3	Medium-Duty	15

Make	Model	Class	Market Sector	2024 Sales
Kenworth	K270E	Class 6	Medium-Duty	9
	K370E	Class 7	Heavy-Duty	4
	T680	Class 8	Heavy-Duty	29
Mack	LR600	Class 8	Heavy-Duty	2
Mercedes-Benz	eSprinter	Class 2b	Medium-Duty	52
New Flyer	Xcelsior	Class 8	Transit Bus	26
Nova Bus	LFS	Class 8	Transit Bus	1
Peterbilt	520EV	Class 8	Heavy-Duty	10
	220EV	Class 6/7	Heavy-Duty	3
	579EV	Class 8	Heavy-Duty	2
Ram	Promaster EV	Class 2b	Medium-Duty	5
Rivian	EDV 500	Class 2b	Medium-Duty	4
	EDV 700	Class 2b	Medium-Duty	512
Rizon	FEC9KS	Class 5	Medium-Duty	37
Tesla	Semi	Class 8	Heavy-Duty	2
Volvo	VNR	Class 8	Heavy-Duty	167
Workhorse	W56	Class 6	Medium-Duty	3
Total Class 2b through Class 8 MDHD EVs				6,541

Source: Atlas Public Policy

^a Class 2b includes 10,423 vehicles classified as fleet vehicles

2.3.3. Charging Infrastructure Deployment

The CEC estimates there are 16,173 active and under-development MDHD charging stations in California. Of these, the CEC approximates that 14,129 charging ports are MDHD private sites and 2,044 are public.¹³ For comparison, the MDHD charging stations accounted for in this evaluation account for 3,614 activated ports PTD and roughly 6,600 additional ports in the pipeline. The 3,614 MDHD activated ports from the Utilities make up roughly 22.4% of the total estimation reported by the CEC.

2.4. Policy and Legislative Landscape

The 12 Utility programs are a part of a broader policy framework designed to increase EV adoption through various measures such as regulations and incentives. This section describes key policy changes at the federal and state levels in 2024, as well as a summary of recent utility filings across the United States directed at make-ready transportation electrification infrastructure. The EY2023 Evaluation Report covers policies enacted before 2024.¹⁴

¹³ California Energy Commission. MDHD ZEV Station Development in California. Data last updated February 23, 2024. Retrieved March 4, 2025 from <https://experience.arcgis.com/experience/f951c1433f804daea7f4c33c271aa935/>

¹⁴ Cadmus, Energetics, et al. October 2024. "Standard Review Projects and AB 1082/1083 Pilots: Evaluation Year 2023 (Year 3)." <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/sb-350-te/srp-ab10821083-2023-evaluation-report102024.pdf>

2.4.1. National-Level Policies and Programs

Federal actions in 2024 funded the policy agenda established in previous years, including the EV charging grants set forth in the Bipartisan Infrastructure Law (BIL) of 2021 and the updated tax credit provisions for transferability through the Inflation Reduction Act (IRA) of 2022.

In 2024 the BIL continued to fund the National Electric Vehicle Infrastructure (NEVI) Formula Program and the Charging and Fueling Infrastructure (CFI) Discretionary Grant Program. These investments impact more than just the personal LDV market as they provide BTM charging infrastructure and charging equipment funding for light-duty, medium-duty, and heavy-duty fleets. In 2024, CFI awards (round 1b and round 2) across the United States accounted for \$1.157 billion in funding comprising 83 community grant project awards and 17 corridor grant project awards and 57.4% of the funding awarded focusing on LDV charging, 26.4% on MDHD charging, and 16.2% on both. In 2024, California was awarded \$272.7 million from CFI awards (round 1b and round 2) with seven community grant project awards and four corridor grant project awards, of which 58.0% of the total \$272.7 million in funding are targeting MDHDs, 35.3% are targeting LDVs, and 6.7% are targeting both. To date, California has been awarded \$441.2 million (24.8% of the total awards of \$1.779 billion for all three rounds) from the first three rounds (round 1, round 1b, and round 2) of the CFI program, including 14 community grant project awards and seven corridor grant project awards, of which 52.9% of recipients are targeting MDHDs, 39.2% are targeting LDVs, and 7.9% are targeting both.

2.4.2. State Policy

California made investments in 2024 to build a larger and more reliable ZEV infrastructure. The CEC approved two major investment plans for allocating state funds over the next four years as a part of the broader Clean Transportation Program (CTP) for ZEV infrastructure for the 2023–2024 Investment Plan¹⁵ and the 2024–2025 Investment Plan¹⁶ in calendar year 2024 totaling \$3.3 billion.

The most directly relevant new initiative to the SB 350 Utility programs is D.24-09-020 (Decision Establishing Target Energization Time Periods and Procedure for Customers to Report Energization Delays), which the CPUC issued on September 12, 2024.¹⁷

¹⁵ CEC approves \$1.9 billion for 2023-2024 Investment Plan. <https://www.energy.ca.gov/news/2024-02/cec-approves-19-billion-plan-expand-zero-emission-transportation-infrastructure>

¹⁶ CEC approves \$1.4 billion for 2024-2025 Investment Plan. <https://www.energy.ca.gov/news/2024-12/cec-approves-14-billion-plan-expand-zero-emission-transportation-infrastructure>

¹⁷ CPUC Decision 24-09-020. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M540/K806/540806654.PDF>

Advanced Clean Fleets

On January 13, 2025, the California Air Resources Board (CARB) withdrew its request for a waiver and authorization for the Advanced Clean Fleets (ACF) Regulation. Although this milestone did not occur during EY2024, it impacts the majority of MDHD fleets operating in California. For more information on the ACF Regulation, refer to the more detailed description in the previous EY2023 report.¹⁸ Per the guidance on the CARB’s website,¹⁹ California will not enforce the parts of the ACF Regulation that need federal approval, such as those affecting high priority and drayage fleets. However, the regulation still applies to state and local government fleets.

This decision follows OIR R.24-01-018 and implements SB 410, also known as the Powering Up Californians Act. D.24-09-020 establishes new statewide energization targets for Electric Rules 15 and 16,²⁰ maintains the existing timelines set for Electric Rules 29 and 45 from Resolution E-247,²¹ sets statewide timelines for certain upstream capacity upgrade activities, and requires the Utilities to gain process efficiencies within their direct control to accelerate timelines. If the Utilities achieve the targeted timelines, the maximum timelines for grid connections could decrease by up to 49%. For upstream capacity upgrades, the Utilities are required to adopt timelines rather than targets due to the complexity of and lack of sufficient data for large infrastructure upgrades. Table 10 displays the new target and timeline guidance the CPUC will hold the Utilities to, starting from the date a customer requests energization. Additionally, D.24-09-020 provides customers with a new process for reporting energization delays when requesting new or upgraded service from the Utilities. The CPUC expects Phase 2 of the Energization proceeding to commence in 2025.

Table 10. D.24-09-020 New Energization Targets and Timelines for California Utilities

Energization Type	Average Energization Target (calendar days)	Maximum Energization Target (calendar days)	Maximum Timeline (calendar days)
Rule 29/45	182	335	N/A
Application Decision	10	45	N/A
Main-Panel Upgrade	30	45	N/A
New or Upgraded Circuit	N/A	N/A	684
Substation Upgrade	N/A	N/A	1,021
New Substation	N/A	N/A	3,242

¹⁸ SB350 Standard Review Projects and AB 1082/1083 Pilots Evaluation Report (Year 3). <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/sb-350-te/srp-ab10821083-2023-evaluation-report112024.pdf>

¹⁹ ACF. [Advanced Clean Fleets | California Air Resources Board](#)

²⁰ Electric Tariff Rules 15/16 – Distribution-Line-and-Service Extensions. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/electric-reliability/undergrounding-program-description/rule-20/cpuc-rule-20-undergrounding-programs-current-proceeding-r1705010/electric-tariff-rules-15-and-16-distribution-line-and-service-extensions>

²¹ CPUC’s Resolution E-247. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M500/K043/500043680.PDF>

Table 11 provides a historical overview of important and significant legislation, policies, and programs in California relevant to transportation electrification.

Table 11. Legislation, Policy, and Program History of Transportation Electrification in California

History of Transportation Electrification by Year	
Key:	
CA Executive Orders	CEC Programs
CA Legislative Actions (SB and AB)	CPUC Orders Instituting Rulemaking (OIRs), Decisions, and Resolutions
CARB Regulations and Programs	Other
Pre-2015	(2012) EO B-16-12: 1 million ZEVs by 2025 (2006) AB 32: Global Warming Solutions Act (2008) SB 375: Sustainable Communities and Climate Protection Act (2009) SB 626: Evaluate policies to develop charging infrastructure (2009) CARB Approves Low Carbon Fuel Standard (LCFS) (2009) CARB begins Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP) (2010) CARB begins Clean Vehicle Rebate Project (CVRP) (2011) CARB begins implementing LCFS (2012) CARB adopts Advanced Clean Cars I for model years 2015–2025 (2009) CPUC OIR R.09-08-009 (2011) CPUC D.11-07-029 addressed a range of EV policy issues (2013) CPUC D.13-06-014 extended the treatment of EV charging costs (2013) CPUC OIR R.13-11-007 (2014) CPUC D.14-12-079 adoption of rules to expand EV infrastructure (2014) CPUC D.14-12-083 directed the investor-owned utilities (IOUs) to receive credits for electricity and natural gas sold as a fuel (2012) \$102.5 million NRG settlement to deploy EV charging infrastructure
2015	SB 350: Clean Energy and Pollution Reduction Act of 2015, which enacted Public Utilities Code Section 740.12.1 requiring the CPUC, CEC, and CARB to support the acceleration of widespread TE CARB approves readoption of LCFS
2016	CARB begins implementing readoption of LCFS CPUC D.16-01-023 authorized \$22 million for SCE Charge Ready Pilot CPUC D.16-01-045 authorized \$45 million for SDG&E Power Your Drive Pilot CPUC D.16-12-065 authorized \$130 million for PG&E EV Charge Network pilot
2017	AB 1082: EV Charging Infrastructure: Schools and Educational Institutions AB 1083: EV Charging Infrastructure: State Parks and Beaches CEC Electric Vehicle Infrastructure Project (CALeVIP 1.0) Launched VW settlement requires Electrify America to invest \$800 million in California

History of Transportation Electrification by Year	
2018	EO B-48-18: 5 million ZEVs by 2030, 250,000 chargers by 2025 SB 1014: Clean Miles Standard and Incentive Program: ZEVs SB 1000: EV Charging Infrastructure AB 2127: EV Charging Infrastructure: assessment CARB approves amendments to LCFS CPUC 18-12-006 authorized SCE to spend an additional \$22 million CPUC OIR: R.18-12-006, DRIVE Rulemaking CPUC D.18-01-024 approved the first TE applications under SB 350 CPUC D.18-05-040 approved \$738 million for Utilities' Standard Review Projects (SRP) CPUC D.18-09-034 authorized TE funding for Bear Valley, Liberty, and PacifiCorp
2019	SB 676: EV-Grid Integration CPUC D.19-08-026 approved \$107 million for SDG&E MDHD & V2G school bus CPUC D.19-09-006 authorized \$4 million for PG&E low- and moderate-income (LMI) customers CPUC D.19-10-055 authorized PG&E subscription-based EV rate CPUC D.19-11-017 approved pilots for EV charging at schools, parks, and beaches
2020	EO N-79-20: 100% Light-duty ZEV sales by 2035; 100% MDHD ZEV sales by 2045 AB 841: TE and School Energy Efficiency Stimulus Program CARB approved Advanced Clean Trucks (ACT), ZEV sales requirements CPUC D.20-08-045 authorized \$436 million for SCE on Charge Ready program CPUC D.20-09-025 clarified that EVSPs for MDHD are not public utilities CPUC D.20-12-023 established SDG&E's rate for separately metered EV CPUC D.20-12-027 directed utilities to spend LCFS credits on equity programs CPUC D.20-12-029 implementation of SB 676
2021	CARB adopts Clean Miles Standard for Transportation Network Companies CEC Funded CALeVIP 2.0 Launched CPUC D. 21-04-014 approved \$43.5 million for SDG&E on a pilot extension CPUC D.21-07-028 established near-term priorities for utility investment CPUC D. 21-11-017 authorized PG&E to offer an optional day-ahead rate CPUC D.21-12-033 extended common treatment policy for PEVs CPUC Resolution E-5175 clarified EVSE communications protocols CPUC Resolutions E-5167 and E-5168 established new EV Infrastructure rules
2022	AB 2061: Requires the CEC to develop uptime recordkeeping and reporting standards for EV chargers and charging stations CARB adopts Advanced Clean Cars II for model years 2026–2035 CPUC R.22-07-005 widespread demand flexibility through electric rates CPUC D.22-08-024 authorizes Plug-In EV Submetering Protocol CPUC D.22-11-040 adopted a long-term TE policy framework CPUC D.22-12-054 authorized \$52.2 million for PG&E's EV Charge 2 program CPUC Resolution E-5192 approved \$11.7 million for PG&E's vehicle-grid integration (VGI) pilots CPUC Resolution E-5227 approved SCE's low port rebate proposal CPUC Resolution E-5236 approved SCE programs from LCFS Holdback credits CPUC Resolution E-5247 establishing an energization timeline

History of Transportation Electrification by Year	
2023	SB 123: Harmonizes requirements between EVSE requirements and the NEVI Program SB 410: CPUC to establish reasonable energization time periods AB 50: CPUC to establish criteria for customers to receive timely energization CARB approves ACF CARB closes new enrollments to the CVRP CPUC R.23-12-008 establishes venue for TE policy and closes 18-12-006 CPUC Resolution E-5257 approved modifications to PG&E and SCE's <i>per se reasonableness</i> metrics
2024	SB 59: Authorizes the CEC to require any weight class BEV to be bidirectional capable AB 2697: Requires the CEC to apply network roaming standards to only major EV charging network operators AB 2037: Authorizes counties to test reliability of EVSE and provides leeway to issue fines for broken chargers EPA grants waiver for CARB's Advanced Clean Cars II CEC approves \$3.3 billion for Clean Transportation Program CPUC D.24-09-020 establishes target energization timelines and procedures to report delays

2.4.3. Alternative Funding Paths

Since the initiation of the Utility programs, MDHD fleets in California have gained access to a number of new funding paths for TTM, BTM and/or EVSE infrastructure. The most notable overlapping programs are the Utilities' EV Infrastructure Rules (Rule 29 at SCE and PG&E and Rule 45 at SDG&E) and the CEC's EnergIIZE program. Table 12 below compares these programs across a number of dimensions.

Table 12. Comparison of SRPs, EV Infrastructure Rules, and EnergIIZE Program

	Standard Review Projects	EV Infrastructure Rules	CEC EnergIIZE Program
Sponsor	SCE, PG&E, SDG&E	All Utilities in California	CEC
Budgeted	\$687M	Per Resolutions E-5167 and E-5168, costs are recovered through general rate cases and budgeted through a Memorandum Account.	\$544M (\$90M conditionally awarded by Oct 2024)
Duration	2019–2026	2022 onward	2022 - 3/31/2026
Eligible Expense	TTM, BTM, EVSE ^a	TTM	BTM, EVSE, H2 refueling
Eligible Participants	Commercial on-road, off-road fleets with Class 2b to Class 8 vehicles	Commercial on-road, off-road fleets; multifamily buildings	Commercial on-road, off-road fleets with Class 2b to Class 8 vehicles
DAC Requirements	40% of spending in DACs	None	60% of spending in DACs
Stackable Funding	Cannot be stacked with Rule 29/45	Cannot be stacked with SRPs	Stackable with other federal and Utility programs ^b
Activated MDHD Sites	220	Not available from Utilities broken out for MDHD sites	34 ^b

	Standard Review Projects	EV Infrastructure Rules	CEC EnergIIIZE Program
Activated Ports	3,614	Not available from Utilities broken out for MDHD sites	299

^a EVSE eligible expenses are only available to MDHD customer sites located in a DAC and not on the Fortune 1000 list, as well as transit and school bus fleets regardless of DAC site status.

^b The Evaluation Team reviewed data from the CEC EnergIIIZE program and found that 59% of sites in that program were also enrolled in SRP.

2.5. Barriers to MDHD Vehicle Electrification

This is a new section in this year's Evaluation report that explores why the MDHD market has been slower to develop than was anticipated in the original CPUC decisions in 2018 and 2019.²² Public charging programs are not discussed in this section.

2.5.1. Progress Toward Site and Vehicle Goals

Figure 13 shows progress toward the combined *per se reasonableness* site (left) and vehicle (right) targets. Solid lines depict actual historical data. Dashed lines show projections made by the Evaluation Team.²³ The methodology behind these curves is described in *Appendix B*.

²² In its original decisions in 2018 (Decision 18-05-040) and 2019 (Decision 19-08-026), the CPUC required 870 sites for Charge Ready Transport, 700 sites for PG&E EV Fleet, and 300 sites for SDG&E PYDFF. Additionally, the CPUC required 8,490 vehicles for SCE Charge Ready Transport, 6,500 vehicles for PG&E EV Fleet, and 3,000 vehicles for SDG&E PYDFF. Those site goals have been lowered to 500 for SCE Charge Ready Transport and 375 for PG&E EV Fleet (Resolution E-5257, Resolution E-5347).

²³ Contracted sites are projected using an average of number of signed contracts for the previous three years (2022-2024). Activated sites are projected using the contracted site trend line and assuming a 10% drop-out rate between contracted sites and activated sites and a three-year lag between contract signing and activation. VAP projections use an average VAP count for the previous three years (2022-2024). Projected vehicle deliveries use estimates in the VAPs filed by program participants, accounting for 5-year VAPs of PG&E EV Fleet and 10-year VAPs for the other two programs.

Figure 13. Utility Program Progress Toward Site and Vehicle Targets

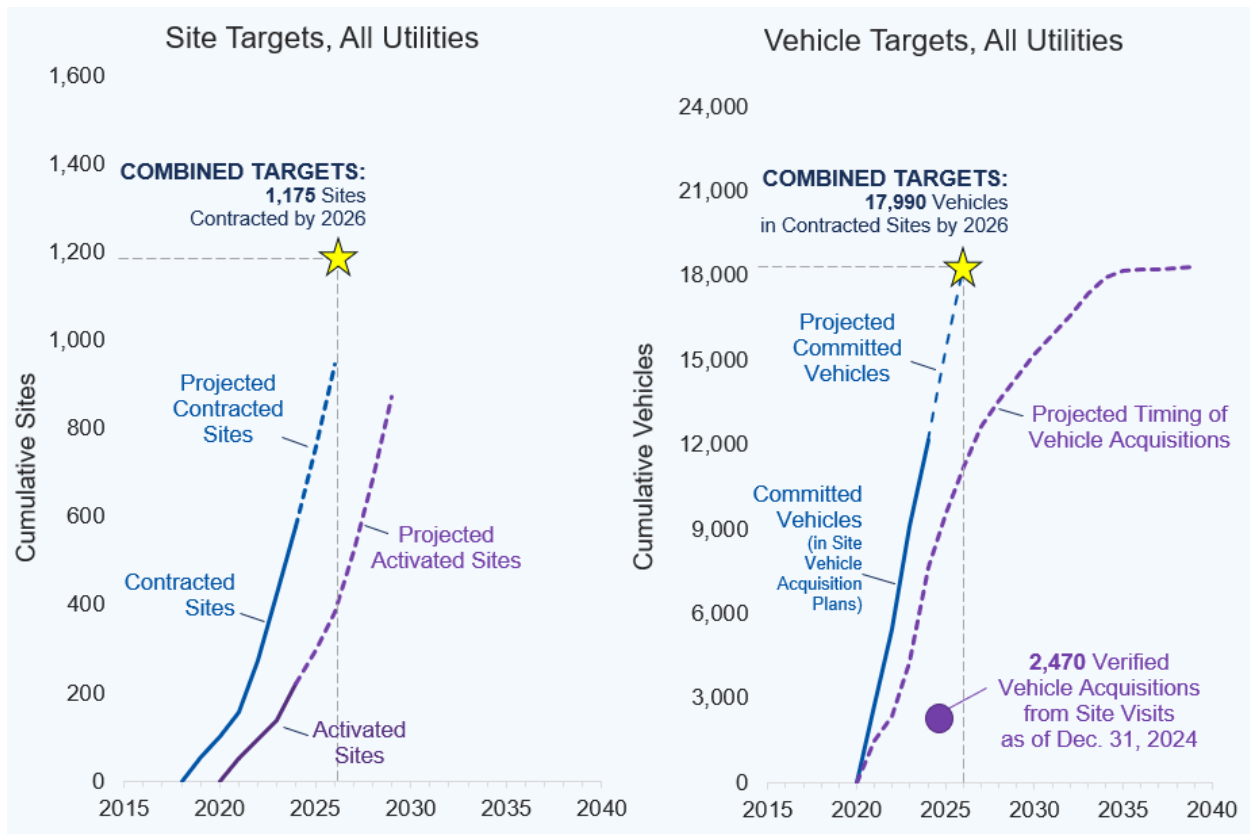
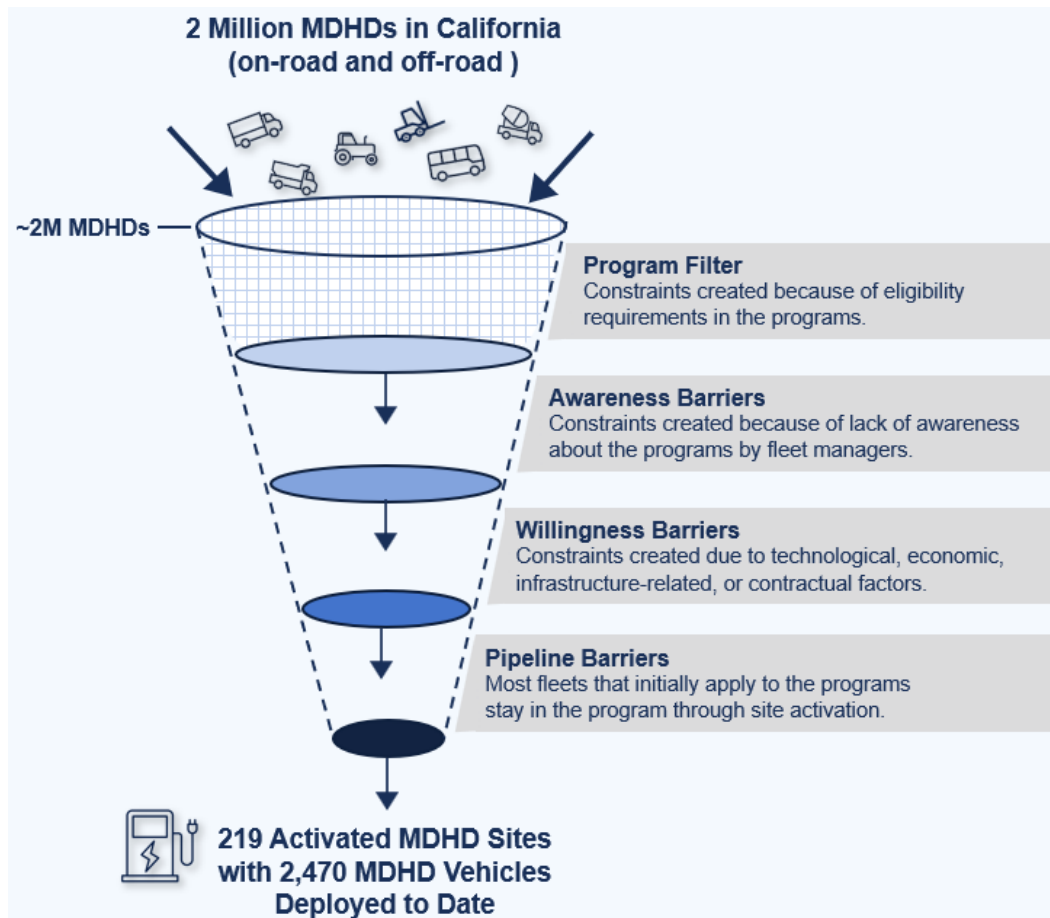


Figure 13 provides several insights: First, together the programs are on track to meet the combined vehicle targets but not their combined site targets. Figure 13 also highlights the long lead time between a site signing a contract with the Utility and acquiring the last of its planned vehicles. This long lead time is driven by a 3+ year activation timeline plus a 5-year or 10-year VAP (depending on the Utility). In other words, for MDHD programs that end in 2026, the last vehicles will not be delivered until the late 2030s.

2.5.2. Funnel Framework

The Evaluation Team developed a conceptual framework to illustrate barriers that reduce program participation (Figure 14).

Figure 14. Conceptual Diagram of Barriers to MDHD Program Participation



At the top of the funnel are all MDHD Class 2b–8 vehicles in California—approximately 2.2 million on-road and off-road vehicles. At the bottom are the 219 activated sites that currently support an estimated 2,470 deployed MDHD vehicles in the Utility programs.²⁴ Between these end points are a set of barriers that lower the program participation rate, discussed below. The diagram is conceptual in nature. In reality, the stages in the filter may not follow a linear, step-by-step process.

Program Filter

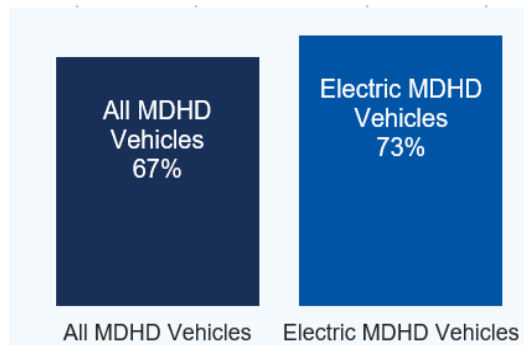
The program filter barriers are created by eligibility requirements of the Utility programs. Below, several such barriers are discussed and quantified when feasible.

²⁴ This is likely an undercount since some of the vehicles were verified by the Evaluation Team during site visits in previous years, and fleets have likely increased their vehicle counts.

Service Territory

To enroll in the MDHD programs, fleets must be located in the service territory of SCE, PG&E, or SDG&E. These three territories cover roughly 78% of the land area in California, serve 79% of California’s population, and encompass 67% of the registered on-road MDHD vehicles.²⁵ This service territory constraint reduces the number of eligible participants from the full pool of California MDHDs. Figure 15 shows the fraction of Class 2b to Class 8 vehicles that are included in the Utility territories. As shown, the share of California electric MDHD vehicles in these territories is six percentage points higher than the share of all MDHD vehicles in Utility territory.

Figure 15. Share of Total MDHD Vehicles Inside Utility Service Territories



2+ Vehicle Requirement

The Utility MDHD programs require fleets to commit to acquiring at least two EVs. Some MDHD fleets, especially small businesses, own a single vehicle and may not agree to acquire at least two EVs. We estimate that 84% of the state’s MDHD vehicles—and 78% of the total vehicle parking locations—belong to fleets with only two or more vehicles.²⁶ One fleet manager interviewee communicated that having already purchased EVs and EVSE they could not expand their fleet further to meet the program requirements.²⁷

Approved Product List

The Utility programs require fleets to choose from a set of vendors on the Utilities’ approved product lists (APLs). These lists have less than half of vendors offering EVSE in the United States.²⁸ Through interviews with staff from all three Utilities, the Evaluation Team learned that the APL creates a barrier to participation for some fleets who have a preferred EVSE vendor that is not on the APL.

Cost Threshold

The Utilities use a maximum cost per site and cost per vehicle threshold in alignment with their site and vehicle goals to screen customer applications. Cost thresholds are based on the available funding remaining in the program budget divided by the number of sites or number of vehicles. Sites with cost estimates that exceed these thresholds are encouraged by the Utilities to enroll in Rule 29 or Rule 45.

²⁵ MDHD vehicle percentage estimated using 2023 data in the CARB EMFAC tool. Vehicle types included are Class 2b trucks, Class 3, 4, 5, 6, 7, 8 vehicles and buses. This excludes mobile homes and other Class 2 vehicles.

²⁶ EMFAC Database using 2023 vehicle populations. <https://arb.ca.gov/emfac/fleet-db/9b44758fdcc351a75c8183fb51d804ffcba04f60>

²⁷ Five interviews with fleet managers that dropped out of the program were conducted.

²⁸ Estimated by comparing EPRI’s APL list to the SB 350 APL. <https://www.epri.com/vpl>

According to interviews with Utility staff, these thresholds limit the number of potential program applicants, although staff did not quantify the magnitude of this barrier.

Other Constraints

In interviews with Utility staff and fleet managers, a number of other eligibility-related barriers were identified, including the requirement to use International Brotherhood of Electrical Workers (IBEW) signatory labor during site development, the requirement to maintain the infrastructure for at least 10 years, and the requirement to allow a property easement.

Awareness Barrier

Even if fleets are eligible for a Utility program, they will not participate if they lack awareness about the programs. Awareness is a well-recognized constraint to EV adoption and is defined as having a low existing knowledge base about the programs or low ability to access or acquire knowledge about the programs.

To understand the level of awareness of eligible fleets in the service territory, the Evaluation Team interviewed Utility staff in charge of developing new leads for program participants. While the Utilities track metrics such as number of leads and lead conversion rates, they do not track the percentage of fleets in their service territory who are aware of their program.

The primary mechanisms for building awareness of the programs included program websites, online interest forms, webinars, conference/workshop presentations, and in-person events. Across the three Utilities, staff highlighted these specific awareness-related initiatives, which we discuss in subsequent sections of this report:

- **SCE** staff reported they focused on identifying vehicle application and industry segments with a high likelihood conversion, as well as targeted approaches for those segments. The top three organizations of interest were schools, municipalities, and transit agencies. One approach used by SCE to address uncertainty around conversion to EVs was to build a webinar series that built attendee understanding of specific topics with live question-and-answer sessions.
- **PG&E** staff reported a shift to more in-person events this year. The PG&E team found that experiential events such as ride and drives as well as events focused on technology and applications rather than regulatory topics had greater impact in developing leads and applicants for the program. PG&E staff also utilized a brand ambassador campaign, which engaged 570 businesses. The PG&E team reported that they were fine-tuning lead conversion from this campaign.
- **SDG&E** staff noted their annual EV Fleet Day event was a major source of lead generation. They also noted they conducted outreach through organizations such as the Chamber of Commerce and port tenant groups, in both English and Spanish. Presentations in Spanish improved attendee engagement. Additionally, SDG&E staff noted that 12 cross border trade fleets had expressed interest in the program, and the team is building their capacity to service that fleet community.

Willingness Barrier

For a variety of reasons discussed below, only a subset of fleets that are eligible and aware of the MDHD programs will participate. Factors that impede willingness to participate are centered on the technology, economic, and infrastructure issues or concerns. This section presents high-level insights drawn from the participant survey of PG&E and SCE participants; the source of these insights will be referred to as survey respondents. Additionally, this section draws insights from interviews conducted with five fleet managers that dropped out of the program to highlight critical factors impacting their willingness to participate. These insights will be referred to as fleet manager interviewees. More detailed information on the results of that survey and the dropout interviews can be found in the respective program findings sections.

Economic Factors

High up-front cost of EVs, EVSE, and charging infrastructure. The cost of EVs, relative to the cost of alternatives, across all vehicle classes is a key barrier to fleet electrification. This cost difference is reflected in the cost premium for EVs in comparison to traditionally fueled vehicles, as well as the associated costs for charging infrastructure. Figure 16 shows this cost differential between generic, electric and diesel Class 3 to 8 vehicles as estimated by the National Renewable Energy Laboratory (NREL).²⁹ The premium for EVs increases (as a percentage) as vehicle class rises. Note, the Evaluation Team does not collect vehicle costs as part of this evaluation.

This barrier was noted in multiple interviews held by the Evaluation Team. Staff at two (of three) Utilities and three (of six) fleet managers stated in phone interviews that high up-front costs associated with fleet electrification, relative to ICE alternatives, prevented greater program participation. Two of the six fleet managers interviewed mentioned that vehicle incentive levels do not go far enough to defray fleet electrification costs.

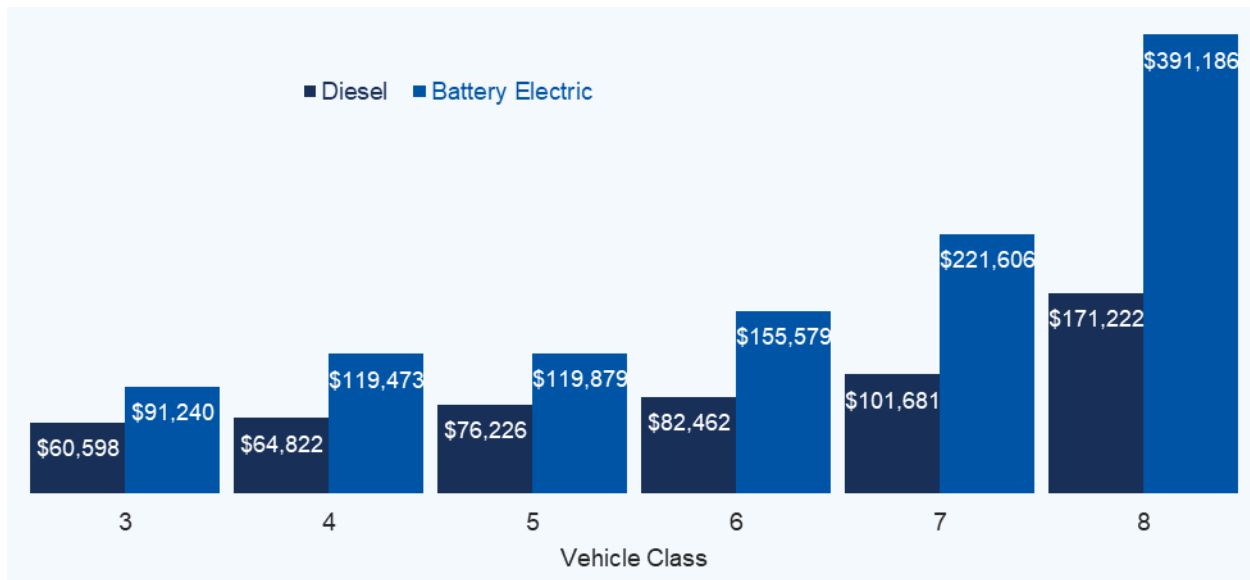
The up-front cost barrier is also reflected in fleet manager surveys. Prior to program participation, 15 of 24 survey respondents indicated that EV costs were a key willingness barrier, and 16 of 24 respondents indicated the same barrier for EVSE costs. After participating in the program, the number of respondents indicating that EVSE costs were a key barrier dropped to nine and the number of respondents indicating that EV costs were a barrier dropped to nine as well. This indicates that while the program did lower the barrier posed by the high up-front cost of EVs and EVSE, the cost barrier remained a key consideration for some respondents.

Differences between EV and CNG Transit Buses

In an evaluation of 28 electric transit buses at three transit agencies in 2023, NREL found that electric transit buses were \$370,081 more expensive than CNG equivalents and \$792,663 more expensive than modeled diesel buses.

²⁹ This figure uses the 2023, constant scenario from NREL's 2024 *Transportation Annual Technology Baseline* (ATB). <https://atb.nrel.gov/transportation/2024/technologies>

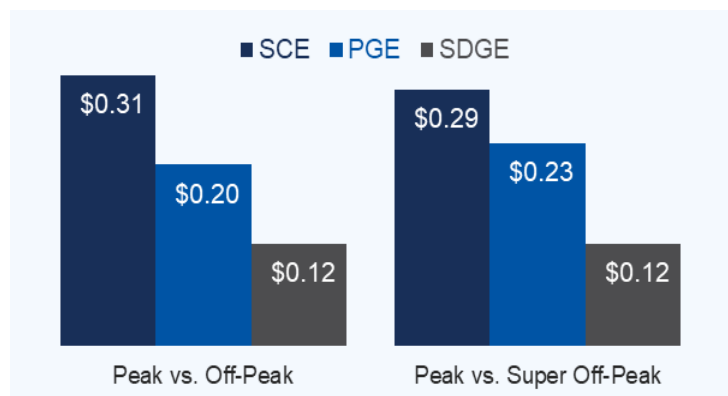
Figure 16. Comparison of 2024 Up-Front Modeled Cost for Diesel vs. BEVs



Uncertainty around regulations and program rules. One Utility staff interviewee asserted that uncertainty around implementation of the ACF regulations may delay or inhibit fleet electrification and program participation. A Utility representative highlighted that “a lot of industries are in the wait and see period,” due to uncertainty around regulatory enforcement. Two fleet manager interviewees also mentioned regulatory uncertainty as a barrier to participation. Additionally, two fleet manager interviewees emphasized they changed their procurement plans due to market uncertainty. One fleet manager emphasized that economic slowing, especially in the freight sector, magnified the financial risk associated with EVs, versus ICE vehicles.

Uncertainty around access to TOU rates. During an interview, one Utility staff member noted that some fleets are unable to take advantage of off-peak TOU rates due to long charge times and/or inflexible loads. As presented in Figure 17, the savings available to fleets by using the off-peak versus the peak pricing can be as high as \$0.31/kWh in SCE territory. These TOU rates are offered at different maximum monthly kilowatt demand levels and include subscription costs and over consumption fees not included in these prices. Survey results indicate that all fleet managers (24 respondents) are

Figure 17. Average Cost Difference in TOU Rates



For SCE, Super Off-Peak is available only in the winter, when peak demand rates are lower. Weekend peak rates are not represented here. These averages include winter and summer values.

SDG&E rates do not include EECC, WF-NBC, Schedule DWR-BC. The \$/kWh values are an average of all TOU rates offered by the Utilities.

aware of Utility TOU rates, but six respondents were not aware of the total costs of fleet charging for their company.

EV Fleet Costs: New Workforce Demands

One fleet manager interviewee highlighted that some fleets lack dedicated fleet management teams. Considering EV fleet management includes planning for route selection, charging needs, and time of use needs; workforce capacity gaps in some firms may require new departments or subcontractors. This may incur additional costs, not included in ICE or other technology alternatives operation, which may further erode the willingness of fleet managers to transition to EVs. Survey responses indicate fleets will need support in identifying new routes, available and functioning charging infrastructure, and in finding qualified drivers and technicians for their vehicles.

Technology Factors

Uncertainty around the ability of EV and EVSE technology to meet the needs of fleet owners. Despite efforts to provide educational resources, staff from two of the three Utilities noted in interviews that the current vehicles available do not always meet the needs of every vehicle type, especially heavy-duty or high mileage applications. Three fleet manager interviewees noted uncertainty around the ability of EVs to meet their fleet needs, and one interviewee highlighted uncertainty about the impacts of auxiliary equipment such as liftgates on vehicle range. One fleet manager communicated that uncertainty around long lead times between vehicle purchase and delivery presented a challenge for picking the correct technology and was a barrier to their participation. Six of 11 surveyed fleet managers noted that prior to program participation they were concerned about the EV range not matching the duty cycle mileage. Additionally, an equal number of respondents highlighted that en route charging would not meet their operational needs. Two fleet manager respondents said that after program participation, these concerns were mitigated. This may indicate the continued value of real world and business case examples when addressing willingness barriers.

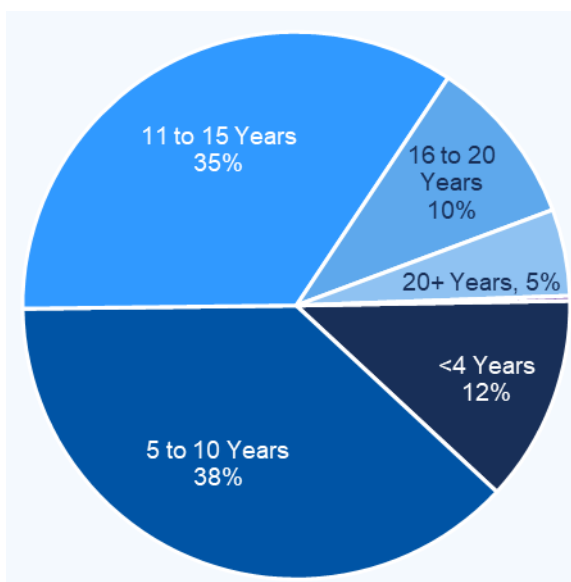
Uncertainty around the longevity of OEMs and EVSE firms: A Utility interviewee reported fleet managers felt uncertain about the ability of EV and EVSE vendors to support their fleet over the life of the product. Additionally, two fleet manager interviewees emphasized that uncertainty around charger and vehicle selection, especially with long lead times for actual delivery, necessitates improved guidance on these topics. Two fleet manager interviewees emphasized that the uncertainty around firms, as well as EV and EVSE technology as it evolves, is magnified by the long lead times between vehicle purchase and delivery as well as the long timeline between contract signing and site activation.

Perception of hydrogen as a key alternative. Two Utility interviewees noted that some fleets thought hydrogen was a better substitute for ICE vehicles which may negatively impact program participation. Similarly, two fleet manager interviewees highlighted that hydrogen and propane were better alternatives for their business model, relative to EVs.

Vehicle Depot and On-Route Charger Deployment

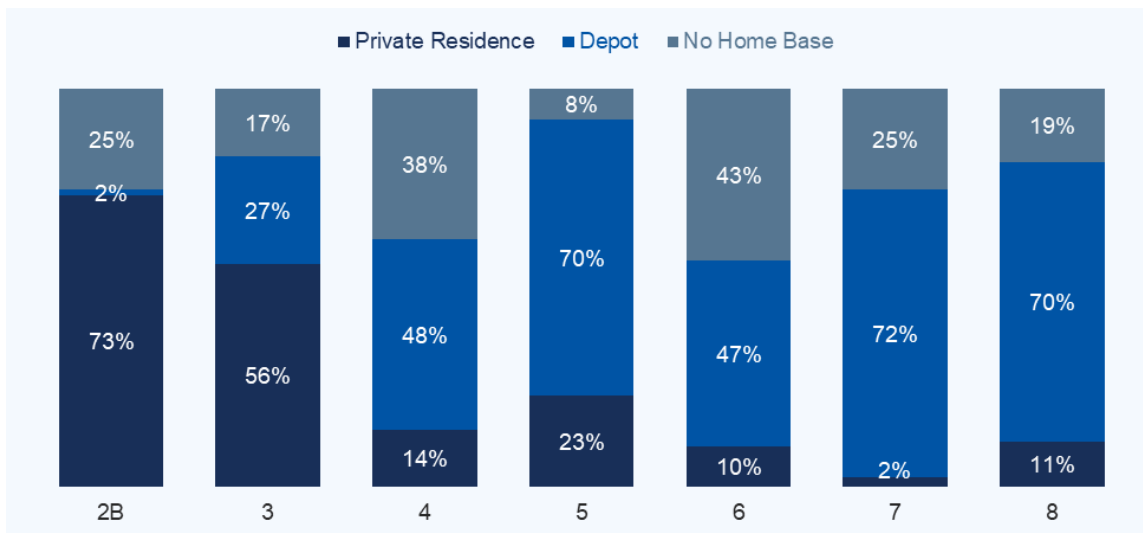
Land contractual factors: A large fraction of fleets lease the land of their depots, which means a fleet must collaborate with another party to participate in the programs. According to interviews with staff from two Utilities, a fleet owner's inability to install chargers due to renting, instead of owning, was a key willingness constraint. In a 2020 survey of MDHD fleets implemented by CARB, 56% of fleets reported owning (instead of leasing) the facility at which they parked their vehicles.³⁰ This survey included 1,866 fleets, 7,767 facilities, and 386,286 vehicles above 8,500 lbs. Additionally, as shown in Figure 18, the CARB survey estimates that 50% of land leases span 10 years or less, creating a challenge for long lead infrastructure and/or fleets needing to make 10-year VAPs.

Figure 18. Length of Fleet Leases in California



At-home parked vehicles: Vehicles parked at private residences are not eligible for the MDHD programs. As shown in Figure 19, the fraction of vehicles that park at homes varies by vehicle class. In total, 45% of California's MDHD vehicles are based at private residences according to data in the 2021 Vehicle Inventory and Use Survey (VIUS).³¹

Figure 19. Fraction of Class 2B to Class 8 Vehicles in California, by Home Base Location



³⁰ CARB 2022, Large Entity Reporting Statewide Aggregated Data. https://ww2.arb.ca.gov/sites/default/files/2022-02/Large_Entity_Reporting_Aggregated_Data_ADA.pdf

³¹ U.S. Department of Transportation, Vehicle Inventory and Use Survey from 2021. <https://www.bts.gov/vius>

Depot and on-route space constraints: Two Utility interviewees said that space availability at depots or the availability of on-route property to install chargers, was a factor in fleets’ willingness to participate. In addition to space, fleet owners noted other space-related factors were barriers to participation, such as the location of excess distribution capacity relative to their fleet parking location. One fleet owner and one Utility highlighted the positive impact that publicly accessible distribution capacity maps had on willingness to participate.³²

Pipeline Barrier

Pipeline barriers are any reason in which sites withdraw from the Utility programs between signing a contract and activation of the site. The average lead time between contract signing and site activation is more than three years across sites, providing opportunities for a fleet to change its electrification strategy. Across the three MDHD programs, a relatively small number of contracted sites withdraw from the programs, ranging from 6% to 14%. Of these, approximately 15% are because the fleet resubmitted an application with new plans or combined the application with another. The Evaluation Team conducted six interviews with fleets who had withdrawn from the programs—two from SCE and four from PG&E. These interviewees included representatives of a school district, a delivery vehicle site, a site for ride-hailing vehicles (some of which were medium-duty), a charging hub provider, a fleet of intermodal Class 8 trucks, a fleet of medium-duty pickup trucks. Two key themes emerged as reasons for program withdrawal: Large load studies revealing customer upgrades exceeded Utility cost thresholds and changing regulatory signals. We describe each below.

Customer Upgrade Demand Exceeding Utility Cost Thresholds

Two fleets that withdrew from the program did so after their Utility required a large load study. Both fleets stated that the load study indicated that their upgrades exceeded Utility cost thresholds. After completing the large load study, which interviewees said took four to six months following contract signing, the Utility informed both fleets that they would need to either lower their proposed load requirements or pursue service through EV Infrastructure Rule 29.

Shifting Regulatory and Administrative Landscape

Two fleets cited shifting regulatory requirements as their reason for withdrawal. Both fleets initially noted that the ACF regulation was a central driver for their interest in electrifying. When it became apparent that the ACF would no longer be enacted for commercial fleets, the two fleets withdrew from the program. One of the two interviewees further noted the change in the federal administration and the resulting uncertainty on long-term policy support for EVs was an additional factor.

All interviewees were aware of other stackable grant programs, such as CEC EnergyIIZE and those offered in certain air quality management districts. Five of the six interviewees were satisfied with the level of support they received from the Utilities.

³² For an example of a distribution capacity map, view the links in the Data Portal section on the CPUC website.
<https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/distribution-planning/data-portals-and-integration-capacity-analysis>.

3. Statewide MDHD Vehicle Findings

This section discusses statewide findings for school buses, transit buses, medium-duty vehicles, and heavy-duty vehicles across all Utilities' programs program-to-date. These four market sectors are the only market sectors with a sufficient number of sites (i.e., that meet the 15-15 Rule) to be isolated and discussed in detail. Other market sectors such as airport GSE do not meet the 15-15 Rule criteria.³³ This chapter is an important contribution to this evaluation report since policy makers, fleet managers, and other key stakeholders typically make fleet electrification and programmatic decisions for individual vehicle categories.

3.1. Summary Statistics

Table 13 shows the number of sites for five key program statuses (applications, contracts, activated, operational, and sites visited) for the four market sectors as of the end of 2024. Similar to prior evaluation years, the medium-duty vehicle sector received the greatest number of applications (393), but school buses lead in the number of activated sites with 85, compared with 50 for medium-duty vehicles, 47 for heavy-duty vehicles and 23 for transit buses.

Table 13. Sites by Program Status and Vehicle Category in the Program to Date

Market Sector	Applications ^a	Contracts	Activated	Operational	Sites Visited
School Bus	229	169	85	85	83
Transit Bus	69	55	23	23	21
Medium-Duty Vehicle	393	219	50	47	48
Heavy-Duty Vehicle	169	106	47	46	44

^a The count of applications excludes sites that have been cancelled or withdrawn.

Table 14 focuses in on activated sites across the same four market sectors by highlighting the total number of vehicles and ports for each sector. Although school buses dominate the programs thus far in terms of activated sites with 85, medium-duty vehicle and heavy-duty vehicle market sectors have more vehicles and ports. The transit bus sector has the fewest activated sites, vehicles, and ports of the four market sectors, with 23 sites, 275 vehicles, and 221 ports.

Table 14. Activated Sites, Vehicles, Ports by Vehicle Category in the Program to Date

Market Sector	Activated Sites	Vehicles	Ports
School Bus	85	1064	786
Transit Bus	23	275	221
Medium-Duty Vehicle	50	1400	970
Heavy-Duty Vehicle	47	1215	1071

³³ The 15-15 Rule protects customer privacy by limiting the reporting of metrics and data when an insufficient number of customers exist. In practice, this means certain metrics cannot be included in public reporting unless there are at least 15 sites and as long as no single site accounts for more than 15% of all energy consumption. More information on the 15-15 Rule can be found in Decision 14-05-016.

Figure 20 shows the difference between the sites' full VAP and the number of vehicles observed during site visits by market sector. The school bus and heavy-duty vehicle sector sites had the largest portion of the vehicles listed in their VAPs delivered in the first year after site activation (about half), while the medium-duty vehicle sector sites had the smallest portion (about one-quarter).

The Evaluation Team observes vehicles only once during initial site visits. The Team expects to observe fewer vehicles than the total specified in the site VAP, because not all vehicles are delivered upon site activation and additional vehicles are added as sites mature. However, actual vehicle counts have also been lower than the number of vehicles expected based on the VAP schedule (not shown in Figure 20). The Evaluation Team previously recommended that Utilities annually track and update customer VAP progress to ensure compliance. Two Utilities have implemented this recommendation. While the gap between actual and expected vehicles is not concerning at this time, closely monitoring sites in subsequent years will be important to ensure that customers are compliant with contracted VAPs.

Figure 20. Full VAP and Site Visit Observed Vehicles

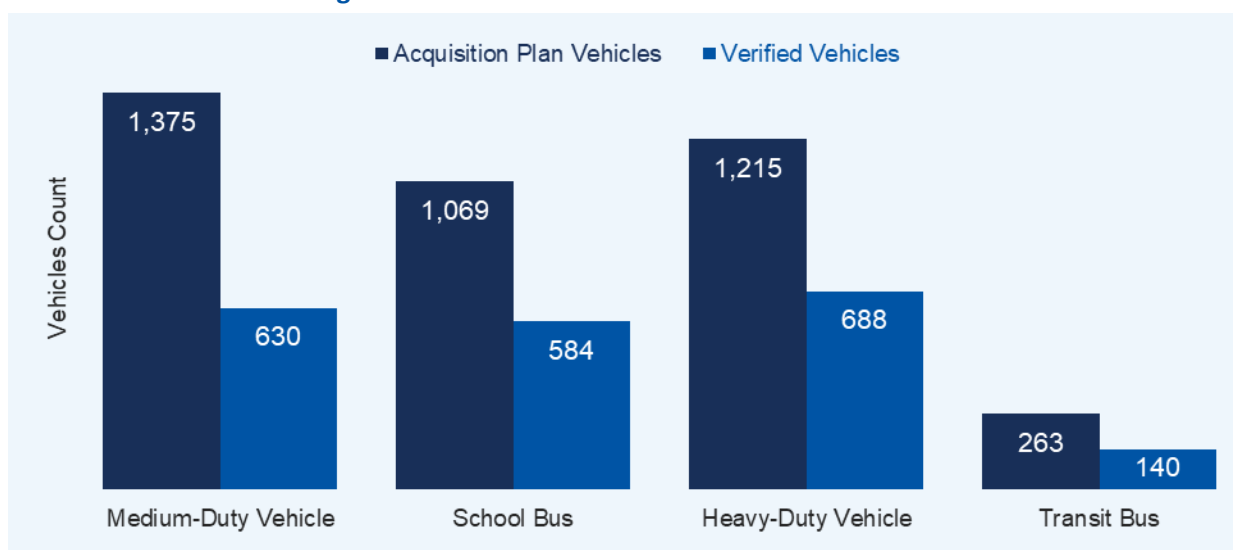
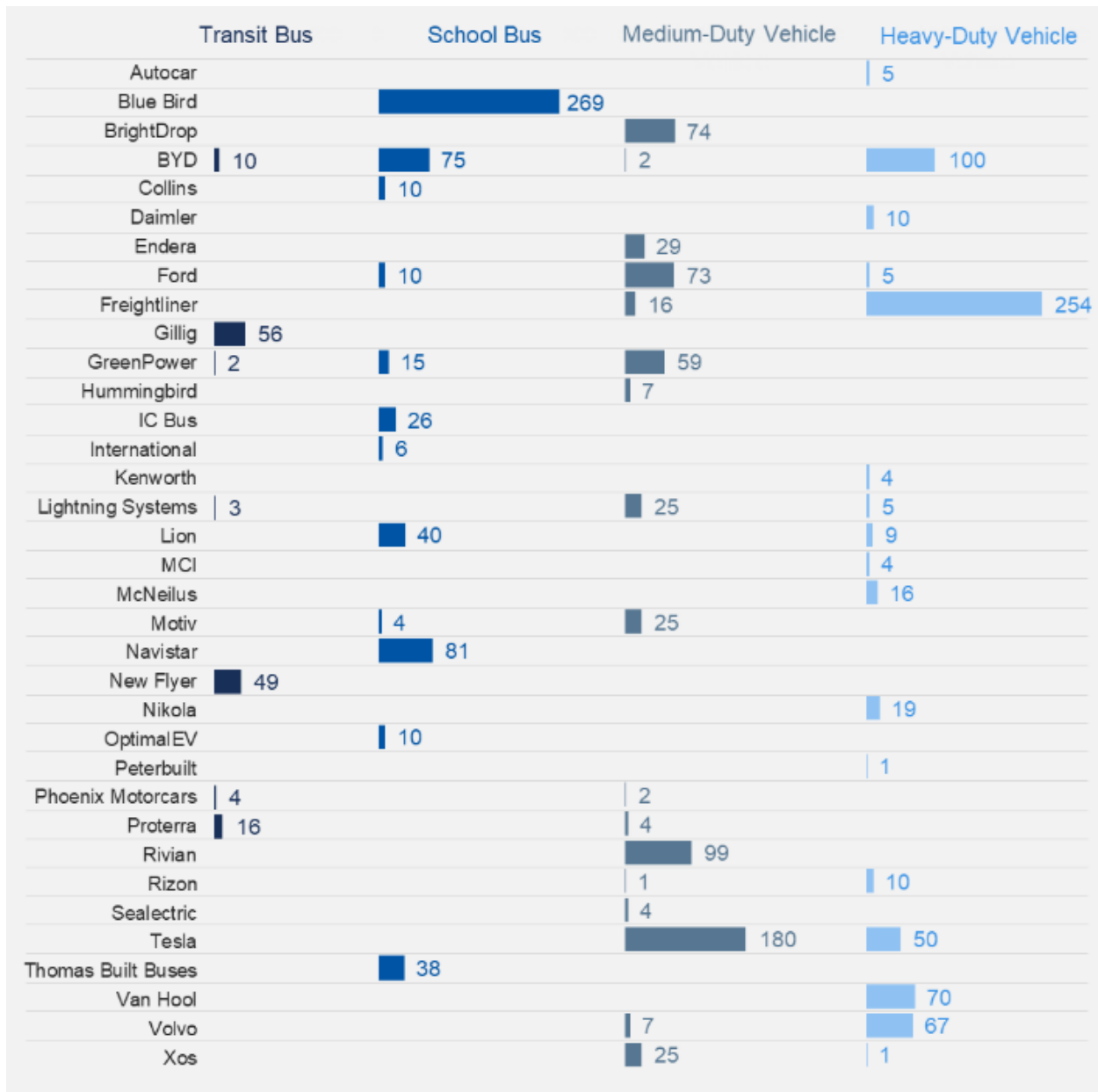


Figure 21 shows the vehicle make by market sector for all vehicles observed at activated sites in the program to date.

Figure 21. Vehicle Make by Market Sector for PTD Sites



3.2. Site-Activation Timelines

Table 15 shows the median calendar days for each CPUC program phase aggregated across the same four market sectors (school bus, transit bus, medium-duty vehicle, and heavy-duty vehicle) for EY2021, EY2022, EY2023, and EY2024. As shown in Table 15, overall median calendar days have been steadily increasing in each of the last three years. For example, the start-to-finish median calendar days in EY2021 was 600 days, compared to 725 days in EY2022, 862 days in EY2023, and 983 days in EY2024.

Large, complex projects such as MDHD sites inherently take longer than small sites to complete, and therefore overall activation timelines increase as these sites come online in later program years. The

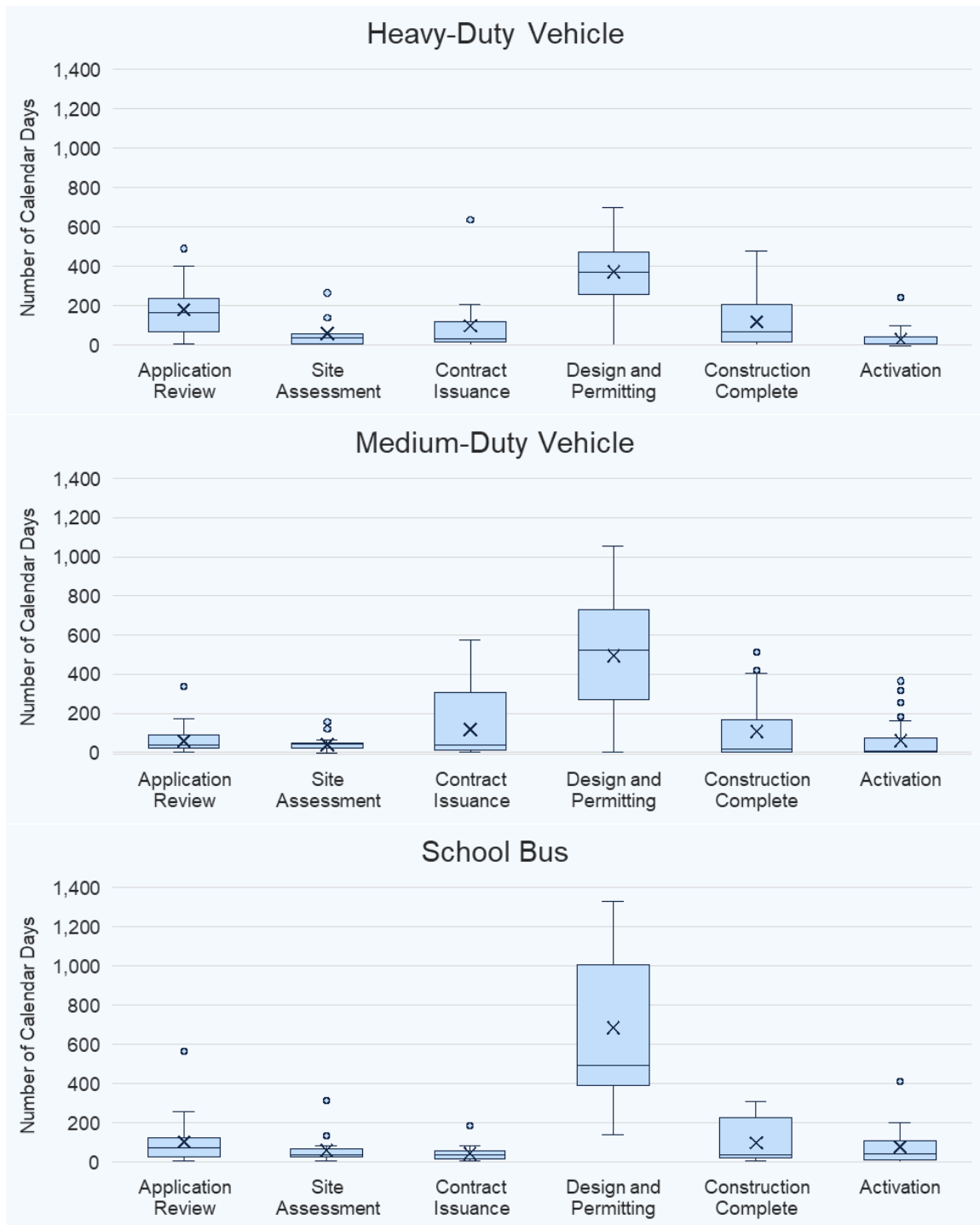
Evaluation Team therefore does not currently have concerns about increasing activation timelines. In 2025 the Evaluation Team will begin to review project timelines based upon application year, in addition to activation year to determine if trends can be more accurately examined as more sites come online. This assessment will be contextualized with CPUC decision D.24.09.020, which established timelines for energization requests.

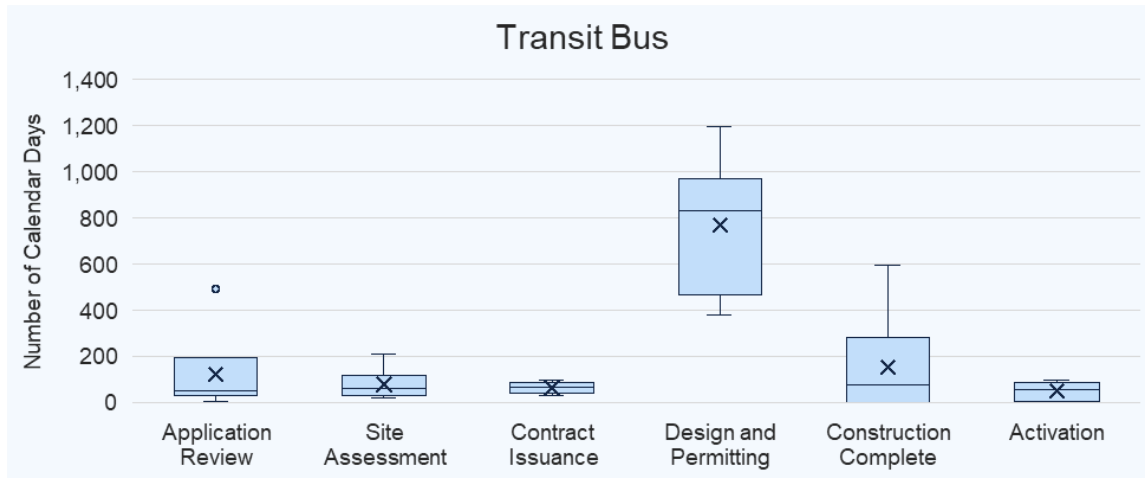
Table 15. Median Calendar Days by Evaluation Year and Program Phase

CPUC Program Phase	Median Calendar Days			
	EY2021	EY2022	EY2023	EY2024
Application Review	34	32	60	69
Site Assessment	37	55	48	40
Contract Issuance	32	46	55	38
Design and Permitting	224	276	356	491
Construction Complete	83	130	106	56
Activation	26	17	21	22
Start-to-Finish	600	725	862	983

Figure 22 expands the analysis of program phase duration by displaying the average number of calendar days per phase (denoted by X), calendar day median (middle line inside of box), first quartile (bottom of box), third quartile (top of box), minimum (bottom tail), maximum (top tail), and outliers (dots) for each of the four market sectors.

Figure 22. Calendar Days per Phase for EY2024 Sites by Market Sector





3.3. Utility Infrastructure Costs

This section examines BTM and TTM infrastructure costs for financially closed-out sites in the program to date across all MDHD programs.³⁴ The Evaluation Team’s dataset includes cost information for 147 sites with a total of 102 MW of installed capacity and 2,062 ports through PTD 2024. Of these sites, 69 are school bus sites, 23 are transit bus sites, 24 are medium-duty vehicle sites, 15 are heavy-duty vehicle sites, and 16 other market sector sites. All 147 sites in the dataset have Utility-owned TTM infrastructure. Only 65 of the 147 sites have Utility-owned BTM infrastructure, with the remaining sites having customer-owned BTM infrastructure.

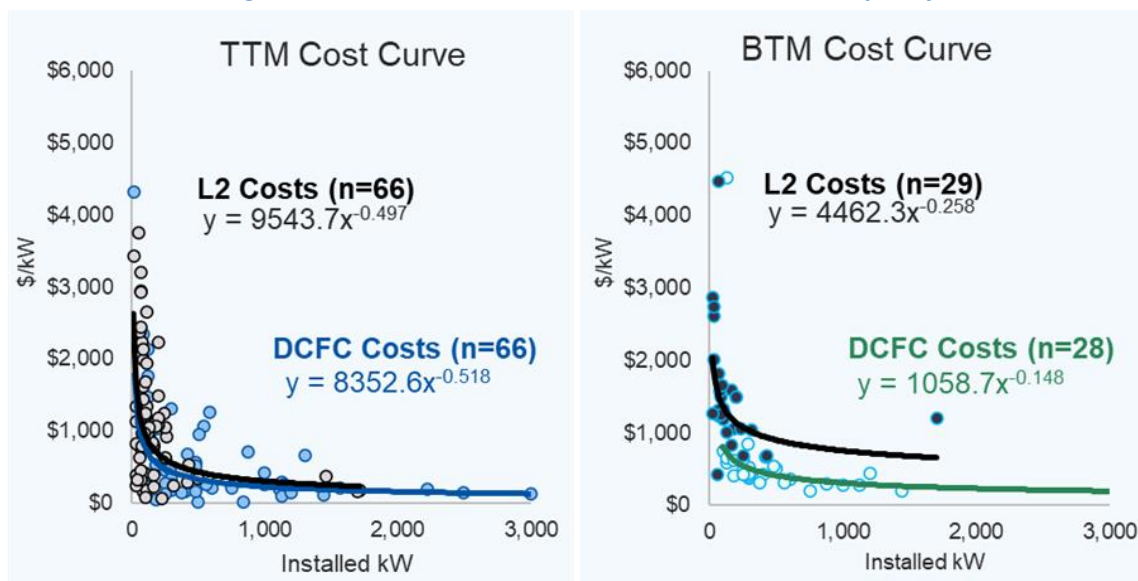
Analyzing sites with Utility-owned TTM and BTM infrastructure allows the Team to understand the full cost of site development, because Utilities track payments for each incurred cost of installing the infrastructure, including for design, permitting, capital costs, project management, and labor. Utilities do not track all actual costs for customer-owned BTM.

Figure 23 shows the relationship between the cost of TTM (left) and BTM (right) installations for sites with Utility-owned TTM and BTM, and the installed site capacity for L2 and DCFC sites. We excluded mixed sites (with both L2 and DCFC) for simplicity. The curves indicate that costs per installed kilowatt are less for larger sites (i.e., those with more installed capacity) than for smaller sites. However, the marginal cost-effectiveness gains for both TTM and BTM and for both L2 and DCFC sites level off at around 500 kW of installed capacity. This capacity is likely too large for most public L2-only sites but could be a design consideration for public mixed (L2 and DCFC), public DCFC, and fleet sites. Power equations of the form $Y=Ax^b$ provide the best fit of the data out of the functions the Evaluation Team attempted. R-squared values for the curves vary from 0.0084 to 0.64. The 0.0084 R-squared value stems from the BTM DCFC Costs, indicating that caution should be taken when interpreting this graph. The

³⁴ Financially closed out sites are a subset of activated sites for which the Utilities have administratively completed financial paperwork.

other cost curves R-squared values range from 0.28 to 0.64, which are slightly higher R-squared values than EY23, but still relatively low, indicating further caution for interpreting results.

Figure 23. TTM and BTM Cost versus Installed Site Capacity



The Evaluation Team produced TTM and BTM distributions for heavy-duty vehicles (Figure 24), medium-duty vehicles (Figure 25), school buses (Figure 26), and transit buses (Figure 27).

Figure 24. Heavy-Duty Vehicle Costs (n=19 sites)

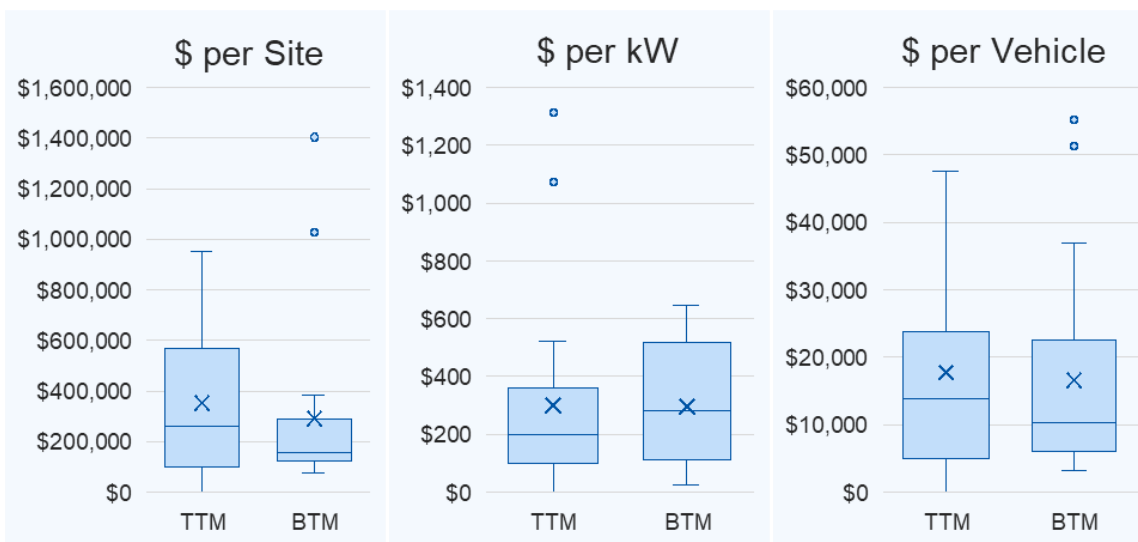


Figure 25. Medium-Duty Vehicle Costs (n=23 sites)

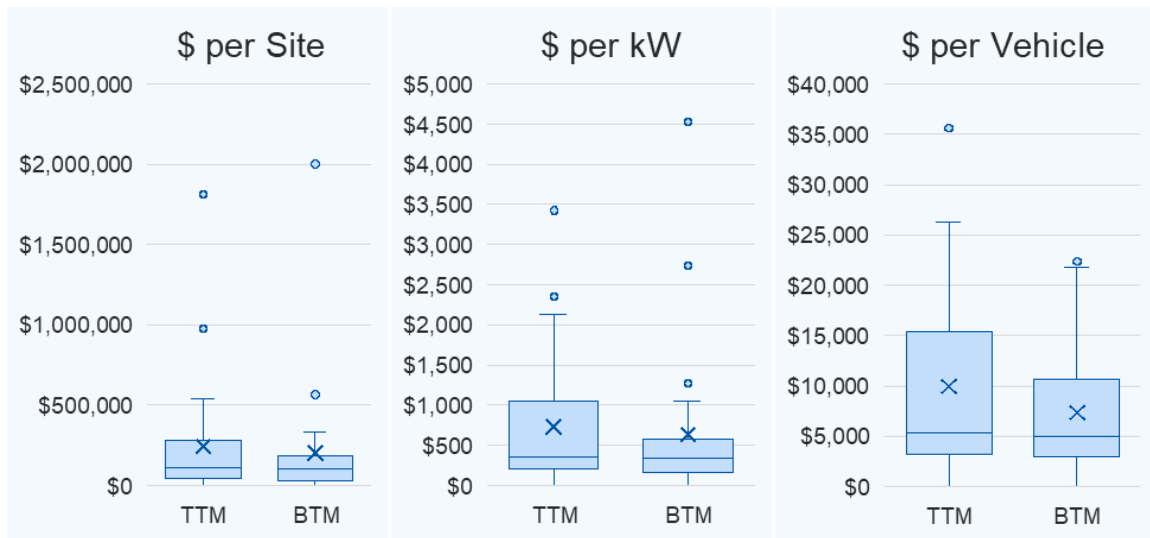


Figure 26. School Bus Costs (n=69 sites)

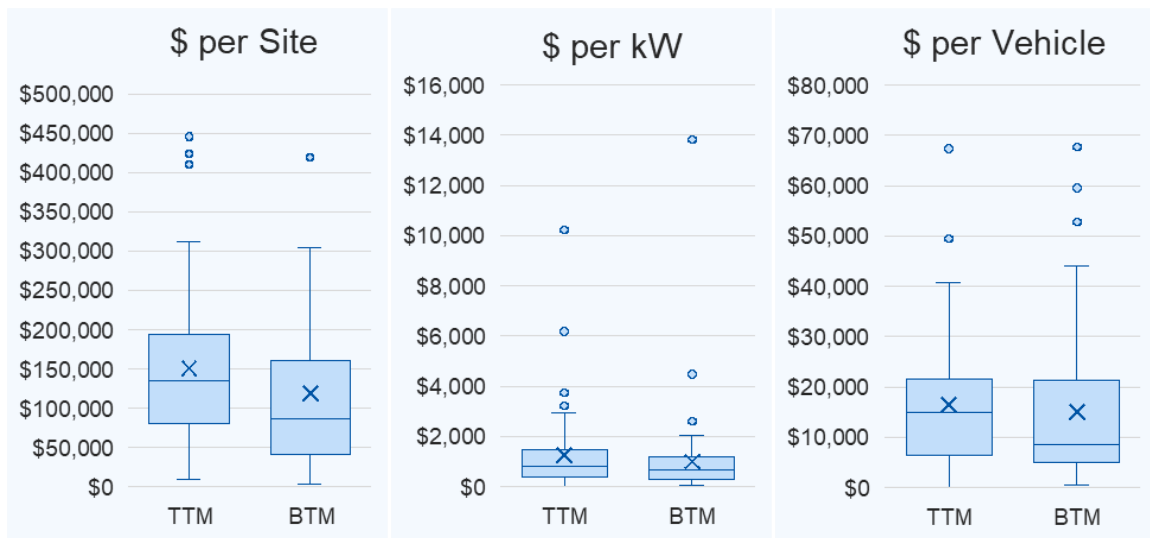
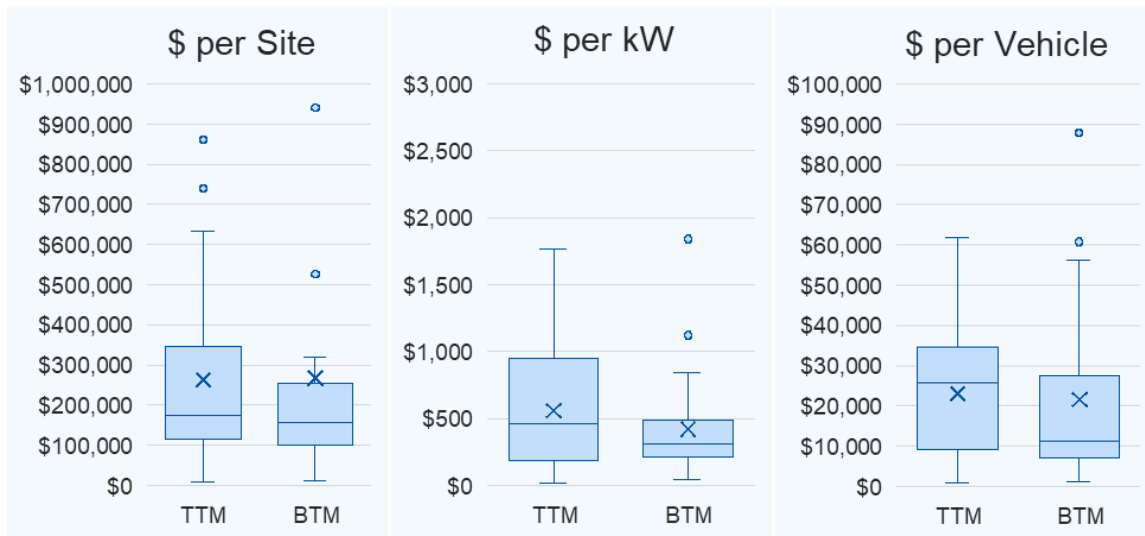


Figure 27. Transit Bus Costs (n=23 sites)



3.4. EVSE Capacity Utilization

3.4.1. Comparison of Installed Capacity (kW) to Maximum Demand

The Evaluation Team conducted an analysis of a subset of sites activated through the MDHD programs to observe to what extent sites are using their total capacity. By dividing installed EVSE capacity by the site's maximum demand in kilowatts, the Team determined each site's utilization percentage, or the percentage of the installed capacity that was used at the site.

To determine which sites to use for this analysis, the Team began with 219 MDHD activated PTD sites in the SRP programs, which we filtered to include only those with available AMI data and consistent operations for a period of at least six months. We removed sites with peak demand that significantly exceeded installed capacity, which we saw at sites that had added additional chargers outside of the SRP program or that had building loads that were tied to the same meter as EV chargers.

The average utilization percentage across the remaining population of 73 MDHD sites is 62.7%. Utilization percentage varied across utilities, as shown in Table 16.

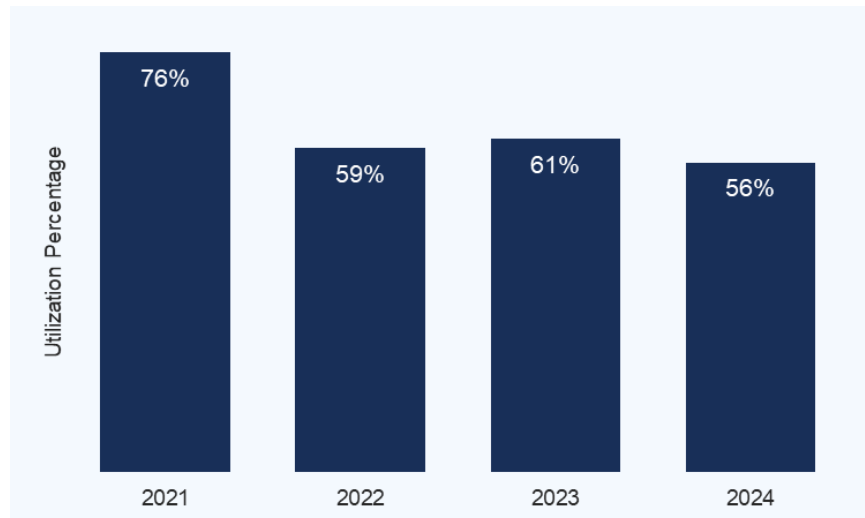
Table 16. MDHD Site Utilization Summary Statistics

Utility Program	Average Utilization Percentage	Sample Size (n)
SCE Charge Ready Transport	46.6%	13
SDG&E PYDFF	57.5%	14
PG&E Fleet	68.9%	46
All Programs	62.7%	73

Figure 28 illustrates the relationship between average site utilization percentage and year of activation across all PTD sites, grouped by year of activation date. The Evaluation Team expected that as sites matured and acquired additional vehicles, utilization percentage would increase. As shown, sites

activated in EY2021 have the highest utilization percentage, while those in EY2024 have the lowest, indicating that sites' utilization increases as they mature in operations. The Team will monitor this trend in future evaluation years as sites mature and additional sites are included in the analysis.

Figure 28. Average Utilization Percentage of Sites by Activation Year



3.4.2. Site Maturation

In addition to analyzing utilization percentages for the subset of MDHD sites, the Evaluation Team conducted an analysis of the 73 sites in the Utilities' MDHD programs to determine the average maturity date, which is the point at which a site reaches consistent demand in kilowatts regardless of the percentage of VAP that the site has fulfilled. The Team used the third demand peak of the first period of consistent power draw as the maturity date to remove data that may have occurred during EVSE testing or during irregular vehicle charging operations when the site first became operable. The purpose of this analysis was to identify site trends across programs and determine if sites are becoming operational more rapidly as the EV market matures.

Figure 29 exhibits the distribution of MDHD sites and the average number of weeks between their activation date and their site maturity date. As shown in the figure, 61 out of 73 sites reached maturity in less than 20 weeks, with only 16.4% of sites taking longer. Nearly one-third (23 sites) reached maturity in less than four weeks, and the average number of weeks across all sites was roughly 11 weeks.

Figure 29. Average Duration for Sites to Reach Maturity

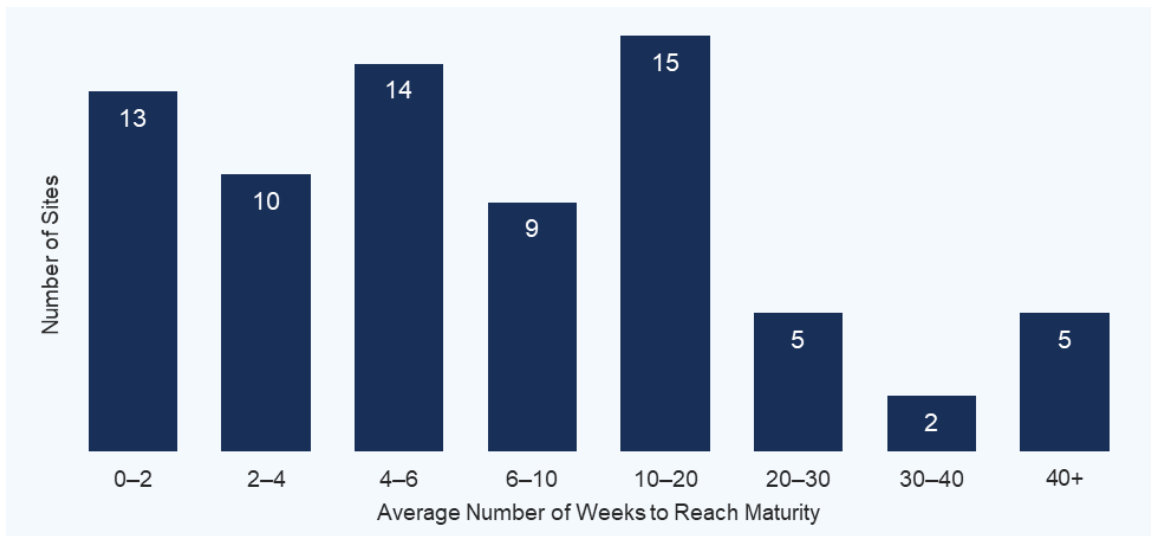
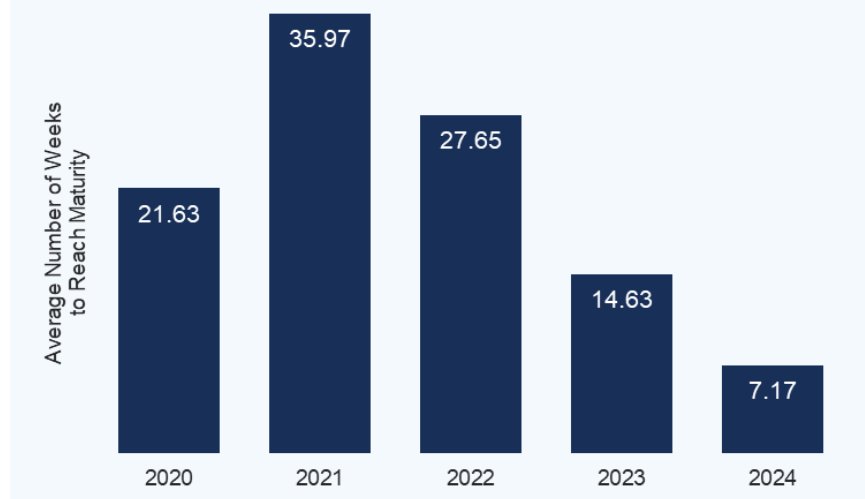


Figure 30 drills down on the time to reach site maturity based on the MDHD site's year of activation. The data show that the average number of weeks sites take to reach maturity has decreased significantly over the past few years, illustrating that sites are maturing faster every year. After peaking in 2021 at an average of 36 weeks, the average time to maturity declined to 27.7 weeks in 2022, 14.6 weeks in 2023, and 7.2 weeks in 2024. This may be a result of fewer delays in receiving vehicles, fewer operational issues with vehicles and charging equipment upon activation, or fleet managers becoming comfortable with deploying EVs into their fleets more rapidly than in prior evaluation years.

Figure 30. Average Duration to Reach Site Maturity by Activation Year Cohorts

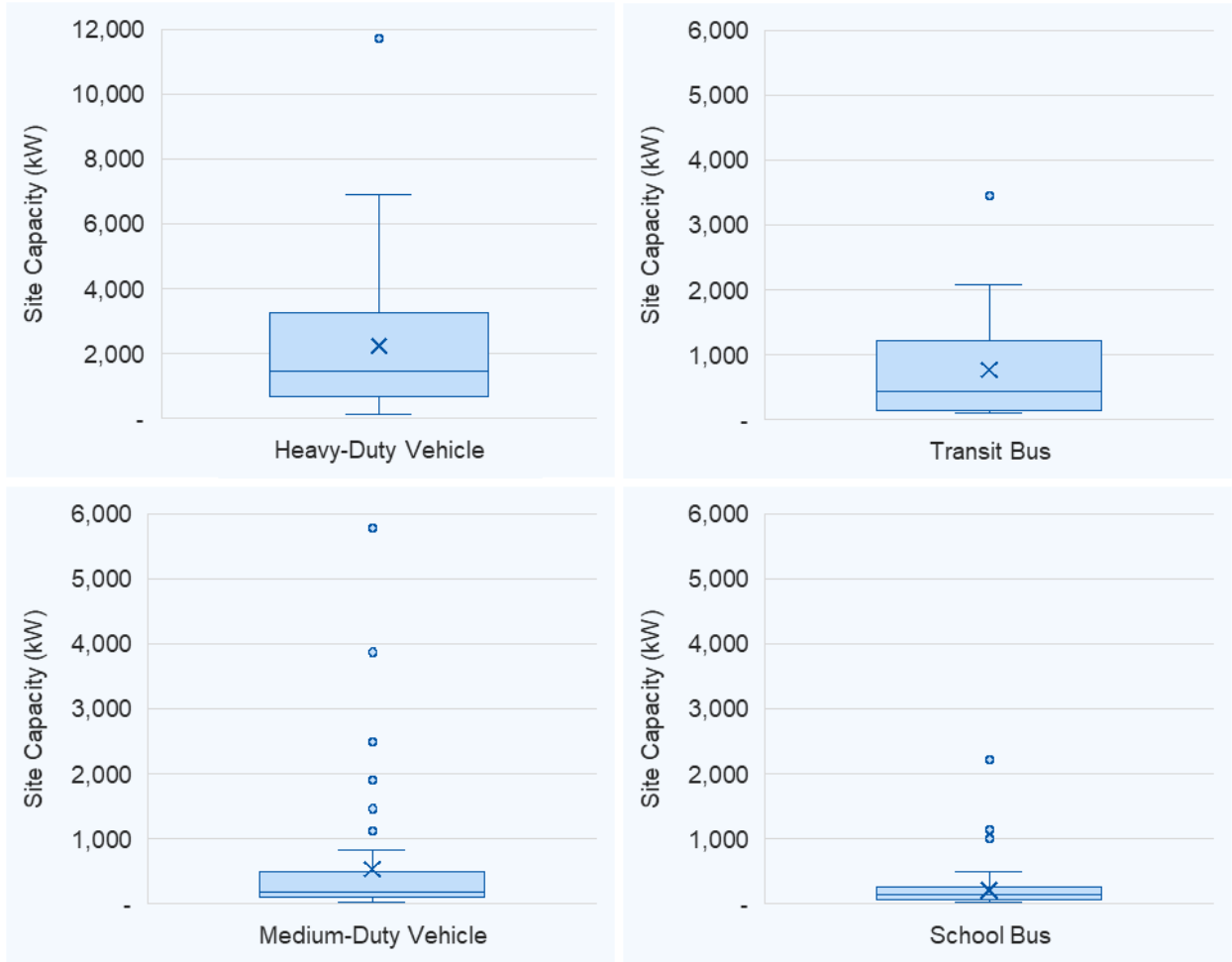


3.5. Grid Impacts

3.5.1. Installed Charging Capacity

Figure 31 shows the distribution of average installed charging capacity per site by the four main vehicle market sectors across all Utility programs. The heavy-duty vehicle sector has both the highest average installed capacity (approximately 2,000 kW per site), and the largest variation in site capacity. Multiple heavy-duty vehicle sites have been built with less than 300 kW of capacity and two to four ports, while several sites have in excess of 5,000 kW of installed capacity. School bus sites have the lowest average installed capacity of just over 200 kW per site, with the number of installed ports ranging from 2 to 74.

Figure 31. Average Installed Charging Capacity per Site by Market Sector, All Utilities



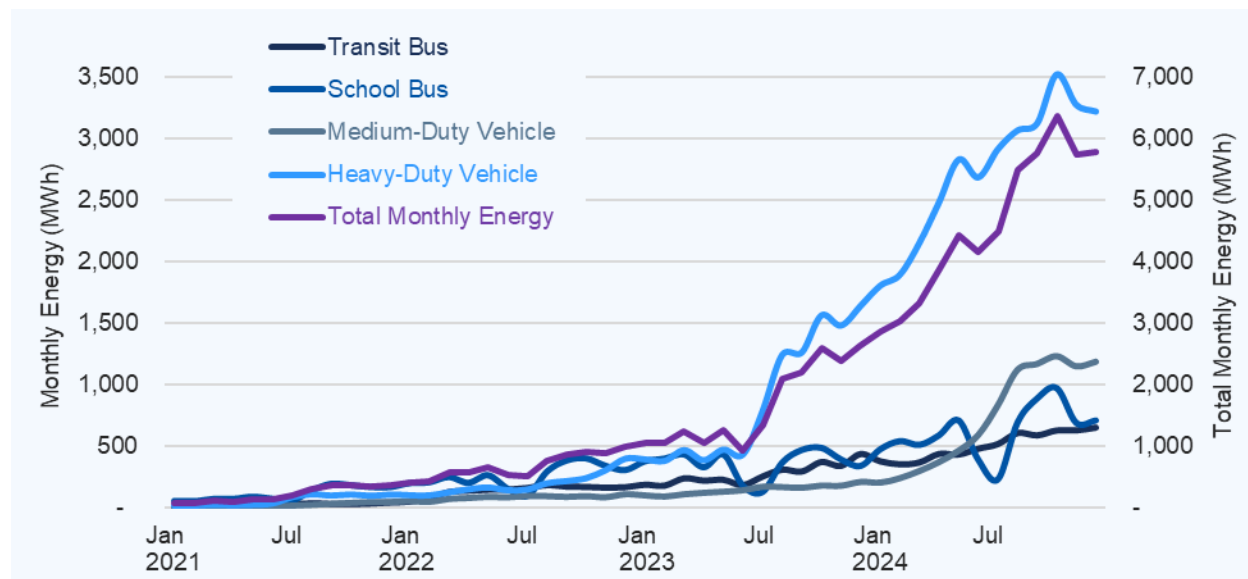
Note: Scale for the heavy-duty vehicle market sector is not consistent with that of the other market sectors

3.5.2. Monthly Energy Consumption

Figure 32 shows total energy consumption by month across four market sectors in all Utility MDHD programs. As shown, total monthly consumption continued to grow throughout 2024 at a rate similar to that of 2023, rising to peak consumption of 6,257 MWh in 2024, from 2,476 MWh in 2023. Like 2023,

peak consumption occurred in October with the second half of the year showing similar growth rates. The transit bus sector shows steady year over year growth. The school bus sector shows similar growth, but energy consumption varies by season (because of third quarter holidays and summer vacation). Consumption for the medium-duty vehicle sector picked up significantly in 2024. The heavy-duty vehicle sector accounted for the largest growth, rising from 1,500 MWh in late 2023 to over 3,100 MWh by the end of 2024.

Figure 32. Cumulative Monthly Energy Consumption across Four Utility Program Market Sectors, 2021–2024



3.5.3. Maximum Monthly Demand

Figure 33 shows total maximum demand by month for the four market sectors in all Utility MDHD programs, by individual market sector and combined. The heavy-duty vehicle sector accounts for the largest demand across programs (nearly 15 MW), which is equal to the combined demand of the three other market sectors (all currently near 5 MW). Across all MDHD programs, peak demand reached almost 25 MW in 2024. Through the end of 2024, other categories including forklift, truck refrigeration unit (eTRU), truck stop electrification, and airport GSE accounted for less than 600 kW of aggregate maximum demand.

Figure 33. Maximum Monthly Demand across Four Utility Program Market Sectors PTD

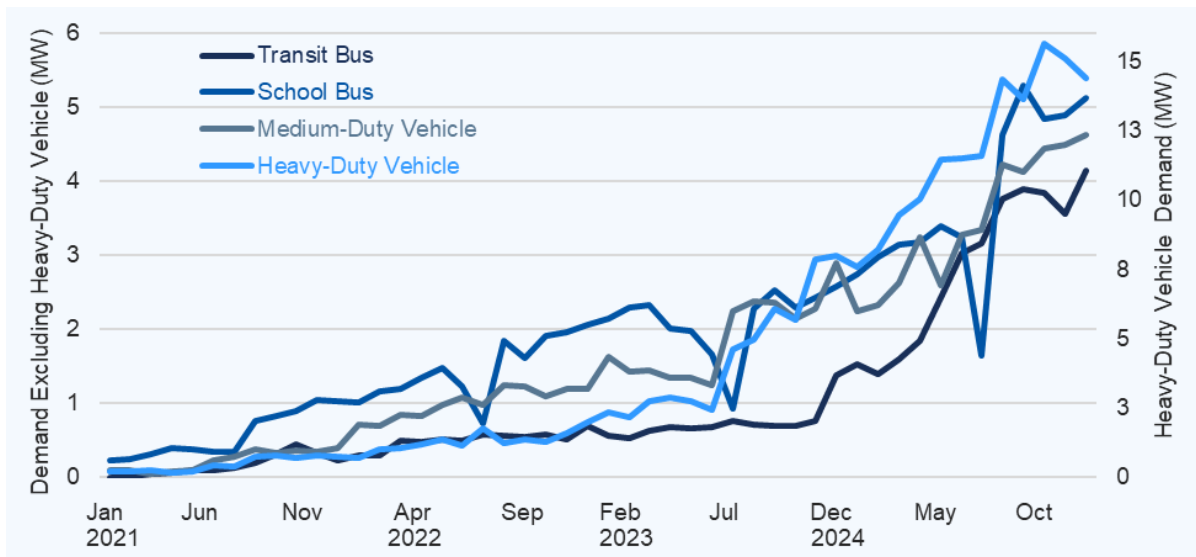
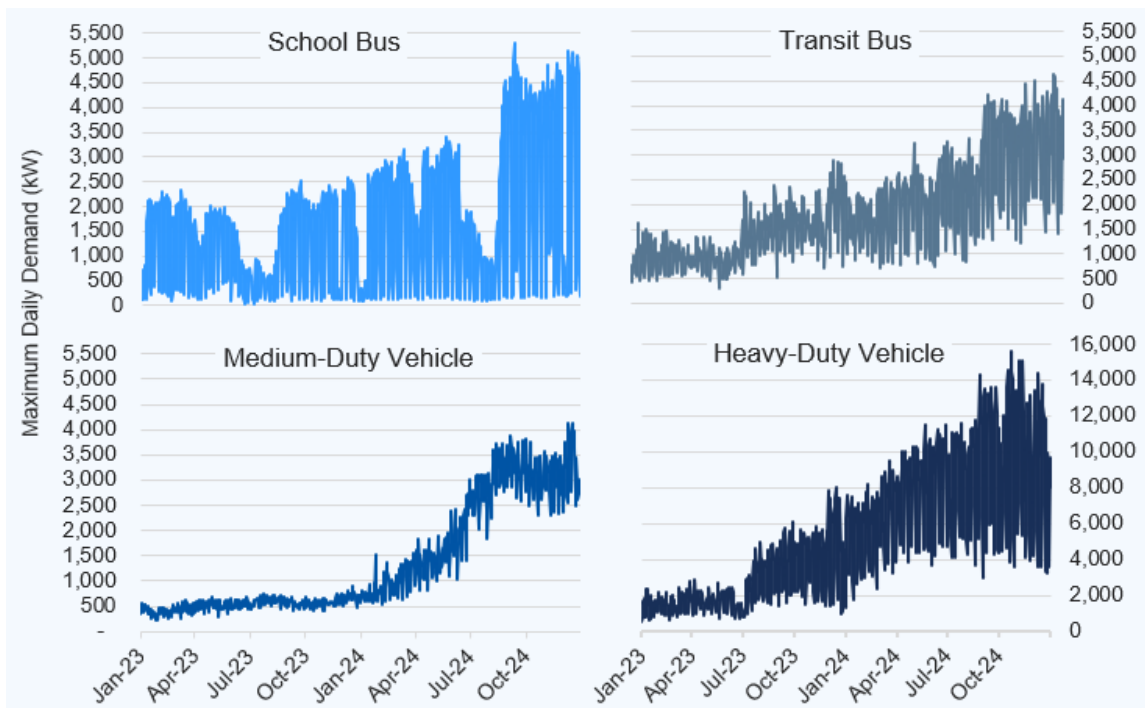


Figure 34 shows the variability in daily demand over the past two years for each market sector. The daily demand for the school bus, transit bus, and medium-duty vehicle sectors appears to have leveled out in the second half of 2024, while the heavy-duty sector shows daily demand continuing to increase. School buses have the most variability in demand because they rarely operate on weekends, while the other market sectors operate on weekends but significantly less than on weekdays.

Figure 34. Variations in Minimum and Maximum Daily Demand for Four Market Sectors across Utility MDHD Programs, 2023-2024



Note: Scale for the heavy-duty vehicle market sector is not consistent with that of the other market sectors

Table 17 shows ratios of high demand days to low demand days during the second half of 2024. This provides an understanding of how different operations are for the four market sectors between weekdays and weekends, which typically see fewer vehicles operating and show lower demand. The school bus sector shows a very high ratio of high to low demand days, which suggests there are almost no weekend operations. The medium-duty vehicle sector appears the most consistent with a 2.3:1 ratio, which is closer to ratios for the transit bus and heavy-duty vehicle sectors than to the school bus sector. Many operators in those three sectors have significant weekend operations.

Table 17. Ratio of High-to-Low Demand Days in 2024

Market Sector	Number of High Demand Days	Number of Low Demand Days	Ratio of High to Low Demand Days
Heavy Duty	15,641	2,956	5.3
Medium Duty	4,127	1,825	2.3
Transit Bus	4,636	847	5.5
School Bus	5,305	98	54.1

3.5.4. Daily Load Curves

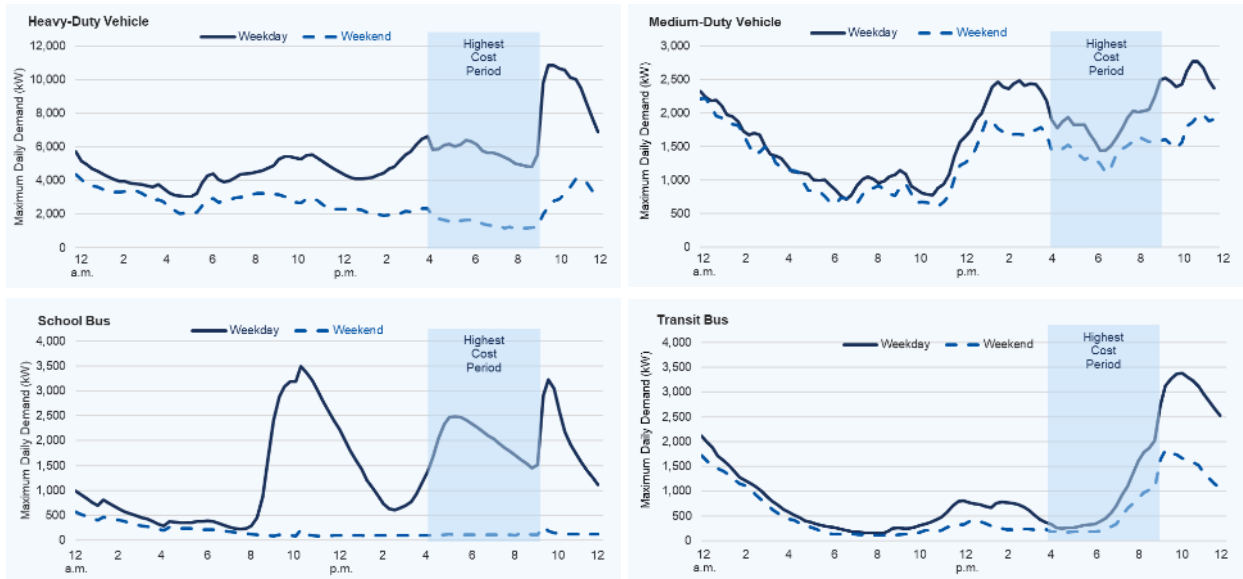
Figure 35 shows the average daily load curve for each of four market sectors in Q4 2024 and highlights variations in daily charging behavior between sectors, which lead to notable differences in the amount of charging demand during the highest cost period of 4 p.m. to 9 p.m.:

- **School bus:** charge twice daily, with later sessions occurring in the afternoon or evening dependent on load management
- **Transit bus:** some midday charging, but most during the evening
- **Heavy-duty vehicle:** consistent charging with load management delaying significant load until 9 p.m.
- **Medium-duty vehicle:** two post-shift charging spikes with timing dependent on load management

Each of the four market sectors shows a significant spike in demand beginning at 9 p.m. This indicates that some sites are implementing load management to avoid charging during the highest cost period. Though only approximately 21% of sites use load management, data show that load management has a real and significant impact on reducing demand when the grid is most vulnerable.

Figure 35 further characterizes how these four market sectors operated differently during weekdays and weekends in Q4 2024. The school bus sector has almost no weekend operations, while the other sectors show approximately 50% less energy usage on Saturdays and even less on Sundays. This means that some charging that currently takes place on Friday and Saturday at 9 p.m. could be shifted to low-cost and low-emissions energy periods in the midday on weekends. School buses have regular access to chargers at midday on weekdays, while the other fleets are constrained to weekends for midday charging. Load management and scheduled charging functionality will be needed to allow these fleets to take advantage of midday low-cost and low emissions energy periods.

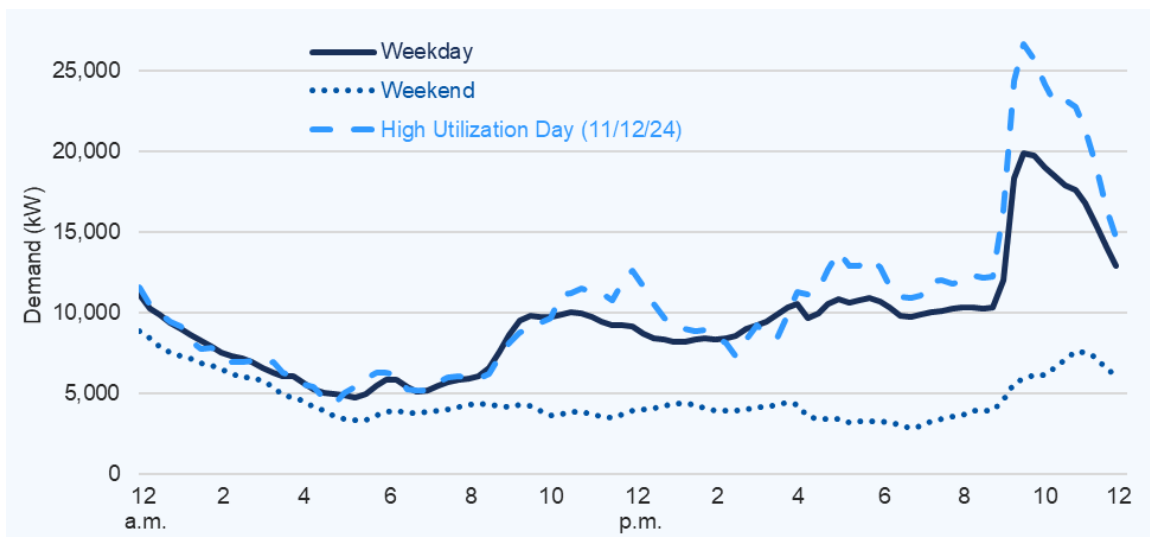
Figure 35. Market Sector Weekday and Weekend Day 2024 Q4 Average Load Curves



Note: The scale for the heavy-duty vehicle and medium-duty vehicle market sectors is not consistent with that of the school bus and transit bus market sectors

Figure 36 shows the combined load curve of all Utility MDHD programs on the highest day of utilization (11/12/24), as well as the average load curve for weekdays and weekends in EY2024. Weekend utilization is relatively low and consistent. Weekdays and the highest utilization day show that as much as 50% of load is shifted until 9 p.m., reducing consumption during peak periods along with grid congestion and the need for grid upgrades. Regular and more focused follow-up contact with these customers by energy experts could lead to even more dramatic benefits. Site visits have shown that most fleet operators are interested in their data but not as familiar with monitoring and managing costs for their EVs as for their conventional fleets.

Figure 36. Total Average Load Curves Q4 2024

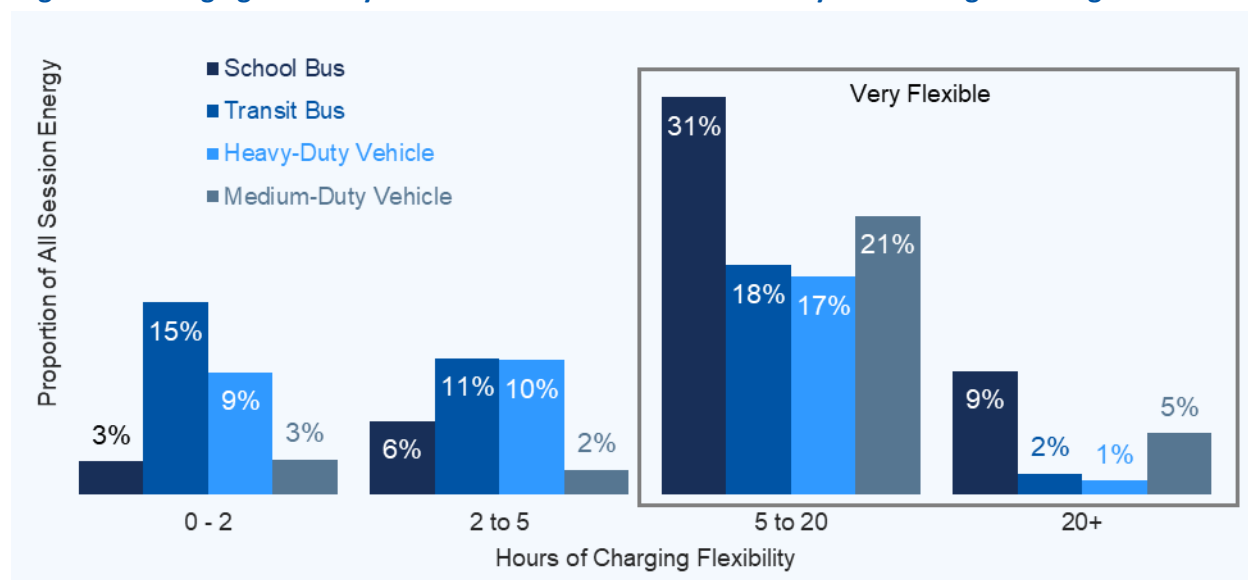


3.5.5. Charging Flexibility

The Evaluation Team used site charging data to determine the amount of time vehicles of each market sector are connected to a charging port but not actively consuming energy. This allowed the Team to assess charging flexibility, or the ability for a vehicle to shift charging from periods of high-cost electricity to periods of low-cost electricity without impacting vehicle operations. Figure 37 shows the charging flexibility of each of the four market sector fleets for charging sessions that overlap the highest cost time period of 4 p.m. to 9 p.m. The legend indicates that the proportion of all session energy per market sector.

For example, 49% of all school bus charging sessions overlap with the highest cost time period of 4 p.m. to 9 p.m., meaning that a portion of load could be shifted to lower cost time periods. During site visits to school bus sites, fleet operators confirmed that there is often 15 hours available for buses to charge between completing afternoon shifts and heading out again in the morning and that the charging period may be as short as three hours. As shown in Figure 37, 40% of the energy consumed during school bus charging sessions could be shifted to non-peak periods.

Figure 37. Charging Flexibility of Four Market Sectors Across Utility MDHD Programs Program-to-Date



The Team used charging data to derive a number of other notable findings for the school bus and other sectors:

- School bus sites using load management can generally minimize their high-cost consumption so that it accounts for just 10% of total consumption on a kWh basis, while the high-cost consumption for the sites not using load management is closer to 33% of all energy consumed.
- Non-load-managed school bus sites consume three times more high-cost energy than necessary
- Charging during peak periods is two times more expensive for PG&E and SDG&E school bus site customers, and six times more expensive for SCE school bus site customers than charging during the lowest-cost time period.

- 45% of transit bus charging sessions overlap with peak periods, and 20% of energy consumed could be shifted to lower-cost periods
- 38% of heavy-duty vehicle charging sessions overlap with peak periods, and 18% of energy consumed could be shifted to lower cost periods
- 31% of medium-duty vehicle charging sessions overlap with peak periods, and 26% of energy consumed could be shifted to lower cost time periods.

3.5.6. Average Energy Pricing by Billing Month in 2024

Utility rates have appeared fairly consistent over the past two years. Though each Utility has at least two EV tariff options, they are overall similar to the EV tariffs presented in Table 18. While the cost of energy consumption for PG&E and SDG&E customers in high-cost time periods is at least double the lowest cost available, SCE's customers pay four times more for energy consumption during high-cost periods than during low-cost period in the winter and six times more during the summer, when on-peak charging costs are the highest. This pricing sends a very clear signal and an incentive for customers to shift charging if customers are aware of this pricing difference.

Table 18. Utilities High and Low EV-Oriented Energy Pricing

Utility Tariff ^a	SDGE EV-HP	SCE TOU-EV-7 ^b	PG&E BEV1
Low Cost per Kilowatt-hour	\$0.12	\$0.14	\$0.17
High Cost per Kilowatt-hour	\$0.24	\$0.58	\$0.4
Ratio of High Cost to Low Cost	2.0	4.1	2.4

^a Tariff pricing does not include taxes or demand-oriented costs

^b SCE high pricing is in summer and its low pricing is in winter. Referring to Option E.

Compared to Utility tariff energy costs, billing data show what customers are actually achieving for energy costs on a monthly basis. Figure 38 shows the monthly electricity costs across all MDHD sites in four market sectors (x-axis) and the proportion of charging that occurred from 4 p.m. to 9 p.m. during that billing month. The lowest monthly cost is approximately \$0.15/kWh, and very few billing months have energy consumption costs below \$0.25/kWh, which is 65% higher than the lowest Utility rates. The vast majority of billing months have energy consumption costs greater than \$0.25/kWh, with many exceeding \$0.45/kWh. The charging flexibility analysis shown in Figure 38 suggests that many of these fleets have the opportunity to significantly reduce energy costs by shifting demand to lower-cost time periods.

Figure 38. Monthly Electricity Costs and Portion Occurring During Peak Periods for Four Market Sectors

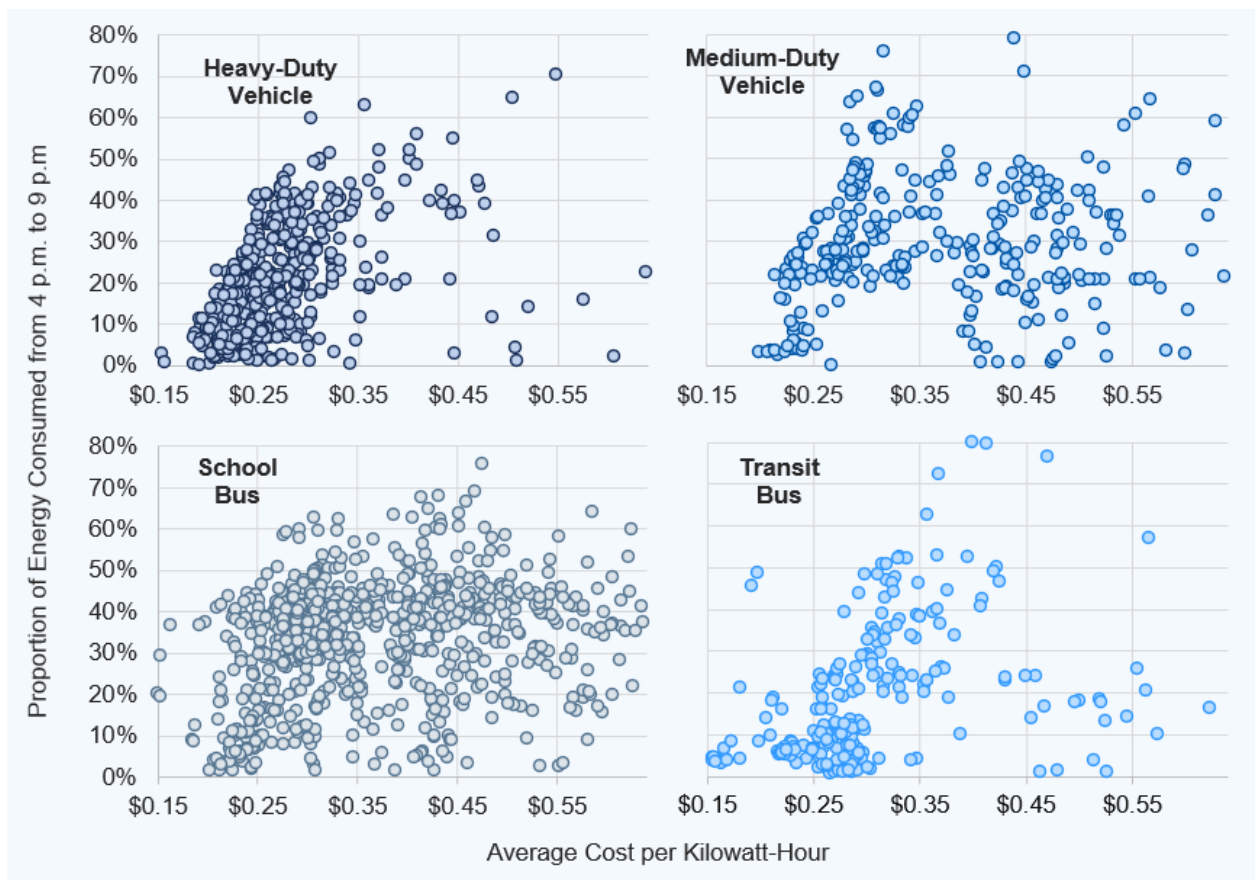


Figure 39 shows the distribution of average monthly billing costs per kilowatt-hour for all sites and sectors in Utility MDHD programs for which at least six months of billing data was available in EY2024 (n=169). The lowest cost sites appear to show monthly billing between \$0.20/kWh and \$0.28/kWh through the use of load management to alter time of use (avoiding 4 p.m. to 9 p.m.), combined with a high volume of energy consumption. The median average monthly electricity cost is \$0.37/kWh, with a majority of sites having an average cost over \$0.33/kWh and with many sites exceeding \$0.43/kWh.

3.6. Petroleum Displacement and GHG Emissions Impacts

Table 19 shows the annual petroleum displacement and GHG emissions reductions associated with counterfactual vehicles that were replaced by EVs supported by charging infrastructure deployed under the Utilities' MDHD programs. Annual values per vehicle are based on the total reduction and total number of EVs observed during site visits. The heavy-duty vehicle market sector shows the largest annual petroleum displacement and annual GHG emissions reductions in total, but the transit bus market sector shows the largest annual petroleum displacement and annual GHG emissions reductions per vehicle. After the heavy-duty vehicle and transit bus market sectors, the school bus market sector has the next largest annual petroleum displacement and annual GHG emissions reductions for both the total and per vehicle with the medium-duty vehicle market sector having the smallest impacts both overall and per vehicle.

Figure 39. Summary of Average Monthly Electricity Costs per Kilowatt-Hour, all MDHD Utility Program Sites

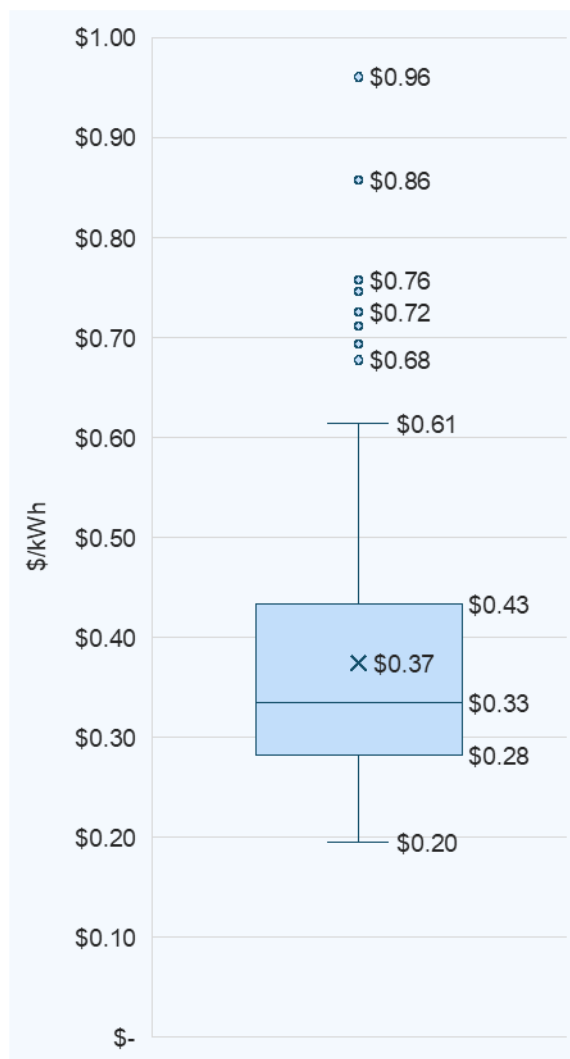


Table 19. Annualized Petroleum Displacement and GHG Emissions Reductions of Four Market Sectors across Utility MDHD Programs in 2024

Market Sectors	Annual Petroleum Displacement (gallons)	Annual CO2e Reduction (MT)	Site Visit Observed EVs	Annual Petroleum Displacement per Vehicle (gallons)	Annual CO2e Reduction per Vehicle (MT)
Heavy-Duty Vehicle	3,209,949	33,813	744	3,197	26.4
Medium-Duty Vehicle	524,383	5,154	522	982	7.6
School Bus	768,649	8,173	602	1,342	11.8
Transit Bus	913,487	8,007	165	5,027	34.7

Figure 40 shows the average petroleum displacement per vehicle by market sector, and Figure 41 shows the average GHG emissions per vehicle by market sector in the box and whiskers format.

Figure 40. Average Petroleum Displacement per Vehicle by Market Sectors for All Utilities

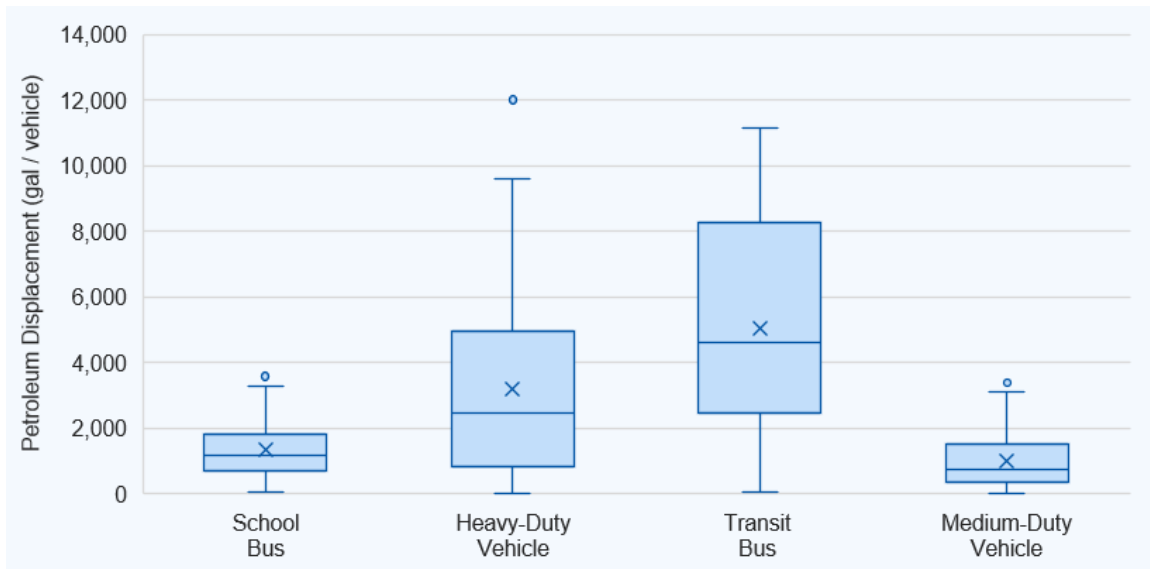


Figure 41. Average GHG Emissions Reduction per Vehicle by Market Sectors for All Utilities

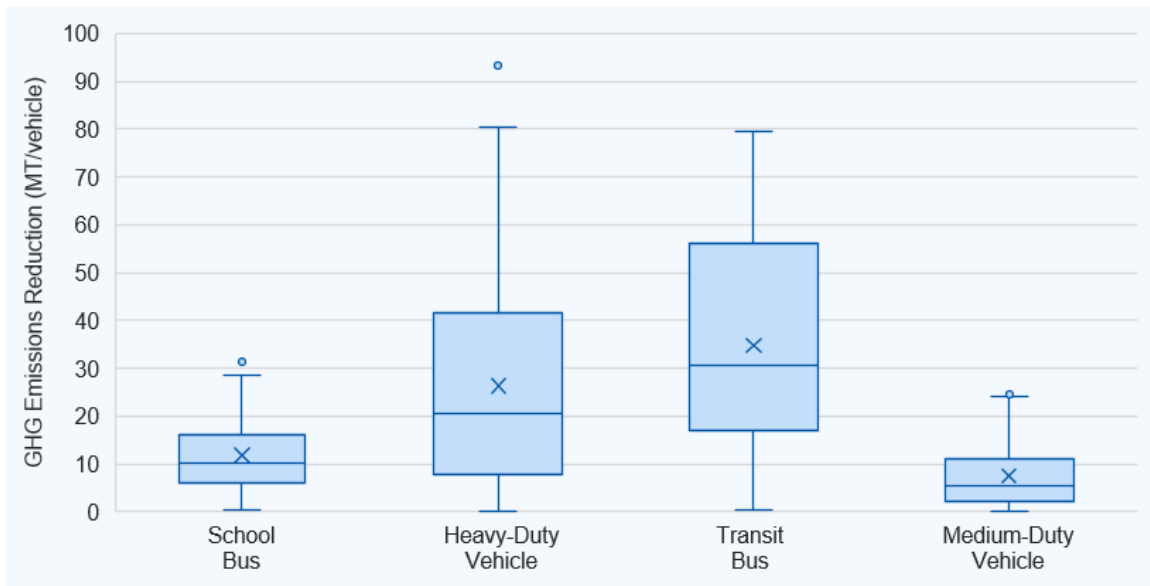
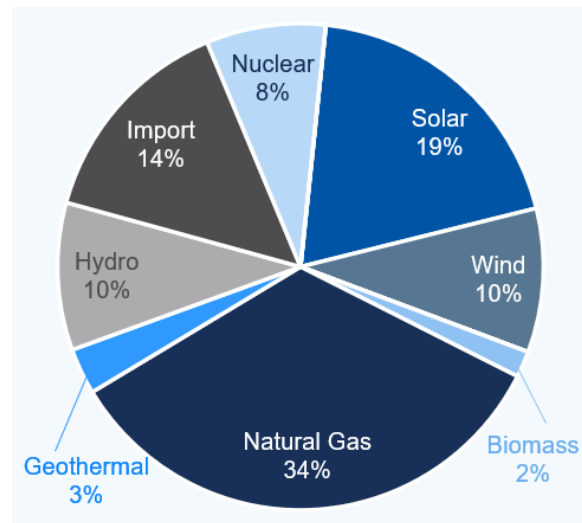


Figure 42 shows the annual program net electricity generation mix during the hours when the EVs were charging. The CAISO grid mix continually changes depending on factors such as the total demand for power on the grid and the availability of fossil generation and variable renewable resources such as solar. Based on the real-time grid conditions when the charging occurred, the overall energy mix was about 52% zero-emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 34% natural gas. Increased use of managed charging would reduce emissions as EVs charge at off-peak times when grid power is supplied with greater amounts of renewable generation. The following section identifies the potential for fleets to further reduce GHG emissions through shifting their time and rate of charging.

Figure 42. Electricity Mix, ALL MDHD Sites



3.7. Available Improvements in Utility Bills and Electricity GHG

The previous two sections have described energy trends and their impacts on emissions and electricity costs. The following section identifies to what extent load management could decrease emissions and/or electricity costs using consumption and charging session data from 2024. Roughly two-thirds (7 of 10) of the Network Service Providers (NSPs) in the MDHD programs represent these sites. As shown in Table 20, approximately 20% of MDHD program sites exhibit use of load management, with SCE showing the highest percentage of 24%.

Table 20. Sites exhibiting use of load management, Utility MDHD Programs

Utility	Total Sites	Sites Exhibiting Load Management	Load Management Percentage
SCE	86	21	24%
PGE	108	18	17%
SDG&E	25	5	20%
Total	219	44	20%

All three utilities provide a significant drop in energy costs outside of the 4 p.m. to 9 p.m. peak TOU period, as shown in Figure 43. Reflecting lower-emissions midday electricity, SCE and PG&E have aligned their tariffs to include a midday Super Off Peak (lowest-cost) period. However, only SCE drops the midday price significantly (by approximately 50%) relative to other off-peak hours; PG&E offers only a slight reduction (5% to 10%). SDG&E still designates midnight to 6 a.m. for least-cost energy.³⁵ A larger midday drop by PG&E and SDG&E could create a stronger price signal for fleets to charge their vehicles more at that time and to reduce charging after 9 p.m.

Figure 43. EV Rate TOU Pricing Across Utility Programs

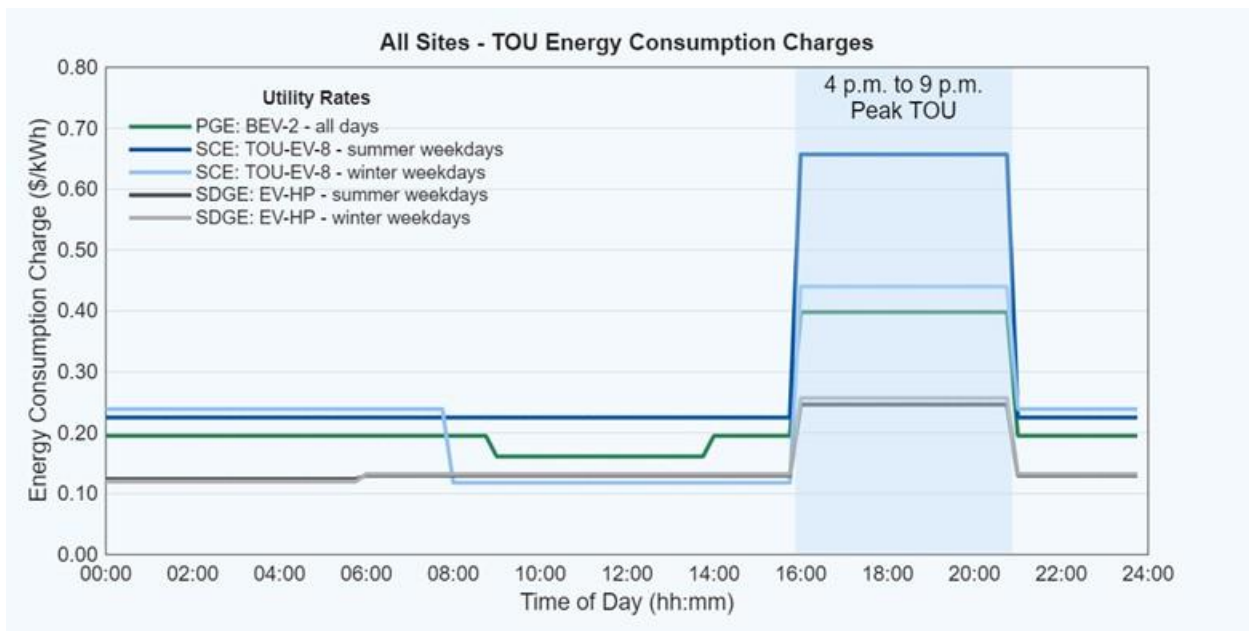


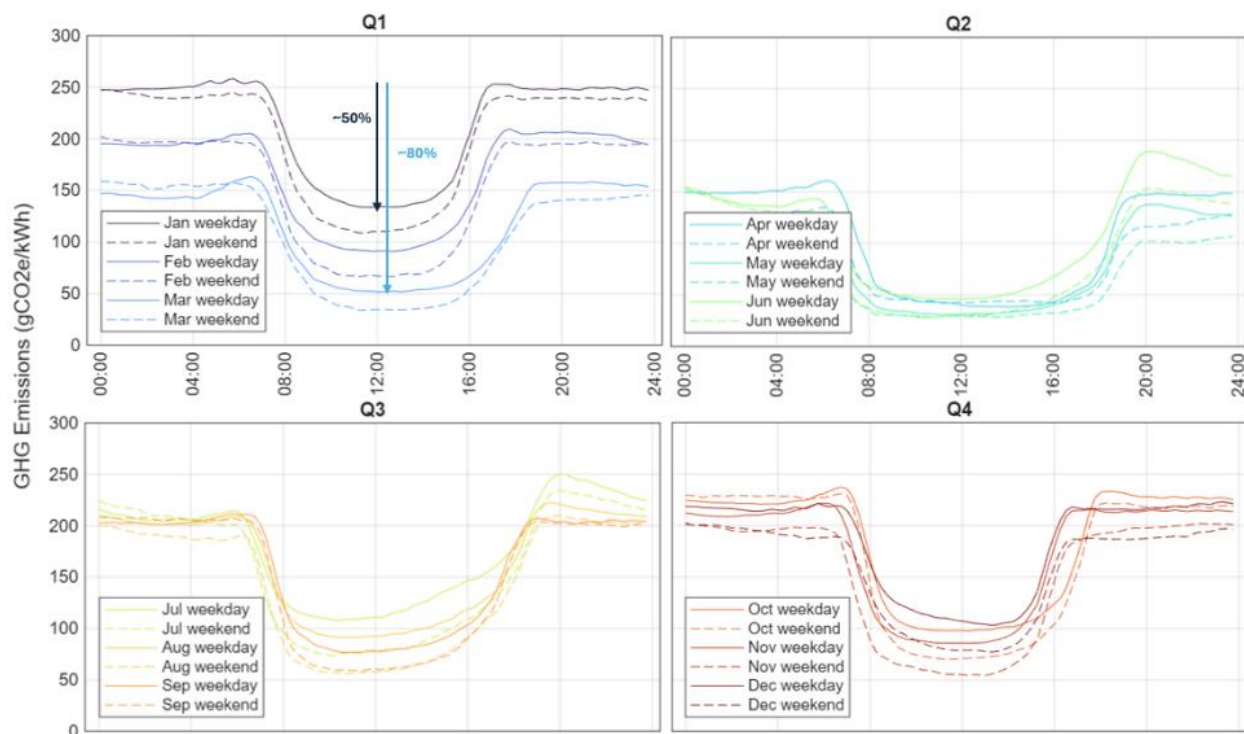
Figure 44 characterizes the variability in California’s 2024 average electricity emissions on a 15-minute basis, aggregated across weekdays and weekend days each month. Average emissions are generally lowest daily from 9 a.m. until 4 p.m. and generally highest between 7 p.m. and 7 a.m. Evening grid electricity generally produces two to four times the midday emissions.

As can be seen in Figure 44, weekend days in the first, second, and fourth quarters of 2024 offered midday energy that often produced 20% to 30% lower emissions than weekdays. (Third-quarter

³⁵ See pricing plans at <https://www.sdge.com/residential/pricing-plans/about-our-pricing-plans/whenmatters>

emissions did not differ drastically between weekdays and weekends, potentially due to demand for electricity peculiar to the summer.) Many fleets operate Monday through Friday, which appear to offer flexibility to delay charging operations from the highest emissions (directly after 7 p.m.) and highest cost (4 p.m. to 9 p.m.) to midday periods.

Figure 44. 2024 Weekday and Weekend Average CAISO GHG Emissions by Month



In summary, fleets that typically charge at night can save over 60% of associated emissions by charging midday. The most prominent potential for emissions reductions is for Monday through Friday operators to delay charging from Friday evenings to midday on weekends.

This section of the report reviews the results of two models to investigate to what extent fleets can reorganize their energy usage to reduce either site-level Utility bills or average electricity emissions attributable to EV charging. Figure 45 highlights business as usual (BAU) load curves aggregated by the four largest market sectors across all Utilities. It also displays the shifted load curves for the cost-minimized and emissions-minimized cases from the load management optimization.

The cost-minimizing (cost-min) curve shows that most fleets could have avoided using nearly all of their historical energy usage between 4 p.m. to 9 p.m. School bus fleets in particular could adopt increased midday charging by charging to less than full in the evenings. Results of the emissions-optimized case (GHG-min.) are similar in terms of maximizing midday charging, though conflicts appear when low emissions intersect with high energy prices (e.g., 4 p.m. to 6 p.m.). In general, shifting charging from evening to midday reduces emissions. Fleets opting into LCFS's Smart Charging approach can use this analysis to increase their credit generation and revenue.

Figure 45. Potential of Shifting Energy Usage to Reduce Electricity-GHG and Utility Costs

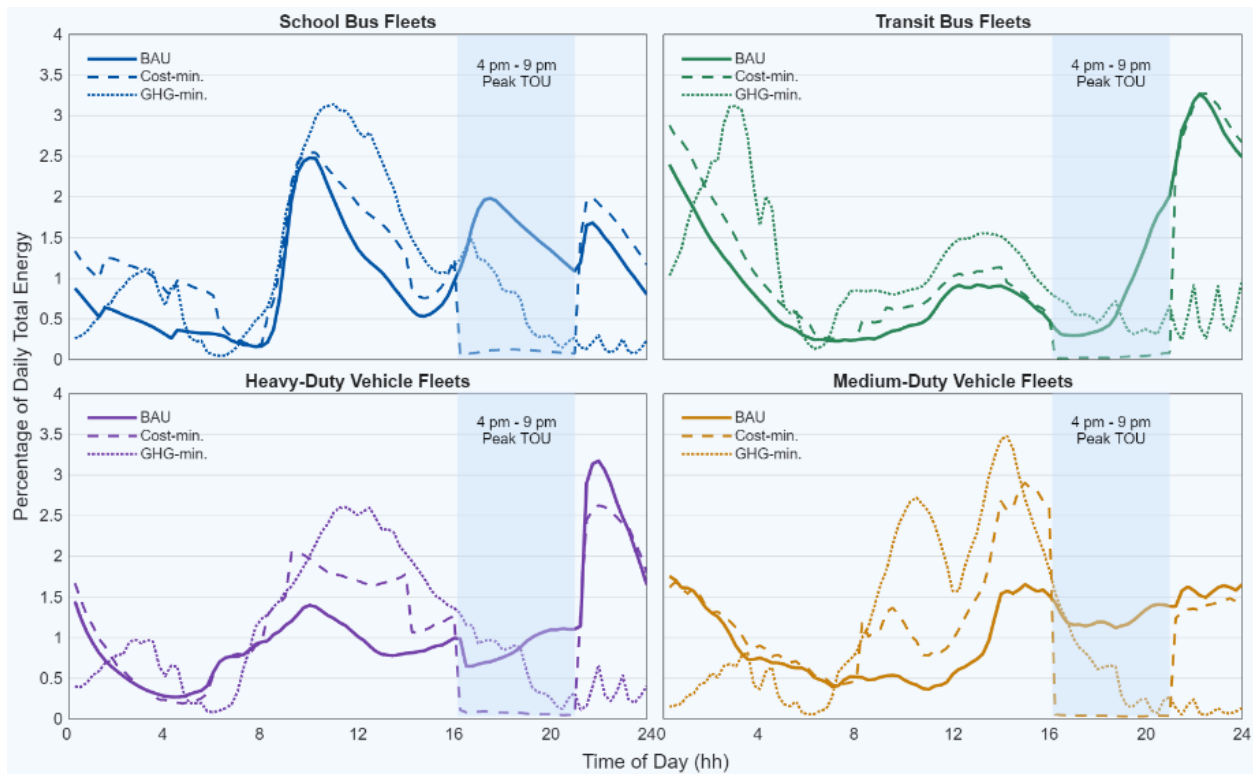
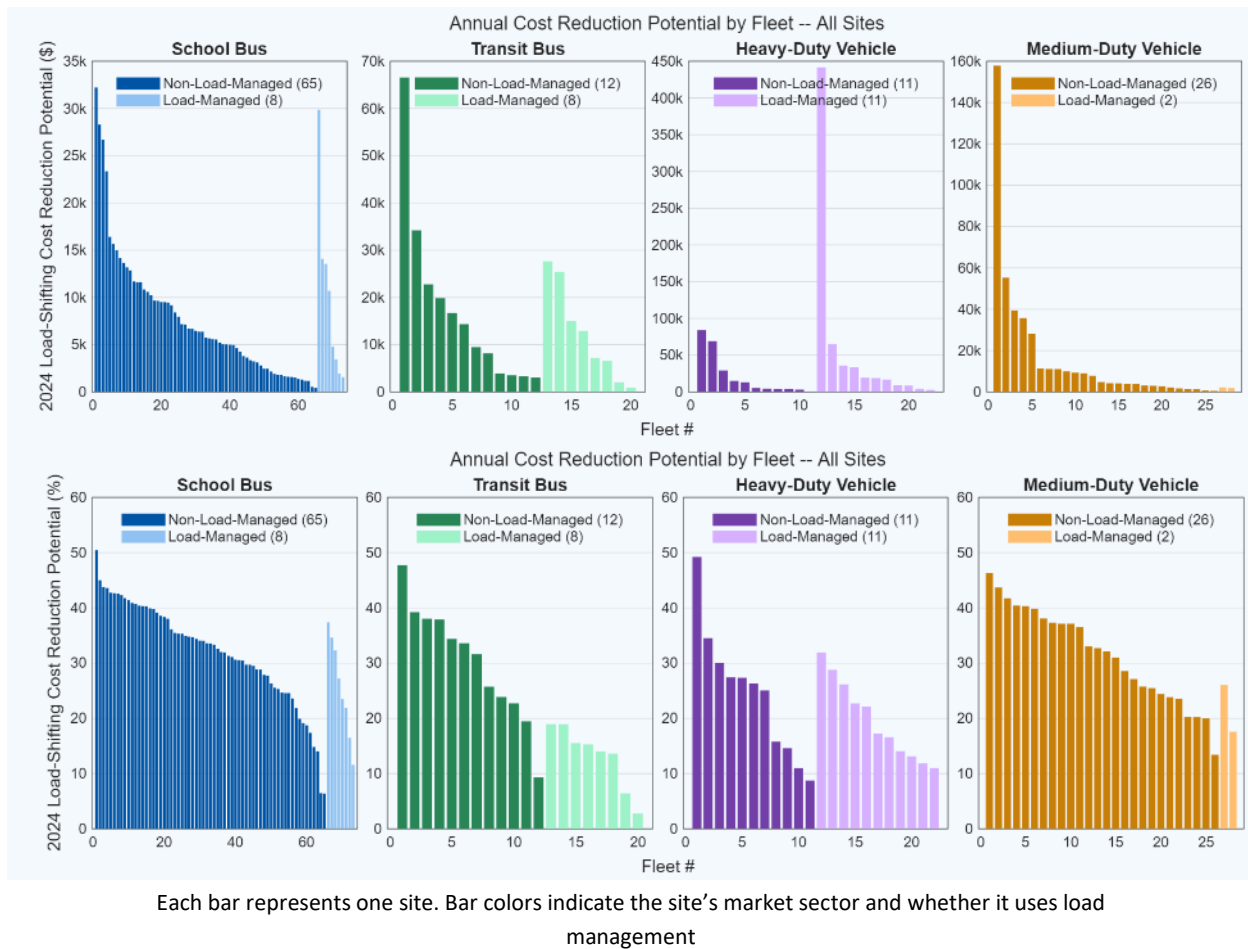


Figure 46 shows annual cost reduction potential on an individual site basis both in terms of dollars and proportional savings. Each bar represents one site, and bars are ordered from high to low potential. MDHD vehicle operators show the most potential for actual dollar savings. Around two-thirds of school bus sites could realize over \$5,000 per year in savings, and one-quarter could achieve over \$10,000. In many cases, sites identified as using load management have load curves that are surprisingly similar to those of sites without load management. One explanation for this is that while load-managed sites shows consistent usage, they may have used load management for only part of 2024. The modeling shows that 70% of operators could save 20% annually while over 40% of operators could save over 30% annually. A significant opportunity exists for vehicle operators to reduce the operating costs for their EV fleets early in their vehicles' lifetime.

Figure 46. Available Annual Dollar and Proportional Utility Bill Savings Modeling



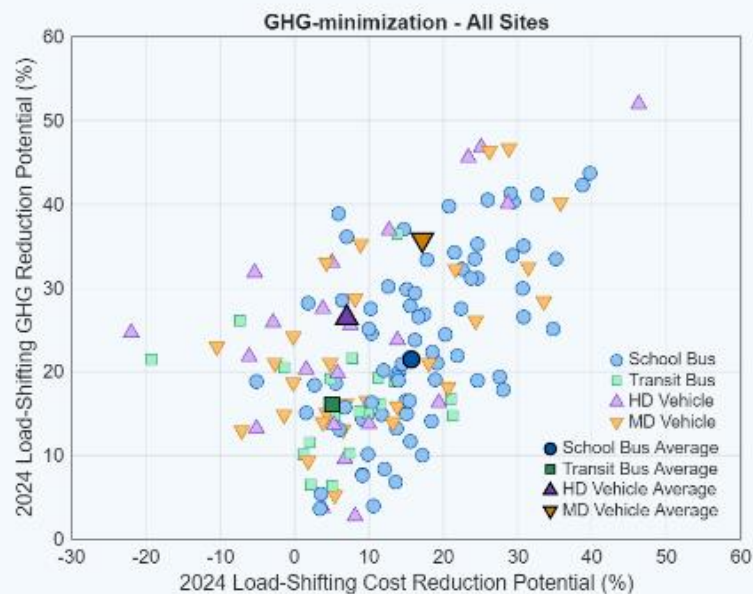
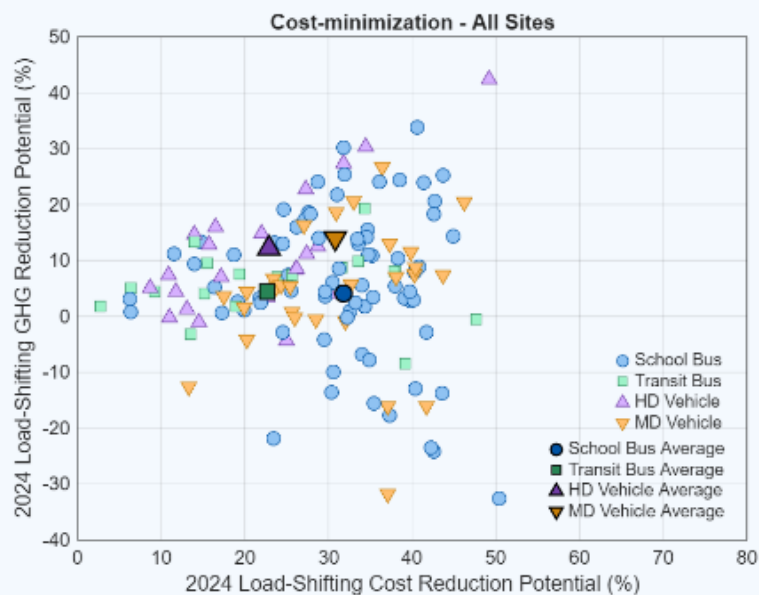
The Evaluation Team performed separate optimization modeling to determine whether shifting charging loads would minimize Utility costs and decrease electricity emissions attributable to EV charging. Figure 47 presents results from each optimization grouped by market sector. Each chart shows the tradeoffs for the other variable (i.e., the emissions impacts of minimizing costs and the cost impacts of minimizing emissions), and each axis depicts achievable results for each goal (emissions or costs). The Grid Impacts section for each Utility provides more detail about the tradeoffs when optimizing for each of these two variables.

In general, cost and emissions co-benefits are achievable: decreases in emissions coincide with reductions in costs. A notable exception affects sites in the SDG&E service territory, where the lowest costs occur in the evening when overall grid demand is low but grid emissions are high. This rate structure means that SDG&E sites may not fully realize co-benefits of reduced costs and reduced emissions.

While many sites can see a 20% to 40% improvement in costs, a small but significant number of sites would see an increase in emissions as a result of cost-optimized load shifting. Even so, charging flexibility suggests there is significant opportunity to reduce both emissions and costs with current tariffs. This

may further indicate that tariff design or approaches used in demand response programs could have a significant influence on how EV fleets operate. As an example, a program could use day-before or day-of communication to encourage fleets to avoid energy consumption from 4 p.m. to 9 p.m. by increasing charging midday.

**Figure 47. Results of Available Annual Improvements
When Modeling for GHG and Utility Costs by Market Sector**



3.7.1. Recommendations to Improve Costs (and GHG) of EV Fleets

Thus far, a minority of sites appear to have used load management, and some of these sites may use it inconsistently. When used consistently, load management can be highly effective at reducing utility bills. For many sites, the greatest cost-reduction opportunity results from shifting load to avoid highest-cost TOU periods. Some fleets in the PG&E and SDG&E service territories may also see substantial cost savings from reducing each month's peak demand and thus mitigating associated charges.

Utilities and their customers typically have long and meaningful working relationships with partnerships that have evolved over years. Utilities and the Evaluation Team can build on the trust they have built with customers to proactively approach customers and act as an advisor to convert more of these fleets to using load management. Improving electric grid efficiency, enhancing renewable energy uptake, and reducing capital and maintenance costs could improve outcomes for utilities, fleets, and ratepayers.

3.8. Fleet Manager Net-to-Gross Analysis

The Evaluation Team based our approach for the MDHD programs enhanced self-report NTG analysis on information we obtained as part of in-depth surveys with participating fleet managers. The Team conducted the survey via an online survey platform, Qualtrics, and delivered the survey links using email contact information provided by the Utilities.

As part of the net impacts analysis, the Evaluation Team estimated program effects on participants to exclude impacts from actions that participants would have taken without the program (freeridership) and to include any program-attributable indirect impacts on participants (participant spillover).

Table 21 shows the estimated NTG ratios by market sector, along with the overall average fleet manager NTG ratio of 0.55 for all surveyed sites. The higher the NTG ratio, the higher the level of influence the programs had over fleet manager decision-making. In our analysis, the school bus market sector was estimated to have the highest NTG ratio of the five sectors at 0.62, and the transit bus market sector had the lowest estimated NTG ratio at 0.38.

Table 21. MDHD Fleet Manager NTG Analysis Results

Market Sector	Responding Sites	NTG
School Bus	22	0.62
Distribution	12	0.53
Transit	7	0.38
Forklift	5	0.39
Heavy-Duty Vehicle	3	0.39
Overall	49	0.55

3.9. Truck Choice Model

The Evaluation Team employed the UC Davis Truck Choice Model (TCM)³⁶ to understand future adoption scenarios of MDHD EVs in California given a range of government incentives and market conditions. The TCM mimics fleet manager decision-making on vehicle choices using a generalized cost equation that accounts for all real and perceived costs associated with vehicles and fueling infrastructure for diesel, CNG, electric, and hydrogen options.³⁷ The model has been used by UC Davis extensively since 2017 to explain how California policies and programs impact fleet operator decisions involving the purchase of alternative-fuel MDHD vehicles.

The Evaluation Team used the TCM to explore the new EV sales shares of five market sectors in 2030 and 2035 in California (Figure 48). New EV sales shares refer to the fraction of sales that are EVs. We ran the model for eight scenarios defined in Table 22 for both 2030 and 2035. Each scenario uses a set of reference assumptions on vehicle costs, fuel costs, infrastructure costs, and vehicle usage described in *Appendix B*. Each scenario varies one or two of the reference assumptions at a time to test the impact on the new EV sales share.

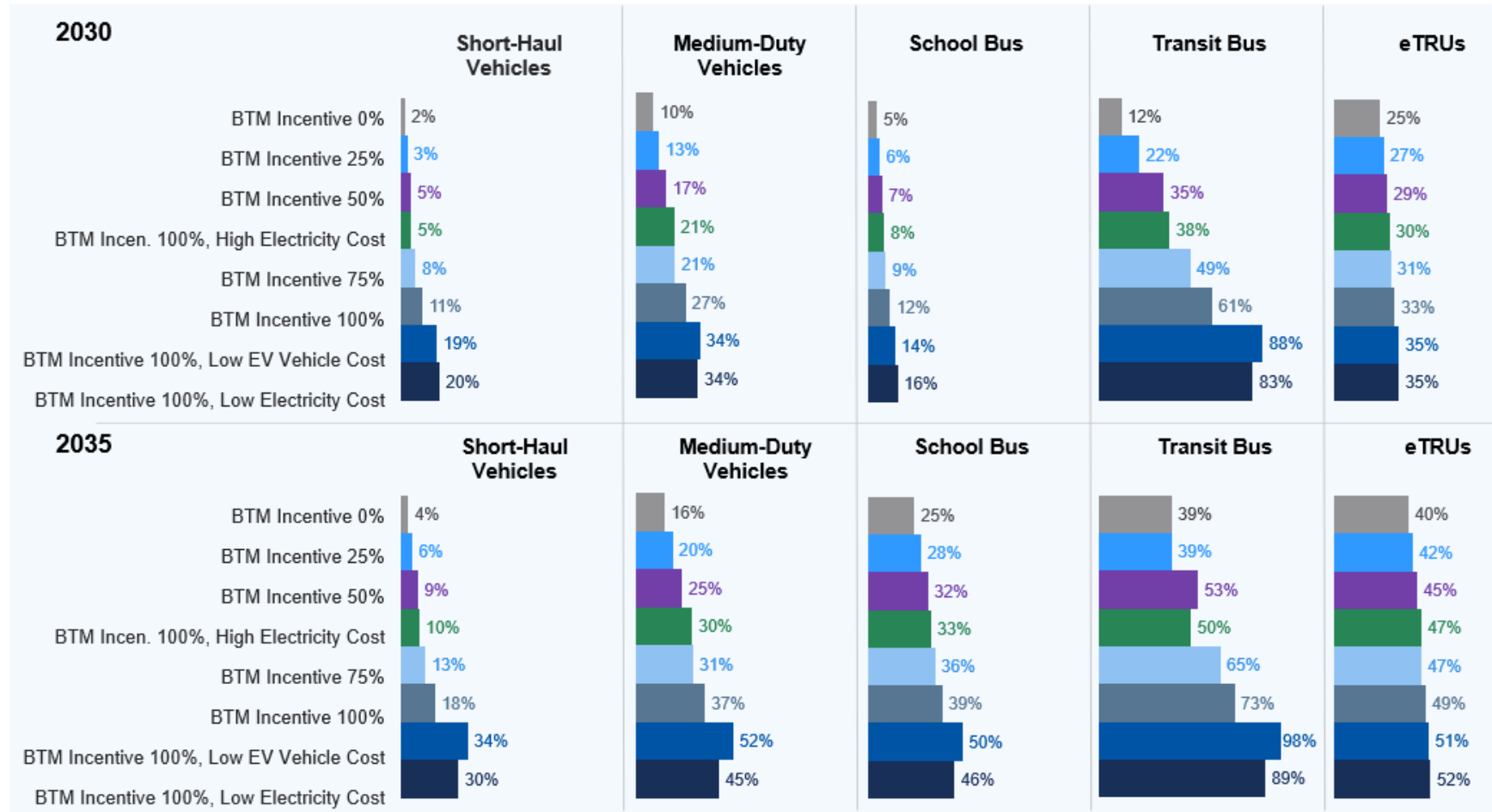
Table 22. Descriptions of Scenarios

ID	Scenario	Scenario Description
1	BTM Incentive 0%	Utilities do not provide a BTM incentive. The BTM cost is covered entirely by the fleet.
2	BTM Incentive 25%	The Utilities pay 25% of the BTM cost and the fleet pays 75% of the BTM cost.
3	BTM Incentive 50%	The Utilities pay 50% of the BTM cost and the fleet pays 50% of the BTM cost.
4	BTM Incentive 100%, High Electricity Cost	The Utilities pay 100% of the BTM cost, and the cost of electricity is 20% higher than the reference assumptions in <i>Appendix B</i>
5	BTM Incentive 75%	The Utilities pay 75% of the BTM cost and the fleet pays 25% of the BTM cost.
6	BTM Incentive 100%	The Utilities pay 100% of the BTM cost and the fleet pays 0% of the BTM cost.
7	BTM Incentive 100%, Low EV Vehicle Cost	The Utilities pay 100% of the BTM cost and the fleet pays 0% and the up-front EV vehicle cost is 20% lower than reference assumptions in <i>Appendix B</i> .
8	BTM Incentive 100%, Low Electricity Cost	The Utilities pay 100% of the BTM cost and the fleet pays 0% and the electricity cost is 20% lower than reference assumptions in <i>Appendix B</i> .

³⁶ [Miller 2017] Miller, Marshall, Qian Wang, Lewis Fulton, NCST Research Report: Truck Choice Modeling: Understanding California's Transition to Zero-Emission Vehicle Trucks, Research Report UCD-ITS-RR-17-36, 2017.

³⁷ Generalized cost is akin to total cost of ownership but also includes nonmonetary factors like risk.

Figure 48. New EV Sales Share in Five Market Sectors



3.9.1. Discussion

Figure 48 provides several insights. First, the figure highlights the importance of BTM incentives. Across the five market sectors in 2030, the difference in new EV sales share between Scenario 1 (BTM Incentive 0%) and Scenario 6 (BTM Incentive 100%) ranges from seven percentage points for the school bus sector to 49 percentage points for the transit bus sector. BTM incentives are projected to be more impactful in 2035 for most market sectors. This is expected behavior because while the BTM costs are assumed to stay the same between 2030 and 2035, vehicle costs should decline and fuel costs should increase by only a few percentage points.

A second insight is that across scenarios, EV new sales shares will increase from 2030 to 2035 in every market sector. The transit bus market sector has the greatest percentage point increase between 2030 and 2035, because the share of the BTM cost (relative to other costs) for transit bus is the largest of any of the sectors. The eTRU BTM funding is the smallest of all sectors, and the eTRU spread in market share is also the smallest.

A third insight is that lowering the electricity cost assumption by 20% increases the new EV sales share for all market sectors. This can best be seen when comparing Scenario 6 (BTM Incentive 100%) with Scenario 8 (BTM Incentive 100%, Low Electricity Cost). In 2030, the increase in sales shares from reducing the electricity cost by 20% ranges from four percentage points to 22 percentage points.

Similarly, increasing the electricity cost by 20% decreases the market share for all market sectors. The changes are most pronounced in the short-haul and transit bus market sectors, which have higher vehicle miles travelled and lower fuel economy. Lowering the EV vehicle cost increases EV market share across market sectors due to a straightforward decrease in the generalized cost. The two market sectors with the highest EV vehicle costs, short-haul and transit bus, show the highest increase in market share because a fixed change of 20% of EV vehicle cost has the largest absolute cost impact.

3.9.2. Truck Choice Model Limitations

This analysis is based on several inputs that could change significantly over time. In some cases, these inputs rely on policies that are not fixed in future years. Other inputs make use of technology cost projections, which are always somewhat uncertain. The section below discusses some of the critical inputs and how they could differ from those used in this analysis.

Changes from EY2023 Report Findings

Results from last year's report covered the years 2025 and 2030, while this year's results cover 2030 and 2035. The sales share results in 2030 from this year's model output are lower for all the market sectors than last year's results. Two input factors changed significantly from last year to this year: First, the recent UC Davis study used for capital cost inputs includes smaller vehicle cost reductions over time than earlier studies; consequently, the capital costs for some EV and FCEV market sectors are higher this year than last year. Second, this year's average electricity cost is \$0.37/kWh compared to last year's assumed average cost of \$0.27/kWh. The Evaluation Team used \$0.37/kWh because this is the actual average cost of electricity for activated PTD sites. The higher electricity cost can add significantly to the

overall generalized cost especially for sectors that have high average vehicle miles travelled and lower fuel economy such as short-haul and transit bus.

HVIP Incentives

Presently, HVIP funding is allocated every year with the total amount varying. Once ZEVs show significant market penetration, it is uncertain if and how HVIP funding will change. We have assumed that there will be enough funding allocated to meet the needs of all fleets purchasing ZEVs, but that situation would require large increases in the total allocation. If those increases do not occur, funding could decrease or be eliminated.

Vehicle Costs

Projections of EV costs assume significant increases in volume sales to reduce component costs. These increases are likely to occur in LDVs, but the magnitude of the increases in volume is much smaller for truck OEMs. Projections for truck batteries could be optimistic resulting in lower cost reductions in the 2030 to 2035 time period.

Low Carbon Fuel Standard (LCFS) Program

The LCFS program lowers the effective electricity and hydrogen costs for fleets enrolled in the program. The LCFS credit price and the program target carbon intensities vary as a function of time and determine the potential cost savings for the various fuels. The credit price has varied over time and could become higher or lower than assumed in this analysis. Recently, the LCFS credit price was over \$150/credit, but presently, it has fallen to roughly \$75/credit. The price could rise resulting in greater electricity savings or fall resulting in less savings.

Advanced Clean Truck/Advanced Clean Fleet

CARB's ACT and ACF regulations aggressively mandate the sale and purchase of zero-emission trucks and buses. Recently, California withdrew its application for a waiver for the ACF regulation, removing the mandate on fleet purchases for some fleets. A recent Congressional Review Act resolution³⁸ was enacted into law rescinding the waiver that allowed California to enforce the ACT regulation. Without these regulations, the projected cost assumptions for vehicle technology and BTM could change as OEMs deprioritize selling ZEVs.

Hydrogen Price and Availability

Currently, hydrogen fuel is available in limited locations. In addition, since there are few FCEVs on the road, the demand for hydrogen fuel is low causing the price to remain high. The lack of fuel availability and the high price act as large disincentives for fleets to purchase FCEVs. If these two barriers were

³⁸ H.J. Res. 87, "Joint Resolution providing congressional disapproval under chapter 8 of title 5, United States Code, of the rule submitted by the Environmental Protection Agency relating to 'California State Motor Vehicle and Engine Pollution Control Standards; Heavy-Duty Vehicle and Engine Emission Warranty and Maintenance Provisions; Advanced Clean Trucks; Zero Emission Airport Shuttle; Zero-Emission Power Train Certification; Waiver of Preemption; Notice of Decision'"

reduced, FCEVs could better compete with EVs for market share, which would reduce the projected sales shares of EVs.

3.10. Market Effects

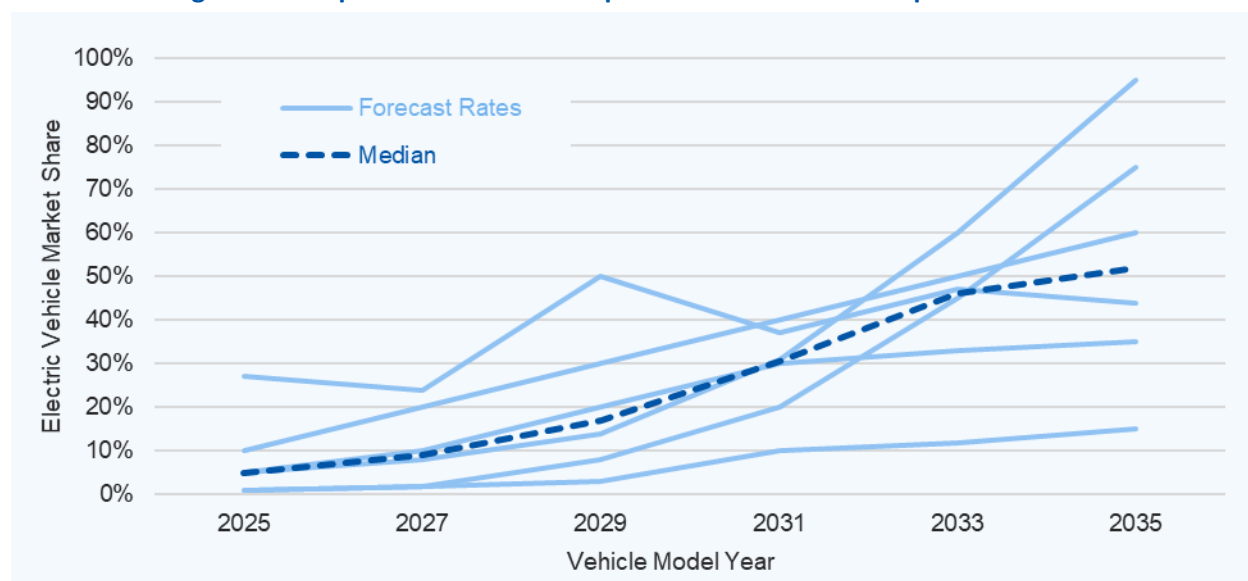
For the market effects analysis, the Evaluation Team assessed structural long-term changes in the transportation electrification market by comparing actual market activity to what would have happened in the absence of the programs.

3.10.1. TRU Electrification Market Share Baseline

The Evaluation Team forecasted the baseline market share of eTRUs in California through vehicle model year 2035 following two rounds of the Delphi method, which involved surveying a panel of subject matter experts about future EV market adoption rates. The eTRU panel comprised six experts. After each round, the Evaluation Team presented panelists with the other panelists' responses and asked if they wanted to change their answers. This iterative method sometimes results in consensus and near-consensus forecasts.

Figure 49 shows the individual curves from the first round of input (Round 1) along with the median curve. The baseline represents electrification in the California market in the absence of Utility incentives. The horizontal axis indicates vehicle model year and applies to only new vehicles, not the entire statewide vehicle stock.

Figure 49. Delphi Panel's Round 1 Updated Electric eTRU Adoption Forecasts



Round 1 forecasts of market share by 2035 varied widely, from the most conservative estimate of 15% to the most aggressive estimate of 95%. In Round 2, all six panelists agreed with the median or consensus forecast. As described in *Appendix B*, the forecasting rounds continue until a majority consensus is reached. Because all panelists were in agreement after Round 2, the Round 1 median

forecast is considered to be the final consensus result. The baseline consensus forecast for electric transit bus market share estimated that 52% of new TRU sales in California will be eTRUs by 2035.

Although the main goal of the Delphi panel is to derive a consensus forecast, panelists' supporting rationales also contain valuable qualitative insights. Aggregating the supporting comments revealed deeper insights into factors that panelists predict will accelerate or impede transit bus electrification in California.

The wide range and variability in panelists' forecasts reflect the uncertain policy environment for eTRUs. Key elements of CARB's TRU Regulation—which would have specified when a certain percentage of all new TRU purchases in California would be required to be zero-emission for California fleets—have not been approved by the EPA. Five of six panelists cited the unclear status of California regulations and federal policy as major factors influencing their projections.

Four of six panelists identified high capital costs and economic barriers as key constraints on eTRU adoption. One expert noted that while eTRUs offer lower operating costs than their diesel counterparts, their significantly higher up-front costs will likely prevent fleets from achieving total cost of ownership (TCO) parity with diesel units over a five-year period. Two panelists emphasized that these financial challenges are especially burdensome for small fleets. Large fleets with more resources are expected to invest in eTRUs in anticipation of future regulations, but small or independent fleets are unlikely to adopt eTRUs in the absence of regulatory requirements or substantial incentives. One panelist pointed out that non-truck trailers are often ineligible for grants because they are not classified as vehicles, further limiting the availability of financial support for certain eTRU types.

Two panelists elaborated on the current state of the eTRU technology. According to one panelist, the eTRU market is still in its infancy and eTRU battery systems still need time to be proven as reliable, at which point fleets will be more likely to invest. Given that the primary use case for eTRUs is food transportation, most eTRUs still have a diesel backup system due to food safety concerns. According to another panelist, as the technology matures and new eTRU options enter the market, along with the rollout of depot and public charging, fleets will be more likely to purchase eTRUs to accommodate future zero-emissions regulations.

Panelists cited several long-term drivers of adoption, including declining battery costs, improving return on investment, private-sector fleet decarbonization goals, and the potential approval and enforcement of CARB's TRU regulation. Together, these factors are expected to create a more favorable economic and regulatory environment for eTRU adoption over the next decade.

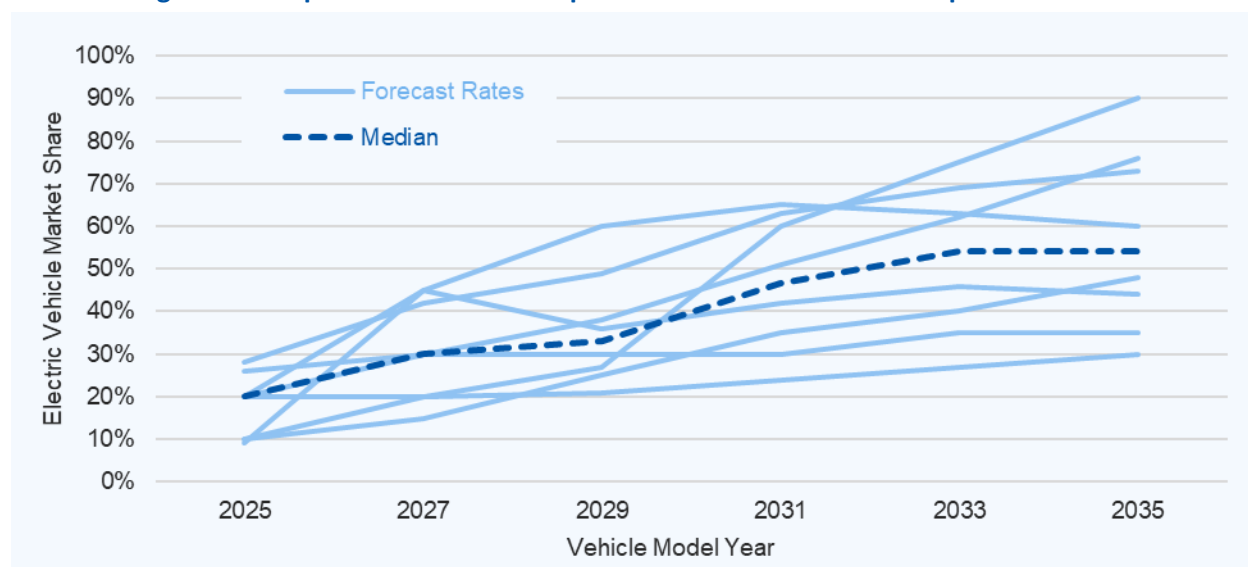
Highlights

- The baseline consensus forecast for eTRU market share estimated that 52% of new TRU sales in California will be eTRUs by 2035.
- Five of six panelists cited the unclear status of California regulations and federal policy as major factors influencing their projections.
- High capital costs and technology immaturity are slowing early adoption, especially for small fleets, but experts expect that decreasing battery costs, improved ROI, and the eventual approval of CARB regulations will drive long-term market growth.

3.10.2. Transit Bus Electrification Market Share Update

The Evaluation Team updated the baseline forecast for electric transit bus market share in California through vehicle model year 2035 following two rounds of input from a Delphi panel of eight experts. This baseline represents electrification in the California market in the absence of Utility incentives. The Evaluation Team updated the consensus forecasts developed during a previous Delphi panel that we conducted as part of the EY2022 report. Of the eight panelists, five had participated in the EY2022 consensus forecast and three were new additions to the panel. Figure 50 shows the individual curves from the first round of input (Round 1) along with the median curve. The horizontal axis indicates vehicle model year and applies to only new vehicles, not the entire statewide vehicle stock.

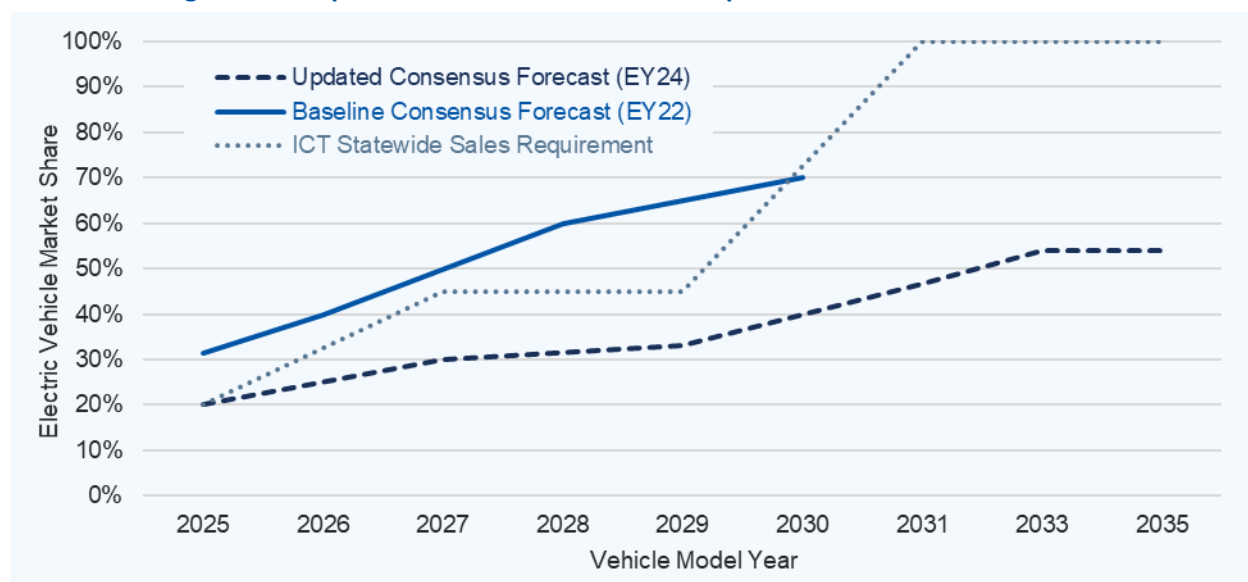
Figure 50. Delphi Panel's Round 1 Updated Electric Transit Bus Adoption Forecasts



Round 1 forecasts of market share by 2035 ranged from the most conservative estimate of 30% to the most aggressive estimate of 90%. In Round 2, all eight panelists agreed with the median or consensus forecast. As described in *Appendix B*, the forecasting rounds continue until a majority consensus is reached. Because all panelists were in agreement after Round 2, the Round 1 median forecast is considered to be the final consensus result.

Figure 51 shows the final updated consensus forecast compared to the previous consensus forecast from EY2022 and the zero-emission transit bus sales schedule from the ICT regulation. The ICT regulation specifies calendar year purchase requirements (when a certain percentage of all new vehicle purchases must be zero-emission) for California public transit agencies.³⁹

Figure 51. Delphi Panel’s Electric Transit Bus Updated Market Share Forecasts



The updated consensus forecast for electric transit bus market share estimated that 54% of new transit bus sales will be battery electric in California by 2035. The updated consensus forecast fell below both the baseline consensus forecast and the ICT sales requirements, suggesting that in the absence of Utility incentives and under current market conditions, transit buses may fail to meet the regulatory electrification goals outlined by CARB. The forecast also reflects that experts have a more conservative outlook for the battery electric bus (BEB) market compared than they did just a few years ago, which has led them to lower their expectations.

Although the main goal of the Delphi panel is to derive a consensus forecast, panelists’ supporting rationales also contain valuable qualitative insights. Aggregating the supporting comments revealed deeper insights into factors that panelists predict will accelerate or impede transit bus electrification in California.

Panelists in EY2024 were less optimistic than those in the EY2022 panel about the pace of BEB adoption. Their forecasts suggested a nonlinear, fluctuating trajectory rather than steady growth, which they attributed to persistent supply chain challenges, growing uncertainty around funding, and increasing market competition from other zero-emission technologies—particularly hydrogen fuel cell buses.

³⁹ The ICT regulation specifies different sales requirements for small (<100 bus) and large (>100 bus) transit agencies. The Evaluation Team used the statewide requirement in our analysis, which assumes similar turnover at large and small transit agencies.

All four panelists whose forecasts fell below the median cited supply chain challenges around manufacturing and reliability as key reasons for skepticism around short-term BEB adoption. These panelists noted that while existing orders will be fulfilled, new orders are expected to slow due to the problems with the OEM market. One panelist emphasized that California's approved vendor list currently includes only three manufacturers, one of which is bankrupt and another foreign-owned (making it ineligible for federal funding), which leaves only one eligible supplier for transit agency procurement. Other concerns included long lead times (often exceeding 24 months), recurring reliability issues, extended vehicle downtime, insufficient vendor maintenance support, and a shortage of qualified service technicians, particularly for proprietary systems. One panelist noted that state transit associations are increasingly voicing opposition to the zero-emission bus (ZEB) transition due to challenges with reliability, vendor availability, vehicle range, and overall cost.

Three panelists identified recent shifts in federal funding and policy priorities as sources of short-term disruption in the BEB market. One mentioned that the federal action to revoke California's waivers has introduced uncertainty, and another predicted that reduced federal funding will impact transit agencies' ability to meet ICT goals. Two panelists emphasized the need for significant infrastructure upgrades, and two others called out high costs as factors slowing adoption. One specifically pointed to the high up-front capital costs of BEBs compared to those for diesel buses, along with rising electricity prices. Another noted that limited electrical capacity is preventing additional BEB procurements and that necessary TTM upgrades would require self-funding.

Three panelists also highlighted increasing competition from hydrogen fuel cell buses, particularly for longer-range duty cycles for which fuel cells may offer operational advantages. Three panelists noted that BEB range limitations remain a critical barrier to broader adoption.

Panelists expressed greater optimism about the long-term outlook for BEB adoption. Five panelists cited improving BEB economics and ongoing technological advancements that are expected to make ZEBs increasingly attractive on a TCO basis compared to fossil fuel alternatives. Two panelists specifically pointed to declining battery costs. One of these further mentioned local concerns about air pollution and global momentum toward electrification as key drivers of technological advancements and cost reductions—factors that, combined with growing public awareness and acceptance of electric buses, are expected to accelerate long-term adoption.

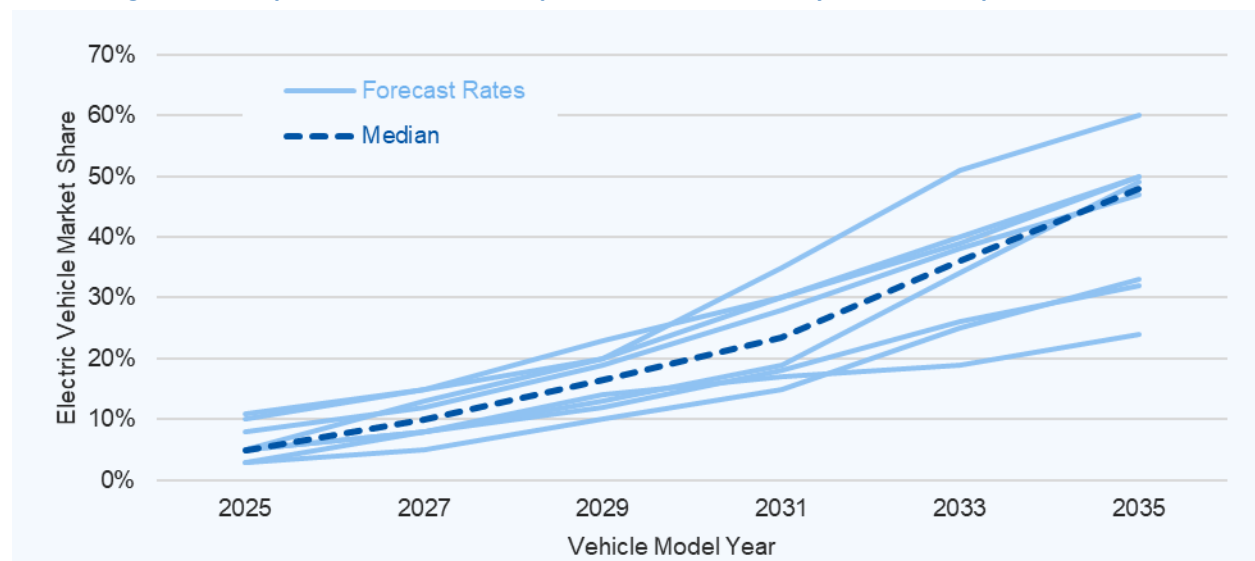
Highlights

- The updated consensus forecast for the electric transit bus market share estimated that 54% of new transit bus sales will be battery electric in California by 2035.
- The updated consensus forecast fell below both the EY2022 baseline consensus forecast and the ICT sales requirements.
- Experts cited supply chain challenges around manufacturing and reliability as reasons why the electric transit bus market share would not meet ICT regulations.

3.10.3. Medium-Duty Vehicle Electrification Market Share Update

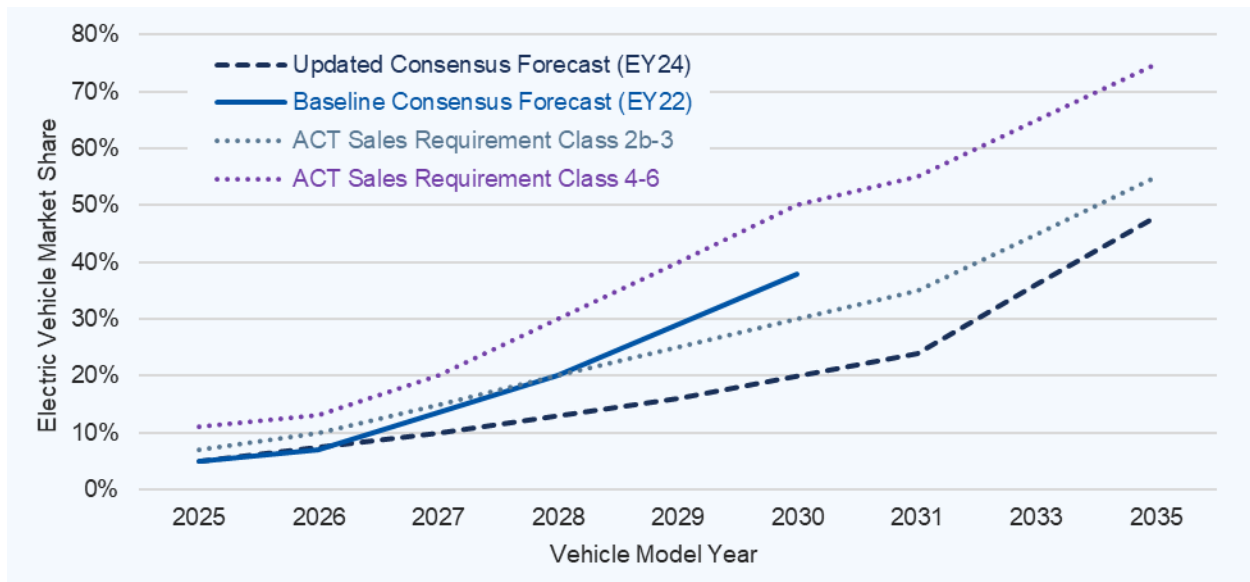
The Evaluation Team updated the baseline forecast for electric medium-duty vehicles, focusing on the Class 2b – 6 delivery vehicle market share in California through vehicle model year 2035 following two rounds of input from a Delphi panel. This baseline represents electrification in the California market in the absence of Utility incentives. The Evaluation Team updated the consensus forecasts developed during a previous Delphi panel that we conducted as part of the EY2022 report. Of the eight panelists, five had participated in the EY2022 consensus forecast and three were new additions to the panel. Figure 52 shows the individual curves from the first round of input (Round 1), along with the median curve. The horizontal axis indicates vehicle model year and applies to only new vehicles, not the entire statewide vehicle stock.

Figure 52. Delphi Panel’s Round 1 Updated Electric Delivery Vehicle Adoption Forecasts



Round 1 forecasts of market share by 2035 varied from the most conservative estimate of 24% to the most aggressive estimate of 60%. In Round 2, six of eight panelists agreed with the median or consensus forecast, while two panelists submitted new forecasts and rationales. As described in *Appendix B*, the forecasting rounds continue until a majority consensus is reached. Because over half of the panelists were in agreement after Round 2, the Round 2 median forecast is considered to be the final consensus result. Figure 53 compares the final consensus estimate to the consensus estimate in the EY2022 evaluation and shows the relevant sales schedules from the ACT regulation. The ACT regulation specifies when a certain percentage of all new vehicle sales in California must be ZEVs.

Figure 53. Delphi Panel’s Electric Delivery Vehicle Updated Market Share Forecast



The updated final consensus forecast for the electric delivery vehicle market estimated that 48% of new delivery vehicle sales will be battery electric in California by 2035. This marks a revision from the baseline consensus forecast that falls short of the ACT sales requirements. This suggests that without Utility incentives and under current market conditions, the delivery sector may struggle to meet the electrification goals set by CARB.

Of the two experts who disagreed with the median forecast, one lowered their forecast, citing diminishing political support likely to reduce both research and development investment and funding for vehicle deployment. The other raised their projection, arguing that they expect the delivery vehicle market’s TCO to be competitive with diesel and gasoline models by 2027. This panelist further noted that smaller delivery vehicles (e.g., Class 2b/3 cargo vans) are poised for strong adoption due to cost parity and relatively simple infrastructure—particularly if the ACT rule remains in effect—even in the absence of additional incentives or Utility support. However, this panelist acknowledged that the medium-duty step van market will face greater challenges without such support.

Although the main goal of the Delphi panel is to derive a consensus forecast, panelists’ supporting rationales also contain valuable qualitative information. Aggregating the supporting comments revealed deeper insights into factors that panelists predict will accelerate or impede delivery vehicle electrification in California.

Compared to the EY2022 panel, participants in EY2024 were notably less optimistic about the pace of electrification in the delivery vehicle market. While their updated forecasts suggest a slowdown in near-term battery electric delivery vehicle adoption, they still project steady, linear growth—which accelerates in the 2030s as market conditions and infrastructure improve.

Six panelists mentioned that the uncertainty around enforcement of the ACT regulation, as well as shifts in federal policy, are creating hesitation among fleet operators and slowing adoption in the short term. One panelist also mentioned that tariffs are adding to investment risk and slowing BEV purchases.

Four panelists predicted that improving BEV economics, expanded vehicle offerings, and more accessible financing models in the 2030s will accelerate adoption. One panelist additionally noted that corporate sustainability commitments and state and local programs will provide indirect support by driving emissions reductions, particularly in urban logistics and warehouse operations. However, as adoption increases due to better economics, three panelists predict infrastructure will become the primary constraint—especially without Utility support.

Five panelists highlighted the differing outlooks for smaller delivery vehicles (e.g., Class 2b/3 cargo vans) versus heavier delivery trucks (Class 4–6). They were generally more optimistic about the adoption of smaller vans, citing stronger return on investment, more favorable TCO, and the relative ease of infrastructure deployment—since Class 2b/3 vehicles can be accommodated by L2 charging. One expert pointed to Ford’s 2025 gas-powered Transit and E-Transit models being similarly priced as evidence that vehicles in this segment have already reached price parity with their ICE counterparts.

Heavier delivery trucks, on the other hand, face more difficulty in meeting ACT requirements—which call for 75% of new Class 4–8 rigid truck sales to be zero-emission by 2035 (versus 55% of new Class 2b and 3 truck sales). Panelists noted that these larger vehicles have higher up-front costs and may require DCFC and greater energy capacity, depending on duty cycles and utilization. Two panelists specifically stated that without Utility incentives and support, heavier delivery vehicles are more vulnerable to delayed adoption.

Overall, four of the eight panelists explicitly emphasized the importance of incentives and policy support from California Utilities. One panelist also referenced HVIP, and another mentioned LCFS funding as critical funding sources. These experts agreed that, in the absence of Utility incentives, adoption of battery electric delivery vehicles—particularly in the heavier weight classes—is likely to stagnate or slow considerably.

Highlights

- The updated consensus forecast for electric delivery market share estimated that 48% of new delivery vehicle sales will be battery electric in California by 2035.
- The updated consensus forecast is lower than both the EY2022 baseline consensus and the ACT sales requirements.
- Most panelists anticipate that uncertainty around policy and funding will slow adoption in the near term, but that improving economics will accelerate growth in the 2030s—at which point infrastructure will become the primary constraint.
- Experts agreed that, in the absence of Utility incentives, adoption of battery electric delivery vehicles—particularly in the heavier weight classes—is likely to stagnate or slow considerably.

4. Southern California Edison Transportation Electrification Programs

4.1. Charge Ready Transport Program

4.1.1. Overview

This overview provides a detailed description of the SCE Charge Ready Transport program; summaries of the program implementation process, performance metrics, materials, and budget; and a timeline of major milestones. Following the overview the Evaluation Team presents the 2024 findings, highlights, and lessons learned.

Program Description

Per Decision 18-05-040, SCE's Charge Ready Transport program provides infrastructure for fleet electrification at a low cost or at no cost to participants who procure or convert at least two medium- or heavy-duty (MDHD) EVs. SCE launched the Charge Ready Transport program in May 2019 to accelerate the adoption of MDHD EVs by lowering the TCO for fleets, assist businesses in reducing emissions, and offer an avenue for customers to take advantage of current incentives. Charge Ready Transport has an approved budget of \$342.6 million.⁴⁰ Though the program originally targeted 870 sites supporting 8,490

EVs procured or converted to electric, the site goal was reduced in 2023 in Resolution E-5257 to 500 sites.

Charge Ready Transport Program Design Goal

Accelerate the adoption of MDHD EVs by lowering the TCO for fleets, assisting businesses in reducing emissions, and offering an avenue for customers to take advantage of current incentives.

Through the Charge Ready Transport program, SCE covers the cost of most or all of the distribution charging infrastructure needed up to the first point of connection with a participant's EVSE. Participants can choose Utility ownership or customer ownership of BTM infrastructure. If SCE owns both the Utility-side and the customer-side of the meter infrastructure, then SCE pays to design, construct, own, and maintain all

infrastructure up to the EVSE. The participant will then pay to install, own, and maintain the EVSE. If the participant decides to own the BTM infrastructure, SCE will pay to design, construct, own, and maintain all TTM infrastructure, and the participant will pay to design, construct, own, and maintain all BTM infrastructure and will receive a rebate for up to 80% of what it would have cost SCE to perform the BTM work or for the participant's actual installation costs, whichever amount is lower. Additional charger rebates are available for

Original Program Target

Achieve a minimum of 870 sites with 8,490 MDHD EVs procured or converted.

Revised Program Target

Achieve a minimum of 500 sites with 8,490 MDHD EVs procured or converted.

⁴⁰ This amount does not include the budget for the evaluation.

transit and school bus deployments and for fleets that are located in DACs and not operated by Fortune 1000 companies.

To participate in the Charge Ready Transport program, fleets must meet specific criteria. The program requires participating customers to lease, purchase, or convert at least two MDHD EVs. MDHD EVs include various categories of eligible vehicle and transportation equipment such as airport GSE, forklift, heavy-duty vehicle, medium-duty vehicle, port cargo truck, school bus, transit bus, and TRU. Program-eligible vehicles include commercial PHEVs approved by SCE for use in the outlined market sectors, on-road vehicles with a GVWR exceeding 6,000 pounds (Class 2b through Class 8), and non-road vehicles. Additionally, fleets must own or lease the site property, operate and maintain the infrastructure for 10 years, provide monthly data related to EV usage for five years, and use approved vendors for the EVSE, among other requirements. Pursuant to the SB 350 Decision, the Charge Ready Transport program's infrastructure budget should spend a minimum of 15% for transit agencies, a maximum of 10% for forklifts, and a minimum of 25% for ports and warehouses in SCE's territory. A minimum of 40% of sites should be in DACs in SCE's territory.

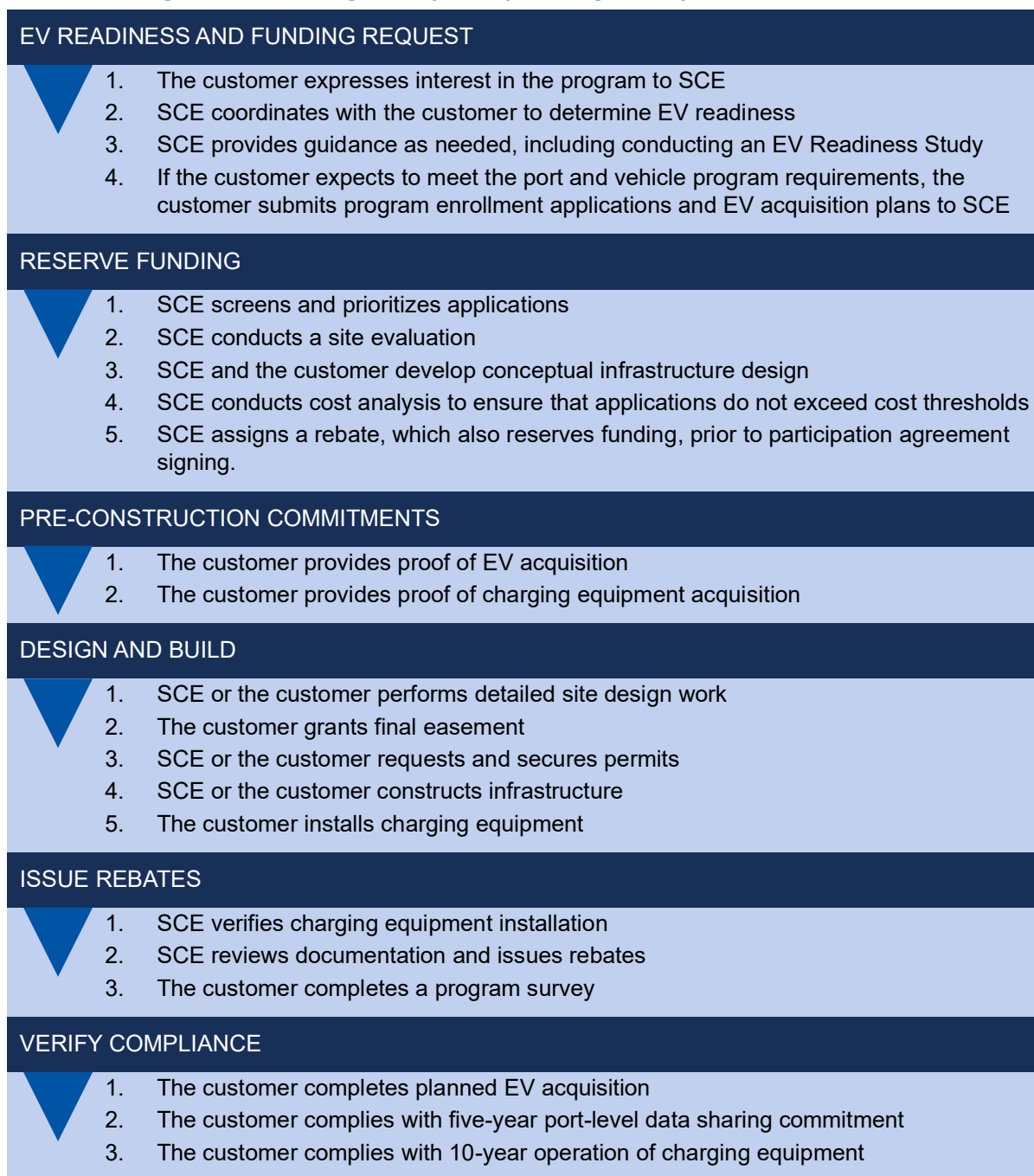
SCE offers EV-specific TOU rates to support commercial EV fleet customers (TOU-EV-7, TOU-EV-8, and TOU-EV-9), which include demand charge relief.⁴¹ In Decision 22-08-001, SCE received approval for an extension of the demand charge holiday for TOU-EV-8 and TOU-EV-9. The specific charge paid by the customer includes a monthly fixed customer charge, an energy charge (per kilowatt-hour), and a demand charge, based on the highest recorded demand during each monthly billing period.

Implementation

Figure 54 details the key steps in the Charge Ready Transport program implementation process. There were no major changes to the implementation process in 2024.

⁴¹ Southern California Edison. 2018. "Business Rate Basics: Rate Schedules TOU-EV-7, TOU-EV-8, TOU-EV-9 for Business Customers Charging Electric Vehicles." https://www.sce.com/sites/default/files/inline-files/TOU-EV-7_8_9_Rate_Fact_Sheet_WCAG.pdf

Figure 54. SCE Charge Ready Transport Program Implementation Process



Program Performance Metrics

The Evaluation Team reviewed the participating sites in SCE’s Charge Ready Transport program and organized them by program status. Table 23 displays the number of sites in the program by completion status as of December 31, 2024.

Table 23. SCE Charge Ready Transport Program Complete Site Count by Status

Site Status	EY2024	Program to Date
Utility Construction Complete	34	99
Activated	31	86
Operational	32	86
Closed Out	26	55

In EY2024, the SCE Charge Ready Transport program received 82 applications, signed contracts with 69 sites, and activated 31 sites that supported 744 vehicles across six market sectors. This brought the total number of Charge Ready Transport program applications to 278 and the total number of executed contracts to 222.⁴² As shown in Table 24, 65% of sites activated in 2024 (20 of 31) and 67% of sites activated by the end of 2024 (58 of 86) are located within a disadvantaged community (DAC).

Table 24. SCE Charge Ready Transport Program Activated Sites by Market Sector in EY2024 and Program to Date

Market Sector	EY2024		Program to Date	
	Number of Sites in DAC	Number of Sites in Non-DAC	Number of Sites in DAC	Number of Sites in Non-DAC
Forklift	-	1	-	1
Heavy-Duty Vehicle	15	1	27	1
Medium-Duty Vehicle	2	5	3	9
School Bus	3	3	20	13
Transit Bus	-	1	5	3
TRU	-	-	3	1
Total	20	11	58	28

In EY2024, the highest participation rate in the SCE Charge Ready Transport program came from the heavy-duty vehicle market sector, which accounts for 52% of EY2024 activated sites. The medium-duty vehicle market sector accounts for the second highest number of sites, with 23% of EY2024 activated sites, followed by the school bus market sector, with 19% of EY2024 activated sites. The transit bus and forklift market sectors each had one activated site in EY2024. The TRU market sector had no activated sites in EY2024.

In the SCE Charge Ready Transport program to date, school bus fleets represent 38% of all activated sites. Heavy-duty vehicle and medium-duty vehicle sites are the next most common market sectors, accounting for 33% and 14% of activated sites to date, respectively. The transit bus market sector accounts for 9% while the TRU market sector accounts for 5% of activated sites to date. The forklift market sector is the least represented in the program with one site.

SCE installed charging infrastructure to support 744 MDHD vehicles across six market sectors in EY2024 based on 10-year VAPs submitted by customers at the time of application. This brings the total number

⁴² The application and contract totals do not include applications that were withdrawn, rejected, or put on hold.

of MDHD vehicles electrified in the Charge Ready Transport program to 1,950. As shown in Table 25, the heavy-duty vehicle market sector is the largest sector of MDHD vehicles electrified (453, or 61%) in EY2024, followed by medium-duty vehicle (228, or 31%). Next is the school bus market sector (45, or 6%). The MDHD sectors with the fewest electrified vehicles in EY2024 are forklifts (12, or 2%) and transit bus sites (6, or 1%).

By the end of EY2024, the SCE Charge Ready Transport program had 86 activated sites satisfying 17% of the program's *per se reasonableness* revised goal of 500 sites. These sites support the electrification of 1,950 MDHD vehicles per customers' VAPs, which achieves 23% of the program's *per se reasonableness* goal of electrifying 8,490 MDHD vehicles. The 222 contracts signed in the program to date could meet 44% of the program's *per se reasonableness* goal of 500 sites and could support 4,824 MDHD vehicles, meeting 57% of the program's *per se reasonableness* goal of 8,490 vehicles electrified. The total 278 customer applications could satisfy approximately 56% of the program's site goal and would support 6,210 MDHD vehicles, which could satisfy 73% of the program's electrified vehicles goal.

Table 25. SCE Charge Ready Transport Program *Per se Reasonableness* Site and Vehicle Goal Progress

Program Metric	<i>Per se Reasonableness</i> Goal	Program to Date
Activated Sites	500	86
MDHD EVs	8,490	1,950

The 31 sites activated in EY2024 installed 673 charging ports to support the 744 electrified MDHD vehicles. Most of these (469) are DCFC ports with L2 ports accounting for the remaining 204. In the SCE Charge Ready Transport program to date, 1,699 L2 and DCFC ports have been installed at activated sites to support charging of 1,950 MDHD EVs, equating to roughly 1.15 vehicles per charging port.

The CPUC established six phases in the program timeline per the SB 350 reporting template. As presented in Table 26, at the end of 2024 more than half (61%) of customer applications were either in the Activation or the Contract Issuance phase. Of the remaining applications, the majority were in either the Design and Permitting, Site Assessment and Construction Complete phases. The smallest number of applications were in the Application Review phase of the program.

Table 26. SCE Charge Ready Transport Program Sites, Vehicles, and Ports by Program Phase, as of December 31, 2024

CPUC Program Phase	Number of Sites	Total Number of EVs Supported	Total Number of Ports ^b
Application Review	19	284	186
Site Assessment	30	602	608
Contract Issuance	61	1,694	1,540
Design and Permitting	44	841	702
Construction Complete	30	538	464
Activation ^a	99	2,251	1,901

^a Note, sites in the Activation phase exceeds Activated Sites in the program to date because this table includes sites that have entered but have not yet completed this program phase.

^b Note, ports for sites in Activation phase will reflect the quantity of ports identified during site visits, for those activated sites that have been visited.

Table 27 shows the median durations per program phase (measured in calendar days) for EY2024 and PTD activated sites. The column labeled EY2024 refers to sites activated in 2024. The Program to Date column refers to all sites activated from the initiation of the program through December 31, 2024.

Values in Table 27 provide insight into program phase length trends over time. Sites in each column did not necessarily pass through each phase in the same calendar year. For example, EY2024 activated sites may have passed through Contract Issuance in 2021 while others passed through in 2022 or 2023. Across all program phases, Contract Issuance and Activation have the shortest median durations, and Design and Permitting has the longest median duration.

Table 27. SCE Charge Ready Transport Program Median Calendar Days per Phase for EY2024 and PTD Sites

CPUC Program Phase	Median Calendar Days	
	EY2024	Program to Date
Application Review	165	100
Site Assessment	39	37
Contract Issuance	27	22
Design and Permitting	395	258
Construction Complete	150	138
Activation	19	29

Median durations also vary by market sector. For instance, for forklift sites activated in EY2024, the median calendar days for Design and Permitting was 288 days; however, transit bus applications took a median of 494 days to pass through this program phase. The median durations per program phase in EY2024 were similar to the PTD median durations for most of the phases. The outliers were Application Review, Design and Permitting, and Construction Complete, all of which had notably longer median durations for EY2024 than for the program to date.

Figure 55 expands the analysis of program phase duration for EY2024 by displaying the average number of calendar days per phase (denoted by X), calendar day median (middle line inside of box), 1st quartile (bottom of box), 3rd quartile (top of box), minimum (bottom tail), maximum (top tail), and outliers (dots). Program applications experienced the most variation in completion time within the Design and Permitting phase, which involves an external review and substantial back-and-forth with applicants to finalize site layout, design, easements, and conveyances, if required. This was followed by Construction Complete, which requires coordination among contractors and supply chain vendors. Application Review also had a high degree of variation in completion time, most likely a result of conducting engineering capacity studies and the communication required between program administrators and applicants to solidify the site scope and ensure that applicants had completed the required documentation. Customer applications in the Site Assessment and Contract Issuance phases experienced the lowest mean and variance in calendar days among all the program phases, despite a few outliers.

Figure 55. SCE Charge Ready Transport Program Calendar Days per Phase for EY2024 Sites

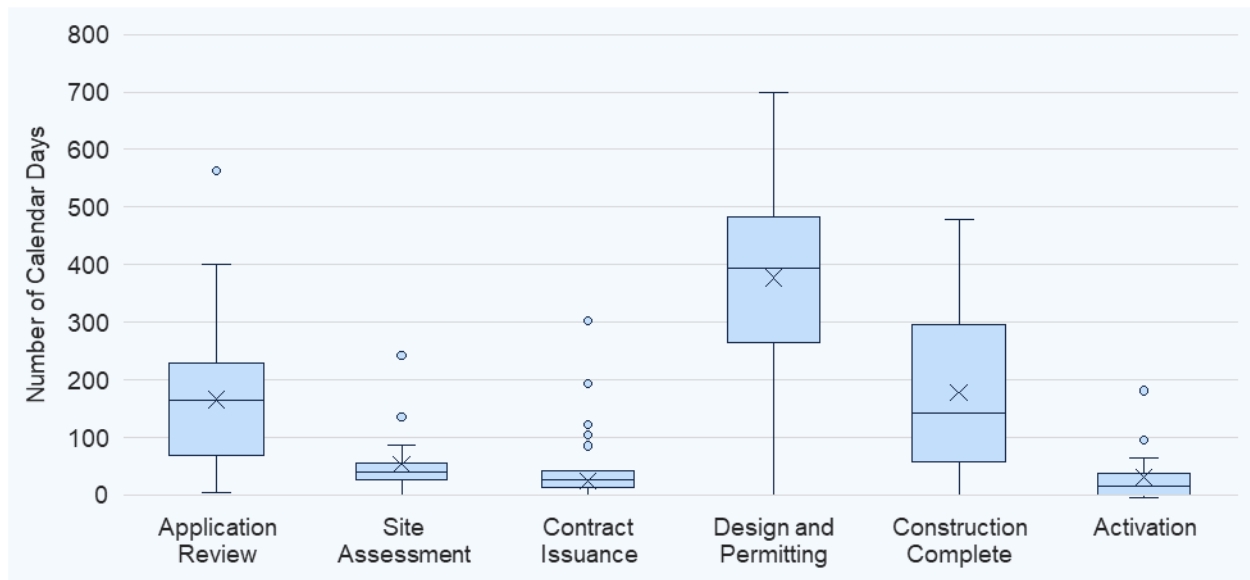


Table 28 displays the median number of calendar days that the Charge Ready Transport program process took from start to finish (Application Review to Activation) for 31 activated sites across six market sectors in EY2024 and the median for the program to date. The overall median start-to-finish timeline for site activation for EY2024 sites was 959 calendar days, down 1 day from the median in EY2023 (960 days), which was an increase from EY2022 (841 days). As displayed in Table 28, median start-to-finish durations varied widely across market sectors from less than two years (heavy-duty vehicles, 855 days) to nearly three years (forklifts, 1,018 days) in EY2024. The 86 PTD activated sites had an overall median start-to-finish duration of 796 days.

Table 28. SCE Charge Ready Transport Program Median Duration for Site Activation by Market Sector for EY2024 and PTD Sites

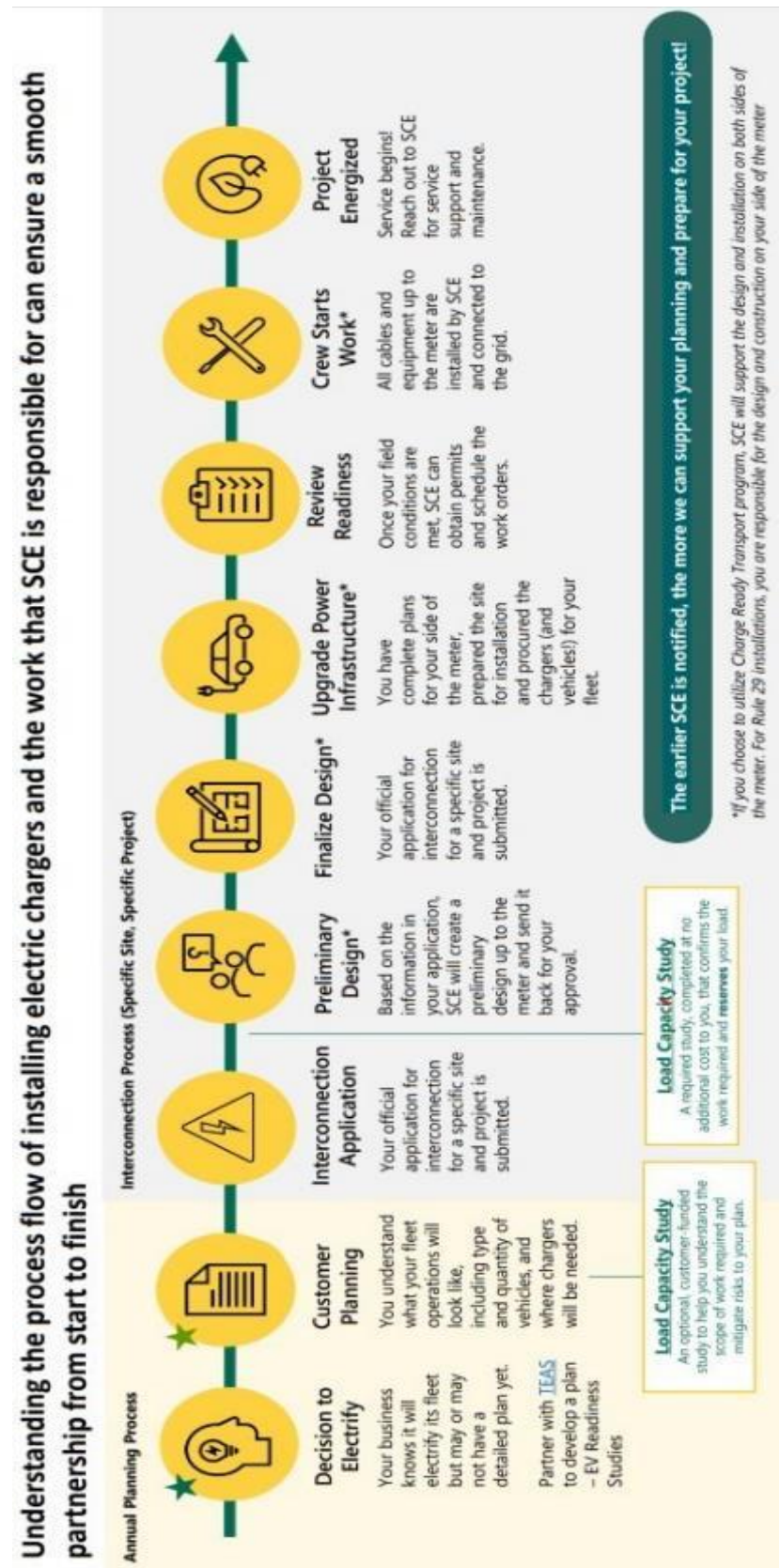
Market Sector	EY2024		Program to Date	
	Median Duration Start-to-Finish (Calendar Days)	Number of Activated Sites	Median Duration Start-to-Finish (Calendar Days)	Number of Activated Sites
Forklift	1,018	1	1,018	1
Heavy-Duty Vehicle	855	16	774	28
Medium-Duty Vehicle	979	7	910	12
School Bus	903	6	723	33
Transit Bus	979	1	918	8
TRU	-	-	919	4
All Market Sectors	959	31	796	86

Program Materials Summary

Throughout 2024, SCE aligned the Charge Ready Transport program's marketing, education, and outreach (ME&O) strategy with external drivers of fleet electrification, this includes policy, EV availability, and grant funding. SCE's approach focuses on drivers for electrification through equipment availability, grants, and policy regulations with strategies that further address these barriers. At the same time, SCE ran a broader strategy and campaign to ensure maximum program participation. In total, staff participated in 21 in-person events (including ride and drives, in-person case studies, panel sessions, and booths at industry events) and two digital campaigns (webinars and targeted digital campaigns). This section highlights key findings and successes from the review of program materials and ME&O activities SCE conducted in 2024:

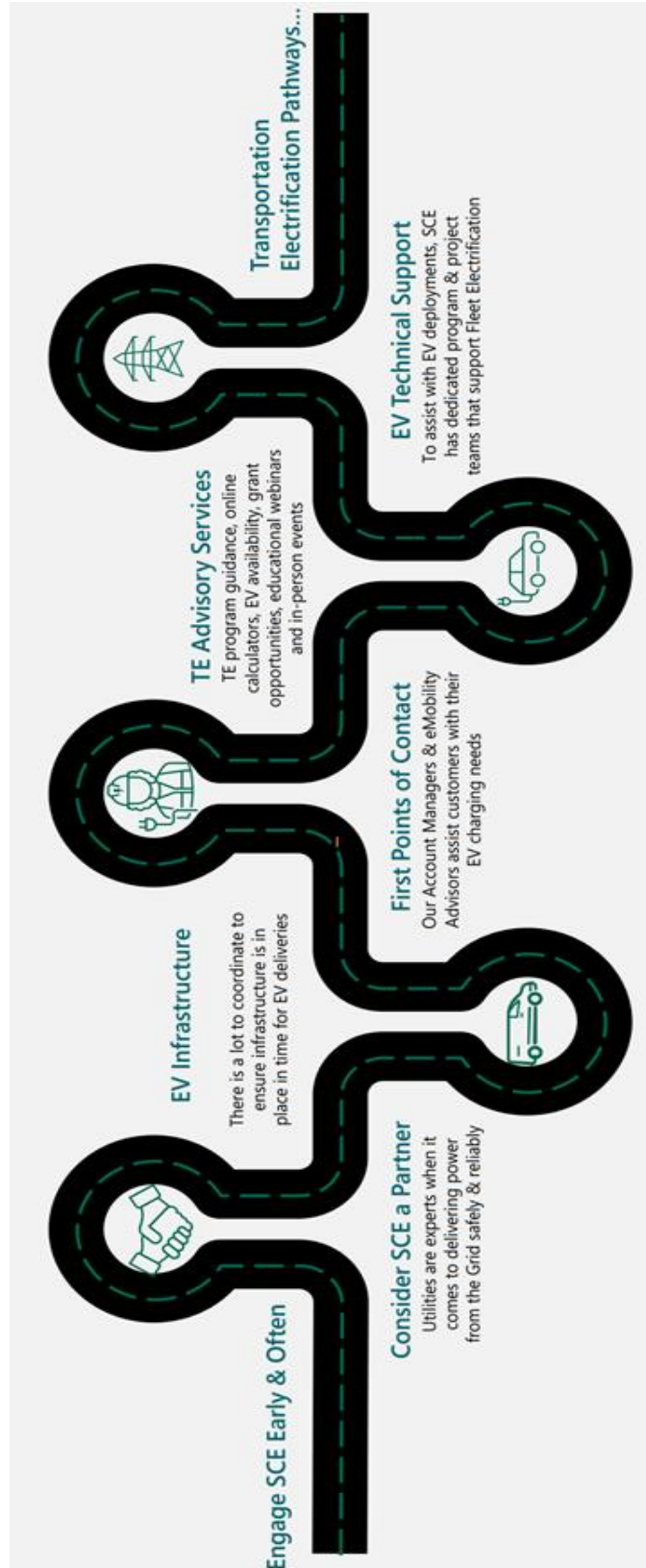
- **Industry Working Groups/Webinars.** Program staff hosted industry working groups to discuss program offerings, the impact of new regulations on both fleets and programs, grid capacity, distributed energy resources, rate structures, and new programs. The webinars provided specific updates on grid preparation for EV adoption and highlighted the importance of a separate EV meter for sites. For example, one session focused on SCE's Power Site Search tool, which is a GIS tool providing public access to SCE distribution circuits and substations to help customers understand available infrastructure and what might need to be upgraded before EV chargers could be installed. Additionally, SCE also hosted webinars on the benefits of stacking incentives, including a dedicated session for OEM dealers focused on state and local fleets. In total, SCE participated in or co-hosted 27 webinars. Figure 56 is an example of a slide presented in these webinars.

Figure 56. SCE Charge Ready Transport Implementation Process Flow



- **Case Study Engagement.** SCE staff learned that fleet operators wanted to hear more from their peers about how they had completed electrification projects and shifted outreach focus in 2024 to present case studies about site performance, customer journeys, charge management, technician and driver trainings, maintenance operation, and more. SCE events now cover both the “why” of electrification through discussing relevant regulations (which vary based on industry and fleet type), and the “how” of electrification through peer case studies, which specifically highlight the Charge Ready Transport program as a solution.
- **Outreach Focused on Gauging Electrification Readiness.** SCE staff reach and prepare customers for program participation in a variety of ways. Staff send emails to customers through individual program outreach with strategic messaging to address anticipated fleet pain points. Account managers cultivate relationships with customers and promote programs, which builds SCE’s credibility as a trusted, neutral advisor. Finally, SCE helps fleets at the early stages of their transition through an EV Readiness Study and provides advisors through its Transportation Electrification (TE) Advisory Services program. SCE’s outreach ensures that customers are aware of the Charge Ready Transport program and sets customer expectations before they apply to the program.
- **CARB “Next Stop to Zero” Road Show.** In 2024, SCE collaborated with CARB to do a “Road Show” event at SCE’s Energy Education Center in Irwindale with five different telecasted panels, vendor displays, and vehicles. The event attracted more than 250 in-person participants, over 100 online viewers, and representatives from over 50 fleets, giving attendees the opportunity to hear from different industry experts. Staff considered the event a big success in reaching a wide audience.
- **Targeted Digital Campaigns.** SCE leveraged its partnership with the Harbor Trucking Association to help promote SCE programs. This included two digital marketing e-blast waves in March and November of 2024.
- **Support with Finding Other EV Funding.** In addition to grant writing assistance, which SCE offered in previous years, SCE staff continued to provide outreach, education, and information on EV funding opportunities through Transportation Electrification Advisory Services (TEAS), which helped customers navigate rebates, tax incentives, and stackable incentives via fact sheets, case studies and webinars on EV topics. Staff further expanded assistance with funding opportunities in 2024 through the grant funding tool—an online calculator listing all funding available. Designed and revised based on customer input, the calculator presents multiple scenarios to stack available funds inclusive of infrastructure and vehicles. SCE updates this tool quarterly and as needed to keep up with funding changes and market conditions. SCE staff also work with CARB and other agencies to keep up with regulations, partnerships, and the latest information on funding opportunities for customers. Figure 57 details the support offerings SCE provides for prospective participants as presented in an SCE webinar.

Figure 57. SCE Charge Ready Transport Support Offerings



Budget Summary

As shown in Figure 58, from program inception in 2019 through December 31, 2024, SCE has spent \$54.4 million of \$342.6 million (constant dollars) of the approved Charge Ready Transport program budget.⁴³ In 2024, program spending was \$19.6 million.

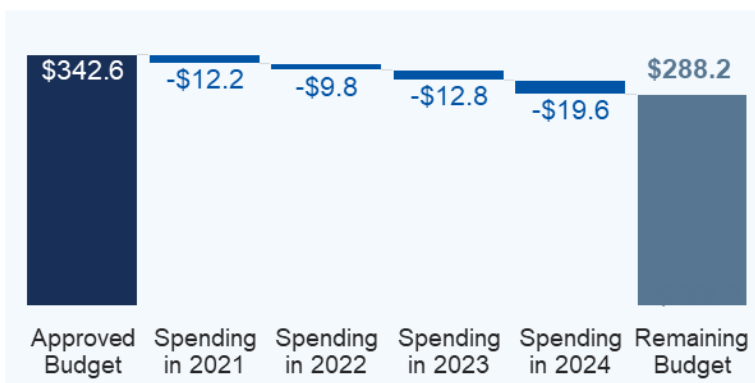
Timeline

Since the beginning of the Charge

Ready Transport program SCE has filed two Advice Letters. In 2022, SCE filed AL 4761 jointly with PG&E, requesting to adjust the site count from 870 to a range between 470 and 870 sites, to extend the program timeline, and to modify the vehicle purchase or conversion requirements for public charging sites for MDHD vehicles. In July of 2023, SCE staff confirmed that the program was required to comply with International Organization for Standardization (ISO) 15118 standard.⁴⁴ ISO 15118 covers communication between EVs and charging systems, which affects the range of equipment on the Approved Product List (APL) that program participants may choose. In August 2023, Resolution E-5257 approved the site count adjustment to a minimum of 500 sites and granted the timeline extension but denied the request to modify vehicle purchase or conversion requirements for public charging sites for MDHD vehicles. Sites for the Charge Ready Transport program must be fully contracted for by December 31, 2026, but will continue construction beyond 2026 as needed.

Figure 59 shows all major milestones from the beginning of the program.

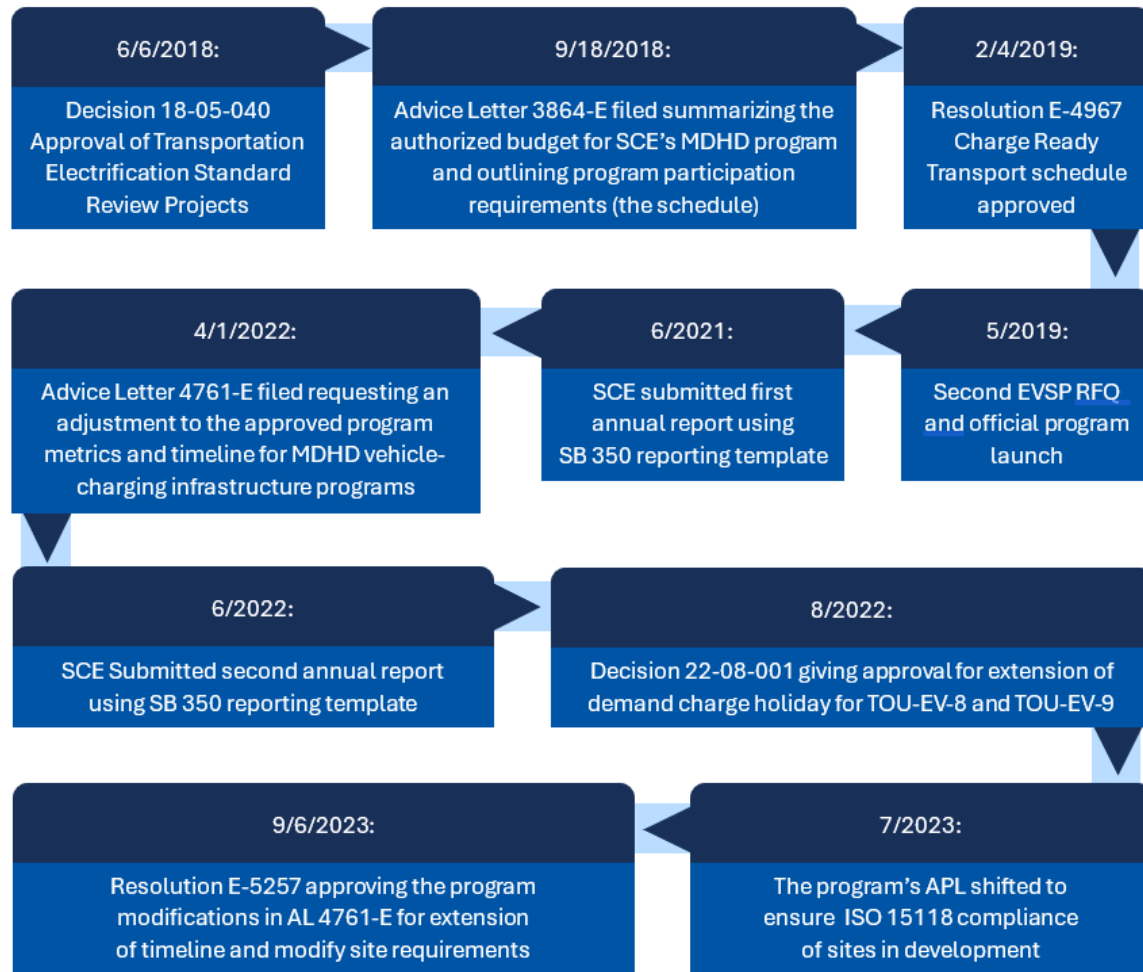
Figure 58. SCE Charge Ready Transport Program Budget (Millions USD) as of December 31, 2024



⁴³ The amount spent accounts for sites that have been fully financially closed out and for administration and marketing costs incurred through the end of 2024. Costs are considered spent/recorded as incurred after a site is fully complete and invoiced, which includes the payment of rebates that require the customer to submit paperwork.

⁴⁴ Although the ISO 15118 went into effect in 2023, it was clarified in the 2024 close out interviews the program needed to retroactively comply.

Figure 59. SCE Charge Ready Transport Program Key Milestones



4.1.2. Findings

The following sections provide findings from the Utility staff interviews, as well as from surveys, site visits, and deep dive sites. The Evaluation Team also provides insights from the co-benefits and co-costs analysis, site costs, as well as the grid impacts, petroleum displacement, GHG and criteria pollutant reductions, health, and net impacts.

Table 29 summarizes key impact parameters for EY2024 sites as well as for the program to date. Annual estimates of impacts are provided for metrics calculated as part of the impact evaluation. Additionally, the table provides estimates of impacts across all sites included in the program population through the end of 2024.

Table 29. SCE Charge Ready Transport Program Impacts Summary

Impact Parameter	EY2021 Sites ^a	EY2022 Sites ^a	EY2023 Sites ^a	EY2024 Sites ^a	EY2024 Sites Percentage in DAC	PTD Sites Actual	PTD Sites Actual Percentage in DAC
Population of Activated Sites (#)	24	15	16	31	65%	86	67%
Sites Included in Analysis (#)	16	15	15	30	67%	85	67%
Ports Installed in Analyzed Sites (#)	63	432	420	579	86%	1,609	81%
EVs Supported (#) ^b	184	456	449	742	83%	1,950	78%
Electric Energy Consumption (MWh)					93%		86%
Petroleum Displacement (DGE)	99,699	208,972	937,186	1,840,121	93%	4,163,432	82%
GHG Emission Reduction (MT GHG) ^c	723	1,739	7,246	14,470	92%	33,088	83%
NO _x Reduction (kg)	278	2,114	8,336	10,193	93%	28,496	96%
PM ₁₀ Reduction (kg)	1.32	16.0	75.6	111.6	95%	260	95%
PM _{2.5} Reduction (kg)	1.25	14.9	72.2	106.1	95%	247	95%
ROG Reduction (kg)	14.2	656	289	561.6	94%	2,716	90%
CO Reduction (kg)	7,055	36,191	5,166	13,831	93%	134,225	57%

^a Energy consumption, petroleum displacement, and emissions reductions are based on annualized data. PTD results in the table are based on actual data (see *Appendix B* for more details).

^b The Evaluation Team derived the EVs supported value from applicants' VAPs. This value represents the maximum number of vehicles expected to be supported by the charging infrastructure.

^c GHGs include CO₂, CH₄, and N₂O multiplied by their respective GWP as defined by IPCC AR5 (see *Appendix B* for more details).

Utility Staff Insights

In addition to monthly check-in calls with key SCE staff to discuss the status of the Charge Ready Transport program, the Evaluation Team conducted a close-out interview with staff in March 2025 to review overall program challenges and successes in 2024. The following bullets summarize specific uncertainties experienced in 2024 by Charge Ready Transport customers and SCE:

- Uncertainty and Shifting Market Conditions.** In 2024, SCE's marketing approach needed to respond to the rapid changes and legislative uncertainty that impact the program audiences. As ACF and Rule 29 became more important factors in fleet decision-making, SCE shifted its technical assistance and marketing to help fleets navigate the increasingly complex policy environment in the following ways:
 - Shifts in Program Audience.** The number of heavy-duty vehicle and off-road applications have dropped; in 2021-2022 53 applications were received across these sectors, while in 2023 to 2024 only 12 applications were received in the same market sectors. These used to be the largest sectors, but in 2024, medium-duty vehicles surpassed them with 51 applications. Staff noted uncertainties around ACF regulations impacted heavy-duty vehicles particularly. Additionally, staff noted more state government, local government, and school applications in 2024 than in previous years.
 - Program Withdrawal Risk.** More customers have expressed interest in withdrawing from the program than in previous evaluation years, although only a few have acted on this

interest. The financial consequences for participants of terminating after signing an agreement discourages most late-stage changes. Withdrawal of participants creates multiple administrative challenges for SCE. For example, when materials have been assigned to sites that ultimately do not proceed, SCE must reassign those materials. Additionally, SCE may need to “claw back” costs that were incurred to date for the site.

- **ACF Waivers.** Staff noted that application volume from sectors covered by ACF,⁴⁵ including drayage, high priority, federal fleets, was limited in 2024 after CARB paused enforcement while waiting for EPA approval. The regulation was a key piece for driving applications from these sectors in previous years. Program staff noted that this additional regulatory uncertainty causes delays in customer action.
- **Customer Misperceptions of Timing.** Staff have received feedback that customers perceive Rule 29 as a faster path to installing EV infrastructure. However, this perception does not reflect that Rule 29 customers are typically further along in their planning, as the application requires completed site plans and energy modelling. The Charge Ready Transport program allows customers to enter earlier in the process and offers support in developing site design. When comparing both pathways, after design completion, the time to completion is generally similar. Though the Charge Ready Transport program design process can be perceived as being longer, staff point out that it is due to additional support offered through the design process that Rule 29 does not include.
- **Additional Regulatory Compliance.** Program staff confirmed through CPUC Decision D.22-11-040 that they are held to International Organization for Standardization (ISO) 15118, which details standards for communication between EVs and charging systems. The standards enable smart charging capabilities between EVs, EVSE, and the grid. As this standard was not a part of the initial program design, the addition of the standard caused challenges for staff to assess which completed sites prior to 2024 were not in compliance and what corrective actions were needed. Additionally, the quantity of equipment on the Approved Product List (APL) customers reduced to follow ISO 15118. The Charge Ready Transport program initially had to remove 150 equipment models from the APL and worked retroactively to address compliance for sites already in development or completed before 7/1/23, which required additional design and equipment coordination efforts. By late 2023, many models were eventually reinstated after manufacturers attested to compliance and the APL expanded.
- **VAP Concerns.** Customers must navigate many uncertainties in the EV market, including concerns about the availability of vehicle types, the timelines for EV vehicle types still in development, or general volatility in the EV market and funding opportunities. This presents a challenge for the Charge Ready Transport program, which requires participants to sign onto a VAP as part of their agreement. While customers may already be procuring some vehicles, the contract requiring them to do so remains a barrier due to this uncertainty.

⁴⁵ The ACF Regulation from CARB is designed to accelerate zero-emissions technology with targeted policies such as manufacturer sales mandates and purchase mandates for high-priority fleets.

Customers have raised concerns about the VAP requirements, but SCE staff cannot provide exceptions as is clear in the written decision.

- **Concern Over Program Goals Progress.** SCE site goals vary by subsector. Though SCE is ahead of schedule on site DAC, warehouse, and transit goals, staff report that meeting the other program *per se reasonableness* goals by the end of 2026 may be challenging.
 - **Site goal (500).** To meet SCE's site goal, staff are interested in attracting participants who own and operate multiple sites and can help boost site numbers. These opportunities were reduced by certain ACF categories not moving forward, therefore causing concern for the achievability of the site goal.
 - **Market Share Goals.** Based on the mix of project types in the pipeline, program staff are optimistic that most market share goals will be met but are concerned about the 15% minimum budget transit agency goal minimum budget goal for transit agencies. SCE did a potential study to identify candidate transit agencies for participation, and determined that the goal will be difficult to meet due to the low number of fleets in their territory. Notably, transit agencies are also looking at technological alternatives to electrification, such as hydrogen, or have not considered electrification plans.
 - **Vehicle goal (8,490).** The vehicle count goals may also be challenging to meet, but SCE staff anticipate being close to achieving these goals as they have larger, more cost-effective sites supporting high vehicle counts per project.
- **Customer-Owned Switch Gear Complications.** Customer-owned BTM infrastructure sites face further supply chain challenges and longer lead times than the SCE-owned infrastructure with switchgears. Staff are also seeing larger loads in customer projects, which require the engineering team to enforce primary metering from primary switchgears. Primary switchgears have additional complexities compared with secondary switchgears, and therefore have longer timelines to install, sign off on, and operate.
- **Cost Assumptions.** As actual costs became known from sites that closed by the end of 2024, staff re-evaluated their approach to site cost estimation. Previously, the program relied on spreadsheet estimations that used assumptions from the original program decision to generate the estimated costs. When a site is finished, SCE reviews the difference between the site estimated cost and the actual cost and includes any necessary adjustments to improve future cost estimates. Additionally, the IBEW Labor Requirements for customer side make ready participants require customers to use union labor to construct sites, which can be an unanticipated cost barrier for participants.

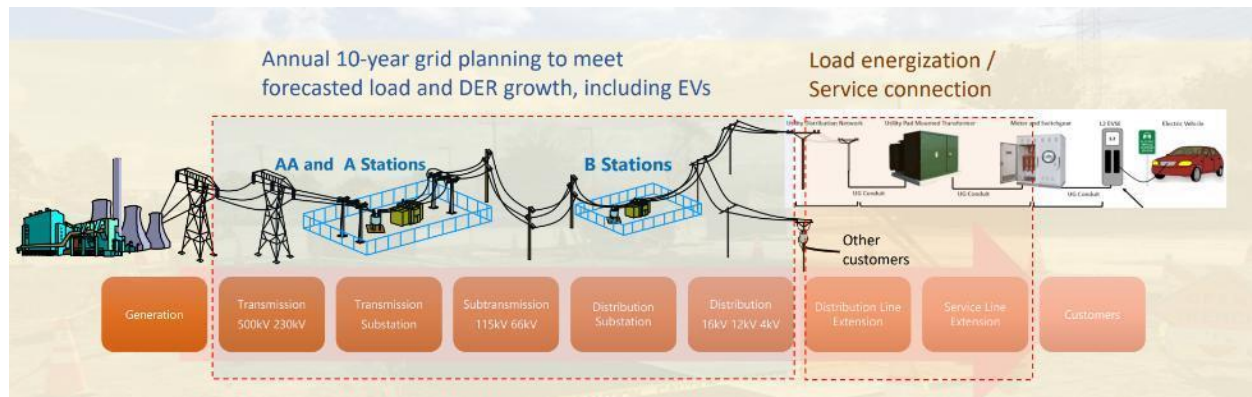
SCE staff also reported notable successes in 2024:

- **Strategic Partnerships.** In 2024, staff continued efforts from previous years to strengthen industry partnership and relationships with previous participants. For example, SCE regularly collaborated with organizations such as California League of Cities, CARB National Electrical Manufacturers Association (NEMA), and the California Research Board to expand audiences,

including the municipal market. Staff also partnered with Harbor Trucking and CALSTART to co-host webinars and events.

- Ensuring Customer Readiness and Education.** SCE staff, particularly the Business Development and Partnerships Team, made additional efforts this year to prepare fleet customers for electrification. In 2024, staff noted challenges with customer operations, such as adapting to TOU rates. In addition, staff have been working to mitigate misunderstandings and adoption challenges, such as making sure chargers are compatible with vehicles to ensure proper functioning. Figure 60 is an example slide staff presented in a webinar to improve customer education about the grid and load distribution.

Figure 60. SCE Charge Ready Transport Load Education Example Slide



- Stability In Uncertainty.** Since program initiation, the Charge Ready Transport program has been available, the market has shifted significantly as regulations have shifted, new technologies have emerged which can come with new challenges, and EV companies have gone out of business. Despite the market evolution, Charge Ready Transport has remained consistent and available. While the market conditions have caused concerns to the program, stakeholders reported that the stable offering from a reliable provider to navigate complex projects fills an important need in the market.
- Process Design Enhancements.** SCE staff implemented changes to improve the program processes.
 - Environmental Screener.** At the end of 2023, the application process added an environmental screener. To address environmental and design issues that often emerged late in the project timeline, SCE revised its application process in 2024. The application requires customers to complete a five-question environmental questionnaire that covers factors such as environmental factors, land agreements, permits, or rules, and site characteristics. Staff also conduct a site feasibility study during vetting to identify permitting, easement, or ownership issues early on. These updates have helped create a thorough front-end process, reducing late-stage site changes and delays.
 - Switchgear Procurement.** The program is moving from a general contractor procurement model where the general contractor procures the switchgear to an SCE-run model where the Utility works directly with three manufacturers to attain materials to meet their needs

and prices. These adjustments have created a consistent procurement process by providing forecasting for manufacturers and participants on switchgears, greatly reducing concern about switchgear procurement going forward.

- **Staff Coordination.** The SCE Transportation Electrification Project Management (TEPM) team made process improvements for internal implementation efficiencies in 2024. As project volume increased, staff created dedicated “pods” composed of a project manager, junior project manager, and analyst, dedicated to the charge ready side. These pods streamlined communication, data processing, and project tracking. TEPM also partnered with other internal teams to improve workflows and strengthen coordination across stages of projects.
- **Improved Cost Estimates.** As noted above, SCE staff constantly review actual site costs to ensure that estimates are accurate.

In addition to discussing challenges and successes, SCE staff noted the broader electrification market continues to face volatility, with high vehicle costs, insurance challenges, limited vehicle availability, regulatory uncertainty, and operational hurdles such as shifting their operations to better utilize their TOU rates. SCE staff also noted that these barriers, along with customer misperceptions and skepticism about EV technologies, leads to slow adoption within the MDHD vehicle market.

Despite these challenges, SCE staff stated they think the Charge Ready Transport program plays a major role in accelerating market adoption by offering a stable and reliable pathway to electrification. Through infrastructure funding, design and construction support, and educational resources, including webinars, peer connections, and training, the Charge Ready Transport program reduces risk and enables fleet managers to move forward with projects that might otherwise stall. Its consistency in a rapidly evolving market gives participants the confidence to commit to electrification.

Highlights

- Staff continued to monitor and assess the feasibility of the program’s goals in the current timeline. Program staff continued to implement program changes in 2024 to improve processes, such as the environmental questionnaire and switchgear procurement adjustments, resulting in eliminating procurement delays for necessary equipment.
- SCE continued to strengthen strategic partnerships in marketing and outreach to expand and diversify the program’s participating customer base in 2024.
- Policy uncertainty continues to impact utility planning, program participation, and customer choices in the EV market.
- Despite the impacts of market fluctuation, the Charge Ready Transport program has worked to address market barriers to provide a consistent and stable EV offering for customers, adding value to the market.

Survey Results

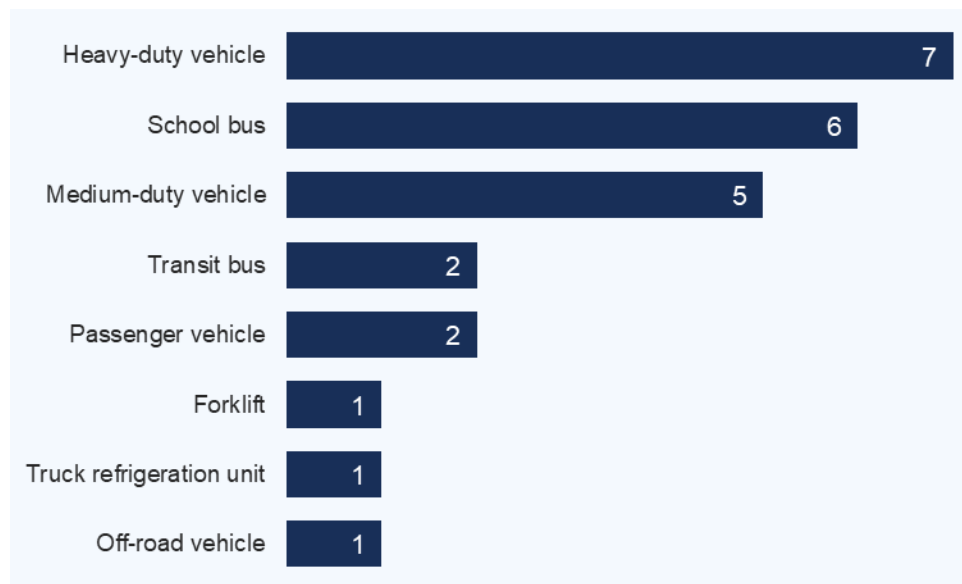
The Evaluation Team surveyed participating fleet managers about their motivations for and barriers to electrification, satisfaction with and awareness of the program, experience with EVs and charging infrastructure, and perspective on the industry. The team received a total of 13 complete survey responses and three partial responses. As shown in Table 30, the fleet managers surveyed represented companies across the five vehicle sectors. Ten of the fleet managers reported that their fleets consisted of vehicles from only one market sector, while the other six had vehicles from between two and five market sectors in their fleet.

Table 30. SCE Charge Ready Transport Program Fleet Manager Survey Sample for EY2024 Sites (n=13)

Market Sector	Number of Partial Surveys	Number of Completed Surveys
Heavy-duty vehicle	1	3
Medium-duty vehicle	-	3
School bus	1	5
Transit bus	1	1
TRU	-	1
Total	3	13

Figure 61 shows the frequency of each vehicle type among respondents' fleets. Heavy-duty vehicles were the most common among respondents, with over half of fleet managers (seven of 16) reporting these vehicles as part of their fleet.

Figure 61. SCE Charge Ready Transport Program Participant Vehicle Types in Fleets

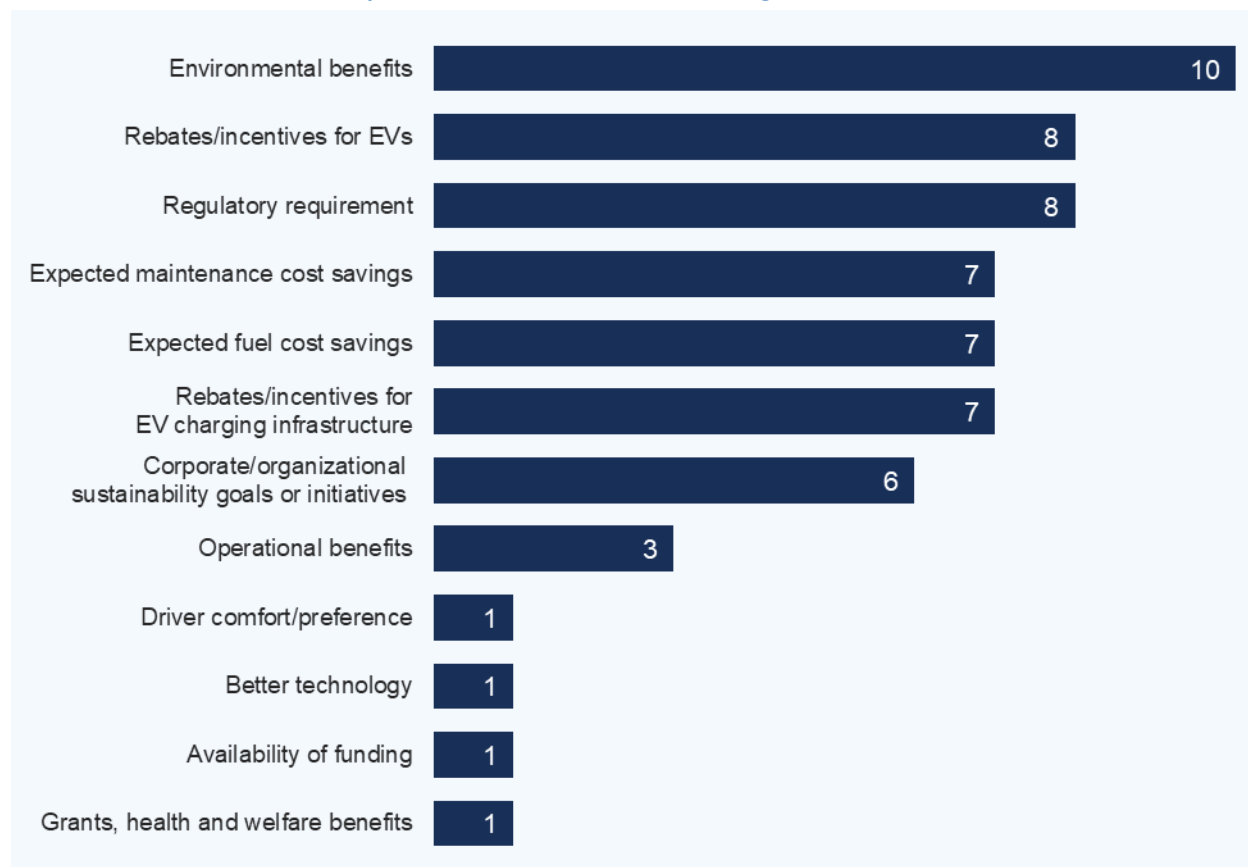


Source: Fleet Manager Survey Question A1 "What types of vehicles/equipment do you have in your fleet?" (n=16, multiple responses accepted)

Electrification Motivators and Barriers

The Evaluation Team asked fleet managers about their motivations for transitioning to EVs. As shown in Figure 62, the top motivator was *environmental benefits*, cited by 10 of 13 respondents. The next most common motivators were *rebates/incentives for EVs* and *regulatory requirements*, both cited by eight fleet managers. *Rebates/incentives for EV charging infrastructure*, *expected fuel cost savings*, and *expected maintenance cost savings* were each identified as motivators by seven respondents. Motivators were similar in EY2023 when rebates for EVs and EV charging infrastructure were the most common motivators with six respondents each. Notably, *regulatory requirement* went from being one of the least common motivators in EY2023, chosen by only two respondents out of seven, to the second highest motivator in EY2024. Environmental benefits also rose slightly as a respondent motivator, from the second most common choice in EY2023 to the most common in EY2024.

**Figure 62. SCE Charge Ready Transport Program
Participant Motivators for Transitioning to EVs in EY2024**

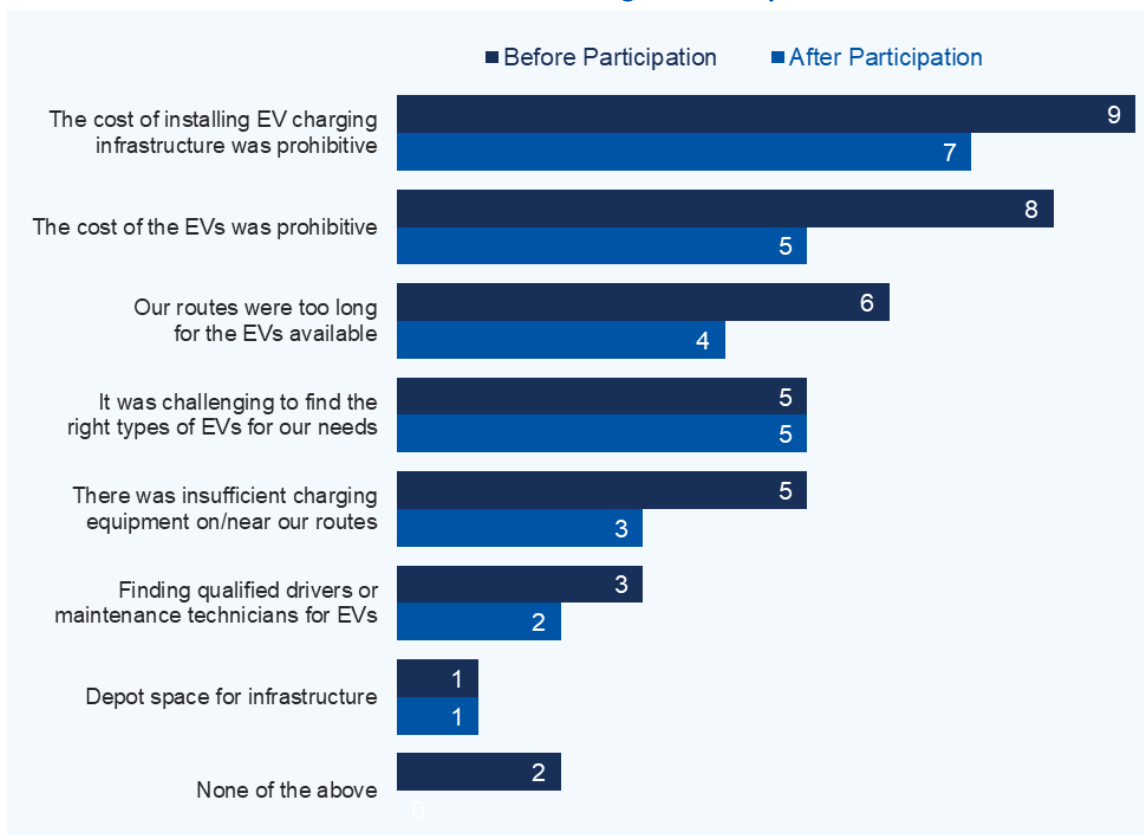


Source: Fleet Manager Survey Question C1 “Why did your fleet decide to transition to EVs?” (n=13, multiple responses accepted)

The Evaluation Team asked fleet managers which barriers to electrification their fleets faced before participating in the SCE Charge Ready Transport program and which remained after participation. Figure 63 shows that prior to participating, fleet managers found the cost of both EVs and installing EV charging infrastructure to be the biggest barriers to electrification, mentioned by nine and eight respondents, respectively. The next most mentioned barriers to electrification before participating were fleet

managers' routes being too long for the EVs available, mentioned by six respondents. After participating, the largest remaining barrier reported by fleet managers continued to be the cost of installing EV infrastructure, mentioned by seven respondents. The cost of the EVs (five respondents), the length of routes (four respondents), and the challenge of finding the right type of EV (five respondents) all remained barriers for many fleet managers, though not all.

Figure 63. SCE Charge Ready Transport Program Barriers to Electrification Before and After Program Participation in EY2024



Source: Fleet Manager Survey Questions F3 and F4 “Which of the following barriers to electrification did your fleet face before participating in the EV Fleet program?” and “You mentioned that the following were barriers to electrification before participating in the Charge Ready Transport program. Do any of these barriers still exist after you participated in the program?” (n=13, multiple responses accepted)

Program Satisfaction

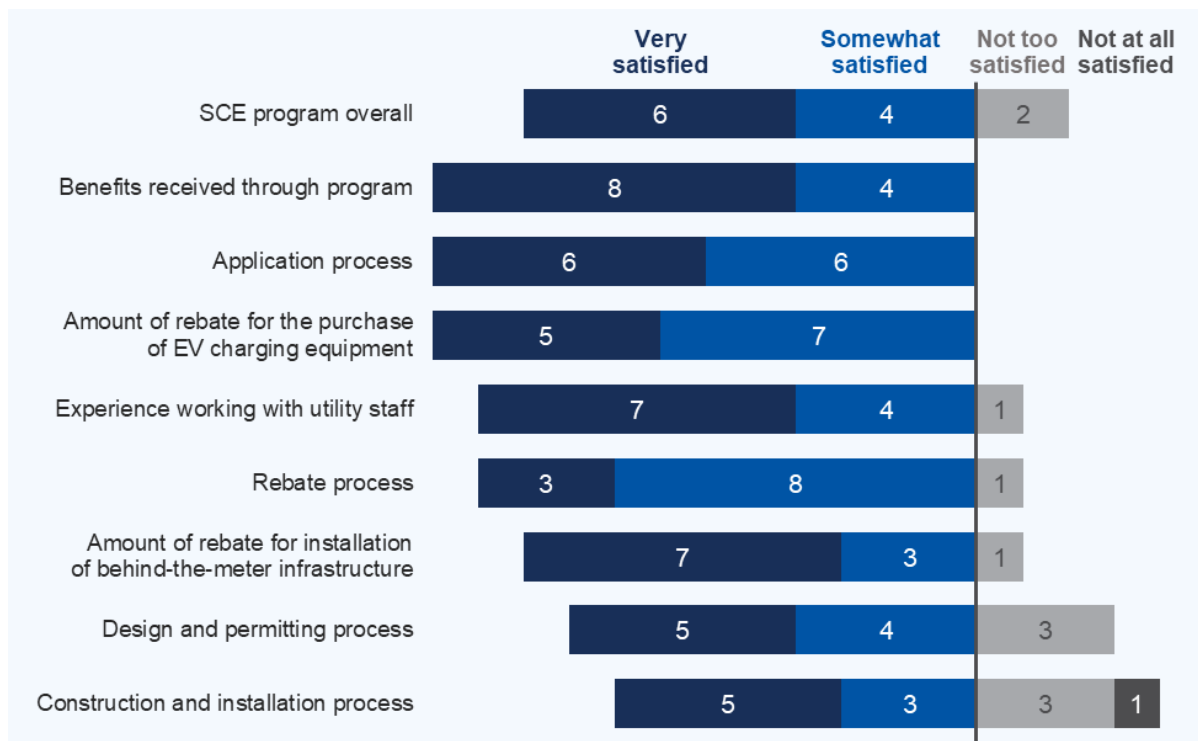
The Evaluation Team asked fleet managers to rate their satisfaction with SCE’s Charge Ready Transport program overall and with specific elements of the program. Across all program elements, fleet managers generally reported strong satisfaction (Figure 64). Fleet managers were mostly satisfied with the program overall, with six managers rating themselves as *very satisfied*, four rating themselves as *somewhat satisfied*, and two rating themselves as *not too satisfied*. The program element that received the highest satisfaction ratings was the benefits managers received through the program, such as the provision of utility-side, TTM infrastructure, for which eight respondents rated themselves as *very*

satisfied. Fleet managers were mostly satisfied with the other elements of the program. They expressed the most dissatisfaction with the design and permitting process and the construction and installation process, with three of the 12 respondents reporting feeling *not too satisfied* with each and one additional respondent feeling *not at all satisfied* with the latter process.

Asked about what they were particularly satisfied with, three respondents cited the quality of support from the team at SCE, who one fleet manager called “responsive, knowledgeable, and helpful.” The program element that fleet managers felt particularly dissatisfied with was the time that the overall process took, as four respondents mentioned. Of those four, two highlighted the struggle with employee turnover and rotation that took place over the course of the project on both their and SCE’s side.

Satisfaction with the SCE Charge Ready Transport program was similar to satisfaction reported in EY2023, with the majority of fleet managers feeling satisfied with the program. Fleet managers were similarly happy with the SCE staff in EY2024, highlighting the “knowledge from SCE” and commenting that the SCE team “were great to work with.” The application process saw the largest improvement in satisfaction ratings, as one respondent of six rated themselves as *not too satisfied* in EY2023 and none reported such dissatisfaction in EY2024. Fleet managers were less satisfied with the construction and installation process in EY2024 than in the previous year, when only one respondent rated themselves as *not too satisfied* with the program element and the remaining five respondents rated themselves as *very satisfied*.

Figure 64. SCE Charge Ready Transport Program Satisfaction with Program Elements in EY2024



Source: Fleet Manager Survey Question B1 “Thinking about your experience with the Charge Ready Transport program, how satisfied are you with the following?” (n=12)

The Evaluation Team asked fleet managers how likely they were to recommend the Charge Ready Transport program to another company on a scale of 1 to 10. Half of respondents (six of 12) gave a rating of 10, meaning they had already recommended the program to other companies. One fleet manager rated their likelihood of recommending the program as 9, one rated it as 8, one as 7, and three rated it as 5 or 4, resulting in a Net Promoter Score (NPS) score of +33.⁴⁶

Program Awareness

The Evaluation Team asked fleet managers how they had learned about the Charge Ready Transport program. Eight of the 12 responding fleet managers learned about the program **directly from SCE**, three from an **EV/EVSE manufacturer**, and one from a **school bus vendor**. Eight of 13 fleet managers also responded that they were aware that they needed upgrades to the electrical infrastructure from the utility grid to their meter to charge EVs at their site, while five were not.

Experience with EVs and Charging Infrastructure

When asked to rate their ease with using their EV charging equipment, nearly all fleet managers reported having an easy time. Six respondents reported that their charging equipment was *very easy to use*, six others reported that the equipment was *somewhat easy to use*, and one reported that they found their EV charging equipment *not at all easy to use*. The Evaluation Team asked fleet managers to rate the reliability of their EVs and the charging equipment, as shown in Figure 65. Fleet managers found their EVs to be more reliable than their charging equipment, with one rating their EV as *not too reliable* compared to three rating the charging equipment as *not too reliable*. One fleet manager rated both their EVs and charging equipment as *not at all reliable*.

Figure 65. SCE Charge Ready Transport Program Reliability of Vehicles and Charging Equipment in EY2024



Source: Fleet Manager Survey Questions C3 and C4 “How would you rate the reliability of the EVs that are part of your fleet?” and “How would you rate the reliability of the EVSE?” (n=13)

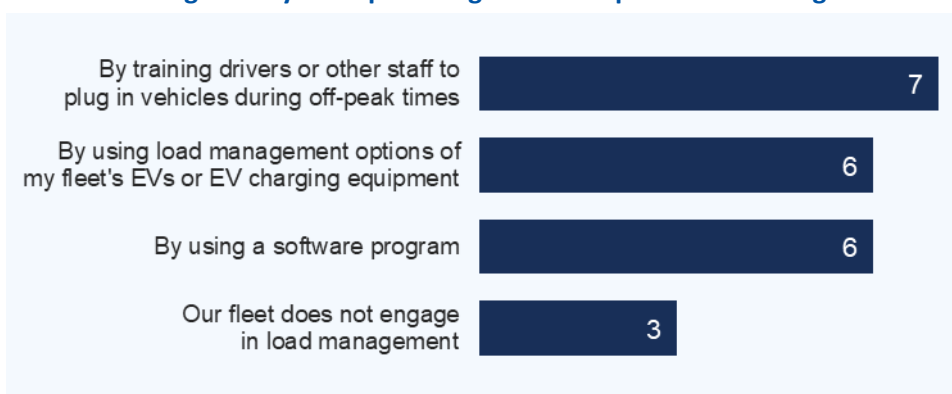
⁴⁶ The NPS is calculated by subtracting the program detractors (those who rated their likelihood to recommend the program as a 0 through 6) from the program promoters (those who rated their likelihood to recommend the program as a 9 or 10). The fleet managers who gave ratings of 7 and 8 were labeled as passive and their rating did not negatively or positively impact the score.

Experience with Load Management and EV Charging

Asked whether they knew that SCE charges different electricity rates per kilowatt-hour depending on the time of day, all 13 responding fleet managers said they were aware of this. Asked further whether they were aware of the cost to their company to charge their fleet, 10 of 13 fleet managers said they were aware of the cost, while three said they were not.

The Evaluation Team asked fleet managers if they took any actions to ensure that they purchased the lowest-cost electricity for charging their fleet or, in other words, if they participated in load management. Ten of the 13 respondents reported that they did so. The Evaluation Team asked those that did practice load management what specific actions they took, with results shown in Figure 66. The most common action taken for load management was training drivers or other staff to plug in vehicles during off-peak times, reported by seven fleet managers. Six fleet managers used load management options included with their EVs or EV charging equipment and six used a software program.

Figure 66. SCE Charge Ready Transport Program Participant Load Management Practices



Source: Fleet Manager Survey Question C12 "What actions, if any, do you take to ensure you are purchasing the lowest cost electricity for charging fleet vehicles? A term you may have heard for this is load management" (n=13, multiple responses accepted)

The Evaluation Team also asked the ten fleet managers who practiced load management their reasons for implementing the strategy. Seven fleet managers reported that they implemented load management to lower the cost of charging via charging time management, three did so to manage the stability of their electrical system, and two did so to reduce the need to install additional power sources. Two other fleet managers reported that they were required to implement it, one by SCE and the other to "control grid impact."

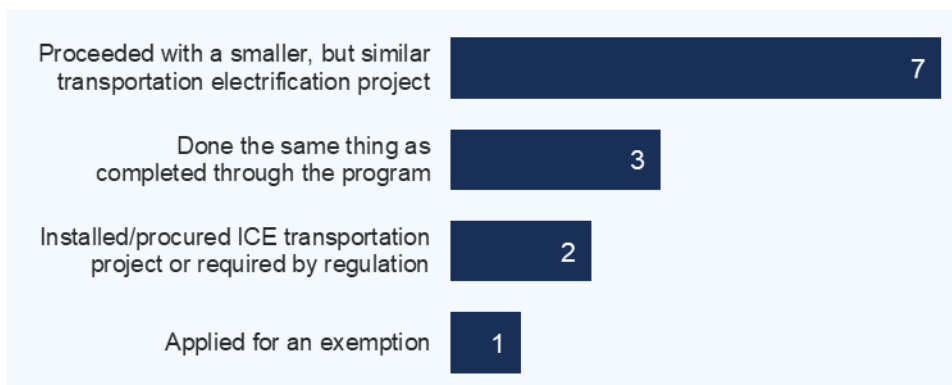
Three of the 13 respondents reported that they did *not* practice load management. Of those three, one cited an issue with not being able to use the charger software outside of peak hours, one said they were still working on practicing load management, and the third said they were not interested.

Impact of Program on Fleet Electrification

The Evaluation Team asked fleet managers about whether they planned to accelerate procurement of EVs and related equipment because of their experience with the program. Five respondents said that they would accelerate procurement, three reported that they planned to slow procurement, and five did not plan to change their procurement plans.

As shown in Figure 67 the Evaluation Team asked fleet managers what they would have done regarding electrification if the SCE Charge Ready Transport program had not been available. Seven fleet managers said they would have proceeded with smaller, but similar electrification projects, with four estimating that they would have reduced their project size by 50%. Three fleet managers said they would have done the same thing as what they did through the program, two would have instead proceeded with an ICE transportation project or whatever was required by regulation, and one would have applied for an exemption from regulation.

Figure 67. SCE Charge Ready Transport Participant Actions if the Program Were Not Available



Source: Fleet Manager Survey Question G1 “If the SCE fleet electrification program had not been available, which of the following alternatives would you organization most likely have done?” (n=13)

Fleet managers reported their planned acquisition of EVs over the next five and ten years, shown by sector in Table 31. The bulk of the current fleet size and planned acquisitions come from one medium-duty sector fleet manager, who has a current fleet of 500 ICE vehicles and 160 EVs.

Table 31. SCE Charge Ready Transport Program EV Acquisition Projection by Vehicle Type in EY2024

Sector	Current Fleet Size		EV Type									
			School Bus		Transit Bus		Medium-Duty		Heavy-Duty		Forklifts	
	ICE	EVs	5 years	10 years	5 years	10 years	5 years	10 years	5 years	10 years	5 years	10 years
Heavy-duty vehicle (n=3)	19,375	86	-	-	-	-	-	-	40	80	-	-
Medium-duty vehicle (n=3)	500	160	-	-	-	-	127	187	25	125	10	10
School bus (n=5)	206	72	96	25	-	-	10	10	-	-	-	-
Transit bus (n=1)	88	23	-	-	25	25	-	-	-	-	-	-
TRU (n=1)	100	2	-	-	-	-	-	-	2	5	-	-

Industry Perspective

Asked how well-positioned they thought their industry or sector was for electrification, half of the responding fleet managers reported being *not too well-positioned* (six respondents of 12). Two fleet managers reported being *extremely well-positioned* and three fleet managers reported being *somewhat well-positioned*. One respondent reported their positioning as *neutral*. No fleet managers reported that their industry was *not at all well-positioned*. Those who did not feel well-positioned mentioned cost, reliability, and suitability of specific vehicles. Two respondents suggested the immaturity of EVs as reason, citing a “lack of successful working examples” and that “people are still learning.” In EY2023, in contrast, fleet managers rated their industry only positively, with two of four rating it *extremely well-positioned* and one each rating it *somewhat well-positioned* and *neutral*.

The Evaluation Team asked fleet managers what they saw as the limitations of current EV options for their market sector. Two respondents mentioned the mileage range of available EVs as a major limitation. Three other respondents noted that MDHD EV options are not “interchangeable with ICE-powered options,” highlighting fuel cost competitiveness and reliability. Finally, fleet managers were asked whether, given what they know or believe about requirements for fleets to purchase zero-emission MDHD trucks, electric or diesel trucks seemed like a riskier purchase in the next three years and ten years. For the three-year projection eleven respondents said that electric trucks would be the riskier choice and one said diesel. For the ten-year projection, seven respondents said that electric trucks would be the riskier choice and five said diesel.

Interview Results

The Evaluation Team interviewed two fleet managers who withdrew from the SCE Charge Ready Transport program. One managed a large fleet of freight transportation trucks that operate across the country and the other managed the school buses and other vehicles for a school district (Table 32)

Table 32. SCE Charge Ready Transport Program Withdrawn Fleet Managers

Fleet Manager	Business Type	Fleet Size ^a
Respondent 1	Freight and cargo transportation	2,000
Respondent 2	School district	324

^a The Evaluation Team asked respondents to only include vehicles in their fleet that are in SCE’s territory, to the best of their ability.

The respondent from the freight transportation company cited California state regulations requiring 10% of their fleet to be electric by 2027 as the most significant motivator for initially embracing EVs and participating in the program but also said that increased customer interest and fleet suitability pushed them toward the decision. The school district planned to embrace EVs as replacements for older vehicles as needed and as long as there was a comparable EV.

Asked about their main reasons for stopping participation, the fleet manager originally motivated by regulation said that regulations no longer required electrification, and the “business environment” did not encourage the transition to EVs. The other respondent was not sure that their company’s procurement plan for vehicles would work with the program because of the procurement timeline

crossing multiple fiscal years, stating that there was a “fear [of] committing to a plan we may not be able to meet.”

Prompted about what they would recommend to SCE to change about the program, both fleet managers said that the rebate levels were not high enough, with one arguing that the cost after the incentive "has to be a little bit closer to the diesel option or the alternative because our competitors are using diesel and if we make our cost structure more expensive, our customers are not willing to pay for it." One of the fleet managers also suggested that it would be helpful for SCE to provide recommendations and advice regarding which specific chargers to purchase, making it easier for fleet managers to select among the various market options, which would allow them to participate more easily in the program.

Both fleet managers were asked to rate their experience with the program both overall and for specific program phases (Table 33). One fleet manager reported being *very satisfied* with the program overall, the application process, and the application timeline, though *somewhat dissatisfied* with the level of program services, which they thought were limited. Again, both fleet managers highlighted their dissatisfaction with the level of the rebates, with one saying that the total cost of the site was “still more expensive than owning and operating a diesel truck” even after factoring in the rebate. Overall, the withdrawn fleet managers appeared to be in agreement that rebates are not enough to ensure that EVs are competitive with existing ICE offerings.

Table 33. SCE Charge Ready Transport Program Withdrawn Fleet Managers’ Program Satisfaction

Program Component	Respondent 1	Respondent 2
Overall satisfaction	4 – <i>very satisfied</i>	<i>Respondent #2 opted not to provide quantitative answers but did provide qualitative results, which are included above.</i>
Application process	4 – <i>very satisfied</i>	
Application timeline	4 – <i>very satisfied</i>	
Program services	2 – <i>not too satisfied</i>	
Rebate amount	N/A	

Highlights

- Fleet managers were motivated primarily by environmental benefits (10 of 13 fleet managers), rebates/incentives (eight of 13 fleet managers), and regulatory requirements (eight of 13 fleet managers).
- Top barriers to fleet electrification before program participation included the cost of charging infrastructure (nine of 13 fleet managers) and the cost of EVs (eight of 13 fleet managers). After program participation, the cost of charging infrastructure remained a top barrier (seven of 13 fleet managers).
- 10 of 12 responding fleet managers rated themselves as *very satisfied* or *somewhat satisfied* with their experience with the SCE Charge Ready Transport program.
- Eight of 12 responding fleet managers learned about the Charge Ready Transport program from SCE.
- 11 of 13 fleet managers said that EVs were *very reliable* or *somewhat reliable*, and nine of 13 said that EV charging equipment was *very reliable* or *somewhat reliable*.
- 10 of 13 responding fleet managers said they practiced load management with their fleets.
- Five of 13 responding fleet managers planned to accelerate EV and EV charging equipment procurement due to their experience with the program.
- Six of 12 responding fleet managers said they felt that their industry or sector was not well-positioned for electrification.
- One fleet manager who withdrew from the Charge Ready Transport program said that regulations no longer required fleet electrification and the other was not certain they could commit to an electrification plan.

Site Visit Findings

For EY2024, the Evaluation Team completed 42 site visits in the SCE territory across several market sectors: heavy-duty (including port cargo; drayage), medium-duty, school bus, transit bus, and eTRU. During the site visits, the Team collected qualitative and quantitative information that provided the Team with an understanding of fleet composition and operations. Site visits were used to verify basic information about sites such as quantity of installed charging equipment and capacity, NSPs the fleets use, types and quantities of EVs in use or scheduled for delivery, and physical influences on construction designs. Site visits also allowed the Team to understand fleets' familiarity with their energy use and costs compared to conventional vehicles and use of load management to mitigate utility bills. During these visits we discussed potential funding sources beyond Utility investment and investigated whether fleets had an interest in on-site solar and/or battery storage. Site visits also provided an opportunity to obtain direct feedback from the individuals involved in these projects from inception through construction and operations.

Table 34 provides a summary of charging site characteristics by market sector, including number of site locations visited, number of L2 and DCFC charging ports, and total charging capacity. In total, the EY2024 activated sites in the SCE Charge Ready Transport program added 149 L2 ports, and 515 DCFC ports with more than 47 MW of EV charging capacity. The TRU count to date includes 15 ports for forklifts, because

one site hosted both types (but predominantly TRUs). Figure 68 is a visual representation of Table 34, showing charging port and charging capacity of Charge Ready Transport program site visit locations by market sector for EY2024 and the program to date.

Table 34. SCE Charge Ready Transport Program Quantity of Ports by Type and Installed Capacity, by Market Sector

Market Sector	EY2024 Sites Visited	EY2024 Sites Ports	EY2024 Sites Capacity (kW)	PTD Sites Visited	PTD Sites Ports	PTD Sites Capacity (kW)
eTRU	0	0	0	4	480	7,013
Forklifts	1	7	417	1	7	417
Heavy Duty Vehicles	16	469	39,215	27	604	58,245
Medium Duty Vehicles	7	137	6,681	13	229	14,221
School Bus	6	45	857	33	276	5,950
Transit Bus	1	6	253	8	62	4,801
Totals	31	664	47,424	86	1,658	90,647

Figure 68. SCE Charge Ready Transport Program Site Visit Ports and Capacity, EY2024 and PTD Sites

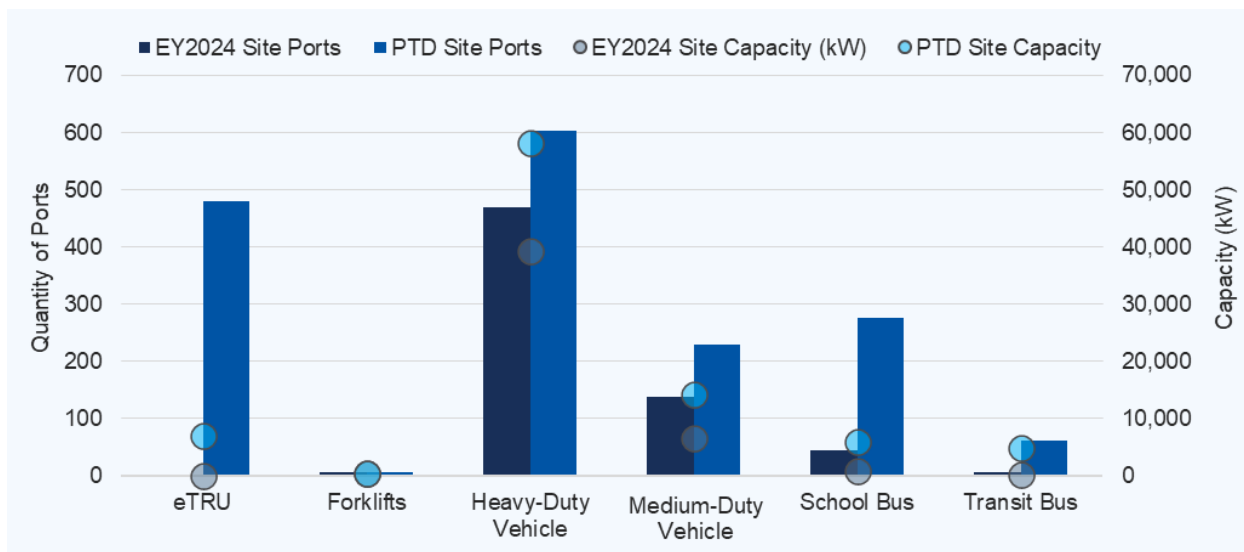
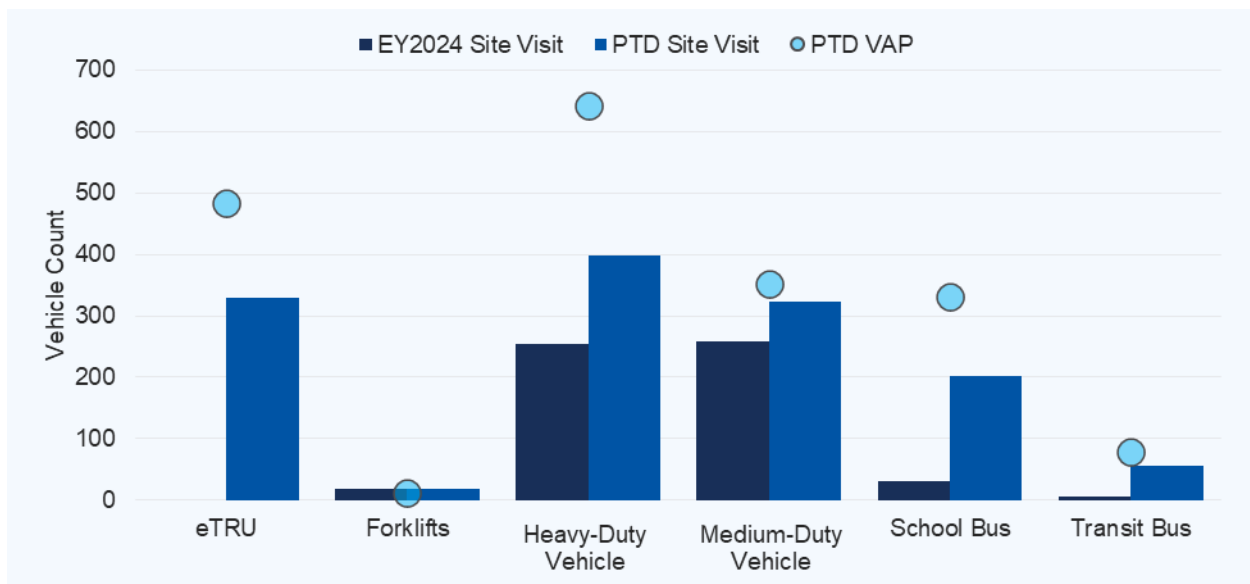


Figure 69 shows the counts of vehicles noted through site visits compared with the counts in long-term VAPs. Market sectors closest to plan include heavy-duty vehicle, medium-duty vehicle and forklifts. In general, the findings in Figure 69 are expected since the Evaluation Team only visits each site only once and does not maintain a updated count of vehicles for sites activated in previous years. Forklift sites are often coupled with vehicles in other market sectors. As a response to a recommendation in the EY2023 Evaluation Report, SCE has implemented a process to follow up with each participating fleet on an annual basis to update the number of delivered EVs and adjust future planned deliveries to meet the numbers of EVs specified in the VAPs.

Figure 69. SCE Charge Ready Transport Program Comparison of Verified Vehicles to Long-Term VAP



The following sections provide a summary of key observations and data collected during site visits, organized by market sector.

Common Site Visit Findings Across Utility Programs

Logistics providers were a large contingent of the program’s EY2024 activated sites that the Evaluation Team visited this year, representing MDHD trucks. Dealership projects expanded across Utility programs; these typically have low charger utilization from dealer demonstration or service vehicles., unless the dealership also operates a leasing service, in which case the leased vehicles and chargers are used regularly. National fleets also were more evident across the state in EY2024 than in previous years.

An interesting finding was that several sites across MDHD programs had a significant amount of light-duty charging. This stems from a variety of reasons including public access, logistics services in which the sites support any client vehicle needs, and use of LDVs to make up for limited availability or reliability of medium-duty vehicles.

Several vehicle manufacturers have filed for bankruptcy recently. This affects operators of transit bus, school bus, medium-duty vehicle, and heavy-duty vehicle market sectors. Some of these entities are parts suppliers to other vehicle manufacturers, amplifying negative impacts across market sectors.

Many fleets do not review their utility bills, energy use, or charging statistics (from NSPs). Often a site host’s finance office receives all the utility bills but does not share relevant information with fleet managers. Therefore fleet managers do not know the costs of their EV operations, the extent to which those costs could be reduced, or how those costs compare with conventional fleet vehicle costs.

Heavy-Duty Vehicle

In EY2024, the Evaluation Team conducted site visits to 16 heavy-duty vehicle sites, which have a total of 384 charging ports and a total installed capacity of 39,215 kW. This market sector represents over 50%

of site visits, 66% of total charging ports and 83% of installed capacity in the Charge Ready Transport program in EY2024. Notably, this market sector shows a significant number of Class 8 truck deployments, some of which were used for multiple shifts a day. These are the largest EVs in the marketplace and have very high operational use compared to other vehicle types. The SCE territory represents the majority of Class 8 electric truck deployments across the state. The 2024 sites also include the first refuse collection vehicles.

Heavy-duty vehicle fleets tend to be larger in scale than fleets in other market sectors, both in number of ports and installed capacity per site. These sites also typically have made a clear load management plan to avoid charging when energy is at the highest cost (from 4 p.m. to 9 p.m.). The Team visited two sites where solar arrays (450 kW and 1,500 kW) and energy storage (1 MWh and 7.8 MWh) are part of the customer-owned BTM installation for resiliency and load management purposes; however, long-term site operational costs will take some time to determine, and both of these fleets at these sites are tracking their costs for TCO accounting. Some of the Class 8 trucks are still early generation, and fleet operators said that they experienced more frequent downtime than with diesel trucks. One fleet that operates 40 Class 8 trucks said that typically only 30 are available for daily operation. Another fleet that uses the same make and model Class 8 truck reported a good experience with these trucks; however, they are only using three of 10 vehicles on daily routes while they gain confidence in the vehicles' range and reliability, and most charge at lower power (relative to the size of the battery) at 90 kW to 180 kW. Typical DCFC power levels for this market sector are 100 kW, 120 kW or 180 kW, with the latter as the most common. The Team observed DCFC capable of charging up to 360 kW (and in one case up to 1 MW); however, we did not see trucks at these locations that are capable of charging at these power levels. Some of the latest generation Class 8 trucks have slightly larger batteries (400+ kWh) and longer driving range (over 200 miles), allowing fleets to place them on routes that were not possible to accomplish with the first generation of electric Class 8 trucks.

The diversity in this market is interesting in that installations range from as few as three DCFC ports to as many as 65. Some sites used dual-port chargers serving a single parking space, in which case they were counted as a single port for evaluation purpose in alignment with SCE. A second port provides some resilience in case one plug is causing issues or a cord gets damaged and ensures that the vehicle can always draw the maximum power from the station. Additionally, some truck models can use two ports at the same time to charge at a higher rate. Some sites had installed charging capability for a small portion of their fleet, for example 12 chargers in a fleet of more than 100 trucks, while others had electrified a high percentage of facility, such as 18 out of 24 trucks. Thirteen of 16 sites have installed charging capacity greater than 900 kW, with six over 2 MW and the largest site with nearly 12 MW. Figure 70 shows an example of a heavy-duty truck yard with DCFC chargers.

Among the heavy-duty vehicle sites, eight different original equipment manufacturer (OEM) brands were observed: half legacy manufacturers and half newer market entrants. One HD manufacturer and other medium-duty and component suppliers have recently declared bankruptcy, which may cause issues for some operators. Some vehicles were leased with service agreements that saw quick responses from the dealer or the manufacturer when trucks experienced issues.

Two sites the Evaluation Team visited have significantly more vehicles than chargers (two or three times), which can require a high level of coordination between dispatchers and drivers to ensure that vehicles are charged as required for operations. This high vehicle-charger ratio can mean a higher load factor, which often translates to lower utility bills. However, the load factor is more important when a utility tariff includes demand-oriented costs. SCE's current TOU-EV 8 and TOU-EV 9 rates do not currently include demand charges but are scheduled to start phasing in these charges as early as March 2026 at 16.6% per year over a five-year period. For TOU-EV 7, the phasing in of demand charges started in March of 2024.

Figure 70. SCE Charge Ready Transport Program Heavy-Duty Truck Yard with 80 DCFC Charging Ports



Medium-Duty Vehicle

In EY2024, the Evaluation Team conducted site visits to seven medium-duty vehicle sites, which have 137 charging ports and a total installed capacity of 6,682 kW. This market sector consisted primarily of shuttle and delivery type vehicles, with some medium-duty pickup trucks at some locations. At least two sites have been built to make the charging easily accessible to the public when not in use by fleet vehicles, with EVSE at visible retail locations or close to and visible from main streets. As a result, these sites have had higher utilization rates than others in this market sector. These sites do meet the program requirements of confirmed orders for two vehicles, although one site had not received any vehicles yet, while another operator had opted to charge their vehicles with a L2 charger at the same site due to its lower price. The cost of energy at this location as advertised for the public is \$0.69 per kWh and a \$0.99 flat fee. As discussed in the public charging section of this evaluation

Figure 71. SCE Charge Ready Transport Program Medium-Duty Delivery Truck Available for Rent or Lease



report, \$0.69 per kWh is among the highest electricity costs.

Also within this category are several box trucks designed for local deliveries that will be sold or leased by dealership locations. The dealer locations may charge the vehicles used for regular rentals, charge customer fleets on a regular basis, or top off vehicles that are being serviced. Two vehicle manufacturers declared bankruptcy in 2024, which may cause issues for any operators of their vehicles. Figure 71 shows an example of a medium-duty truck site.

Transportation Refrigeration Unit

In EY2024, the Evaluation Team conducted site visits to one site that had vehicles in both the heavy-duty vehicle and TRU sectors. At this site, charging islands were built to support both trucks and TRUs with 20 electrified truck and trailer charging spaces on each side of a symmetrical parking lot behind the fence. While it seemed like a good idea to co-locate the TRU and the truck chargers during the planning and

Figure 72. SCE Charge Ready Transport Program Charging Island Supporting TRU and Truck Charging



design phase, daily truck charging requirements necessitate truck charging while TRUs are being loaded at the facility's docks, requiring decoupling of the truck and trailer which presents a logistical challenge. This site also has close to a dozen battery powered TRUs. Traditionally, TRUs have the ability to plug in while stationary and use a generator while in transit; on the other hand, battery powered TRUs have solar instead of a diesel generators can use axle-driven electric generators to maintain the battery while in motion.

A second heavy-duty vehicle site also had TRU ports that predated the SRP project. Some of these ports were repurposed with portable DCFC to charge trucks while the permanent truck EVSE were installed. Figure 72 shows an example of a TRU charging site.

School Bus

In EY2024, the Evaluation Team conducted site visits to six school bus sites, including one that was a small expansion from an earlier site (two additional L2 ports were added to bring the site total to nine L2), with a total of 45 charging ports and a total installed capacity of 857 kW. All schools sites used L2 EVSE and one site also had a DCFC port as a resiliency measure in case an electric school bus does not get adequately charged overnight or is used for afterschool activities in addition to its typical daily routes. Otherwise, these sites were very similar to other school bus sites that the Team visited during previous evaluation years.

Transit Bus

In EY2024, the Evaluation Team visited a single transit bus site (shown in Figure 73) with six charging ports (two L2 and four DCFC) and a total installed capacity of 253 kW. This site experienced reliability and repair issues with the electric buses, resulting in minimal use in 2024.

Forklifts

In EY2024, the Evaluation Team visited a single forklift site with seven charging ports and a total installed capacity of 417 kW. The site features both L2 and DCFC, which was being used to charge medium-duty service trucks.

Figure 73. SCE Charge Ready Transport Program Coach Style Electric Bus at a Dual Port DCFC Charging Station



Highlights

- SCE has implemented a process to follow up with each participating fleet on an annual basis to update the number of delivered EVs and adjust future planned deliveries to meet the number of EVs specified in the VAPs. While some fleets have already met their long-term VAP, several fleets are behind on their long-term plans. Several vehicle manufacturers have been noted as having filed for bankruptcy recently. This affects transit, school, medium duty, and heavy duty market sectors.
- Several sites across MDHD programs had a significant amount of light duty charging, attributed to installations available for public access, client vehicle requirements, and reliability/availability issues with MD vehicles.
- In EY2024, the HD market included 66% of total charging ports and 83% of installed capacity, nearly 40 MW, primarily to serve Class 8 trucks. Several sites have significantly more vehicles than chargers, requiring significant coordination to ensure that vehicles can charge as needed.
- HD fleet operators reported paying more attention to load management opportunities, attributed to the high energy consumption of these sites.
- Eight different Class 8 OEM brands were observed: half legacy manufacturers and half newer market entrants. Some fleet operators reported more reliability issues and downtime in comparison to ICE vehicles.
- Newer generation Class 8 trucks have larger batteries (400+ kWh) and longer range (over 200 miles), allowing fleets to place them on routes that were not possible to accomplish with the first generation of electric Class 8 trucks

Deep Dives

The Evaluation Team conducted deep dives for three Charge Ready Transport sites in EY2024. The Evaluation Team considered sites with significant demand, energy consumption, or installed charging capacity; sites that had an ability to expand EV infrastructure; and sites with load management, unique vehicles or charging equipment, a large fleet, and importantly a fleet manager who was willing to participate in the deep dive process.

The three sites were completed in 2023 and include a school bus operator and two heavy-duty Class 8 fleet operators. As part of the deep dives, the Team conducted in-depth fleet manager interviews, analyzed AMI and EVSP data, and developed fleet driver surveys. While all three fleets were open to interviews and discussion of their EV projects, none of the three fleets participated in the driver surveys.

Findings presented in this section reflect the results of the interviews, the data analysis, and driver survey feedback, where available. *Appendix A* presents detailed case studies on each of these fleets.

School Bus Fleet

The Evaluation Team selected a school bus fleet that operates Type C school buses for a deep dive analysis because of the site's low proportion of energy usage during the 4 p.m. to 9 p.m. peak period. Type C school buses carry up to around 80 passengers, with a front-mounted engine and the passenger door behind the front wheels.

The site charges its 38 Type C electric buses using 38 DCFC stations and follows a two-shift charging schedule. This schedule involves plugging in when buses return from morning routes and again when buses return from afternoon routes around 5 p.m., though evening charging power is limited by management software until after 9 p.m. This results in a low percentage of monthly energy consumed during the 4 p.m. to 9 p.m. peak period (approximately 15%). During the first phase of this project, more chargers were installed than the Utility anticipated, resulting in a bottleneck at the site's transformer, which would otherwise have been able to fully serve the anticipated number of chargers. As a result, all 38 chargers cannot be run concurrently at full power and require around 200 kW more capacity than the transformer is capable of supplying. The Utility has worked closely with the site to ensure that the fleet's duty cycles are not adversely impacted by this situation. The upgraded transformer is expected to be added along with six additional chargers in 2025, using make-ready infrastructure installed as part of the first phase of the project.

The fleet manager expressed satisfaction with their vehicles, noting that reliability has been good and any issues that arise are quickly resolved by the manufacturer. However, the fleet manager has noticed that tire wear is becoming an issue, with the buses wearing through tires twice as quickly as the vehicles they replaced. The fleet is exploring different avenues to mitigate this, including using retreaded tires on the rear wheels and conducting demonstrations of EV-specific tire compounds.

This site has served as a case study for several other school bus fleets both in California and across the United States, providing guidance, feedback, and lessons learned in the process of developing its electric school bus fleet and charging site. For instance, the fleet manager has advised other fleets to take advantage of solar photovoltaic systems and batteries for peak shaving and resilience, as the fleet manager regretted the lack of solar at their own site.

Heavy Duty Fleet 1

The Evaluation Team selected a heavy-duty freight fleet operating 92 Class 8 heavy-duty tractor trucks for a deep dive based on several considerations, including the site's large fleet, a high ratio of trucks to chargers, and a high load factor, reflective of consistent utilization.

The 92 trucks charge on only 32 DCFC ports across 16 charging units, resulting in a ratio of approximately three trucks per port. Each charger has two ports—one port is 300 A and the second is 500 A—and drivers are instructed to use the 500 A port whenever it is available. Prioritizing the 500A plug allows for the first truck to charge more quickly, while leaving the secondary 300A port available to start charging a secondary truck. Combined with the presence of on-site staff who rotate trucks between chargers as needed, this allows for the EVSE to effectively fuel the site's vehicles even at a high vehicle-to-ports ratio. According to the fleet manager, the trucks have generally been reliable, and the manufacturer has been responsive and able to resolve issues quickly. However, the electric trucks still experience more parked downtime for maintenance and repairs than their diesel counterparts, with an average of about 10% of their downtime over 24 hours, compared to 2% downtime among the diesel trucks. In terms of drivers and operations, the fleet benefitted significantly from having an internal contact who took responsibility for training other drivers on the operational quirks and challenges of the electric trucks.

The site has moderate consumption during the 4 p.m. to 9 p.m. peak period, during which time the cost of electricity is significantly higher than other times during the day. Compared to other heavy-duty fleets, the site uses around 10% more of its energy during this time. This is due to a pressing need to keep the trucks charged whenever they return from shifts, which at times naturally overlaps with the expensive time period. However, the fleet is still able to complete its routes and duty cycles without significant downtime for charging, which is a testament to the efficacy of providing fewer, more powerful charging ports rather than a higher number of less powerful ports.

Heavy Duty Fleet 2

The Evaluation Team selected a heavy-duty freight fleet operating 18 Class 8 heavy-duty tractor trucks for a deep dive. The freight fleet operates three additional sites: two in SCE territory and one in PG&E territory. The Team's selection of this site for a deep dive was the result of several considerations, primarily the operator's unique service of offering guidance and electrification best practices to clients, and as a result operating multiple SB 350-funded sites.

The 18 Volvo electric trucks at this site are used in two shifts (morning and evening), making drayage trips to and from the ports of Los Angeles and Long Beach and the main site in Los Angeles. Trucks charge on 14 ABB Terra units: eight 180 kW Terra 184 dual-port units and six 175 kW ABB Terra 175 dual-port units, all operating on Synop network software. As with the other heavy-duty fleet, the trucks prioritize operational reliability over charging optimization, and a significant portion of this fleet's operational energy is consumed between 4 p.m. and 9 p.m. (around 30% to 40% over most of 2024).

The fleet highlighted that its sites funded under the SB 350 program tend to take longer from inception to completion than those executed under SCE's EV Infrastructure Rule 29. Two of the fleet's recent sites were completed within 18 months under this rule, while, the SB 350 project required upwards of two years to progress from application to completion. The SB 350 and Rule 29 program processes differ significantly, which may explain the discrepancy in site completion times. For example, project planning is the responsibility of the customer pre-submission in the Rule 29 program, while the Utility performs project planning under SB 350. In addition, the fleet's ability to apply lessons learned from its experience with the Charge Ready Transport program to the Rule 29 process likely improved completion time for those sites.

Fleet Driver Surveys

None of the three fleets in SCE territory opted into fleet driver surveys in 2024.

Highlights

- Two of the three deep dive sites highlighted the success of their EV operations, noting that their site's active management (one via software, one via physically moving vehicles) has allowed them to maintain steady, reliable operations.
- Fleet managers at all three sites reflected about the importance of good advocacy. One fleet has an involved manager ensuring that vehicles are charging and operating as expected; one fleet has an internal early EV adopter who developed a training program for the site; and the third fleet is its own advocate, providing guidance to clients on appropriately sizing charging stations and vehicle batteries.
- Two of the fleets reported that their EVs have higher instances of downtime and additional resource consumption than their ICE counterparts. One fleet manager stated that their EVs experienced more instances of lengthy downtime; another said that their vehicles' tires wear out approximately twice as often as tires on their ICE vehicles.

Co-Benefits and Co-Costs

Through fleet manager surveys, deep dive fleet manager interviews, deep dive fleet driver surveys, and site visits, the Evaluation Team identified several co-benefits and co-costs associated with the Charge Ready Transport program's vehicle electrification sites.

Fleet Manager Surveys

The fleet manager surveys used both aided (asking fleet managers if they have noticed a specific co-benefit or co-cost) and unaided (open-ended) questions to assess co-benefits and co-costs.

For EY2024, 12 fleet managers completed the fleet manager survey and Table 35 shows that all 12 fleet managers expected to realize benefits for their community or fleet from electrifying in at least one category. Fleet managers broadly expected benefits to the community to be more significant than those to their fleets. For instance, 10 fleet managers expected *significant benefits* from improved air quality and health and seven expected *significant benefits* from reduction in noise pollution. However, five of 12 fleet managers expected *no benefits* from increased fleet flexibility. These results are consistent with results from EY2023, when four of six fleet managers expected *significant benefits* from improved air quality and health, reduced noise pollution, and improved driver comfort and convenience, more so than the other categories.

Other benefits mentioned by fleet managers included "less down time, less maintenance, more satisfied employees, more satisfied customers" and the "reduction in harmful emissions [being] a tremendous health benefit" for drivers.

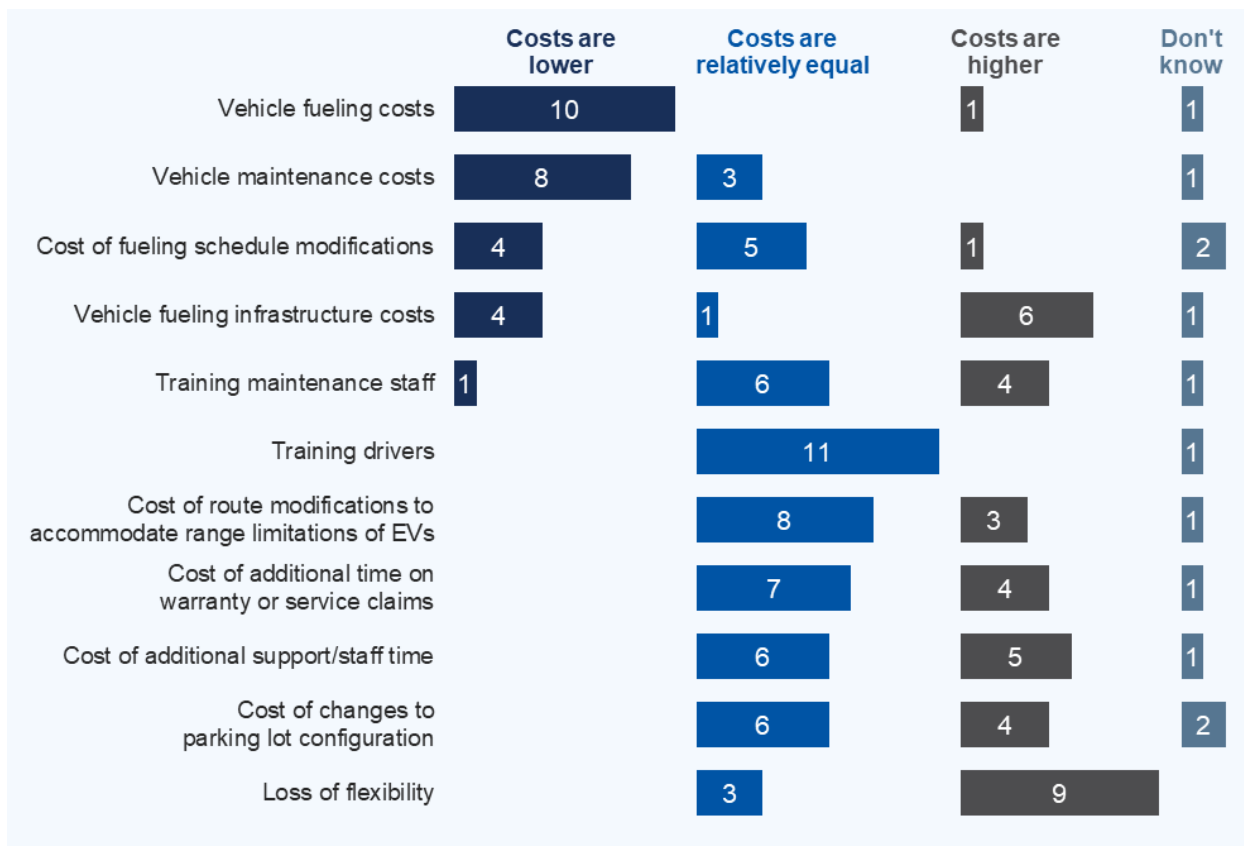
Table 35. SCE Charge Ready Transport Program Benefits Fleet Managers Reported from Electrification in EY2024

Benefits	Significant Benefits	Some Benefits	No Benefits	Not Sure
Encourages other individuals/fleets to convert to EVs	3	5	3	1
Improved air quality/health	10	2	–	–
Reduction in noise pollution	7	4	1	–
Improved driver comfort/convenience	3	7	2	–
Increased fleet flexibility	1	5	5	1

Source: Fleet Manager Survey Question D1. “What ancillary benefits do you think will be realized for your community/fleet as a result of electrifying?” (n=12)

The Evaluation Team asked fleet managers to estimate how the costs associated with operating and maintaining their fleets have changed since electrification. As shown in Figure 74, 10 of 12 fleet managers reported lower costs for vehicle fueling costs and eight of 12 observed lower vehicle maintenance costs. Nine of 12 fleet managers cited higher costs for the loss of flexibility with the new vehicles. Many fleet managers estimated that their costs remained relatively equal across cost categories. These results are largely consistent with EY2023, when fleet managers estimated lower costs and higher costs for similar cost categories.

Figure 74. SCE Charge Ready Transport Program Observed Cost Changes since Electrification in EY2024

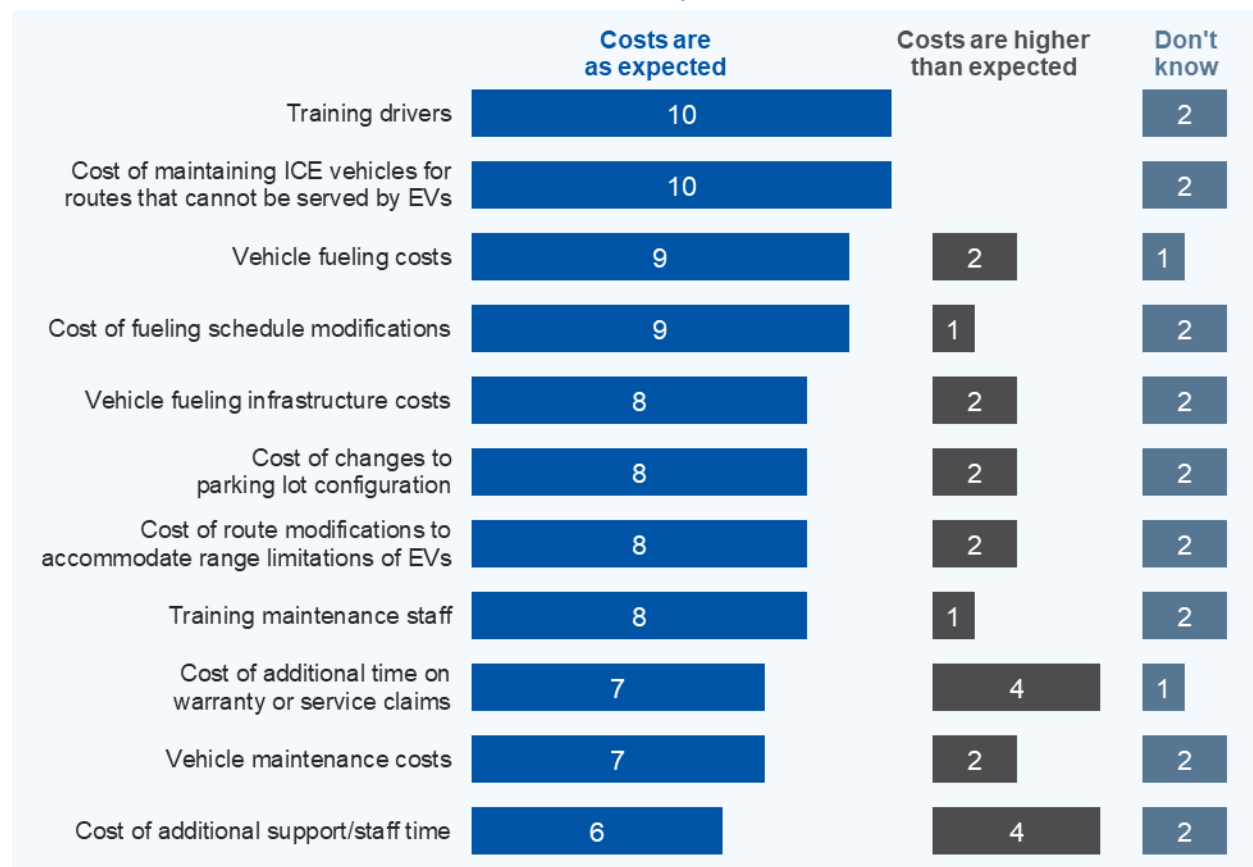


Source: Fleet Manager Survey Question E1. “Please think about all the costs associated with operating and maintaining your fleet. For each cost type, please estimate how much the cost has changed since transitioning your fleet to EVs.” (n=12)

The Evaluation Team asked fleet managers to what extent they expected operational and maintenance costs to change. As shown in Figure 75, costs changed *as expected* for between six and 10 fleet managers across all categories. No fleet managers reported costs as *lower than expected* in any category. In contrast, several fleet managers reported that cost changes were *higher than expected* across categories. Four of 12 fleet managers reported that the cost of additional time on warranty or service claims and the cost of additional support or staff time was *higher than expected*. Apart from no fleet managers experiencing *lower than expected* costs, results were mostly consistent with EY2023.

Fleet managers mentioned other costs incurred as a result of electrifying, with one fleet manager reporting that “tire replacement has doubled” and another citing “damage [of] charging/plug in stations.”

**Figure 75. SCE Charge Ready Transport Program
Differences between Electrification Expectations and Costs in EY2024**



Source: Fleet Manager Survey Question E2. “Have these operational and maintenance costs been what you expected?” (n=12)

Deep Dive Fleet Manager Interviews

The Evaluation Team conducted deep-dive interviews with three participating fleet managers to assess the co-costs and co-benefits of transportation electrification for fleets and drivers. During the interviews, fleet managers noted some challenges:

- **EV reliability.** Fleet managers reported problems with keeping their EV fleet fully operational, due to a combination of software, electrical, and hardware issues. Two of the fleets reported experiencing more downtime than with counterfactual vehicles, though both also noted that their EV manufacturers were responsive and helpful in addressing and minimizing downtime.
- **Lack of flexibility.** One fleet manager noted that their schedule and duty cycle required high-power charging, as opposed to longer periods of lower-powered charging. This bleeds slightly into the 4 p.m. to 9 p.m. period of higher rates for their site, but the site prioritizes the ability to complete their duty cycles over minimizing costs. A second fleet manager uses a similar strategy, acknowledging that their drayage duty cycle inevitably requires some costs incurred during the 4 p.m. to 9 p.m. period.
- **Lengthy project completion timelines and equipment shortages.** One fleet manager manages sites within both the SB 350 program and the SCE Rule 29 program. The fleet's recent Rule 29-funded sites were completed in approximately six months less time than those funded by SB 350, which may be due to a variety of factors including the responsibility for planning and the fleet manager's ability to apply lessons learned from participating in the Charge Ready Transport program to the Rule 29 program.
- **Utility accommodation.** after one site installed more chargers than expected, the Utility was able to accommodate the change to the planned installation. While site cannot operate all of its chargers concurrently, the installed charging infrastructure is functional and adequately supports the site's duty cycles.

Two of the three fleet managers expressed that having staff advocating for the electrification on site has helped to facilitate smooth transitions and improve vehicle reliability. One of these fleets' champions is their fleet manager who monitors charging patterns and constantly adjusts schedules and parameters to improve service reliability, the other is an early-adopter staff member who developed a training course on the EVs for their fellow drivers. The second site also uses on-site charge "handlers" to move vehicles between charging stations to facilitate higher load factors. The third fleet acts as its own champion, providing consulting and recommendations to fleets with which they contract to tailor electrification solutions to each site's unique needs and duties.

Highlights

- All twelve interviewed fleet managers anticipated benefits for their community or fleet through the transition to electrification.
- Ten of twelve fleet managers expected *significant benefits* from improved air quality and health, improved driver comfort and convenience, and reduced noise pollution.
- Ten fleet managers reported *lower costs* for vehicle fueling costs since electrification, and eight also reported *lower costs* for vehicle maintenance costs. Four fleet managers also reported lower costs for the cost of fueling schedule modifications and for vehicle fueling infrastructure costs.
- None of the twelve fleet managers interviewed reported lower than expected costs across the categories; however, at least one-half of the interviewees reported that costs were as expected for all eleven categories.
- The three deep dive interviews with fleet managers uncovered three main challenges around EV reliability, lack of flexibility, and lengthy project completion timelines and equipment shortages.

Site Costs

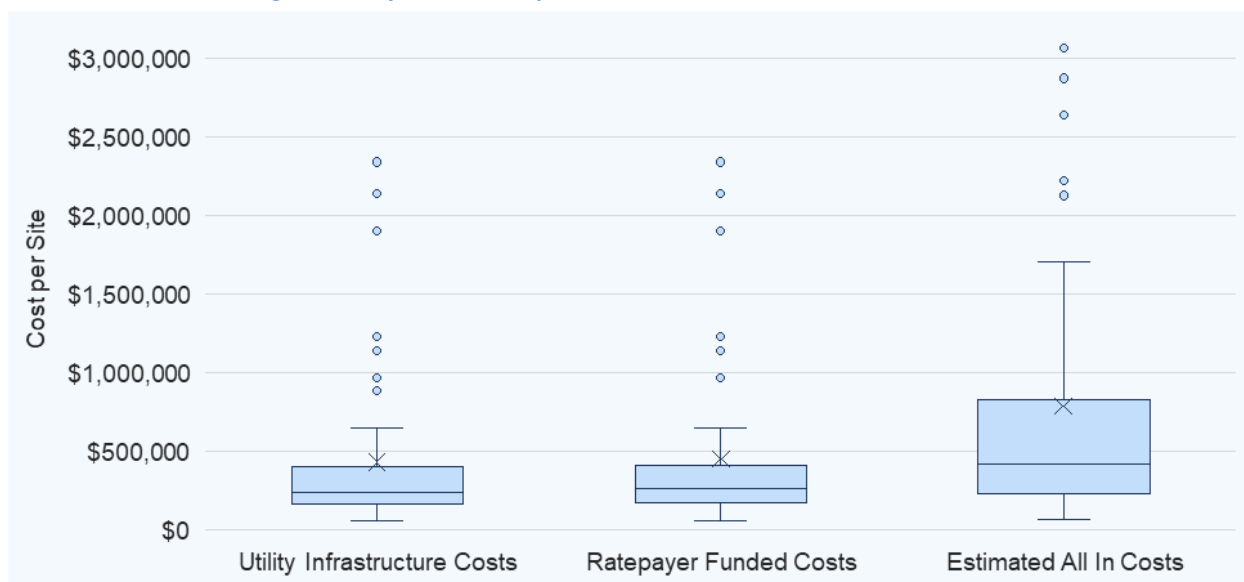
The Evaluation Team conducted an analysis on the 55 sites with fully closed out finances as of December 31, 2024, including sites activated in EY2021, EY2022, EY2023, and EY2024. The set of fully closed out sites is smaller than the set of activated sites because of the time lag involved in performing activities such as collecting receipts, paying invoices, and obtaining administrative approvals. Cost estimates presented here are in nominal dollars.

The 55 sites had a mix of L2 and DCFC ports, with an average of 758 kW of installed capacity and 18.6 ports per site. The 55 sites included 26 school bus sites, eight transit bus sites, six medium-duty vehicle sites, five heavy-duty vehicle sites, five port cargo truck sites, three TRU sites, and two forklift sites. Of the 55 sites, seven sites had customer-owned BTM; the rest were utility-owned BTM. Market sectors are grouped together to meet customer confidentiality requirements. While this aggregation masks findings for given market sectors, it provides insights into the relative magnitude of costs faced by MDHD fleets. For a discussion of site costs by market sector, see *Statewide MDHD Vehicle Findings*. In future evaluation years, the Evaluation Team expects to have sufficient data points to disaggregate certain market sectors.

Figure 76 shows the distribution of site-level costs for the 55 sites. The horizontal lines of the boxes show the 25th, 50th, and 75th percentile of sites; the “x” represents the mean site cost; and the three panels are defined as follows:

- **Utility Infrastructure Costs.** Actual site costs of installing the site borne by the Utility for the TTM and BTM⁴⁷ infrastructure, including capital and labor costs.⁴⁸
- **Ratepayer-Funded Costs.** Actual site costs of installing the site are borne by the Utility for TTM, BTM infrastructure,⁴⁹ and EVSE rebate including capital and labor costs.
- **Estimated All-in Costs.** Estimated costs of installing the site borne by the Utility and the customer including capital and labor costs. The value is calculated by summing TTM,⁵⁰ BTM,⁵¹ and EVSE costs.⁵²

**Figure 76. SCE Charge Ready Transport Program Per-Site Costs
Organized by Three Perspectives, Across 55 Closed-out PTD Sites**



⁴⁷ Or BTM incentive if site infrastructure is customer owned

⁴⁸ Utility Infrastructure costs are the same as the Ratepayer-Funded Costs, except they do not include the EVSE rebates.

⁴⁹ Or BTM incentive if site infrastructure is customer owned

⁵⁰ The Utility pays 100% of the TTM costs and therefore reports actual TTM costs to the Evaluation Team.

⁵¹ The Evaluation Team receives actual BTM costs for sites with Utility-owned BTM. In total, 48 of 55 sites with fully closed out financials have utility-owned BTM. For the seven customer-sponsored BTM sites, the BTM cost is estimated as multiplying the rebate amount times 1.2.

⁵² Because actual EVSE costs are not known by the Utility, The Evaluation Team estimates EVSE equipment costs using an assumption of \$3,000 per port for L2 ports.

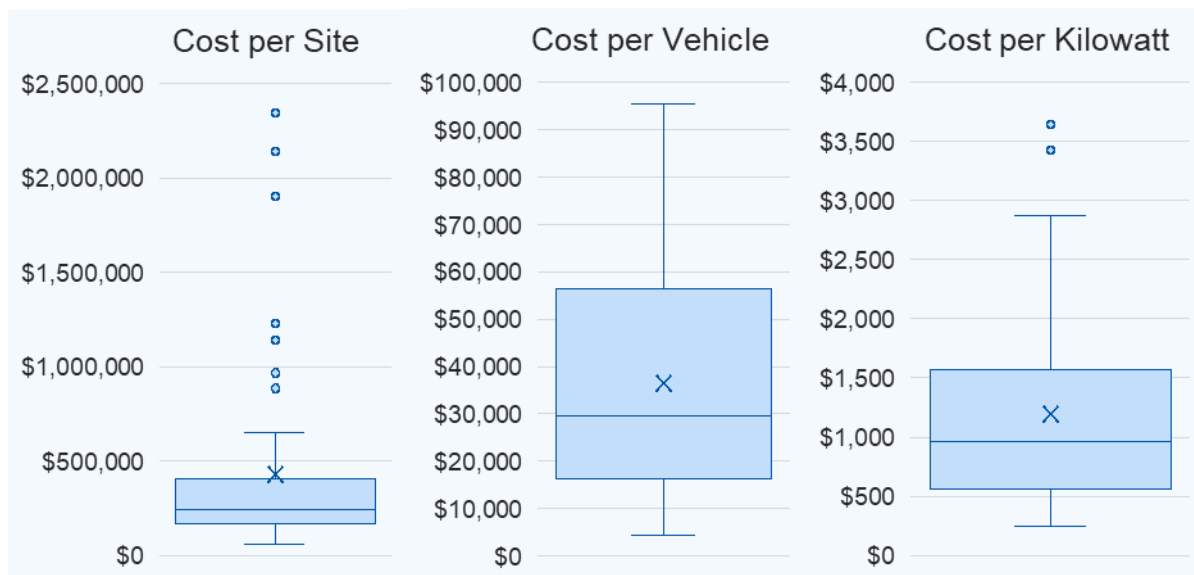
Figure 77 shows estimated average all-in costs for the 55 PTD sites. EVSE has the largest cost across the sites, followed by BTM, then TTM. Together, the average all-in TTM, BTM, and EVSE cost is \$802,698 through 2024.⁵³

Figure 78 shows the distribution of utility infrastructure costs (corresponding to the far-left panel) presented per site, per vehicle, and per kilowatt. The average utility infrastructure cost, including TTM and BTM borne by SCE through 2024, was \$430,204 per site, \$36,450 per vehicle,⁵⁴ and \$1,158 per kilowatt of installed charging capacity. Although not shown, nearly 71% of SCE Charge Ready Transport program spending on infrastructure for financially closed out sites to date has been on DAC sites, exceeding the 40% program target.

Figure 77. SCE Charge Ready Transport Program Average Estimated All-In Costs, Across 55 Closed-out PTD Sites



Figure 78. SCE Charge Ready Transport Program, Utility Infrastructure Cost per Site, per Vehicle, and per Kilowatt for 55 Closed-out PTD Sites



⁵³ Calculated by summing all TTM, BTM, and EVSE costs borne by SCE and the customer and dividing by 55 sites. Sites with customer-owned BTM have synthesized BTM costs.

⁵⁴ Vehicle count is taken from the site's VAP.

Highlights

- Estimated all-in costs paid by the customer and SCE vary widely between sites, with an average per PTD site of \$802,698 through 2024.
- The average utility infrastructure cost, including TTM and BTM borne by SCE through 2024, was \$430,204 per PTD site, \$36,450 per vehicle, and \$1,158 per kilowatt.
- Nearly 71% of SCE Charge Ready Transport program spending on infrastructure for financially closed out sites to date has been on DAC sites, exceeding the 40% program target.

Grid Impacts

This section describes grid impacts for the Charge Ready Transport program based on an analysis of energy consumed and customer bills by operational charging stations installed through the program in EY2024.

Data Sources

The primary data source for the analyses detailed in this section is energy usage data provided in regular 15-minute intervals from the AMI. Other data sources include customer bills, LCFS program information, and charging session-specific data provided by NSPs. There are several important differences between AMI and NSP data. While AMI data reflect only energy usage, NSP data include session start and stop time, the duration of a vehicle's connection to a charging port, the duration of a vehicle actively pulling power, and the specific port used for a session. An AMI meter does, however, track standing loads (such as those the EVSE uses for communications, cooling, active power converters, solenoids, and screens), which NSPs typically cannot do. When AMI data is missing from the dataset, the Evaluation Team uses NSP data to fill in the gaps.

Summary of Grid Impacts

Table 36 presents the estimated SCE Charge Ready Transport program grid impacts.

Table 36. SCE Charge Ready Transport Program Grid Impacts

Impact Parameter	Actual 2024	Actual Program to Date	10-Year Projection PTD
Operational Sites ^a	31	86	86
Installed Capacity (kW)	47,371	92,102	92,102
Electric Energy Consumption, MWh			514,400
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)			95,658 (18.6%)
Maximum Demand, kW (with date and time)	14,487 (10/22/24 10:30 p.m.)	14,487 (10/22/24 10:30 p.m.)	N/A
Maximum On-Peak Demand, kW (with date and time)	11,771 (11/19/24 5:15 p.m.)	11,771 (11/19/24 5:15 p.m.)	N/A

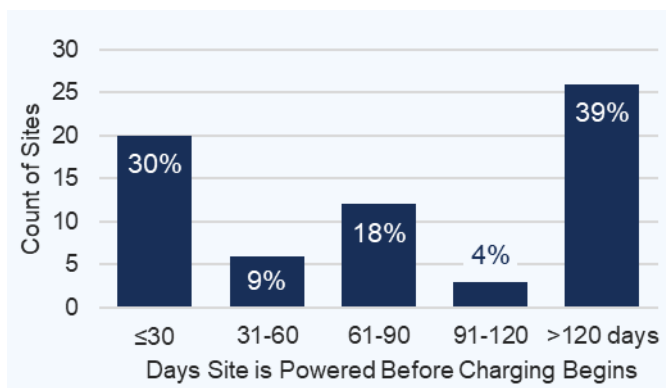
^a Only 31 of the 2024 operational sites had sufficient data to be included in the impacts analysis

Energy Trends

Site Startup

The Evaluation Team examined the duration between Charge Ready Transport program site activation and operation to illustrate the timing relationship between readiness of charging infrastructure and actual vehicle charging. AMI data demonstrates that approximately 60% of sites had significant operations within 90 days of activation, as illustrated in Figure 79. However, as the final column of Figure 79 shows, nearly 40% of sites were not in use for at least four months after activation. Based on discussions during site visits, the primary cause of delays in operation was a delay in vehicle delivery. Additionally, transit operators often took several months to commission vehicles.

Figure 79. SCE Charge Ready Transport Program Percentage of Sites by Days between Activation and Operation for PTD Sites



Consumption and Maximum Demand

Figure 80 depicts the growth of SCE's monthly energy consumption and maximum demand for all operational sites in the Charge Ready Transport program to date. In EY2024 both consumption and maximum demand increased as new sites became operational.

Charge Ready Transport program sites collectively reached over 14.4 MW of maximum demand at the end of 2024, with an installed capacity of approximately 92 MW. Demand more than doubled compared to demand at the start of the year of around 6.5 MW. As detailed in *Site Visit Findings*, the low demand relative to the installed capacity can be attributed to several factors, including fleet operators still gaining experience with new vehicles, waiting for delivery of vehicles, or not yet having commissioned all vehicles, leading to slow growth in utilization. Less-than-perfect reliability of vehicles and charging equipment were also factors.

Figure 80. SCE Charge Ready Transport Program Monthly Energy Consumption and Maximum Demand

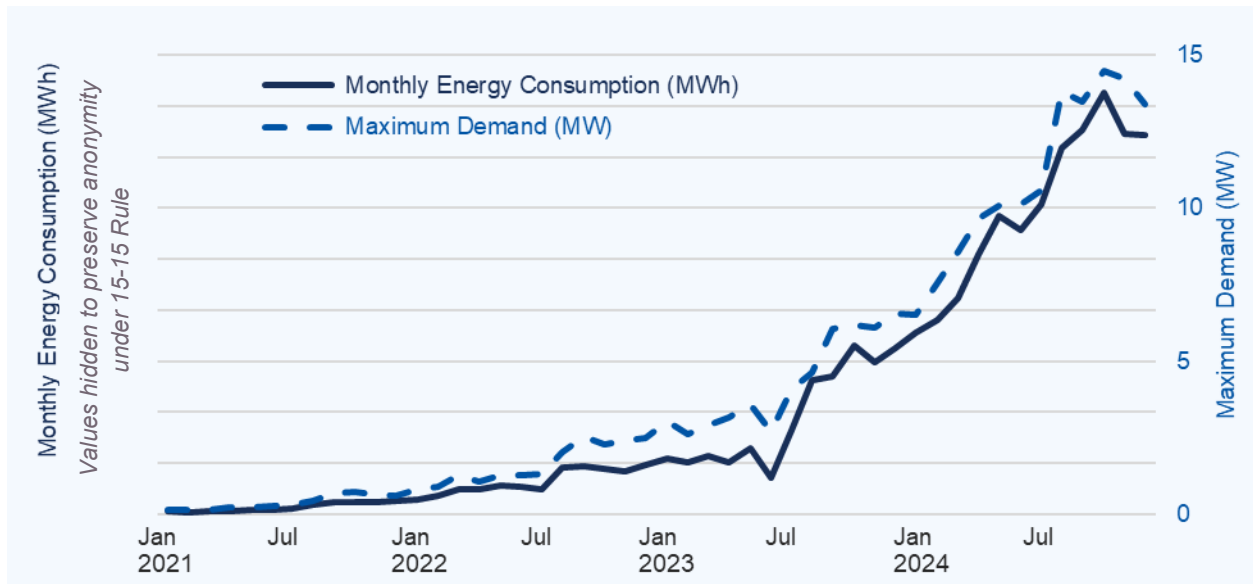


Figure 81 provides insight into energy consumption trends of activated sites by program reporting year. Projects activated in EY2023 and EY2024 show much larger consumption than sites activated in EY2021 and EY2022. Trends in energy consumption vary between evaluation years. EY2022 and EY2023 had similar numbers of activated sites with very different results; EY2022 sites have had a relatively consistent consumption across all evaluation years, while consumption for EY2023 sites rose dramatically throughout the second half of 2023 and throughout 2024. EY2024 saw the largest total of new activated sites (31) and displayed rapid growth, rising to over 1 MWh by June 2024 as new larger sites came online. EY2024 sites may already be beginning to show a pattern of consistent use, which may show that sites are maturing more rapidly, and vehicles are entering operations faster than in previous evaluation years.

Figure 81. SCE Charge Ready Transport Program Monthly Energy Consumption of Activated Sites Grouped by Initial Reporting Year PTD

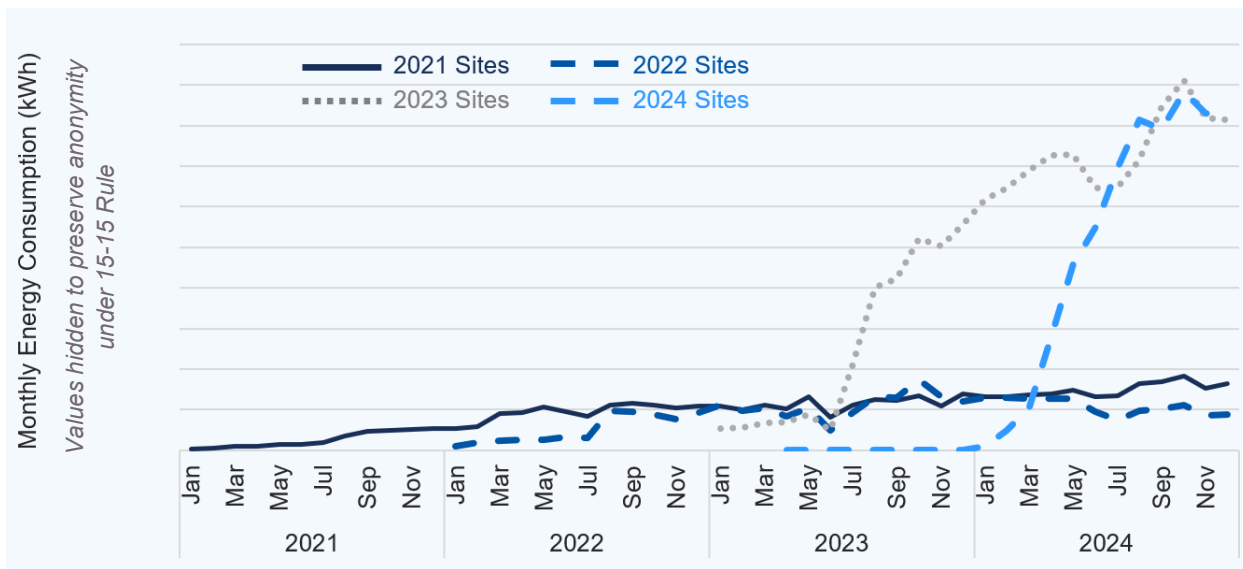
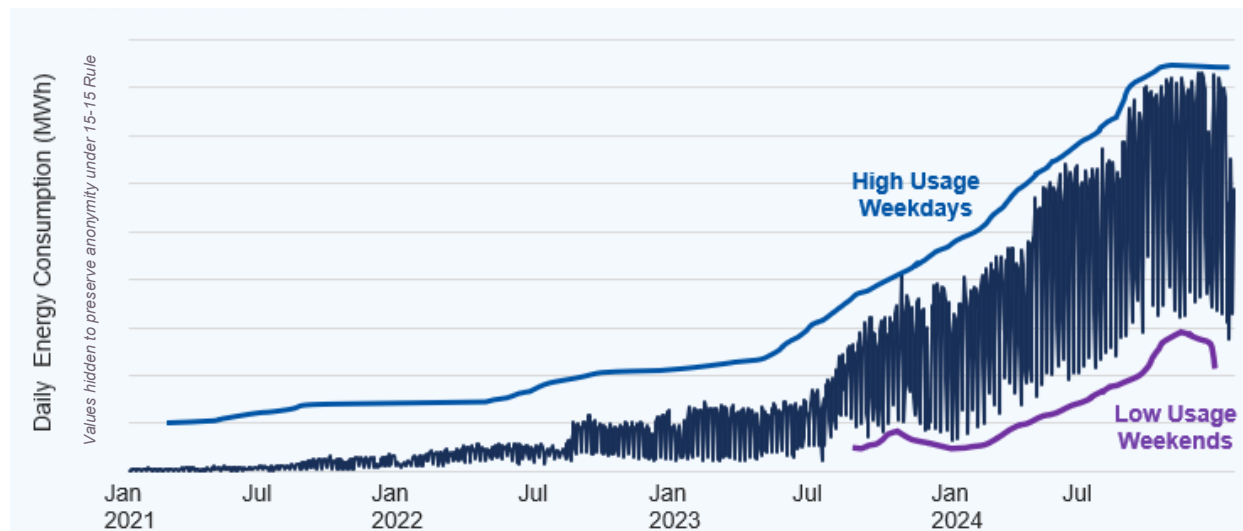


Figure 82 shows similar daily fluctuations from a demand perspective, with wide variations in daily consumption between weekdays and weekends. The high marks typically represent weekday operation, while the low marks typically represent weekend operation. In the final months of 2024, weekday energy uptake typically fluctuated between 100 and 150 MWh, while weekend days ranged between 50 MWh and 100 MWh.

Figure 82. SCE Charge Ready Transport Program Daily Energy Consumption for PTD Sites



Similarly, maximum demand has grown but is more consistent in the second half of 2024. Maximum days surpassed 14 MW, while low days still reached 5 MW as shown in Figure 83.

Figure 83. SCE Charge Ready Transport Program Daily Maximum Demand for PTD Sites

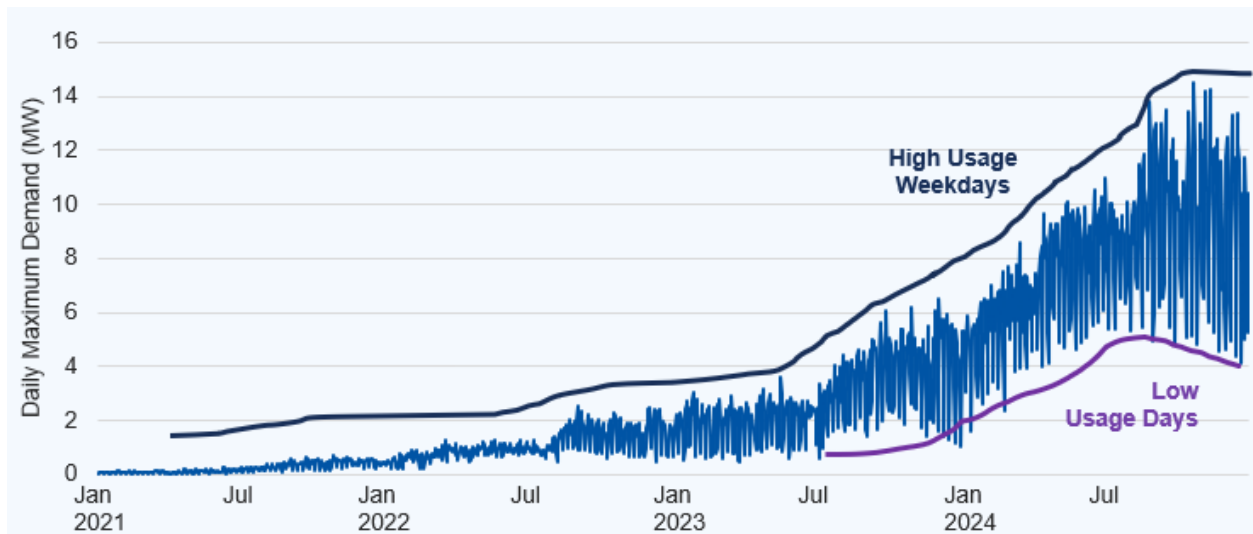
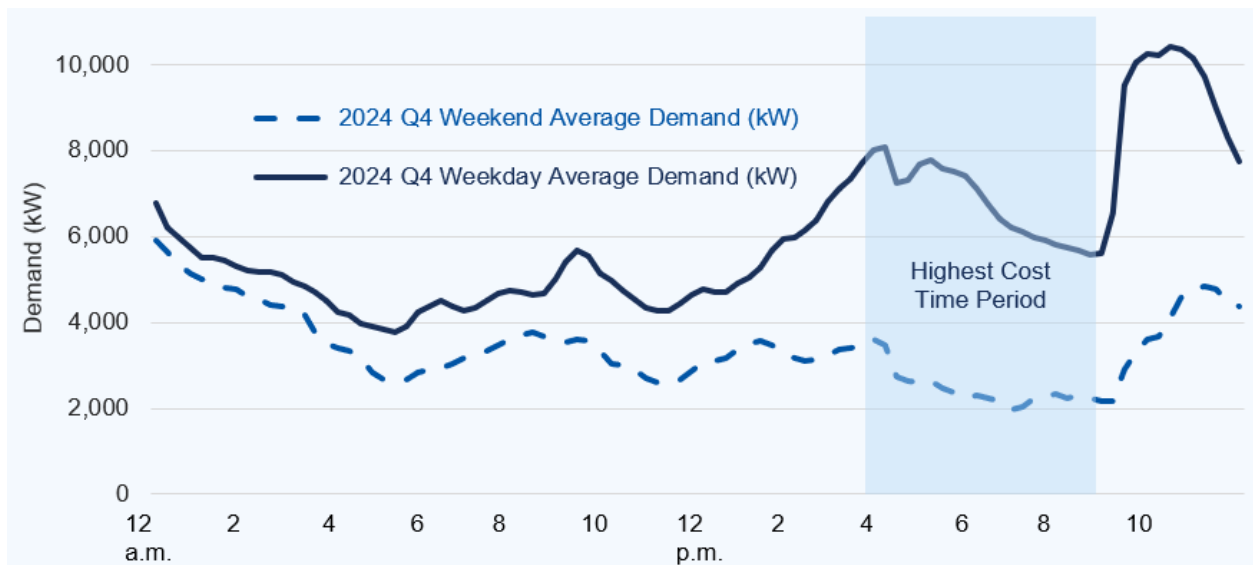


Figure 84 depicts an average weekday and weekend day in the 4th quarter. The final quarter of 2024 exhibited the most-consistent consumption and demand of the year. Notable weekday attributes include an average of 750 kW drop at 4 p.m. and a steep increase of almost 4,000 kW in demand at 9 p.m., indicating the use of load management to avoid high-cost energy.

Figure 84. SCE Charge Ready Transport Program Average Weekday and Weekend Q4 2024 Load Curves



Load Management and Charging Flexibility Analysis

This section describes analyses around load management and load flexibility. Load-managed sites are those that adopt techniques to avoid charging vehicles during periods of peak energy prices. The analyses consider sites to be load-managed if they exhibited consistent load-management regardless of when load management was implemented during the year; otherwise, they are labeled as non-load-managed.

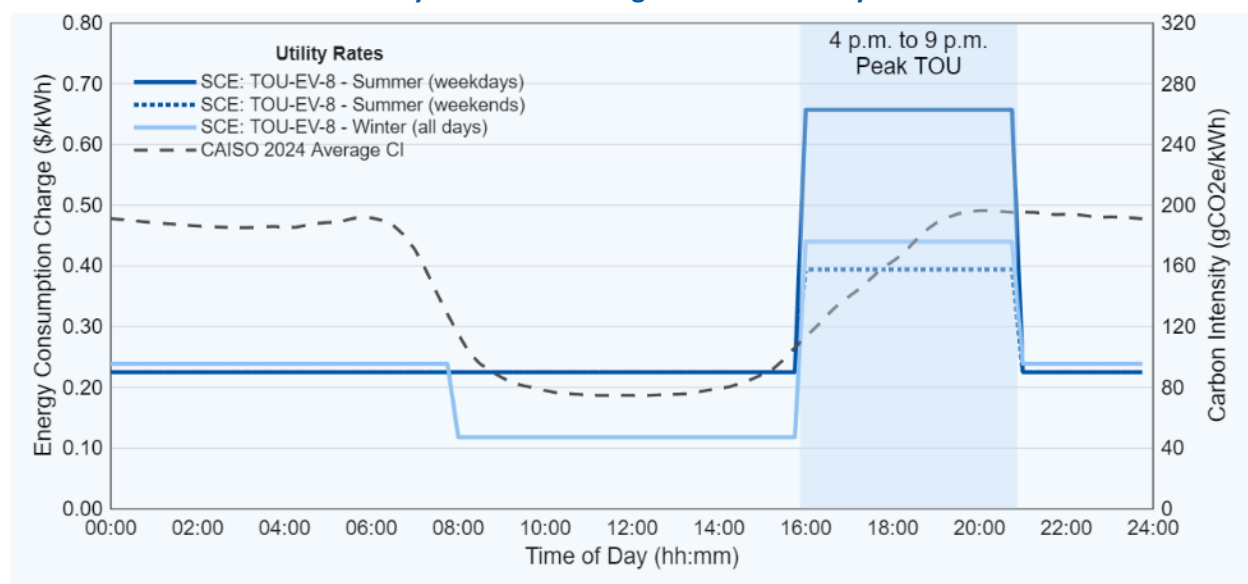
The peak TOU period (daily from 4 p.m. to 9 p.m.) for TOU-EV-8 and TOU EV-9 rate structures (20 kW to 500 kW and >500 kW demand, respectively) in 2024 for SCE’s Charge Ready Transport program, provides energy at costs ranging from \$0.11 to \$0.66 per kilowatt-hour depending on the season and time of day. Figure 85 displays these TOU rate curves for summer and winter weekdays for TOU-EV-8. Winter days (October 1 – May 31) have a Super-Off-Peak period from 8 a.m. to 4 p.m. Lower-cost TOU periods, such as the winter Super-Off-Peak period, often correlate with lower carbon intensity of the grid, as indicated by the dashed line in the figure, which shows the CAISO 2024 average carbon intensity (gCO₂e/kWh). As the actual carbon intensity of the grid varies continuously by time of day and day of year, this reference line indicates the time-of-day average across all days in 2024.

What is Load Management?

Load Management is an effort to control vehicle charging for several purposes:

- Mitigation of electricity costs through TOU periods or demand (rate of consumption)
- Participation in special programs (such as Demand Response or California LCFS)
- Compensation for limited electrical capacity

Figure 85. SCE Charge Ready Transport Program Hourly TOU Electricity Rates and Average Carbon Intensity in 2024



The Evaluation Team periodically reviews data on a site-by-site basis throughout the year to identify load-managed sites. Visiting sites in person and speaking to fleet managers also provides context around load management intent. SCE is different from the other Utilities in that its EV tariff does not currently include demand-related costs.

There are nearly thirty NSPs operating at Charge Ready Transport program sites, however only one-third of NSPs have customers consistently using load management. Further, of the 86 operational sites at the end of 2024, only 21 exhibited strong use of load management, with an additional four showing

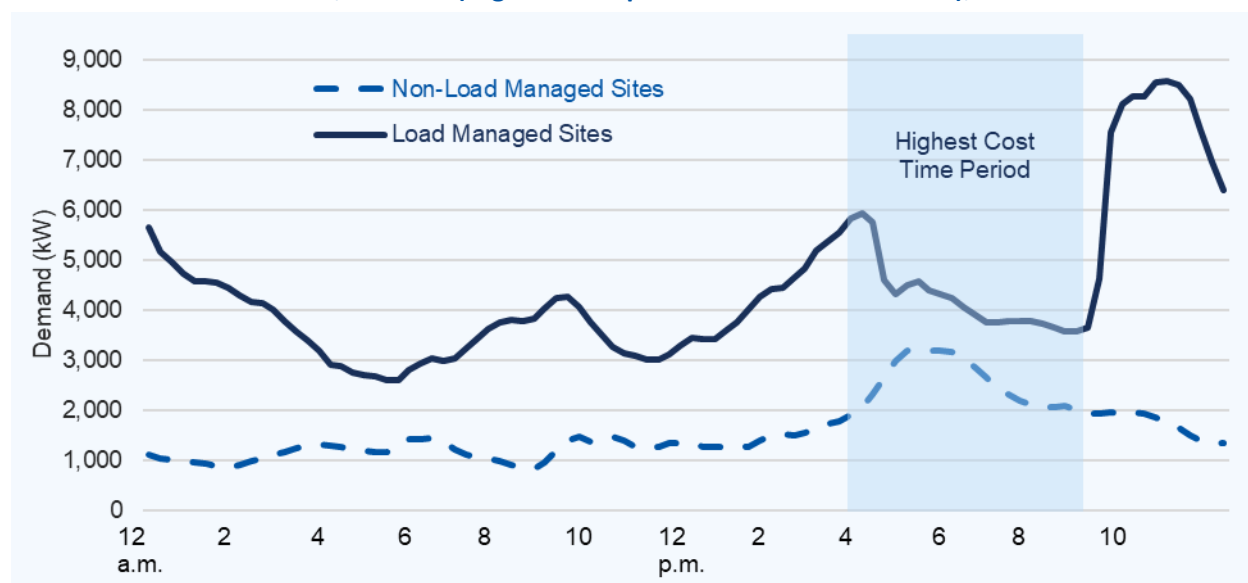
inconsistent use of load management in EY2024. Notably, four sites that displayed consistent use of load management in EY2023 are no longer doing so in EY2024. Load management is evident in several ways:

- Load spikes quickly around 9 p.m.
- The proportion of total monthly energy consumption that was used between 4 p.m. and 9 p.m. is often below 10%.
- Charging often drops off steeply at 4 p.m.

The Evaluation Team assessed consumption trends for sites that had implemented load management and those that had not. The group of sites using load management had between 15% and 20% of monthly consumption occur from 4 p.m. to 9 p.m., while sites that did not use load management averaged over 30%. The best individually performing sites in the Charge Ready Transport program are able to achieve total monthly consumption below 10% from 4 p.m. to 9 p.m.

Figure 86 illustrates the differences in electricity demand at different times between load-managed and non-load-managed sites (determined using consumption data). While the curve for the load-managed sites does show demand from 4 p.m. to 9 p.m. some sites were inconsistent in the 4th quarter. In this example load is shown to begin increasing at approximately noon until 4 p.m. for load-managed sites and drops from approximately 6 MW to as low as 3.5 MW for an approximate 40% load drop. Individual sites can see even higher load curtailment. What would otherwise be an increasing load during that time period is delayed, until a notable load ramp of around 8.5 MW once prices drop at 9 p.m. Conversely, the curve for the non-load-managed sites spikes around 5 p.m., coincident with many fleet vehicles returning to the site, and do not show any load growth at 9 p.m.

Figure 86. SCE Charge Ready Transport Program Load-Managed and Non-Load-Managed Site Demand, 2024 Q4 (High Consumption and Demand Months), PTD Sites



Charging Flexibility

The Evaluation Team used site charging data to determine the amount of time vehicles are connected to a charging port but not actively consuming energy. This allowed the Team to assess charging flexibility, or the ability for a vehicle to shift charging from periods of high-cost electricity to low-cost electricity without impacting vehicle operations. This is the amount of time vehicles are connected to a charging port but not consuming electricity.

In addition, site visits allowed the Evaluation Team to confirm vehicles' make, model, and battery size, all of which affect charging flexibility as well as operational characteristics. For instance, many school bus charging sessions use less than half of the vehicle's battery capacity. Providing feedback to operators about historical usage trends like charging session size in relation to battery size and available time to charge may help inform charging plans.

Figure 87 shows the relative charging flexibility of various vehicle market sectors. Figure 87 uses only charging sessions that took place partially or entirely during periods of highest cost electricity and omits charging sessions that did not overlap with the period between 4 p.m. and 9 p.m. Three of the categories had approximately 40% of charging session energy overlap with the period between 4 p.m. to 9 p.m., while one (MD truck) had only 25%. Some of these operators use load management, so their vehicles did not charge during that period; however, these sessions are relevant to the analysis of how much time a vehicle was connected but not drawing power.

Figure 87. SCE Charge Ready Transport Program Charging Flexibility for PTD Sites in Sessions Overlapping the Time Period Between 4 p.m. and 9 p.m.

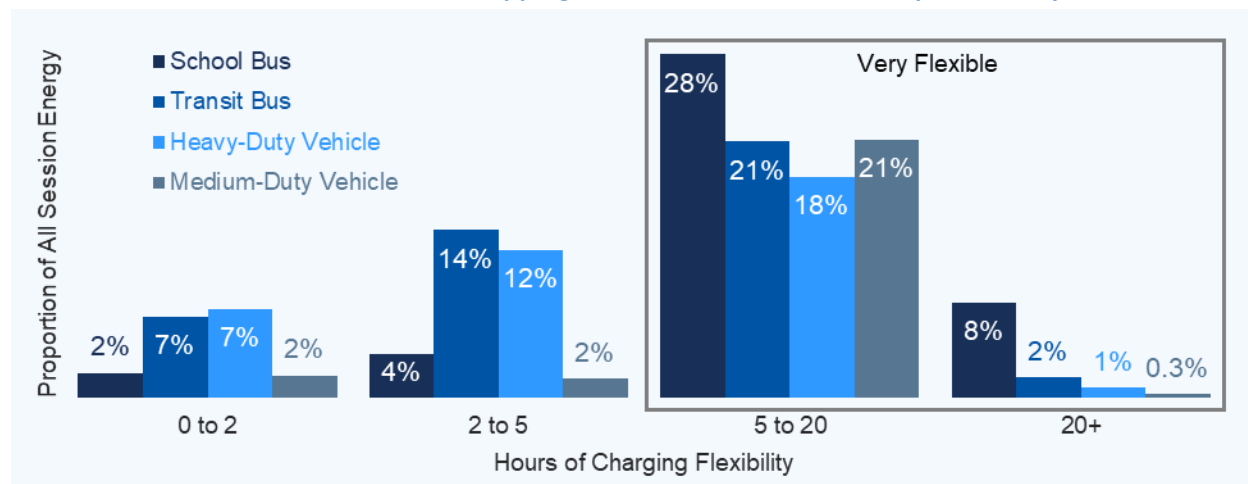


Figure 87 also shows that a high proportion of energy from charging sessions is from vehicles with enough flexibility to entirely avoid the highest-cost time period. As the period of highest-cost electricity lasts for five hours (4 p.m. to 9 p.m.), a vehicle with a charging period longer than five hours would need at least five hours of charging flexibility to fully shift consumption from on-peak to off-peak periods. In the example above, 36% of the energy consumed by the school bus sector had over five hours of flexibility (total of sessions with five to 20 and 20+ hours of charging flexibility) compared to 23% for transit bus, 19% for heavy-duty vehicle, and 21% for medium-duty vehicle sectors. It should also be

noted that vehicles with less than five hours of charging flexibility will benefit from adopting load management by shifting a portion of demand to periods of lower-cost electricity.

Fleets operating a single shift are usually able to benefit the most from load management, while fleets operating multiple daily shifts face the most challenges to leveraging load management, as vehicle charging takes place throughout the 24-hour period. However, while it is more difficult for sites with multiple shifts to avoid charging during the 4 p.m. to 9 p.m. period, they also tend to have consistent use at all times of day. This can avoid typical peak consumption aligned with the end of the workday (5 p.m.) and somewhat reduces the proportion of charging from 4 p.m. to 9 p.m., resulting in comparatively lower average energy costs on a kilowatt-hour basis.

Costs and Billing

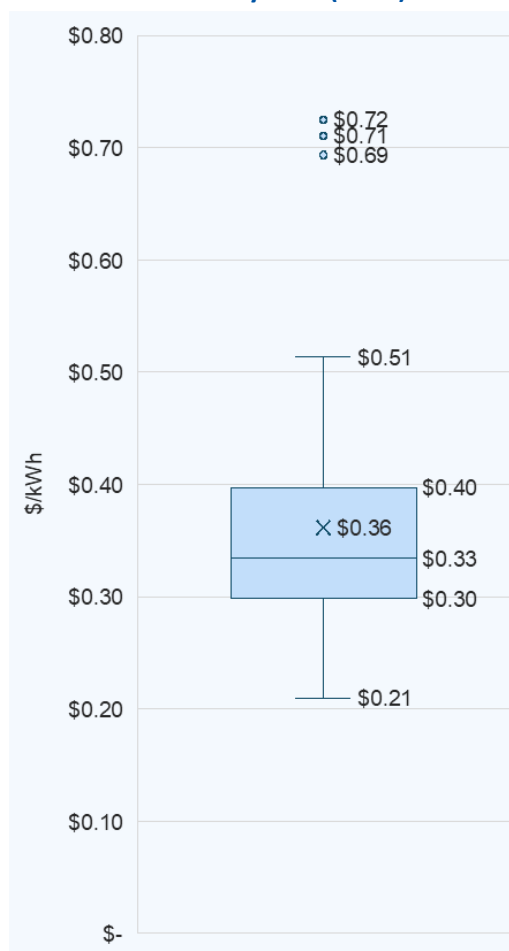
Previous sections have focused on energy trends and on charging flexibility, identifying that significant charging is taking place from the peak period of 4 p.m. to 9 p.m. and that much of this load could be shifted to periods of lower demand. The following section examines utility cost and billing trends and identify how sites may reduce costs based on charging flexibility. The Evaluation Team's review of billing data focuses on the average unit cost of a kilowatt-hour for a given site-billing month compared to the TOU-based tariff cost of energy.

NSPs' load management capabilities and fleets' adoption rate of load management impact costs and energy trends. When provided, load management may be a base offering or tiered-cost package, depending on the provider. Interoperability between hardware, software, and vehicles presents challenges that can make load management impractical or difficult to achieve.

Many fleet operators remain unaware of their energy use and charging costs despite utility bills and even though most EVSPs make data available. Often a site host's finance office will receive utility bills but will not share information with fleet operators that would enable them to compare energy costs with other fuel types in their fleets. The Evaluation Team uses energy trends as discussion points during site visits if operations have started. Many fleet operators said they had not seen these data trends prior to the evaluation site visits.

Figure 88 shows the distribution of average monthly billing cost per kilowatt-hour for sites in the program for which at least six months of billing data was available in EY2024 (n=77). SCE base rates range between \$0.11 and \$0.66/kWh, to which services fees and taxes are added.

Figure 88. SCE Charge Ready Transport Program Summary of Average Monthly Electricity Cost (n=77)



The best results appear to show monthly billing between \$.016 and \$.030/kWh through use of load management intervening on time of use (avoiding 4 p.m. to 9 p.m.), combined with a high volume of energy consumption. The majority of sites reflect over \$.33/kWh, with several sites averaging over \$.60/kWh.

Figure 89 illustrates the positive relationship between percentage of on-peak energy consumption and the average monthly customer bills for sites billing more than 20 MWh (each dot represents a month) and highlights the potential financial opportunity to use load management to reduce costs. The 2024 data show a bit more of a trend with lower 4 p.m. to 9 p.m. consumption following lower average costs. Costs appear to hit a floor around \$.20/kWh with a few outliers just below that.

Figure 89. SCE Charge Ready Transport Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for High Consumption Billing Months (>20 MWh) for PTD Sites

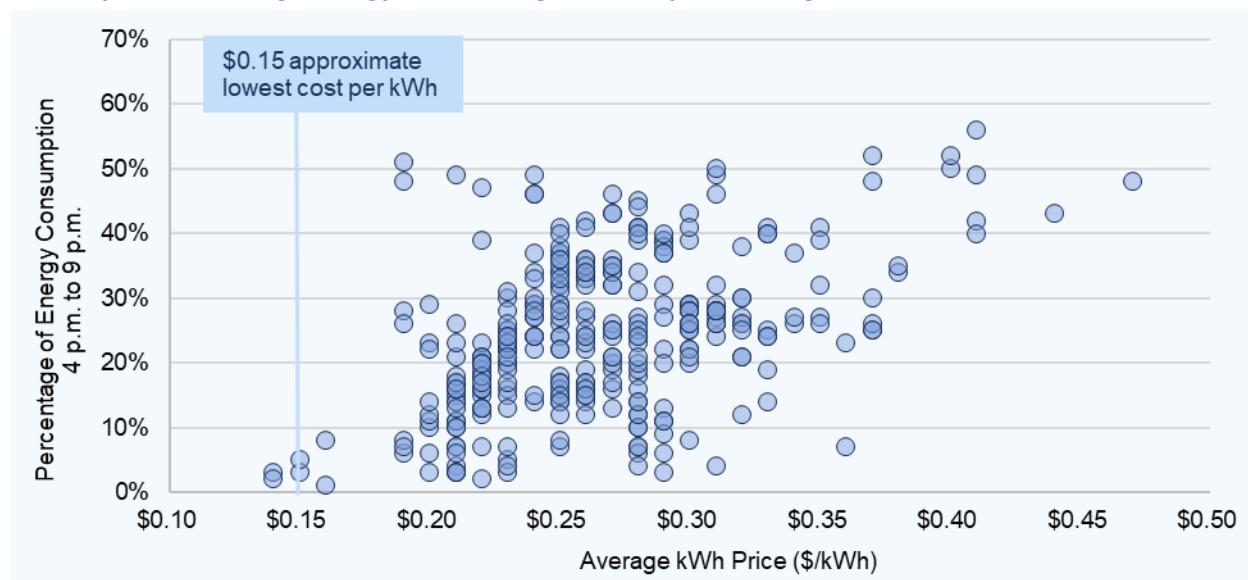
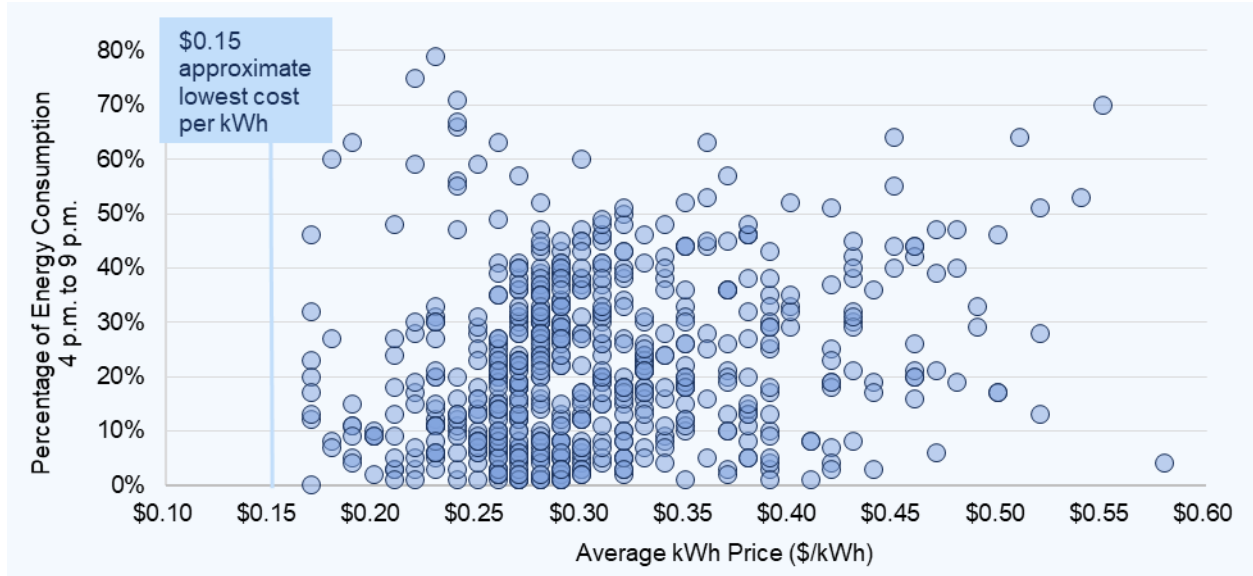


Figure 90 shows billing for sites that consume between 5 MWh and 20 MWh. These also show a strong positive correlation between energy consumption from 4 p.m. to 9 p.m. and average unit pricing. This should provide further encouragement for fleets to focus on improving their load-management efforts. Many of these customers' bills show an average of \$.20 to \$.30 per kilowatt-hour, so cost savings of 30% for users averaging \$.40 or more per kilowatt-hour are likely achievable. More of these data points show above \$.4 than the large billing months.

Figure 90. SCE Charge Ready Transport Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for Medium Consumption Billing Months (5 to 20 MWh) for PTD Sites



Fleets that used less than 5 MWh per month show a greater correlation between average unit pricing and overall monthly consumption. Figure 91 illustrates that sites with the lowest monthly energy consumption often have the highest electricity costs per kilowatt-hour. This can be attributed to fixed fees, which are spread across the total kilowatt-hours consumed and therefore have a greater impact on sites with lower total consumption.

Figure 91. SCE Charge Ready Transport Program Total Monthly Energy Consumed vs. Average Energy Price for Low-Consumption Billing Months (<5 MWh) for PTD Sites

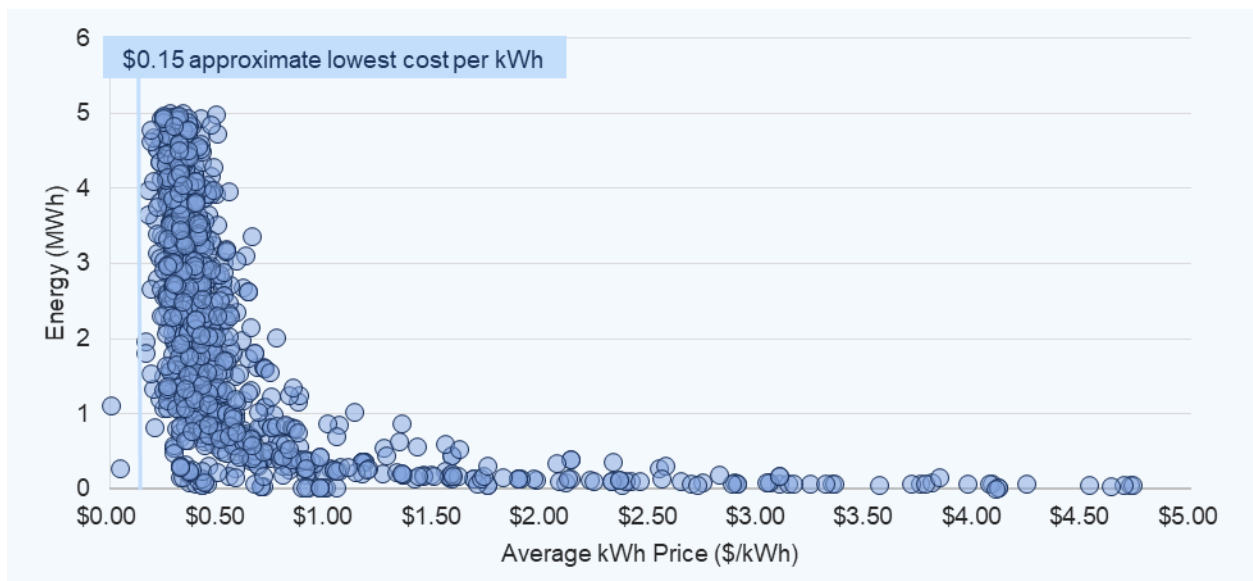
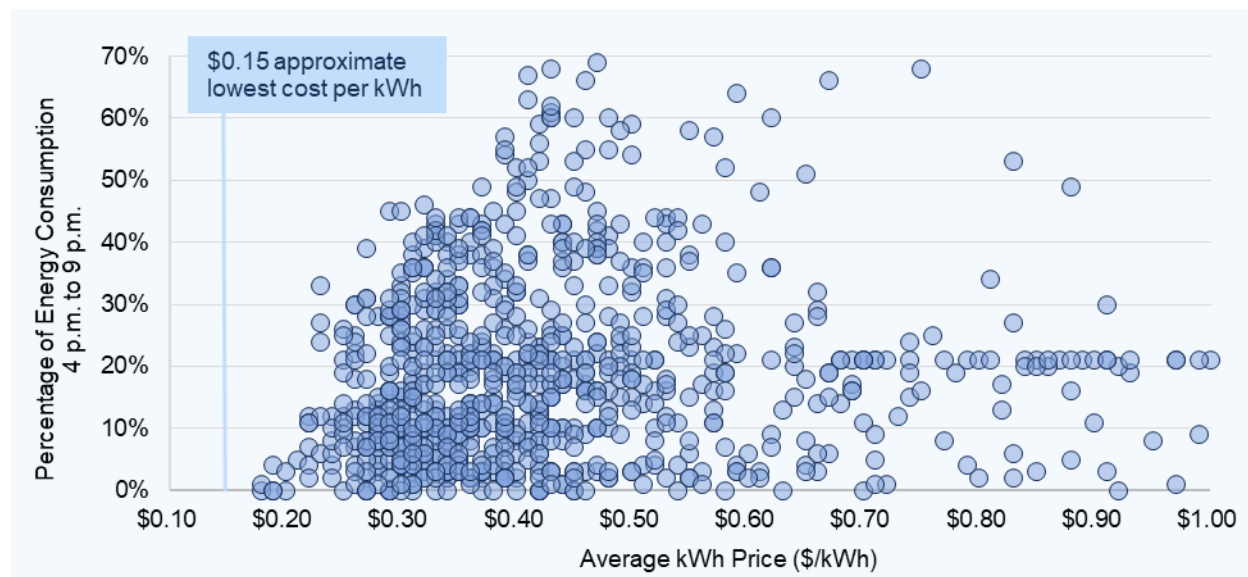


Figure 92 also shows a correlation between the proportion of consumption from 4 p.m. to 9 p.m. and average energy price as occurs with higher-energy users, highlighting the opportunity for low-energy users to reduce costs by using load management.

Figure 92. SCE Charge Ready Transport Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for Low Consumption Billing Months (<5 MWh) for PTD Sites



Electricity Cost and Emissions Optimization Analysis

This section builds upon the grid impact findings above to include an analysis of hypothetical customer bills and emissions under an optimal load management scenario, assuming perfect load management across all sites. While real-world constraints—such as technology, operations, and education—currently prevent ideal load management, the findings shed light on the long-term potential of load management. To quantify the potential benefits of using load management, the Evaluation Team analyzed observed outcomes of sites with and without existing load management practices and conducted a load-shifting optimization exercise to estimate the total potential cost savings and emissions reductions. This optimization analysis utilizes NSP data, where available, to assess charging flexibility for each site. For sites without sufficient NSP data reported, the analysis uses AMI data and a charging session availability template to assess charging flexibility. The template is derived for each market sector based on the charging behavior of sites with NSP charging session data within each sector.

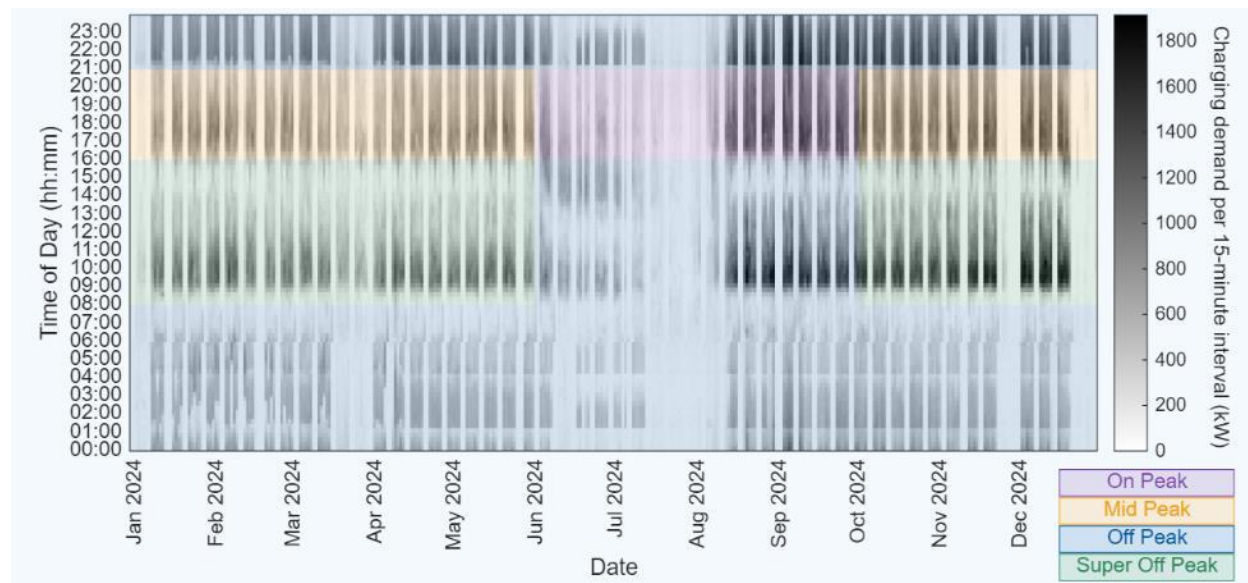
Load Management Outcomes Observed in EY2024

Of the 86 operational PTD sites, the Evaluation Team assessed 64 sites with AMI and NSP data that met the requirements for analysis. Of these 64 sites, 29 were school bus sites and 35 were from other market sectors, including transit bus, medium-duty vehicle, heavy-duty vehicle, port cargo truck, and forklift.

Figure 93 and Figure 94 depict the business-as-usual (BAU) historical energy consumption of school bus fleets and non-school bus fleets, respectively, in aggregate during EY2024. BAU represents the current

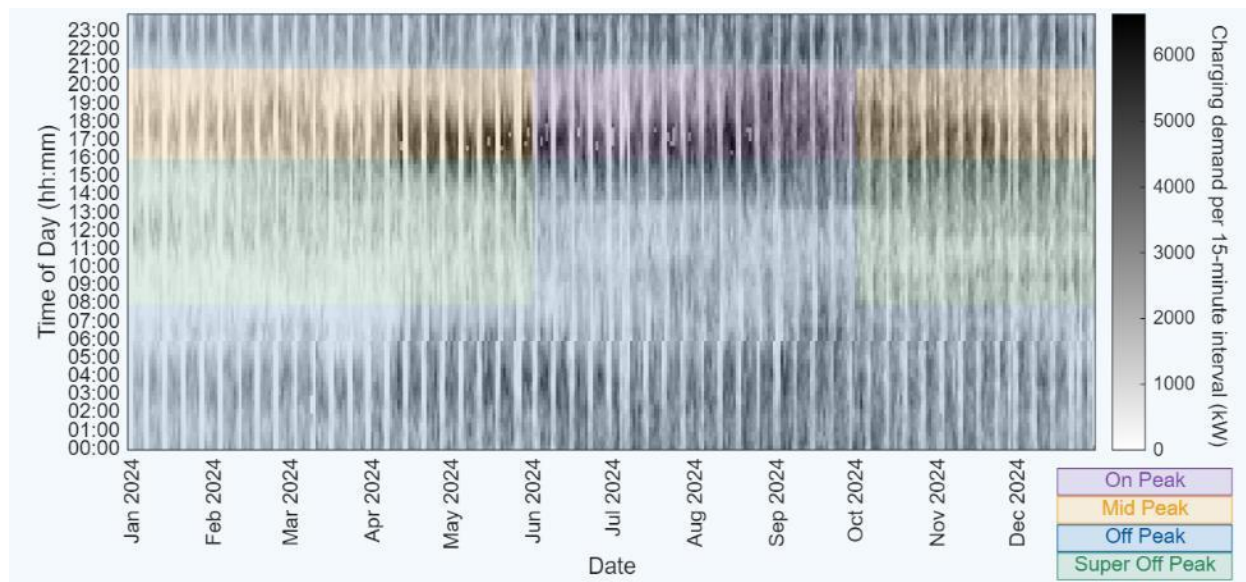
charging behavior of the 64 sites represented in this analysis. The areas in the figures with darker shading correspond to times of day (y-axis) and days throughout the year (x-axis) with higher collective charging demand, as measured by the scale on the right of the plot. Areas with no shading represent no energy demand. School bus fleets show a consistent trend of charging twice per day: once beginning around 9 a.m. after the morning routes to pick up students, and again around 4 p.m. to 5 p.m. after buses complete afternoon runs. The second charging session directly coincides with higher TOU rates. Some sites using load management are clearly delaying charging until 9 p.m. to avoid peak TOU energy costs. The figure also shows lower demand during winter break, spring break, and summer vacation periods when school bus operation is minimal. In 2024, it appears that many school bus sites deployed more electric buses and/or increased the charging levels after returning from the summer break, which reflects the continued program growth in 2024.

Figure 93. SCE Charge Ready Transport Program Heatmap of the Collective BAU Charging Demand for All SCE School Bus Fleets in 2024



Dark shading intensity indicates average charging demand (kW) per 15-minute interval.
Colored regions indicate TOU periods.

Figure 94. SCE Charge Ready Transport Program Heatmap of the Collective BAU Charging Demand for All SCE Non-School Bus Fleets in 2024

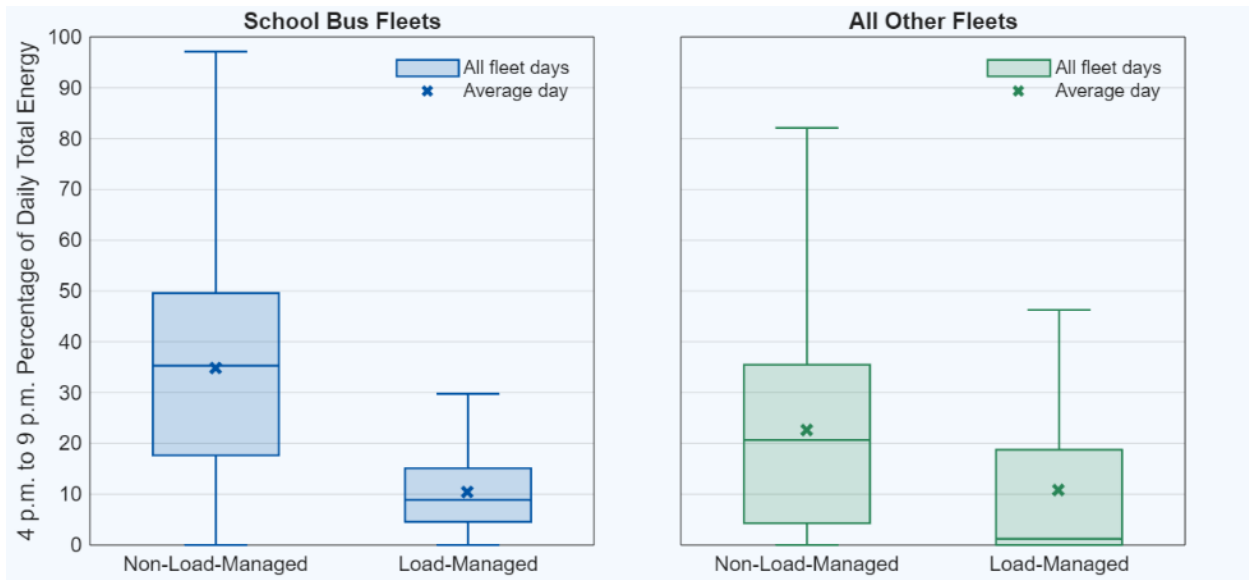


Dark shading intensity indicates average charging demand (kW) per 15-minute interval.
Colored regions indicate TOU periods.

The Evaluation Team compared NSP charging sessions that utilized load management strategies to non-load-managed sessions for the school bus and non-school bus fleets to evaluate the effectiveness of the existing load management at minimizing energy during the 4 p.m. to 9 p.m. peak TOU period.

The box plots in Figure 95 compare the distributions of daily on-peak (4 p.m. to 9 p.m.) energy consumption, as a percentage of daily total energy, between load-managed and non-load-managed days. On average, non-load-managed school buses show approximately 35% of daily consumption occurring between 4 p.m. and 9 p.m. For the average load-managed day, the percentage drops significantly to 10% of overall consumption. For other market sectors (shown on the right), the average non-load-managed day shows 23% of consumption during the peak TOU period, compared to just over 10% for load-managed days. These comparisons help guide the Team's estimates of how much energy from non-load-managed days (and fleets) can shift to potentially save money and emissions.

Figure 95. SCE Charge Ready Transport Program Distribution of the Fraction of Daily EV Charging Load Occurring in the Peak TOU Period



The box and whisker plot represents the distribution of daily total energy consumed from 4 p.m. to 9 p.m. across one operating day by group, with the average value for all operating days per group indicated by an X.

This analysis strongly suggests that the few fleets with existing load management programs do effectively reduce the fraction of energy consumed between 4 p.m. and 9 p.m. and thereby reduce their energy consumption costs.

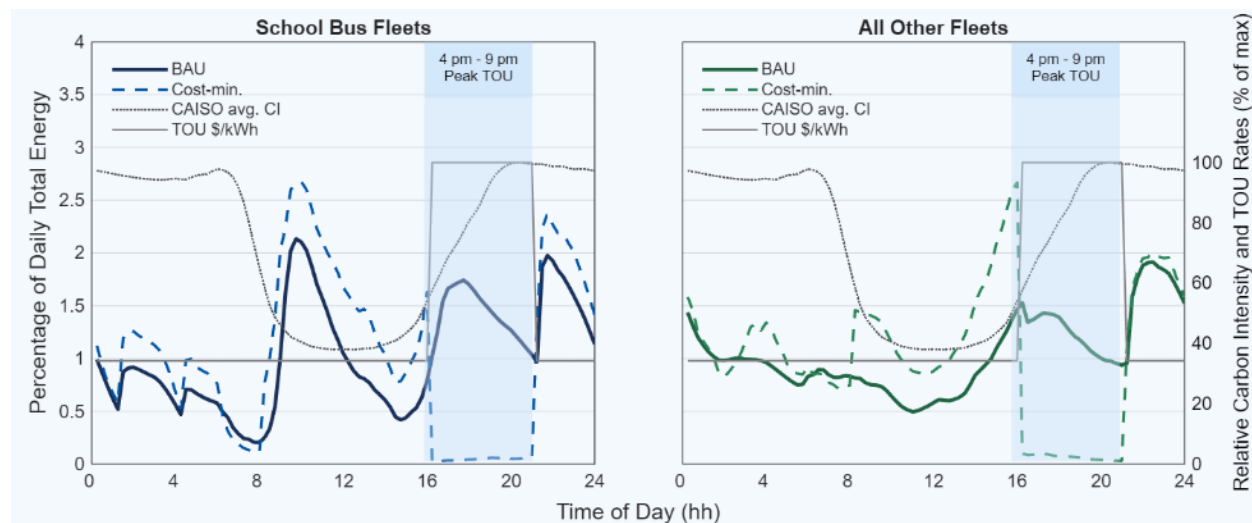
Potential Benefits of Optimal Load Management

The Evaluation Team analyzed charging session data to estimate the potential value of optimal load management, considering each site's observed operating patterns and potential ability to shift vehicle charging loads. This analysis included 29 school bus sites and 35 sites in other market sectors that had sufficient AMI and NSP data reported for 2024 to complete the optimization.

The Evaluation Team developed and executed an optimization routine that reviews each site's daily charging behavior and shifts energy consumption from the peak time period (4 p.m. to 9 p.m.) into the lowest-cost periods of the day whenever there was both unused charging capacity and vehicle charging availability during those periods. The Evaluation Team used NSP charging session data to ascertain how many vehicles were plugged in and how many kilowatt-hours of energy could be shifted during each time period. For hours in the same TOU rate period, the Team used carbon intensity of the electric grid (evaluated from CAISO 2024 GHG emissions factors) and BAU charging load as tiebreakers to determine vehicle charging priorities. Though the optimization algorithm is capable of incorporating monthly demand charges, SCE TOU-EV-8&9 tariffs do not currently use these. After completing the load-shifting to minimize costs, the resulting costs and GHG emissions were calculated for the load-shifted case, and the results were compared to the BAU case to determine cost-reduction and GHG-reduction potential for each site.

Figure 96 illustrates how optimally shifted loads differ from BAU loads, averaged across EY2024. For both school bus and other market sector sites, the average day's load can be almost completely shifted out of the high cost 4 p.m. to 9 p.m. window and into midday charging (8 a.m. to 4 p.m.) and/or overnight charging (9 p.m. to 8 a.m.). These time periods offer the lowest energy consumption costs, and the midday charging period (which has off-peak rates during summer months and super-off-peak during winter months) also corresponds to the lowest average carbon intensity of grid electricity.

Figure 96. SCE Charge Ready Transport Program Fraction of Daily EV Charging Load Occurring at Each 15-Minute Interval for the Average Day in this Analysis, BAU Compared to Cost-Minimization



Note: Line color indicates site market sector and dashed versus solid lines indicate whether the load is BAU or shifted.

Figure 97 shows the cost reduction potential for 2024 in total dollars for each of the 64 sites analyzed. Each bar represents the hypothetical savings by site if the site were to use its load flexibility to minimize electricity costs. The sites are segmented into load-managed and non-load-managed sites. The top graph shows the total dollar value of savings and the bottom graph shows the percentage savings.

The following key methodological notes provide context for this analysis:

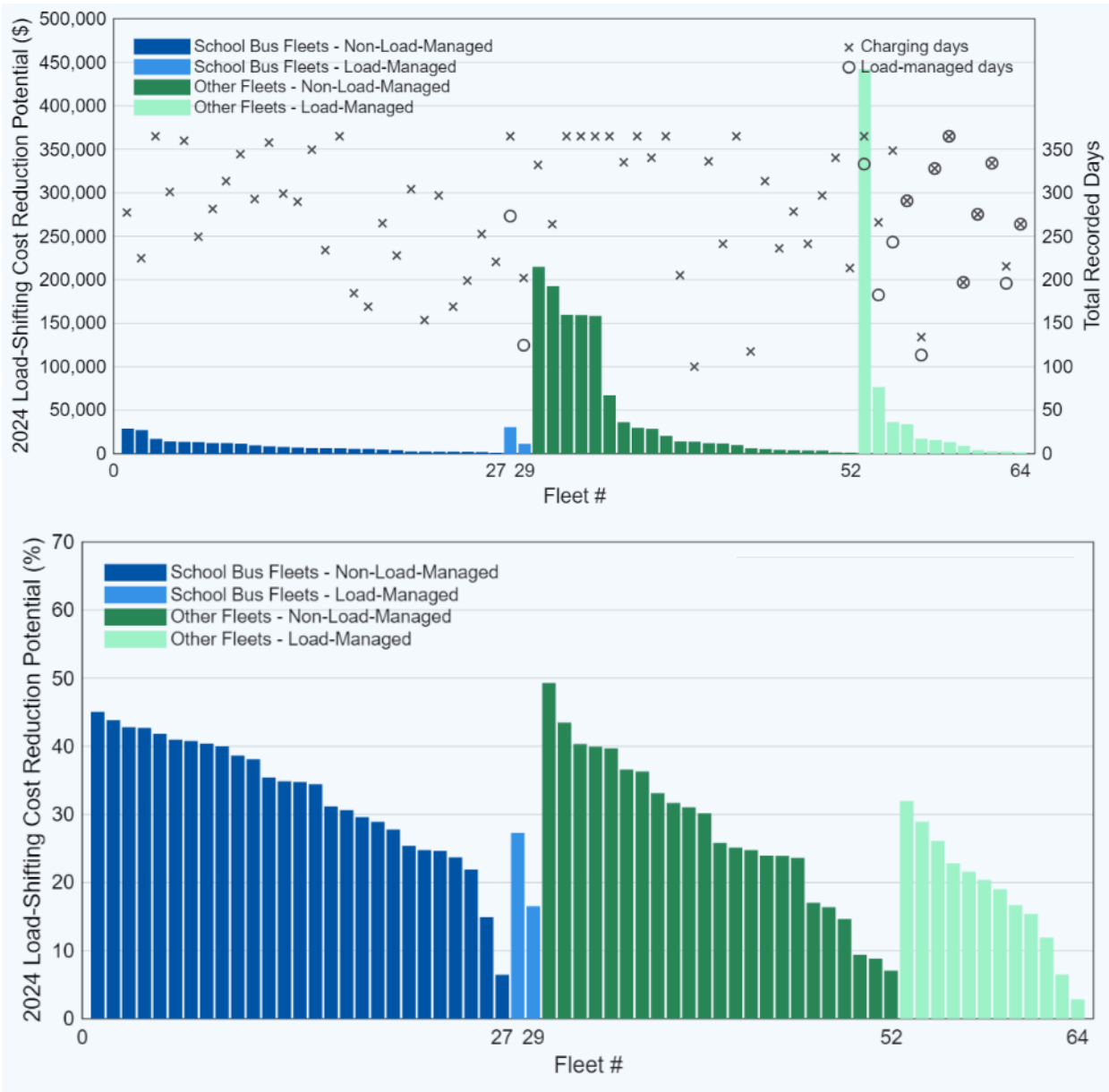
- The analysis considers the volumetric (cost per kilowatt-hour) component of each site's electricity costs as well as any demand charges that may apply under the utility's rate structure. The cost-minimization approach developed in this analysis ensures that the monthly total cost (energy consumption plus demand charges) will be minimized. This allows for an increase in monthly peak demand so long as the increased demand charges (where they apply) are more than offset by TOU cost savings resulting from load-shifting to less expensive TOU periods. In most cases, monthly peak demand was either maintained, having no impact on costs, or decreased, resulting in additional cost savings.
- These results reflect only the portion of the year in which each fleet operated and provided charging data; annualized projections of these cost reductions could be substantially higher, in absolute terms, for fleets that have less than a full year of charging data included in this analysis or that have not yet reached mature operations.

- These results reflect only the portion of each site’s vehicle fleet that it electrified in EY2024. A fully electrified vehicle fleet would see higher cost reduction potential from load management.
- This analysis considers the cost-saving potential of load management, but it does not consider the potential of load management to generate revenue via LCFS Smart Charging credits.
- This analysis examined the actual charging behavior at each site (using actual recorded plug-in and unplug times) to determine charging opportunities and does not account for other operational or scheduling improvements for charging electrified fleets, which could enable more-effective load management, resulting in higher potential cost reduction.

Figure 97 provides several insights. The figure shows that even load-managed sites have the potential to save energy by better utilizing their load flexibility. For example, as shown on the top graph, sites that are already using load management have cost reduction potential ranging from \$27,000 in the school bus market sector and up to \$442,000 for the largest sites in other market sectors. In general, sites that are implementing load management have less opportunity to realize additional savings than sites that have not implemented load management to date. Many of these sites can capture additional savings by improving consistency of load management operations and better coordinating load management scheduling if their EVSP is capable and their operations allow.

Non-load-managed sites have cost reduction potentials ranging from \$28,000 for non-load-managed school bus sites to \$212,500 for other market sectors (not disclosed due to the 15-15 Rule). Sites that have the greatest potential savings are extremely large sites with high energy consumption and therefore higher overall costs. For example, as shown in the bottom graph, the load-managed fleet with \$442,000 cost reduction potential has about 30% cost reduction potential—which is similar to many other fleets regardless of market sector.

Figure 97. SCE Charge Ready Transport Program Total Annual Cost Reduction Potential of Each Site with Use of Optimal Load Management

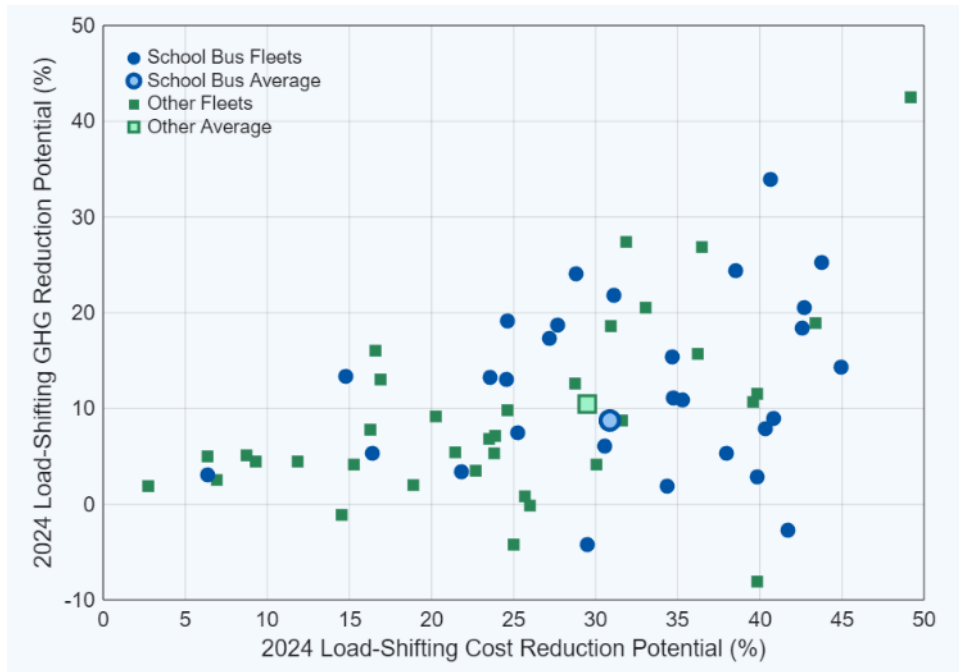


Each bar represents one site. Bar colors indicate the site's market sector and whether it uses load management.

Because lower-cost TOU periods often correspond to periods with lower carbon intensity for grid electricity, optimizing load management for energy cost savings can have a secondary effect of reducing the resulting carbon emissions from vehicle charging. Figure 98 shows estimated cost reductions and corresponding GHG emissions reductions for each site resulting from a *cost-minimizing load-management strategy* (considering carbon intensity only as a tiebreaking factor when there is sufficient charging flexibility). The vast majority of sites have the potential for significant reduction in GHG

emissions—approximately 10%, on average, and up to more than 40% in one case, simply by avoiding costly energy consumption from 4 p.m. to 9 p.m.

Figure 98. SCE Charge Ready Transport Program Potential Percentage Cost Reduction and Attributed GHG Emissions Reduction of Optimal Load Management, Cost-Minimization



In addition to the cost-minimization load-shifting analysis, the Evaluation Team evaluated the maximum achievable reduction in GHG emissions with load-shifting. To do this, the team reran the load-shifting optimization routine on the same data set with the objective of minimizing GHG emissions at each site. This approach maximizes the amount of charging that can take place during the middle of the day when the carbon intensity of grid electricity is the lowest, given that additional charging capacity and vehicle charging availability exists at each site. Figure 99 shows how the average charging load profile for the GHG-minimization approach compares to the cost-minimization and BAU average load profiles. Figure 100 displays the resulting combination of cost-reduction potential and emissions-reduction potential for each site when load-shifting is employed to minimize GHG emissions.

Figure 99. SCE Charge Ready Transport Program Fraction of Daily EV Charging Load Occurring at Each 15-Minute Interval for the Average Day in this Analysis, BAU Compared to Cost-Minimization and GHG-Minimization

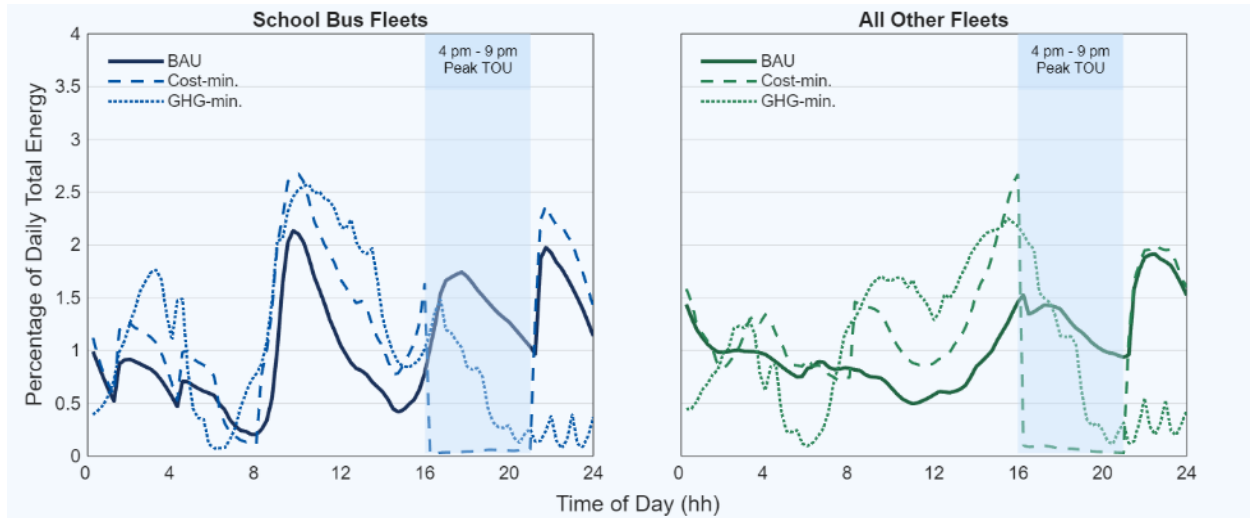


Figure 100. SCE Charge Ready Transport Program Potential Percentage Cost Reduction and Attributed GHG Emissions Reduction of Optimal Load Management, GHG-Minimization

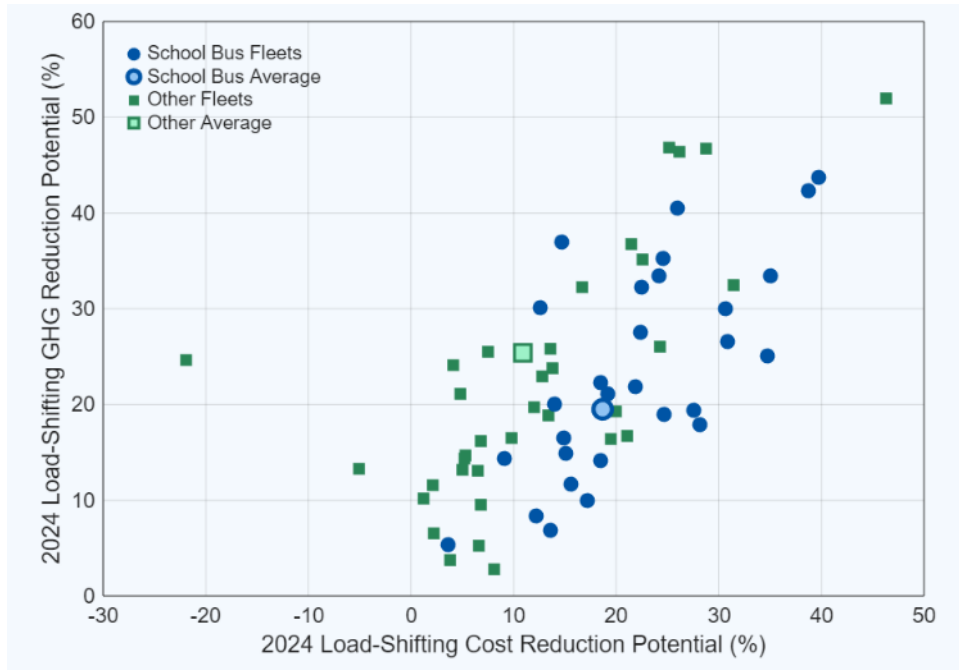


Table 37 aggregates these results across all sites included in the analysis. Overall, optimizing the load shift to minimize charging costs could reduce school bus sites' collective energy consumption costs by 31% and attributed electricity grid GHG emissions by 9%; for other market sectors, it could reduce energy consumption costs by 29% and attributed electricity grid GHG emissions by 11%. Load shifting to minimize GHG emissions across all sites could achieve reductions in GHG emissions two to three times higher than the cost-minimization approach, but these reductions would come at the expense of lower

cost savings. One question that arises is how to best use the lowest-emission energy? One potential solution is to adopt processes from demand response programs by instructing customers to add load during times of substantial low emission energy and providing financial incentives, instead of typical demand response financial penalties. The CEC has supported piloting such solutions through its Responsive, Easy Charging Products with Dynamic Signals (REDWDS) program.

Table 37. SCE Charge Ready Transport Program Summary of Potential Cost and Attributed GHG Emissions Reductions, Aggregated across All Included Fleets

	School Bus Fleets	All Other Fleets	All Fleets Combined
Total number of fleets	29	35	64
Total 2024 operating days	7,928	10,144	18,072
Cost-minimization load-shifting			
Cost Reduction Potential (\$)	261,796	1,794,638	2,056,434
GHG Reduction Potential (kg CO ₂ e)	38,058	410,580	448,638
Cost Reduction Potential (%)	30.9%	29.5%	29.7%
GHG Reduction Potential (%)	8.8%	10.5%	10.3%
GHG-minimization load-shifting			
Cost Reduction Potential (\$)	159,097	664,403	823,500
GHG Reduction Potential (kg CO ₂ e)	84,766	995,551	1,080,317
Cost Reduction Potential (%)	18.8%	10.9%	11.9%
GHG Reduction Potential (%)	19.6%	25.5%	24.9%

Highlights

- Maximum demand reached 14.4 MW, more than double the maximum demand at the start of the year of 6.5 MW.
- Although 30% of sites began vehicle charging within 30 days of power availability, nearly 40% took over 120 days.
- The number of load-managed sites grew from four in EY2022 to nine in EY2023 and 21 in EY2024 out of 86 activated sites.
- Sites activated in EY2024 are beginning to show a pattern of consistent use, indicating that sites are maturing more rapidly and vehicles are entering operations faster than in previous evaluation years. EY2021 and EY2022 sites appear to have reached full maturity with consistent utilization across months in EY2024.
- Charging data indicates that there is significant opportunity for most fleets to shift their charging energy use to lower-cost time periods. Potential savings are as high as \$212,500 for non-load-managed sites, and \$442,000 site sites already using load management.
- On average, sites can reduce GHG emissions by 10% by avoiding consumption from 4 p.m. to 9 p.m.

Petroleum Displacement

The Evaluation Team estimated the petroleum displacement attributable to vehicle electrification enabled by SCE’s Charge Ready Transport program. The Team used DGE for reporting purposes. However, as the transit bus market sector primarily uses compressed natural gas (CNG) fuel, the Team converted transit bus natural gas consumption into DGE units based on the CNG fuel’s energy content.

Table 38 presents petroleum displacement impacts for the Charge Ready Transport program through 2024, including estimated actual impacts for 2024, actual impacts for PTD sites, and a 10-year forecast for PTD sites. The results include the five market sectors represented in the program, with the majority of vehicles in the heavy-duty vehicle sector followed by the medium-duty vehicle sector. The usage in the program to date is over 34 million electric miles, estimated based on electricity consumption of just over 52,3983.88 MWh. This translates into a displacement of over 4 million DGE.

Table 38. SCE Charge Ready Transport Program Petroleum Displacement Summary

Market Sector	Usage (n=85)				Petroleum Displacement (DGE)		
	2024 Actual ^a kWh	PTD Actual ^b kWh	2024 Actual Use	PTD Actual Use	2024 Actual	PTD Actual	10-Year Projection
Forklift			642 hours	940 hours	668	978	5,496
Heavy-Duty Vehicle			11,911,093 miles	15,309,901 miles	1,729,306	2,235,803	21,356,578
Medium-Duty Vehicle			10,436,271 miles	11,925,677 miles	528,010	714,758	7,580,237
School Bus	3,157,209		2,452,929 miles	5,311,408 miles	269,126	583,967	2,368,495
Transit Bus			933,486 miles	2,215,224 miles	234,151	565,227	1,926,626
TRU			18,262 hours	84,726 hours	13,514	62,697	186,866
Total	36,106,091	52,393,883	25,733,779 miles 18,905 hours	34,762,210 miles 85,666 hours	2,774,775	4,163,431	33,424,298

^a “2024 Actual” represents the data from all activated sites from program inception for the calendar year 2024.

^b “PTD Actual” represents the data from all activated sites from program inception for all program years.

Highlights

- All operational sites in 2024 collectively achieved a PTD impact of over 4 million gallons of petroleum displaced.
- The heavy-duty vehicle sector accounted for over half of the petroleum displaced in 2024 and is projected to account for more than two-thirds of the petroleum displaced over 10 years.
- Over a 10-year period, the current operational sites will displace around 33 million gallons of petroleum.

Greenhouse Gas and Criteria Pollutant Impact

The Evaluation Team calculated reduced emissions from displaced fossil fuel use from ICE vehicles that were not in service because of the Charge Ready Transport program. First, we developed ICE counterfactual equivalents for each market sector, and then we calculated the emissions associated

with these vehicles under conditions that otherwise matched the EVs, which provided a baseline. Although EVs have no tailpipe emissions, the mix of generation sources from the electric grid used includes renewable as well as fossil fuel power to supply electricity to the charging stations, with the latter primarily responsible for emitting GHGs and criteria pollutants into the atmosphere.

Table 39 shows GHG impacts estimates from the Charge Ready Transport program for three time periods across market sectors: estimated reductions that reflect what program sites saved in 2024, PTD reductions from all sites, and a 10-year projection based on annualized data from all sites.

Table 39. SCE Charge Ready Transport Program GHG Reductions Summary

Market Sector	Usage (n=85)				GHG Reduction (MT)		
	2024 Actual ^a kWh	PTD Actual ^b kWh	2024 Actual Use	PTD Actual Use	2024 Actual	PTD Actual	10-Year Projection
Forklift			642 hours	940 hours	6	8	50
Heavy-Duty Vehicle			11,911,093 miles	15,309,901 miles	14,481	18,421	188,852
Medium-Duty Vehicle			10,436,271 miles	11,925,677 miles	3,747	5,055	56,596
School Bus	3,157,209	6,844,390	2,452,929 miles	5,311,408 miles	2,362	5,014	21,593
Transit Bus			933,486 miles	2,215,224 miles	1,658	4,009	14,147
TRU			18,262 hours	84,726 hours	131	581	1,846
Total	36,106,091	52,393,883	25,733,779 miles 18,905 hours	34,762,210 miles 85,666 hours	22,384	33,088	283,084

^a “2024 Actual” represents the data for EY2024 from all sites activated in the program to date.

^b “PTD Actual” represents the data from all activated sites from program inception for all program years.

Table 40 shows estimated local tailpipe emissions from ICE vehicles that the Charge Ready Transport program displaced. The Transit Bus sector showed the highest reduction in CO emissions due to the assumption that the displaced buses ran on CNG. In addition, our analysis confirmed that TRU and heavy-duty vehicle sites can achieve significant savings due to the poor emissions profile of diesel-powered TRU and yard tractors.

Table 40. SCE Charge Ready Transport Program Local Emissions Reductions, PTD Actual

Market Sector	PTD Actual ^a (n=85)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Forklift	1.1	1.2	1.1	1.3	54.6
Heavy-Duty Vehicle	111.11	210.48	201.09	719.49	8,267.95
Medium-Duty Vehicle	-	15.5	14.3	180.3	13,313.3
School Bus	-	12.0	11.5	53.4	1,529.5
Transit Bus	-	1.1	1.0	137.7	110,857.1
TRU	182.6	19.4	17.8	1,623.5	202.3
Total	294.8	259.6	246.8	2,715.6	134,224.8

^a “PTD Actual” represents the data from all activated sites from program inception for all program years.

Table 41 shows the same information as Table 40 for 2024 actual use. These are the localized emissions reductions that occurred based on actual Charge Ready Transport program operations this year.

Table 41. SCE Charge Ready Transport Program Local Emissions Reductions, 2024 Actual

Market Sector	2024 Actual ^a (n=85)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Forklift	0.8	0.8	0.8	0.9	37.5
Heavy-Duty Vehicle	82.3	165.0	157.7	558.2	6,454.5
Medium-Duty Vehicle	-	12.6	11.6	161.6	8,438.0
School Bus	-	5.7	5.4	25.1	712.6
Transit Bus	-	0.5	0.4	57.9	46,690.4
TRU	55.4	4.7	4.3	501.6	61.0
Total	138.5	189.2	180.2	1,305.3	62,394.0

^a "2024 Actual" represents the data for EY2024 from all sites activated in the program to date.

Table 42 provides estimates of savings over the 10-year period. These are the annualized emissions reductions from all PTD sites extended over a decade. Again, transit buses show very high CO reduction, but a much smaller reduction of PM and ROG due to replacing CNG fueled vehicles. Heavy-duty vehicles account for more than 80% of the reduction in PM. TRUs account for more than half of the ROG reductions.

Table 42. SCE Charge Ready Transport Program Local Emissions Reductions, 10-Year Projection for PTD Sites

Market Sector	PTD Sites 10-Year Projected Impact (n=85)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Forklift	9.4	7.5	6.9	11.4	331.8
Heavy-Duty Vehicle	861.4	2,888.8	2,761.6	7,634.4	90,362.0
Medium-Duty Vehicle	-	192.7	177.7	3,461.7	140,734.7
School Bus	-	56.1	53.7	243.9	6,675.2
Transit Bus	-	3.9	3.8	483.4	390,352.4
TRU	1,546.0	92.7	85.3	15,020.9	1,703.4
Total	2,416.8	3,241.8	3,088.9	26,855.7	630,159.6

Table 43 shows counterfactual vehicle GHG emissions, emissions from the electricity used to charge the EVs, GHG emissions reductions, and percentage differences. Table 44 shows the net reductions of NO_x emissions from using EVs, based on the counterfactual and Utility emissions. The Evaluation Team estimated a total annualized GHG reduction of 80% and a NO_x reduction of 78% from the use of EVs compared to counterfactual vehicles for EY2024 sites. Reviewing the PTD emissions reveals an estimated 79% actual reduction in GHG emissions and 80% reduction in NO_x emissions.

Table 43. SCE Charge Ready Transport Program Counterfactual GHG Reductions

Market Sector	EY2024 Sites Annualized GHG (MT) (n=30)				PTD Sites GHG (MT) (n=85)			
	Counter factual	Utility	Reduction	% GHG Reduction	Counter factual	Utility	Reduction	% GHG Reduction
Forklift	N/A	N/A	N/A	N/A	10.0	1.7	8.3	83%
Heavy-Duty Vehicle	11,556.19	2,381.71	9,174.48	79%	23,680.75	5,260.11	18,420.64	78%
Medium-Duty Vehicle	6,139.0	1,177.1	4,961.9	81%	6,242.8	1,187.7	5,055.0	81%
School Bus	401.8	68.7	333.1	83%	6,178.1	1,163.9	5,014.2	81%
Transit Bus	N/A	N/A	N/A	N/A	4,943.5	934.3	4,009.2	81%
TRU	N/A	N/A	N/A	N/A	702.4	121.5	580.8	83%
Total	18,097.0	3,627.5	14,469.5	80%	41,757.5	8,669.3	33,088.2	79%

Table 44. SCE Charge Ready Transport Program Counterfactual NO_x Reductions

Market Sector	EY2024 Sites Annualized NO _x (kg) (n=30)				PTD Sites NO _x (kg) (n=85)			
	Counter factual	Utility	Reduction	% NO _x Reduction	Counter factual	Utility	Reduction	% NO _x Reduction
Forklift	N/A	N/A	N/A	N/A	12.9	1.4	11.5	89%
Heavy-Duty Vehicle	12,377.58	1,970.48	10,407.10	84%	26,090.95	4,276.80	21,814.15	84%
Medium-Duty Vehicle	464.9	973.4	(508.6)	None	952.2	987.3	(35.1)	None
School Bus	350.5	56.3	294.2	84%	5,531.7	988.0	4,543.7	82%
Transit Bus	N/A	N/A	N/A	N/A	247.9	786.5	(538.6)	None
TRU	N/A	N/A	N/A	N/A	2,803.4	103.5	2,699.9	96%
Total	10,670.3	2,334.7	8,335.6	78%	35,639.0	7,143.5	28,495.5	80%

Figure 101 shows the annual program net electricity generation mix matching the hours when the EVs were charging. The California Independent System Operator (CAISO) grid mix continually changes depending on factors such as the level of total demand for power on the grid and the availability of fossil generation and variable renewable resources such as solar.

At this stage of the program, it appears that charging increases during the peak hours of solar output when grid emissions are lowest. Approximately 14% of the grid mix comprises electricity imports, which do not vary by time of day for analysis purposes, but which match the resource mix purchased for the California grid.⁵⁵

⁵⁵ The power associated with imports comes from a mixture of renewables, hydro, nuclear, and natural gas power plants located outside of California (<https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation>).

Based on the real-time grid conditions when charging occurred, the overall energy mix comprised 52% zero-emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 34% natural gas. The Evaluation Team expects emissions reductions from these sites over 10 years to increase as the grid becomes cleaner. Additionally, the increased use of managed charging, where possible, will reduce emissions as EVs charge at off-peak times and when the grid is supplied with greater amounts of renewable generation. Emissions will further decrease with the addition of more charging sites and EVs in future evaluation years.

Figure 101. SCE Charge Ready Transport Program Net Electricity Mix, Program to Date

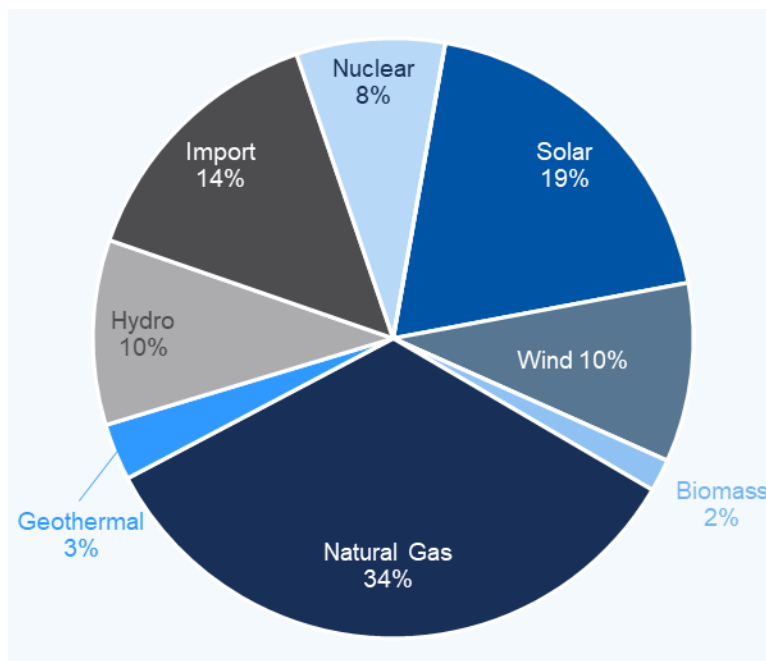
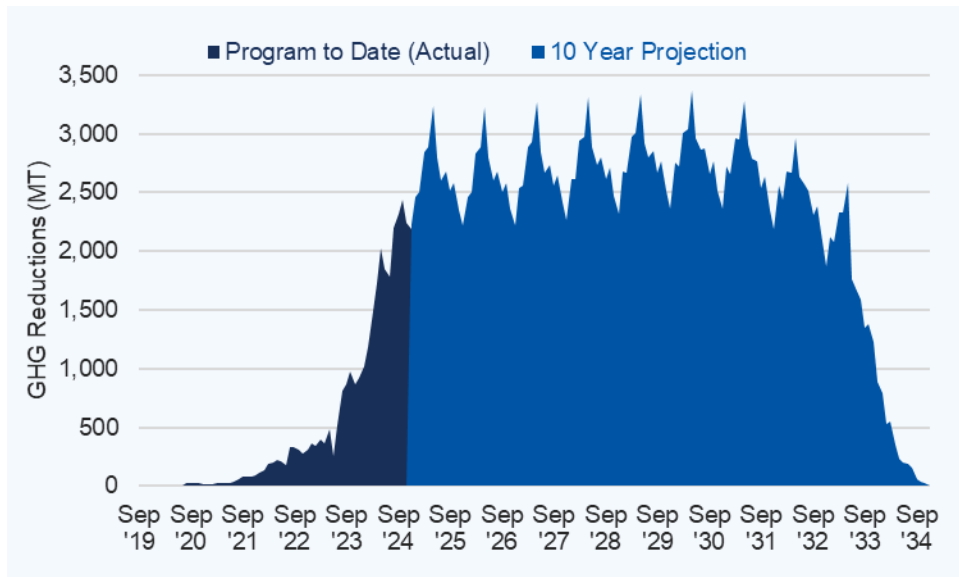


Figure 102 shows how GHG emissions reductions have increased as a result of the Charge Ready Transport program and how these reductions are likely to grow over time for all active sites. The analysis period ranges from the activation date of the first site in the program through the end of 2024. The analysis incorporates the net reduction (counterfactual emissions minus utility emissions) for each fleet within the SCE Charge Ready Transport program. PTD emissions reductions appear in dark navy, and anticipated benefits based on annualization appear in royal blue. As each site has its own starting date of operation, the 10-year sunset for each appears as a gradual tapering off of program benefits between 2030 and 2034. This taper reflects that benefits are no longer counted after 10 years, although fleets will likely continue to use the infrastructure. While each year's operations appear similar, there are several key factors driving the variations such as seasonality of Utility generation sources (high Utility emissions will appear as a dip on the curves), holidays occurring on weekends versus weekdays, and extrapolation for sites that became operational late in 2024 and will operate year-round in future years.

Figure 102. SCE Charge Ready Transport Program Historical and Forecasted GHG Reductions for PTD Sites



Highlights

- PTD results show a 79% reduction in GHGs and an 80% reduction in NOx emissions.
- The greatest reduction in local emissions was for CO, with an estimated reduction of more than 62,000 kg in 2024 and a projected 10-year reduction of more than 448,000 kg.
- Based on the real-time grid conditions when EV charging occurred, the overall energy mix contained about 52% zero-emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 34% natural gas.

Health Impacts

The Evaluation Team calculated public health impacts (as benefits and costs) of reductions in criteria pollutants from vehicle electrification. The pollutants we included in the analysis are primary PM_{2.5} and precursors of secondary PM_{2.5}, including NO_x, sulfur dioxide (SO₂), ammonia (NH₃), and VOCs. This analysis considered only tailpipe emissions reductions rather than full lifecycle emissions (such as power plant emissions). The Evaluation Team used the EPA CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) to evaluate the health benefits associated with the emissions reductions. COBRA estimates the county-level benefits for the county in which emissions are reduced. It also estimates the effect of the transport of emissions on all counties in the United States; however, this analysis includes only the effects of the emissions reductions in California. The Evaluation Team disaggregated the county-level effects to estimate the potential health benefits of sites for DACs and non-DACs.

Economic value depends on the health effects associated with the emissions, that is, whether they are associated with illnesses or death. The monetary value of the morbidity reductions associated with

emissions reductions include avoided lost wages, avoided medical costs, and the amount of money people are willing to pay to avoid an illness or condition like respiratory disease. The value of the reduced mortality associated with emissions reduction is measured by the value of a statistical life, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low and high impact for mortality, representing the uncertainties in the estimates.

The total value of the health benefits associated with emissions reductions from the Charge Ready Transport program for activated PTD sites is between \$3,298,256 and \$4,308,232. Table 45 shows the health benefits in California broken down by health endpoint.

Table 45. SCE Charge Ready Transport Program California Health Benefits for PTD Sites in 2024

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Mortality	0.19	0.257	\$2,853,420	\$3,863,396
Avoided Medical Care				
Hospitalization, Respiratory	0.024	0.024	\$445	\$445
Hospitalization, Cardiovascular	0.01	0.01	\$286	\$286
Hospitalization, Other	0.03	0.03	\$703	\$703
ER Visits, Respiratory	0.449	0.449	\$748	\$748
ER Visits, Cardiovascular	0.019	0.019	\$42	\$42
Out of Hospital Heart Attacks	0.001	0.001	\$66	\$66
Nonfatal Heart Attacks	0.045	0.045	\$3,915	\$3,915
Stroke	0.004	0.004	\$261	\$261
Lung Cancer	0.005	0.005	\$228	\$228
Asthma	237.788	237.788	\$198,698	\$198,698
Hay Fever	9.713	9.713	\$11,136	\$11,136
Lost Productivity				
Minor Restricted Activity Days	61.392	61.392	\$7,942	\$7,942
Work Loss Days	10.435	10.435	\$3,397	\$3,397
School Loss Days	124.155	124.155	\$216,969	\$216,969
Total Health Effects	—	—	\$3,298,256	\$4,308,232

At the site level, sites in the heavy-duty vehicle market sector accounted for 76% of the monetary value from benefits, followed by the school bus (10%), TRU (9%), and medium-duty vehicle market sectors (4%).

As part of this analysis, the Evaluation Team also examined health benefits within DACs, which may be disproportionately burdened by sources of pollution (including air pollution from ICE vehicles). Because COBRA estimates effects at only the county level, the Evaluation Team disaggregated the health benefits by census tract using the relative population of each tract from the most recent American Community Survey. For example, we allocated 10% of the value of the health benefits to a census tract with 10% of the county's population. The Evaluation Team then estimated the total benefits allocated to DACs and

non-DACs.⁵⁶ This approach assumes that the benefits of emissions reductions are distributed evenly throughout the county. If the sites are located in DACs, and the emissions reductions are greater in the tracts near the sites, this approach understates the potential benefit to DACs. Additional information about emissions dispersion within counties would provide more precise estimates of health benefits to DACs and non-DACs.

In our analysis, Los Angeles County had 56% of the total benefits, followed by Orange County (12%), San Bernadino (9%), Riverside County (7%), and San Diego County (6%). Overall, 32% of the total benefits were in DACs.

Highlights

- Cumulative health benefit results in California realized by the Charge Ready Transport sites in terms of monetary benefits range from \$3,298,256 for the low estimate to \$4,308,232 for the high estimate.
- Sites in the heavy-duty vehicle market sector had the highest health benefits overall.
- Los Angeles County had the highest proportion of overall impacts at 52%, followed by Orange County (12%), San Bernadino (9%), Riverside County (7%), and San Diego County (6%).
- The proportion of overall benefits attributed to DACs for the program to date is 32%

Net Impacts

As part of the net impacts analysis, the Evaluation Team estimated program effects on participants to exclude impacts from actions that participants would have taken without the program (freeridership) and to include any program attributable indirect impacts on participants (participant spillover).

Enhanced Self-Report

The Evaluation Team based our approach for the MDHD programs' enhanced self-report NTG analysis on information we obtained as part of in-depth surveys with participating fleet managers. The Evaluation Team conducted the survey via an online survey platform, Qualtrics, and delivered a link to the survey using email contact information provided by SCE. The Evaluation Team based the MDHD fleet manager NTG methodology approach on the CPUC nonresidential customer self-report NTG framework originally developed for energy efficiency programs.⁵⁷ *Appendix B* provides more detail about the MDHD fleet manager self-report NTG methodology.

The Evaluation Team estimated the core component of the CPUC NTG methodology through three program attribution index (PAI) site scores (PAI-1A, PAI-2, and PAI-3). The Team used three separate sets

⁵⁶ DAC census tracts are defined as those included in the SB 535 Disadvantaged Communities List (2022), which includes DAC categories for CalEnviroScreen 4.0 Top 25%, CalEnviroScreen 4.0 High Pollution Burden Score and Low Population Count, and 2017 Disadvantaged Community (CalEnviroScreen 3.0 only).

⁵⁷ California Public Utilities Commission, Energy Division. February 20, 2015. *Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers*.

of questions to assess three components of the core NTG ratio, with each PAI score on a scale of 0.0 to 1.0 representing a different way of characterizing Charge Ready Transport program influence. The analysis included fleet manager responses from 13 of the 30 participating sites that were sent the survey.⁵⁸

The Evaluation Team calculated the resulting self-report NTG for each site prior to accounting for participant spillover, as the average of the three PAI score values. One minus the final core NTG ratio of 0.57 equals the 0.43 freeridership ratio for the MDHD program.

The participant spillover analysis revealed that since participating in the Charge Ready Transport program, none of the surveyed fleet managers reported electrifying more of their fleet without the benefit of funding from the SCE program. Additionally, none of the fleet managers reported that their participation in the program was important in any of their additional purchasing decisions. The resulting participant spillover ratio is 0.00. The final program-level NTG ratio of 0.57 equals one minus the freeridership ratio plus the participant spillover ratio. These NTG values are presented in Table 46, along with the average final core NTG for the SCE Charge Ready Transport program sites surveyed.

Table 46. SCE Charge Ready Transport Program NTG Fleet Manager Analysis Results in EY2024

Fleet Manager Survey Completes (n)	Average of PAI-1A Score NTG	Average of PAI-2 Score NTG	Average of PAI-3 Score NTG	Average of Final Core NTG	Freeridership Ratio	Participant Spillover Ratio	Final NTG Ratio
13	0.61	0.47	0.62	0.57	0.43	0.00	0.57

Highlights

- EY2024 program-level freeridership ratio is 0.43 with a 0.00 participant spillover ratio, which resulted in a program-level NTG ratio of 0.57.
- The EY2024 NTG ratio of 0.57 (n=13) is higher than the EY2023 NTG ratio of 0.38 (n=5), indicating the Charge Ready Transport program had more influence on the surveyed EY2024 fleets' decision to complete the transportation electrification projects compared to the surveyed EY2023 fleets.

4.1.3. Lessons Learned

By incorporating lessons learned from fully executed sites, program staff improved and adapted program processes to accommodate ongoing challenges with site costs and to mitigate delays.

As in previous evaluation years, costs for both TTM and BTM equipment continue to present challenges for Utility staff along with difficulties with vehicle procurement and increasing construction costs from labor constraints, material costs, and supply chain delays. Navigating these challenges was particularly difficult for the program in its earlier years, as there was much uncertainty and unknown about actual site costs. However, with the completion and maturity of early projects, SCE staff were able to refine and improve processes. For example, in 2023, this included expanding the intake process to include an

⁵⁸ Six distribution sites, five school bus sites, one transit site and one forklift site completed the survey.

environmental questionnaire and generally improving the early stages of the program to ensure customer readiness and smooth project execution. In 2024, SCE staff took several more steps to improve the program, including using actual costs to refine the site cost calculator's estimates during the application process and further expanding the intake questions so that the appropriate switchgear can be ordered as early as possible for the site. Additionally, SCE staff now directly coordinate the ordering and delivery of switchgear to further streamline the process.

Despite the continuing impact of policy uncertainty on utility planning, program participation, and customer choices in the EV market, the Charge Ready Transport program remains a stable offering for SCE customers.

In 2024, SCE staff reported that given continued uncertainty about when, if, and how regulations (such as ACF) will go into effect, it was difficult to plan for an increase (or decrease) in customer interest, inquiries, and potential applications in the program. Staff also noted that that application volume from segments covered by ACF, including drayage, high priority, federal fleets, has been limited after CARB paused enforcement. Additionally, as more regulations and programs have entered the market to support electrification (such as Rule 29), staff shared that the decision-making process has become even more complex for customers, requiring additional support from SCE staff to help them determine what programs are the best fit for them. Overall, staff reflected that navigating the EV market in 2024 seemed challenging for customers, particularly those who were considering purchases from EV companies that are now out of business. Despite these challenges, the Charge Ready Transport program has remained available for customers who are actively seeking to electrify, filling an important need in the market as a stable offering from a reliable provider. Modeling with the UC Davis TCM suggests that continued TTM and BTM support from Charge Ready Transport or other programs is important for increasing the adoption of electric MDHDs across all market sectors.

The program saw activation and operation of larger sites in 2024 compared to previous years, improving cost efficiency on a per-vehicle and per-kilowatt-installed basis. However, cost per site increased.

The average Utility infrastructure cost was \$36,450 per vehicle and \$1,158 per kilowatt of charging capacity installed through 2024 PTD, compared to \$41,395 per vehicle, and \$1,250 per kilowatt installed through 2023 PTD. This cost reduction in 2024 is a result of new, larger sites coming online with an average installed charging capacity of 758 kW per site through 2024 PTD, compared to 429 kW per site through 2023 PTD. While larger sites typically require longer activation timelines due to their complexity, cost-effectiveness per vehicle and per kilowatt of charging capacity installed improves with project scale. As expected, the average per site Utility infrastructure cost, including TTM and BTM, increased per site through 2024 PTD to \$430,204 per site, up from \$304,057 per site through 2023 PTD. Total all-in costs paid by the customer and SCE vary widely between sites, with an average of \$802,698 per site through 2024 PTD, compared to \$504,275 per site through 2023 PTD.

Site activation timelines remained steady in 2024 in comparison to 2023 despite taking on larger, more complex sites.

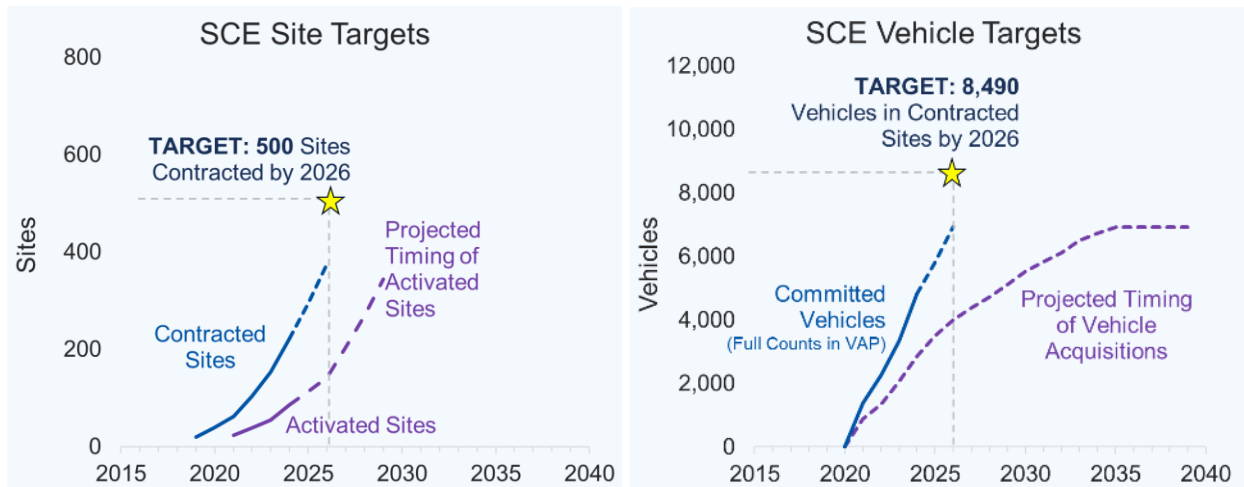
The median time from application to activation was 959 days in 2024 compared to 960 days in 2023 and 841 days in 2022. The Design and Permitting phase has been the longest in duration across all evaluation years. However, this phase increased to 395 days in 2024, rising from 293 days in 2023, for a 35% increase. Design and Permitting represents 41% of the total average activation timeline in 2024 and 32% PTD. Application Review timelines also increased significantly, rising to 165 days, compared to 96 PTD, for an increase of 71%. Other program phases remained consistent between 2023 and 2024. In addition, more sites are taking longer to reach operation after activation, with 39% of 2024 sites taking 120 days or more to become operational after activation, up from 31% in 2023; similarly, only 30% of sites were operational within 30 days of activation in 2024, compared to 40% in 2023. Partially mitigating the delay in use, sites activated in 2024 are beginning to show a pattern of consistent use, indicating that sites are maturing more rapidly and vehicles are entering consistent operations faster than in previous evaluation years.

Despite taking on larger, more complex sites in 2024, the program team has successfully tightened up their processes to maintain site activation timelines. Two-thirds of sites attributed to the heavy-duty market sector host nearly 40 MW of new capacity.

The Charge Ready Transport program lags behind its goals for number of sites and vehicles, and program spending remains low, but DAC spending remains above target.

In 2024, 31 sites with 579 charging ports were activated supporting 742 vehicles, based on VAPs of activated sites. The program supports six market sectors, and while school bus fleets continue to be the most common site type (38% of sites), heavy duty vehicle sites have grown significantly to now account for 33% of all sites in the Charge Ready Transport program. This shows greater diversity in the participant pool and also indicates a trend toward larger sites. The 86 total activated sites (with 1,609 charging ports) in the program to date meet 17% of the program's *per se reasonableness* goal of 500 sites and support 1,950 vehicles which meet 23% of the program's *per se reasonableness* goal of 8,490 additional vehicles electrified. As shown in Figure 103, the Charge Ready Transport program is not on pace to meet either its vehicles electrified or its activated site goals. The figure shows contracted sites and activated sites on the left. The figure shows committed vehicles in the VAPs and estimated timing of delivery of vehicles on the right.

Figure 103. SCE Charge Ready Transport Program Historical and Forecasted Progress Toward Site and Vehicle Goals



The Charge Ready Transport program will make additional progress toward these goals as more sites reach activation. For example, the 222 contracts signed in the program to date could support 4,824 MDHD vehicles, which would meet 44% of the program’s site goal and 57% of the program’s vehicle goal. However, as shown in Figure 103, SCE is not on pace to meet either its site or its vehicle goals.

Program spending in 2024 totaled \$19.6 million, which is significantly higher than the \$12.8 million spent in 2023. This brings total program spending to \$54.4 million out of an approved budget of \$342.6 million, which represents 16% of total funds. The total spending does not include funding reserved for some contracted sites. However, nearly 71% of the programs spending on infrastructure for financially closed out sites to date has been on DAC sites, exceeding the 40% program target.

Though overall consumption increased significantly, peak demand represents a small portion of installed charging capacity, and the majority of fleet operators are not implementing load management.

Across 2024 operational sites, more than 47 MW of new charging capacity was installed, bringing total capacity for the PTD sites to over 92 MW. Overall consumption in 2024 was just under 50 MWh, nearly doubling of consumption of around 25 MWh in 2023. Peak demand reached 14.5 MW in 2024, for a 220% increase over 2023, and utilization also increased to 16% of installed capacity, up from less than 13% in 2023. Overall Charge Ready Transport program sites have an average billing cost of \$0.37/kWh. The best results appear to show monthly billing between \$0.016/kWh and \$.030/kWh through use of load management.

The number of load-managed sites grew from nine of 55 activated sites (16%) in 2023 to 21 of 86 activated sites (24%) in 2024. On a monthly basis, 43% of transit bus charging, 42% of school bus charging 39% of heavy-duty vehicle charging, and 25% of medium-duty vehicle charging has enough flexibility to be shifted to lower cost and lower emissions time periods through the use of load management. Potential savings through use of load management are as high as \$212,500 per site

annually for non-load-managed sites and \$442,000 for sites already using load management through optimization. On average, sites can reduce GHG emissions by 10% by avoiding energy consumption from 4 p.m. to 9 p.m.

Not all EVSPs offer load management capability, and not all fleet operators have direct access to their utility bills to understand TOU cost impacts. During site visits we observed that most operators had a disconnect between what they expected the electricity to cost versus their actual costs. However, most fleet operators were aware of TOU pricing, regardless of whether they were aware of usage trends and costs.

The Charge Ready Transport program sites continue to help displace petroleum, reduce GHG and local emissions, and provide health impacts.

The Charge Ready Transport program sites have displaced more than four million gallons of petroleum in the program to date. Specifically, the heavy-duty vehicle sector accounted for over two million, of the petroleum displaced PTD. In addition, the program resulted in a reduction of over 33,000 MT of GHGs to date. These sites all contributed to lowering local emissions, with CO reduction of over 130,000 kg to date as the most prominent. Overall, 32% of the PTD health benefits are in DACs, and the total monetized health benefits from sites ranging from \$3,298,256 to \$4,308,232.

Fleet managers are motivated to participate in the program and perceive a range of financial and environmental benefits.

Fleet managers reported that they were motivated to transition to EVs primarily because of environmental benefits (10 of 13 fleet managers), rebates/incentives (eight of 13 fleet managers), and regulatory requirements (eight of 13 fleet managers). The primary barriers before and after participation (seven fleet managers) were the cost of installing charging infrastructure (three before; two after) and the cost of EVs (two before; one after). Despite cost being a continued concern in 2024, fleet managers reported a range of financial-related benefits with most (10 of 12) reporting lower costs for vehicle fueling costs and more than half (eight of 12) also reporting lower costs for vehicle maintenance. Furthermore, four of 12 fleet managers also reported lower costs for the cost of fueling schedule modifications and for vehicle fueling infrastructure costs. Finally, all twelve interviewed fleet managers said they anticipated benefits for their community or fleet through the transition to electrification such as improved air quality and health, improved driver comfort and convenience, and reduced noise pollution.

Participating fleet managers are satisfied with their experience with The Charge Ready Transport program and have been positively influenced by their program participation; however, opportunities remain to improve fleet manager confidence in industry readiness for electrification.

Overall, nearly all (10 of 12) fleet managers rated themselves as *very satisfied* or *somewhat satisfied* with their experience with the SCE Charge Ready Transport program with eight indicating they had learned about the program from SCE staff and six saying they had recommended it to others. Regarding specific program experiences, 11 of 13 fleet managers said that EVs were *very reliable* or *somewhat reliable* and nine of 13 said that EV charging equipment was *very reliable* or *somewhat reliable*. In

addition, 10 of 13 fleet managers reported that they practiced load management with their fleets. Reflecting on their participation in the Charge Ready Transport program, seven of the 13 fleet managers said they would have proceeded with a smaller, but similar project in the absence of the program; and five of 13 indicated that they planned to accelerate EV and EV charging equipment procurement because of their experience with the program. Finally, when asked if they felt that their industry or sector was not well-positioned for electrification, fleet managers were divided with half (six of 12) saying they were well-positioned and the other half saying that they were not.

4.2. Schools and Parks Pilots

4.2.1. Overview

This overview provides a detailed description of the SCE Schools and Parks Pilots; summaries of the pilot implementation process, performance metrics, program materials, and budget; and a timeline of major milestones. Following the overview are detailed findings, highlights, and lessons learned.

Pilot Description

Schools Pilot: Per Decision 19-11-017, SCE’s Schools Pilot (Charge Ready Schools) offers direct installation of and incentives for installing approximately 250 L2 ports at 40 K–12 schools. SCE staff designed the pilot to enable K–12 schools to offer public charging to not only school staff, but also the local community.

Participating schools can opt to install SCE-owned EVSE or choose to own the EVSE themselves. For sites where SCE owns the EVSE, SCE also operates and maintains the EVSE.

However, the site host is still required to prepare the site for make-ready deployment (such as

Schools Pilot Targets

- 250 L2 ports
- 40 K–12 schools
- 40% in DAC locations

Schools Pilot Design Goal

Empower K–12 schools to offer public charging to staff, students, parents, and the greater community.

easement) and to pay all electricity charges. If the site host opts to own the EVSE, SCE offers a rebate based on the market costs for each type of charger. At the time of the Decision this rebate was up to \$2,000 per port for L1 and L2 chargers.

However, before the Schools Pilot launched, staff adjusted the incentive approach to ensure that sites choosing the

ownership option would receive the same benefits as those choosing to have SCE own the EVSE. This adjustment maintains a static cost for the EVSE but also considers the required agreement to operate and maintain the equipment, warranty, and network fees for eight years. As a result of this change, the Schools Pilot rebate does not support DCFC. As per the Decision, SCE staff offer customers an option to manage and pay for qualified state-licensed labor to install customer-side infrastructure, for which SCE provides a rebate of up to 100% of the installation cost.⁵⁹ Participating schools also commit to providing charging equipment usage data for a minimum of eight years.

⁵⁹ No site host opted for this option.

In addition to the EVSE offerings, SCE has worked with the Energy Coalition (TEC) staff to develop a K–12 Campus EV Awareness Campaign in 2022. The campaign officially launched in March of 2023 and continued to be rolled out in 2024.

Parks Pilot: Per Decision 19-11-017, SCE planned to offer direct installation of approximately 120 L2, 10 DCFC, and an optional 15 mobile chargers across 27 state parks and beaches. After a master participation agreement (MPA) was signed in 2022 and site viability was explored further, the Parks Pilot’s goals were adjusted per AL 4926-E-A (approved in 2023), by reducing the state parks and beach target to 21 sites and augmenting the DAC location requirement to include DAC-adjacent locations.⁶⁰ SCE staff designed the Parks Pilot to encourage state parks and beaches to charge their own EV fleets and to offer charging services to staff and patrons with LDVs.

Parks Pilot Targets

- 120 L2, 10 DCFC, and 15 optional mobile charging stations
- 27 state parks and beaches
- 25% in DAC locations

2023 Updated Parks Pilot Targets

- Up to 21 state parks and beaches
- 25% in DAC and DAC-adjacent locations

SCE owns, builds, and operates the EVSE and contracts with a third-party vendor to serve as the customer of record for the charger. The third-party vendor is responsible for all electricity costs, must participate in a demand response program, and must report the prices it passes on to the EV drivers.

SCE staff planned to deploy a customer marketing campaign in 2024 to publicize the availability of EV

Parks Pilot Design Goal

Encourage state parks and beaches to charge their own EV fleets and to offer charging to staff and patrons with LDVs.

charging stations, with the goal of reducing range anxiety, facilitating EV adoption, and encouraging park patrons to drive EVs to parks or beaches with EVSE. As no sites were completed in 2024, this campaign has been delayed until sites are ready for promotion, which will likely happen in 2025 or 2026.

Implementation

Figure 104 shows the implementation process for the Schools and Parks Pilots from site identification to close-out. The Schools Pilot is fully subscribed and no longer taking applications, and the Contract Issuance step is slightly different for the Parks Pilot, since the California DPR approved the MPA in 2022 that applies to all state parks in SCE service territory participating in the Parks Pilot. Each individual site will have site addendums to the MPA based on specific site needs and designs. In 2024, SCE succeeded in securing the final addendum agreement, bringing the total number of sites to nine.⁶⁰

⁶⁰ As noted in EY2023 and EY2024 close-out interviews with Utility staff, although up to 21 sites were viable at the time of the Advice Letter, ultimately, SCE and the DPR moved forward with nine sites as they determined that these nine sites would be sufficient for SCE to achieve the port goal.

Figure 104. SCE Schools and Parks Pilots Implementation Process



Program Performance Metrics

The Evaluation Team analyzed sites participating in the SCE Schools Pilot by site status. Table 47 provides the count of SCE Schools Pilot sites by completion status in EY2024 and for the pilot to date.

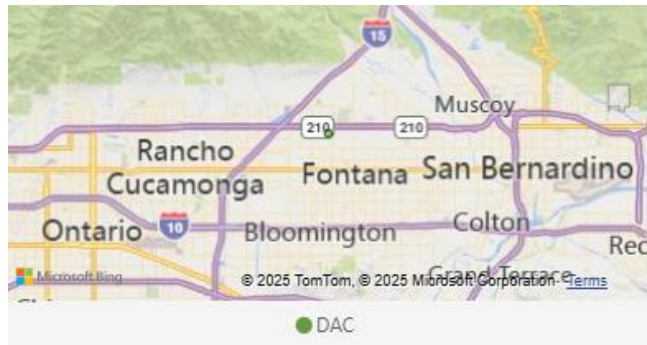
Table 47. SCE Schools Pilot Complete Site Count by Status

Site Status	EY2024	Pilot to Date
Utility Construction Complete	4	25
Activated	1	22
Operational	4 ^a	21
Closed Out	18	19

^a Despite being operational, usage data was not available for one site at the time of the 2023 evaluation report. For purposes of evaluation reporting, this site is counted as newly operational in 2024.

In EY2024, only one site was activated in the SCE Schools Pilot as shown in Figure 105. This site also became operational in EY2024 and is located inside a DAC. In total, 30 contracts have been signed in the pilot to date, with no additional contracts signed in EY2024.

Table 48 presents site-level data for the SCE Schools Pilot, showing DAC status and number of L2 ports for the activated sites in EY2024 and for the pilot to date. In EY2024, 100% of activated sites were in a DAC, bringing the cumulative percentage of DAC sites to 55%, which exceeds the pilot's *per se reasonableness* DAC goal of 40% of sites. With the addition of six ports in EY2024, the total number of installed ports in the pilot to date is 172 L2 charging ports.

Figure 105. SCE Schools Pilot Activated Charging Stations**Table 48. SCE Schools Pilot Activated Site Data in EY2024 and Pilot to Date**

EY2024			Pilot to Date		
Number of Activated Sites inside DAC	Number of Activated Sites outside DAC	Number of L2 Charging Ports	Number of Activated Sites inside DAC	Number of Activated Sites outside DAC	Number of L2 Charging Ports
1	0	6	12	10	172

As shown in Table 49, the 22 activated sites in the SCE Schools Pilot meet 55% of the Schools Pilot's *per se reasonableness* goal of 40 sites. The 172 L2 ports at the activated sites meet 69% of the pilot's *per se reasonableness* goal of 250 L2 charging ports. The 30 customer contracts signed in the pilot to date could satisfy 75% of the pilot's *per se reasonableness* site goal and would provide 250 L2 ports, which could meet 100% of the pilot's L2 charging port goal. Based on this trend, the Evaluation Team expects SCE to meet its *per se reasonableness* goals by the end of the program.

Table 49. SCE Schools Pilot Site and Port *Per se Reasonableness* Goal Progress

Pilot Metric	<i>Per se Reasonableness</i> Goal	Pilot to Date
Activated Sites	40	22
L2 Ports	250	172

The CPUC established six phases in the program timeline per the SB 350 reporting template. Table 50 shows the median durations by program phase for EY2024 and pilot-to-date activated sites. The median number of calendar days per program phase for EY2024 sites in the Schools Pilot ranged from 63 days for Application Review to six days for Contract Issuance. For sites activated in EY2024, median durations across the Application Review, Site Assessment, and Contract Issuance phases were similar to those for the Schools Pilot to date.

Table 50. SCE Schools Pilot Median Calendar Days per Phase

CPUC Program Phase	Median Calendar Days	
	EY2024 Site ^a	Pilot to-Date-Sites
Application Review	63	63
Site Assessment	37	38
Contract Issuance	6	20
Design and Permitting	0	403
Construction Complete	0	97
Activation	0	0

^a Only one site was activated in EY2024; median calendar days is reflective of duration for this single site

Program Materials Summary

Schools Pilot: SCE launched the Schools Pilot curriculum in 2023 in partnership with TEC. The curriculum comprises grade-level-specific materials to provide educators with tools and resources to effectively teach their students the nuances of electrification and EV ownership.⁶¹ In 2024, TEC continued to conduct proactive outreach to schools to promote the curriculum. In addition to virtual outreach, TEC established connections with schools through in-person engagement. TEC and SCE also developed a welcome letter and recruitment presentation to participating teachers and schools, which introduced the curriculum and its purposes and shared resources for implementing the program. By the end of 2024, eight educators at eight different schools were enrolled in the curriculum, serving 1,210 students.

Parks Pilot: SCE did not conduct any marketing or outreach activities specifically for the Parks Pilot in 2024.

⁶¹ The 2023 evaluation report provides additional detail about the curriculum and outreach materials: (<https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/sb-350-te/srp-ab10821083-2023-evaluation-report112024.pdf>).

Budget Summary

As shown in Figure 106, through the end of 2024, SCE spent \$6.3 million (constant dollars) of the School Pilot's \$9.9 million budget and \$1.4 million (constant dollars) of the Parks Pilot's \$9.9 million budget. SCE spent \$0.6 million of the Schools Pilot budget and \$0.2 million of the Parks Pilot budget in 2024. Through 2024, the Schools Pilot continued to outspend the Parks Pilot as the Schools Pilot was well into the process of constructing planned sites, while Parks Pilot sites were still being planned in 2024.

Timeline

Since the beginning of the Pilots, SCE has filed five Advice Letters: three pertaining to the Schools Pilot and two pertaining to both the Schools and Parks Pilots. SCE filed AL 4926-E on December 22, 2022, requesting the reallocation of funds for charging sites in DACs to include sites within five miles of DACs (i.e., DAC adjacent). Approval for AL 4926-E was delayed because of a protest on January 11, 2023, from the Public Advocates Office (PAO) that requested more information about the efforts SCE had made to prioritize DAC sites. SCE submitted a reply on January 19, 2023, detailing the work that the Parks Pilot team had completed to assess viability of each potential Parks Pilot site. The detail SCE provided was sufficient for the PAO, and AL 4926-E-A was officially approved on June 22, 2023. Although SCE did not submit a formal Advice Letter for final site selection, SCE and DPR proceeded with nine park sites, which are expected to achieve the Pilot's port installation goal. In 2024, SCE succeeded in securing the ninth and final site-specific addendum agreement.

Figure 107 shows major milestones since the beginning of the Schools and Parks Pilots.

Figure 106. SCE Schools and Parks Pilots Budget (Millions USD) as of December 31, 2024

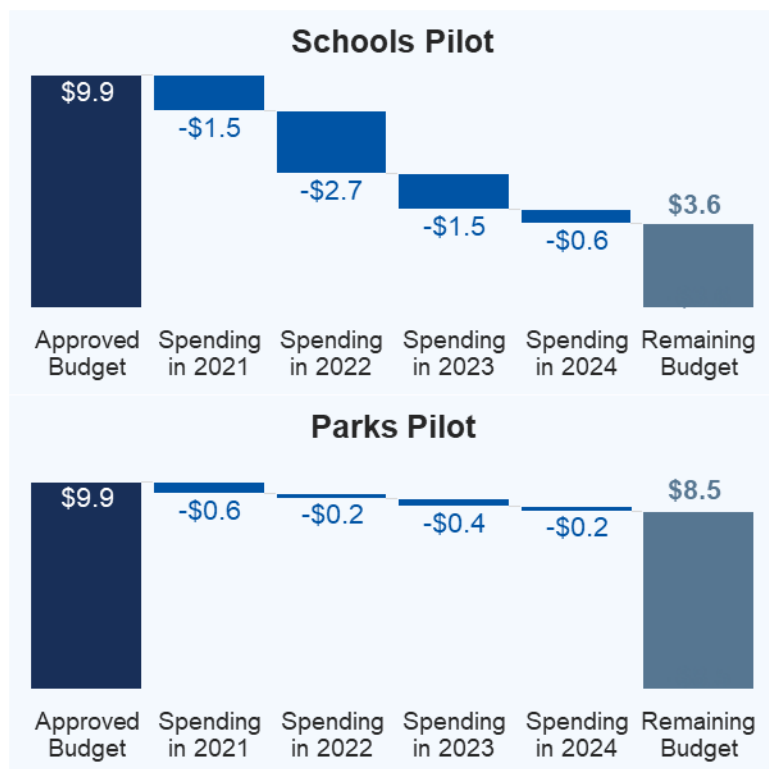
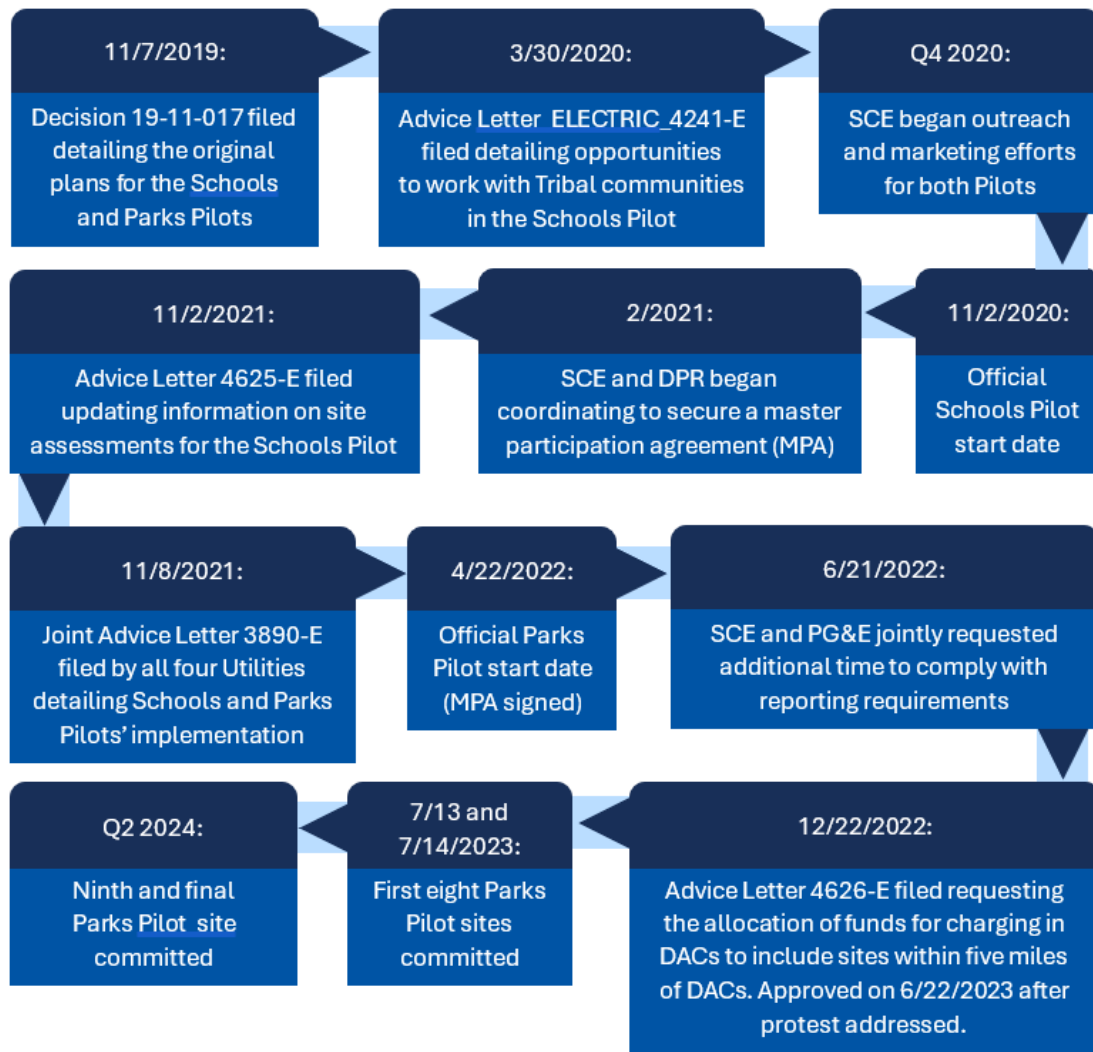


Figure 107. SCE Schools and Parks Pilots Key Milestones



4.2.2. Findings

This section provides findings from analyses of the incremental EV adoptions, site visits and site costs, grid impacts, petroleum displacement, GHG and criteria pollutant reductions, and health impacts, as well as insight from Utility staff interviews.

Table 51 summarizes key impact parameters for EY2024 as well as for the program to date. Annual estimates of impacts are provided for metrics calculated as part of the impact evaluation. Additionally, the table provides estimates of impacts across all sites included in the program population through the end of 2024.

Table 51. SCE Schools Pilot Impacts Summary

Impact Parameter	EY2021 Sites ^a	EY2022 Sites ^a	EY2023 Sites ^a	EY2024 Sites ^a	EY2024 Sites Percentage in DAC	PTD Sites Actual	PTD Sites Actual Percentage in DAC
Population of Activated Sites	1	12	8	1	100%	22	50%
Sites included in analysis (#)	0	8	4	1	100%	21	56%
Charging Ports Installed (#)	12	88	66	6	100%	172	54%
Electric Energy Consumption (MWh)	N/A	50	33.8	0.1	100%	415.2	41%
Petroleum Displacement (gasoline gallons equivalent [GGE])	N/A	4,137	2,555	4	100%	33,737	40%
GHG Emission Reduction (MT GHG) ^b	N/A	32	20.32	0.03	100%	264.32	41%
PM ₁₀ Reduction (kg)	N/A	0.2	0.11	0.00019	100%	1.33	41%
PM _{2.5} Reduction (kg)	N/A	0.1	0.10	0.00017	100%	1.23	41%
ROG Reduction (kg)	N/A	2.6	1.55	0.002	100%	22.25	40%
CO Reduction (kg)	N/A	86	54.5	0.09	100%	753.77	40%

^a Energy consumption, petroleum displacement, and emissions reductions are based on annualized data. Pilot-to-date results in the table are based on actual data (see *Appendix B* for more details). The one site in EY2021 was not included in the EY2021 Evaluation Report due to insufficient data but is included in PTD impact results in this report.

^b GHGs include CO₂, CH₄, and N₂O multiplied by their respective GWP as defined by IPCC AR5 (see *Appendix B* for more details).

Incremental EVs Adoption

The Evaluation Team estimated the effect of the public charging stations on household EV adoption for neighboring populations⁶² with a two-stage analysis. In Stage 1, we looked at historical impacts of public EV charging on vehicle ownership. See *Appendix B* for details about the Stage 1 analysis. Using the impact estimates from the Stage 1 analysis,⁶³ the Evaluation Team estimated the impact of SCE investments in public charging on EV ownership for Stage 2. By the end of EY2024, 22 charging sites in

⁶² The availability of public charging networks may affect EV purchases via two main avenues. The first is a network effect, through which EV owners gain increased access to the public charging stations due to station placement at destinations such as workplaces, commercial establishments, schools, and parks. We expect the availability of EV charging equipment at convenient locations (for midday charging away from home) to increase the convenience of owning an EV (such as by reducing range anxiety) and to increase the probability of EV ownership. The second avenue is a neighborhood effect on the driving population living in areas neighboring the public EV charging stations. We expect the availability of nearby charging infrastructure to lower the cost of EV ownership by providing alternatives to home charging. We anticipate that public EV charging will have the biggest impact on residents of multifamily buildings, many of whom will have limited access to EV charging equipment, or on low-income households, who may be unable to afford home EV charging equipment. Public charging access may boost EV ownership through both channels and positive interactive effects may exist between the channels that boost the overall impact of public charging networks. The Evaluation Team focused on analyzing the second channel. We will analyze impacts for the first channel separately when data become available.

⁶³ The Stage 1 analysis used vehicle registration data from 2015 to 2023, the most recent period with complete information at the CBG level. The EY2024 estimates assume the impact of Utility-specific stations remains unchanged over time, which may not reflect actual market and technological changes in 2024.

SCE's Schools Pilot had been activated. We estimated the impact of these stations based on annual EV registrations as well as pilot-to-date cumulative EV registrations driven by the program.

Based on the composite measure of public charging access, the Evaluation Team calculated the change in access to public charging due to SCE's Schools Pilot investment for each census block group (CBG) where the investments affected access. Table 52 shows that the pilot-to-date average change in access across all affected CBGs was approximately six, and the average change in the number of chargers (ports) was approximately five per affected CBG. For reference, the average change in access across all CBGs in California was 1.05 between 2015 and 2023. The average normalized EV annual registration per 1,000 households was nearly 70 in the affected CBGs in the 2020 baseline year.

Table 52. SCE Schools Pilot Summary Statistics of Effects on CBGs

	CBG Mean (Standard Deviation)			
	Change in Composite Measure of Access ^a	Change in Number of Chargers ^a	Normalized Annual EV Registrations ^b	Number of Households ^c
SCE Schools Pilot	6.28	5.02	69.31	461.70
	(6.09)	(4.36)	(371.26)	(277.45)
CBGs (N)	45	45	45	45

These values are averages for the CBGs whose access to public charging was affected by SCE's investments.

^a Change in composite measure of access and number of chargers is from 2020 to 2024.

^b Normalized annual EV registrations are average annual values in the affected CBGs in 2020 per 1,000 households.

^c Number of households is based on 2015–2019 American Community Survey (ACS).

Sample standard deviations are in parentheses.

The Evaluation Team calculated the impact of the Schools Pilot Utility charging investments on neighboring EV ownership. This involved combining the ordinary least squares (OLS) and instrumental variable two-stage least squares (IV-2SLS) regression estimates of the impact of public charging access on EV registrations from Stage 1 with the estimates of the CBG changes in public charging access and household counts.⁶⁴ The impacts of the SCE investments on EV registrations will depend on the extent to which the investments increased access to EV charging in the affected CBGs and the number of neighboring households in the CBGs.

Table 53 shows estimates of the annual and pilot-to-date EV registrations attributable to the SCE Schools Pilot charging investments. Based on the OLS long differences model,⁶⁵ SCE School Pilot investments in charging facilities increased EY2024 annual EV registrations by 10 vehicles. The pilot-to-date impact is 18 vehicles. Based on the IV-2SLS long differences model, the School Pilot investments

⁶⁴ In Stage 1, the Evaluation Team estimated the impact of public EV charging access on EV ownership. Stage 2 built on the Stage 1 analysis and was an attribution analysis for Utility-specific investments. A notable benefit of this approach is that it is applicable to evaluations of other programs increasing EV charging access as well, which ensures methodological consistency.

⁶⁵ The long differences model estimates indicate the impact of public charging on EV registration over eight years. The team annualized these estimates by dividing the results by eight.

increased annual EV registrations by 20 vehicles. The Evaluation Team prefers the IV-2SLS-based estimates because they account for the potential endogenous siting decisions of public charging (i.e., siting public charging infrastructure in locations likely to have above- or below-average rates of EV adoption). These estimates reflect the 22 activated Schools Pilot facilities operating for a full year.

Table 53. SCE Schools Pilot EV Registrations Attribution

EY2024 Annual Increase of EV Registrations Driven by the Utility Program		PTD Cumulative Increase of EV Registrations Driven by the Utility Program	
OLS	IV-2SLS	OLS	IV-2SLS
10.10	19.65	18.08	56.74
(0.69)	(2.25)	(0.99)	(4.21)

The table shows the EV registrations attributable to the utility investments in public charging infrastructure. The left panel shows the impacts of utility investments since 2020 on registrations in EY2024. The right panel shows the cumulative impacts of Utility investments since 2020 on EV registrations in EY2021, EY2022, EY2023, and EY2024. The Evaluation Team based these estimates on the OLS and IV-2SLS long differences models. The Team estimated the OLS long differences model using data for all CBGs in the analysis sample. We estimated the IV-2SLS long differences model for CBGs in the 20 largest California cities. The long differences are five-year estimates, which the Evaluation Team annualized by dividing the results by five. For each affected CBG, the Team calculated the increase in annual registrations as the product of the regression-based access coefficient divided by eight, multiplied by the change in composite public charging access from utility investments (between baseline 2020 and EY2024), multiplied by the number of CBG households (in thousands). Robust standard errors clustered at the CBG level are in parentheses.

The SCE Schools Pilot investments in public charging had relatively small impacts on EV ownership in EY2024. Across all 45 affected CBGs, the total annual number of EV registrations is about 3,119 ($45 * 69.31$) in baseline year 2020, so the preferred IV-2SLS regression method estimates that the pilot-to-date cumulative impact of the SCE Schools Pilot increased EV registrations by about 1.8% ($37.08 / 3,119$). The increase in estimated cumulative impacts from EY2023 to EY2024 was modest, rising from 1.2% to 1.8%, compared to the substantial increase observed between EY2022 and EY2023, when impacts nearly tripled. A key reason for the smaller growth this year is that the number of active public charging stations increased by only one station. An average of 70 EV registrations per CBG puts these CBGs in the 94th percentile for EV registration among CBGs, implying a high level of baseline EV registration. This high baseline also explains why the percentage effects are small. The Evaluation Team attributes the impact primarily to the growth in charging stations and the increased number of influenced CBGs.

Highlight

- The model's output shows that the Schools Pilot may have contributed to the PTD EV adoption of 56 EVs for households neighboring the infrastructure.

Site Visits

The Evaluation Team visited the single newly completed site in EY2024. During the site visit, the Team documented six L2 charging ports installed with a total capacity of 58 kW and a total of six parking spaces within reach of charging cords, including one or more ADA-compliant spaces per site. Figure 108 and Table 54 show ports and capacity based EY2024 sites as well as PTD sites.

Figure 108. SCE Schools Pilot L2 Ports and Capacity Observed in 2024 and in the Pilot to Date

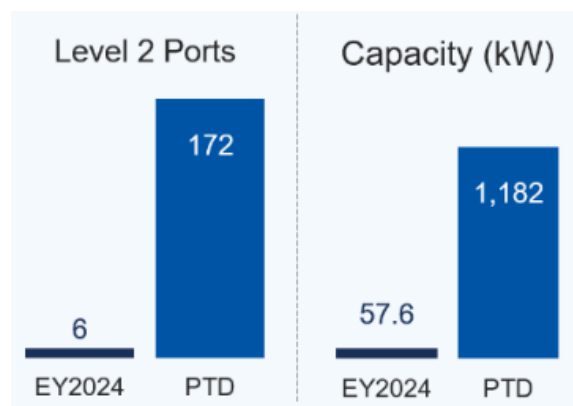


Table 54. SCE Schools Pilot Ports and Capacity Observed during Site Visits

Site Visit	Ports	Installed Capacity	Number of Sites
EY2024 Sites	6	58	1
PTD Sites	172	1,182	22

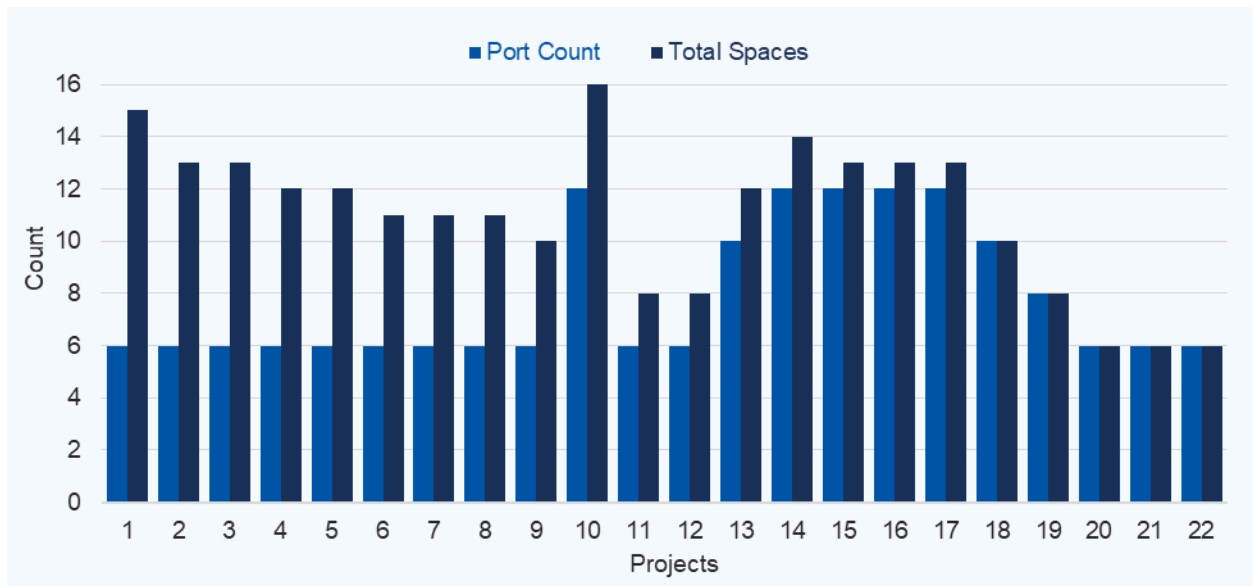
The lone site activated in EY2024 is one of two schools out of 30 in the program that opted for customer-owned EVSE ownership. Unique to this site is the use of 40-amp output L2 EVSE (9.6 kW as shown in Figure 109). In comparison, most other school sites use 30- to 32-amp rated EVSE. The higher power level of the chargers at this site may allow slightly faster charging times, although this additional speed may not be beneficial to those charging for a full workday or school day.

Besides the power level, the site was similar to others visited in past evaluation years in terms of chargers, capacity, and design, and had an equal number of parking spaces within reach of charging ports to the number of ports (a one-to-one ratio). On average, the SCE Schools Pilot sites show a ratio of one-to-five parking spaces within reach of a charging port with just under half the sites above that ratio. Figure 110 shows the number of ports and the number of parking spaces that can access these ports based on PTD site visits. The top nine sites average two spaces within reach of each charging port. This allows additional vehicles to use a charging port without moving the first vehicle, which can improve charger utilization.

Figure 109. SCE Schools Pilot Display on a Higher Power L2 Charger



Figure 110. SCE Schools Pilot Visited Sites Charging Port Availability by Site for PTD Sites



The Evaluation Team reviewed the pricing structure available to EV drivers. SCE uses TOU EV-oriented billing rates, some of which (TOU-EV 7) began phasing in a 16.6% increase in demand charges in 2024.

- One of the 22 sites the Evaluation Team visited did not have rates posted at the time of the site visit nor were rates found during subsequent research at Plugshare.com or other NSP websites
- Ten sites provide TOU pricing to EV drivers
 - Costs change between low- to peak periods by 125% to 330%, or \$0.05 to \$0.35 per kilowatt-hour.
 - Energy costs ranged from \$0.12/ kWh to \$.75/ kWh
- Eleven sites provide flat rates to EV drivers
 - Energy costs range from \$0.3/ kWh to \$0.53/ kWh
 - Five of these sites use idle fees to influence EV drivers to turn over the charging station
 - Idle fees range from \$3 to \$20 per hour
 - Grace periods, once charging is complete, ranged from 15 minutes to four hours

Highlights

- One site opted to own their chargers and selected slightly higher-powered L2 equipment.
- Nine sites average more than 1.5 parking spaces within reach of each charging cord.
- Five sites provide TOU rates that may help influence when drivers charge.
- Seven sites use idle fees to encourage turnover and therefore improve access to charging ports.

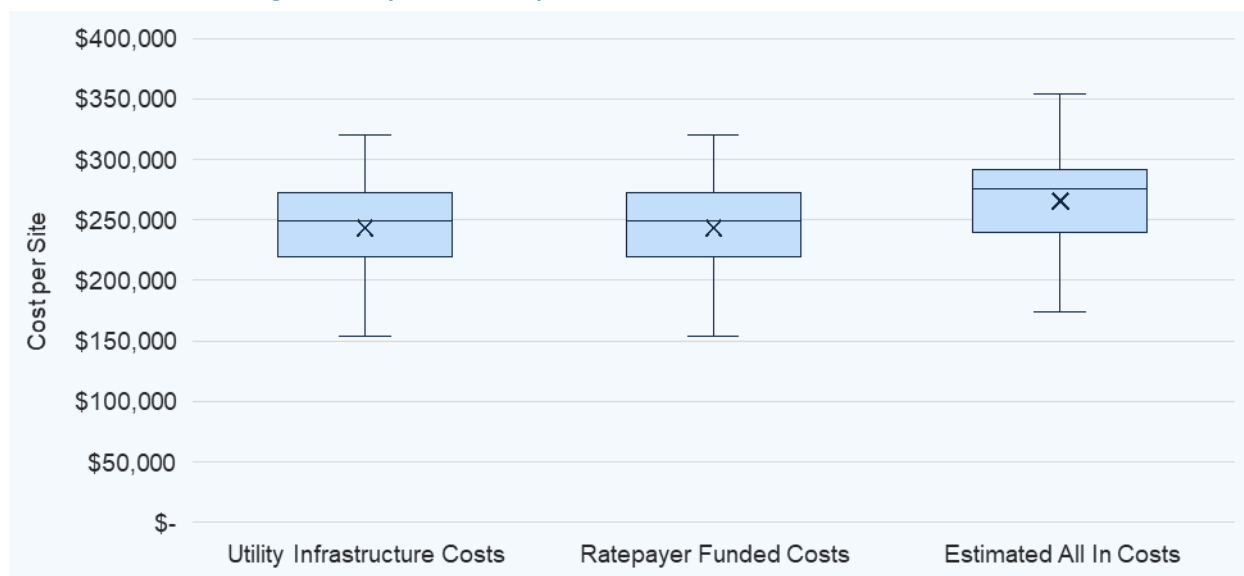
Site Costs

The Evaluation Team conducted an analysis of the 19 school sites with fully closed out finances as of December 31, 2024, including EY2021, EY2022, EY2023, and EY2024 activated sites. The set of fully closed out sites is smaller than the set of activated sites because of the time involved in performing activities such as collecting receipts, paying invoices, and obtaining administrative approvals. Cost estimates presented here are in nominal dollars. The 19 sites all had L2 ports, with an average of 53.5 kW of installed capacity and 7.9 ports per site.

Figure 111 shows the distribution of site-level costs for the 19 sites. The horizontal lines of the boxes show the 25th, 50th, and 75th percentile of sites; the “x” represents the mean site cost; and the three panels are defined as follows:

- **Utility Infrastructure Costs.** Site costs borne by the Utility for TTM and BTM.⁶⁶
- **Ratepayer-Funded Costs.** All site costs paid for by the Utility, including TTM, BTM and EVSE rebate.
- **Estimated All-in Costs.** The total estimated cost of installing the site, including capital and labor costs for the Utility and the customer. The value is calculated by summing 100% of TTM,⁶⁷ BTM, and EVSE costs.

**Figure 111. SCE Schools Pilot Per-Site Costs
Organized by Three Perspectives, Across 19 Closed-out PTD Sites**



⁶⁶ Utility infrastructure costs are the same as the ratepayer-funded costs, except the Utility infrastructure costs do not include EVSE rebates.

⁶⁷ The Utility pays 100% of the TTM costs and therefore reports actual TTM costs to the Evaluation Team.

Figure 112 shows average all-in costs for the 19 sites. BTM is the largest cost across the sites, followed by TTM, then EVSE. Together, the average all-in TTM, BTM, and EVSE cost is \$265,624 through 2024 PTD.⁶⁸

Figure 113 shows the distribution of utility infrastructure costs (corresponding to the far-left panel in Figure 111) per site, per vehicle, and per kilowatt. The average Utility infrastructure cost, including TTM and BTM borne by SCE through 2024 PTD was \$243,510 per site and \$4,861 per kilowatt of installed charging capacity.

Figure 112. SCE Schools Pilot Average All-In Costs, Across 19 Closed-out PTD Sites

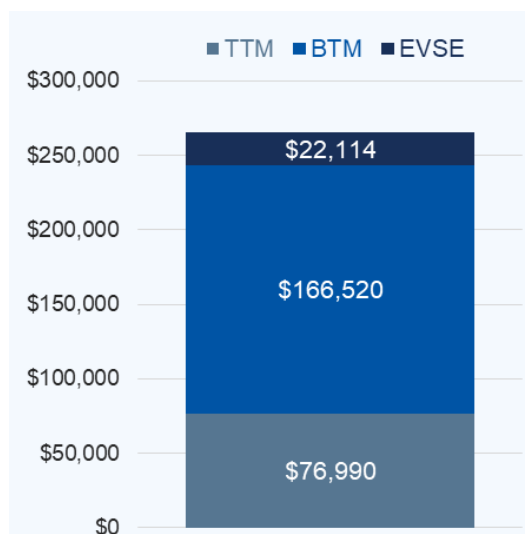


Figure 113. SCE Schools Pilot Cost per Site and per Kilowatt Across 19 Closed-out Sites



Highlights

- Estimated all-in costs paid by the customer and SCE vary widely between sites, with an average of \$265,624 PTD per site. On average, BTM was the largest cost across the sites, followed by TTM and EVSE costs.
- The average utility infrastructure cost PTD, including TTM and BTM borne by SCE, was \$243,510 per site, and \$4,861 per kilowatt.

⁶⁸ Calculated by summing all TTM, BTM, and EVSE costs borne by SCE and the customer and dividing by 19 sites.

Grid Impacts

The Evaluation Team determined grid impacts for the SCE Schools Pilot based on our analysis of energy consumed by operational charging stations installed by the program through the end of 2024, combined with charging session data from the NSPs.

Data Sources

The primary data source used in this section is energy usage data provided in regular 15-minute intervals from the AMI. Other data sources include customer bills and charging session–specific data provided by NSPs. There are several important differences between AMI and NSP data. While AMI data reflect only energy usage, NSP data include energy usage, session start and stop time, the duration of a vehicle’s connection to a charging port, the duration of a vehicle actively pulling power, and the specific port used for a session. An AMI meter does, however, track standing loads (such as those the EVSE uses for communications, cooling, active power converters, solenoids, and screens), which NSPs typically cannot do. When AMI data are missing from the dataset, the Evaluation Team uses NSP data to fill the gaps.

Summary of Grid Impacts

Table 55 presents the estimated Schools Pilot program grid impacts.

Table 55. SCE Schools Pilot Grid Impacts

Impact Parameter	Actual 2024	Actual Program to Date	10-Year Projection PTD
Operational Sites	4	21	21
Installed Capacity (kW)	57.6	1,074.6	1,074.6
Electric Energy Consumption, MWh	252	415	2,850
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)	37 (14.5%)	56 (13.6%)	387 (13.6%)
Maximum Demand, kW (with date and time)	215 (8/16/24 9:15 AM)	215 (8/16/24 9:15 AM)	N/A
Maximum On-Peak Demand, kW (with date and time)	83 (3/17/24 4:15 PM)	90 (5/22/23 7:30 PM)	N/A

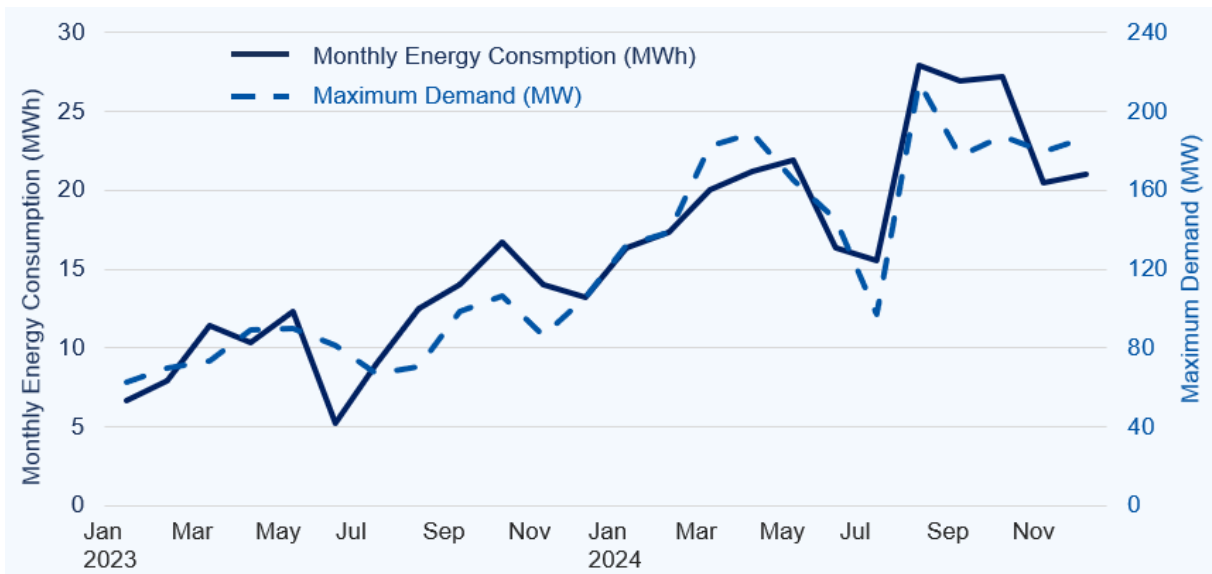
The remainder of this section offers detailed findings on actual consumption, demand, and charging session–oriented trends of the combined sites through calendar year 2024.

Energy Trends

Sites in the Schools Pilot reached a total consumption of over 250 MWh in 2024, leading to a pilot-to-date total of 415 MWh. One site was activated in 2024, yielding 21 total activated sites through the end of 2024. Demand peaked at 215 kW in aggregate across all sites at 9:15 a.m. on August 16, compared to nearly 11 MW of installed capacity. The Evaluation Team attributes this gap between installed capacity and demand to the adoption rate of these charging stations by EV drivers, as discussed later in this section.

Figure 114 plots monthly energy consumption and maximum demand values for the Pilot.

Figure 114. SCE Schools Pilot Monthly Energy Consumption and Maximum Demand



Total daily energy consumption continues to increase across program sites, with daily consumption approaching 1.4 MWh by end of year and maximum demand experiencing significant fluctuation. The end of the year showed maximum demand of 215 kW as presented in Figure 115.

Figure 115. SCE Schools Pilot Daily Energy Consumption and Maximum Demand, Pilot-to-Date Sites

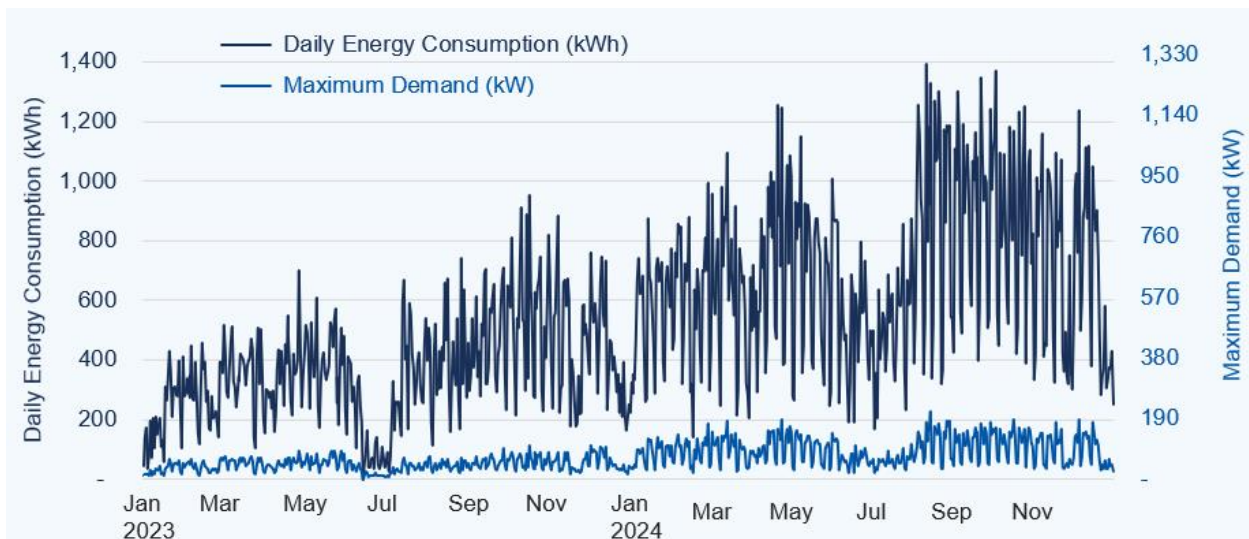


Figure 116 shows average load curves of weekdays and weekends in the fourth quarter of 2024. These load curves are representative of typical workplace charging seen in many other examples outside of the SCE portfolio. This pattern consists of a load that ramps up between 6 a.m. and 9 a.m. as drivers arrive, peaks between 9 a.m. and 11 a.m. as all connected vehicles are charging, and tapers off over the rest of the day as individual vehicles complete their charge. On average, weekend loads are much flatter and show slightly higher average charging demand than weekdays late at night and in the early morning, which may represent charging during events outside of regular school hours.

Figure 116. SCE Schools Pilot Average Weekday and Weekend Q4 2024 Load Curves

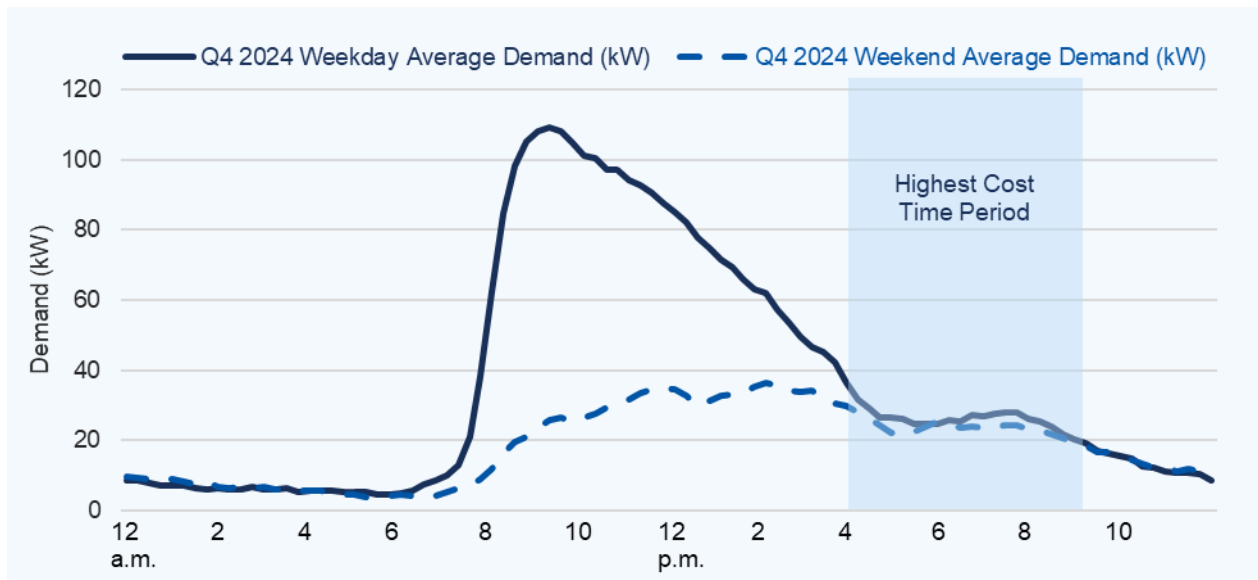
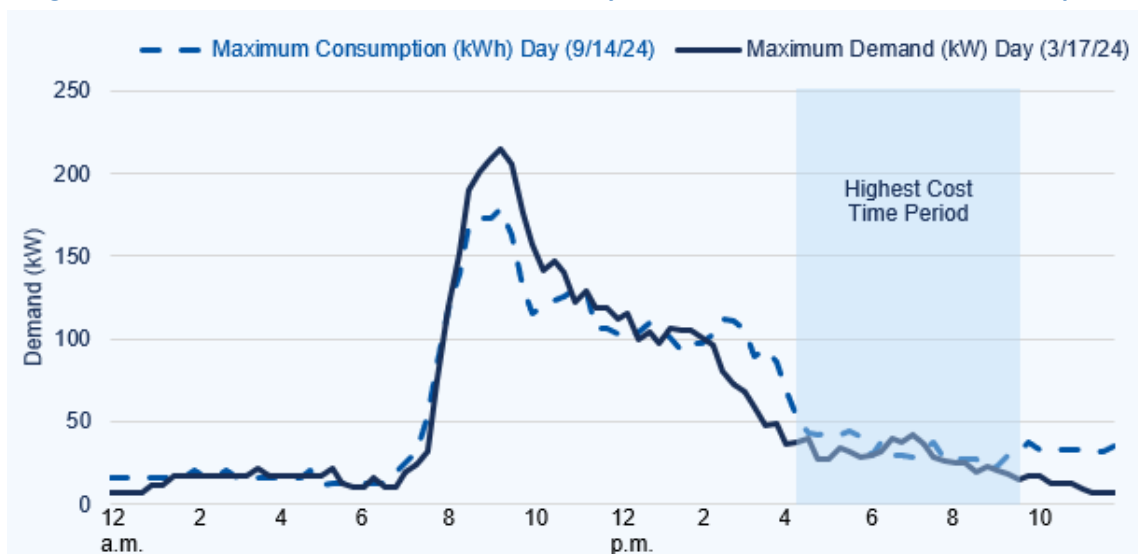


Figure 117 depicts daily load curves for example days with high maximum demand and consumption. Both days show notable charging between 175 kW and 215 kW during the morning hours, with some charging occurring in the afternoon and evening hours, which indicates that some of the sites are supporting the local community outside of just faculty and staff at the schools. In other words, an additional EV charging audience benefits from and in turn increases utilization of these sites.

Figure 117. SCE Schools Pilot Load Curves on Days of Maximum Demand and Consumption



The data continues to show that some of these sites charge public vehicles in addition to vehicles of school district employees. Additionally, this subset of sites typically has higher utilization than other sites that are not shared with the public. This finding may present an opportunity to design similar sites in the future with a policy to enable higher utilization and greater public charging access. Residents in

multifamily dwellings who live nearby may especially benefit from access to charging. Most of the Schools Pilot sites are considered private and, as such, are not always shown on native NSP websites or Plugshare.com.

The impact of pricing on grid impacts for these sites—such as how and to what extent EV drivers use energy—remains inconclusive due to lack of pricing data. SCE reports that all Schools Pilot sites use their EV-specific tariffs, which make use of TOU rates for the customer of record—i.e., school districts or their NSP or similar partners that operate the EVSE. However, the site hosts can select the pricing the NSP offers to EV drivers who use the charging facilities. Most sites did not provide the Evaluation Team with pricing information during site visits.

Usage Trends

Most of these sites are over a year old and many are over two years old, allowing for better analysis of site performance over time. This section assesses program characteristics by comparing energy consumption and load factor (a measure of consistency of usage) across sites.

Figure 118 and Figure 119 aggregate monthly energy consumption trends for active sites, grouping sites that have achieved a 15% load factor (Figure 118) and sites that have not (Figure 119). This was done to improve data accessibility, rather than to determine what a “good” load factor is. Sites with a higher load factor more frequently dispense over 1.5 MWh monthly. Only one site below a 15% load factor achieved regular 2 MWh months.

Figure 118. SCE Schools Pilot Monthly Energy Consumption (>15% Load Factor)

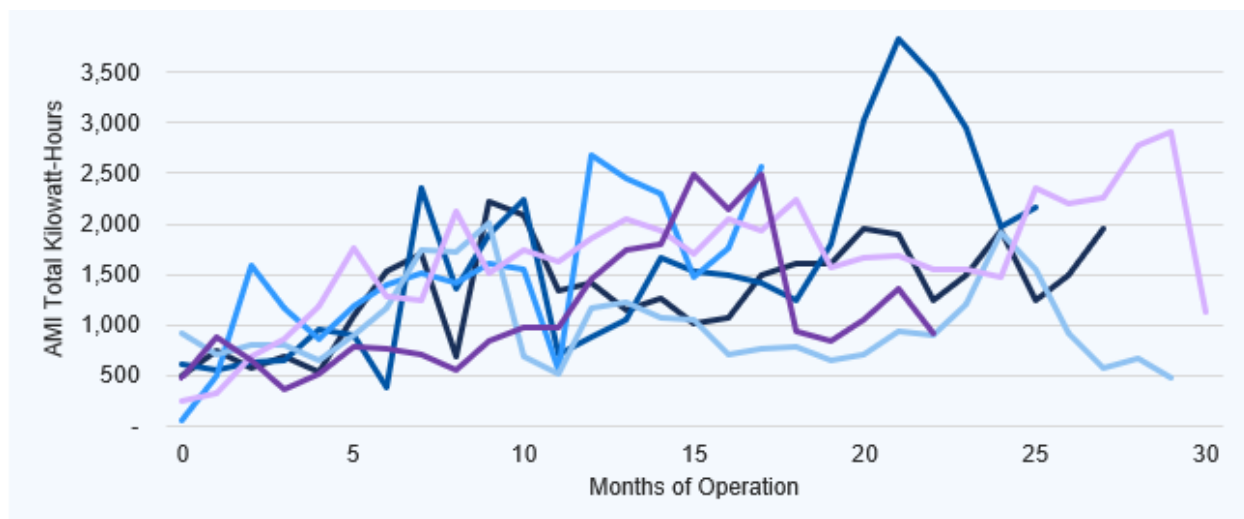
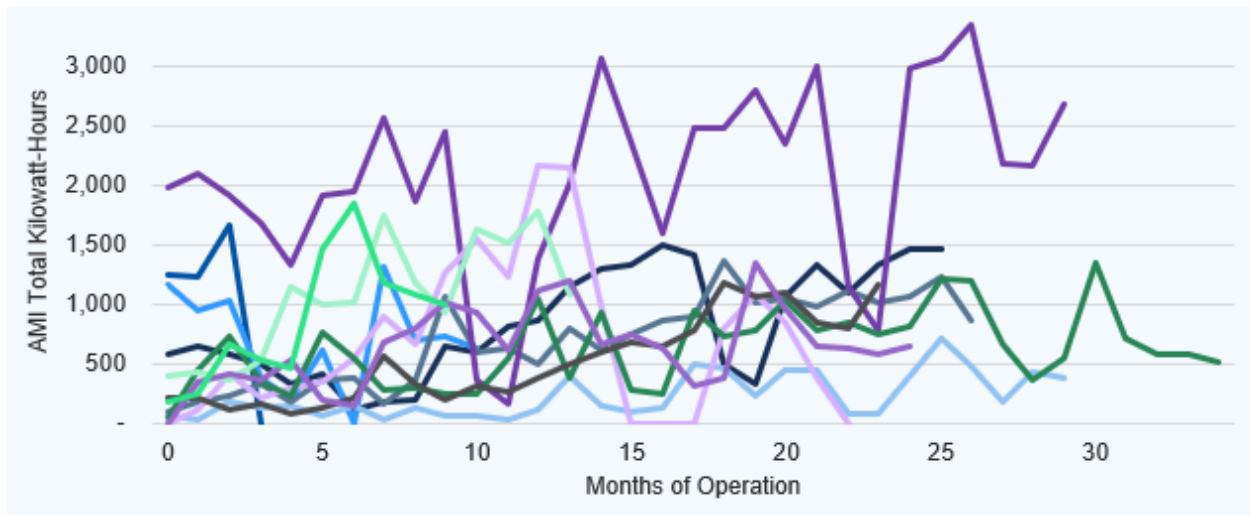


Figure 119. SCE Schools Pilot Monthly Energy Consumption (<15% Load Factor)



The oldest sites have been operational for three years, while a large portion of sites have been operational over 18 months. This analysis begins when a site sees initial charging sessions rather than when AMI data is first available to eliminate early periods when chargers are powered up but not necessarily commissioned by their NSPs or available for use.

Figure 120 and Figure 121 show the monthly load factor of School Pilot sites. Load factors compare a site's actual monthly energy consumption to its highest possible consumption if the maximum-demand 15-minute interval were consistent all month. A constant demand, for example, would result in a 100% load factor (which is highly unlikely in practice).

One third of the sites have reached over 15% load factor at some point and generally have a much higher minimum load factor than the other sites.

Figure 120. SCE Schools Pilot Monthly Load Factor (>15%)

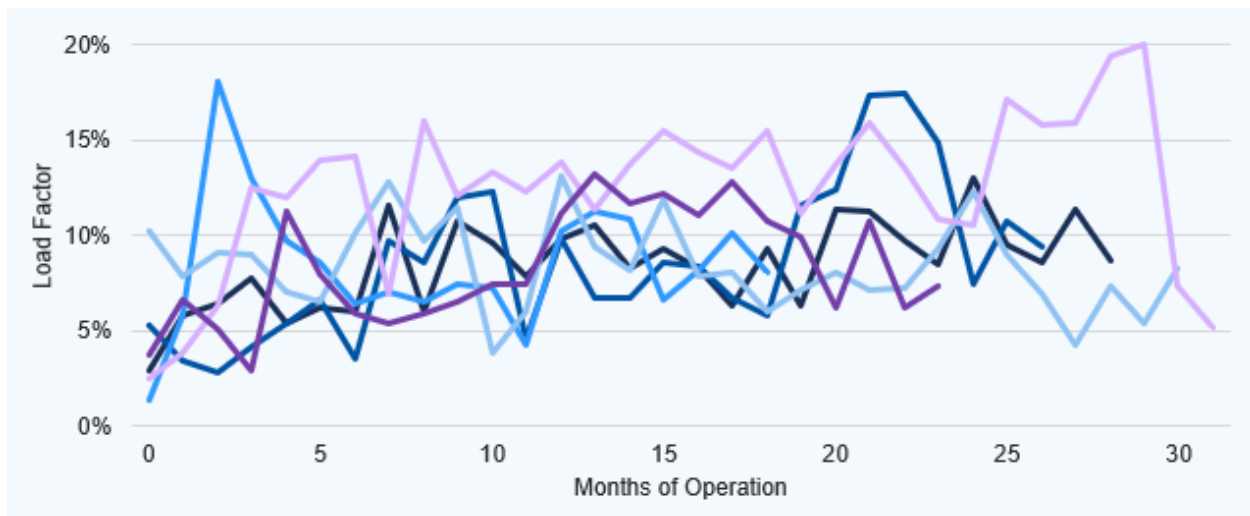
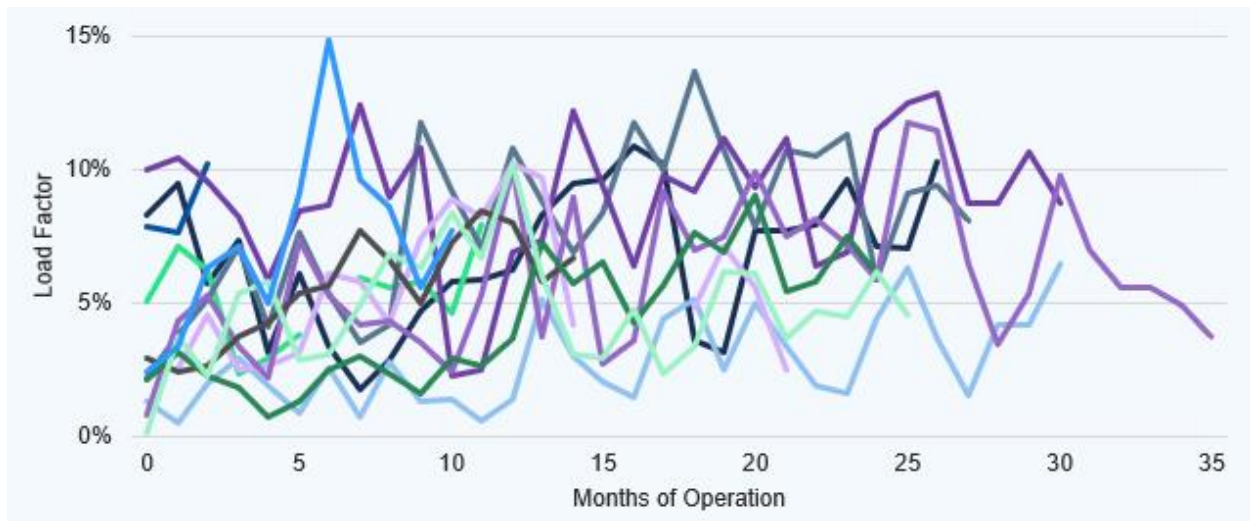


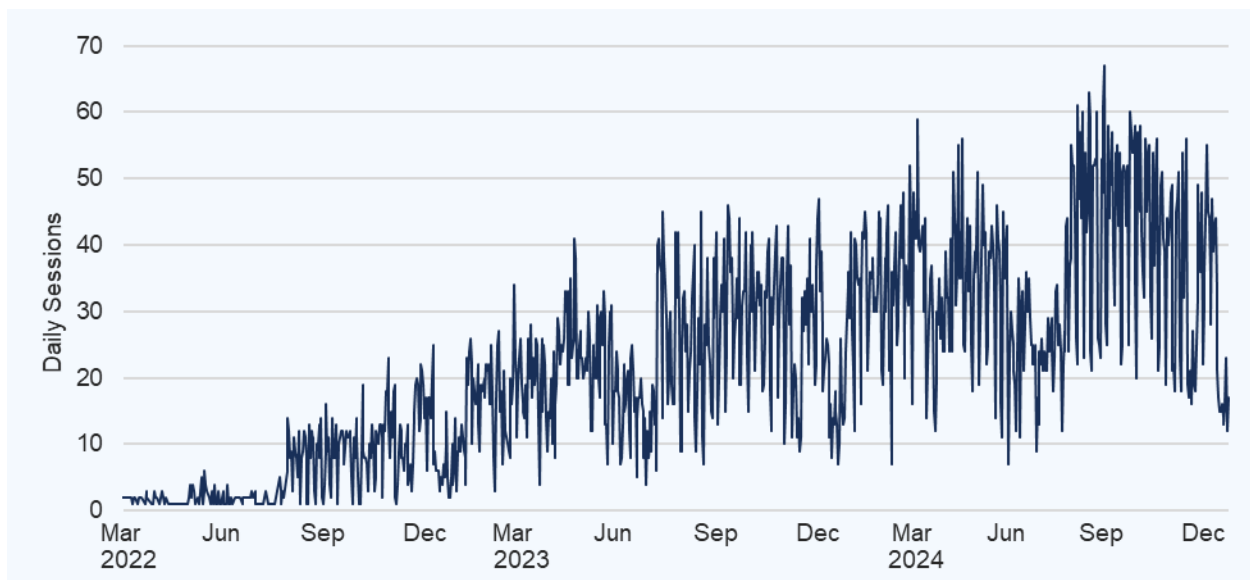
Figure 121. SCE Schools Pilot Monthly Load Factor (<15%)



The graphic shows that the load factor for most of these sites currently hovers between 6% and 12%. Some low months represent summer or school breaks when charging is less likely to occur. Overall, the load factor suggests that maximum demand is very inconsistent at most sites and may reflect what is currently low utilization and the EV audience still developing for these sites.

Figure 122 presents the total number of charging sessions in the Schools Pilot. Over 20,000 charging sessions have occurred in the program to date, with approximately 60% in 2024. Before the holidays in 2024 utilization was approaching 60 sessions a day. Based on the following chart, the portfolio consistently appears to be increasing utilization.

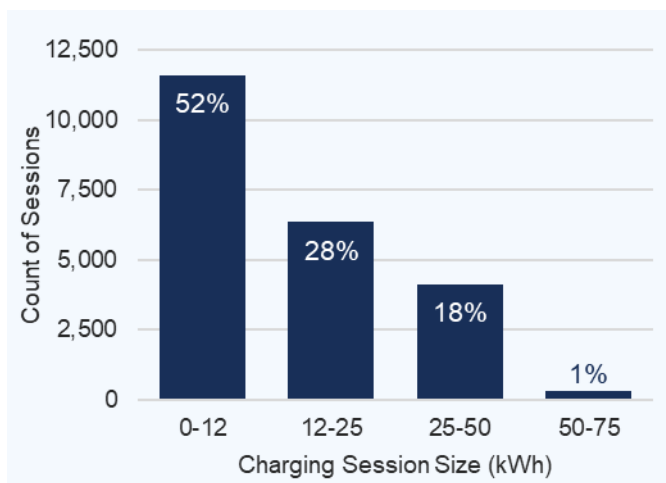
Figure 122. SCE Schools Pilot Daily Charging Sessions for PTD Sites



Given that these sites are within school districts, there is a noticeable valley throughout the Summer and Winter break periods.

Figure 123 presents the distribution of charging sessions by consumption (kilowatt-hours) and by the duration of those charging sessions (hours) for all sites in the Schools Pilot to date. As shown, over 50% of all charging sessions were less than 12 kWh, representing shorter charging sessions. Only 1% of charging sessions were over 50 kWh, which would likely represent a vehicle charging with a nearly depleted battery at the beginning of a charging session. Erratic charging sessions (below 1 kWh or less than 0.1 hours) were not included.

Figure 123. SCE Schools Pilot Charging Session Count by Consumption Size PTD



Highlights

- Sites in the Schools Pilot reached a total consumption of over 250 MWh in 2024, leading to a pilot-to-date total of 415 MWh.
- One site was activated in 2024, yielding 22 total activated sites through the end of 2024.
- The majority (52%) of charging sessions dispensed less than 12 kWh.

Petroleum Displacement

The Evaluation Team estimated Pilot-induced petroleum displacement related to the 21 operational SCE Schools Pilot sites using three key pieces of information: electricity used for vehicle charging, EV annual miles traveled, and annual counterfactual vehicle fuel consumption. From this information, we estimated the reduction in equivalent gallons of petroleum as a result of the SCE Schools Pilot. Table 56 presents petroleum displacement impacts for the Schools Pilot sites through 2024, including estimated actual impacts for 2024, actual impacts for all sites PTD, and a 10-year forecast for pilot-to-date sites.

Table 56. SCE Schools Pilot Petroleum Displacement Summary, PTD Sites

DAC	Usage (n=21)				Petroleum Displacement (GGE)		
	2024 Actual ^a (kWh)	PTD Actual ^b (kWh)	2024 Actual Use (miles)	PTD Actual Use (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC	111,752	169,530	332,763	505,042	8,870	13,594	82,600
Outside DAC	140,619	245,627	419,076	732,165	11,489	20,143	109,748
Total	252,371	415,157	751,839	1,237,207	20,359	33,737	192,348

^a "2024 Actual" represents the data from all activated sites from program inception for the calendar year 2024.

^b "PTD Actual" represents the data from all activated sites from program inception for all program years.

Highlights

- The 21 operational sites collectively achieved a PTD impact of nearly 34,000 gallons of petroleum, with 44% within DACs in 2024.
- Over a 10-year period, the sites will displace more than 190,000 gallons of petroleum.

Greenhouse Gas and Criteria Pollutant Impact

The Evaluation Team calculated reduced emissions from displaced fossil fuel use from ICE vehicles that were not in service as a result of the SCE Schools Pilot. The Team first developed one ICE counterfactual, then calculated the emissions associated with this vehicle under conditions that otherwise matched the EVs to provide a baseline. Although EVs have no tailpipe emissions, the fossil-fuel power plants that supply electricity to the vehicle chargers still release some GHGs and criteria pollutants.

Table 57 presents the GHG reduction resulting from the 21 operational Schools Pilot in 2024, along with the PTD and 10-year totals, by impact location. Overall, the Schools Pilot achieved a reduction of 82% of GHG emissions (264 MT total) relative to the counterfactual to date (324 MT, not shown in table), with just 41% of the impact within DACs.

Table 57. SCE Schools Pilot GHG Reductions Summary, PTD Sites

DAC	Usage (n=21)				GHG Reduction (MT)		
	2024 Actual ^a (kWh)	PTD Actual ^b (kWh)	2024 Actual Use (miles)	PTD Actual Use (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC	111,752	169,530	332,763	505,042	74	108	720
Outside DAC	140,619	245,627	419,076	732,165	94	156	942
Total	252,371	415,157	751,839	1,237,207	167.7	264.3	1,662

^a “2024 Actual” represents the data from all activated sites from program inception for the calendar year 2024.

^b “PTD Actual” represents the data from all activated sites from program inception for all program years.

Of the local emissions, the Schools Pilot had the highest impact in reducing CO, resulting in an estimated PTD reduction of 754 kg and a projected 10-year reduction of more than 4,000 kg (Table 58).

Table 58. SCE Schools Pilot Local Emissions Net Reductions

Emissions	EY2024 Sites (n=1)			PTD Sites (n=21)	
	Inside DAC	Outside DAC	Total ^a	Actual	10-Year Projection
PM ₁₀ (kg)	0.0002	0	0.0002	1.33	7.8
PM _{2.5} (kg)	0.0002	0	0.0002	1.23	7.1
ROG (kg)	0.002	0	0.002	22.25	164.5
CO (kg)	0.091	0	0.091	754	5,429

^a Columns may not sum to total due to rounding.

Figure 124 shows the mix of electricity from the CAISO grid used to support the SCE Schools Pilot sites.⁶⁹ Based on the real-time grid conditions when the EVs charged, the overall energy mix contained about 60% zero-emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 30% natural gas. With the CAISO grid adding more renewables to meet the Renewable Portfolio Standard, GHG and criteria pollutant emissions will continue to decrease.

Figure 124. SCE Schools Pilot Net Electricity Mix, Pilot to Date

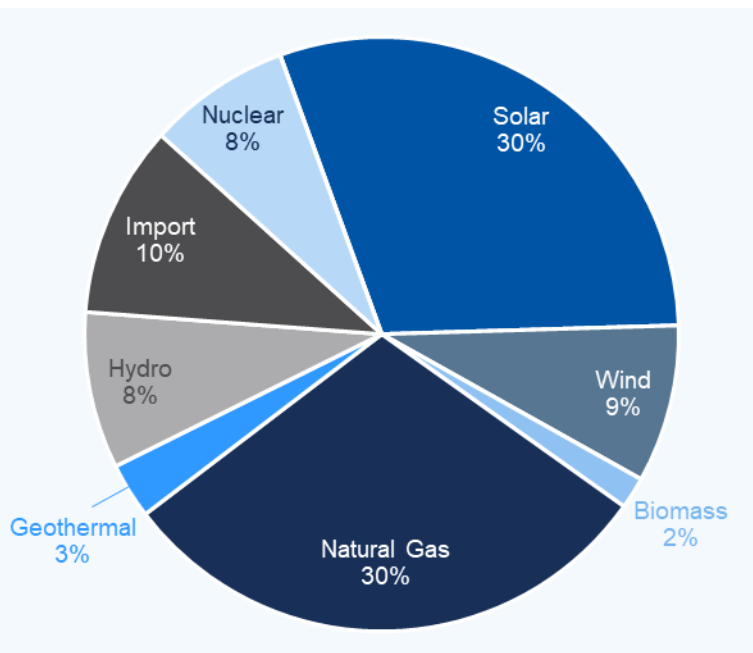
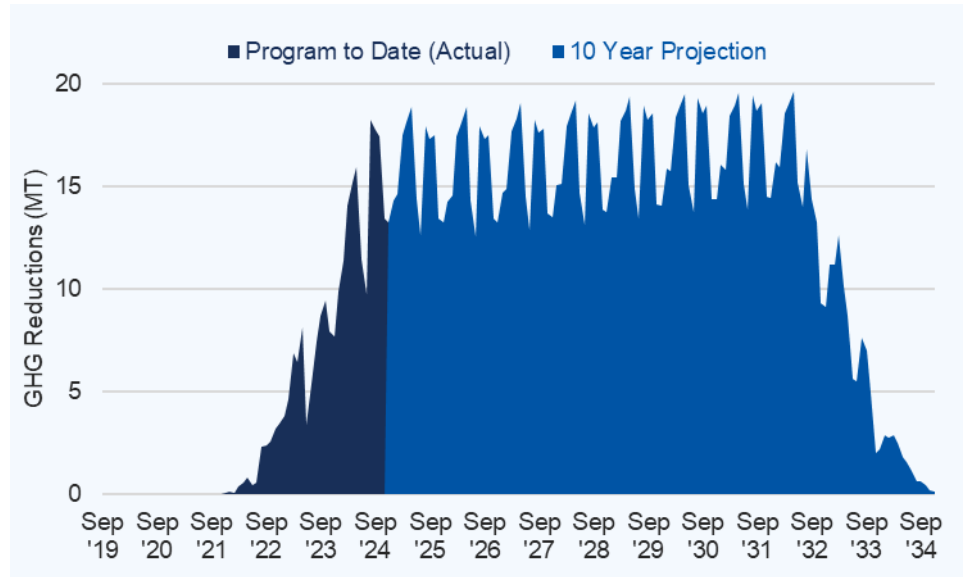


Figure 125 shows how Pilot GHG reductions have increased to date and are expected to grow over time for all activated sites. The analysis period ranges from the date of activation for the first site in the Pilot through the end of 2024. The analysis incorporates the net reduction (counterfactual emissions minus utility emissions) for each site within the SCE Charge Ready Schools Pilot. Emissions reductions from the pilot to date are shown in dark navy, while anticipated benefits based on annualization appear in royal blue. Starting dates of site operation vary, so the 10-year sunset for each site appears as a gradual tapering off of Pilot benefits after 2032. While each year's operations appear similar, there are several key factors driving the variations such as seasonality of Utility generation sources (high utility emissions will appear as a dip on the curves), holidays occurring on weekends versus weekdays, and extrapolation for sites that became operational late in 2024 and will operate year-round in future years.

⁶⁹ The power associated with imports comes from a mixture of hydro, nuclear, and natural gas plants located outside the CAISO grid.

Figure 125. SCE Schools Pilot Historical and Forecasted GHG Reductions, Pilot-to-Date Sites



Highlights

- In 2024, the Schools Pilot achieved an 82% reduction of GHG to date with 41% of its impact occurring within DACs.
- The greatest reduction in local emissions in 2024 was for CO with a projected 10-year period reduction of more than 5,400 kg.
- Based on the real-time grid conditions when EV charging occurred, the overall energy mix contained about 60% zero-emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 30% natural gas.

Health Impacts

The Evaluation Team calculated public health impacts (as benefits and costs) of reductions in criteria pollutants from vehicle electrification. Pollutants included in the analysis are primary PM_{2.5} and precursors of secondary PM_{2.5}, including NO_x, SO₂, NH₃, and VOCs. This analysis considered only tailpipe emissions reductions rather than full lifecycle emissions (such as power plant emissions). The Evaluation Team used the EPA's COBRA to evaluate the health benefits associated with emissions reductions. COBRA estimates the county-level benefits for the county in which emissions are reduced. It also estimates the effect of the transport of emissions on all counties in the United States; however, this analysis includes only the effects of the emissions reductions in California. The Evaluation Team disaggregated the county-level effects to estimate the potential health benefits of sites for DACs and non-DACs.

Economic value depends on the health effects associated with the emissions, that is, whether they are associated with illnesses or death. The monetary value of the morbidity reductions associated with emissions reductions include avoided lost wages, avoided medical costs, and the amount of money

people are willing to pay to avoid an illness or condition like respiratory disease. The value of the reduced mortality associated with emissions reduction is measured by the value of a statistical life, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low and high impact, representing the uncertainties in the estimates.

The total value of the health benefits associated with emissions reductions from the Charge Ready Schools program for activated PTD sites is between \$3,268 and \$4,619. Table 59 shows the cumulative health benefits in California broken down by the electrification of SCE Charge Ready School sites for the program to date health endpoint.

Table 59. SCE Schools Pilot California Health Benefits for PTD Sites in 2024

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Mortality	Mortality	< 0.000	< 0.000	\$2,867
Avoided Medical Care				
Hospitalization, Respiratory	< 0.000	< 0.000	\$0	\$0
Hospitalization, Cardiovascular	< 0.000	< 0.000	\$0	\$0
Hospitalization, Other	< 0.000	< 0.000	\$1	\$1
ER Visits, Respiratory	< 0.000	< 0.000	\$1	\$1
ER Visits, Cardiovascular	< 0.000	< 0.000	\$0	\$0
Out of Hospital Heart Attacks	< 0.000	< 0.000	\$0	\$0
Nonfatal Heart Attacks	< 0.000	< 0.000	\$5	\$5
Stroke	< 0.000	< 0.000	\$0	\$0
Lung Cancer	< 0.000	< 0.000	\$0	\$0
Asthma	0.223	0.223	\$180	\$180
Hay Fever	0.009	0.009	\$10	\$10
Lost Productivity				
Minor Restricted Activity Days	0.08	0.08	\$10	\$10
Work Loss Days	0.014	0.014	\$4	\$4
School Loss Days	0.107	0.107	\$187	\$187
Total Health Effects	-	-	\$3,268	\$4,619

As part of this analysis, the Evaluation Team also examined health benefits within DACs, which may be disproportionately burdened by sources of pollution (including air pollution from ICE vehicles). Because COBRA estimates effects at only the county level, the Evaluation Team disaggregated the health benefits by census tract using the relative population of each tract from the most recent American Community Survey. For example, we allocated 10% of the value of the health benefits to a census tract with 10% of the county's population. The Evaluation Team then estimated the total benefits allocated to DACs and non-DACs.⁷⁰ This approach assumes that the benefits of emissions reductions are distributed evenly

⁷⁰ DAC census tracts are defined as those included in the SB 535 Disadvantaged Communities List (2022), which includes DAC categories for CalEnviroScreen 4.0 Top 25%, CalEnviroScreen 4.0 High Pollution Burden Score and Low Population Count, and 2017 Disadvantaged Community (CalEnviroScreen 3.0 only).

throughout the county. If the sites are located in DACs, and the emissions reductions are greater in the tracts near the sites, this approach understates the potential benefit to DACs. Additional information about emissions dispersion within counties would provide more precise estimates of health benefits to DACs and non-DACs.

In our analysis, Los Angeles County had 31% of the total benefits, followed by Orange County (23%), Riverside County (13%), San Diego County (9%), and San Bernadino (8%). Overall, 26% of the total benefits were in DACs.

Highlights

- Cumulative health benefit results in California realized by the Charge Ready Schools sites in terms of monetary benefits range from \$3,268 for the low estimate to \$4,619 for the high estimate.
- Los Angeles County had 31% of the total benefits, followed by Orange County (23%), Riverside County (13%), San Diego County (9%), and San Bernadino (8%).
- The proportion of overall benefits attributed to DACs for the program to date is 26%.

Utility Staff Insights

In addition to monthly check-in calls with key SCE staff to discuss the status of the Schools and Parks Pilots, the Evaluation Team also conducted a close-out interview with staff in March 2025 to review overall Pilot challenges and successes in EY2024. The following sections group these challenges and successes by those that apply to both pilots followed by those that are applicable to only one pilot.

Schools Pilot and Parks Pilot

Starting 2021 and through 2024, SCE staff reported that site construction costs were higher than originally anticipated in 2018 (when the program funding cap was decided). These costs were influenced by labor constraints, material costs, and supply chain delays. Several years into implementation and dealing with the reality of increasing costs, SCE staff have learned to account for increased costs when planning as detailed in evaluation reports in prior years.⁷¹

Schools Pilot

Since the Schools Pilot is nearing completion, challenges for the 2024 Schools Pilot surrounded construction, maintenance, and operational barriers:

- **Permitting.** Continued from 2022, staff noted in 2024 that jurisdictions and organizations that had authority to provide permits (such as the Division of State Architect) continue to have long lead times before site permits are approved, causing delays in beginning construction for many school sites.

⁷¹ Cadmus, Energetics, et al. October 2024. "Standard Review Projects and AB 1082/1083 Pilots: Evaluation Year 2023 (Year 3)." <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/sb-350-te/srp-ab10821083-2023-evaluation-report102024.pdf>

- **Vandalism.** In 2024, four constructed sites were vandalized, an increase from two vandalized sites in 2023. Three sites had cables stolen, and two of those sites had cables stolen twice. Although SCE is working with affected schools to address these issues, safety measures, such as mitigation practices, continue to be considered at activated sites. Additionally, repair costs due to vandalism strained the program budget because they are not covered by warranty, meaning SCE must pay for repairs out of the program budget.
- **Ownership Models and Maintenance Responsibilities.** With many Charge Ready Schools sites having finished construction and transitioning to long-term maintenance in 2024, there is an ongoing need to clarify the responsibility structure between SCE, EVSE providers, and schools. The EVSE providers often invoice schools instead of SCE for maintenance costs due to a lack of clarity on warranty coverage. The resulting unexpected maintenance costs, in addition to increased coordination between SCE, EVSE providers, and schools, have added strain to the program's budget.

Although staff identified some challenges at this stage in the Schools Pilot, they also noted successes for 2024. In particular, SCE received positive feedback from participating schools and was able to successfully roll out its custom curriculum to schools in its territory:

- **Positive Engagement and Feedback from School Sites.** Continuing from 2023, in 2024 SCE staff noted that once construction was completed and chargers were utilized, some school staff and stakeholders become enthusiastic about having the chargers there. According to Utility staff, this has led to positive word-of-mouth promotion of the chargers, the Pilot, and sometimes to districts contacting SCE to explore possibilities of more chargers at existing sites and/or new sites at different schools. Additionally, schools have expressed satisfaction with SCE's handling of maintenance issues and costs for utility-operated sites.
- **School Curriculum.** In 2024, SCE, in partnership with TEC, continued to promote the EV-focused Schools Pilot Curriculum (primarily designed in 2022). TEC proactively engaged schools by conducting in-person and virtual outreach to districts. This led to increased enrollment in the curriculum in 2024. SCE and TEC staff hold monthly check-in meetings to monitor the outreach and adoption progress.
- **Increased Touchpoints with Schools.** As a part of SCE's efforts to improve communication with site hosts, program staff held joint onboarding training sessions with EVSE providers to speak about SCE's role and provide an overview of the program's steps. This has helped EVSE providers maintain good relationships with schools, in addition to increasing SCE's communication with schools.

Parks Pilot

In 2022, SCE was able to receive the signed MPA from the State Parks Department and eight of the sites were secured in 2023. In 2024, SCE succeeded in securing the ninth and final site, including the addendum agreement for the site. Most of the program's activity was focused on finalizing site design,

permitting, and starting to plan for construction in 2025. Challenges for the Parks Pilot mainly revolved around design delays and coordination with state and local Parks staff:

- **Cross-Jurisdiction Coordination.** With the MPA signed by state-level authorities at the DPR, SCE staff have moved on to primarily coordinating with local districts on design plans. While they have managed to navigate the varying needs across sites, coordinating with both site-specific and state-level staff has presented some challenges. Staff turnover at DPR and the handoff from State Parks to district staff have led to minor delays in site planning and implementation. There have also been minor delays due to communication challenges with district-level staff, who often were not involved in initiating the Pilot and face competing priorities.
- **Site-Specific Design Concerns.** Staff shared that a district noted that at one site, the initial design plans did not account for a specific cultural concern and involved digging over ancient burial grounds. As a result, the site's design had to be revised to avoid disturbing the area.

Despite these challenges, SCE staff reported that overall, it was a productive year for the Parks Pilot due to several major successes:

- **Secured Final Addendum.** Though coordinating with staff across multiple jurisdictions can be challenging, ultimately SCE succeeded in securing the ninth and final site-specific addendum agreement in 2024.
- **Direct Engagement with Parks Districts.** In 2024, SCE held meetings with every single participating Parks district to discuss the program and walk through the program's steps, which helped to solidify direct district engagement. SCE staff noted that increased communication is key to understanding how individual districts function and to establishing more accurate, favorable timelines and setting achievable expectations.
- **Interest in Fast Charging.** SCE staff noted that site hosts had expressed more interest in fast charging than anticipated, even at the sites where fast chargers are not being installed through the Parks Pilot.

Highlights

- **Schools:** With many Charge Ready Schools sites having finished construction and transitioning to long-term maintenance in 2024, there has been an ongoing need to clarify responsibility structure between SCE, EVSE providers, and schools. SCE began holding joint training sessions for schools with EVSE providers to improve communication and clarify roles and responsibilities for the sites.
- **Schools:** SCE received positive feedback from participating schools and saw increased interest in chargers and curriculum after targeted outreach and onboarding sessions.
- **Parks:** SCE secured the final site addendum and moved forward with design and permitting.
- **Parks:** While cross-jurisdiction coordination posed some delays, SCE built stronger relationships with district staff through direct outreach and regular engagement. Some sites also expressed growing interest in fast charging.

4.2.3. Lessons Learned

Schools Pilot

The Schools Pilot sites are helping to displace petroleum, reduce GHG and local emissions, and achieve nominal health impacts overall and within DACs.

SCE's Schools Pilot sites to date have displaced nearly 34,000 gallons of petroleum, with 40% within DACs. In addition, all pilot-to-date sites resulted in an 82% reduction in GHG, with 40% of the impact and 26% of the health benefits in DACs, and the total monetized health benefits ranging from \$3,268 to \$4,619. These sites all contributed to lowering local emissions, with CO reduction showing the most prominent projected reductions of 5,400 kg over a ten-year period.

Utilization of Schools Pilot sites is increasing, in both number of sessions and overall energy consumption, partly because of increasing public usage.

Despite only one new site activation in EY2024, overall energy consumption from the Schools Pilot sites more than doubled to 252 MWh from 121 MWh in EY2023. Over 20,000 charging sessions have taken place in the pilot to date, with over 60% occurring in EY2024. Energy consumption rose steadily throughout EY2024, from approximately 16 MWh in January to 23 MWh in November, with dips in demand in June, July, and December, which coincide with breaks in the school year. Charging activity outside of school hours at some sites, including on the weekends, indicates that sites are supporting the local community in addition to school employees. Most charging sessions (52%) are small, with less than 12 kWh dispensed per session.

Although site costs continue to remain high, over the last three years SCE staff have identified several effective strategies to mitigate costs and have been able to spend more time on improving communication and pilot processes.

SCE began the Schools and Parks Pilots during the COVID-19 pandemic, which had unprecedented economic impacts across nearly every market. These changes were so significant that the estimates SCE had created for Decision 19-11-017 (which mandated the Schools and Parks Pilots at their determined funding levels) did not reflect the actual costs for site implementation. Though higher-than-expected costs continued to strain the program budget in EY2024, SCE staff have been able to better anticipate the impact of increased costs to plan site costs more accurately by using final costs from previously completed projects in the program as a reference. In EY2024, program staff focused more attention on improving communication with the schools and EVSE providers as more schools transitioned to maintenance for their operational sites. The average Utility infrastructure cost of TTM and BTM borne by SCE across sites in the pilot to date was \$243,510 per site and \$4,861 per kilowatt of installed charging capacity.

SCE's Schools Pilot has a nominal, but growing, influence on neighborhood EV adoption.

In EY2024, the Schools Pilot increased the number of operational sites by one, to 22 total. The model's output shows that the Schools Pilot may have contributed to the PTD EV adoption of 56 EVs for households neighboring the infrastructure.

Parks Pilot

By improving coordination with district-level DPR staff, SCE staff secured the final site addendum in EY2024.

In 2022, SCE received a signed MPA from the State Parks Department, and in 2023 it secured eight of Parks Pilot sites. In EY2023, although discussions regarding individual site design with district-level DPR staff were generally productive, SCE staff noted that coordinating with district- and state-level staff paired with DPR staff turnover led to minor delays throughout the site planning and implementation process. In EY2024, SCE staff focused on improving the regularity and increasing the cadence of communications with district-level staff and fostered stronger relationships by engaging in conversations about other electrification interests, such as fast charging. In addition, staff succeeded in securing the ninth and final site, including completing the addendum agreement for the site.

5. Pacific Gas & Electric Transportation Electrification Programs

5.1. EV Fleet Program

5.1.1. Overview

This overview provides a detailed description of the PG&E EV Fleet program, summaries of the program implementation process, performance metrics, materials, and budget; and a timeline of major milestones. Following the overview are detailed findings, highlights, and lessons learned.

Program Description

Per Decision 18-05-040, PG&E designed the EV Fleet program to provide infrastructure for fleet electrification at low or no cost to participants. The program launched in June 2019 and encompasses incentives and rebates, site design and permitting, construction, activation, maintenance, and upgrades. The program goal is to help fleets install EV charging infrastructure easily and cost-effectively, saving money, eliminating tailpipe emissions, and simplifying vehicle maintenance. PG&E's EV Fleet program has an approved budget of \$236.3 million.⁷² The program originally aimed to complete 700 sites; however, in 2024 Resolution E-5257 reduced this goal to support fleet electrification for a minimum of 375 sites. The vehicle goal remained consistent at 6,500 medium-duty and heavy-duty (MDHD) EVs to be procured or converted through the program.

EV Fleet Program Target

Achieve a minimum of 375 sites supporting 6,500 MDHD EVs.

EV Fleet Program Design Goal

Accelerate adoption by providing fleet assistance to install EV charging easily and cost-effectively, saving money, eliminating tailpipe emissions, and simplifying maintenance.

Through the EV Fleet program, PG&E constructs all TTM infrastructure and, depending on the cost-effectiveness of each site, will cover the costs for BTM infrastructure. Otherwise fleet operators design, build, own, operate, and maintain BTM infrastructure. PG&E provides rebates for BTM infrastructure based on the number of vehicles the infrastructure supports, capped at 80% of the cost of the BTM infrastructure. Additional charger rebates of up to 50%

of the cost of the EVSE are available for transit agencies, school districts, and fleets located in DACs that are not operated by Fortune 1000 companies.

The EV Fleet program requires participating customers to lease, purchase, or convert at least two MDHD EVs. Applicants are not restricted by industry. Fleets must own or lease the property where the chargers are installed, operate and maintain the infrastructure for 10 years, provide data related to EV usage for five years, and use EVSE that meets CPUC safety checklist requirements among other participation requirements. PG&E offers participating sites EV-specific TOU rates (BEV-1 and BEV-2).

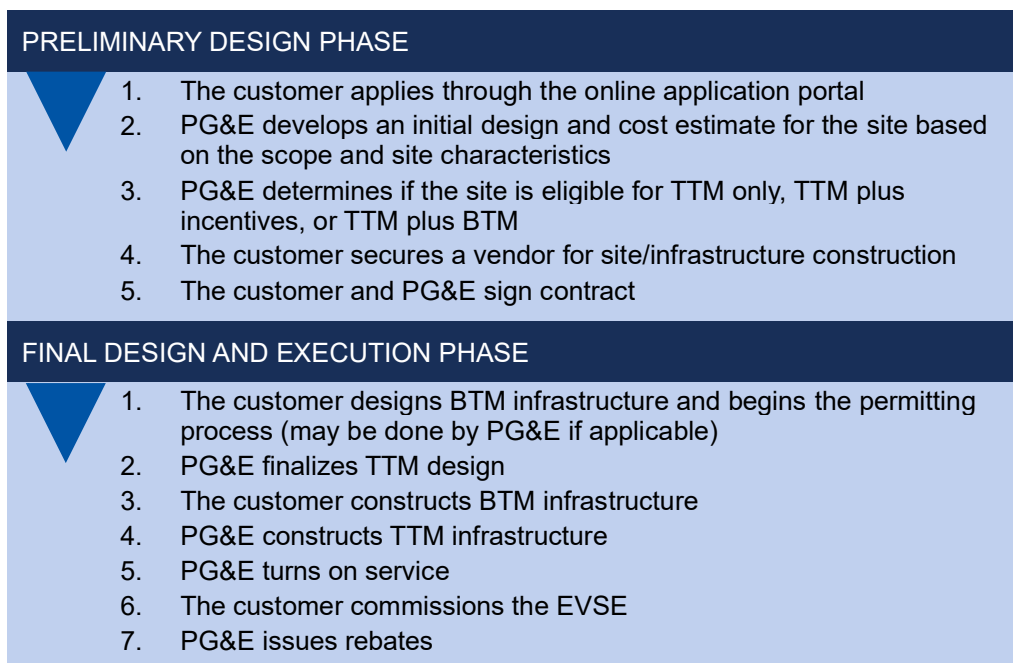
⁷² This amount does not include the evaluation budget.

The SB 350 Decision specifies how PG&E should distribute EV Fleet program funding. The infrastructure budget must allocate a minimum of 15% for transit agencies, a maximum of 10% for forklifts, and a minimum of 25% on installations in DACs in PG&E’s territory.

Implementation

Figure 126 shows the key steps in the EV Fleet program implementation process. There were no major changes to the implementation process in 2024.

Figure 126. PG&E EV Fleet Program Implementation Process



Program Performance Metrics

The Evaluation Team reviewed the sites participating in the PG&E EV Fleet program and organized them by program status. Table 60 provides the count of sites in the PG&E EV Fleet program by completion status as of December 31, 2024.

Table 60. PG&E EV Fleet Program Complete Site Count by Status

Site Status	EY2024	Program to Date
Utility Construction Complete	42	115
Activated	46	108
Operational	43 ^a	103
Closed Out	39	91

^a Despite being operational, usage data was not available for two sites at the time of the 2023 evaluation report. For purposes of evaluation reporting, these two sites are counted as newly operational sites in 2024, which is when they were first reported as operational.

In EY2024, the PG&E EV Fleet program received an additional 158 applications, signed contracts with 79 sites, and activated 46 sites to support 1,132 MDHD EVs across five market sectors. This increased the

total number of applications received to date by the PG&E EV Fleet program to 525 and the total number of contracts executed to date to 318.⁷³ As Table 61 displays, 46% (21 of 46) of sites in the EV Fleet program activated in EY2024 are in a DAC, and 44% (48 of 108) of sites activated to date are located within a DAC.

Table 61. PG&E EV Fleet Program Activated Sites by Market Sector in EY2024 and Program to Date

Market Sector	EY2024		Program to Date	
	Number of Sites in DAC	Number of Sites in Non-DAC	Number of Sites in DAC	Number of Sites in Non-DAC
Forklift	1	1	4	2
Heavy-Duty Vehicle	5	3	12	6
Medium-Duty Vehicle	9	10	13	15
School Bus	5	7	14	28
Transit Bus	1	4	5	8
TRU	–	–	–	1
Total	21	25	48	60

In EY2024, the highest participation rate in the PG&E EV Fleet program came from the medium-duty vehicle market sector, which represented 41% of activated sites. School bus fleets represented 26%, followed by heavy-duty vehicle fleets with 17% of EY2024 activated sites. Of EY2024 activated sites, 11% were transit bus fleets, while only 4% were forklift sites.

Participation in the PG&E EV Fleet program continues to be dominated by school bus fleets, which represent 39% of all activated sites in the program to date. Medium-duty vehicle fleets are the second most common market sector overall, with 27% of all activated sites. Heavy-duty vehicle fleets account for 16% and transit bus fleets for 12% of activated sites, while the forklift and TRU market sectors combined have the fewest sites, with less than 10% of activated sites as of December 31, 2024.

Through the EV Fleet program, PG&E installed charging infrastructure to support 1,132 MDHD vehicles across five market sectors in EY2024 based on five-year VAPs submitted by customers at the time of application. This brings the total number of supported MDHD EVs in PG&E's EV Fleet program to 2,006 per VAPs. In EY2024, medium-duty vehicle market sector accounted for most vehicles, followed by heavy-duty vehicle, school bus, transit bus, and forklift market sectors, as shown in Figure 127.

⁷³ Total applications includes any applications that were put on hold. Total contracts does not include sites that were rejected or withdrawn

As shown in Table 62, the PG&E EV Fleet program had 108 activated sites to date, supporting the electrification of 2,006 MDHD vehicles per customers' VAPs. The 318 contracts signed in the EV Fleet program meet 85% of the program's *per se reasonableness* goal of 375 sites and could support 6,547 MDHD vehicles, meeting 100% of the program's *per se reasonableness* goal of 6,500 vehicles electrified. The total 525 customer applications could satisfy the program's site goal and electrified vehicles goal.

Figure 127. PG&E EV Fleet Program Vehicles Supported by Market Sector, EY2024 Sites

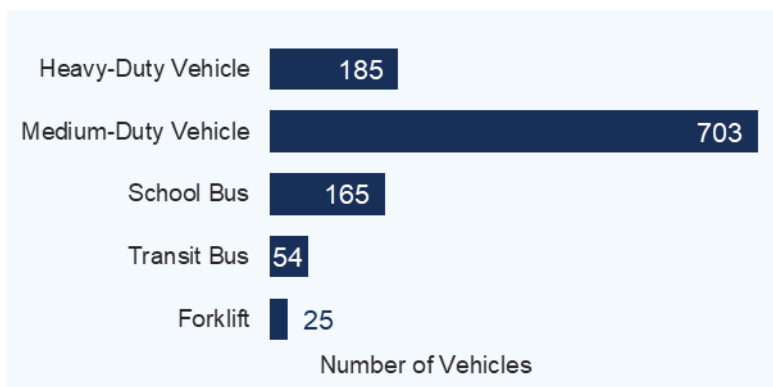


Table 62. PG&E EV Fleet Program *Per se Reasonableness* Site and Vehicle Goal Progress

Program Metric	<i>Per se Reasonableness</i> Goal	Program to Date
Activated Sites	375	108
MDHD EVs	6,500	2,006

The 46 sites activated in EY2024 installed 1,009 charging ports to support the 1,132 electrified MDHD vehicles. L2 ports accounted for 687 of these, with 322 DCFC ports making up the remainder. In the PG&E EV Fleet program to date, 1,658 L2 and DCFC ports have been installed at activated sites to support charging of 2,006 MDHD EVs in the EV Fleet program, equating to roughly 1.2 vehicles per charging port.

The CPUC established six phases in program timelines per the SB 350 reporting template. As displayed in Table 63, at the end of 2024 over a third of customer applications (34%) were in the Design and Permitting phase, which is a potential bottleneck because it involves external review and requires communication with applicants to finalize site plans. Overall, the majority (81%) of sites were in either Application Review, Design and Permitting, or Activation, with the remaining 19% of sites in the Site Assessment, Contract Issuance, and Construction Complete phases.

Table 63. PG&E EV Fleet Program Sites and Vehicles by Program Phase as of December 31, 2024^a

CPUC Program Phase	Number of Sites	Total Number of EVs Supported
Application Review	168	2,615
Site Assessment	41	925
Contract Issuance	64	1,100
Design and Permitting	203	4,212
Construction Complete	6	57
Activation ^b	109	2,278

^a This table includes sites that were not cancelled or on hold as of December 31, 2024.

^b Sites in the Activation phase exceeds Activated Sites in the program to date because this table includes sites that have entered but have not yet completed this program phase.

Table 64 displays the median durations per program phase (measured in calendar days) for EY2024 and program to date activated sites. The column labeled EY2024 refers to sites activated in 2024. The Program to Date column refers to all sites activated from the initiation of the program through December 31, 2024.

Values in Table 64 provide insight into program phase length trends over time. Sites in each column did not necessarily pass through each phase in the same calendar year. For example, some sites in the EY2024 column may have passed through Design and Permitting in 2024 while others passed through in 2023. For sites activated in 2024, the Design and Permitting program phase had the longest median duration, while the remaining five program phases had roughly equivalent median durations.

Table 64. PG&E EV Fleet Program Median Calendar Days per Phase for EY2024 and PTD Sites

CPUC Program Phase	Median Calendar Days	
	EY2024	Program to Date
Application Review	42	28
Site Assessment	35	42
Contract Issuance	63	53
Design and Permitting	634	427
Construction Complete	23	30
Activation	33	22

Median durations also vary by individual market sectors. For instance, heavy-duty vehicle applications took a median of 399 days to complete the Design and Permitting phase, while transit bus applications took a median of 872 days to pass through this program phase. The median durations per program phase in EY2024 were similar to their PTD counterparts for all phases except the Design and Permitting phase. The Design and Permitting Phase had significantly longer median durations for EY2024 (624 days) when compared to PTD (427 days). Design and Permitting also continues to be the longest phase, with a median of 427 days PTD, or 56% of the overall implementation timeline.

Figure 128 expands the analysis of program phase durations for EY2024 by displaying the average number of calendar days (denoted by X), the median calendar days (middle line in box), first quartile (bottom of box), third quartile (top of box), minimum (bottom tail), maximum (top tail), and outliers (dots). Program applications experienced far greater variation in completion time within the Design and Permitting phase than in any other program phase. As previously mentioned, this could stem from this phase's external review and substantial back-and-forth with applicants to finalize site layout, design, and BTM. This was followed by Construction Complete, which requires coordination among contractors and supply chain vendors. Customer applications in the Application Review, Site Assessment, Contract Issuance, and Activation phases experienced the lowest mean and variance in calendar days among all the program phases, despite a few outliers.

Figure 128. PG&E EV Fleet Program Calendar Days per Phase for EY2024 Sites

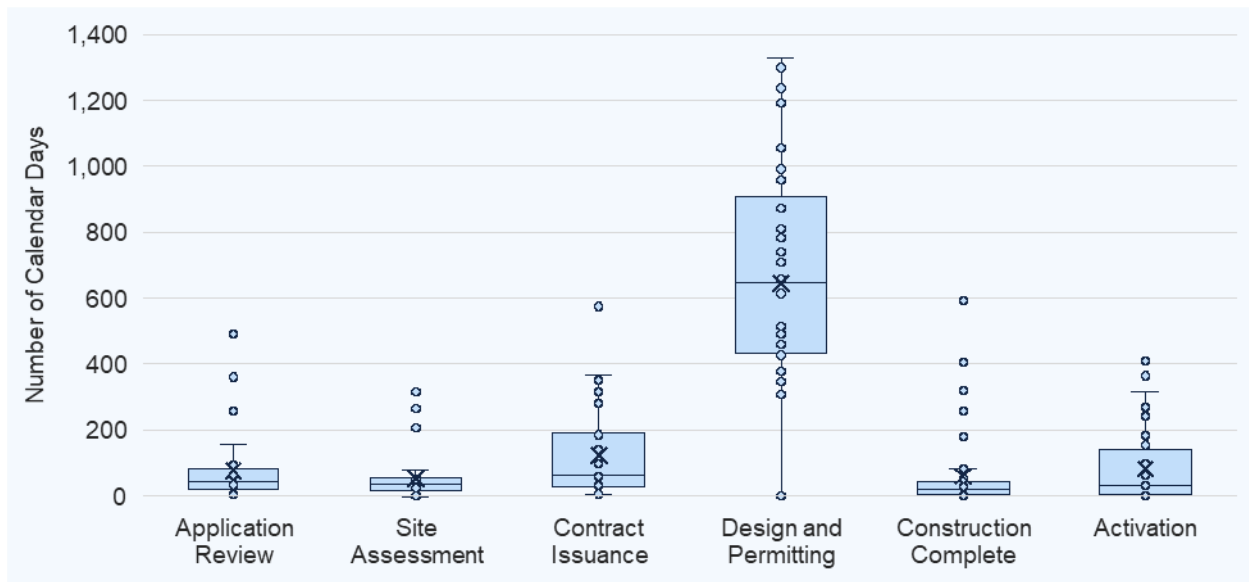


Table 65 displays the median number of calendar days that the EV Fleet program took from start to finish (application review to activation) for 46 activated sites across five market sectors in EY2024 and for 108 activated sites to date. The overall median start-to-finish timeline for site activation for EY2024 sites was 989 calendar days. The overall median start-to-finish timeline for site activation for these sites was the shortest for heavy-duty vehicle sites with 865 days and longest for school bus sites, which took 1,380 days to complete the program. The overall median start-to-finish timeline for site activation for all PTD sites was 766 calendar days, ranging from 393 days for TRU applications to 1,166 days for transit applications.

Table 65. PG&E EV Fleet Program Median Duration for Site Activation by Market Sector for EY2024 and PTD Sites

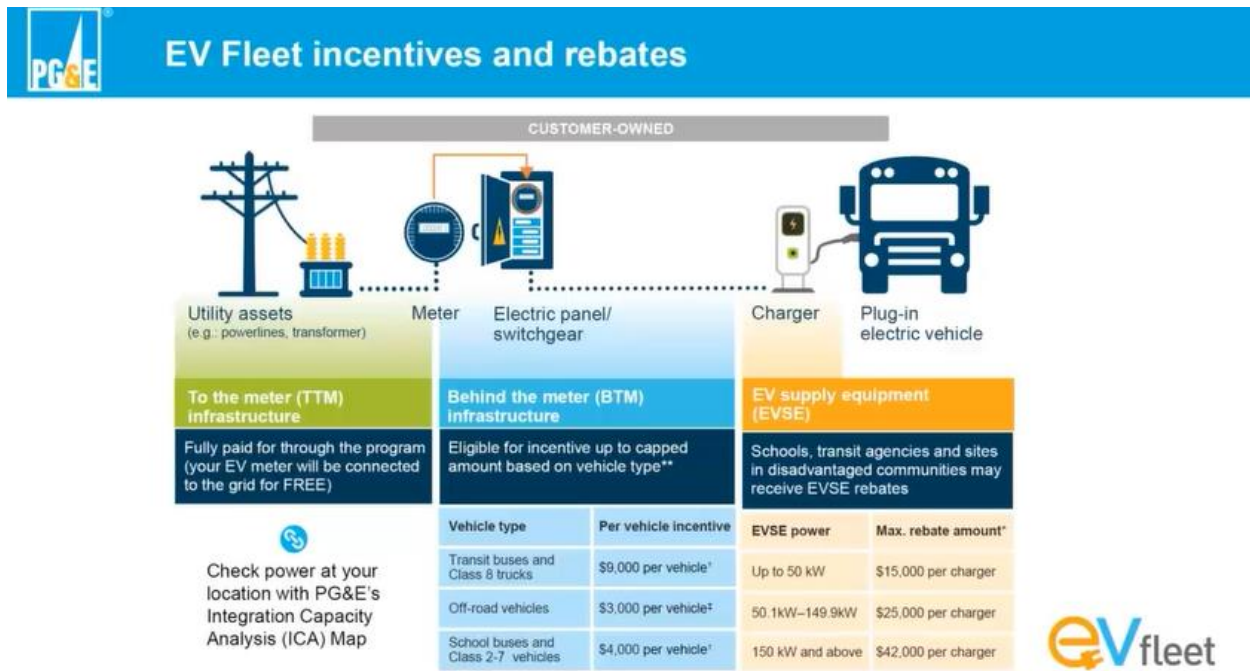
Market Sector	EY2024		Program to Date	
	Median Duration Start-to-Finish (Calendar Days)	Number of Activated Sites	Median Duration Start-to-Finish (Calendar Days)	Number of Activated Sites
Forklift	958	2	659	6
Heavy-Duty Vehicle	865	8	826	18
Medium-Duty Vehicle	972	19	744	28
School Bus	1,380	12	721	42
Transit Bus	1,194	5	1,166	13
TRU	—	-	393	1
All Market Sectors	989	46	766	108

Program Materials Summary

This section highlights findings from the review of program material and ME&O activities PG&E staff conducted in 2024. PG&E staff expanded customer education and outreach efforts to increase program participation through targeted engagement in events and leads generation:

- **Brand Ambassador Campaign.** PG&E partnered with Brand Ambassadors to conduct a direct, in-person approach to outreach in 2024, referred to as the Brand Ambassador Campaign, to meet with potential participants. The campaign focused on promoting the program to smaller businesses located in DAC areas who operate fleets of 2 to 19 vehicles, to spread awareness of the EV Fleet program and collect surveys from customers who agreed to participate. PG&E piloted this four-day direct approach in San Leandro, conducting door-to-door visits, attempting to speak to 570 businesses, and reaching 289. Based on the total number of attempted visits, PG&E achieved a 9% survey response rate. Among businesses the Brand Ambassadors were able to speak with directly, 18% engaged in a conversation. Staff plan to make a few modifications to their approach to try and increase response rates if they pursue this initiative again in 2025.
- **Municipality Focus.** In Fall of 2024, PG&E focused their outreach approach on municipalities and small to mid-size business to reduce the cost per site of enrolling projects in the program. PG&E staff attended the 2024 League of California Cities to connect with more municipalities. During close-out interviews for EY24 in March 2025, PG&E staff report an influx in signed contracts with municipalities in early 2025 as a result of these efforts coupled with the enforcement of CARB's ACF regulation for state and local government agencies.
- **TEAS Implementation.** In 2024, CPUC approved a resolution to include a TEAS program for PG&E with around \$20 million in funding. The TEAS program, later renamed EV Fleet Advisory Services (EV FAS), provides in-depth, additional one-on-one customer support for determining EV readiness, which can include determining if EV Fleet or Rule 29 is an appropriate pathway. PG&E staff from each program collaborate when engaging fleets, using strategies such as co-marketing and joint participation in industry events. The PG&E staff refer fleets to one of the two programs based on their level of fit across several dimensions, such as readiness for electrification, site cost estimate, number of vehicles, intended EVSE vendor, among others. An example of some education provided during these events is shown in Figure 129. PG&E may also adopt the EV FAS program as a long-term technical assistance model upon the conclusion of the EV Fleet program, depending on the outcome of the Transportation Electrification Framework (TEF) and CPUC approval.

Figure 129. PG&E EV Fleet Program Incentive and Rebate Education in Joint Webinar



- Event Attendance.** PG&E attended and hosted multiple events in 2024, including ride and drives, conferences, workshops, and events focused on educating customers on regulatory requirements. For the ACT exposition, staff hosted a workshop breakout session in a hotel conference room. The session was crowded, and generated interest and program leads, supporting the team's goal of getting in front of PG&E customers at a major national event. Staff attended approximately thirty events in 2024.
- Media Attention.** PG&E's support in electrification for school fleets earned multiple press releases detailing the project's impact. PG&E worked with Zum and Oakland Unified to complete a complex site with 74 bi-directional EV chargers. Multiple articles quoted PG&E staff and noted PG&E's role of providing load in record time, contributing to the site being deployed a year ahead of schedule. In all, PG&E staff tracked over 40 media stories highlighting the program in 2024.

Budget Summary

As shown in Figure 130, from program inception through December 31, 2024, PG&E spent \$70.2 million of the approved \$236.3 million budget for the EV Fleet program. In 2024, the program spent \$20.7M.

Timeline

Since the beginning of the program PG&E has filed two Advice Letters. In 2022, PGE&E and SCE jointly filed

AL 6546-E for program metrics and changes but received a protest from the CPUC. In response, PG&E filed AL 6524-E-A in April 2023 to address CPUC concerns from the initial Advice Letter. Although the CPUC granted the timeline extension in August 2023, it denied PG&E's proposal to eliminate the site requirements and to modify the vehicle purchase and conversion requirements. Therefore, PG&E filed AL 7121-E on December 28, 2023, as a response to the rejected modifications for site goals in AL 6546-E-A. Instead of eliminating the site requirement, AL 7121-E proposes a reduction of the site goal minimum. In October of 2024, the CPUC approved AL 7121-E, which reduced the minimum number of sites to 375. Figure 131 shows all major milestones from the beginning of the program.

Figure 130. PG&E EV Fleet Program Budget (Millions USD) as of December 31, 2024

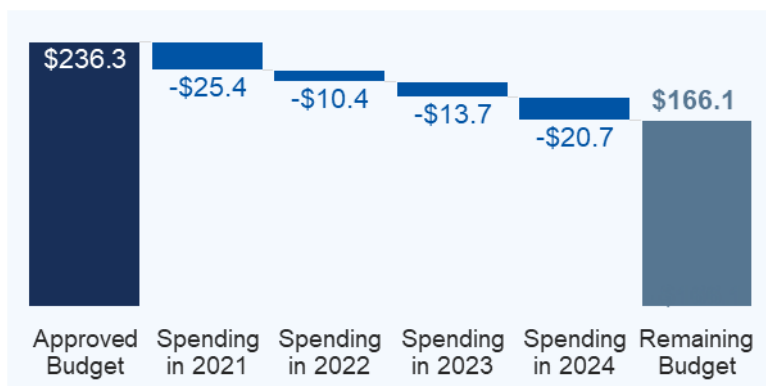
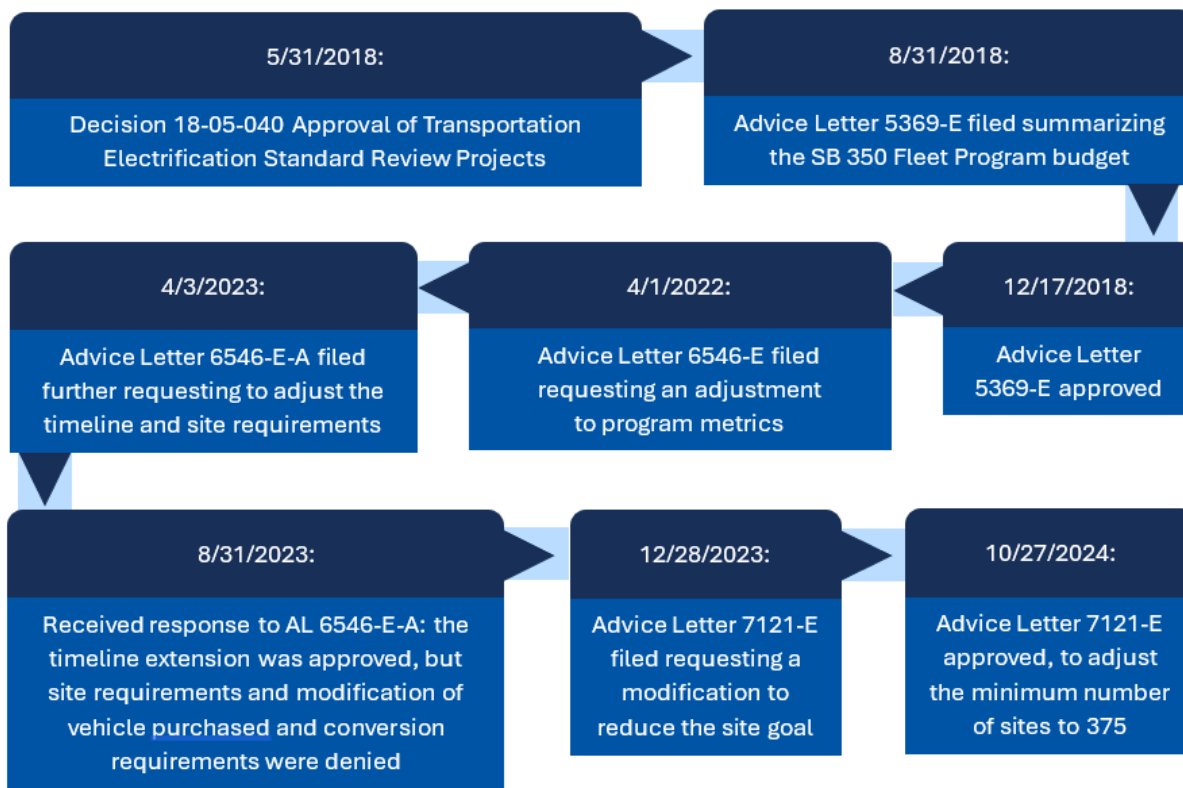


Figure 131. PG&E EV Fleet Program Key Milestones



5.1.2. Findings

This section provides findings from the Utility staff interviews, surveys, and site visits and deep dives. The Evaluation Team also provides insights from the co-benefits and co-costs analysis, site costs, as well as grid impacts, petroleum displacement, GHG and criteria pollutant reductions, health, and net impacts.

Table 66 presents key impact parameters for EY2024 and the program to date. Annual estimates of impacts are provided for metrics calculated as part of the impact evaluation. Additionally, the table provides estimates of impacts across all sites included in the program population through 2024.

Table 66. PG&E EV Fleet Program Impacts Summary

Impact Parameter	EY2021 Sites ^a	EY2022 Sites ^a	EY2023 Sites ^a	EY2024 Sites ^a	EY2024 Sites Percentage in DAC	PTD Sites Actual	PTD Sites Actual Percentage in DAC
Population of Activated Sites (#)	28	14	20	46	46%	108	44%
Sites Included in Analysis (#)	24	13	18	39	41%	100	43%
Ports Installed in Analyzed Sites (#)	197	132	250	968	40%	1,628	45%
EVs Supported (#) ^b	265	184	383	1,132	38%	2,006	45%
Electric Energy Consumption (MWh)				11,646	65%		58%
Petroleum Displacement (DGE)	306,260	207,454	342,618	1,004,513	64%	2,639,374	56%
GHG Emissions Reductions (MT GHG) ^c	2,655	1,660	2,314.8	7,787	62%	20,938	56%
NO _x Reduction (kg)	1,625	587	621.1	5,413	64%	15,047	67%
PM ₁₀ Reduction (kg)	32.9	2.5	11.79	47.0	84%	147	80%
PM _{2.5} Reduction (kg)	29.5	2.4	11.22	41.4	83%	133	80%
ROG Reduction (kg)	236	33.5	63.9	491.6	88%	1,434	75%
CO Reduction (kg)	12,946	20,884	17,935	98,679	81%	222,192	57%

^a Energy consumption, petroleum displacement, and emissions reductions are based on annualized data. PTD results in the table are based on actual data (see *Appendix B* for more details).

^b The Evaluation Team derived the EVs supported value from applicants' VAPs. This value represents the maximum number of vehicles expected to be supported by the charging infrastructure.

^c GHGs include CO₂, CH₄, and N₂O multiplied by their respective GWP as defined by IPCC AR5 (see *Appendix B* for more details).

Utility Staff Insights

In addition to monthly check-in calls with key PG&E staff to discuss the status of the EV Fleet program, the Evaluation Team conducted a close-out interview with staff in March 2025 to review overall program challenges and successes in EY2024. Staff identified several program challenges:

- Site Costs.** As in previous years, per-site costs were higher than expected in 2024, both for TTM and BTM. Equipment costs have continued to increase, making electrification harder for customers (as the program was not designed to cover all customer BTM costs) and decreasing the number of sites that would be cost-effective for the program. Additionally, funding opportunities for sectors the program works with, such as schools, have been reduced. Staff said

that multiple schools the EV Fleet program works with had reached out in 2024 to either extend their VAP or decrease their scope of work based on budget cuts.

- **Site Execution.** PG&E staff reported multiple challenges to completing sites after the contract was signed:
 - *Equipment Delays.* Equipment procurement, particularly switchgears, remains a significant challenge due to long lead times that began in 2020, decreased to 35- to 40-week wait times in 2023, and have continued to decrease to approximately 28 weeks in 2024.
 - *Design and Construction Delays.* Like in 2023, customers asked for equipment and design changes to their sites at later stages in 2024, even after their contract was signed, which increased the site cost and project cycle time. PG&E staff had to review the request, work the changes into the contract, and potentially engage contractors to redo design work. In early 2024, the program began requiring customers to secure a design contractor before signing. Program staff noted that this requirement may be helping to reduce delays because customers started finalizing charging and vehicle decisions earlier in the process.
- **Grid Capacity.** PG&E staff stated that if a customer applies with a project for which PG&E cannot fulfill 100% of the load request 100% of the time, it works with customers to determine a solution aligned with the grid's capacity in the design process. For example, in 2024 PG&E program staff coordinated off-peak EV charging scheduled and enrolled participants in TOU rates that encourage off-peak energy usage before the site was completed. PG&E program staff will continue to explore ways to support customers practicing load management, such as by using Flex Connect⁷⁴, in 2025. Three EV Fleet participants signed agreements to participate in Flex Connect in 2024.

PG&E staff also reported notable successes in 2024:

- **Goal Achievement.** The program met its DAC goal and staff anticipate meeting its vehicle goal based on currently committed sites. Staff anticipate meeting the revised site goal as the program currently has a robust pipeline in the assessment stage and a steady flow of applications. With the site goal modifications, staff have turned their focus to transit agencies (despite being historically expensive sites) to strive to meet the regulatory requirement to spend 15% of the budget on transit sites.
- **In Person Outreach Shifts.** Staff adapted messaging and in-person outreach to match customer interests. After observing a drop in attendance in their webinars in 2024, PG&E staff shifted their outreach strategy to attend more in-person events, such as ride and drive events (like CALSTART ride and drive in Oakland), relevant conferences (such as the California League of Cities and California Transit Association Conference), and ZEV tours (by Project Clean Air). Staff said that the ZEV tours generated new leads for the program. Although webinars have been less successful than in-person events, staff have continued to support CARB webinars for customers

⁷⁴ The PG&E Flex Connect Pilot coordinates a site's power demand based on when supply is readily available, allowing customers with controllable loads to connect to the grid without waiting for a capacity upgrade.

who favor virtual attendance. PG&E staff also mentioned that events centered around regulatory requirements were less fruitful for the program than those focusing on EV technology. Therefore, PG&E shifted its focus to technology spotlights by, for example, hosting a joint IOU “Ask your Utility Anything” format in which participants could inquire about topics of interest to them.

- **Load Management Advisory Services.** The program has increased its attention to load management. Staff prepared to expand advisory services in TEAS to support customers interested in load management in 2025. EV Fleet program staff will continue to look for opportunities in 2025 to support customers who are not eligible for advisory services in load management.

Highlights

- Similar to previous years, costs for both TTM and BTM equipment continue to be a challenge.
- Even after contracts have been signed, PG&E staff face challenges with customer equipment and design changes and delays, which contribute to increased costs and cycle times. The program began requiring customers to secure a design contractor before signing in early 2024. Staff noted that this step has reduced design changes by prompting earlier customer decisions on charging and vehicles.
- The program met its DAC goals in 2024 and is on track to meet its vehicle, site, and transportation market sector goals.
- In 2024, PG&E staff shifted outreach efforts to increase in-person events and continued to focus messaging on EV technology instead of policy requirements to better engage customers.
- PG&E staff continue to work with requests from large customers, and PG&E is improving its customer education on load management.

Survey Results

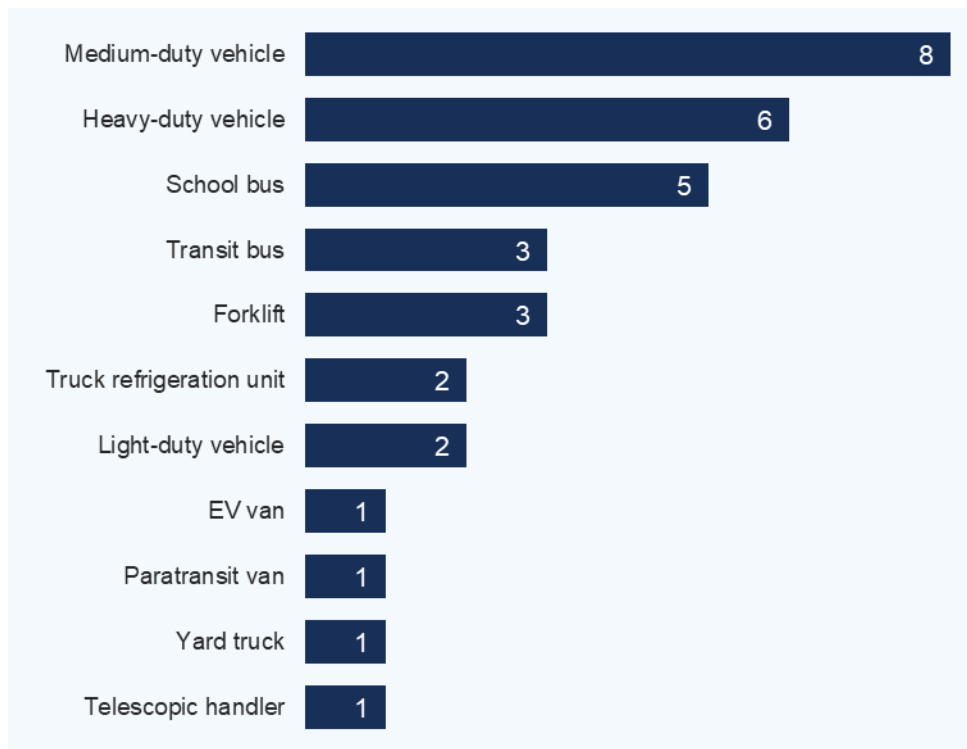
The Evaluation Team asked participating fleet managers about their motivations and barriers to electrification, satisfaction with and awareness of the program, experience with EVs and charging infrastructure, and perspective on the industry. The Evaluation Team received a total of 11 complete survey responses and four partial responses. As shown in Table 67, The fleet managers surveyed represented companies across the five vehicle sectors. Seven of the fleet managers reported that their fleets consisted of only one type of vehicle, while the other eight had between two and four types of vehicles in their fleets.

Table 67. PG&E EV Fleet Program Fleet Manager Survey Sample for EY2024 Sites (n=15)

Sector	Number of Partial Surveys	Number of Completed Surveys
Heavy-duty vehicle	2	1
Medium-duty vehicle	-	2
School bus	1	4
Transit bus	1	4
Total	4	11

Figure 132 shows the frequency of each vehicle type among respondents' fleets. Medium-duty vehicles were the most common among respondents, with over half of fleet managers (eight of 15) reporting them as part of their fleet.

Figure 132. PG&E EV Fleet Program Participant Vehicle Types in Fleets

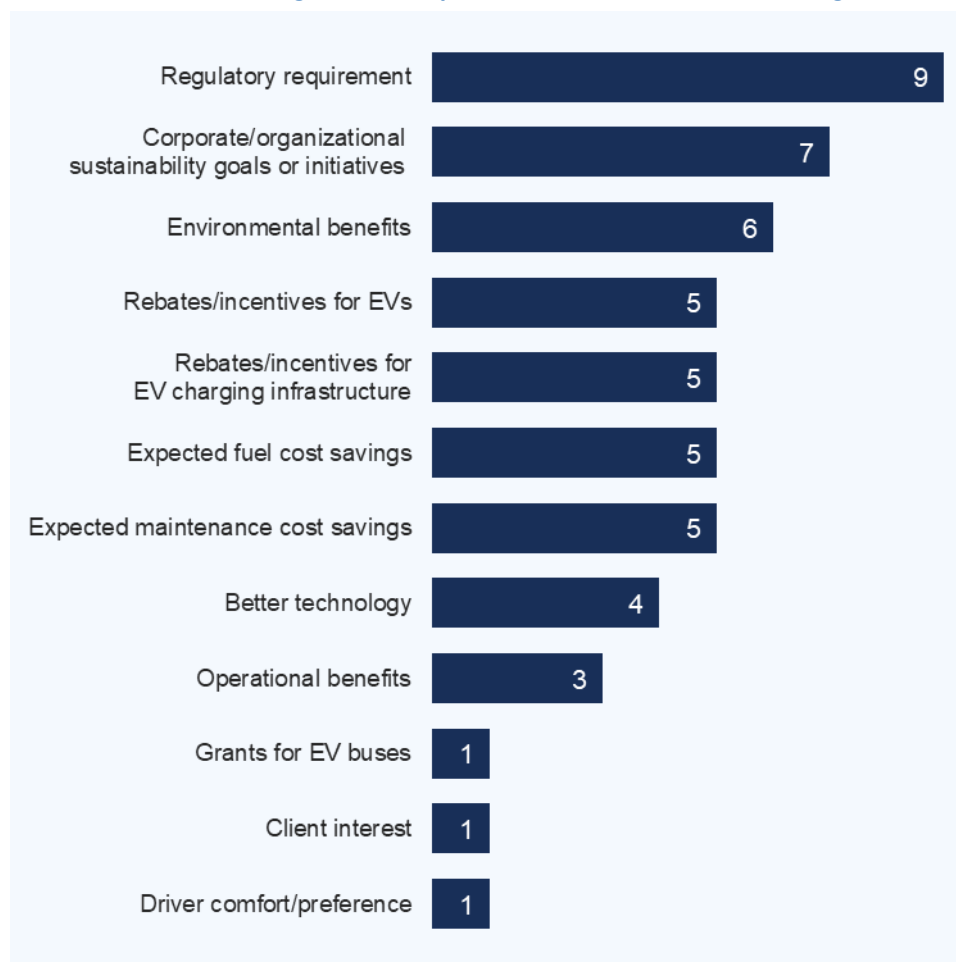


Source: Fleet Manager Survey Question A1 "What types of vehicles/equipment do you have in your fleet?" (n=15, multiple responses accepted)

Electrification Motivators and Barriers

The Evaluation Team asked fleet managers about their motivations for transitioning to EVs. As shown in Figure 133, the top motivator was *regulatory requirement*, cited by nine of 11 respondents. The next most common motivators were *corporate/organizational sustainability goals or initiatives*, cited by seven fleet managers, and *environmental benefits*, cited by six. *Rebates/incentives for EVs*, *rebates/incentives for EV charging infrastructure*, *expected fuel cost savings*, and *expected maintenance cost savings* were each identified as motivators by five respondents. Motivators were similar in EY2023 when *corporate/organizational sustainability goals or initiatives* was the most common response with three out of four fleet managers mentioning it. Notably, *regulatory requirement* was one of the least common motivators in EY2023, chosen by only one respondent, before rising to the top motivator in EY2024.

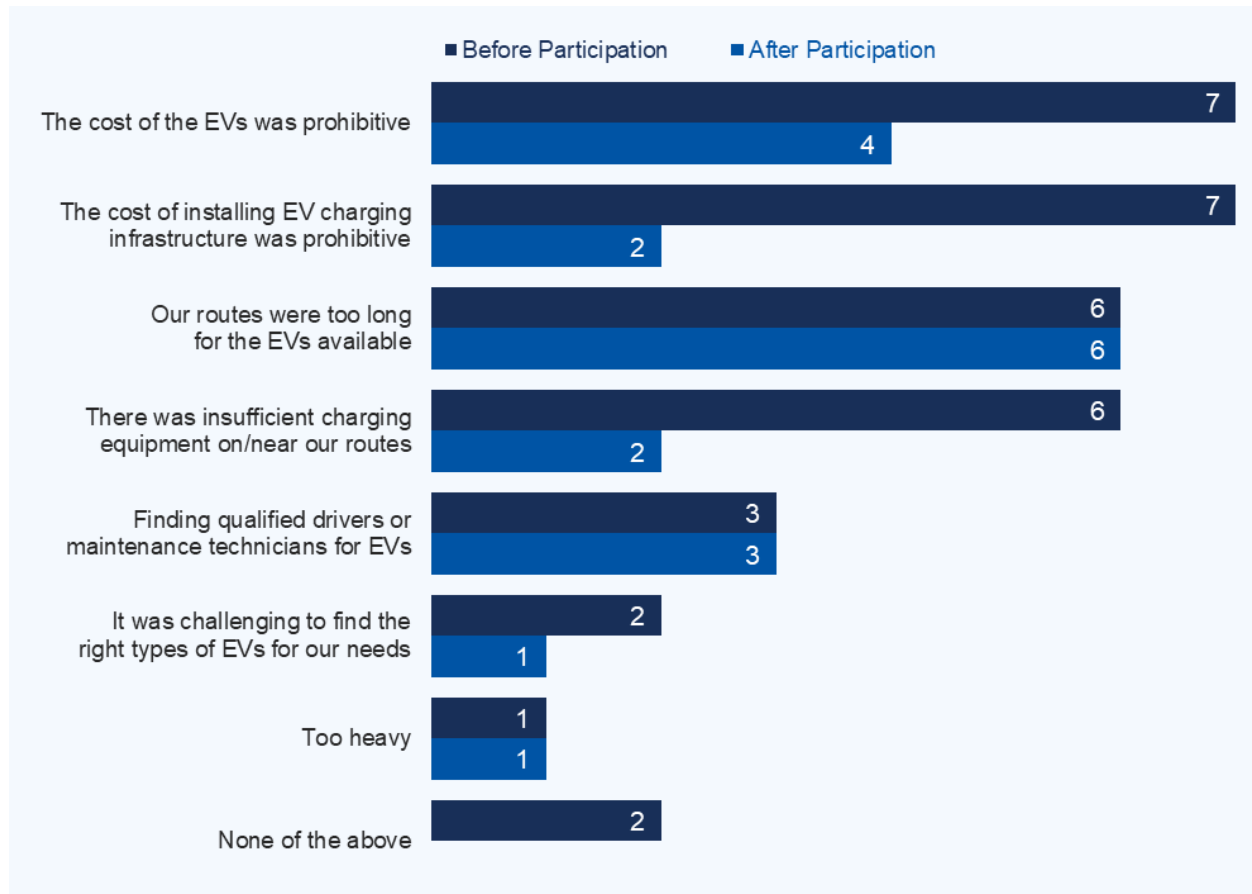
Figure 133. PG&E EV Fleet Program Participant Motivators for Transitioning to EVs in EY2024



Source: Fleet Manager Survey Question C1 “Why did your fleet decide to transition to EVs?” (n=11, multiple responses accepted)

The Evaluation Team asked fleet managers which barriers to electrification their fleets faced before participating in the PG&E EV Fleet program and which remained after participation. Figure 134 shows that prior to participating, fleet managers found a prohibitive cost of both EVs and installing EV charging infrastructure to be the biggest barriers to electrification, mentioned by seven respondents each. The next most mentioned barriers to electrification before participating were fleet managers’ routes being too long for the EVs available and insufficient charging equipment on/near their routes, mentioned by six respondents each. After participating, routes being too long remained a significant barrier to electrification, still mentioned by six respondents, while the cost of EVs (four of seven initial respondents), the cost of installing EV charging infrastructure (two of seven initial respondents), and insufficient charging equipment on/near routes (two of six initial respondents) were no longer considered barriers to electrification by nearly as many fleet managers.

Figure 134. PG&E EV Fleet Program Barriers to Electrification Before and After Program Participation in EY2024



Source: Fleet Manager Survey Questions F3 and F4 “Which of the following barriers to electrification did your fleet face before participating in the EV Fleet program?” and “You mentioned that the following were barriers to electrification before participating in the EV fleet program. Do any of these barriers still exist after you participated in the program?” (n=11, multiple responses accepted)

Program Satisfaction

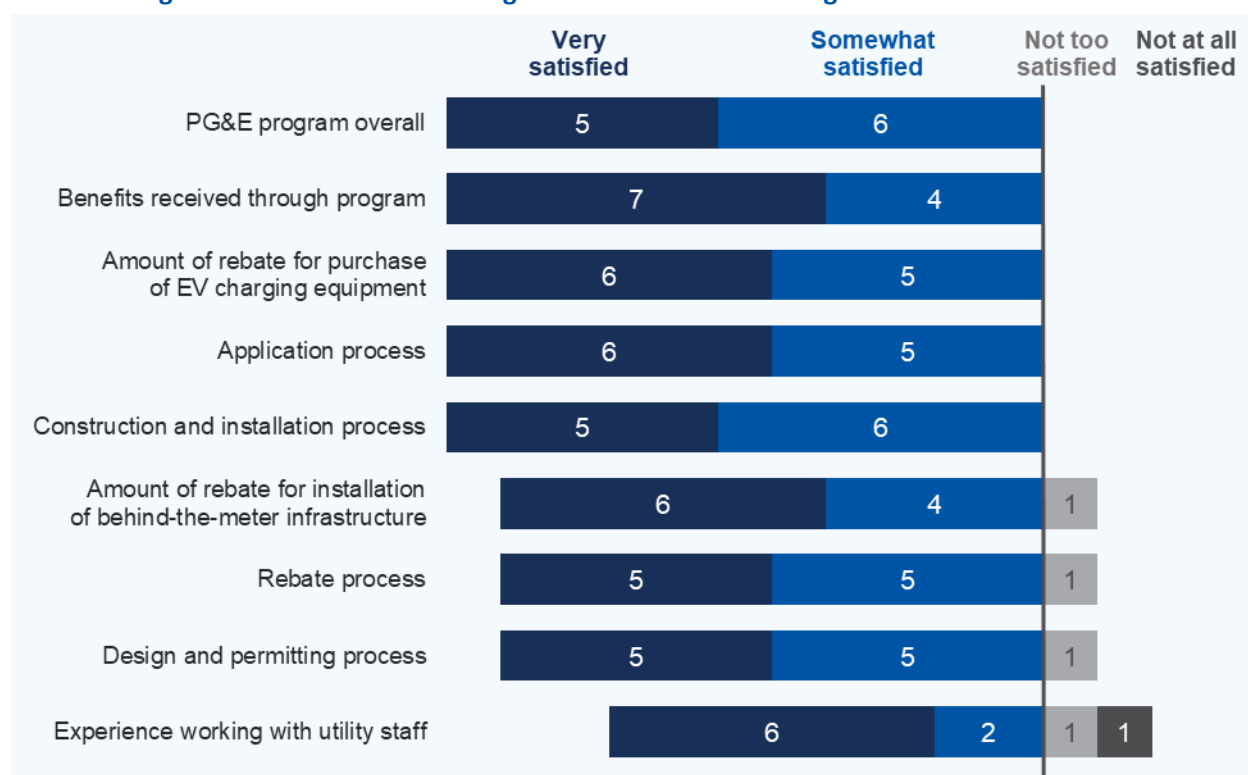
The Evaluation Team asked fleet managers to rate their satisfaction with PG&E’s EV Fleet program and various elements of the program. Across all program elements, fleet managers generally reported strong satisfaction (Figure 135). Fleet managers were satisfied with the overall program, with five managers rating themselves as *very satisfied* and six rating themselves as *somewhat satisfied*. The program element with the highest satisfaction ratings was the benefits managers received through the program, such as the provision of utility-side, TTM infrastructure, for which seven respondents rated themselves as *very satisfied*. The amount of the rebate for the installation of customer-side, BTM infrastructure, the rebate process, and the design and permitting process each had one fleet manager responding *not too satisfied*, and the remaining managers expressing varying degrees of satisfaction. Finally, a majority of fleet managers (six of ten) rated themselves as *very satisfied* with their experience working with utility

staff, though one respondent each rated themselves as *not too satisfied* and *not at all satisfied* with the same program element.

The one fleet manager who was *not at all satisfied* with working with utility staff pointed to their experience with coordination and communication around site construction being “slow and very disorganized,” an issue they suggested could be solved if PG&E had “more associates to meet the needs of the clients.” Despite the dissatisfaction from two respondents with working with utility staff, two others specifically highlighted their positive interactions with their PG&E project manager, one emphasizing that “without him we would not have participated.”

Satisfaction ratings in EY2024 were consistent with EY2023, which also saw almost entirely positive feelings from fleet managers. In EY2023, only the construction and installation process received a *not too satisfied* rating (one respondent of four), and no elements saw fleet managers rate themselves as *not at all satisfied* in EY2024. The one negative rating in EY2023 was the result of interactions with an outside construction firm; these concerns were not raised by respondents in EY2024.

Figure 135. PG&E EV Fleet Program Satisfaction with Program Elements in EY2024



Source: Fleet Manager Survey Question B1 “Thinking about your experience with the EV Fleet program, how satisfied are you with the following?” (n=11)

The Evaluation Team asked fleet managers how likely they were to recommend the EV Fleet program to another company on a scale of 1 to 10. Over half of respondents (six of 11) gave a rating of 10, meaning they would be highly likely to recommend the program to other companies. Two more fleet managers

rated their likelihood of recommending the program as 9, one rated it as 7 and two rated it as 5, resulting in a net promoter score (NPS)⁷⁵ of +55.

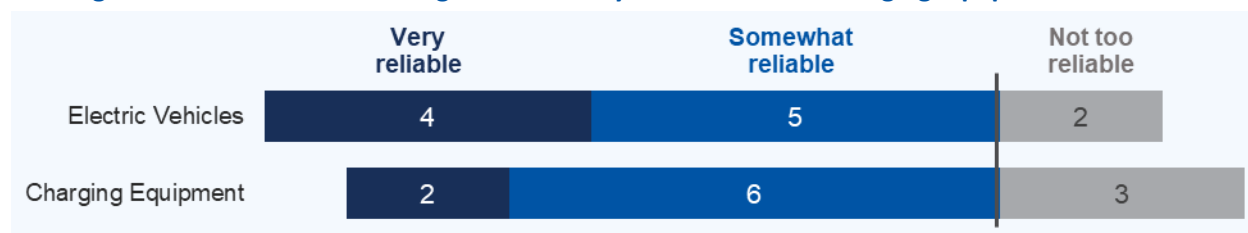
Program Awareness

The Evaluation Team asked fleet managers how they learned about the EV Fleet program. Six of the 11 responding fleet managers learned about the program **directly from PG&E**, two learned about it from a **contractor or engineer**, and one fleet manager each learned about it from an **EV/EVSE manufacturer**, another fleet, and a different company. Nine of the 11 fleet managers said that they were aware that they needed upgrades to the electrical infrastructure from the utility grid to their meter to charge EVs at their site, while two said they were not aware of this.

Experience with EVs and Charging Infrastructure

When asked to rate their ease with using their EVSE, all fleet managers reported that it was relatively easy. Six respondents reported that their charging equipment was *very easy to use* and the remaining five reported that the equipment was *somewhat easy to use*. On the topic of reliability, fleet managers found their EVs to be more reliable than their charging equipment, with four rating their vehicles *very reliable*, five rating them *somewhat reliable*, and two rating them as *not too reliable* (Figure 136). For comparison, only two respondents rated the charging equipment as *very reliable* while three rated it as *not too reliable*. One fleet manager experienced problems with their chargers being “new technology” with “lots of adjustment problems.” Another reported that out of their eight chargers, “at most times we only have four [chargers] that work.”

Figure 136. PG&E EV Fleet Program Reliability of Vehicles and Charging Equipment in EY2024



Source: Fleet Manager Survey Questions C3 and C4 “How would you rate the reliability of the EVs that are part of your fleet?” and “How would you rate the reliability of the EVSE?” (n=11)

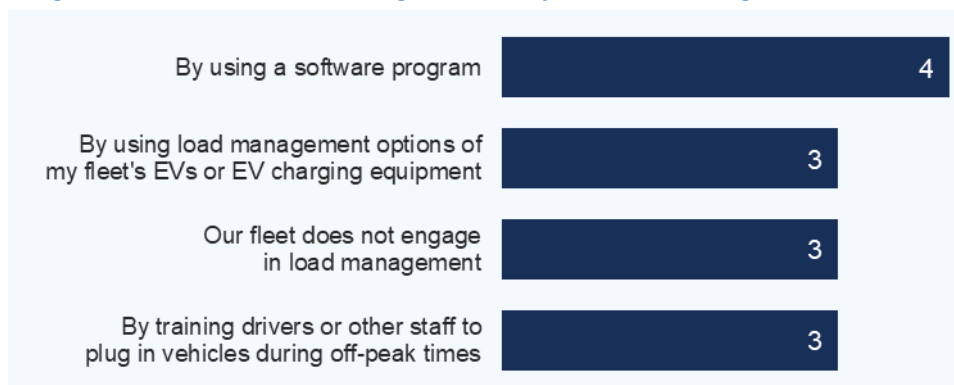
⁷⁵ The NPS is a metric of brand loyalty that measures how likely customers are to recommend a program to others. Respondents rate their likelihood to recommend the program on a 0 to 10 scale, where 0 means *not at all likely* and 10 means *extremely likely*. Respondents who give a rating of 9 or 10 are known as promoters, those who give a rating of 7 or 8 are known as passives, and those who give a rating of 0 to 6 are known as detractors. The NPS is expressed as a number between -100 and +100 that represents the difference between the percentage of promoters and the percentage of detractors (with passives excluded from the calculation).

Experience with Load Management and EV Charging

Asked whether they were aware that PG&E charges different electric rates per kilowatt-hour depending on the time of day, all 11 fleet managers replied that they knew this. Asked further whether they were aware of the cost to their company to charge their fleet, eight of 11 fleet managers said they were aware, while three said they were not.

The Evaluation Team asked fleet managers whether they took any actions to ensure that they purchased the lowest-cost electricity for charging their fleet or, in other words, if they participate in load management. Of the 11 respondents, eight reported that they did. Figure 137 shows their responses regarding what load management actions these fleet managers took. The most common action taken for load management was using a software program, reported by four fleet managers. Three fleet managers used load management options included with their EVs or EV charging equipment and three fleet managers said that they trained their drivers or other staff to plug in their vehicles during off-peak electric rate times.

Figure 137. PG&E EV Fleet Program Participant Load Management Practices



Source: Fleet Manager Survey Question C12 "What actions, if any, do you take to ensure you are purchasing the lowest cost electricity for charging fleet vehicles? A term you may have heard for this is load management" (n=11, multiple responses accepted)

The Evaluation Team also asked the eight fleet managers who practiced load management about their reasons for implementing the strategy. Six fleet managers reported that they implemented load management to lower the cost of charging via charging time management, two did so to manage the stability of their electrical system, and another was required to implement it by their charging infrastructure supplier.

Of the three fleet managers who did not practice load management, one reported issues with software not working as intended and compatibility with software/chargers/vehicles. Another fleet manager reported that their site has not been operational long enough, and the third reported that they "charge when vehicles need charging." Asked if they planned to engage in load management and how they would, the fleet manager that reported experience software issues said that they still planned to implement load management by using software. The fleet manager whose site was not operational long

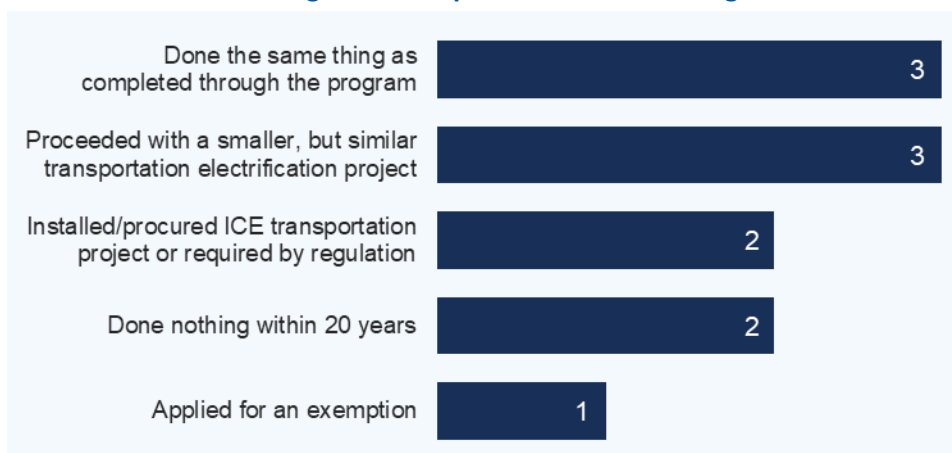
enough said they planned to engage in load management via load management options offered by their EVs or charging equipment. The third fleet manager did not plan to practice load management.

Impact of Program on Fleet Electrification

The Evaluation Team asked fleet managers whether they planned to accelerate procurement of EVs and related equipment because of their experience with the program. Only one respondent said that they would accelerate procurement, two reported that they planned to slow procurement, and eight said they did not plan to change their procurement. The fleet manager who planned on accelerating EV procurement claimed that “lessons from [their] initial EV infrastructure program allows [them] to more effectively plan and manage subsequent projects.”

As shown in Figure 138 the Evaluation Team asked fleet managers what they would have done in relation to electrification if the PG&E EV Fleet program had not been available. Three fleet managers said they would have done the same thing as what they did through the program, three more said they would have proceeded with smaller projects, two would have instead proceeded with an ICE transportation project or whatever was required by regulation, two would have done nothing within the next 20 years, and one would have applied for an exemption.

Figure 138. PG&E EV Fleet Program Participant Actions if the Program Were Not Available



Source: Fleet Manager Survey Question G1 “If the PG&E fleet electrification program had not been available, which of the following alternatives would you organization most likely have done?” (n=11)

Fleet managers reported their planned acquisition of EVs over the next five and ten years, shown by sector in Table 68. The bulk of the current fleet size and planned acquisitions come from one heavy-duty sector fleet manager, who has a current fleet of 23,000 ICE vehicles and 103 EVs.

Table 68. PG&E EV Fleet Program EV Acquisition Projection by Vehicle Type in EY2024 (n=12)

Sector	Current Fleet Size		EV Type									
	ICE	EVs	School Bus		Transit Bus		Medium-Duty		Heavy-Duty		Forklifts	
			5 years	10 years	5 years	10 years	5 years	10 years	5 years	10 years	5 years	10 years
Heavy-duty vehicle (n=1)	23,000	103	-	-	-	-	30	80	500	1,000	50	150
Medium-duty vehicle (n=2)	309	2	-	-	-	-	-	1	-	-	-	-
School bus (n=5)	123	34	-	-	-	-	-	-	-	-	-	-
Transit bus (n=4)	269	19	-	-	25	12	25	55	20	50	-	-

Industry Perspective

The Evaluation Team asked how well-positioned fleet managers thought their industry or sector was for electrification, to which they largely reported being *not too well-positioned* (four respondents) or *not at all well-positioned* (one respondent). Two fleet managers reported being *extremely well-positioned*, and one fleet manager reported being *somewhat well-positioned*. Three others reported their positioning as *neutral*. Those who did not feel well-positioned said that long routes were a main reason (two respondents), and others cited limited EV producers, low mechanic knowledge and available parts, and low return on investment. In EY2023, fleet managers were more optimistic about their industry positioning: two rated their industry as *extremely well-positioned*, one as *somewhat well-positioned*, and one as *neutral*, with none rating their positioning negatively.

The Evaluation Team asked fleet managers what they saw as the limitations of current EV options for their market sector. Two respondents mentioned the mileage range of available EVs as a major limitation. Other respondents noted that maintenance, foreign-owned EV manufacturers' dominance of the market limiting availability of federal funding, and the risks of being an early adopter to new EV technology. Finally, fleet managers were asked whether, given what they know or believe about requirements for fleets to purchase zero-emission MDHD trucks, electric or diesel trucks seemed like a riskier purchase in the next three years and the next ten years. For the three-year projection, six respondents said that diesel trucks would be the riskier choice and five said electric. For the 10-year projection, seven respondents said that diesel trucks would be the riskier choice and four said electric.

Interview Results

The Evaluation Team interviewed four fleet managers who withdrew from the PG&E program. Respondents included fleet managers for a garment and uniform rental company that delivers and retrieves rentals from customers, a ride share company, a public transit organization with buses, and an EV charging depot developer and operator that offers charging services for customers' fleets (Table 69).

Table 69. PG&E EV Fleet Program Withdrawn Fleet Managers

Fleet Manager	Business Type	Fleet Size
Respondent 1	Garment/uniform rental	284
Respondent 2	Rideshare	100
Respondent 3	Public transportation	57
Respondent 4	Charging depot developer and operator	None

The total size of respondents' fleets varied widely, from about 4,000 nationally (nearly 300 in California) for Respondent 1's fleet to 57 for Respondent 3's transit fleet. As an operator of a charging depot to charge other company's fleets, Respondent 4's company did not manage a fleet.

As reasons for electrifying, respondents cited the sustainability benefits of EVs, the vehicles' relative speed and quietness, and organizational pressure. When asked why they tried to participate in the program, two respondents cited the high cost of EV fleet vehicles and infrastructure that the program could ease and one highlighted the practical benefits of working alongside PG&E versus outside of the program, which they described as "very painful." Two of the interviewed fleet managers noted that they were apprehensive about joining the program: one because of a limited understanding of the end of life for an EV fleet and another due to a perceived lack of investment by PG&E.

Asked about their main reasons for stopping participation, two fleet managers cited PG&E's inflexibility with site power demand increases. As the needed power demand for one site rose from 5 MW to 10 MW, for example, PG&E informed them that it was too much load for the program so they would have to proceed through service planning instead. Another respondent pointed to shifting bus fleet needs no longer necessitating their participation in the program. A fourth fleet manager ended their participation early in the process until they could "better understand what the future brings [for EVs]."

When asked what changes participants would recommend to improve PG&E's program, fleet managers broadly called for more flexibility from PG&E to address participants' needs. One respondent wished there was increased assistance for smaller companies, while another suggested that the Utility reduce the number of vehicles required to enter the program. Another respondent called for PG&E to adopt a more transparent distribution capacity viewing portal like one offered by SCE so they could better plan their project size. The same fleet manager suggested that PG&E offer a first-round feasibility study to help participants better understand the available capacity for their site. Lastly, one fleet manager underscored the incompatibility between PG&E's program deadlines and the long lead time of approximately two years for ordering electric buses, stating that the Utility would also have to extend program deadlines and become more familiar with and flexible about vehicle order lead times if they wanted to encourage participation in the program.

When asked about the program overall, fleet managers gave ratings ranging from *not at all satisfied* to *very satisfied*, reflecting their varied experiences. Comments from fleet managers clarified that, once past the initial stages of intake into the program, the experience of actually participating in the program tended to be positive. On specific aspects of the program such as application process, application

timeline, and interactions with PG&E staff, respondents gave both positive and negative comments, as shown below (Table 70):

- Negative comments:
 - On application timelines, a fleet manager stated that the utility can be “very unpredictable.”
 - A manager who reported being somewhat unsatisfied called the utility “very anti-customer” in the way it dealt with changing site needs.
 - On the rebates, satisfaction ratings were more consistently negative. One fleet manager said that they are “always not satisfied unless [they] can get to a price range competitive with the price of an ICE vehicle.”
- Positive comments:
 - A fleet manager who reported being very satisfied with utility staff said they did a “really good job.”
 - One fleet manager who dropped the program for at least one of their projects, but participated successfully with a different project, noted that the utility representative with whom they worked was “super helpful, awesome, very responsive, very clear.”

Table 70. PG&E EV Fleet Program Withdrawn Fleet Managers’ Program Satisfaction

Program Component	Respondent 1	Respondent 2	Respondent 3	Respondent 4
Overall satisfaction	4 – <i>very satisfied</i>	1 – <i>not at all satisfied</i>	3 – <i>somewhat satisfied</i>	
Application process	3 – <i>somewhat satisfied</i>	2 – <i>not too satisfied</i>		
Program services		3 – <i>somewhat satisfied</i>		
Rebate amount	1 – <i>not at all satisfied</i>	2 – <i>not too satisfied</i>		
Working with program staff	3 – <i>somewhat satisfied</i>	2 – <i>not too satisfied</i>		

After withdrawing from the program, two fleet managers pursued Rule 29 for their EV projects, favoring the flexibility of that process with their larger energy demand needs. A third decided to pause their EV project until they had a better understanding of the impacts of changes in the federal government. Two respondents stated that they utilize other local and federal programs to fund their EV investments.

Highlights

- Fleet managers were motivated to participate primarily because of regulatory requirement (nine of 11 fleet managers), corporate/organizational sustainability goals or initiatives (seven of 11 fleet managers), and environmental benefits (six of 11 fleet managers).
- Top barriers to fleet electrification before program participation were the cost of EVs (seven of 11 fleet managers), the cost of EV charging infrastructure (seven of 11 fleet managers), insufficient charging infrastructure along routes (six of 11 fleet managers), and routes being too long (six of 11 fleet managers). After program participation, all barriers became less significant except for routes being too long (six of 11 fleet managers).
- All responding fleet managers rated themselves as *very satisfied* or *somewhat satisfied* with their experience participating the EV Fleet program.
- Nine of 11 fleet managers said that EVs were *very reliable* or *somewhat reliable* and eight of 11 said that EV charging equipment was *very reliable* or *somewhat reliable*.
- Eight of 11 responding fleet managers reported that they practiced load management with their fleets.
- One of 11 responding fleet managers planned to accelerate EV and EV charging equipment procurement due to their experience with the program, while eight of 11 fleet managers did not plan on changing their procurement plans.
- Four of 11 responding fleet managers said they felt that their industry or sector was not well-positioned for electrification.
- Two of four responding fleet managers who withdrew from the EV Fleet program cited inflexibility with site power demand increases.

Site Visit Findings

In EY2024, the Evaluation Team completed 46 site visits in the PG&E territory across several market sectors: heavy-duty vehicle, medium-duty vehicle, school bus, transit bus, and forklift. During the site visits, the Team collected qualitative and quantitative information that provided the Team with an understanding of fleet composition and operations. We used site visits to verify aspects about sites such as the number of installed chargers, EVSPs the fleet uses, types of EVs in use or scheduled for delivery, and physical influences on construction designs.

Table 71 provides a summary of charging site characteristics by market sector, including number of site locations visited, number of ports, and total charging capacity. In total, the PG&E EV Fleet program added 1,005 ports with over 36 MW of EV charging capacity in EY2024. Eight heavy duty sites account for 20 MW, which is more than half of this capacity. The total 2024 site capacity more than doubled the PTD site capacity to nearly 66 MW. Figure 139 is a visual representation of Table 71 showing charging port and charging capacity of the EV Fleet program sites the Evaluation Team visited by market sector for EY2024 and for the program to date. Reported installed capacity accounts for only active charging ports installed on the Utility-provided TTM infrastructure, while the Utility SB 350 report includes TTM installed capacity, which for some sites includes chargers that are not yet installed.

Table 71. PG&E EV Fleet Program Quantity of Ports and Installed Capacity, by Market Sector

Market Sector	EY2024 Sites	EY2024 Ports	EY2024 Capacity (kW)	PTD Sites	PTD Ports	PTD Capacity (kW)
eTRU	0	0	0	1	16	160
Forklifts	2	28	294	6	46	620
Heavy Duty Vehicles	8	150	20,471	16	408	37,436
Medium Duty Vehicles	19	605	7,717	30	707	10,893
School Bus	12	169	4,118	42	361	7,516
Transit Bus	5	53	3,992	13	124	9,270
Total	46	1,005	36,592	108	1,662	65,894

Figure 139. PG&E EV Fleet Program Site Visit Ports and Capacity, EY2024 and PTD Sites

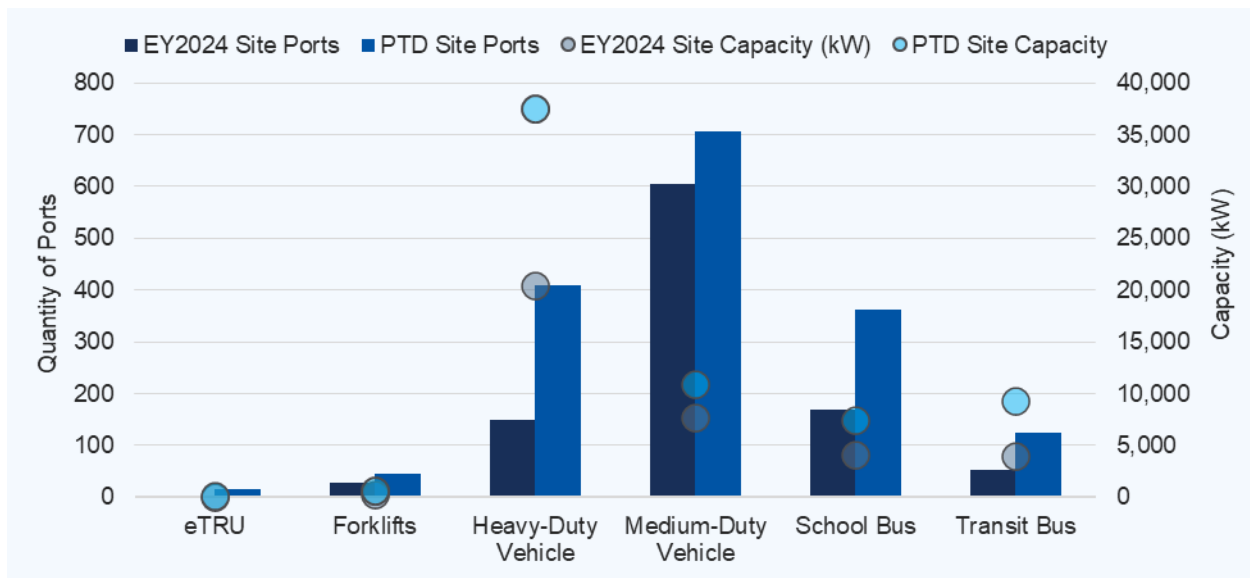
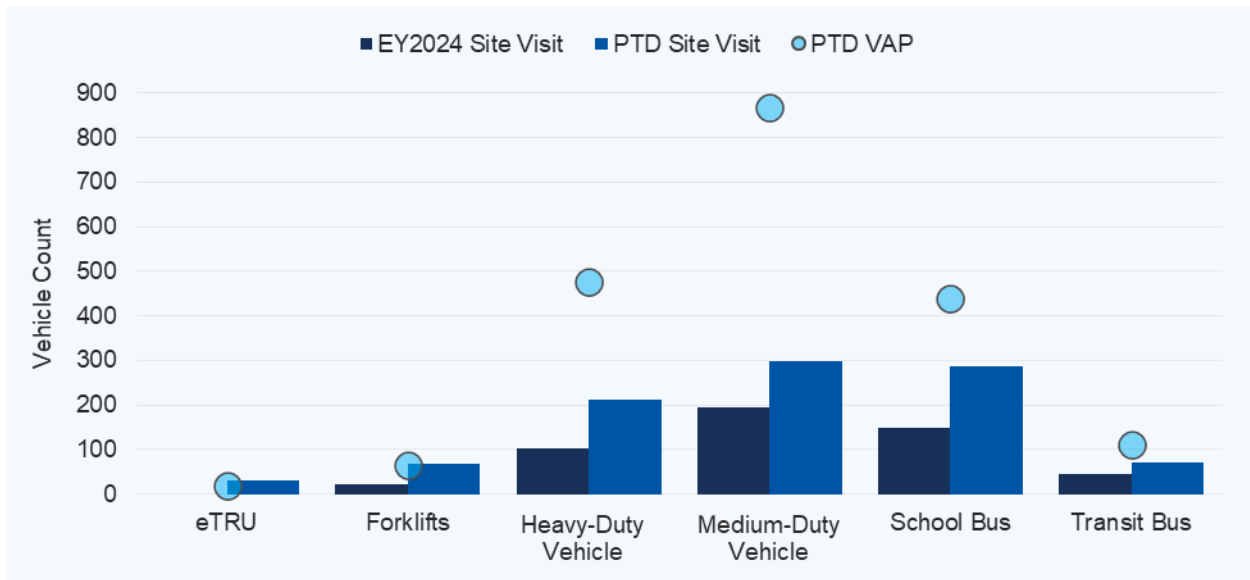


Figure 140 shows a count of vehicles verified through site visits for both PTD sites and the sites completed in 2024. The five-year VAP for these sites is included as well. The figure and analysis suggest that vehicle deliveries are not running on schedule and that the fleets have not yet acquired the vehicles specified in their agreement with PG&E. The TRU, forklift, and transit bus market sectors are closest to plan; however, they have much lower VAP numbers compared to the heavy-duty vehicle, medium-duty vehicle, and school bus market sectors

Figure 140. PG&E EV Fleet Program Comparison of Verified Vehicles to Long-Term VAP



During site visits, the Evaluation Team reviewed charge management capabilities and electrical infrastructure, discussed future vehicle/equipment replacement plans (including vehicle adoption) and public funding sources, and investigated whether fleets had an interest in on-site solar and/or battery storage. Site visits allowed the Team to obtain direct feedback from the individuals involved with operations and to identify EVSP points of contact to obtain charging session data.

The following sections provide a summary of key observations and data collected during site visits, organized by market sector.

Common Site Visit Findings Across Utility Programs

Logistics providers were a large contingent of the program's EY2024 activated sites that the Evaluation Team visited this year, representing MDHD trucks. Dealership projects began to appear across Utility programs; these typically have low charger utilization, unless the dealership also operates a leasing service, in which case the leased vehicles and chargers are used regularly. National fleets were more evident across the state in EY2024 than in previous years.

An interesting finding was that several sites across MDHD programs had a significant amount of light-duty charging. This stems from a variety of reasons including public access, logistics services in which the sites support any client vehicle needs, and use of LDVs to make up for limited availability or reliability of medium-duty vehicles.

Several vehicle manufacturers have filed for bankruptcy recently. This affects operators of transit, school, medium duty, and heavy-duty market sectors. Some of these entities are parts suppliers to other vehicle manufacturers, amplifying negative impacts across market sectors.

Many fleets do not review their utility bills, energy use, or charging statistics (from NSPs). Often a site host's finance office receives all the utility bills but does not share relevant information with fleet

managers. Therefore fleet managers do not know the costs of their EV operations, the extent to which those costs could be reduced, or how those costs compare with conventional fleet vehicle costs

School Bus

The Evaluation Team visited PTD sites with a significant number of vehicles this past year, with school buses currently meeting approximately two-thirds of their VAP at the time of visits. Reliability tends to be a regularly cited issue with bus manufacturers providing varying levels of service.

School bus sites reported a number of positive experiences with vehicles, chargers, and NSPs:

- A site modeled its operations on a successful fleet from another Utility's territory that had provided mentoring, using the same brands of buses, EVSE, and NSP. The site has served the fleet very reliably so far. The NSP helped to test and successfully implement a load management plan within the first few months of bus deployment.
- Another school provided positive feedback on Type D buses from a new manufacturer.⁷⁶ Drivers and students enjoyed the improved comfort of the EV, and the manufacturer quickly resolved small issues such as a faulty windshield wiper motor.
- One site completed construction in spring 2024 and had started operating fully for the fall school year. It included not only a large fleet of 74 electric buses but the ability to participate in V2G services. This site began participating in Emergency Load Reduction Program (ELRP) events almost immediately, transferring power back to the grid during emergency events in September 2024. This fleet also demonstrated strict adherence to a set charging schedule design to maximize charging during periods with the lowest cost and emissions, which enabled the fleet to eliminate charging during peak times.

Some school bus sites discussed challenges they had experienced:

- More than one site used temporary, lower powered L2 chargers (9.6 KW) while they waited for new PG&E service.
- One site that experienced charging connectors overheating and melting said that its vendor took many months to repair and replace equipment under warranty. The same vendor did not include load management capability, which limited the fleet's ability to select low-cost electricity.
- Another site reported that its NSP was hard to reach and not helpful in setting up fleet charging schedules.
- A rural district had difficulties with establishing a reliable internet connection to allow its networked chargers to function. One bus could not achieve its advertised range, which necessitated a reworking of bus routes. This bus also spent a substantial time out of service and had to be towed multiple times. The school saw a decline in enrollment as families left over the school's inability to provide reliable transportation.

⁷⁶ A Type D school bus is a "transit-style" school bus with the body installed on a chassis; the engine mounted in the front, mid-ship or rear; and a GVWR of more than 10,000 pounds, designed to carry more than 10 people.

- One service provider has begun to acquire parts from two bankrupt businesses to help keep its customers' fleets in service.
- School districts continue to voice concerns about using their vehicles for field trips and sports. Limited battery capacity and charging capacity with L2 chargers could be a bottleneck for activities beyond regular routes. A fleet manager reported working with the California Association of School Transportation Officials (CASTO) to develop resources to help districts coordinate on EV charging.

Transit Bus

One site constructed a new greenfield facility with a relatively new charger model with load management from an older brand. The operator incorporated older chargers moved from a different facility.

The reliability of the one brand of bus this site uses has been poor, partially due to limited service after the manufacturer filed for bankruptcy.

Several municipal transit bus operators mentioned near- and mid-term plans to use hydrogen fuel cell buses. Though unlikely to impact current VAPs, this will likely limit overall expansion of EV transit bus fleets. Operators have said that fuel cell EVs (FCEVs) provide longer driving range and relies on centralized fueling like current diesel and CNG bus operations. EV charging typically takes up more depot space than FCEV charging. Figure 141 shows charging along a fence line to minimize the footprint and take advantage of nearby power. At least one operator noted that hydrogen is still quite costly as a fuel compared to electricity.

Figure 141. PG&E EV Fleet Program Transit Bus Charging Adjacent to Power



Medium-Duty Vehicle

The Team visited several private/employer-based transportation vendors operating medium-duty vehicles. Contacts at these sites all noted two challenges with their shuttles:

- Service is very limited and expensive due to bankruptcies
- Vehicle offerings are limited, and the range of the available vehicles is also limited and has been over advertised

A unique site seen this year employed several vans and pickup trucks from a major manufacturer. The fleet uses these EVs for a combination of roadside service providing charging to stranded EVs and replacement starter batteries for all vehicles. The site has determined that spending the time to charge

a vehicle long enough for it to drive to a nearby charger is not worthwhile and has shifted to towing stranded vehicles instead. Its operation includes two (technically heavy duty) flatbed tow trucks that were built as prototypes and have relatively small batteries for their size and emergency operation function, which can involve long distances. Dispatchers have had to deal with more logistics to make use of these trucks. These appear to be some of the very first flatbed tow trucks in the state.

Figure 142 depicts one of two charging rows at a delivery vehicle site that has one of the largest installations the Evaluation Team has seen in terms of both the number of electrified parking spaces and the total capacity. Trenching spans more than 90 parking spaces with switch gear distributed in the middle. This is fed by primary high voltage from the Utility and then distributes lower voltages to L2 EVSE with smaller branch circuits. Although this customer is deploying 10 to 200 vehicles per site, the limit on BTM incentives based on 25 vehicles means the Utility contribution to these sites accounts for only a small portion of total costs.

Figure 142. PG&E EV Fleet Program Large-Scale Deployment of Chargers at a Medium-Duty Vehicle Site



Most of these sites had positive sentiment around their vehicles though one brand of vehicles continues to be largely unreliable. Most if not all these sites, including sites with several national brands, have not initiated load management. This could be due to national project leads' lack of awareness about local electricity pricing or prioritization of construction planning over operations. Most local operators were open to reviewing their data and agreed there was room for load management based on their regular and extended operations.

One medium-duty site plans to combine shuttle services with public charging. The shuttles had not been delivered by the end of 2024, but the equipment has been used for significant public charging.

Heavy-Duty Vehicles

Refuse trucks, semi-trucks and private transit motor coaches added to the diversity of sites this past year. The refuse trucks are a new brand, and the various sites had very little operational history at the time of site visits. Site contacts acknowledged the importance of training—for example, well used regenerative braking could be crucial to maximizing range. Infrastructure for heavy duty fleets took a variety of forms, usually using DCFCs capable of at least 60 kW per port. Figure 143 shows a containerized solution.

Motor coach brands the Evaluation Team saw in 2025 were similar to brands seen in previous years. Site contacts said these EVs were fairly reliable, and that they presented a unique green-branding opportunity because they could be seen broadly around the region. Most sites seemed to have started employing load management early in their operations to avoid high-cost time periods. However, these sites all show considerable load spiking indicating that they are charging faster than needed and therefore incurring higher than necessary costs from demand capacity subscriptions. This is discussed in more detail in the *Grid Impacts* section.

Figure 143. PG&E EV Fleet Program Containerized Power Solution and Several Chargers and Switchgear Pad and Island



An agricultural site has put yard trucks to work several shifts a day. This site has a high ratio of trucks to ports compared to most other sites, which is unusual. The Evaluation Team saw two other instances of high ratios of vehicles per charging port; one in another Utility service territory and one in another PG&E site discussed below.

One heavy-duty site participated in the Flex Connect pilot to install a 6 MW interconnection while accepting lower charging limits based on an hour-by-hour schedule. This allowed the site to electrify a fleet of 50 Class 8 vehicles much sooner than would have otherwise been possible. These 50 trucks shared eight high powered (over 750 kW) dispensers, which the trucks frequently cycled through. Some trucks with shorter routes needed to be charged only every other day. The site had also installed a battery energy storage system (BESS), to allow full flexibility in charging times, even when the grid was constrained.

Forklifts

The Evaluation Team visited two forklift sites in 2025. One site moves building materials around an outside yard (Figure 144), and the other loads and unloads agricultural products. Both already had experience with electric forklifts prior to participating in the EV Fleet program. One made use of the program to rewire its legacy vehicles onto a separate service to take advantage of EV-specific tariffs. The other would like to more quickly acquire electric forklifts. Unfortunately, ongoing CARB emissions compliance issues with one of their on-road vendors has hampered their on-road fleet compliance. This in turn means they do not qualify for Air District funding for forklifts, delaying their electrification and perhaps future sites with PG&E and another Utility.

Figure 144. PG&E EV Fleet Program Outdoor Forklifts at a PG&E Site



Highlights

- The heavy-duty market including refuse trucks, semi-trucks, and motor coaches continues to grow.
- Four refuse sites were completed in 2024 but had limited use as the first trucks were being tested on regular garbage collection routes.
- Medium-duty sites included major delivery sites with 20 to 50 ports and some facilities with over 100 ports installed and plans to expand in the future.
- Not using load management limits financial and emissions reduction benefits for several large installations and many school bus sites
- One school bus site with 74 vehicles demonstrated strong load management performance as well as V2G capabilities.
- Transit districts are using EVs to satisfy compliance in the short term. Many see hydrogen fuel cell technology as their future due to simpler refueling operations though fuel costs are a serious concern.
- Some heavy-duty sites show a vehicle to charger ratio higher than one to one. One site participated in the Flex Connect pilot and had installed battery storage to overcome grid constraints.
- EV reliability issues and range limitations continued to be reported by many visited fleets.

Deep Dives

The Evaluation Team conducted deep dives in EY2024 for three sites in the EV Fleet program that were completed in 2023 and that had significant demand, energy consumption, or installed charging capacity. The Evaluation Team was also interested in sites with a demonstrated ability to expand EV infrastructure, the presence of load management, unique vehicles or charging equipment, a large fleet size, and a fleet manager who was willing to participate.

The three PG&E EV Fleet program sites the Team examined were a transit shuttle operator, a Class 8 heavy freight operator, and a transit bus agency. The Evaluation Team conducted in-depth fleet manager interviews and analyzed data from AMI and EVSPs. During interviews, the Team requested permission to survey drivers; however, no sites were ultimately able to administer surveys.

Findings presented in this section are based on interviews and data analysis. *Appendix B* presents more-detailed case studies on each of these fleets.

Transit Shuttle Operator

The Evaluation Team selected a private transit shuttle operator that provides workplace shuttles for employees of a single company within the greater San Francisco Bay area. The shuttle operator has 44 electric shuttle buses, including 21 BYD motor coaches, four MCI coaches, eight Van Hool single-level coaches, 10 Van Hool double-decker coaches, and one Starcraft Ford/Lightning Motors shuttle. Vehicle

reliability has been good, with the fleet's only major reported issue being the partial triggering of fire suppression systems during the washing of certain buses.

The fleet charges its buses on a wide array of DCFC equipment: in addition to 59 ports installed as part of a previous project, the EV Fleet site installed 82 additional DCFC ports: four dual-port ChargePoint 62.5 kW CPE250 units and 37 dual-port 180 kW ABB units. Charger reliability has been fair, with the fleet expressing disappointment with a particular manufacturer's difficulty resolving a recurring issue that ultimately affected every charger from that manufacturer. EVSE from a second manufacturer proved to be more reliable, but was not immune to similar issues, and the fleet manager believes that corrosion from saltwater spray from the nearby San Francisco Bay may be a major culprit. The chargers operate on BP Pulse software, which has been successful in reducing the amount of peak period energy the site consumes. Less than 10% of the energy the site uses for charging its vehicles is used during the 4 p.m. to 9 p.m. peak period. The fleet manager understood the impact of using even this small amount of high-tariff energy, communicating that the peak-rate energy accounts for around 30% to 40% of the fleet's total energy costs. This site has prioritized using EVs on its longest routes to maximize electric mileage and has been encouraged by the overall reliability of the vehicles. The fleet manager expressed some concern about the rate of degradation of the fit and finish on early-generation vehicles, however, the issues the fleet has encountered with its vehicles have been limited in both scope and severity.

The site currently has significantly more ports than vehicles. While the site plans to expand its electric fleet in the near term, it has opted to temporarily support other regional shuttle vehicles in the area. The fleet manager estimates that the site serves around 15 additional partner vehicles, all of which are motor coaches similar in size to those in its own fleet.

Transit Site

The Evaluation Team selected a transit agency operating 10 transit buses for a deep dive because of its early deployment of electric buses (starting with 88 kWh Proterra buses in 2018), its use of peak-shaving hardware, and its partial use of fast overhead charging to fuel its buses.

The site operates 10 Gillig transit buses: nine with 484 kWh batteries and one with a 686 kWh battery. While vehicle reliability has been good, two of the buses have had their batteries replaced under warranty. The vehicles run 115-mile routes over the course of the day. The site has experienced significant issues with its early vehicles, though these were not directly related to the vehicles procured as part of the EV Fleet program. With the manufacturer of these early vehicles out of business, the fleet manager has needed to rely on obtaining parts from decommissioned vehicles and chargers to keep these buses on the road.

The fleet charges its EV Fleet buses overnight using depot chargers (eight 62.5 kW ChargePoint CPE250 units with pairing kits, allowing for up to 125 kW) and enroute using overhead EVSE installed at a transit center (two 500 kW Siemens units, on a separate meter). The transit center offers peak load shaving and backup power in the form of on-site energy storage and a fossil fuel generator. The fossil fuel generator is not intended to directly charge the buses but can power a single overhead charger if needed.

The fleet uses ChargePoint networking software on its depot chargers, with some minor load management to postpone charging to after the 4 p.m. to 9 p.m. peak period of highest-cost energy. However, due to the fleet's long hours of operation (often until 10 p.m. or 11 p.m.), the buses need to charge as quickly as they can. The Siemens overhead chargers are unmanaged by design, as the nature of the fleet's operations require that the buses opportunity charge as quickly as possible, whenever possible.

While the fleet has found success with its Gillig buses, it has no plans for expansion; the fleet has reached its limit for electric buses and adding more would require an upgrade to its service. The fleet is, however, exploring hydrogen fuel-cell buses as an option, and has had initial success with this pathway; the fleet manager anticipates that its fleet will eventually arrive at a split between hydrogen and battery-electric.

Heavy Freight Operator Site

The Evaluation Team selected a heavy freight operator that transports dairy liquids within California's Central Valley. The freight operator has two Volvo VNR electric Class 8 tractor trucks with 450 kWh batteries. The trucks operate on a single 70 mile to 80-mile round trip route per day, hauling heavy (and at times, permitted overweight) liquid tanker trailers for a total vehicle weight of between 80,000 lbs. and 88,000 lbs. To determine exactly how far the trucks can go on a full charge, the fleet conducted tests, gradually increasing trip range until the tractor-trailer combination was unable to complete its duty cycle. The fleet manager found that the vehicle's maximum range was between 90 miles and 100 miles, and noted that they had hoped their trucks would be able to achieve at least 150 miles of range. At the time of the interview, the fleet manager was examining the potential of the second-generation Volvo VNR trucks, which have significantly more battery capacity (over 600 kWh versus 450 kWh).

The trucks are charged on two dual-port 150 kW BTC Power DCFCs, operating on BP Pulse software. The site's load management is good, with the fleet consuming less than 10% of its energy during the 4 p.m. to 9 p.m. peak period. The fleet manager noted that the EVSE have been very reliable, with the most common problem being issues with the initial "handshake," which the fleet has solved by power cycling the EVSE. Other issues the fleet manager reported included delays with site installation, which took place during the COVID-19 pandemic and suffered from supply chain disruptions and shortages.

Highlights

- All three sites report that their vehicles have had fair to good reliability, though lackluster range was cited as a major issue by one fleet.
- While not directly associated with the EV Fleet project, one site has experienced major issues with one of their vehicle manufacturers ceasing operations, leading to the fleet needing to procure used vehicles and chargers as sources for parts.
- All three fleets noted that their charging management allows them to mostly avoid charging during the highest-cost energy periods, with significant load abatement occurring for each site during the 4 p.m. to 9 p.m. peak period.
- No site had greater than 10% of their energy consumed during the high-rate periods during the 2024 evaluation year.

Co-Benefits and Co-Costs

Through fleet manager surveys, deep dive fleet manager interviews, and site visits, the Evaluation Team identified several co-benefits and co-costs associated with the EV Fleet program's vehicle electrification sites.

Fleet Manager Surveys

The fleet manager surveys used both aided (asking fleet managers if they have noticed a specific co-benefit or co-cost) and unaided (open-ended) questions to assess co-benefits and co-costs.⁶

Table 72 shows that all 11 fleet managers expected to realize at least one type of benefit for their community or fleet from electrifying. Fleet managers expected benefits to the community to be more significant than those to their fleets. For instance, eight fleet managers expected *significant benefits* from improved air quality and health and seven expected *significant benefits* from reduction in noise pollution. At the same time, eight of the 11 fleet managers expected *no benefits* from increased fleet flexibility. These results are consistent with results from EY2023, when three of four fleet managers expected *significant benefits* from improved air quality and health and reduced noise pollution and fewer benefits from the other categories.

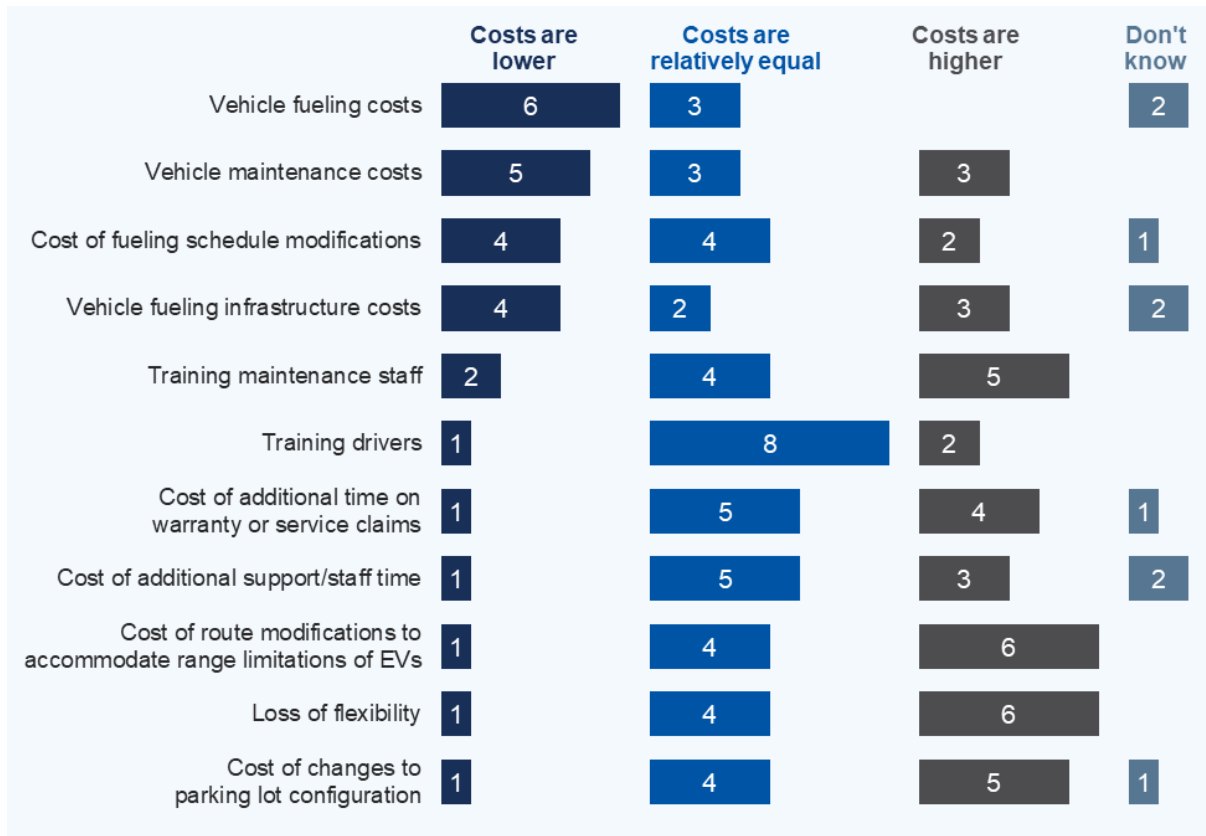
Other benefits mentioned by fleet managers included “showing [their] community that [they] are pollution conscious” and employee retention as their “drivers love the trucks, and techs always want to be on the cutting edge.”

Table 72. PG&E EV Fleet Program Benefits Fleet Managers Reported from Electrification in EY2024

Benefits	Significant Benefits	Some Benefits	No Benefits	Not Sure
Encourages other individuals/fleets to convert to EVs	2	3	5	1
Improved air quality/health	8	2	1	–
Reduction in noise pollution	7	4	–	–
Improved driver comfort/convenience	3	3	3	2
Increased fleet flexibility	2	1	8	–

Source: Fleet Manager Survey Question D1. “What ancillary benefits do you think will be realized for your community/fleet as a result of electrifying?” (n=11)

The Evaluation Team asked fleet managers to estimate how the costs associated with operating and maintaining their fleets have changed since electrification. As shown in Figure 145, six of 11 fleet managers observed lower costs for vehicle fueling costs and five of 11 observed lower vehicle maintenance costs. Six of 11 fleet managers observed higher costs for the cost of route modifications to accommodate range limitations of EVs and the loss of flexibility with the new vehicles. Many fleet managers estimated that their costs remained relatively equal across cost categories. These results are largely consistent with results in EY2023, when two of four fleet managers provided similar answers for the same four cost categories.

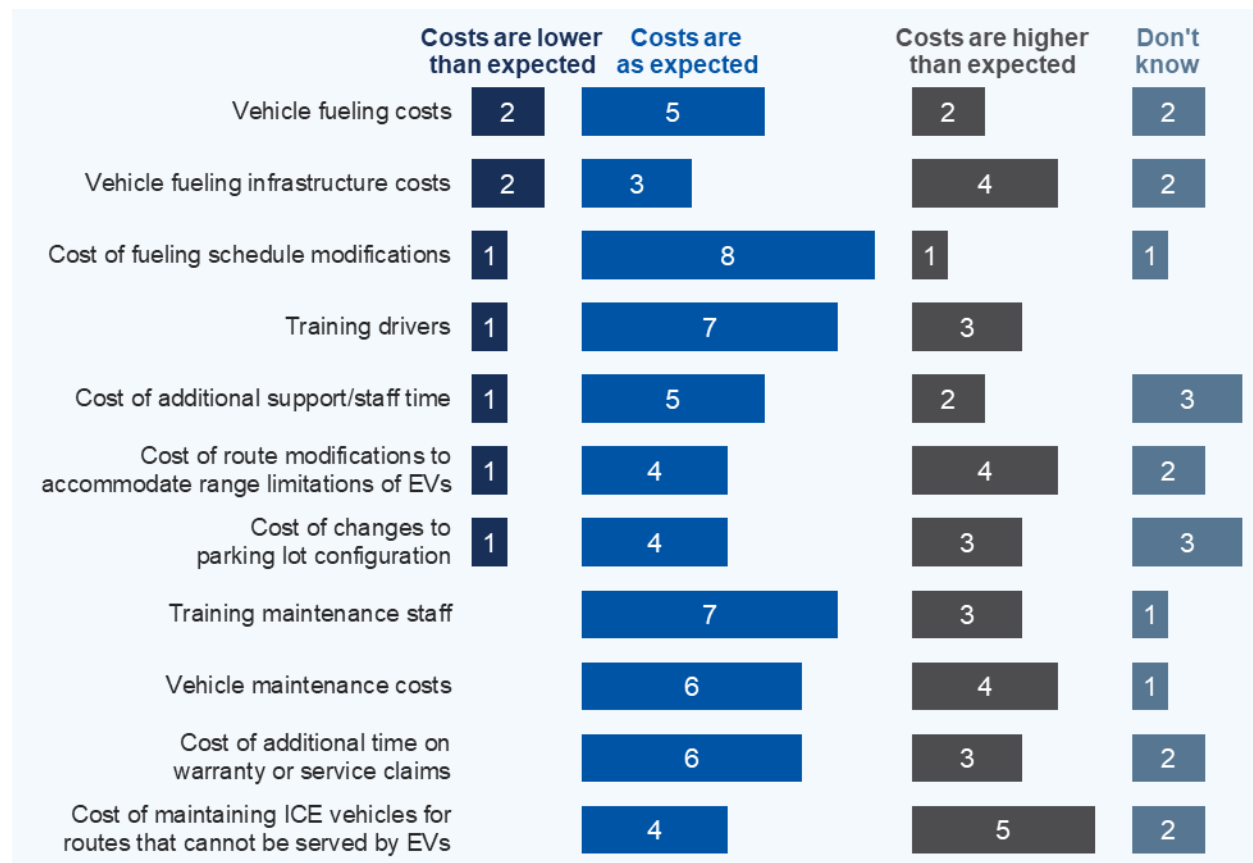
Figure 145. PG&E EV Fleet Program Observed Cost Changes since Electrification in EY2024

Source: Fleet Manager Survey Question E1. “Please think about all the costs associated with operating and maintaining your fleet. For each cost type shown below, please estimate how much the cost has changed since transitioning your fleet to EVs.” (n=11)

The Evaluation Team also asked fleet managers to what extent they expected operational and maintenance costs to change. As shown in Figure 146, costs changed *as expected* for fleet managers across categories, with at least five of 11 respondents reporting so in seven different categories. Few fleet managers reported cost changes as *lower than expected*. Two of 11 fleet managers reported vehicle fueling costs and vehicle fueling infrastructure costs to be *lower than expected* and only one or no fleet managers reported so for other categories. In contrast, several fleet managers reported that cost changes were *higher than expected* across all categories. Five of 11 fleet managers reported that the cost of needing to maintain ICE vehicles for routes or events that cannot be reliably served by EVs changed to an extent that was *higher than expected*. Again, results were consistent with those of EY2023.

Fleet managers mentioned other costs incurred as a result of electrifying including “bringing... sites up to code,” “availability of parts,” and higher costs for registration, insurance, and towing.

**Figure 146. PG&E EV Fleet Program Differences
between Electrification Expectations and Costs in EY2024**



Source: Fleet Manager Survey Question E2. “Have these operational and maintenance costs been what you expected?” (n=11)

Deep Dive Fleet Manager Interviews

The Evaluation Team conducted deep dive interviews with three PG&E fleet managers to assess the co-costs and co-benefits of transportation electrification for fleets and fleet drivers. During the interviews, fleet managers noted several costs:

- **Site material procurement and installation.** One fleet described significant disruptions as a result of the COVID-19 pandemic, leading to long lead times for crucial system components, such as transformers and switchgear, and for the delivery of the vehicles themselves.
- **EV range and charging duration.** One fleet manager said that their EVs generally have enough range to make it through most of their shifts, but the vehicle range was significantly lower than expected.
- **Vehicle manufacturer longevity.** While not directly related to the EV Fleet project, one fleet manager has experienced significant issues with sourcing parts, maintenance, and repair for both the EVSE and the vehicles installed from a manufacturer that is no longer in business.

Despite some of these initial challenges in electrification, all three fleet managers conveyed overall neutral-to-positive experiences with their electrified fleets when vehicles were operating well. One fleet manager noted that they were actively prioritizing placing their electric buses on their longest routes to maximize fuel savings and minimize emissions, and one said that around half their drivers prioritized driving the EVs over their diesel vehicles.

Highlights

- All 11 responding managers anticipated benefits for their community or fleet because of electrification.
- Eight of the 11 fleet managers expected significant benefits from electrification from improved air quality/health, and seven of 11 expected significant benefits from reduced noise pollution.
- Three of 11 fleet managers said costs associated with EVs are higher than with ICE vehicles for maintenance staff training, and five of 11 cited higher costs from loss of fleet flexibility and route modifications to accommodate EV range limitations.
- One fleet manager reported that EV costs were lower than expected for fueling schedule modifications and another two gave this rating for vehicle fueling costs. Four of 11 fleet managers reported that vehicle maintenance costs for EVs were higher than expected.
- Site contacts reported improved air quality and reduction in noise as key benefits (8 and 7, respectively); however, the most commonly reported co-cost was the cost of maintaining ICE vehicles for routes that cannot be reliably served by EVs (5 site contacts), followed by fueling infrastructure costs, vehicle maintenance costs, and the cost of modifying routes to accommodate EVs (4 site contacts for each).
- The three deep dive interviewees noted challenges around site material procurement and installation, EV range and charging duration, and vehicle manufacturer longevity, but all three conveyed an overall neutral-to-positive experience with their electrified fleets.

Site Costs

The Evaluation Team conducted a cost analysis on 75 EY2021, EY2022, EY2023, and EY2024 sites with fully closed out finances as of December 31, 2024. The set of fully closed out sites is smaller than the set of activated sites because of the time lag involved in performing activities such as collecting receipts, paying invoices, and obtaining administrative approvals.

Sites had a mix of L2 and DCFC ports, with an average of 765 kW of installed capacity and 14 ports. The 75 sites included 35 school bus sites, 12 transit bus sites, 10 heavy-duty vehicle sites, 12 medium-duty vehicle sites, four forklift sites, one cargo handling site, and one TRU site. The Team aggregated findings across all market sectors to meet customer confidentiality requirements.

Figure 147 shows the distribution of site-level costs of the 75 sites. The horizontal lines of the boxes show the 25th, 50th, and 75th percentile of sites; the “x” represents the mean site cost; and the three panels are defined as follows:

- **Utility Infrastructure Costs.** Site costs borne by PG&E for TTM and BTM rebates.⁷⁷
- **Ratepayer-Funded Costs.** All site costs paid for by the Utility, including TTM, BTM (or BTM incentive if infrastructure is customer owned), and EVSE rebate.
- **Estimated All-in Costs.** The total estimated cost of installing the site, including capital and labor costs for the Utility and the customer. This value is calculated by summing all of the TTM,⁷⁸ BTM,⁷⁹ and EVSE costs.⁸⁰

⁷⁷ Values are the same as the Ratepayer-Funded Costs except they do not include the EVSE rebates.

⁷⁸ The Utility pays 100% of the TTM costs and therefore reports actual TTM costs to the Evaluation Team.

⁷⁹ The Evaluation Team receives actual BTM costs for sites with Utility-owned BTM, which was applicable for 2 of 75 sites. For the customer-sponsored BTM sites, the BTM cost is estimated as multiplying the rebate amount times 1.2.

⁸⁰ Because actual EVSE costs are not known by the Utility, The Evaluation Team estimates EVSE equipment costs using an assumption of \$3,000 per port for L2 ports and \$45,000 for DCFC ports.

Figure 147. PG&E EV Fleet Program Per-Site Costs Organized by Two Perspectives, Across 75 Closed-out School Bus and Non-School Bus PTD Sites

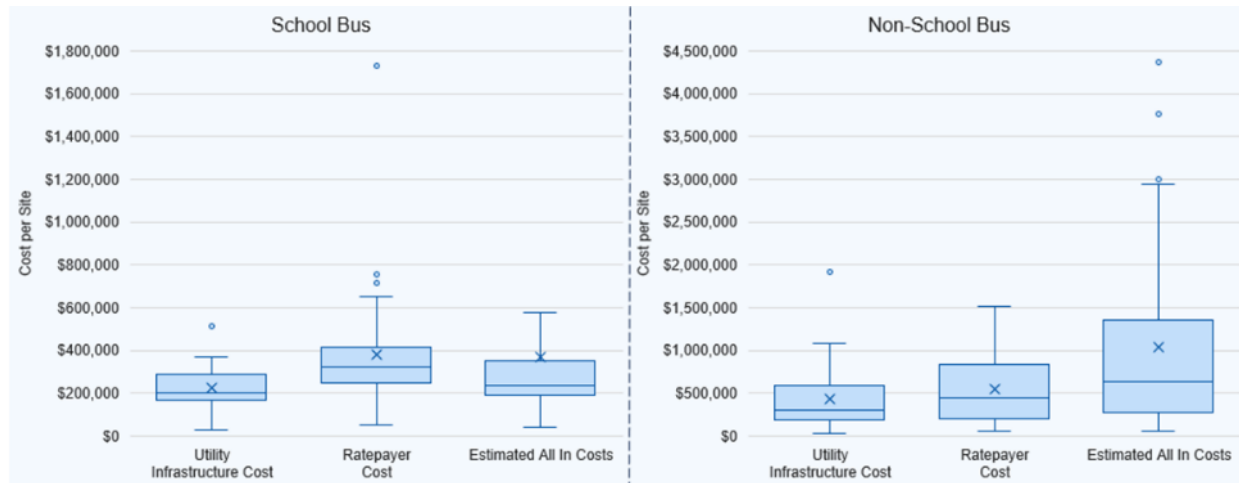


Figure 148 shows the average all-in costs for the 75 sites, with the 35 school-bus sites on the left and 40 non-school bus sites on the right. For the school-bus sites, TTM is the largest estimated cost, followed by EVSE, then estimated BTM. The average all-in school bus costs including the average all-in actual TTM, estimated BTM, and estimated EVSE cost is \$367,480 through 2024 PTD.⁸¹ For non-school bus sites, EVSE is the largest estimated cost, followed by TTM, then estimated BTM. The average all-in non-school bus costs including the average all-in actual TTM, estimated BTM, and estimated EVSE cost is \$1,036,421.⁸² Although not shown, 45% of PG&E EV Fleet program spending on infrastructure for financially closed out sites to date has been on DAC sites, exceeding the 25% program target.

Figure 148. PG&E EV Fleet Program Average Estimated All-In Costs, Across 75 Closed-out School Bus and Non-School Bus PTD Sites

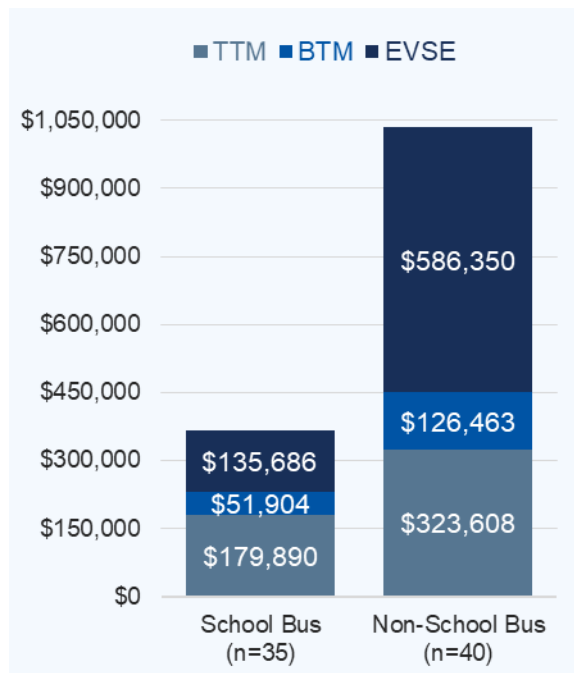


Figure 149 shows the distribution of Utility infrastructure costs presented per site, per vehicle, and per kilowatt. The average Utility infrastructure cost of TTM and BTM borne by PG&E across sites through 2024 PTD was \$331,005 per site,⁸³ \$24,931

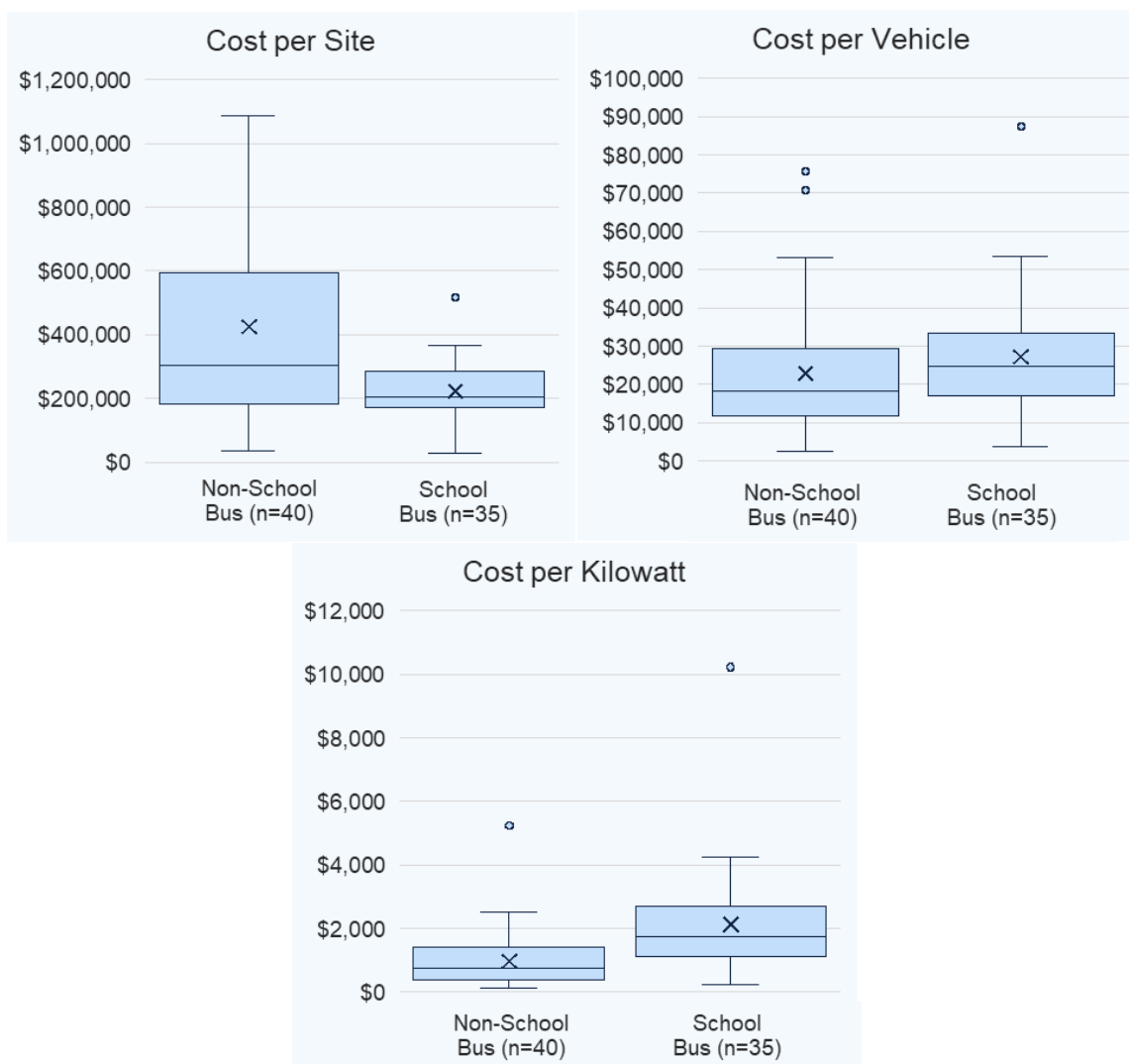
⁸¹ Calculated by summing all TTM, BTM, and EVSE costs borne by PG&E and the customer and dividing by the 35 sites.

⁸² Calculated by summing all TTM, BTM, and EVSE costs borne by PG&E and the customer and dividing by the 40 sites.

⁸³ Calculated by summing all TTM and PG&E-sponsored BTM costs and dividing by the number of sites. Number reflects maximum infrastructure rebate offered for sites that have not yet applied for rebates, which may vary significantly from actual infrastructure rebate amount paid.

per vehicle,⁸⁴ and \$1,508 per kilowatt.⁸⁵ Similar to 2023, school bus sites in 2024 are less expensive than non-school bus sites on a *per site* basis but more expensive on a *per kilowatt* basis, reflecting the higher reliance on L2 chargers (which are more expensive per kilowatt for BTM, TTM, and EVSE) at school bus sites. School bus sites are slightly more expensive than non-school bus sites on a *per vehicle* basis.

Figure 149. PG&E EV Fleet Program, Utility Infrastructure Cost per Site, per Vehicle, and per Kilowatt for 75 Closed-out School Bus and Non-School Bus PTD Sites



⁸⁴ Calculated by summing all TTM and PG&E-sponsored BTM costs and dividing by the sum of all vehicles.

⁸⁵ Calculated by summing all TTM and PG&E-sponsored BTM costs and dividing by the sum of installed capacity.

Highlights

- Estimated All-in costs for school bus sites (i.e., estimates of 100% of the Utility and customer costs) vary widely between sites with an average of \$367,480 through 2024 PTD per site.
- Estimated All-in costs for non-school bus sites (i.e., estimates of 100% of the Utility and customer costs) vary widely between sites with an average of \$1,036,421 through 2024 PTD per site.
- While the EV Fleet program provides TTM infrastructure upgrades for all sites, only two of 75 closed out sites had Utility-constructed BTM infrastructure.
- The average cost of PG&E-sponsored TTM and BTM through 2024 PTD across sites was \$331,005 per site, \$24,931 per vehicle, and \$1,508 per kilowatt. School bus sites are cheaper than non-school bus sites on a per-site basis but more expensive on a per-kilowatt basis, reflecting the higher reliance on L2 chargers (which are more expensive per kilowatt for BTM, TTM, and EVSE) at school bus sites.

Grid Impacts

This section describes grid impacts for the EV Fleet program based on an analysis of energy consumed and customer bills from operational charging stations installed through the program in EY2024.

Data Sources

The primary data source for the analyses detailed in this section is the energy usage–related data provided in regular 15-minute intervals from the AMI. Other data sources include customer bills, LCFS program information, and charging session–specific data provided by NSPs. There are several important differences between AMI and NSP data. While AMI data includes only energy usage, NSP data also includes session start and stop time, the duration of a vehicle’s connection to a charging port, the duration of a vehicle actively pulling power, and the specific port used for a session. AMI meters track standing loads (such as those the EVSE uses for communications, cooling, active power converters, solenoids, and screens), which NSPs typically cannot do. For cases in which AMI data was missing from the dataset, the Evaluation Team used NSP data to fill in the gaps.

Summary of Grid Impacts

Table 73 presents the estimated EV Fleet program grid impacts.

Table 73. PG&E EV Fleet Program Grid Impacts

Impact Parameter	Actual 2024	Actual Program to Date	10-Year Projection PTD
Operational Sites ^a	39	101	101
Installed Capacity (kW)	34,217	63,391	63,391
Electric Energy Consumption, MWh	16,959		249,938
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)	2,730 (16%)	5,362 (18%)	39,848 (16%)
Maximum Demand, kW (with date and time)	11,749 (10/22/24 9:30 PM)	11,749 (10/22/24 9:30 PM)	N/A
Maximum On-Peak Demand, kW (with date and time)	5,819 (11/14/24 7:45 PM)	5,819 (11/14/24 7:45 PM)	N/A

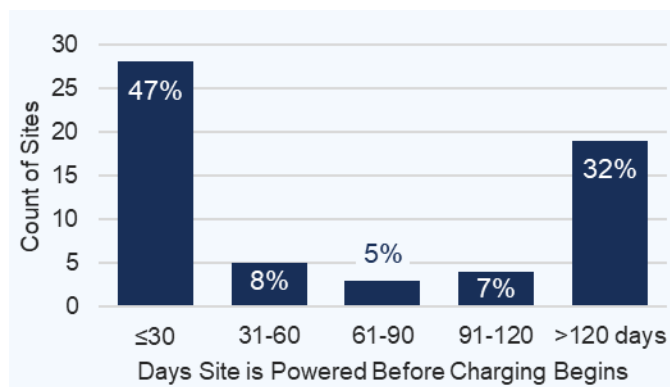
^a Only 39 (Actual 2024) and 101 (Actual PTD) of the operational sites had sufficient data to be included in the impacts analysis

Energy Trends

Site Startup

The Evaluation Team examined the duration between EV Fleet program site activation and operation to illustrate the time between readiness of charging infrastructure and actual vehicle charging. AMI data indicates that from 55% to 61% of sites in the EV Fleet program show significant operations within 60 days of activation, as illustrated in Figure 150. As shown in the final column of this figure, 32% of sites took longer than 120 days from activation and operation, which is slightly higher than last year. Based on discussions during site visits, causes of delays in operation include vehicle delivery, supply chain and reliability.

Figure 150. PG&E EV Fleet Program Percentage of Sites by Days between Activation and Operation for PTD Sites



Consumption and Maximum Demand

Figure 151 depicts the growth of PG&E's monthly energy consumption and maximum demand for all operational sites in the EV Fleet program to date. In the first half of 2024, consumption and maximum demand increased at a similar rate as in 2023 and then leveled off later in the year. The demand may reflect a mix of newer sites engaging in load management and possibly lower cooling loads by vehicles while charging after the summer.

EV Fleet program sites collectively reached almost 12 MW of demand in 2024, with an installed capacity of approximately 66 MW. As detailed in the *Site Visit Findings* section, the low demand relative to the installed capacity is likely due in part to several factors including operators taking time to build expertise, work out EV or EVSE reliability, and wait for delivery of vehicles. Another factor is that installed capacity is intended for future vehicles across site's five-year VAP.

Figure 151. PG&E EV Fleet Program Monthly Energy Consumption and Maximum Demand

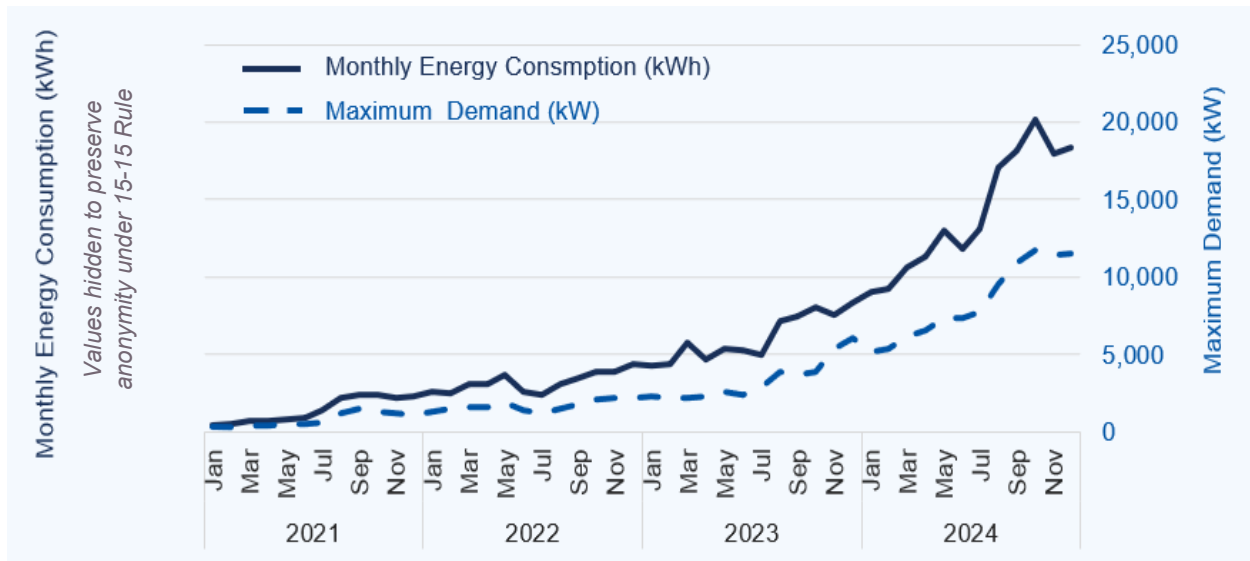


Figure 152 provides insight into monthly energy consumption trends of activated sites by program reporting year. Sites activated in both 2021 and 2023 show consistent consumption while sites from 2022 continue to increase consumption at a faster rate. Though sites activated in 2024 show significant growth, these sites are likely too new for the Evaluation Team to be able to predict whether they will continue to grow or have tapered off. Consumption in months before the year activations took place likely reflects commissioning periods. Significant drops in consumption in the summers often reflect a drop in operations for a large number of school bus sites.

Figure 152. PG&E EV Fleet Program Monthly Energy Consumption of Activated Sites Grouped by Initial Reporting Year PTD

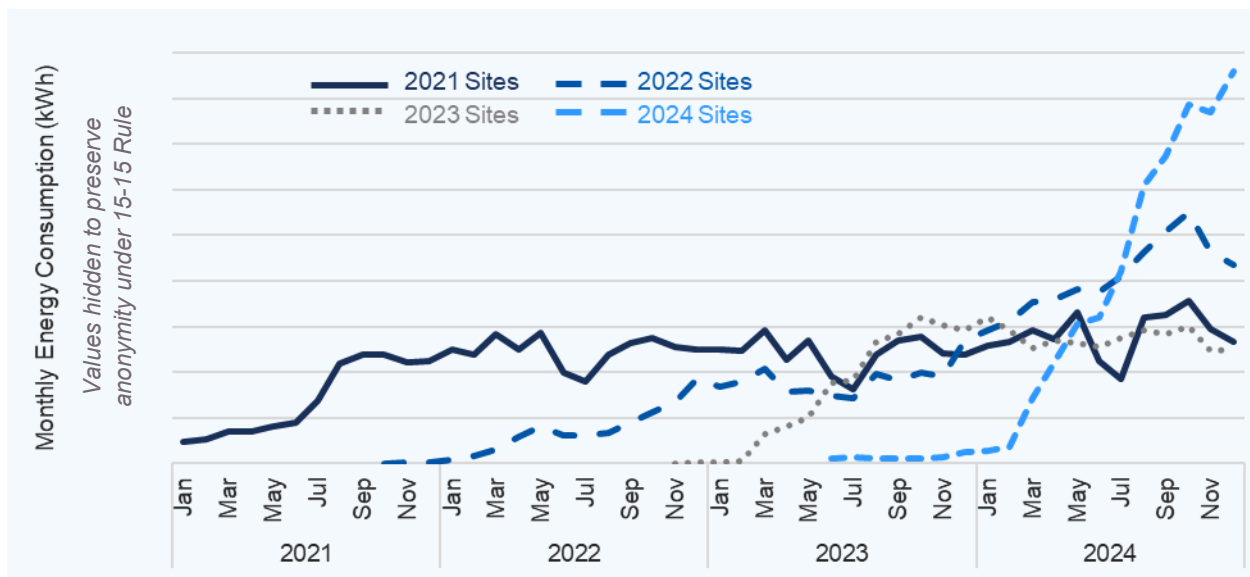


Figure 153 shows wide variations in daily consumption between weekdays and weekends. The peaks typically represent weekday operation, while the dips typically represent weekend operation. The final months of 2024 show regularly occurring days which nearly touch 100 MWh. Weekend energy uptake typically fluctuated between 20 and 40 MWh to end the year.

Figure 153. PG&E EV Fleet Program Daily Energy Consumption for PTD Sites

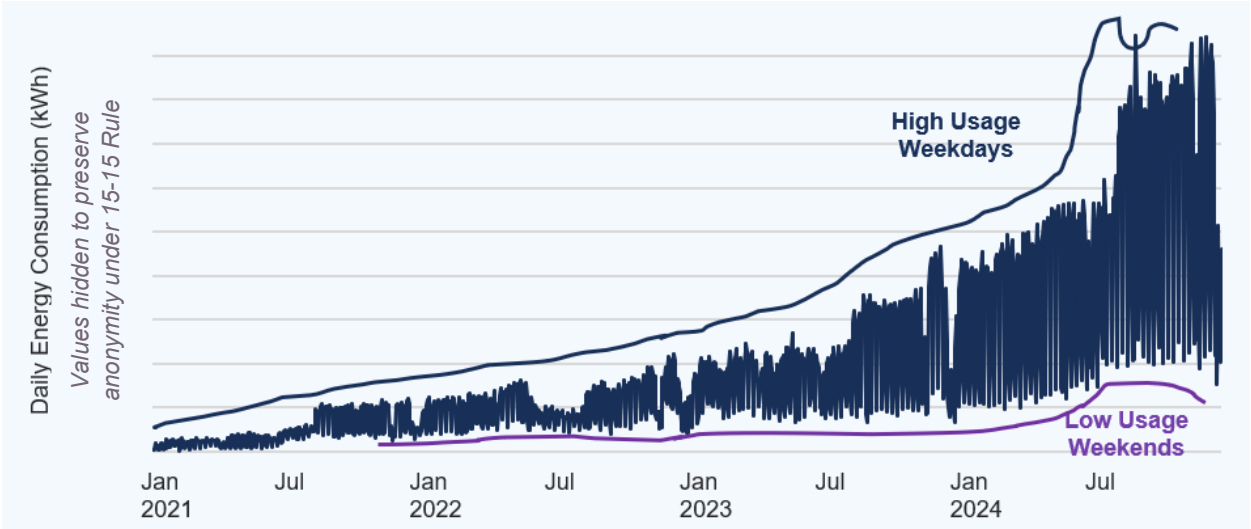
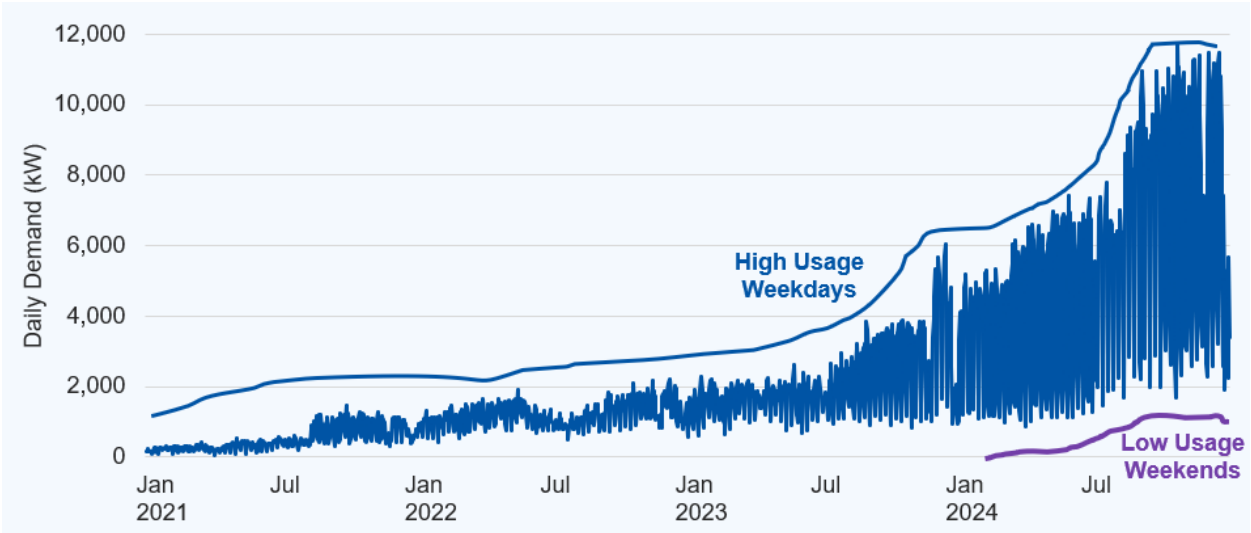


Figure 154 shows daily fluctuations in the maximum demand during the same period. Weekends continued to show demand around 3 MW, while weekdays at the end of 2024 approached 12 MW.

Figure 154. PG&E EV Fleet Program Daily Maximum Demand for PTD Sites



Load Management and Charging Flexibility Analysis

This section describes analyses around load management and load flexibility. Load-managed sites are those that adopt techniques to mitigate recurring high utility bills such as avoiding peak energy prices and reducing unnecessary speed of charging (kW). The analyses consider sites to be load-managed if they exhibited consistent load management at some point in their operations regardless of when load-management was implemented; otherwise, they are labeled as non-load-managed. One indication of load management is the 9 p.m. load ramp that results from a site avoiding demand from 4 p.m. to 9 p.m. and shifting loads to periods of lower cost electricity.

PG&E's peak TOU period occurs each day from 4 p.m. to 9 p.m. During those peak hours under the BEV rate structure the volumetric component of energy costs in 2024 was around \$0.40 per kilowatt-hour, versus below \$0.20 per kilowatt-hour at other times. These TOU rates, displayed in Figure 155, apply to all days throughout the year. Lower-cost TOU periods, such as the Super-Off-Peak period from 9 a.m. to 2 p.m., often correlate with lower carbon intensity of the grid, as indicated by the dashed line in the figure, which shows the CAISO 2024 average carbon intensity

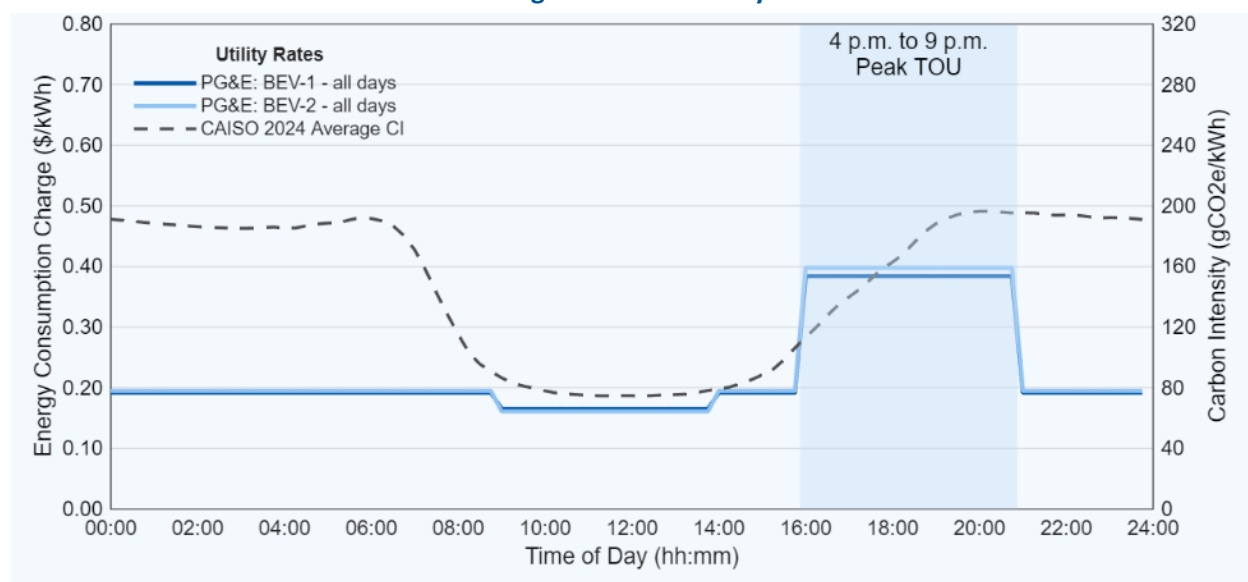
(gCO₂e/kWh). As the actual carbon intensity of the grid varies continuously by time of day and day of year, this reference line indicates the time-of-day average across all days in 2024.

What is Load Management?

Load Management is an effort to control vehicle charging for several purposes:

- Mitigation of electricity costs
- Participation in special programs (Demand Response or California LCFS)
- Compensation for limited electrical capacity

Figure 155. PG&E EV Fleet Program Hourly TOU Electricity Rates and Average Carbon Intensity in 2024



The Evaluation Team periodically reviews data on a site-by-site basis throughout the year to identify load-managed sites. Visiting sites in person and speaking to fleet managers also provides context around load management intent.

Of the approximately 100 operational sites, 18 exhibit strong indications of using load management throughout 2024. Four of which performed intermittently throughout the year. Seven sites previously noted for load management no longer use it. Load management is most evident in two ways:

- Load spikes around 9 p.m. and sometimes drops significantly at 4 p.m.
- The proportion of total monthly energy consumption used between 4 p.m. and 9 p.m. is often below 10%

The Evaluation Team assessed consumption trends for sites that had implemented load management and those that had not. Figure 156. compares the average load curves of load-managed and non-load-managed sites. It shows vastly different charging activity from 4 p.m. and 9 p.m. between the two groups. On average 4 MW of demand is being postponed to after 9 p.m.

Though the load-managed group has reacted to PG&E rates through waiting to charge vehicles, they do result in a significant load spike. Generally, such a spike means vehicles are charging faster than they need causing higher than necessary utility bills. The *Charging Flexibility* section below will help quantify how fast vehicles need to charge and how much high-cost energy is necessary. The Billing Analysis section will review results of modeling using charging flexibility to discuss how much less demand and therefore demand-oriented costs could be saved by all of the fleets regardless of current load management.

Figure 156. PG&E EV Fleet Program Load-Managed and Non-Load-Managed Site Demand, 2024 Q4 (High Consumption and Demand Months), PTD Sites

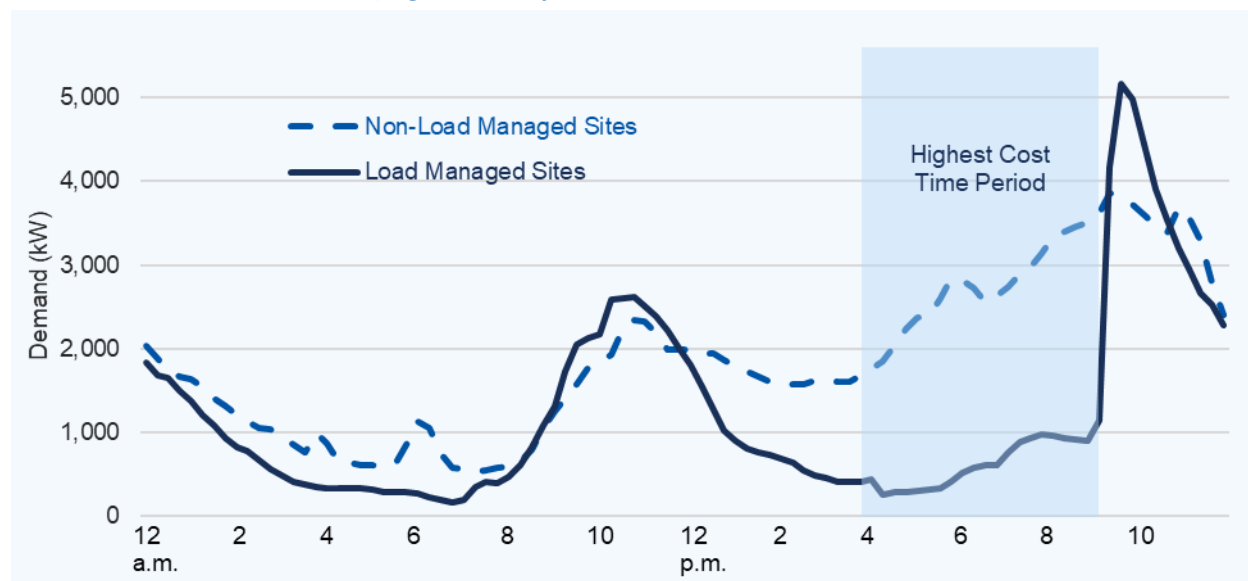
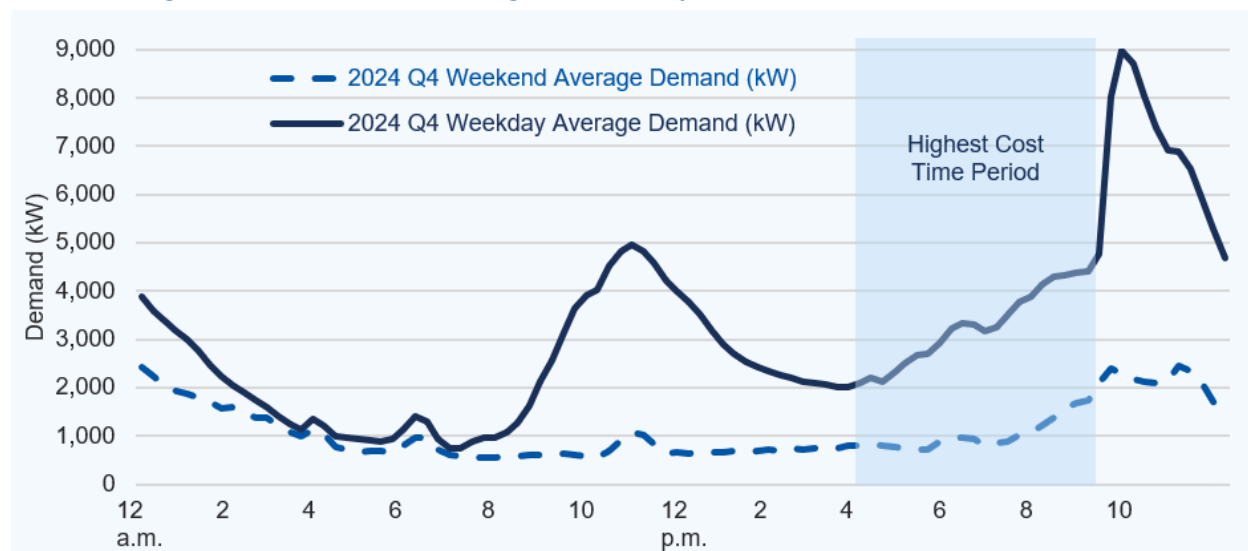


Figure 157 shows the average weekday and weekend daily load across all sites in the EV Fleet program for final quarter of 2024. The weekday average shows a combination of both load curves above. Weekends have much less consumption and demand compared to weekdays. Some advanced fleets are thought to avoid charging on Friday nights so they can make use of PG&E's Super Off Peak from 9 a.m.

to 2 p.m. This time period is otherwise inaccessible for most fleets operating Monday through Friday aside from school buses.

Figure 157. PG&E EV Fleet Program Weekday and Weekend Q4 2024 Load Curves



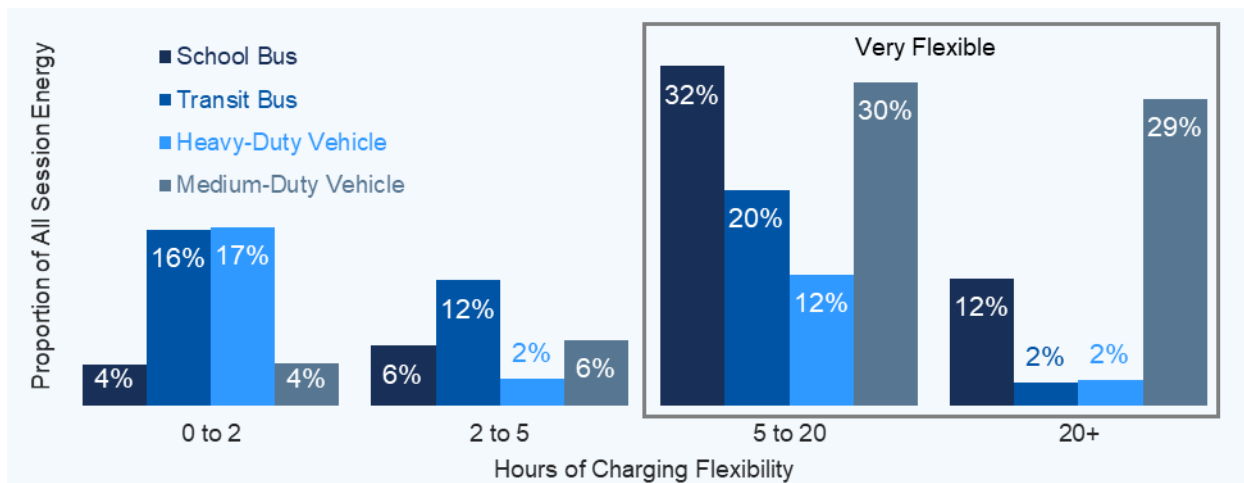
Charging Flexibility

The Evaluation Team used site charging data to determine the amount of time vehicles are connected to a charging port but not actively consuming energy. This allowed the Team to assess charging flexibility, or the ability for a vehicle to shift charging from periods of high-cost electricity to low-cost electricity without impacting vehicle operations. In addition, site visits allowed the Evaluation Team to confirm vehicles' make, model, and battery size, all of which affect charging flexibility as well as operational characteristics. For instance, many school bus charging sessions use less than half of the vehicle's battery capacity. Providing feedback to operators about historical usage trends like charging session size in relation to battery size and available time to charge may help inform charging plans.

Figure 158 shows the relative charging flexibility of various vehicle market sectors school bus and non-school bus fleets which represents the number of hours that fleet vehicles are connected to a charging port but not consuming electricity. The following figure uses only charging sessions that took place partially or entirely during periods of highest cost electricity and omits charging sessions that did not overlap with the period between 4 p.m. and 9 p.m.

Two market sectors consumed unnecessarily over 40% of their energy from 4 p.m. and 9 p.m. while two others have 15% to 25% that was unnecessary. These relatively small proportions of energy have larger financial repercussions as that time period is twice the cost as when the vehicles could have charged, typically later at night or even over the weekend. While smaller, the groups of charging with under five hours of flexibility also represent opportunity to reduce recurring utility bills.

Figure 158. PG&E EV Fleet Program Charging Flexibility for PTD Sites in Sessions Overlapping the Time Period Between 4 p.m. and 9 p.m.



Fleets operating a single shift are usually able to benefit the most from load management, while fleets operating multiple daily shifts face the most challenges to leveraging load management. However, those with more shifts often have significant energy consumption at all times of day, which somewhat reduces the proportion of charging during 4 p.m. to 9 p.m., resulting in comparatively lower average energy costs.

Costs and Billing

Previous sections have focused on energy trends and on charging flexibility, identifying that significant charging is taking place from the peak period of 4 p.m. to 9 p.m. and that much of this load could be shifted to periods of lower demand. The following section will examine utility cost and billing trends and identify to what extent sites may reduce costs based on charging flexibility. The Evaluation Team's review of billing data focuses on the average unit cost of a kilowatt-hour for a given site-billing month compared to the TOU-based tariff cost of energy.

NSPs' load management capabilities and customer level service impacts fleets' adoption rate of load management impact costs and energy trends. When provided, load management may be a base offering or tiered-cost package, depending on the provider. Interoperability between hardware, software, and vehicles presents challenges that can make load management impractical or difficult to achieve.

Many fleet operators remain unaware of their energy use and charging costs despite utility bills and EVSPs which make metrics available. Often a site host's finance office will receive utility bills but will not share information with fleet operators that would enable them to compare energy costs with other fuel types in their fleets. The Evaluation Team uses energy trends as discussion points during site visits if operations have started. Many fleet operators said they had not seen these data trends prior to the evaluation site visits.

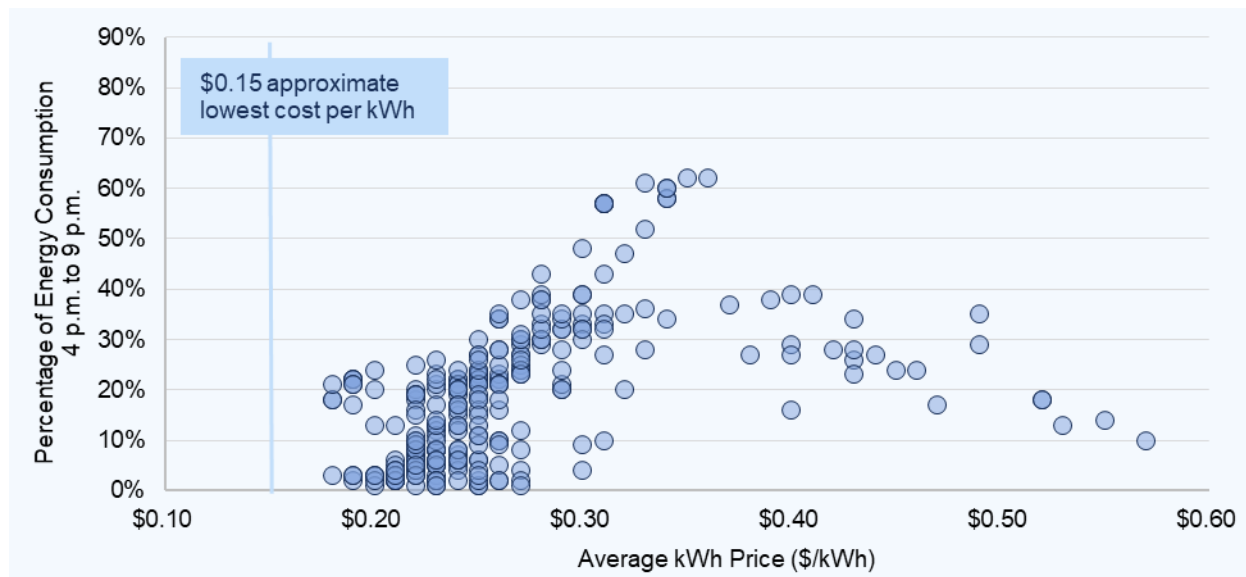
Figure 159 shows the distribution of average monthly billing cost per kWh for sites in the PG&E Fleet program for which at least six months of billing data was available in EY2024 (n=77). Base rates range between \$0.20 and \$0.40/kWh, on top of which are added demand-subscription charges, other service fees and taxes. Overall, these sites have an average billing cost of \$0.36/kWh. The best results appear to show monthly billing between \$0.22 and \$0.27/kWh through use load management intervening on TOU (avoiding 4 p.m. to 9 p.m.) and limits on peak demand, combined with a high volume of energy consumption.

Figure 160 illustrates the relationship between percentage of on-peak energy consumption and the average monthly customer bills for sites billing more than 20 MWh. There is a slight trend showing increased cost coincident with proportion of 4 p.m. to 9 p.m. energy. Costs appear to hit a floor around \$0.2/kWh with a few outliers just below that. This group of billing months averaged \$0.29/kWh. Approximately 275 data points are included. Low outliers may be due to sites that have solar net metering or credits on their account.

Figure 159. PG&E EV Fleet Program Summary of Average Monthly Electricity Costs (n=77)



Figure 160. PG&E EV Fleet Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for High Consumption Billing Months (>20 MWh) for PTD Sites



Billing months for fleets that consumed between 5 MWh and 20 MWh in a month also show a correlation between energy consumption from 4 p.m. to 9 p.m. and average unit pricing (Figure 161). This should provide further encouragement for fleets to focus on improving their load-management efforts. Many of these customers' bills show an average of \$0.20 to \$0.30 per kilowatt-hour. Cost savings of 30% for users averaging \$0.40 or more per kilowatt-hour are likely achievable.

Figure 161. PG&E EV Fleet Program Total Monthly Energy Consumed vs. Average Energy Price for Medium Consumption Billing Months (5 MWh to 20 MWh) for PTD Sites

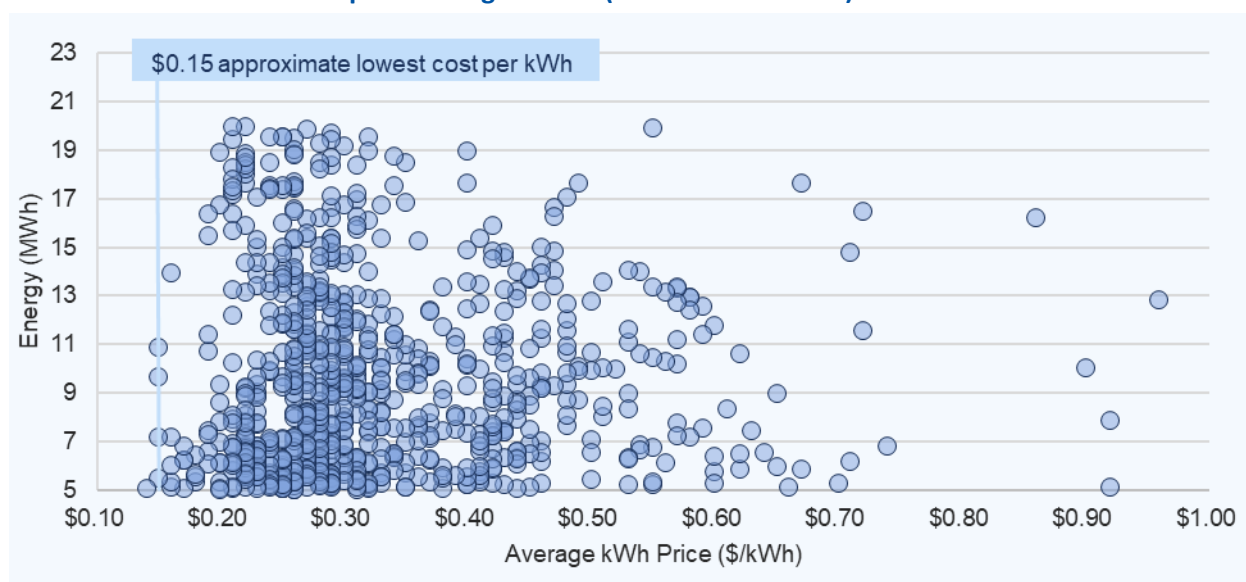
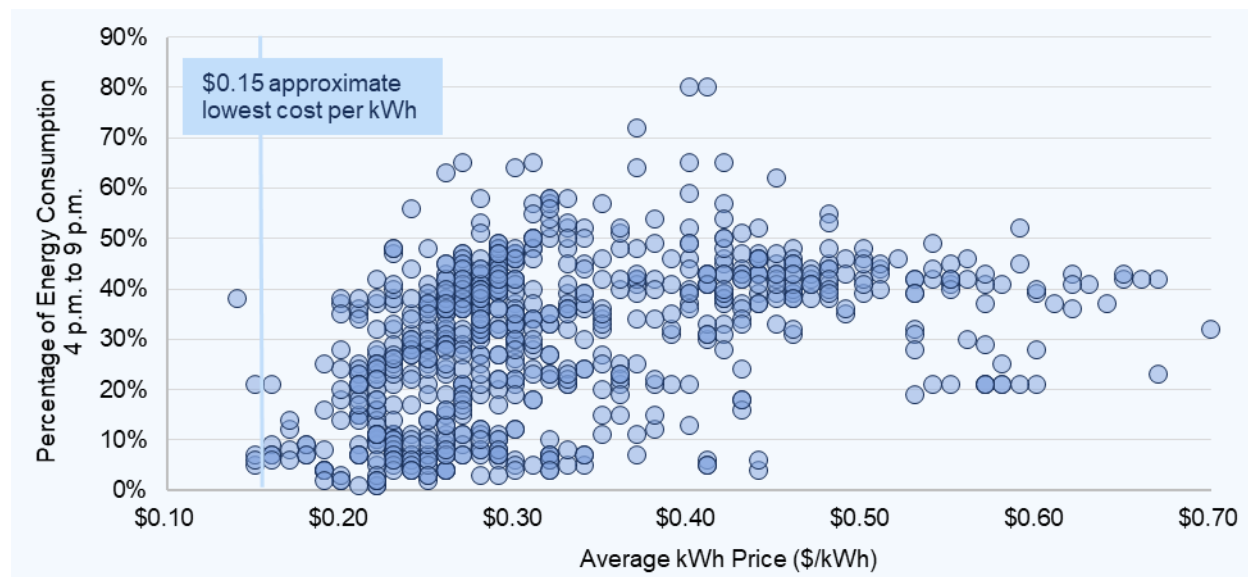


Figure 162 compares proportion of consumption from 4 p.m. to 9 p.m. to average unit of energy costs. A higher proportion of this group are above \$0.40 than in the largest billing months. Approximately 800 billing months are included.

Figure 162. PG&E EV Fleet Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for Medium Consumption Billing Months (5 MWh to 20 MWh) for PTD Sites



Fleets that used less than 5 MWh per month show a greater correlation between average unit pricing and overall monthly consumption. Figure 163 illustrates that sites with the lowest monthly energy consumption are likely to have higher electricity costs per kilowatt-hour. This might be attributed to fixed fees, which are spread across the total kilowatt-hours consumed and therefore have a greater impact on sites with lower total consumption. Approximately 1,000 billing months are included.

Figure 163. PG&E EV Fleet Program Total Monthly Energy Consumed vs. Average Energy Price for Low-Consumption Billing Months (<5 MWh) for PTD Sites

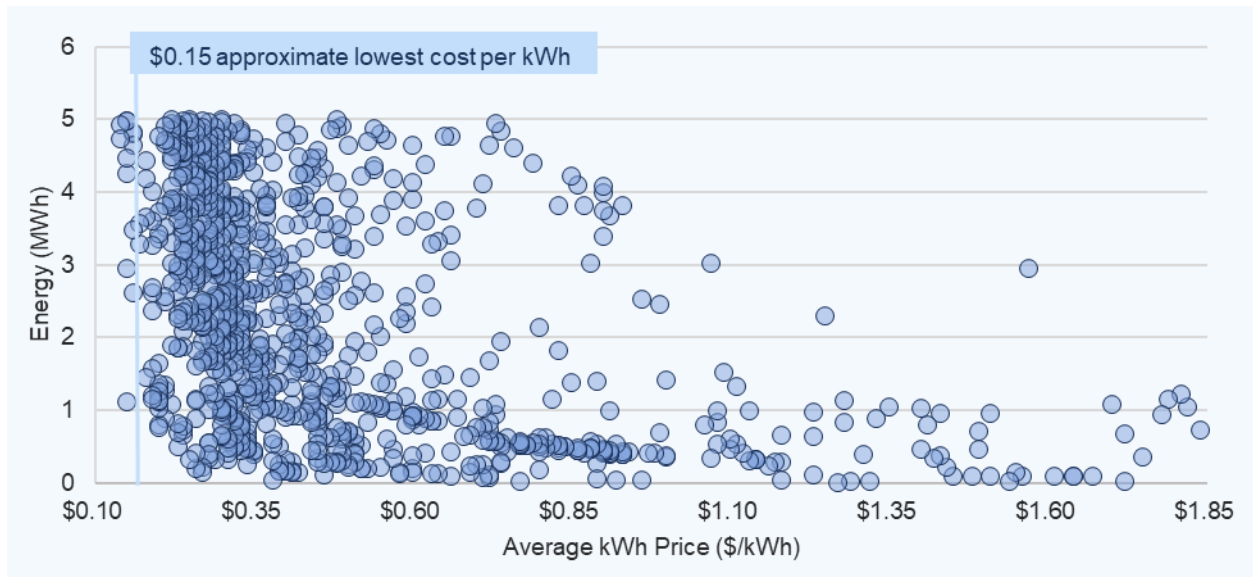
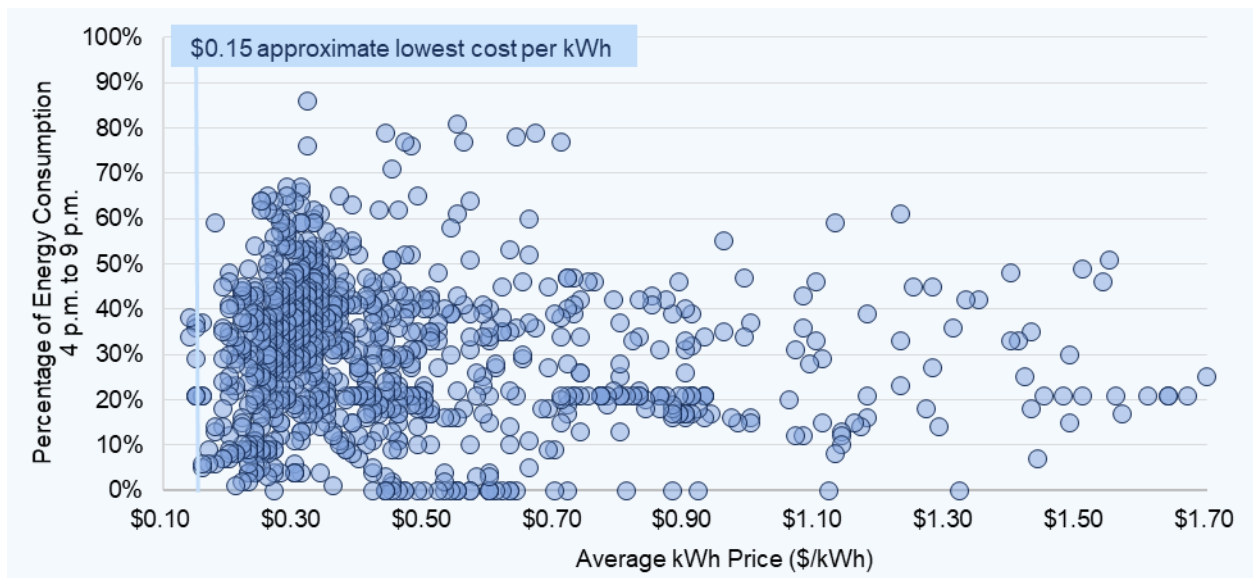


Figure 164 shows a correlation between the proportion of consumption from 4 p.m. to 9 p.m. and average energy price as occurs with higher-energy users, highlighting the opportunity for low-energy users to reduce costs by using load management. Operators with these small billing months may have less opportunity for the lowest costs but can still influence their bills based on TOU periods.

Figure 164. PG&E EV Fleet Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for Low Consumption Billing Months (<5 MWh) for PTD Sites



Electricity Cost and Emissions Optimization Analysis

This section builds upon the grid impact findings above to include an analysis of hypothetical customer bills and emissions. This analysis considered TOU-based load management across sites with enough reliable NSP data. While real-world constraints—such as technology, operations, and education—currently prevent ideal load management, the findings shed light on the long-term potential of load management. To quantify the potential benefits of using load management, the Evaluation Team analyzed observed outcomes of sites with and without existing load management practices and conducted a load-shifting optimization exercise to estimate the total potential cost savings and emissions reductions. This optimization analysis utilizes NSP data, where available, to assess charging flexibility for each site. For sites without sufficient NSP data reported, the analysis uses AMI data and a charging session availability template to assess charging flexibility. The template is derived for each market sector based on the charging behavior of sites with NSP charging session data within each sector. *Appendix B* provides additional methodological notes.

Load management outcomes observed in EY2024

The Evaluation Team assessed a subset of all PTD sites that had the necessary AMI and NSP data—a total of 80 EV Fleet program sites. This analysis does not use data for all 100 operational sites in the EV Fleet program to date, but only for those sites with AMI and NSP data that met analysis requirements. Of these 80 sites, 33 were school bus sites and 47 were from other market sectors, including transit bus, medium-duty vehicles, heavy-duty vehicles, port cargo trucks, and forklifts.

Figure 165 and Figure 166 depict the BAU historical energy consumption of school bus and non-school bus fleets in aggregate during 2024. BAU is the current charging behavior of the 80 sites represented in this analysis. The areas in the figures with darker shading correspond to times of day (y-axis) and days throughout the year (x-axis) with higher collective charging demand, as measured by the scale on the right of the plot. Areas with no shading represent no energy demand. School bus fleets (Figure 165) show a consistent trend of charging twice per day: first, beginning around 9 a.m. after the morning routes to pick up students, then again around 4 p.m. to 5 p.m. after buses complete afternoon runs. The second charging session directly coincides with higher TOU rates. It appears that very few school bus sites are delaying the charging sessions until after 9 p.m. to avoid peak TOU energy costs. The figure clearly shows lower demand during winter break, spring break, and summer vacation periods when school bus operation is minimal. It also indicates that many schools deployed more electric buses and/or increased their usage after returning from the summer break (as seen by the increased demand in August), which reflects the continued program growth in 2024. At all other sites (Figure 166), the majority of charging sessions begin after 9 p.m., avoiding the higher-cost Peak TOU period. These sites also saw continuous growth throughout 2024, as shown by the steadily increasing maximum demand.

Figure 165. PG&E EV Fleet Program Heatmap of the Collective BAU Charging Demand for All PG&E School Bus Fleets in 2024

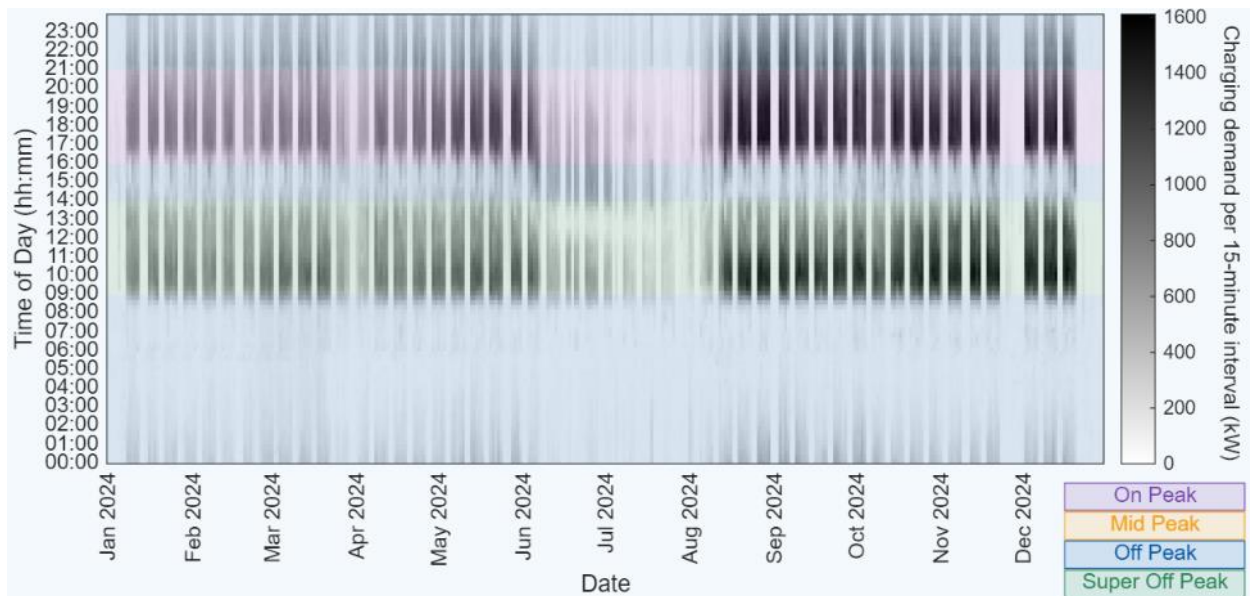
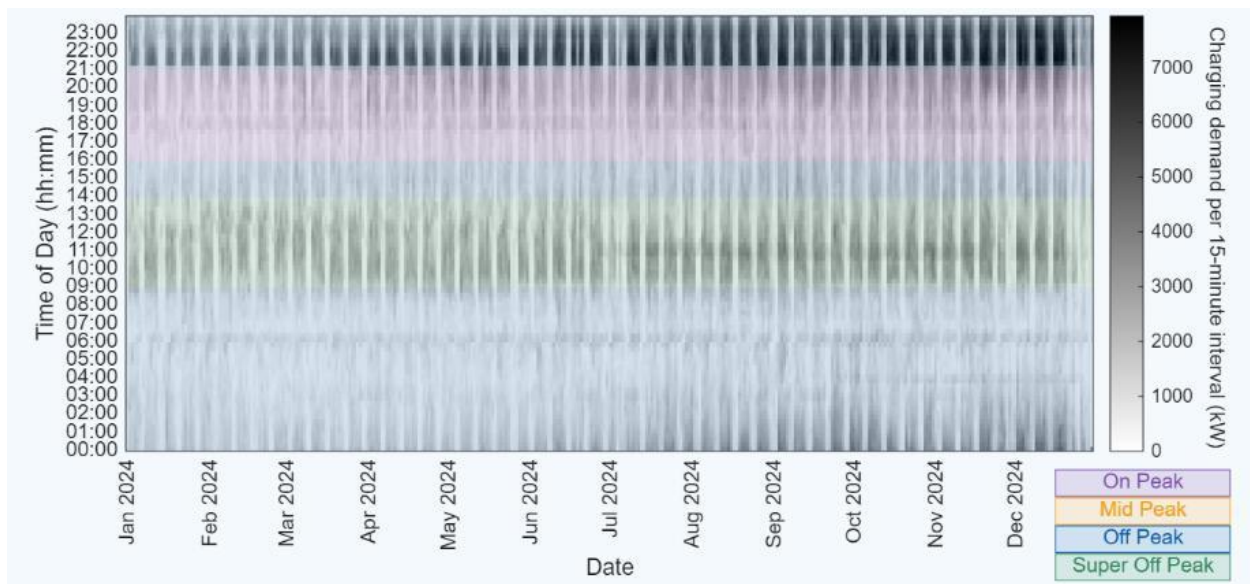


Figure 166. PG&E EV Fleet Program Heatmap of the Collective BAU Charging Demand for All PG&E Non-School Bus Fleets in 2024

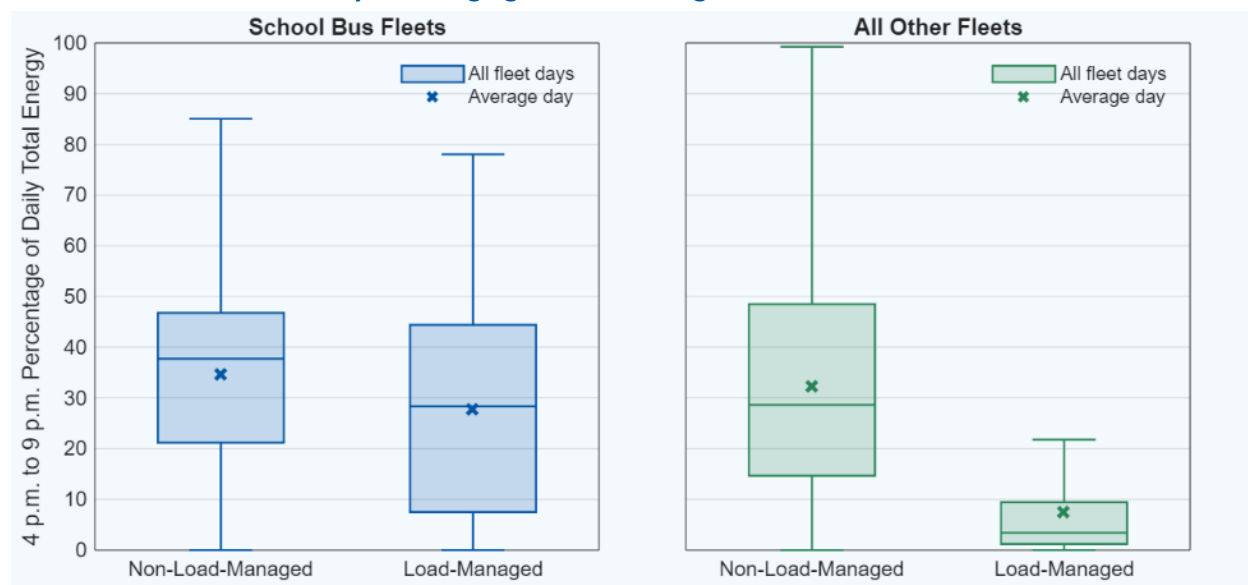


The Evaluation Team compared NSP charging sessions which utilized load management strategies to non-load-managed sessions for the school bus and non-school bus fleets in this analysis to evaluate the effectiveness of the existing load management at minimizing energy during the 4 p.m. to 9 p.m. peak TOU period.

The box plots in Figure 167 compare the distributions of daily on-peak (4 p.m. to 9 p.m.) energy consumption, as a percentage of daily total energy, between load-managed and non-load-managed

days. On average, non-load-managed school buses have approximately 35% of daily consumption occurring between 4 p.m. and 9 p.m. For the average load-managed day, the percentage decreases slightly to under 35% of overall consumption. For other market sectors (shown on the right), the average non-load-managed day has approximately 32% of consumption during the peak TOU period, compared to less than 10% for load-managed days.

Figure 167. PG&E EV Fleet Program Distribution of the Fraction of Daily EV Charging Load Occurring in the Peak TOU Period



The box and whisker plot represents the distribution of daily total energy consumed from 4 p.m. to 9 p.m. across one operating day by group, and the average value for all operating days per group is indicated by an X.

This comparison suggests that existing load management programs reduce the fraction of energy consumed during peak hours and therefore reduce the energy costs. However, outcomes vary substantially across sites (both load-managed and non-load-managed), suggesting that the value of load management depends on each site's operating patterns, charging flexibility, and on the chosen implementation of load management controls.

Potential Benefits of Optimal Load Management

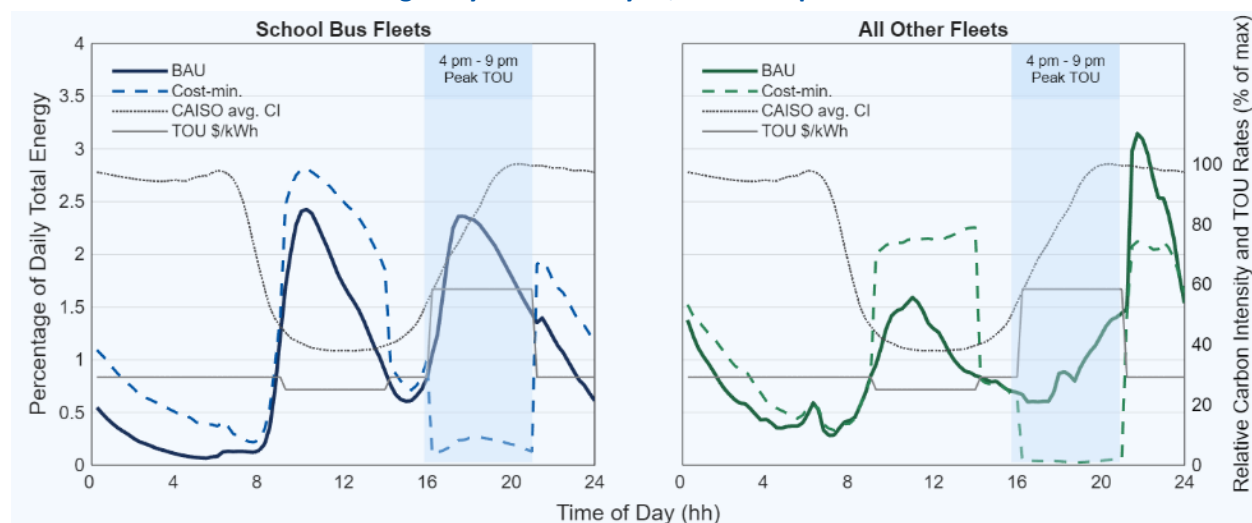
The Evaluation Team analyzed charging session data to estimate the potential value of optimal load management, considering each site's observed operating patterns and potential ability to shift vehicle charging loads. This analysis included 33 school bus sites and 47 sites in other market sectors which had sufficient AMI and NSP data reported for 2024 to complete the optimization.

The Evaluation Team developed and executed an optimization routine that reviews each site's daily charging behavior and shifts energy consumption from the peak time period (4 p.m. to 9 p.m.) into the lowest-cost periods of the day whenever there was both unused charging capacity and vehicle charging availability during those periods. The Evaluation Team used NSP charging session data to ascertain how many vehicles were plugged in and how many kilowatt-hours of energy could be shifted during each time period. For hours in the same TOU rate period, the Team used carbon intensity of the electric grid

(evaluated from CAISO 2024 GHG emissions factors) and BAU charging load as tiebreakers to determine vehicle charging priorities. The optimization algorithm also incorporates any monthly demand charges that may be incurred at the site from vehicle charging and minimizes the total charging costs in the optimization. After completing the load-shifting to minimize costs, the resulting costs and GHG emissions were calculated for the load-shifted case, and the results were compared to the BAU case to determine cost-reduction and GHG-reduction potential for each site.

Figure 168 illustrates how optimally shifted loads differ from BAU loads, averaged across EY2024. For both school bus and other market sector sites, the average day's load can be almost completely shifted out of the high-cost 4 p.m. to 9 p.m. window and into midday charging (9 a.m. to 2 p.m.) and/or overnight charging (after 9 p.m.). These time periods offer the lowest energy consumption costs and the midday charging period (which has super-off-peak rates year-round) also corresponds to the lowest average carbon intensity of grid electricity.

Figure 168. PG&E EV Fleet Program Fraction of Daily EV Charging Load Occurring at Each 15-Minute Interval for the Average Day in this Analysis, BAU Compared to Cost-Minimization



Note: Line color indicates site market sector and dashed versus solid lines indicate whether the load is BAU or shifted.

The Evaluation Team estimated the cost reduction potential of this daily load-shifting, with the following context:

- This analysis considers only the volumetric (cost per kilowatt-hour) component of each site's electricity costs. Optimal load management has the potential to also reduce demand charge subscriptions, which could impact costs especially in lower-volume months. The cost-minimization approach developed in this analysis ensures that peak demand does not increase but does not yet consider potential cost savings resulting from demand reduction.
- These results reflect only the portion of the year in which each fleet operated and provided charging data; annualized projections of these cost reductions could be substantially higher for

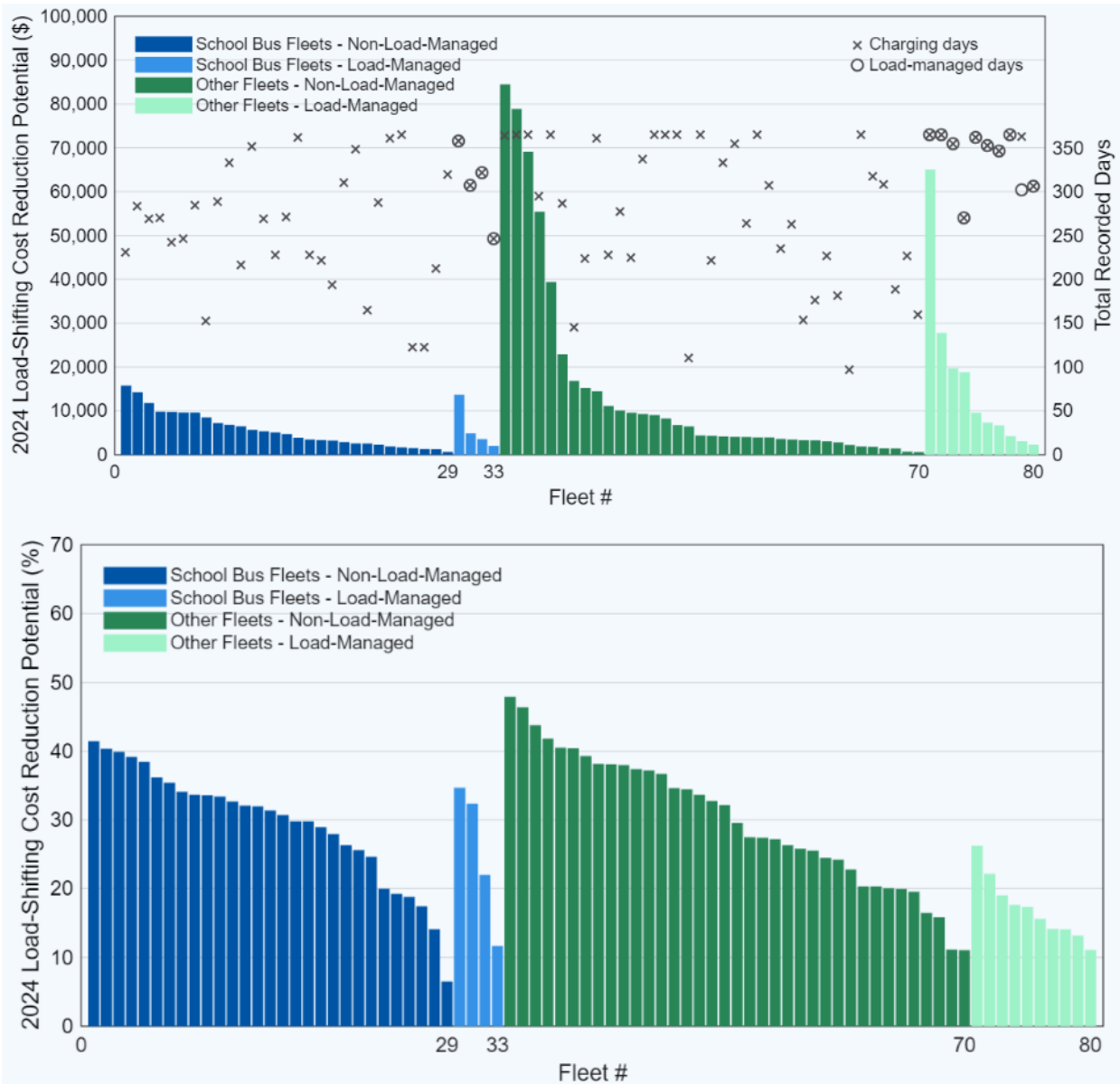
fleets that have less than a full year of charging data included in this analysis or that have not yet reached mature operations.

- These results reflect only the portion of each site’s vehicle fleet that was electrified in EY2024. A fully electrified vehicle fleet would see higher cost reduction potential from load management.
- This analysis considers the cost-saving potential of load management, but it does not yet consider the potential of load management to generate revenue via LCFS Smart Charging credits.
- This analysis examined the actual charging behavior at each site (using actual recorded plug-in and unplug times) to determine charging opportunities and does not account for other operational or scheduling improvements for charging electrified fleets, which could enable more-effective load management, resulting in higher potential cost reduction.

Figure 169 provides several insights. The figure shows that even load-managed sites have potential to save energy by better utilizing their load flexibility. For example, as shown on the top graph, sites that are already using load management have cost reduction potential ranging from \$15,000 in the school bus market sector and up to \$65,000 for the largest sites in other market sectors. In general, sites that are implementing load management have less opportunity to realize additional savings than sites that have not implemented load management to date. Many of these sites can capture additional savings by improving consistency of load management operations and better coordinating load management scheduling if their EVSP is capable and their operations allow.

Non-load-managed sites have cost reduction potential ranging from \$15,000 for non-load-managed school bus sites to \$85,000 for other market sectors. Sites that have the greatest potential savings are extremely large sites with high energy consumption and therefore higher overall costs. For example, as shown in the bottom graph, the non-load-managed fleet with \$85,000 cost reduction potential has over 45% cost reduction potential—similar to many other fleets regardless of market sector.

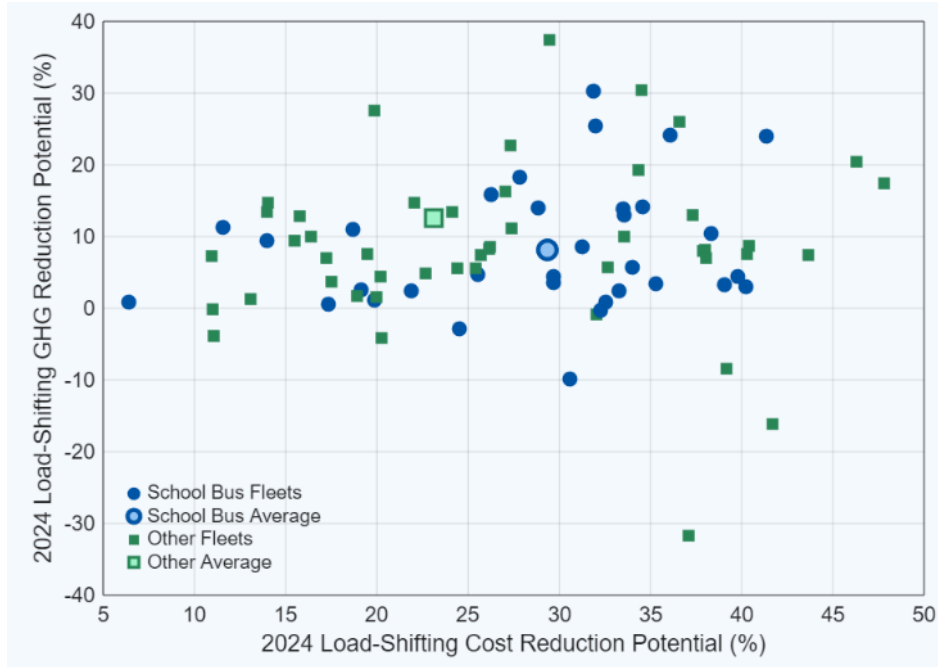
Figure 169. PG&E EV Fleet Program Total Annual Cost Reduction Potential of Each Site with Use of Optimal Load Management



Each bar represents one site. Bar colors indicate the site's market sector and whether it uses load management.

Because lower-cost TOU periods often correspond to periods with lower carbon intensity for grid electricity, optimizing load management for energy cost savings can have a secondary effect of reducing the resulting carbon emissions from vehicle charging. Figure 170 shows estimated cost reductions and corresponding GHG emissions reductions for each site resulting from a cost-minimizing load-management strategy (considering carbon intensity only as a tiebreaking factor when there is sufficient charging flexibility). Across most sites, shifting charging load to reduce costs shows the potential to also reduce GHG emissions—by more than 30% in some cases.

Figure 170. PG&E EV Fleet Program Potential Percentage Cost Reduction and Attributed GHG Emissions Reduction of Optimal Load Management, Cost Minimization



In addition to the cost-minimization load-shifting analysis, the evaluation team wanted to evaluate the maximum achievable reduction in GHG emissions with load-shifting. Thus, the team reran the load-shifting optimization routine on the same data set with the objective to minimize GHG emissions at each site. This approach maximizes the amount of charging that can take place during the middle of the day when the carbon intensity of grid electricity is the lowest, given there is additional charging capacity and vehicle charging availability at each site. Figure 171 shows how the average charging load profile for the GHG-minimization approach compares to the cost-minimization and BAU average load profiles. Figure 172 displays the resulting combination of cost-reduction potential and emissions-reduction potential for each site when load-shifting is employed to minimize GHG emissions.

Figure 171. PG&E EV Fleet Program Fraction of Daily EV Charging Load Occurring at Each 15-Minute Interval for the Average Day in this Analysis, BAU Compared to Cost-Minimization and GHG-Minimization

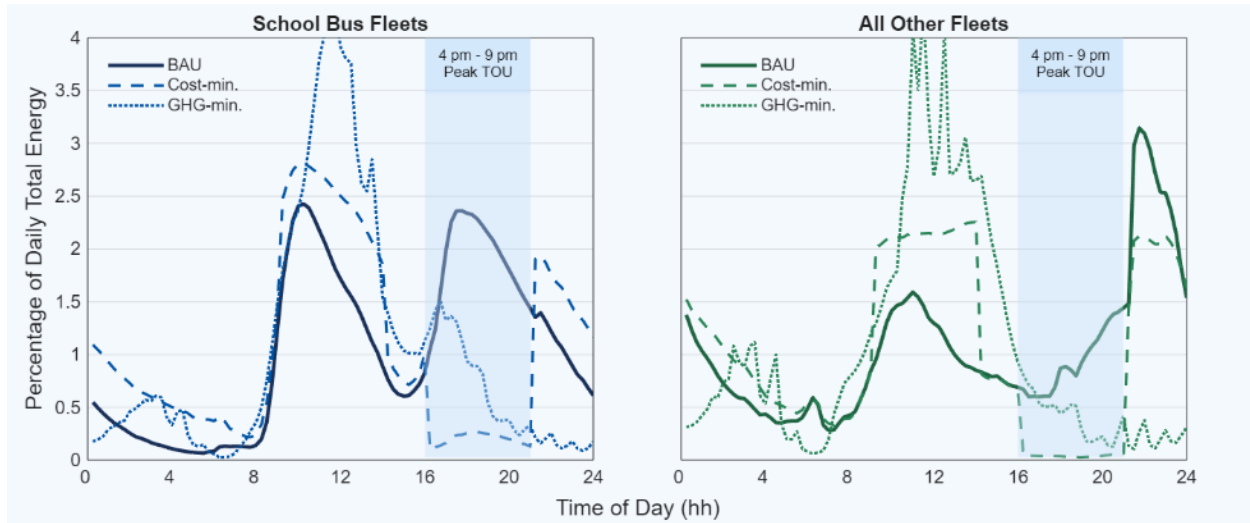


Figure 172. PG&E EV Fleet Program Potential Percentage Cost Reduction and Attributed GHG Emissions Reduction of Optimal Load Management, GHG-Minimization

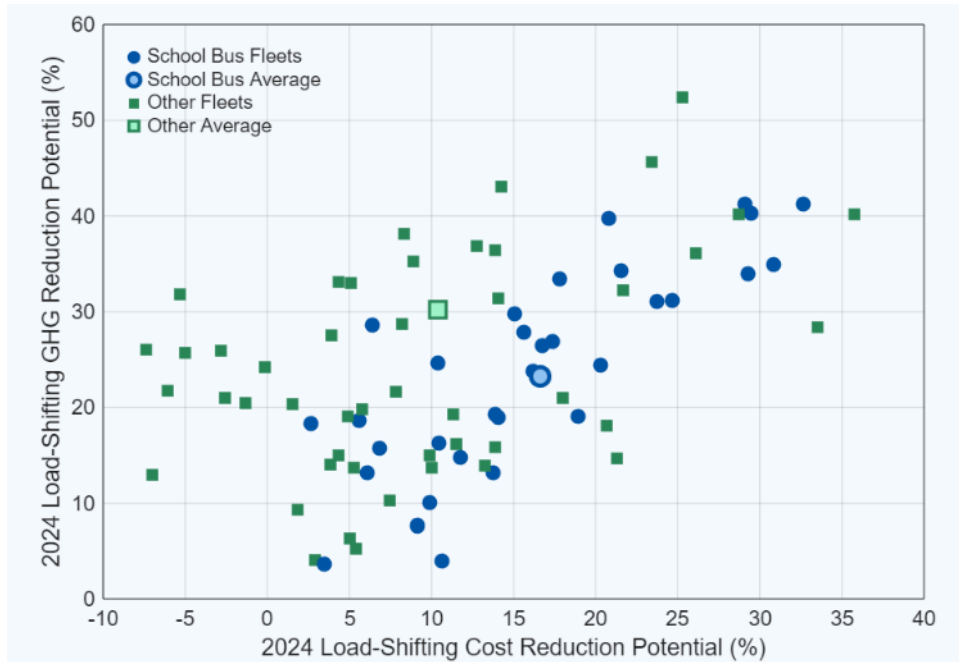


Table 74 aggregates these results across all sites included in the analysis. Overall, optimal load shifting to minimize charging costs could reduce school bus sites' collective energy consumption costs by 29.4% and attributed electricity grid GHG emissions by 8.2%; for other market sectors, it could reduce energy consumption costs by 23.2% and attributed electricity grid GHG emissions by 12.7%. Load shifting to minimize GHG emissions could achieve up to 2-3 times higher reductions in GHG emissions than the

cost-minimization approach (29.3%, on average, across all sites), but it would come at the expense of reduced cost savings.

Table 74. PG&E EV Fleet Program Summary of Potential Cost and Attributed GHG Emissions Reductions, Aggregated Across All Included Fleets

	School Bus Fleets	All Other Fleets	All Fleets Combined
Total number of fleets	33	47	80
Total count of 2024 operating days	8,804	13,617	22,421
Cost-minimization load-shifting			
Cost Reduction Potential (\$)	183,722	685,555	869,277
GHG Reduction Potential (kg CO ₂ e)	25,419	239,915	265,334
Cost Reduction Potential (%)	29.4%	23.2%	24.2%
GHG Reduction Potential (%)	8.2%	12.7%	12.1%
GHG-minimization load-shifting			
Cost Reduction Potential (\$)	104,234	308,893	413,127
GHG Reduction Potential (kg CO ₂ e)	72,449	571,322	643,771
Cost Reduction Potential (%)	16.7%	10.4%	11.5%
GHG Reduction Potential (%)	23.3%	30.3%	29.3%

Highlights

- Charging data indicate that most fleets have a significant opportunity to shift their charging energy use from 4 p.m. to 9 p.m. to lower-cost time periods.
- Shifting energy usage away from the time period between 4 p.m. and 9 p.m. can result in a 20% to 30% reduction in costs and GHG emissions.
- Modeling based on charging flexibility suggests that significant demand from both load-managed and non-load-managed sites can be reduced at midday and around 9 p.m. after prices drop.
- Approximately 60% of all charging sessions overlapped the 4 p.m. to 9 p.m. peak-rate period even though nearly 45% of all charging sessions have enough flexibility to delay charging to lower-cost time periods by using load management.
- Overall, PG&E EV Fleet program sites have an average billing cost of \$0.36/kWh. Sites that avoid charging during the highest-cost time period appear to show monthly billing between \$0.22/kWh and \$0.27/kWh.
- EY2021 and EY2022 sites showed some tapering off after initial growth, followed by steady operations in 2023 and 2024. EY2024 sites showed rapid growth throughout the year
- The number of load-managed sites grew to 18 out of a possible 100, although some older sites showed inconsistent or discontinued use of load management in 2024

Petroleum Displacement

The Evaluation Team estimated the petroleum displacement attributable to vehicle electrification enabled by PG&E's EV Fleet program. The Team used DGE for reporting purposes. However, as the Transit Bus market sector primarily uses CNG fuel, the Team converted transit bus natural gas consumption into DGE units based on the CNG fuel's energy content.

Table 75 presents petroleum displacement for the EV Fleet program through 2024, including estimated actual impacts for 2024, actual impact for all sites PTD, and a 10-year forecast for PTD sites. The results include the five market sectors represented in the program, with the majority of vehicles in the heavy-duty vehicles sector followed by the school bus sector. The estimated PTD usage is over 18 million electric miles, based on electricity consumption of 29,000 MWh. This translates to the displacement of over 2.6 million DGE.

Table 75. PG&E EV Fleet Program Petroleum Displacement Summary

Market Sector	Usage (n=101 ^c)				Petroleum Displacement (DGE)		
	2024 Actual ^a kwh	PTD Actual ^b kWh	2024 Actual Use	PTD Actual Use	2024 Actual	PTD Actual	10-Year Projection
Forklift			26,470 hours	50,842 hours	50,720	97,741	552,682
Heavy-Duty Vehicle			3,822,563 miles	6,927,194 miles	678,155	1,190,315	9,411,115
Medium-Duty Vehicle			2,873,563 miles	3,731,594 miles	205,485	271,445	3,027,184
School Bus	2,927,480	6,840,578	2,274,950 miles	5,308,886 miles	249,275	582,770	2,732,304
Transit Bus			1,212,328 miles	2,104,393 miles	292,888	495,007	4,545,178
TRU			1,649 hours	2,833 hours	1,221	2,096	10,234
Total	16,791,413	29,979,656	10,183,405 miles 28,120 hours	18,072,067 miles 53,675 hours	1,477,744	2,639,374	18,023,177

^a "2024 Actual" represents the data from all activated sites from program inception for the calendar year 2024.

^b "PTD Actual" represents the data from all activated sites from program inception for all program years.

^c Only 101 of the activated sites had enough usage to be included in the impacts analysis

Highlights

- All operational sites in 2024 collectively achieved a PTD impact of more than 2.6 million gallons of petroleum displaced.
- The heavy-duty vehicle sector contributed over 900,000 gallons of displaced petroleum in 2024 and is projected to account for more than one-third of the petroleum displaced over 10 years.
- Over a 10-year period, the sites are expected to displace more than 18 million gallons of petroleum.

Greenhouse Gas and Criteria Pollutant Impact

The Evaluation Team calculated reduced emissions from displaced fossil fuel use from ICE vehicles that were not in service because of the EV Fleet program. First, we developed ICE counterfactuals for each market sector, then the Team calculated the emissions associated with these vehicles under conditions that otherwise matched the EVs, which provided a baseline. Although EVs have no tailpipe emissions, the mix of generation sources from the electric grid includes renewable as well as fossil fuel power to supply electricity to the charging stations, with the latter primarily responsible for emitting GHGs and criteria pollutants into the atmosphere.

Table 76 summarizes GHG impacts for the EV Fleet program for three time periods across market sectors: estimated reductions that reflect what program sites saved in 2024, PTD reductions from all sites, and a 10-year projection based on annualized data from all sites.

Table 76. PG&E EV Fleet Program GHG Reductions Summary

Market Sector	Usage (n=101 ^b)				GHG Reduction (MT)		
	2024 Actual ^a kWh	PTD Actual kWh	2024 Actual Use	PTD Actual Use	2024 Actual	PTD Actual	10-Year Projection
Forklift			26,470 hours	50,842 hours	246	468	2,740
Heavy-Duty Vehicle			3,822,563 miles	6,927,194 miles	5,697	9,752	62,229
Medium-Duty Vehicle			2,873,563 miles	3,731,594 miles	1,653	2,187	25,985
School Bus	2,927,480	6,840,578	2,274,950 miles	5,308,886 miles	2,221	5,054	25,274
Transit Bus			1,212,328 miles	2,104,393 miles	2,074	3,458	33,325
TRU			1,649 hours	2,833 hours	11	19	96
Total	16,791,413	29,979,656	10,183,405 miles 28,120 hours	18,072,067 miles 53,675 hours	11,902	20,938	149,649

^a “2024 Actual” represents the data for EY2024 from all sites activated in the program to date. “PTD Actual” represents the data from all activated sites from program inception for all program years.

^b Only 101 of the activated sites had enough usage to be included in the impacts analysis

Table 77 shows the estimated reductions in local emissions from the tailpipes of ICE vehicles that this program displaced, including hydrocarbons (HC) from off-road forklifts and heavy-duty vehicles. Forklifts showed the highest reduction in ROG emissions due to the poor emissions performance of conventional forklifts. Transit buses showed the greatest reduction in CO, driven by the assumption that displaced transit buses run on CNG.

Table 77. PG&E EV Fleet Program Local Emissions Reductions, PTD Actual

Market Sector	PTD Actual ^a (n=101 ^b)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Forklift	829.0	37.7	28.8	763.4	82,022.9
Heavy-Duty Vehicle	99.72	88.81	84.72	369.21	43,351.09
Medium-Duty Vehicle	-	6.2	5.9	53.3	1,715.8
School Bus	-	12.1	11.6	53.9	1,535.8
Transit Bus	-	1.4	1.3	117.9	93,557.3
TRU	8.6	0.7	0.7	76.5	9.5
Total	937.4	147.0	133.0	1,434.1	222,192.4

^a "PTD Actual" represents the data from all activated sites from program inception for all program years.

^b Only 101 of the activated sites had enough usage to be included in the impacts analysis

Table 78 shows the same information as above, but only for 2024 actuals. These are the localized emissions reductions that occurred based on actual fleet operations this year.

Table 78. PG&E EV Fleet Program Local Emissions Reductions Summary, 2024 Actual

Market Sector	2024 Actual ^a (n=101 ^b)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Forklift	417.7	19.2	14.6	384.7	40,534.0
Heavy-Duty Vehicle	93.2	54.7	52.1	254.9	23,280.6
Medium-Duty Vehicle	-	4.7	4.4	40.9	1,340.7
School Bus	-	5.3	5.1	23.4	663.3
Transit Bus	-	0.7	0.7	71.3	56,853.8
TRU	5.8	0.4	0.4	52.1	6.3
Total	516.6	85.0	77.3	827.3	122,678.8

^a "2024 Actual" represents the data for EY2024 from all sites activated in the program to date.

^b Only 101 of the activated sites had enough usage to be included in the impacts analysis

Table 79 provides an estimate of savings over the 10-year period. These are the annualized reductions from all PTD sites extended over a decade. The table shows that forklift sites account for more than half of total ROG and CO emissions reductions, despite accounting for less than 2% of total electricity use. This is a result of the better emissions performance of electric forklifts compared to conventional forklifts. Forklifts also account for nearly all of the hydrocarbon emissions reductions as modern on-road vehicles have already eliminated these emissions. However, heavy-duty vehicles account for more than 60% of PM emissions reductions.

Table 79. PG&E EV Fleet Program Local Emissions Reductions Summary, 10 Year Projection for PTD Sites

Market Sector	PTD Sites 10-Year Projected Impact (n=101 ^a)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Forklift	9,028.1	208.1	158.1	8,313.9	1,134,699.5
Heavy-Duty Vehicle	904.1	774.0	738.2	2,877.3	276,937.7
Medium-Duty Vehicle	-	55.3	52.4	438.0	13,626.8
School Bus	-	64.9	62.1	282.1	7,725.4
Transit Bus	-	13.3	12.7	1,164.8	919,645.6
TRU	87.4	5.2	4.8	861.9	97.1
Total	10,019.7	1,143.3	1,049.6	14,114.1	2,358,379.6

^a Only 101 of the activated sites had enough usage to be included in the impacts analysis

Table 80 shows counterfactual vehicle GHG emissions, emissions from the electricity used to charge the EVs, and GHG emissions reductions and percentage changes. Table 81 shows the net reductions of NO_x emissions from using EVs, based on the counterfactual and Utility emissions. The Evaluation Team estimated a total annualized GHG reduction of 80% and an NO_x reduction of 77% from the use of EVs instead of counterfactual vehicles for EY2024 sites. Reviewing the program to date data reveals an estimated 81% actual reduction in GHG emissions and 78% reduction in NO_x emissions.

Table 80. PG&E EV Fleet Program Counterfactual GHG Reductions

Market Sector	EY2024 Sites (n=40 ^a) Annualized GHG (MT)				Program-to-Date Sites (n=101 ^b) GHG (MT)			
	Counterfactual	Utility	Reduction	% GHG Reduction	Counterfactual	Utility	Reduction	% GHG Reduction
Forklift	258.3	33.4	224.9	87%	538.2	70.2	468.1	87%
Heavy-Duty Vehicle	2,418.2	549.5	1,868.7	77%	12,227.31	2,474.87	9,752.44	81%
Medium-Duty Vehicle	2,626.2	513.2	2,113.0	80%	2,702.3	515.6	2,186.7	81%
School Bus	1,557.2	245.2	1,312.0	84%	6,165.5	1,111.8	5,053.7	82%
Transit Bus	2,892.1	614.1	2,278.0	79%	4,323.7	865.4	3,458.3	80%
TRU	-	-	-	None	23.5	4.7	18.8	80%
Total	9,752.0	1,955.4	7,796.6	80%	25,980.4	5,042.5	20,937.9	81%

^a Only 40 of the EY2024 activated sites had enough usage to be included in the impacts analysis

^b Only 101 of the PTD activated sites had enough usage to be included in the impacts analysis

Table 81. PG&E EV Fleet Program Counterfactual NO_x Reductions

Market Sector	EY2024 Sites (n=40 ^a) Annualized NO _x (kg)				Program-to-Date Sites (n=101 ^b) NO _x (kg)			
	Counterfactual	Utility	Reduction	% NO _x Reduction	Counterfactual	Utility	Reduction	% NO _x Reduction
Forklift	705	27	678	96%	1,889.7	60.9	1,828.8	97%
Heavy-Duty Vehicle	2,714	448	2,266	84%	9,707.31	2,077.51	7,629.80	78%
Medium-Duty Vehicle	2,078	414	1,664	80%	1,778.2	423.8	1,354.4	76%
School Bus	1,358	203	1,155	85%	5,577.0	962.5	4,614.5	83%
Transit Bus	140	492	(352)	None	222.1	696.5	(474.5)	None
TRU	-	-	-	None	97.8	3.7	94.1	96%
Total	6,995.7	1,584.4	5,411.3	77%	19,272.1	4,225.0	15,047.1	78%

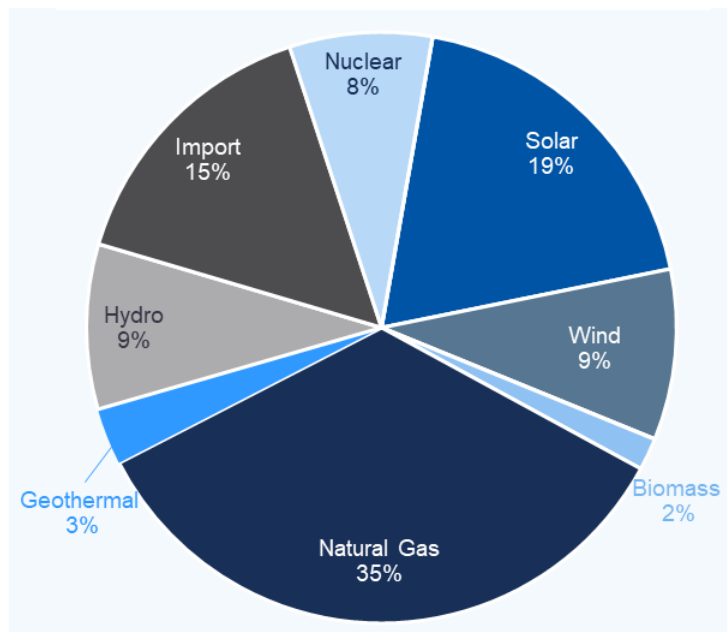
^a Only 40 of the EY2024 activated sites had enough usage to be included in the impacts analysis

^b Only 101 of the PTD activated sites had enough usage to be included in the impacts analysis

Figure 173 shows the program net electricity generation mix matched with the hours that the EVs were charging. The CAISO grid mix continually changes depending on factors such as the level of total demand for power on the grid and the availability of fossil generation and variable renewable resources such as solar.

At this stage of the program, it appears that most fleet vehicles were not predominantly charging during the peak hours of solar output when grid emissions were the lowest. Approximately 15% of the grid mix comprises electricity imports, which do not vary by time of day for analysis purposes but match the resource mix purchased for the California grid.⁸⁶

Figure 173. PG&E EV Fleet Program Net Electricity Mix, Program to Date



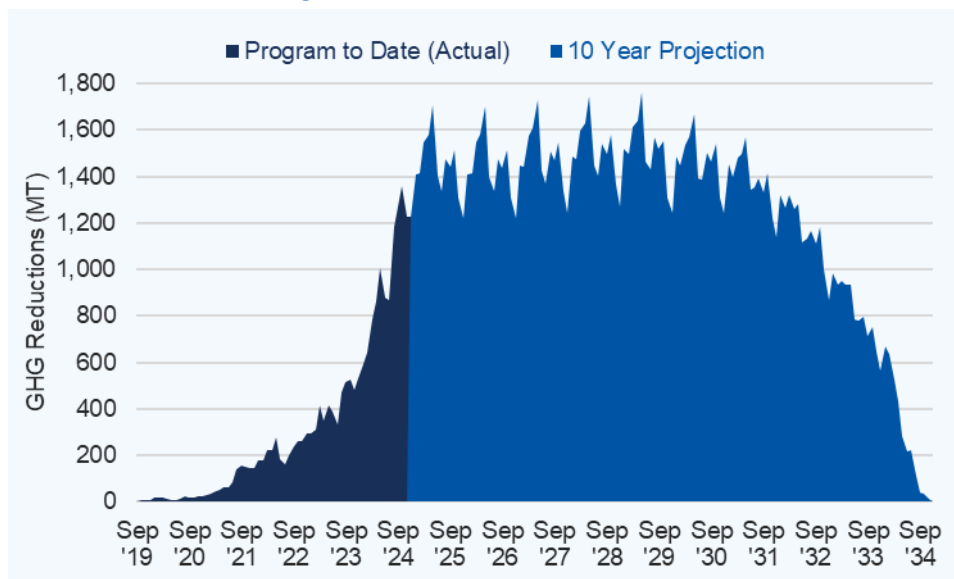
Based on the real-time grid conditions when the EV charging occurred, the overall energy mix was about 50% zero-emission or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 35% natural gas. Emissions reductions from these sites should increase over 10 years as the grid becomes cleaner. Additionally, the increased use of managed charging will reduce emissions as more EVs charge during off-peak times and when the grid is supplied with more renewable

⁸⁶ The power associated with imports comes from a mixture of renewables, hydro, nuclear, and natural gas power plants located outside of California (<https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation>).

resources such as solar. Emissions will further decrease as more charging sites and EVs are added in future evaluation years. The *Electricity Cost and Emissions Optimization Analysis* section in the earlier grid impacts analysis models how fleets could change their charging timing to further reduce the GHG of their electricity consumption as well as improve price performance.

Figure 174 shows how program GHG reductions have increased to date and now these reductions are expected to grow over time for all activated sites. The analysis period ranges from the date that the first site in the program was activated through the end of EY2024. The analysis incorporates the net reduction (counterfactual emissions minus Utility emissions) for each fleet within the PG&E EV Fleet program. PTD emissions reductions appear in dark navy, while anticipated benefits based on annualization appear in royal blue. Because each site has its own starting date of operation, the 10-year sunset for each site can be observed as a gradual tapering off of program benefits between 2030 and 2033. While each year's operations appear similar over the next five years, several key factors are driving the variation. This includes seasonality of Utility generation sources (high Utility emissions will appear as a dip on the curves), holidays occurring on weekends versus weekdays, and inaccuracies in predicted operations for sites that became operational late in 2024.

Figure 174. PG&E EV Fleet Program Historical and Forecasted GHG Reductions for PTD Sites



Highlights

- PTD results show an 81% reduction of GHGs and a 78% reduction in NO_x emissions.
- The greatest reduction in local emissions was for CO with more than 122,000 kg in 2024 and a projected 10-year reduction of more than 2,300,000 kg.
- Based on the real-time grid conditions when EV charging occurred, the overall energy mix contained about 50% zero-emission or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 35% natural gas.

Health Impacts

The Evaluation Team calculated public health impacts (as benefits and costs) of reductions in criteria pollutants from vehicle electrification. The pollutants we included in the analysis are primary PM_{2.5} and precursors of secondary PM_{2.5}, including NO_x, SO₂, NH₃, and VOCs. The analysis considers only tailpipe emissions reductions rather than full lifecycle emissions (such as power plant emissions). The Evaluation Team used the EPA COBRA to evaluate the health benefits associated with emissions reductions. COBRA estimates the county-level benefits for the county in which emissions are reduced. It also estimates the effect of the transport of emissions on all counties in the United States; however, this analysis includes only the effects of the emissions reductions in California. The Evaluation Team disaggregated the county-level effects to estimate the potential health benefits of sites for DACs and non-DACs.⁸⁷

Economic value estimation depends on the health effects associated with the emissions, that is, whether they are associated with illnesses or death. The monetary value of the morbidity reductions associated with emissions reductions include avoided lost wages, avoided medical costs, and the amount of money people are willing to pay to avoid an illness or condition like respiratory disease. The value of the reduced mortality associated with emissions reduction is measured by the value of a statistical life, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low and high impact for mortality, representing the uncertainties in the estimates.

The total value of the health benefits associated with emissions reductions is between \$2,034,554 and \$2,694,026. Table 82 shows the cumulative health benefits in California associated with the emissions reductions realized by the electrification of PG&E EV Fleet program sites for the program to date.

Table 82. PG&E EV Fleet Program California Health Benefits for PTD Sites in 2024

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Mortality	0.119	0.163	\$1,783,920	\$2,443,392
Avoided Medical Care				
Hospitalization, Respiratory	0.012	0.012	\$224	\$224
Hospitalization, Cardiovascular	0.005	0.005	\$161	\$161
Hospitalization, Other	0.016	0.016	\$366	\$366
ER Visits, Respiratory	0.267	0.267	\$446	\$446
ER Visits, Cardiovascular	0.011	0.011	\$25	\$25
Out of Hospital Heart Attacks	0.001	0.001	\$42	\$42
Nonfatal Heart Attacks	0.027	0.027	\$2,304	\$2,304
Stroke	0.003	0.003	\$170	\$170
Lung Cancer	0.003	0.003	\$145	\$145
Asthma	135.044	135.044	\$112,528	\$112,528

⁸⁷ DAC Census Tracts are defined as those included in the SB 535 Disadvantaged Communities List (2022), this includes the DAC categories for CalEnviroScreen 4.0 Top 25%, CalEnviroScreen 4.0 High Pollution Burden Score and Low Population Count, and 2017 Disadvantaged Community (CalEnviroScreen 3.0 only).

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Hay Fever	5.512	5.512	\$6,319	\$6,319
Lost Productivity				
Minor Restricted Activity Days	37.911	37.911	\$4,904	\$4,904
Work Loss Days	6.448	6.448	\$2,099	\$2,099
School Loss Days	69.182	69.182	\$120,900	\$120,900
Total Health Effects	-	-	\$2,034,554	\$2,694,026

At the site level, four market sectors accounted for 99% of the monetary value from benefits. The heavy-duty vehicle market sector had the highest health benefits overall (33%), followed by the forklift (32%), school bus (24%), and medium-duty vehicle (8%) market sectors.

As part of this analysis, the Evaluation Team also examined health benefits within DACs, which may be disproportionately burdened by sources of pollution (including air pollution from ICE vehicles). Because COBRA estimates effects only at the county level, the Evaluation Team disaggregated the health impacts by census tract using the relative population of each tract from the most recent American Community Survey. For example, we allocated 10% of the value of the health benefits to a census tract with 10% of the county's population. The Evaluation Team then estimated the total benefits allocated to DACs and non-DACs⁸⁸. The approach assumes that the benefits of emissions reductions are distributed evenly throughout the county. If the sites are located in DACs, and the emissions reductions are greater in the tracts near the sites, this approach understates the potential benefit of emissions reductions to DACs. Additional information about emissions dispersion within counties would provide more-precise estimates of the health benefits to DACs and non-DACs.

In our analysis, the largest portion of health benefits were in Sacramento County, which had 11% of the total benefits, followed by Alameda County (11%), Santa Clara County (10%), San Joaquin County (9%), and Contra Costa County (9%). Overall, 18% of the total benefits were in DACs.

⁸⁸ DAC census tracts are defined as those included in the SB 535 Disadvantaged Communities List (2022), which includes DAC categories for CalEnviroScreen 4.0 Top 25%, CalEnviroScreen 4.0 High Pollution Burden Score and Low Population Count, and 2017 Disadvantaged Community (CalEnviroScreen 3.0 only).

Highlights

- Cumulative health impact estimates for California counties realized by the electrification of EV Fleet program sites in terms of monetary benefits range from \$2,034,554 to \$2,694,026.
- The heavy-duty vehicle market sector had the highest health benefits overall (33%), followed by the forklift (32%), school bus (24%), and medium-duty vehicle (8%) market sectors.
- The largest portion of health benefits were in Sacramento County, which had 11% of the total benefits, followed by Alameda County (11%), Santa Clara County (10%), San Joaquin County (9%), and Contra Costa County (9%).
- The proportion of overall benefits attributed to DACs is 18%.

Net Impacts

As part of the net impacts analysis, the Evaluation Team estimated program effects on participants to exclude impacts from actions that participants would have taken without the program (freeridership) and to include any program-attributable indirect impacts on participants (participant spillover).

Enhanced Self-Report

The Evaluation Team based our approach for the MDHD program enhanced self-report NTG analysis on information obtained as part of in-depth surveys with participating fleet managers. The Evaluation Team conducted the survey via an online survey platform, Qualtrics, and delivered the survey using email contact information provided by PG&E. The Evaluation Team used the CPUC nonresidential customer self-report NTG framework originally developed for energy efficiency programs as the base to develop the MDHD fleet manager NTG methodology approach.⁸⁹ *Appendix B* details the MDHD fleet manager self-report NTG methodology. The Evaluation Team estimated the core component of the CPUC NTG methodology through three separate program PAI site scores. The Evaluation Team used three separate sets of questions to assess the three components of the core NTG ratio, with each PAI score on a scale of 0.0 to 1.0 representing a different way of characterizing the PG&E EV Fleet program influence. The analysis included fleet manager responses from 11 of the 34 participating sites that were sent the survey.⁹⁰

The Evaluation Team calculated the resulting self-report NTG for each site, prior to accounting for participant spillover, as the average of the PAI-1A, PAI-2, and PAI-3 score values. One minus the final core NTG ratio of 0.51 equals the 0.49 freeridership ratio for the EV Fleet program. The participant spillover analysis found that none of the surveyed sites reported electrifying more of their fleet since participating in the EV Fleet program, without the benefit of funding from the PG&E program or where their PG&E program participation was important in this additional purchasing decision. The resulting participant spillover ratio is 0.00. The final program level NTG ratio of 0.51 equals one minus the

⁸⁹ California Public Utilities Commission, Energy Division. February 20, 2015. *Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers*.

⁹⁰ Four school bus sites, four transit sites, two distribution sites, and one forklift site completed the survey.

freeridership ratio plus the participant spillover ratio. Table 83 presents these scores along with the average final score NTG for the surveyed PG&E EV Fleet program sites.

Table 83. PG&E EV Fleet Program NTG Fleet Manager Analysis Results in EY2024

Fleet Manager Survey Completes	Average of PAI-1A Score NTG	Average of PAI-2 Score NTG	Average of PAI-3 Score NTG	Average of Final Core NTG	Freeridership Ratio	Participant Spillover Ratio	Final NTG Ratio
11	0.63	0.39	0.52	0.51	0.49	0.00	0.51

Highlights

- EY2024 program-level freeridership ratio is 0.49 with a 0.00 participant spillover ratio, which resulted in a program level NTG ratio of 0.51.
- The EY2024 NTG ratio of 0.51 (n=11) is higher than the EY2023 NTG ratio of 0.48 (n=4), indicating the EV Fleet program had more influence on the surveyed EY2024 fleets' decision to complete the transportation electrification projects compared to the surveyed EY2023 fleets.

5.1.3. Lessons Learned

Staff remain focused on adjusting the program to respond to changing market conditions, including high site costs, extended activation timelines, increasing load requests, and regulatory changes.

Similar to previous evaluation years, higher per-site costs continue to be a challenge for both TTM and BTM. In 2024, PG&E staff continued to face challenges even after contracts are signed, including customer equipment and design changes and delays, which contribute to increased costs. Multiple projects have needed to reduce scope due to regulation and policy adjustments due to budget cuts. For example, given continued uncertainty about when, if, and/or how new regulations (such as ACF) will go into effect, program staff cannot properly plan for an increase (or decrease) in interest, inquiries, and potential applications. Additionally, as more regulations and programs enter the market to support electrification (such as Rule 29), the decision-making process becomes even more complex for customers, requiring additional support from PG&E staff to understand what programs are the best fit for them. In the face of these challenges, PG&E filed advice letters for timeline extensions and site goal reductions in 2022 and 2023 to calibrate costs to expected site completion.

PG&E staff continue to build innovative outreach strategies to cater to the specific audiences and needs within their service territory.

PG&E staff enacted multiple new outreach strategies in 2024 such as the DAC Brand Ambassador Campaign, which was launched as a strategic, direct approach to reach smaller businesses, resulting in high engagement in a follow-up survey. PG&E staff also officially launched a TEAS program, piloted a new conference breakout session structure for event outreach, and adjusted outreach strategies to focus on municipalities. PG&E staff reported anticipating a continued shift toward in-person and direct outreach into 2025.

The program saw operation of larger sites in 2024 than in previous years, resulting in higher per-site costs, but spending per vehicle and per kW installed remained similar to 2023.

The average utility infrastructure cost, including TTM and BTM was \$331,005 per site through 2024 PTD, up from \$272,995 through 2023 PTD. The average utility infrastructure cost was \$24,931 per vehicle and \$1,508 per kilowatt installed through 2024 PTD, similar to utility infrastructure costs through 2023 PTD of \$25,635 per vehicle, and \$1,588 per kilowatt installed. These values include both L2 and DCFC sites and aggregate multiple market sectors. Sites had a higher average installed capacity of 765 kW per site through 2024 PTD, compared to 526 kW through 2023 PTD. While larger sites typically require larger activation timelines due to complexity of projects, cost effectiveness of investment per vehicle and per kilowatt of capacity installed improves with site scale. All-in costs paid by the customer and PG&E vary widely between sites, with an average of \$724,248 per site through 2024 PTD, up from \$608,114 through 2023 PTD.

Site activation timelines have gotten longer in 2024 relative to earlier evaluation years due to customer design changes and equipment procurement delays; PG&E has amended program requirements to improve timeline performance.

The median timeline for application to activation was 989 days in 2024 compared to 808 days in 2023, and 784 days in 2022. The Design and Permitting phase has been the longest in duration across all evaluation years. However, this phase increased to 634 days in 2024, rising from 446 days in 2023 and 374 days in 2022. This represents a 42% increase over 2023 and accounts for 64% of the total median activation timeline. Other program phases remained similar to the prior year, with slight efficiencies seen in the site assessment and construction complete phases. The extension of site activation timelines has been attributed to a number of factors, most prominently challenges with customer equipment and design changes and delays, which also contribute to increased costs.

The program began requiring customers to secure a design contractor before signing in early 2024. Staff noted that this step has reduced design changes by prompting earlier customer decisions on charging and vehicles and should help improve activation timelines in 2025.

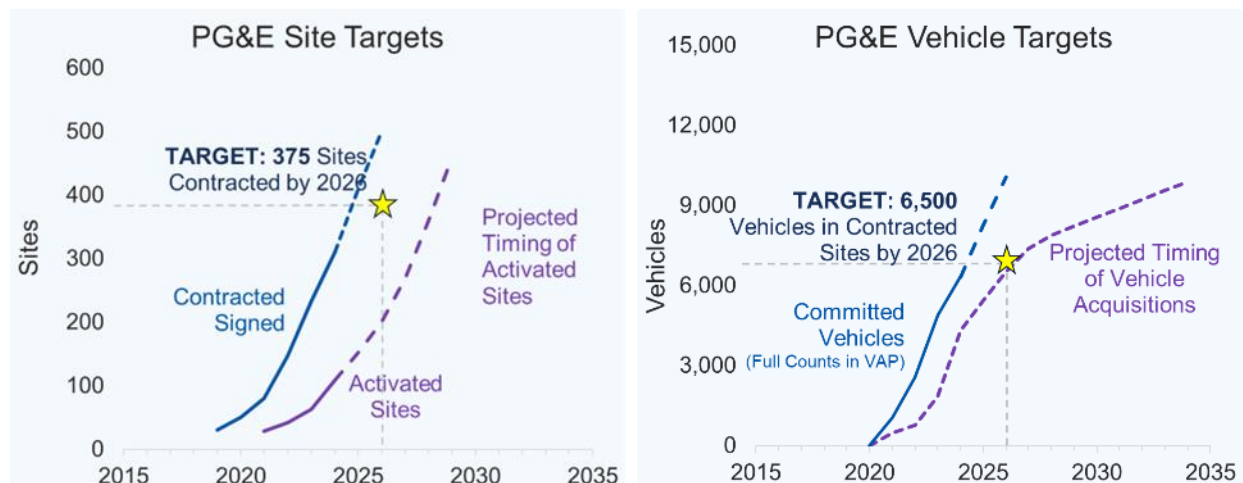
The EV Fleet program is on pace to achieve its new total site and vehicles electrified goals.

Overall program spending remains low, though spending in DACs continues to remain above target. In 2024, 46 sites with 968 charging ports were activated supporting 1,092 vehicles, based on VAPs of activated sites. Six market sectors are supported by the program, with Medium-Duty sites representing the highest participation in 2024 (46% of sites). The 108 total activated (1,628 charging ports) PTD sites meet 29% of the program's *per se reasonableness* goal of 375 sites and support 2,006 vehicles which meets 31% of the program's *per se reasonableness* goal of 6,500 additional vehicles electrified. It should be noted that two large fleet operators, Amazon and FedEx, represent approximately 30% of all electrified vehicles in the EV Fleet program. These customers have allowed for replicable, large projects; other Utility programs have not seen similar customer applications.

The EV Fleet program will make additional progress toward these goals as more sites reach activation. For example, the 310 contracts signed in the EV Fleet program to date could support 6,321 MDHD

vehicles, which would meet 83% of the program's site goal and 98% of the program's vehicle goal. The total 525 customer applications received in the program to date could exceed the program site goal by 40% if all became executed contracts. With the program currently on track to meet vehicle goals, PG&E staff started to focus on smaller sites that would reduce overall cost the program less to reach its site goal. Figure 175 shows that PG&E is on pace to meet its site and vehicle goals.

Figure 175. PG&E EV Fleet Program Historical and Forecasted Progress Toward Site and Vehicle Goals



PG&E spent \$20.7 million of the EV Fleet program budget in 2024, bringing total spending to \$70.2 million out of \$236.3 million of the approved program budget, or 30% of available funding. The total spending does not include funding reserved for contracted sites that have not yet been spent. PTD, the cumulative percentage of DAC sites is 44%, which exceeds the Pilot's *per se reasonableness* goal of 25%.

Though overall consumption increased significantly, peak demand represents a small portion of installed charging capacity, and the majority of fleet operators are not implementing load management.

Across 2024 operational sites, more than 35 MW of new charging capacity was installed, bringing total capacity for the PTD sites to over 67 MW. Overall consumption in 2024 was just under 40 MWh, an ~180% increase over approximately 10 MWh in 2023. Peak demand reached 13.9 MW in 2024, a 184% increase over 2023, while utilization remained constant of approximately 21.6%. Overall, PG&E EV Fleet program sites have an average total monthly billing cost of \$0.36/kWh. Sites that avoid charging during the highest-cost time period through load management appear to show monthly billing costs between \$0.22/kWh and \$0.27/kWh.

The number of load-managed sites changed from 12 out of 62 activated sites (19%) in 2023 to 18 out of 108 activated sites (17%) in 2024. On a monthly basis, nearly 60% of charging has enough flexibility to be shifted to lower cost and lower emissions time periods through the use of load management. Potential savings through use of load management are as high as \$78,700 per site annually for non-load-managed sites, and \$41,000 for sites already using load management through optimization. On average, sites can reduce GHG emissions by 12% by avoiding consumption from 4 p.m. to 9 p.m.

Not all EVSPs offer load management capability, and not all fleet operators have direct access to their utility bills to understand TOU cost impacts. During site visits we observed that most operators had a disconnect between what they expected the electricity to cost versus their actual costs. However, most fleet operators were aware of TOU pricing, regardless of knowing usage trends and costs.

The EV Fleet program sites continue to help displace petroleum, reduce GHG and local emissions, and provide health impacts.

The EV Fleet program PTD sites have displaced more than two million gallons of petroleum. Specifically, the heavy-duty vehicle sector contributed over one million gallons of displaced petroleum. In addition, the program resulted in a reduction of over 20,000 MT of GHG emissions to date. The EV Fleet program sites all contributed to lowering local emissions, with CO reduction being the most prominent, achieving a reduction of 222,192 kg to date. Overall, 18% of the health benefits from PTD sites are in DACs, and the total monetized health benefits from sites range from \$2,510,357 to \$3,322,901.

Although operational cost remains a concern, fleet managers are motivated to participate in the program and experience benefits.

Fleet managers report being motivated to participate primarily because of regulatory requirements (nine of 11), corporate/organizational sustainability goals or initiatives (seven of 11), and environmental benefits (six of 11). The primary barriers before and after participation were the cost of EVs (seven of 11), the cost of EV charging infrastructure (seven of 11), insufficient charging infrastructure along routes (six of 11), and routes being too long (six of 11). After program participation, fleet managers reported that all barriers became less significant except for routes being too long (six of 11). However, three of 11 fleet managers said costs are now higher than with ICE vehicles for maintenance staff training, and five of 11 cited higher costs from loss of fleet flexibility and route modifications to accommodate range limitations of EVs. All (11) fleet managers anticipated benefits for their community or fleet because of electrification such as improved air quality/health and from reduced noise pollution.

Participating fleet managers are satisfied with their experience with the EV Fleet Program and have been positively influenced by their program participation; however, the opportunity to further build fleet manager confidence in industry readiness for electrification remains.

Overall, all (11) fleet managers rated themselves as very satisfied or somewhat satisfied with their experience with the EV Fleet program with six indicating they had learned about the program from PG&E staff and recommended it to others. Regarding specific program experiences, nine of 11 fleet managers said that EVs were very reliable or somewhat reliable and eight of 11 said that EV charging equipment was very reliable or somewhat reliable. In addition, eight of 11 managers reported that they practiced load management with their fleets. Reflecting on their participation in the EV Fleet Program, three of the 11 fleet managers said they would have proceeded with a smaller, but similar project in the absence of the program; and one indicated that they planned to accelerate EV and EV charging equipment procurement due to their experience with the program. Finally, when asked if they felt that their industry or sector was not well-positioned for electrification more than half (seven of 11) thought they were well-positioned.

5.2. Schools and Parks Pilots

5.2.1. Overview

This overview provides a detailed description of the PG&E Schools and Parks Pilots; summaries of the Pilots' implementation process, performance metrics, program materials and budget; and a major milestone timeline. Following the overview are detailed findings, highlights, and lessons learned.

Pilot Description

Schools Pilot: Through its Schools Pilot, PG&E has offered direct installation of and incentives for installing four or six L2 charging ports at K–12 schools within its service territory. The Pilot is designed to provide L2 charging infrastructure at schools and educational facilities in support of California's electrification goals. In the original Decision 19-11-017, PG&E projected installing these chargers across 22 sites.⁹¹

While PG&E will build and maintain the EV service connection

Schools Pilot Targets

- Four or six L2 charging ports at each site
- 22 schools
- 40% in DAC locations

and supply infrastructure for all sites, the equipment can be owned by either PG&E or the site host. For sites where PG&E owns the equipment, the site works with a pre-approved EVSP to help manage equipment operations. If the site host chooses to own the equipment, the site receives a rebate of up to \$11,500 (L2 single) or \$15,500 (L2 dual) for the charger purchase. In all cases, the site host must enroll in a TOU rate. PG&E also provides educational materials

to promote awareness of the newly installed EVSE and benefits of EVs, which it makes available to all schools in its service area.

Parks Pilot: Through its Parks Pilot, PG&E offers direct installation of L2 chargers and DCFC in state parks and beaches within its service territory. PG&E staff designed the Pilot to enable state parks and beaches

Parks Pilot Design Goal

Encourage state parks and beaches to charge their own EV fleets and to offer charging to staff and patrons with LDVs.

to charge the EVs in their own fleet and for staff and patrons to charge LDVs. In Decision 19-11-017, PG&E projected two standard site designs: one with four L2 charging ports at three locations and one with two L2 ports and two DCFC

ports at two locations. Per the Decision, PG&E expected to offer off-grid charging at five – now six⁹² – sites that have sufficient capacity to support charging but where upgrading the existing electric infrastructure would be

Parks Pilot Targets

- 40 L2 and 3 DCFC charging ports
- 15 state parks and beaches
- 25% in DAC locations

⁹¹ In the EY2023 and EY2024 closeout interviews, PG&E staff reported that although PG&E would not achieve the 22-site goal, it is installing more ports than expected and will still reach the port goal of 88 to 132 ports; there was no formal regulatory filing to change the Schools Pilot goals.

⁹² Clarified by PG&E program staff during the EY2024 closeout interviews.

cost-prohibitive given the distance of the electric infrastructure from the site locations. For all sites, PG&E will own the chargers and contract with a third-party EVSP to serve as the customer of record, and who will maintain the equipment and manage the charger electricity costs. PG&E will also post educational signs around the chargers to raise awareness among park and beach patrons that they can charge EVs at state park and beach locations across the state.

Implementation

As interested customers became aware of the Schools Pilot—through PG&E marketing efforts, solicitations from EVSPs, word-of-mouth, or directly from a PG&E account manager—they could choose to apply as the first step in the implementation process. Figure 176 provides detail on the process of taking a site from application to construction for the Schools Pilot.

Figure 176. PG&E Schools Pilot Implementation Process



For the Parks Pilot, PG&E staff assessed every potential state park site in its service territory and, with input from the Department of Parks and Recreation (DPR), selected six sites based on preliminary site designs and cost estimates. In 2024, PG&E and DPR staff signed a MPA that established general terms of participation for the Parks Pilot. Each individual site will have a site addendum to the MPA based on specific site needs and designs. Figure 177 provides detail on the process of taking a site from selection to construction for the Parks Pilot.⁹³

Figure 177. PG&E Parks Pilot Implementation Process

SITE EVALUATION AND SELECTION	
	1. Using CalEnviroScreen 4.0 paired with publicly available GIS data, PG&E created a list of 30 potential sites, 8 of which are in DACs. 2. PG&E's project delivery team conducted partial desktop reviews of all 30 potential sites. 3. PG&E met with districts to gather input from DPR staff on visitor habits and needs for various parks. 4. For 20 sites (18 non-DAC and two DAC), PG&E completed a full desktop review and developed high-level cost estimates for site design. 5. PG&E visited 14 sites to develop detailed cost estimates and confirm feasibility. 6. Together, PG&E and the DPR chose six sites for the pilot.
CONTRACT ISSUANCE	
	1. Building off the MPA signed in 2024, PG&E issues site addendum and preliminary site design to state and district DPR Staff. 2. PG&E and DPR parties sign contract and site is moved to PG&E's project delivery team.
SITE DESIGN AND PREPARATION	
	1. PG&E's project delivery team oversees design contractor throughout design process. 2. With the support of the DPR as needed, PG&E acquires necessary permits.
CONSTRUCTION	
	1. PG&E manages construction of the site.

Program Performance Metrics

The Evaluation Team reviewed sites participating in the PG&E Schools Pilot and analyzed them by pilot status. Table 84 provides the count of PG&E Schools Pilot sites by completion status in EY2024 and for the pilot to date. PG&E did not have any Parks Pilot sites activated or constructed in 2024.

Table 84. PG&E Schools Pilot Complete Site Count by Status

Site Status	EY2024	Pilot to Date
Utility Construction Complete	1	12
Activated	1	12
Operational	1	12
Closed Out	4	11

⁹³ The Parks Pilot Implementation Process figure draws on information from Advice Letter 7504-E, filed on February 21, 2025.

In EY2024, only one site was activated in the PG&E Schools Pilot. This site also became operational in EY2024 and is located inside a DAC. The Pilot has 15 contracts signed to date, two of which were signed in EY2024.

Table 85 presents site-level data for the PG&E Schools Pilot, showing DAC status and the number of ports for the activated sites in EY2024 and in the pilot to date. In EY2024, the only activated site was in a DAC, raising the cumulative percentage of DAC sites to 50% which exceeds the Pilot’s *per se reasonableness* goal of 40% DAC. The pilot deployed six L2 charging ports in EY2024, raising the total number of L2 ports installed to date to 72.

Table 85. PG&E Schools Pilot Activated Site Data in EY2024 and Pilot to Date

EY2024			Pilot to Date		
Activated Sites inside DAC	Activated Sites outside DAC	L2 Charging Ports	Activated Sites inside DAC	Activated Sites outside DAC	L2 Charging Ports
1	0	6	6	6	72

As shown in Table 86, the 12 activated sites to date in the PG&E Schools Pilot meet 55% of the Pilot’s *per se reasonableness* goal of 22 sites and support 72 L2 ports, meeting 82% of the Pilot’s *per se reasonableness* minimum goal of 88 L2 ports and 55% of the Pilot’s maximum port goal of 132 L2 ports.⁹⁴ The 15 customer contracts signed in the pilot to date could satisfy 68% of the pilot’s site goal and would support 90 L2 ports, which would be more than 100% of the Pilot’s minimum port goal and 68% of the maximum port goal.

Table 86. PG&E Schools Pilot Site and Port *Per se Reasonableness* Goal Progress

Pilot Metric	<i>Per se Reasonableness</i> Goal	Pilot to Date
Activated Sites	22	12
L2 Ports	88–132	72

The CPUC established six phases in the program timeline per the SB 350 reporting template. Table 87 shows the median durations by program phase for EY2024 and PTD activated sites. The median number of calendar days per phase for EY2024 sites in the PG&E Schools Pilot ranged from 0 days for Site Assessment to 655 days for Design and Permitting. Overall, median durations across phases in EY2024 were similar to those for the pilot to date.

⁹⁴ Whereas SCE and SDG&E proposed overall port deployment goals for their Schools Pilots, the port goal for PG&E’s Schools Pilot is based on its decision to allow participating schools the option of installing either four or six L2 charging ports, which will result in between 88 and 132 ports installed in total.

Table 87. PG&E Schools Pilot, Median Calendar Days per Phase

CPUC Program Phase	Median Calendar Days	
	EY2024	Pilot to Date
Application Review	35	19
Site Assessment	0	15
Contract Issuance	31	32
Design and Permitting	655	463
Construction Complete	23	39
Activation	27	40

Program Materials Summary

Schools and Parks Pilots: In 2024, PG&E staff maintained information about the pilots on the PG&E website,⁹⁵ which includes several types of relevant information about the Schools and Parks Pilots for prospective site hosts:

- Pilot program summary
- Ownership options and rebates
- Vendor information
- Rebate information
- Criteria for participation
- Partnerships
- Contact information

The website also includes frequently asked questions from prospective program participants. According to key web activities related to the Schools and Parks Pilots that PG&E staff tracked in 2024, there were 491 site visits and 458 unique visitors to the website.

Since 2021, PG&E has fielded a post-activation customer survey for the Schools and Parks Pilots.⁹⁶ The survey assesses customer satisfaction for the program overall, the online information available, the application process, the site walk, the contracting process, and the support from PG&E staff.

To date, the survey has generated nine responses, five of which were in 2024. While the sample size is small, customer feedback has been largely positive. Several respondents commented that the program provided a great opportunity to install EV chargers in places without previous access to EVSE and without the budget to install them, and many expressed interest in additional sites. Survey respondents also praised the PG&E team for being supportive, communicative, and professional throughout the process.

⁹⁵ Information is included in the “Electric Vehicle Programs and Resources” section of PG&E’s website, which has since been removed in 2025.

⁹⁶ As of 2024, only Schools sites had been issued the survey as only Schools sites have been completed to date.

One site host mentioned that although they experienced some delays with their site construction, the program has been very valuable to both the district and the local community, commenting that it “has allowed us to expand the reach for our community to access to EV Charging. I hope in turn, it will increase the proliferation of EVs in our community, which will create a better cleaner environment.”

Schools Pilot: As a result of finalizing the pilot’s last two contracts in April 2024 through a preexisting queue of leads, PG&E staff conducted minimal outreach and marketing for the Schools Pilot in 2024, though staff continued to work with BES representatives to reach out to several schools. PG&E staff also monitored the program inbox to track incoming interest.

- **Targeted Outreach.** Schools Pilot staff engaged PG&E account staff managers who work with school districts on other, non-TE projects to help identify schools that could be good potential candidates for light-duty EV charging.
- **Curriculum Promotion.** PG&E continued to partner with Strategic Energy Innovations (SEI) to roll out the Schools Pilot curriculum. SEI led these initiatives, which included giving presentations to potential districts to help them understand the curriculum and promote it further. In 2024, the curriculum was shared with 22 schools.

Parks Pilot: PG&E staff did not develop any specific marketing materials for the Parks Pilot during 2024 as they focused their efforts on working directly with California State Parks.

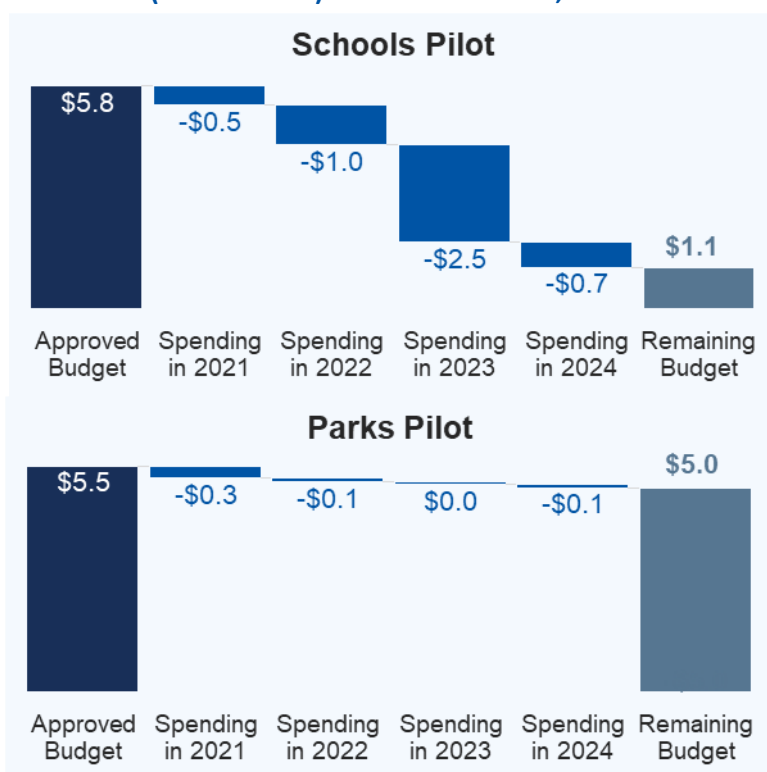
Budget Summary

As shown in Figure 178, from program inception through 2024, PG&E spent \$4.7 million out of the \$5.8 million approved for the Schools Pilot and about \$500,000 out of the \$5.5 million approved for the Parks Pilot. Schools Pilot spending continues to outpace Parks Pilot spending, as a number of Schools Pilot are activated and several sites are under construction, while PG&E staff are still planning sites with DPR staff.

Timeline

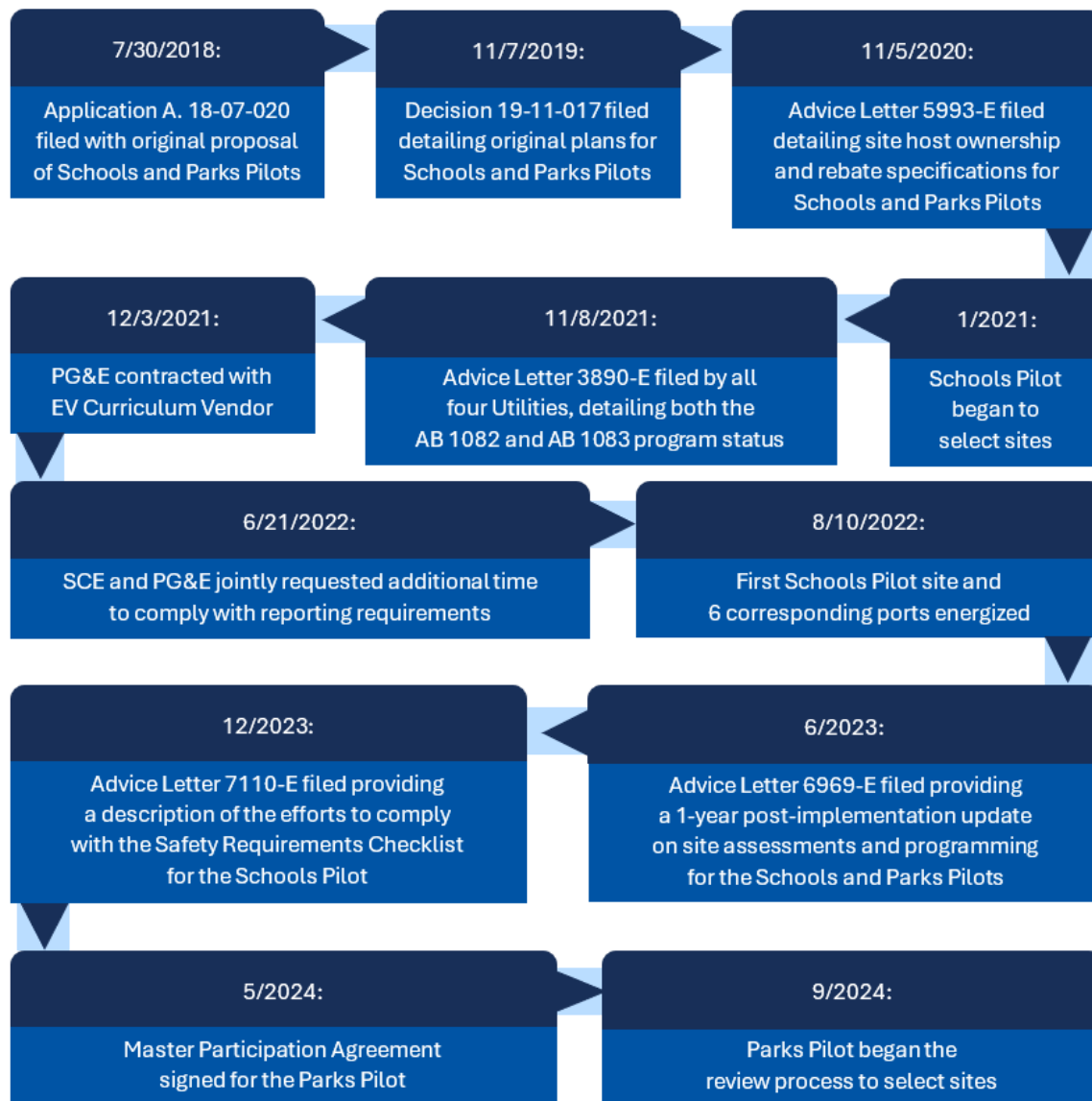
In 2024, for the Schools Pilot, PG&E staff program staff focused on constructing and activating sites and did not file any formal Advice Letters or achieve any regulatory milestones. Throughout most of 2024, PG&E’s

Figure 178. PG&E Schools and Parks Pilots Budgets (Millions USD) as of December 31, 2024



and the DPR legal teams negotiated the MPA, which was signed in May of 2024. From there PG&E staff were able to begin the site selection process. At the end of 2024, PG&E was planning to file two Advice Letters for the Parks Pilot: one regarding Tribal site exclusions and one about the relocation of DAC funds. Figure 179 presents key milestones for the PG&E Schools and Parks Pilots.

Figure 179. PG&E Schools and Parks Pilots Key Milestones



5.2.2. Findings

This section provides findings from analyses of the incremental EV adoptions, site visits, grid impacts, petroleum displacement, GHG and criteria pollutant reductions, and health impacts, as well as insights from Utility staff interviews. Only insights from Utility staff cover both the Schools and Parks Pilots, as only the Schools Pilot has sites in 2024.

Table 88 summarizes key impact parameters for the Schools Pilot in EY2024 and for the pilot to date. Annual estimates of impacts are provided for metrics calculated as part of the impact evaluation. Additionally, the table provides estimates of impacts across all sites included in the program population through the end of 2024.

Table 88. PG&E Schools Pilot Impacts Summary

Impact Parameter	EY2023 Sites ^a	EY2024 Sites ^a	EY2024 Sites Percentage in DAC	Pilot-to-Date Sites Actual	Pilot-to-Date Sites Actual Percentage in DAC
Population of Activated Sites	10	1	100%	12	50%
Sites included in analysis (#)	10	1	100%	12	50%
Charging Ports Installed (#)	60	6	100%	72	50%
Electric Energy Consumption (MWh)			100%	243.6	42%
Petroleum Displacement (GGE)	14,126	241	100%	18,434	42%
GHG Emission Reduction (MT GHG) ^b	110	2.1	100%	148.81	43%
PM ₁₀ Reduction (kg)	0.60	0.01	100%	0.78	42%
PM _{2.5} Reduction (kg)	0.55	0.01	100%	0.72	42%
ROG Reduction (kg)	8.5	0.1	100%	11.65	43%
CO Reduction (kg)	302	5	100%	410.16	43%

^a Energy consumption, petroleum displacement, and emissions reductions are based on annualized data. Pilot-to-date results in the table are based on actual data (see *Appendix B* for more details).

^b GHGs include CO₂, CH₄, and N₂O multiplied by their respective GWP as defined by IPCC AR5 (see *Appendix B* for more details).

Incremental EVs Adoption

The Evaluation Team estimated the effect of the PG&E Schools Pilot public charging stations on household EV adoption for neighboring populations⁹⁷ with a two-stage analysis: the Team first performed an historical analysis of public EV charging impacts on vehicle ownership and then performed an analysis of EV ownership attributable to PG&E Schools Pilot investments. See *Appendix B* for the details of the Stage 1 analysis.

⁹⁷ There are two main avenues through which the availability of public charging networks may affect EV purchases. The first is a network effect, through which EV owners gain increased access to the public charging stations because of the stations' placement at destinations such as workplaces, commercial establishments, schools, and parks. The Evaluation Team expects the availability of EV charging equipment at convenient locations (for midday charging away from home) to increase the convenience of owning an EV (such as lessening range anxiety) and to increase the probability of EV ownership. The second avenue is a neighborhood effect on the driving population living in areas neighboring the public EV charging stations. The availability of nearby charging infrastructure is expected to lower the cost of EV ownership by providing alternatives to home charging. The Evaluation Team expects that public EV charging will have the biggest impact on residents of multifamily buildings, many of whom will have limited access to EV charging equipment, and on low-income households, which may be unable to afford home EV charging equipment. Public charging access may boost EV ownership through both channels, and there may be positive interactive effects between the channels that boost the overall impact of public charging networks. The Evaluation Team focused on analyzing the second channel. We will analyze impacts for the first channel separately when data become available.

Using the impact estimates from the Stage 1 analysis,⁹⁸ the Evaluation Team estimated the impact of PG&E investments in public charging on EV ownership. By the end of EY2024, 12 charging sites in PG&E's Schools Pilot had been activated. We estimated the impact of these stations based on annual EV registrations and on PTD cumulative EV registrations driven by the program.

Based on the composite measure of public charging access, the Evaluation Team calculated the change in access to public charging due to PG&E's Schools Pilot investment for each CBG where the investments affected access. Table 89 shows that the pilot-to-date average change in access across all affected CBG was seven, and the average change in the number of chargers (ports) was five per affected CBG. For reference, the average change in access across all CBGs in California was 1.05 between 2015 and 2023. The average normalized EV annual registration per 1,000 households was 53 in the affected CBGs in the 2020 baseline year.

Table 89. PG&E Schools Pilot Summary Statistics of Effects on CBGs

	CBG Mean (Standard Deviation)			
	Change in Composite Measure of Access ^a	Change in Number of Chargers ^a	Normalized Annual EV Registrations ^b	Number of Households ^c
PG&E Schools Pilot	6.61	5.44	53.39	433.80
	(2.65)	(1.78)	(51.67)	(208.44)
CBGs (N)	32	32	32	32

These values are averages for the CBGs whose access to public charging was affected by PG&E's investments.

^a Change in composite measure of access and number of chargers is from 2020 to 2024.

^b Normalized annual EV registrations are average annual values in the affected CBGs in 2020 per 1,000 households.

^c Number of households is based on 2015–2019 American Community Survey (ACS).

Sample standard deviations are in parentheses.

The Evaluation Team also calculated the impact of the Schools Pilot Utility charging investments on neighboring EV ownership. This calculation involved combining the OLS and IV-2SLS regression estimates of the impact of public charging access on EV registrations from Stage 1 with the estimates of the CBG changes in public charging access and the number of neighboring households in the CBGs.⁹⁹

Table 90 shows estimates of the annual and pilot-to-date EV registrations attributable to the PG&E Schools Pilot charging investments. Based on the OLS long differences model,¹⁰⁰ PG&E School Pilot investments in charging facilities increased EY2024 annual EV registrations by 8 vehicles and PTD EV registrations by 10 vehicles. Based on the IV-2SLS long differences model, the School Pilot investments

⁹⁸ The Stage 1 analysis used vehicle registration data from 2015 to 2023, the most recent period with complete information at the CBG level. The EY2024 estimates assume that the impact of Utility-specific stations remains unchanged over time, which may not reflect actual market conditions and technological changes in 2024.

⁹⁹ In Stage 1, the Evaluation Team estimated the impact of public EV charging access on EV ownership. Stage 2 built on the Stage 1 analysis and was an attribution analysis for Utility-specific investments. A notable benefit of this approach is that it can be applied to evaluations of other programs increasing EV charging access as well, which ensures methodological consistency.

¹⁰⁰ The long differences model estimates indicate the impact of public charging on EV registration over eight years. The team annualized these estimates by dividing the results by eight.

increased annual EV registrations by 15 vehicles. The Evaluation Team prefers the IV-2SLS-based estimates because they account for the potential endogenous siting decisions of public charging (i.e., siting public charging infrastructure in locations likely to have above- or below-average rates of EV adoption). These estimates reflect the 12 activated Schools Pilot facilities operating for a full year.

Table 90. PG&E Schools Pilot EV Registrations Attribution

EY2024 Annual Increase of EV Registrations Driven by the Utility Program		PTD Cumulative Increase of EV Registrations Driven by the Utility Program	
OLS	IV-2SLS	OLS	IV-2SLS
7.62	14.83	9.63	24.15
(0.44)	(1.42)	(0.51)	(1.92)

Note: The table shows the EV registrations attributable to the utility investments in public charging infrastructure. The left panel shows the impacts of utility investments since 2020 on registrations in EY2024. The right panel shows the cumulative impacts of Utility investments since 2020 on EV registrations in EY2021, EY2022, EY2023, and EY2024. Robust standard errors clustered at the CBG level are shown in parentheses.

The PG&E Schools Pilot investments in public charging had relatively small impacts on EV ownership in EY2024. Across all 32 affected CBGs, the total annual number of EV registrations is about 1,708 (32×53.39), so the preferred IV-2SLS regression estimates the PTD cumulative impact of the PG&E Schools Pilot to be an increase in EV registrations of about 1.4% ($24.15 / 1708$). Although modest, this impact has more than doubled from EY2023 (0.6%). An average of 53 EV registrations per CBG in 2020 puts these CBGs in the 60th percentile of the EV registration distribution of CBGs, implying a relatively high level of baseline EV registration.

Highlights

- The model's output shows that the Schools Pilot may have contributed to the PTD EV adoption of 24 EVs for households neighboring the infrastructure.

Site Visits

The Evaluation Team visited the only Schools Pilot site activated in 2024. During the site visit, the Team documented the number of ports installed in EY2024 (6 L2), and installed charging capacity (40 kW). The total ports for PTD sites that the Team visited are now 72 L2 and total installed charging capacity is now 490 kW. Figure 180 and Table 91 show ports and capacity for EY2024 sites as well as for pilot-to-date sites.

Figure 180. PG&E Schools Pilot L2 Ports and Capacity Observed in 2024 and Pilot to Date

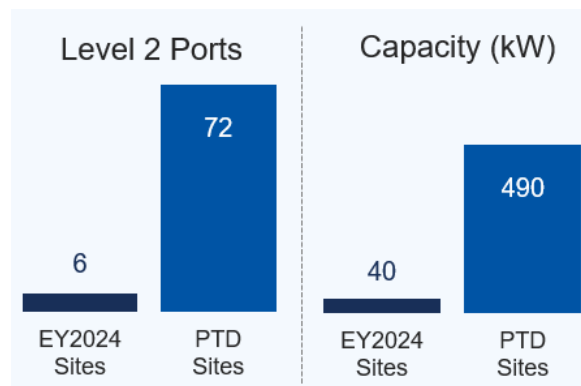


Table 91. PG&E Schools Pilot Summary of Ports and Capacity Observed during Site Visits

Site Visit	Ports	Installed Capacity	Number of Sites
EY2024 Sites	6	40	1
Program to Date Sites	72	490	12

The Team assessed how these new sites fit within the workplace (and to some extent within the public-charging) ecosystem. This is partially a function of the number of parking spaces within reach of a charging cord, regardless of whether these spaces are designated as EV charging spaces. Typically, head-to-head parking offers high access to charging ports if EVSE are not adjacent to one another. Figure 181 shows the site layout for the single activated site in 2024: six charging ports serving six electrified parking spaces with at least one ADA accessible parking space. The site was like others visited in past evaluation years in terms of chargers, capacity, and design, and had an equal number of parking spaces within reach of charging ports to the number of ports (a one-to-one ratio).

Figure 181. PG&E Schools Pilot EY2024 Site Layouts

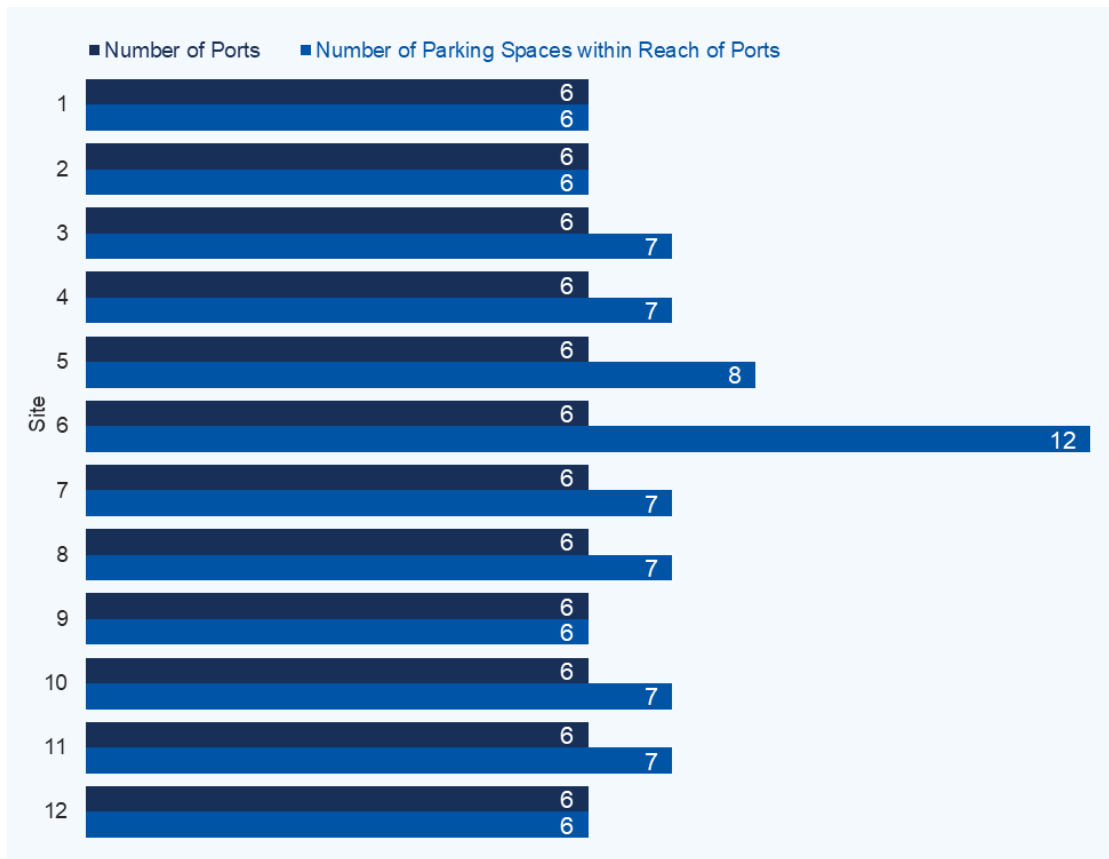


Left panel: Three EVSE with one ADA out of six electrified parking spaces.

Middle panel: Dual port L2 EVSE. Right panel: Step-down transformer and electrical cabinets

To highlight the value of having multiple parking spaces within reach of cords, Figure 182 shows the number of ports and the number of spaces that can access these ports for the sites the Evaluation Team visited. As illustrated by the figure, most sites offer a nearly one-to-one ratio of parking spaces-to-charging ports, with one exception where each charging port can reach two parking spaces. This allows additional vehicles to use a charging port without moving the first vehicle, which can improve charger utilization. PG&E's Schools pilot focused on installing EVSE with dual ports to minimize infrastructure costs, but improved siting practices such as placing stations in medians at head-to-head spaces or increasing the length of charging cords may further increase the number of spaces served by each port.

Figure 182. PG&E Schools Pilot Visited Sites Charging Port Availability by Site for PTD Sites



The Evaluation Team reviewed the pricing structure available to EV drivers including costs for idle time to encourage charger turnover, for encouraging charging when energy emissions and costs are low, and for discouraging charging when costs are high (such as from 4 p.m. to 9 p.m.). We were not able to confirm pricing for most of these sites on site or through public means such as Plugshare.com or websites specific to NSPs. However, the one 2024 activated site charged \$0.60/kWh, with a \$0.50/hour idle fee that starts 90 minutes after charging has been completed. Three sites showed use of TOU pricing, and one site appeared to be providing free charging. One school had signage restricting public charging during the regular school hours but allowing it before and after. The Evaluation Team has been unable to confirm the pricing for approximately half the sites as of May 30, 2025.

Highlights

- The Evaluation Team visited the single site activated in 2024, which included a typical layout for the PG&E Schools Pilot with six electrified parking spaces and a one-to-one ratio of parking spots to ports.
- The Schools Pilot has installed 72 L2 ports program to date providing nearly 500 kW of installed charging capacity.
- The one site activated in 2024 is charging \$0.60/kWh, which is on the higher end of pricing for EV charging, while three other sites are passing along TOU pricing to drivers and one site appears to provide free charging.

Site Costs

The EY2024 report does not include a site cost analysis for the Schools and Parks Pilots because fewer than 15 sites had finalized cost data and therefore the 15-15 Rule metric was not met.

Grid Impacts

The Evaluation Team determined grid impacts for the PG&E Schools Pilot based on the analysis of energy consumed by operational charging stations installed by the program through the end of 2024, combined with charging session data from the NSPs.

Data Sources

The primary data source for the analyses detailed in this section is the energy usage–related data provided in regular 15-minute intervals from the AMI. Other data sources include charging session-specific data provided by NSPs. There are several important differences between AMI and NSP data. While AMI data includes only energy usage, NSP data also includes session start and stop time, the duration of a vehicle’s connection to a charging port, the duration of a vehicle actively pulling power and the specific port used for a session. An AMI meter does, however, track standing loads (such as those the EVSE uses for communications, cooling, active power converters, solenoids, and screens), which NSPs typically cannot do. When AMI data is missing from the dataset, the Evaluation Team uses NSP data to fill in the gaps.

Summary of Grid Impacts

Table 92 presents the estimated PG&E Schools Pilot grid impacts summary.

Table 92. PG&E Schools Pilot Grid Impacts

Impact Parameter	Actual 2024	Actual Program to Date	10-Year Projection PTD
Operational Sites	1	12	12
Installed Capacity (kW)	39.6	489.6	489.6
Electric Energy Consumption, MWh			1,807
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)	17 (10.7%)	31 (12.8%)	179 (9.9%)
Maximum Demand, kW (with date and time)	169 (9/13/24 10:15 AM)	169 (9/13/24 10:15 AM)	N/A
Maximum On-Peak Demand, kW (with date and time)	62 (1/5/24 4:00 PM)	70 (9/28/23 7:00 PM)	N/A

The remainder of this section offers detailed findings on actual consumption, demand, and charging session-oriented trends of the combined sites for 2024.

Energy Trends

Sites in the PG&E Schools Pilot reached a total consumption of nearly 250 MWh including over 150 MWh in 2024. One additional site was activated in 2024, bringing the total number of activated sites through the end of December 2024 to 12. Demand across all sites peaked at 10:15 a.m. on September 13, 2024, at a total of 169 kW, just over one-third of the installed capacity of 490 kW. This time period aligns with workplace charging trends, with most charging occurring in the morning as people arrive to work. Consumption in 2024 (>150 MWh) was nearly double that in 2023 (>80 MWh). Figure 183 plots monthly energy consumption and maximum demand values.

Figure 183. PG&E Schools Pilot Monthly Energy Consumption and Maximum Demand

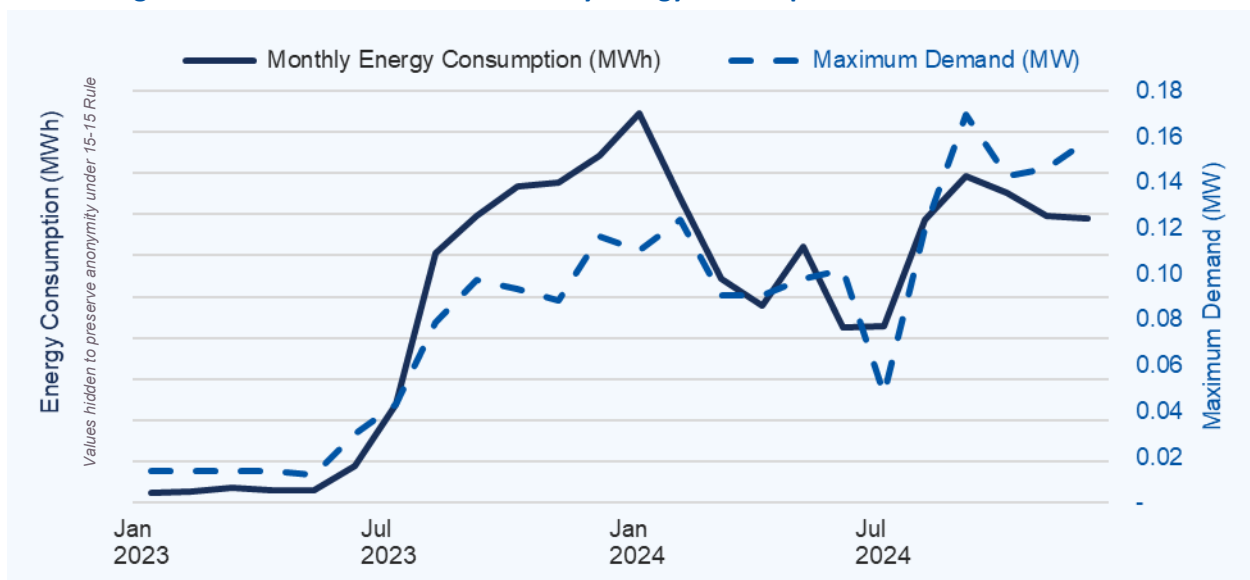


Figure 184 below highlights daily energy trends of demand and consumption. Energy consumption range between 1 MWh and 1.5 MWh on days of highest energy consumption seen in the second halves of

both years. Overall daily consumption toward the end of 2024 ranged from 600 kWh to 800 kWh during weekdays but closer to 200 kWh on weekends. The portfolio is relatively stable utilization in terms of typical daily consumption with only a single site added in 2024. This group of sites will be interesting to watch to see if consumption will continue to grow.

Figure 184. PG&E Schools Pilot Daily Energy Consumption and Maximum Demand, Pilot-to-Date Sites

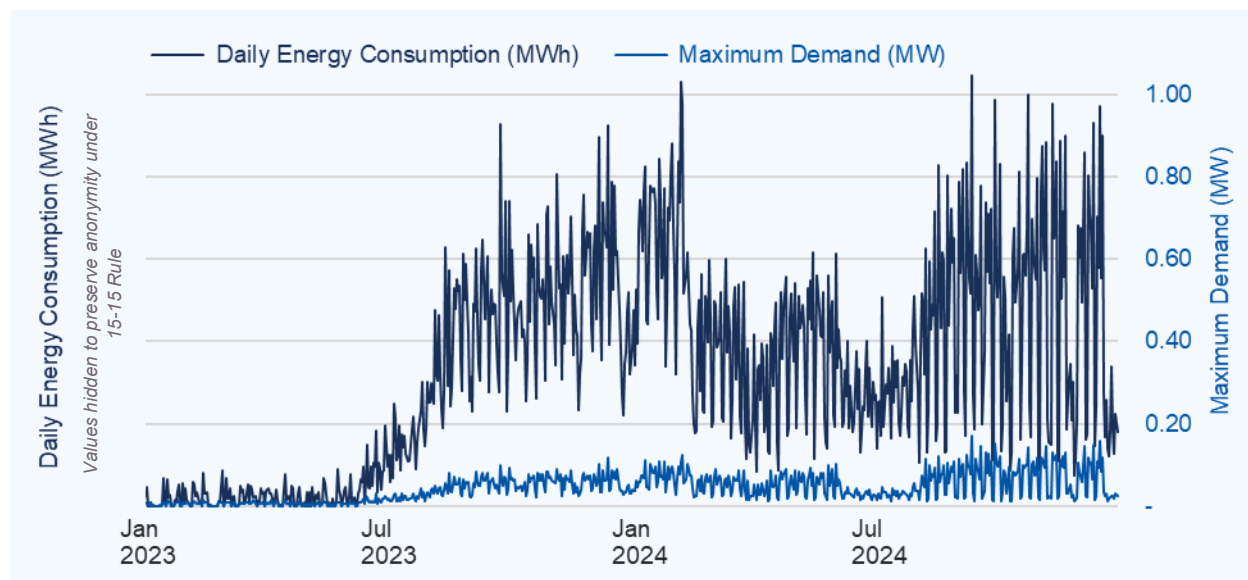
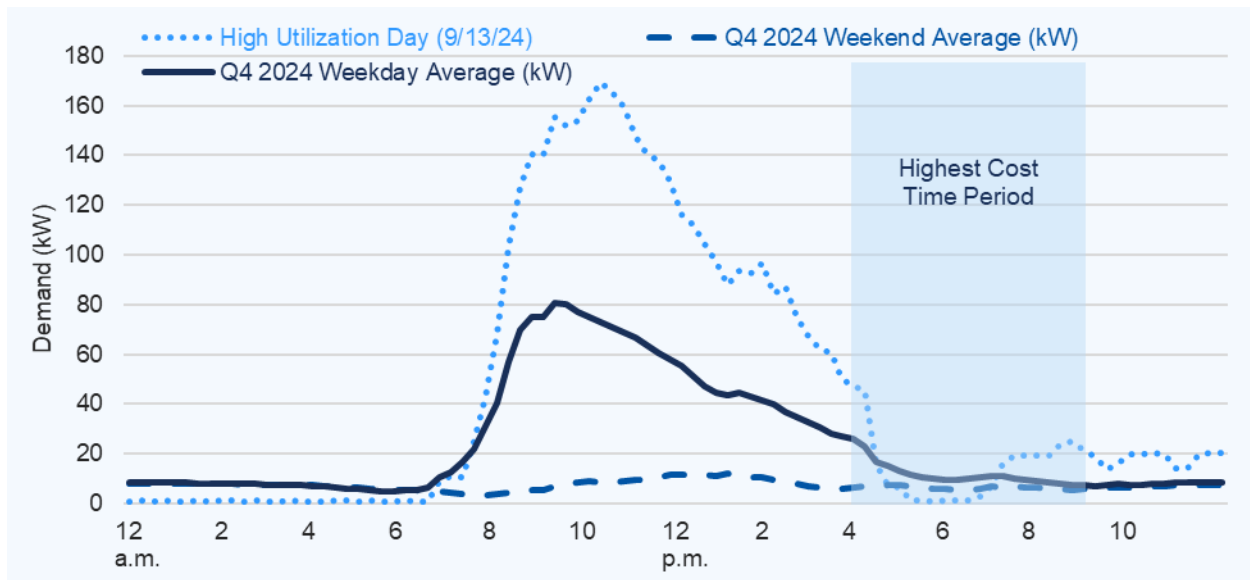


Figure 185 shows the average demand on weekdays and weekends in Q4 2024 for the Schools Pilot and presents an example of a high utilization day for comparison. The average weekday load shape of sites in the Schools Pilot is representative of typical workplace charging. This pattern consists of a load that ramps up between 6 a.m. and 9 a.m. as drivers arrive, peaks between 9 a.m. and 11 a.m. as all connected vehicles are charging, and tapers off over the rest of the day as individual vehicles complete their charge. On average, weekend consumption is much flatter than on weekdays, but sites show slightly more use overnight than weekdays, which may indicate use of the chargers by the local community.

Several sites show regular overnight utilization on both weekdays and weekends, which could be from staff or nearby residents. Overnight and weekend utilization demonstrates the benefits of this pilot to the local community and leads to increased load factor.

Figure 185. PG&E Schools Pilot Average Weekday and Weekend Q4 2024 Load Curves



The effect of pricing on grid impacts for these sites—such as how and to what extent EV drivers use energy—remains inconclusive. Surveying these drivers may reveal whether the price they pay for energy influences their patterns. For instance, we might expect an EV driver to use less energy between 4 p.m. and 9 p.m. if they receive TOU signals indicating a higher energy cost during this period. During site visits, the Evaluation Team can typically determine what pricing EV drivers receive. However, many of these sites historically did not display a pricing plan during the site visit and do not display energy prices publicly on apps. Workplaces tend to see a correlation between charging activity and the lowest TOU rates (late morning into early afternoon), which also typically aligns with a higher proportion of renewable energy on the grid, even if pricing available to EV drivers does not represent this.

Usage Trends

The Schools Pilot initiative and other public-facing projects across the state may provide additional insight into how long similar sites will take to reach operational maturity. Factors that affect sites' timelines may include how EV drivers gain access to chargers and how the availability of workplace charging may influence drivers to trade their conventional vehicle for an EV, or to keep an EV they already have.

Figure 186 displays monthly energy consumption trends for each site based on number of months from activation. All sites have the same number of charging ports and capacity, allowing for a direct comparison on a site-by-site basis. Over the first year, sites' consumption ranged from 100 kWh to over 1,500 kWh. Five sites appear to have achieved over 1 MWh regularly. A few are lower utilization of around 500 kWh to 1 MWh and a couple are much lower.

Figure 186. PG&E Schools Pilot Monthly Energy Consumption Based on Site's Operational Time

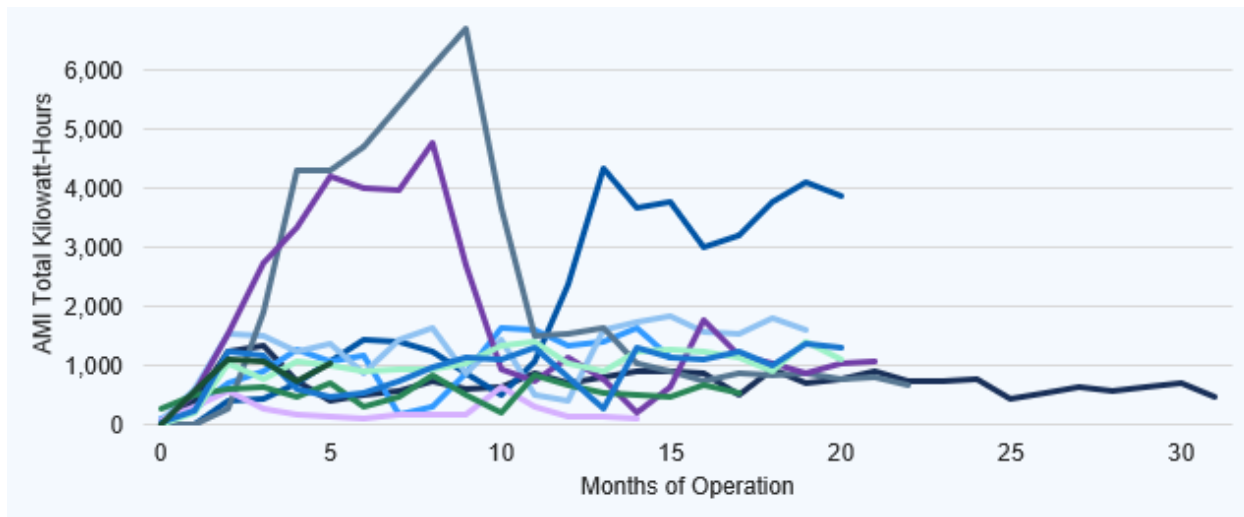


Figure 187 shows the monthly load factor of each site based on number of months from activation. Load factor compares a site's actual monthly energy consumption to what its consumption would be if the maximum demand were maintained at all times during the month. To an extent this is a measure of consistency of operations. A constant maximum demand, for example, would result in a 100% load factor (which is highly unlikely in practice). Growth rates, whether by consumption, load factor, or sessions, may help site and Utility staff better understand the level of demand at a workplace charging site and how long it will take a site to reach full operation and utility.

Figure 187 shows that the load factor for most of these sites currently hovers between 5% and 10%, while load factor for two of the sites is consistently higher. This indicates that maximum demand is very inconsistent at most sites and may reflect low utilization.

Figure 187. PG&E Schools Pilot Monthly Load Factor Based on Site's Operational Time

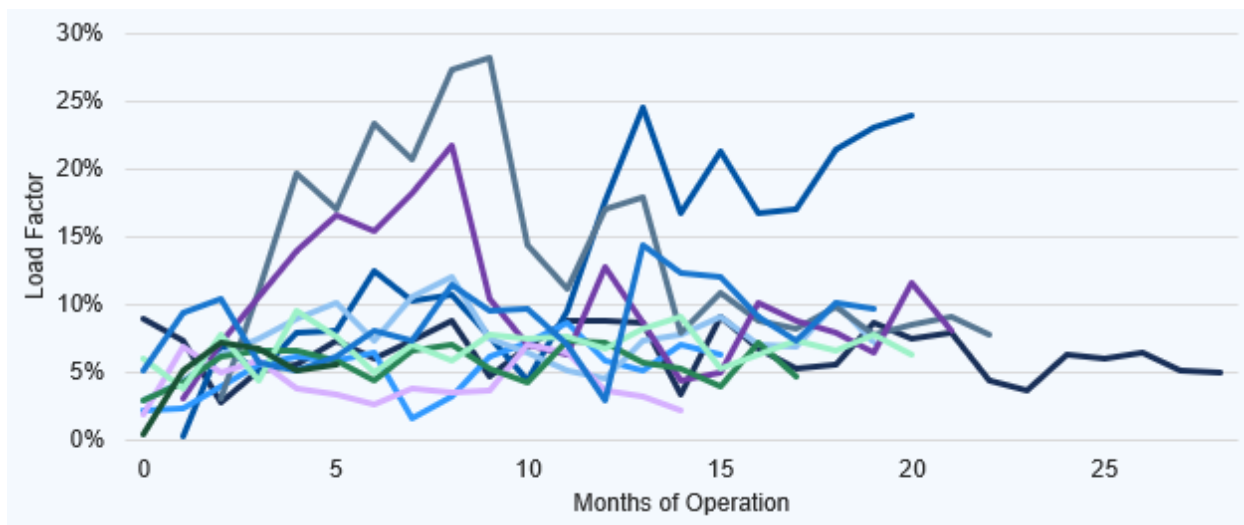


Figure 188 presents the total number of daily charging sessions in the Schools Pilot. Between August and December 2024, charging trends were similar to trends during the same time period in 2023, with the busiest days approaching 50 charging sessions, and the average between 30 and 40. However, daily charging sessions between February and June rarely exceeded 30 daily sessions, and sessions over the summer months never exceeded 30. While not highlighted in the figure, Mondays and Fridays generally exhibit larger consumption than other days of the week.

Figure 188. PG&E Schools Pilot Daily Charging Sessions PTD Sites

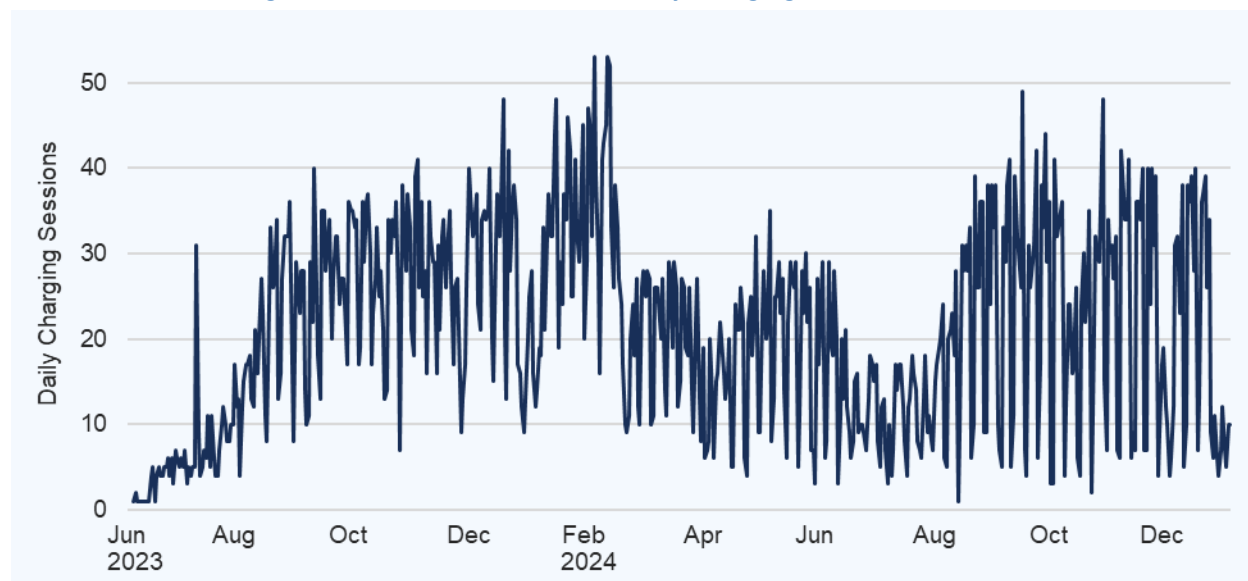
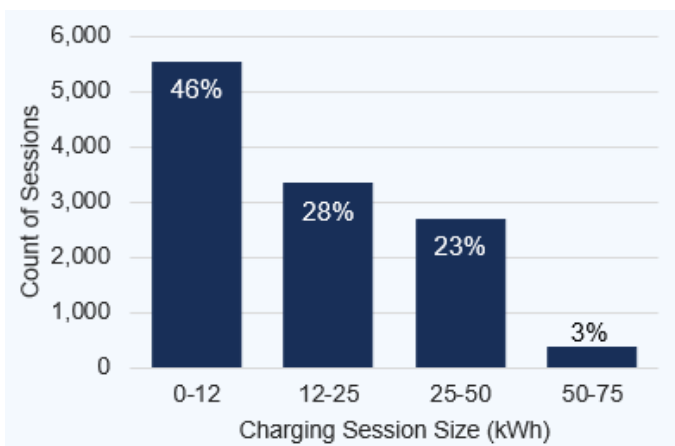


Figure 189 presents the distribution of charging sessions by kilowatt hours consumed for sites in the Schools Pilot. Nearly half of all charging sessions are for 12 kWh or less, while the next two size bins are approximately 25% each. The Evaluation Team did not include erratic charging sessions (below 1 kWh or for less than 0.1 hours) in the figure.

Figure 189. PG&E Schools Pilot Charging Session Count by Consumption Size PTD



Highlights

- Consumption data show relatively consistent yearly energy use and session counts, indicating that most Schools Pilot sites have not grown their user base
- The Schools Pilot sites may take many months or several years to show an impact from influencing drivers to purchase or lease EVs rather than conventional vehicles.
- Daily charging sessions increased two-fold between the beginning and end of August, coinciding with the new school year
- Nearly three-quarters of charging sessions are less than 25 kWh, while 46% are under 12 kWh.

Petroleum Displacement

The Evaluation Team estimated pilot-induced petroleum displacement related to the 12 PG&E Schools Pilot sites using three key pieces of information: electricity used for vehicle charging, EV annual miles traveled, and annual counterfactual vehicle fuel consumption. From this information we estimated the reduction in equivalent gallons of petroleum as a result of the PG&E Schools Pilot. Table 93 presents petroleum displacement impacts for the Schools Pilot sites through 2024, including estimated actual impacts for 2024, actual impacts for all sites in the pilot to date, and a 10-year forecast for pilot-to-date sites.

Table 93. PG&E Schools Pilot Petroleum Displacement

DAC	Usage (n=12)				Petroleum Displacement (GGE)		
	2024 Actual ^a (kWh)	PTD Actual ^b (kWh)	2024 Actual Use (miles)	PTD Actual Use (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC			219,144	303,207	5,590	7,807	63,882
Outside DAC			244,130	420,488	6,170	10,627	54,252
Total			463,274	723,695	11,760	18,434	118,134

^a "2024 Actual" represents the data from all activated sites from program inception for the calendar year 2024.

^b "PTD Actual" represents the data from all activated sites from program inception for all program years.

Highlights

- The 12 operational sites collectively achieved a pilot-to-date impact of more than 18,000 gallons of petroleum, with 42% within DACs.
- Over a 10-year period, the sites will result in displacing over 118,000 gallons of petroleum.

Greenhouse Gas and Criteria Pollutants

The Evaluation Team calculated reduced emissions from displaced fossil fuel use from ICE vehicles that were not in service as a result of the PG&E Schools Pilot. The Team first developed one ICE counterfactual, then calculated the emissions associated with these vehicles under conditions that otherwise matched the EVs to provide a baseline. Although EVs have no tailpipe emissions, the fossil-

fuel power plants that supply electricity to the vehicle chargers still release some GHGs and criteria pollutants.

Table 94 presents the GHG reduction resulting from the School Pilot for the 12 activated schools sites in 2024, along with PTD and 10-year projection, by impact location. Overall, the pilot resulted in a 81% reduction of GHG emissions (149 MT total) relative to the counterfactual to date (184 MT total, not shown in table), with just over 43% of the impact within DACs.

Table 94. PG&E Schools Pilot GHG Reductions

DAC	Usage (n=12)				GHG Reduction (MT)		
	2024 Actual ^a (kWh)	PTD Actual ^b (kWh)	2024 Actual Use (miles)	PTD Actual Use (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC			219,144	303,207	47	64	565
Outside DAC			244,130	420,488	52	85	478
Total			463,274	723,695	99	149	1,044

^a "2024 Actual" represents the data from all activated sites from program inception for the calendar year 2023.

^b "PTD Actual" represents the data from all activated sites from program inception for all program years.

Overall, of the local emissions, the Schools Pilot had the highest impact in reducing CO, resulting in an estimated reduction of 410 kg (Table 95).

Table 95. PG&E Schools Pilot Local Emissions Net Reductions

Emissions	EY2024 Sites (n=1)			PTD Sites (n=12)	
	Inside DAC	Outside DAC	Total	Actual	10-Year Projected Impact
PM ₁₀ (kg)	0.11	-	0.11	0.78	5.1
PM _{2.5} (kg)	0.10	-	0.10	0.72	4.7
ROG (kg)	0.141	-	0.141	11.65	98.0
CO (kg)	5.28	-	5.28	410.2	3,376

Note: Columns may not sum to total due to rounding.

Figure 190 shows the current mix of electricity from the CAISO grid used to support the PG&E Schools Pilot sites.¹⁰¹ Based on the real-time grid conditions when the EV charging occurred, the overall energy mix contained about 58% zero-emission or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 33% natural gas. With the CAISO grid adding more renewables to meet the Renewable Portfolio Standard, the GHG and criteria pollutant emissions will continue to decrease.

Figure 190. PG&E Schools Pilot Net Electricity Mix, Pilot to Date

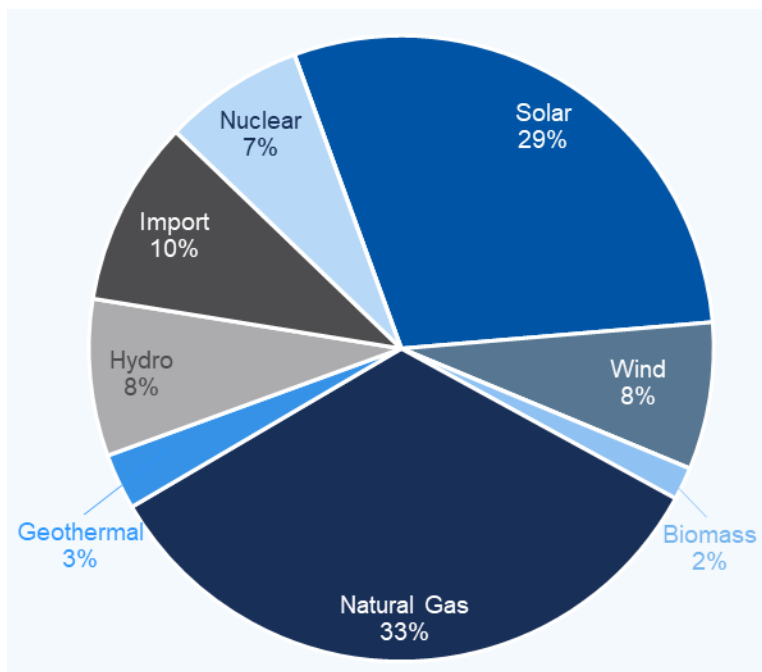
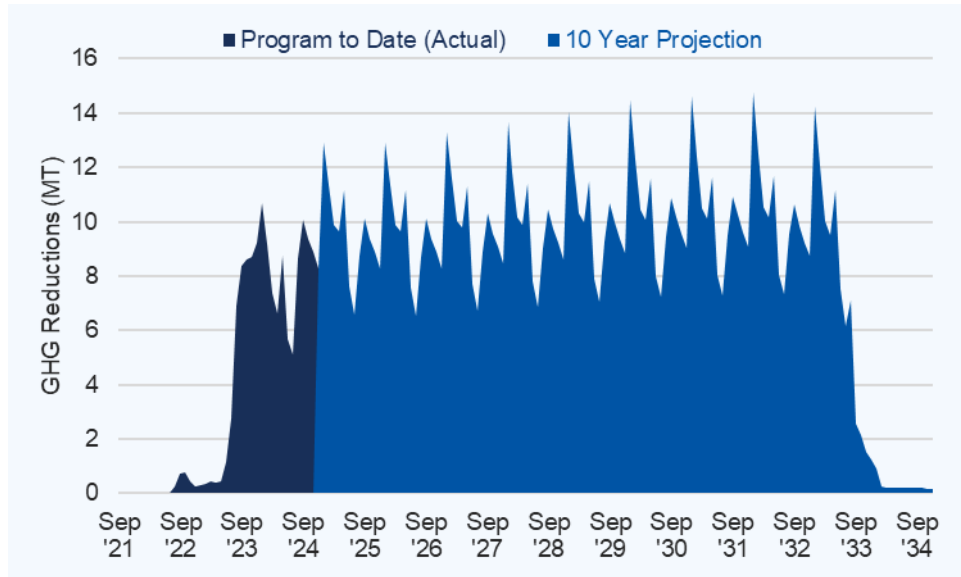


Figure 191 shows how pilot GHG reductions have increased to date and how these reductions are expected to grow over time for all sites. The analysis period ranges from the date that the first site in the program was activated through the end of 2024. The analysis incorporates the net reduction (counterfactual emissions minus utility emissions) for each pilot site. Pilot-to-date emissions reductions appear in dark navy while anticipated benefits based on annualization appear in royal blue. Because each site has its own starting date of operation, the 10-year sunset for each site can be observed as a gradual tapering off of pilot benefits in 2032. While each year's operations appear similar, several key factors are driving the variations such as seasonality of utility generation sources (high utility emissions will appear as a dip on the curves), holidays occurring on weekends versus weekdays, and inaccuracies in predicted operations for sites that became operational late in 2024.

¹⁰¹ The power associated with imports comes from a mixture of hydro, nuclear, and natural gas plants located outside the CAISO grid.

Figure 191. PG&E Schools Pilot Historical and Forecasted GHG Reductions, Pilot-to-Date Sites



Highlights

- In 2024, the Schools Pilot resulted in an 81% reduction of GHG to date with 43% of the impact occurring within DACs.
- The greatest reduction in local emissions was for CO with a projected 10-year period reduction of more than 3,300 kg.
- Based on the real-time grid conditions when EV charging occurred, the overall energy mix contained about 58% zero-emission or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 33% natural gas.

Health Impacts

The Evaluation Team calculated public health impacts (as benefits and costs) of reductions in criteria pollutants from vehicle electrification. Pollutants included in the analysis are primary PM_{2.5} and precursors of secondary PM_{2.5}, including NO_x, SO₂, NH₃, and VOCs. This analysis considered only tailpipe emissions reductions rather than full lifecycle emissions (such as power plant emissions). We used the U.S. EPA's COBRA to evaluate the health benefits associated with emissions reductions. COBRA estimates the county-level benefits for the county in which emissions are reduced. It also estimates the effect of the transport of emissions on all counties in the United States; however, this analysis includes only the effects of the emissions reductions in California. The Evaluation Team disaggregated the county-level effects to estimate the potential health benefits of sites for DACs and non-DACs.

Economic value depends on the health effects associated with the emissions, that is, whether they are associated with illnesses or death. The monetary value of the morbidity reductions associated with emissions reductions include avoided lost wages, avoided medical costs, and the amount of money people are willing to pay to avoid an illness or condition like respiratory disease. The value of the

reduced mortality associated with emissions reduction is measured by the value of a statistical life, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low and high impact for mortality, representing the uncertainties in the estimates.

The total value of the health benefits associated with the emissions reductions is small, between \$2,969 and \$4,253. Table 96 shows the cumulative health benefits in California associated with the emissions reductions realized by the electrification of PG&E Schools Pilot sites for the program to date.

Table 96. PG&E Schools Pilot California Health Benefits for PTD Sites in 2024

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Mortality	< 0.000	< 0.000	\$2,632	\$3,915
Avoided Medical Care				
Hospitalization, Respiratory	< 0.000	< 0.000	\$0	\$0
Hospitalization, Cardiovascular	< 0.000	< 0.000	\$0	\$0
Hospitalization, Other	< 0.000	< 0.000	\$1	\$1
ER Visits, Respiratory	< 0.000	< 0.000	\$1	\$1
ER Visits, Cardiovascular	< 0.000	< 0.000	\$0	\$0
Out of Hospital Heart Attacks	< 0.000	< 0.000	\$0	\$0
Nonfatal Heart Attacks	< 0.000	< 0.000	\$5	\$5
Stroke	< 0.000	< 0.000	\$0	\$0
Lung Cancer	< 0.000	< 0.000	\$0	\$0
Asthma	0.189	0.189	\$152	\$152
Hay Fever	0.008	0.008	\$9	\$9
Lost Productivity				
Minor Restricted Activity Days	0.076	0.076	\$10	\$10
Work Loss Days	0.013	0.013	\$4	\$4
School Loss Days	0.089	0.089	\$156	\$156
Total Health Effects	-	-	\$2,969	\$4,253

As part of this analysis, the Evaluation Team also examined health benefits within DACs, which may be disproportionately burdened by sources of pollution (including air pollution from ICE vehicles). Because COBRA estimates effects only at the county level, the Evaluation Team disaggregated the health benefits by census tract using the relative population of each tract from the most recent American Community Survey. For example, we allocated 10% of the value of the health benefits to a census tract with 10% of the county's population. The Evaluation Team then estimated the total benefits allocated to DACs and non-DACs. This approach assumes that the benefits of emissions reductions are distributed evenly throughout the county. If the sites are located in DACs, and the emissions reductions are greater in the tracts near the sites, this approach understates the potential benefit to DACs. Additional information about emissions dispersion within counties would provide more-precise estimates of the health benefits to DACs and non-DACs.

Santa Clara County had the highest proportion of overall benefits with 15% of the total, followed by Alameda County (14%), Contra Costa County (12%), Sacramento County (9%), and San Joaquin County (9%). Overall, 17% of the benefits were in DACs.

Highlights

- The annual monetary health benefits from PG&E Schools Pilot sites range from a low estimate of \$2,969 to a high estimate of \$4,253.
- Santa Clara County had the highest proportion of overall benefits with 15% of the total, followed by Alameda County (14%), Contra Costa County (12%), Sacramento County (9%), and San Joaquin County (9%).
- Overall, 17% of the benefits are in DACs.

Utility Staff Insights

In addition to monthly check-in calls with key PG&E staff to discuss the status of the Schools and Parks Pilots, the Evaluation Team conducted a close-out interview with staff in March 2025 to review overall Pilot challenges and successes in 2024. The following section groups these challenges and successes into those that apply to both pilots, and those that only apply to one pilot.

Schools Pilot and Parks Pilot

Starting in 2021 and through 2024, PG&E staff reported a continued challenge of site construction costs exceeding expectations, driven by labor constraints, material costs, and supply chain delays. In addition to rising costs affecting site construction, in 2024, PG&E staff also noted that both pilots have experienced delays in the construction timeline due to site hosts' constraints:

- **Construction Labor Costs and Supply.** Construction labor costs have increased more than expected (per the original Decision 19-11-017 from 2018). Participant equipment preferences, such as DCFC for some Parks Pilot sites, will also cause higher-than-expected site costs. These issues mostly impacted the Schools Pilot in previous evaluation years, but the continually increasing labor costs primarily affected the Parks Pilot in 2024, and budget constraints will affect construction in 2025 for the remaining Schools Pilot sites.
- **Timeline Delays.** In 2024, PG&E staff explained that site construction had been delayed for both the Schools and Parks Pilots due to constraints of the site hosts. Schools typically plan work around holidays and summer breaks, and parks generally avoid construction during the spring and summer months.

Schools Pilot

Because most of the construction for the Schools Pilot was completed in 2023, only one site was completed in 2024. Most of the pilot activity in 2024 was focused on securing the sites based on the remaining budget, resulting in additional construction expected in 2025. While the pilot has experienced ongoing budget constraints, PG&E staff have adapted their processes and forecasts to anticipate

increased costs. PG&E staff reported that in 2024, the main challenge for the Schools Pilot was managing the pilot's budget, as well as slower than expected adoption of the School curriculum:

- **Close Monitoring of Pilot Budget.** In 2024, PG&E staff reported that they were carefully tracking the pilot's funds. Although they still considered this to be a minor challenge, budgetary concerns became more prominent because of the need to avoid overcommitting remaining funds.
- **Difficulties in Promoting Curriculum Adoption.** PG&E staff designed the curriculum in 2022 in partnership with SEI and rolled it out fully in 2022 and 2023. Although schools and teachers that received the curriculum generally understood it and received it well, continuing from 2023, PG&E staff noted difficulties in promoting adoption due to teachers having limited time to prepare and teach the curriculum in addition to the Common Core. In 2024, PG&E staff continued to report little curriculum adoption.

Despite some budgetary concerns and limited curriculum adoption, PG&E staff reported a smooth year for the Schools Pilot. PG&E staff were able to finalize plans for the final three sites to be constructed in 2025:

- **Additional Sites After Budget Review.** After the first wave of construction was complete in 2023, PG&E staff performed a detailed budget review and identified remaining funds for additional sites. In 2024, PG&E staff conducted outreach and secured the final two new contracts for the pilot. Construction for these two sites is expected to be completed in 2025.
- **Accommodating Redesign Needs.** A site planned for 2024 was delayed due to challenges with the customer's design plans. However, because the pilot is small with only 15 sites total, PG&E staff were able to dedicate enough time with the site hosts to redesign the site so it could remain in the pilot and be constructed in 2025.

Parks Pilot

Since 2021 and extending into 2024, PG&E staff were in negotiations with the DPR on the MPA that would cover general terms of participation. After the agreement was signed in the first half of 2024, PG&E staff were able to begin the site selection process, which includes securing site-specific participation agreement addenda. In addition to the concerns of increasing costs mentioned above, PG&E staff noted concerns over parking enforcement after site activation in 2024:

- **Enforcement Concerns.** During the site selection process, district DPR staff expressed concerns with enforcement of parking spots for the chargers after they are activated. Although sites are generally placed in locations with abundant parking, enforcing rules that prevent ICE vehicles from parking in EV charging spots and therefore blocking EVs from using the chargers can be a challenge. PG&E staff noted that parks staff appear to be engaged in these considerations and planning for solutions.

In addition to successfully signing the MPA, in 2024 PG&E staff secured the first site-specific addenda and observed increasing interest in EVs among engaged site hosts:

- **Negotiations Between Legal Teams.** Continued from 2022 and 2023, to reach a mutually agreeable MPA, PG&E and the DPR discussed considerations about site locations, differing

charging preferences, and charger ownership terms. In 2024, the legal teams successfully finalized decisions about which parties are responsible for costs, liabilities, and risks and signed the MPA for the pilot.

- **Site Selection Negotiations.** Following the signing of the MPA, PG&E staff successfully secured six sites for the Parks Pilot and finalized the site addendum for one of the sites through collaboration with parks staff at individual districts. Though only one addendum had been signed by the end of 2024, PG&E staff reported that working with the individual districts went smoothly and that they do not anticipate any challenges in securing the remaining five addenda.
- **Increased Interest in Fast Charging.** Although the majority of the sites will have L2 chargers based on the needs identified by parks staff and overall cost effectiveness of these chargers, PG&E staff noted that there will be more fast chargers installed than originally planned due to increased interest in fast charging.

Highlights

- **Schools & Parks:** Similar to previous evaluation years, site costs continue to be a challenge. Rising construction labor and equipment supply costs, along with participant preferences for equipment such as DC fast chargers at Parks sites, drove up site costs.
- **Schools & Parks:** In 2024, site construction timelines were delayed due to host preferences. School sites planned construction around holiday breaks, while park sites avoided work during spring and summer months.
- **Schools:** Despite cost strains and low curriculum adoption, PG&E finished construction on the first wave of sites and secured the final sites for the Schools Pilot while maintaining a close focus on optimizing the budget.
- **Parks:** In 2024, after several years of negotiations, PG&E and the DPR staff signed the MPA. Though there are still compliance and enforcement challenges, PG&E was able to begin the site selection process and ended the year with all six sites secured and one site-specific addendum signed.

5.2.3. Lessons Learned

Schools and Parks Pilots

Although site costs continue to be a challenge, PG&E staff have implemented several effective strategies to mitigate costs.

PG&E staff began the Schools and Parks Pilots during the COVID-19 pandemic, which caused unprecedented economic impacts across nearly every market. These changes were so significant that the estimates originally used for Decision 19-11-017 (which mandated the Schools and Parks Pilots at their determined funding levels) did not reflect actual costs for implementation. Starting in 2023, PG&E staff identified several key strategies as effective for keeping costs low, including pre-desktop reviews, regular reviews of actual costs, and open communication during construction. Securing construction labor and absorbing rising labor and materials costs continued to be compounded by supply chain delays

and additional design considerations such as ADA requirements; However, PG&E staff were able to mitigate these challenges by focusing on carefully managing the budget in 2024.

Schools Pilot

Competing priorities continue to limit opportunities to engage classrooms with the Schools Pilot curriculum.

In 2024, PG&E staff reported little curriculum adoption despite rolling out the curriculum in 2023. Staff indicated that many teachers have limited time for expanded teaching topics as they must focus their time on covering the Common Core. To minimize the burden on teachers, SEI provides training to participating district teachers. However, staff reported that this effort does not reduce the time teachers must spend preparing and teaching the curriculum, leading to little curriculum adoption in both 2023 and 2024.

Demand, consumption and number of daily charging sessions have all increased.

Energy demand increased throughout the year, peaking at 169 kW in September 2024, compared to 116 kW in 2023, representing a 47% increase. Only one site was activated in 2024, increasing overall consumption in 2024 to over 150 MWh from approximately 80 MWh in 2023, around a 90% increase. Three sites have reached a peak consumption month above 4 MWh, while four have never surpassed 1 MWh. This is notable as all sites in the program have the same number of ports. The Schools Pilot experienced between 20 and 30 charging sessions per day in the first half of 2024, which increased to 30 to 40 in the second half of the year. Daily charging sessions dropped by more than 50% over the summer, coinciding with the summer break. Charging occurred outside of school hours at some sites, including on the weekends, indicating that sites are supporting the local community in addition to school employees. Nearly three-quarters of charging sessions are less than 25 kWh, while 46% in the pilot to date are under 12 kWh, which is consistent with 2023.

PG&E Schools Pilot has a nominal but growing influence on neighborhood EV adoption.

In 2024, the Schools Pilot increased the number of operational sites by one to bring the total for the pilot to date to 12. The model's output shows that the Schools Pilot may have contributed to the PTD EV adoption of 40 EVs for households neighboring the infrastructure.

The Schools Pilot sites are helping to displace petroleum, reduce GHG and local emissions, and achieve nominal health impacts overall and within DACs.

The PG&E Schools Pilot sites to date have displaced over 18,000 gallons of petroleum, with 42% within DACs. In addition, the pilot to date has resulted in a 81% reduction of GHG, with 43% of the reduction occurring within DACs. These sites all contributed to lowering local emissions, with CO showing the most prominent projected reductions of 3,376 kg over a ten-year period. Overall, 17% of the health benefits of the pilot sites are in DACs, and the total monetized health benefits range from \$2,969 to \$4,253.

Parks Pilot

PG&E and DPR staff successfully signed the MPA in 2024, resulting in the enrollment of six sites.

The original plan for the Parks Pilot in 2021 was for the Utilities to enter into a collective participation agreement with the DPR; however, the Utilities ultimately determined they had distinctive needs, which resulted in separate MPAs. PG&E staff continued their own MPA negotiations in 2022 and 2023, and at the start of 2024, the PG&E and DPR legal teams were still finalizing decisions about which parties would be responsible for costs, liabilities, and risks. Over the past few years, PG&E staff have also noted that the negotiation process also faced delays when, because of staff turnover, new DPR staff joined the negotiations. Because of these changes, PG&E staff had to take time to orient the new DPR staff to the purpose of the pilot, all steps completed to date, and next steps. Despite these challenges, PG&E staff successfully secured the MPA in 2024. Staff noted that this was a result of positive relationships with DPR staff and an increase in interest from state parties in EVs and EV infrastructure. PG&E staff also indicated that they had started the site selection process and, by the end of 2024, had enrolled six sites and issued one site-specific addenda.

5.3. EV Fast Charge Program

5.3.1. Overview

This overview provides a detailed description of the PG&E EV Fast Charge program; summaries of the program implementation process, performance metrics, materials, and budget; and a timeline of major milestones. Following the overview are detailed findings, highlights, and lessons learned.

Program Description

Per Decision 18-05-040, PG&E staff designed the EV Fast Charge program to support the installation of DCFCs at high-priority locations to encourage transportation electrification and minimize grid impacts. Staff designed the program to support PG&E customers, and EV drivers in general, by providing fast charging make-ready infrastructure, to ultimately accelerate the adoption of EVs. Specifically, staff designed the program to help meet a portion of PG&E's estimated need for fast chargers in its service area by 2025, reduce driver range anxiety, and increase access to charging for all customers, especially those who lack ready access to home charging, need EVSE in transportation corridors for longer trips, or participate in ridesharing. In 2022, PG&E staff revised the original goal of 52 sites to between 30 and 40 EV Fast Charge sites to reflect the rising costs per site and revised the port count forecast to between 156 and 200. PG&E staff met with the CPUC Energy Division in February of 2022 to discuss the revision, which the CPUC accepted.

Original EV Fast Charge Targets

- 52 sites
- 25% in DAC locations

2022 Revised EV Fast Charge Targets

- 30 to 40 sites
- 25% in DAC locations

Through the program, PG&E provides turnkey make-ready EVSE. This make-ready buildout includes design, permitting, construction, and installation of all electric infrastructure from the Utility connection point to the charger stub. PG&E owns and maintains the infrastructure on the Utility side of the

EV Fast Charge Design Goal

Support installation of DCFCs at high-priority locations.

customer meter (electrical infrastructure to the meter panel), also known as TTM infrastructure. PG&E also designs, constructs, installs, owns, and maintains the customer side of the meter infrastructure (electrical infrastructure from the panel to the EV charging interconnection point), also known as BTM infrastructure. PG&E will not install, own, or maintain DCFCs. In addition, the

program design provides multiple business models and flexibility for site hosts and operators: PG&E's customer of record at fast charge sites may be the site host, an EVSP, or another third party. To be eligible for the program, a site must be available 24x7 and install chargers with a minimum output of 50 kW. Customers must cover the cost of the charger, installation, and all ongoing O&M related to the charger for a minimum of five years from the time of activation. Finally, to encourage equitable EVSE installation, sites located in DACs are eligible for a rebate of up to \$25,000 for EVSE.

Implementation

Most site solicitations for the program occurred in 2019 and 2021. In 2023, staff analyzed the program's budget and learned that the program was forecasted to be underspent. Staff then conducted an additional partial solicitation for the program, targeting customers who had already engaged with the program and were likely to execute contracts quickly. As a result, in 2024, PG&E extended an existing contract to add four more sites to the program and continued to track the budget closely to ensure that the remaining budget would cover all of the sites.

PG&E uses an online application platform to facilitate the selection process. The application portal requests detailed information about the site, the site host, and the EVSE owner. The information in the application allows PG&E to verify basic eligibility requirements, apply initial scoring of the site against the program's scorecard, and start infrastructure assessments. As part of the eligibility

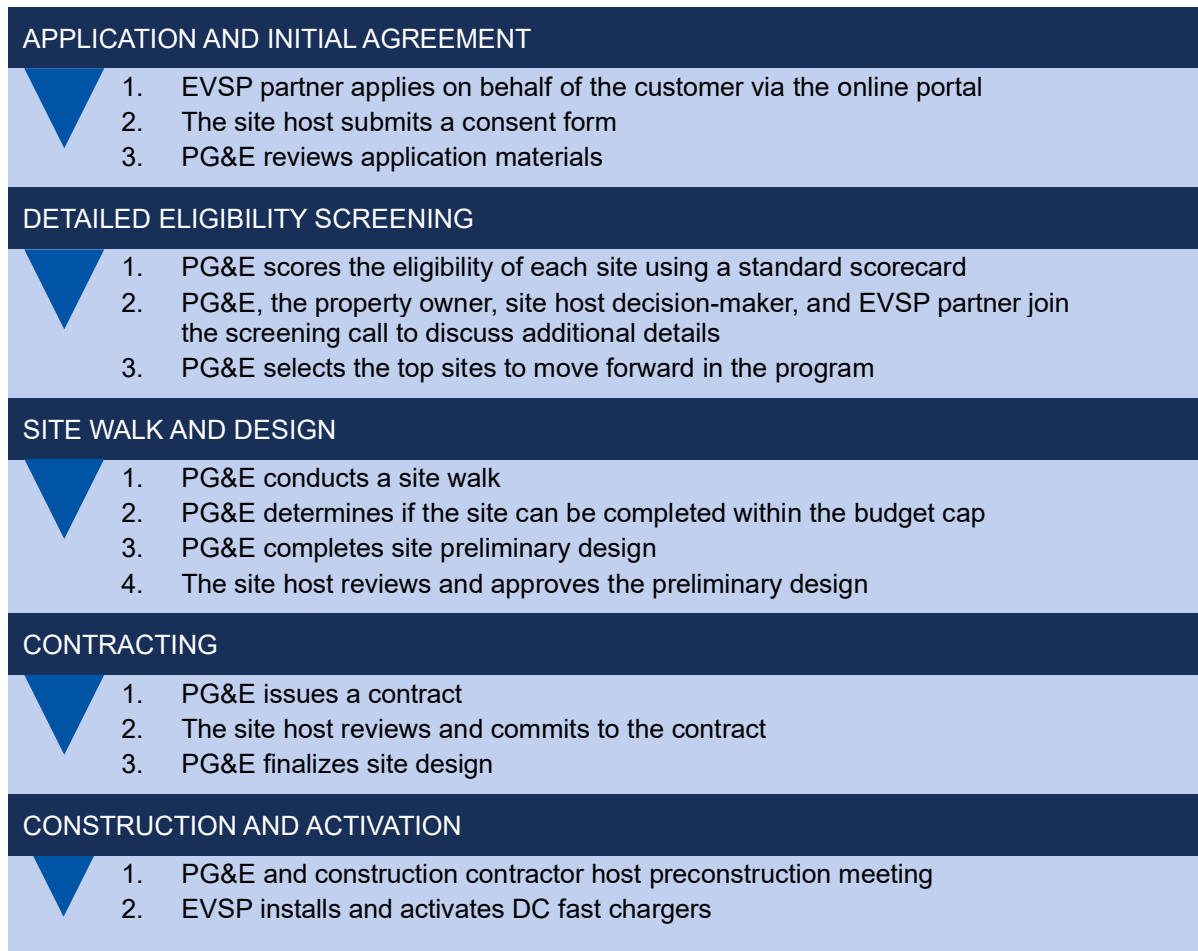
screening process, PG&E staff conducted a screening by phone with each potential site host. Staff refined the phone screening process over the course of implementing the program by making sure site host decision-makers (not just a contact at the site) were included in the call.

Starting in 2022, PG&E allowed site hosts to contribute funding if the site exceeded PG&E's funding limits. After an EVSP engages with a potential customer, the implementation process begins, as detailed in Figure 192.

Example Screening Questions

- Do you understand what the program is and what it will—and will not—provide?
- Who is getting the LCFS credits?
- Which stakeholders will need to review the contract? Have they been engaged?
- How long will it take to sign the contract?

Figure 192. PG&E EV Fast Charge Program Implementation Process



Program Performance Metrics

The Evaluation Team reviewed sites participating in the PG&E EV Fast Charge Program and analyzed them by program status. Table 97 provides the count of sites by completion status in EY2024 and for the program to date.

Table 97. PG&E EV Fast Charge Program Complete Site Count by Status

Site Status	EY2024	Program to Date
Utility Construction Complete	12	32
Activated	11	29
Operational	11	29
Closed Out	11	22

In EY2024, all 11 sites activated in the EV Fast Charge Program were operational. Eight of the 11 EY2024 activated sites (73%) are located inside DACs, as shown in Figure 193. The program signed four additional contracts with customers in EY2024, bringing the total number of contracts signed to date to 39.

Figure 193. PG&E EV Fast Charge Program EY2024 Activated Charging Stations

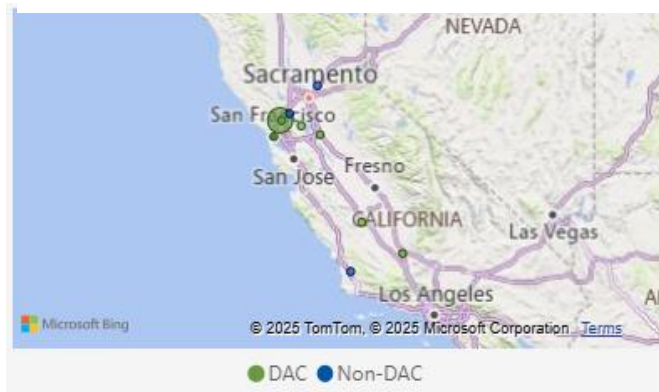


Table 98 presents site-level data for the PG&E EV Fast Charge program, showing DAC status and the number of DCFC ports for the activated sites in EY2024 and in the program to date. In EY2024, 73% of activated sites were in a DAC, bringing the cumulative percentage of DAC sites to 55%, which exceeds the program's *per se reasonableness* DAC goal of 25% of sites. The program deployed 68 additional DCFC ports in EY2024, raising the total number of DCFC ports installed to date to 152, with the number of ports per site ranging from four to eight.

Table 98. PG&E EV Fast Charge Program Activated Site Data in EY2024 and PTD

EY2024			Program to Date		
Number of Activated Sites inside DAC	Number of Activated Sites outside DAC	Number of DCFC Charging Ports	Number of Activated Sites inside DAC	Number of Activated Sites outside DAC	Number of DCFC Charging Ports
8	3	68	16	13	152

As shown in Table 99, the 29 activated sites to date in the PG&E EV Fast Charge Program achieve 97% of the program's *per se reasonableness* minimum goal of 30 sites and 73% of the program's maximum goal of 40 sites. The 29 activated sites to date support 152 DCFC ports, which meets 97% of the program's *per se reasonableness* minimum goal of 156 charging ports and 76% of the program's maximum goal of 200 ports. The 39 customer contracts signed to date could satisfy 100% of the program's minimum site goal and 98% of the maximum site goal, and would support 204 DCFC ports, which could meet 100% of the program's minimum and maximum DCFC port goals.

Table 99. PG&E EV Fast Charge Program Site and Port *Per se Reasonableness* Goal Progress

Pilot Metric	<i>Per se Reasonableness</i> Goal	Program to Date
Activated Sites	30-40	29
DCFC Ports	156-200	152

The CPUC established six phases in the program timeline per the SB 350 reporting template. Table 100 shows the median number of calendar days per phase for EY2024 and PTD activated sites. The median number of calendar days per program phase for EY2024 sites in the EV Fast Charge Program ranged from 47 days for Activation to 630 days for Design and Permitting. In general, the median durations across program phases in EY2024 were similar in magnitude to those for the program to date with the

exception of Design and Permitting, which was about 35% higher in EY2024 than for the program to date.

Table 100. PG&E EV Fast Charge Program, Median Calendar Days per Phase

CPUC Program Phase	Median Calendar Days	
	EY2024	Program to Date
Application Review	74	74
Site Assessment	54	55
Contract Issuance	82	79
Design and Permitting	630	466
Construction Complete	63	59
Activation	47	54

Program Materials Summary

In 2024, PG&E staff maintained a webpage outlining details of the EV Fast Charge program. The webpage provides a program overview and information for site hosts and vendors. PG&E staff tracked key activities related to the EV Fast Charge webpage, which had 867 site visits and 798 unique visitors in 2024. The PG&E website includes answers to frequently asked questions about program participation and costs and provides several types of ME&O materials, created in 2021 for both potential site hosts and EVSP partners. In previous years, PG&E EV Fast Charge staff developed for ESVP partners summaries for each solicitation with key information and an onboarding presentation with program details. In 2024, PG&E continued to make available to both site hosts and EVSPs information sheets about the program, a list of approved products, and an application preparation sheet.

Since 2021, PG&E has conducted an annual post-activation customer survey. In 2024, staff increased their focus on this survey to better understand customer experience. The survey assesses customer satisfaction with the overall program and several key components, including the online information about the overall program and process, the application process, the site walk, the contracting process, and the support provided by PG&E staff.

Although the survey has received fewer responses than expected, with eight responses in 2024 and 16 responses in total, customer feedback has largely been positive. Respondents spoke highly of their working relationship with PG&E, noting that the PG&E team was very supportive, communicative, and professional and effectively resolved any issues that arose throughout the process. Several respondents also commented that the program offered a great opportunity to install EV chargers in places where these respondents would not have had the budget to install them otherwise. One respondent commented, “We would not have been able to have EV chargers without the upgrades that PG&E did to our site. We appreciate PG&E doing the upgrades necessary for us to [install] EV chargers and provide service to our customers.”

While overall satisfaction ratings were high, some site hosts reported challenges during the construction and activation phases. This included timeline delays, incidents of vandalism, and challenges working with a third-party contractor.

Budget Summary

As shown in Figure 194, from program inception through 2024, PG&E spent \$19.0 million of the \$22.4 million EV Fast Charge program budget. Program spending totaled \$5.1 million in 2024.

Timeline

In 2024, program staff focused on constructing and activating sites, and there were no new regulatory milestones. Figure 195 illustrates key milestones from program inception to the end of 2024.

Figure 194. PG&E EV Fast Charge Program Budget (Million USD) as of December 31, 2024

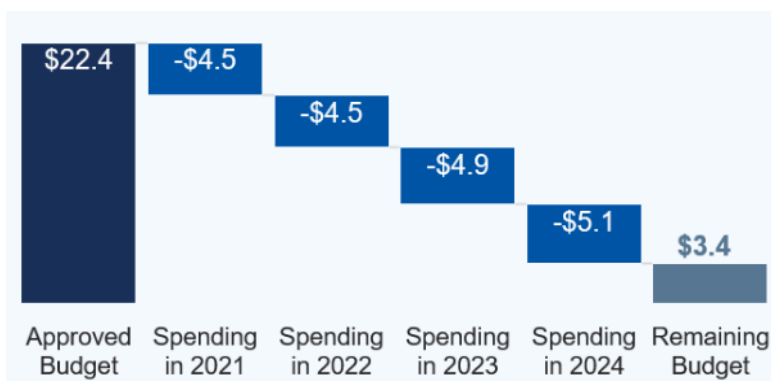
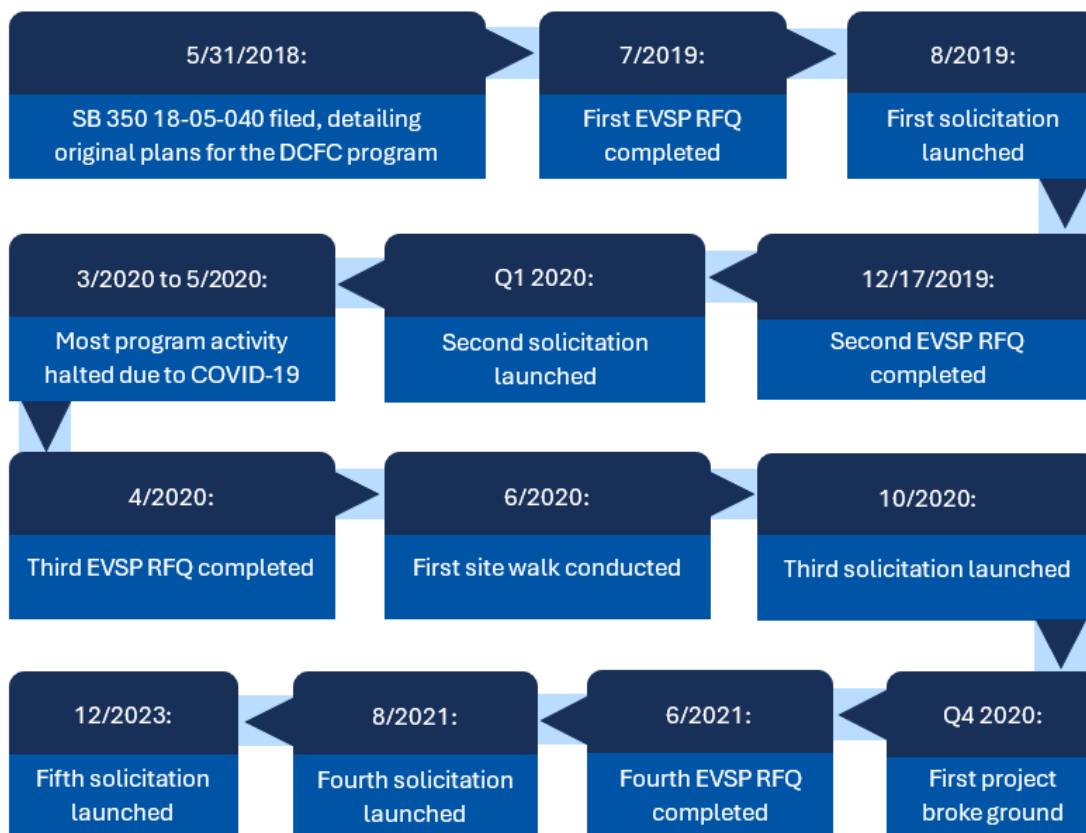


Figure 195. PG&E EV Fast Charge Program Key Milestones



5.3.2. Findings

This section provides findings from analyses of incremental EV adoptions, site visits and site costs, grid impacts, petroleum displacement, GHG and criteria pollutant reductions, and health impacts, and from insights collected during Utility staff interviews.

Table 101 summarizes key impact parameters for EY2024 and the program to date. Annual estimates of impacts are provided for metrics calculated as part of the impact evaluation. The table also provides estimates of impacts across all sites included in the program population through the end of 2024.

Table 101. PG&E EV Fast Charge Program Impacts Summary

Impact Parameter	EY2021 ^a	EY2022 ^a	EY2023 ^a	EY2024 ^a	EY2024 Percentage in DAC	PTD Actual	PTD Actual Percentage in DAC
Population of Activated Sites (#)	4	5	9	11	73%	29	55%
Sites Included in Analysis (#)	4	5	9	11	73%	29	55%
Charging Ports Installed (#)	16	23	45	68	74%	152	55%
Electric Energy Consumption (MWh)				3,703	71%		49%
Petroleum Displacement (GGE)	7,319	20,384	36,682	251,315	71%	339,865	48%
GHG Emissions Reductions (MT GHG) ^b	50	157	286	2,149.1	71%	2678.46	48%
PM ₁₀ Reduction (kg)	0.27	0.80	1.56	11.58	71%	13.94	48%
PM _{2.5} Reduction (kg)	0.24	0.74	1.44	10.65	71%	12.82	48%
ROG Reduction (kg)	4.7	12.7	22.22	146.8	71%	218.83	48%
CO Reduction (kg)	149	423	783	5,509	71%	7562.14	48%

^a Energy consumption, petroleum displacement, and emissions reductions are based on annualized data. PTD results in the table are based on actual data (see *Appendix B* for more details).

^b GHGs include CO₂, CH₄, and N₂O multiplied by their respective GWP as defined by IPCC AR5 (see *Appendix B* for more details).

Incremental EVs Adoption

The Evaluation Team estimated the effect of the public charging stations on EV adoption for neighboring populations¹⁰² with a two-stage analysis. In Stage 1, we looked at historical impacts of public EV charging on vehicle ownership. See *Appendix B* for the details of the Stage 1 analysis.

¹⁰² There are two main channels through which the availability of public charging networks may affect EV purchases. The first is a network effect, through which EV owners gain increased access to the public charging stations because of the stations' placement at destinations such as workplaces, commercial establishments, schools, and parks. The Evaluation Team expects the availability of EV charging equipment at convenient locations (for midday charging away from home) to increase the convenience of owning an EV (such as by lessening range anxiety) and to increase the probability of EV ownership. The second channel is a neighborhood effect on the driving population living in areas neighboring the public EV charging stations. The Evaluation Team expects the availability of nearby charging infrastructure to reduce the cost of EV ownership by providing alternatives to home charging. The Team expects that public EV charging will have the most impact on residents of multifamily buildings, many of whom will have limited access to EV charging equipment, and on residents of low-income households, who may be unable to afford home EV charging equipment. We note that public charging access may boost EV ownership through both channels and that there may be positive interactive effects between the channels that boost the overall impact of public charging networks. The Evaluation Team focused on analyzing the second channel. We will analyze the impacts for the first channel separately when data become available.

Using the impact estimates from the Stage 1 analysis,¹⁰³ the Evaluation Team estimated the impact of PG&E investments in public charging on EV ownership. By the end of 2024, 29 charging stations in PG&E’s EV Fast Charge program were active. The Evaluation Team estimated the impact of these stations on annual EV registrations and on PTD cumulative EV registrations.

Based on the composite measure of public charging access, the Evaluation Team calculated the change in access to public charging due to PG&E’s investments for each CBG where the investments affected access. As shown in Table 102, the PTD average change in access per affected CBG was 5.1, and the average increase in the number of chargers (ports) was 3.89. For reference, the average change in access across all CBGs in California between 2015 and 2023 was 1.05. The average normalized EV annual registration per 1,000 households was 70 in the affected CBGs in the 2020 baseline year.

Table 102. PG&E EV Fast Charge Program Summary Statistics of Effects on CBGs

	CBG Mean (Standard Deviation)			
	Change in Composite Measure of Access ^a	Change in Number of Chargers ^a	Normalized Annual EV Registrations ^b	Number of Households ^c
EV Fast Charge program	5.10 (3.09)	3.89 (2.95)	69.87 (81.17)	471.50 (294.25)
CBGs (N)	74	74	74	74

These values are averages for the CBGs whose access to public charging was affected by PG&E’s investments.

^a Change in composite measure of access and number of chargers is from 2020 to 2024.

^b Normalized annual EV registrations are average annual values in the affected CBGs in 2020 per 1,000 households.

^c Number of households is based on 2015–2019 American Community Survey (ACS).

Sample standard deviations are shown in parentheses.

The Evaluation Team calculated the impact of PG&E’S EV Fast Charge investment on neighboring EV ownership.¹⁰⁴ The calculation combined the OLS and IV-2SLS regression estimates of the impact of public charging access from Stage 1 with the estimates of the CBG changes in public charging access and household counts. The impacts of PG&E’s investments in fast charging on EV registrations depends on how much the investments increased access in affected CBGs and the number of households in the CBGs.

Table 103 presents the estimates of annual and PTD EV registrations attributable to PG&E’S EV Fast Charge program investments. Based on the OLS long differences model,¹⁰⁵ PG&E’s investments in the EV

¹⁰³ The Stage 1 analysis used vehicle registration data from 2015 to 2023, the most recent period with complete information at the CBG level. The EY2024 estimates assume the impact of Utility-specific stations remains unchanged over time, which may not reflect actual market conditions and technological changes in 2024.

¹⁰⁴ In Stage 1 the Evaluation Team estimated the impact of public EV charging access on EV ownership. Stage 2 built on the Stage 1 analysis and was an attribution analysis for Utility specific investments. A notable benefit of this approach is that it can be applied to evaluations of other programs increasing EV charging access as well, which ensures methodological consistency.

¹⁰⁵ The long differences model estimates indicate the impact of public charging on EV registration over eight years. The team annualized these estimates by dividing the results by eight.

Fast Charge program stations increased EY2024 annual EV registrations by 12 vehicles and PTD cumulative EV registrations by 16 vehicles. Based on the IV-2SLS long differences model, PG&E’s investments increased EY2024 annual EV registrations by 23 vehicles and PTD cumulative EV registrations by 40 vehicles. The Evaluation Team prefers the IV-2SLS-based estimates because they account for the potential endogenous siting decisions of public charging (e.g., building public charging infrastructure in locations likely to have low or high rates of EV adoption). These estimates assumed that the 29 activated EV Fast Charge sites operate for a full year.

Table 103. PG&E EV Fast Charge Program Registrations Attribution

EY2024 Annual Increase of EV Registrations Caused by the Utility Program		PTD Cumulative Increase of EV Registrations Caused by the Utility Program	
OLS	IV-2SLS	OLS	IV-2SLS
12.02	23.39	15.69	39.55
(1.90)	(3.70)	(1.93)	(4.02)

Note: The table shows the EV registrations attributable to the utility investments in public charging infrastructure. The left panel shows the impacts of utility investments since 2020 on registrations in EY2024. The right panel shows the cumulative impacts of Utility investments since 2020 on EV registrations in EY2021, EY2022, EY2023, and EY2024. Robust standard errors clustered at the CBG level are in shown parentheses.

Both estimated EY2024 and PTD cumulative impacts of the EV Fast Charge program on EV registrations remain modest but show substantial growth compared to prior evaluation years. Across all estimated CBGs, the total annual number of EV registrations is about 5,170 (74 * 69.87), so the EY2024 impact of the EV Fast Charge program, based on the preferred IV-2SLS regression estimate, lifts EV registrations by 0.5%, and the PTD impact lifts EV registrations by 0.8%. Compared to EY2023, the magnitude of the impact on EV adoption increased by 50%. The enhanced access to fast charging stations in communities is the primary driver of this increased impact.

Highlight

- The model’s output shows that the EV Fast Charge program may have contributed to the increased PTD EV adoption by 40 EVs for households neighboring the infrastructure.

Site Visit Findings

The Evaluation Team visited all 11 EV Fast Charge sites completed in 2024. These 11 sites have a total of 68 DCFC ports and an installed capacity of 7,050 kW. This brings the PTD total to 29 sites with 152 DCFC ports and installed capacity of 12,170 kW. Table 104 and Figure 196 show the total number of ports and observed capacity for EY2024 and PTD visited sites.

Figure 196. PG&E EV Fast Charge Program DCFC Ports and Capacity Observed in 2024 and in the Program to Date

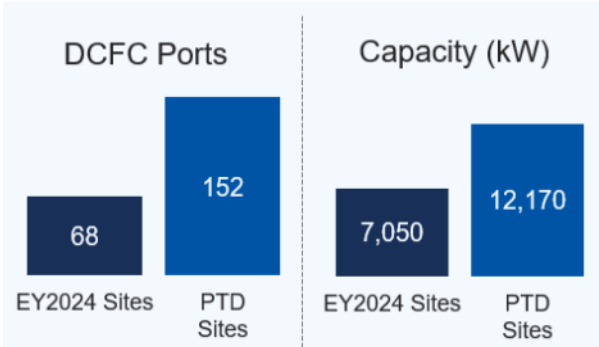
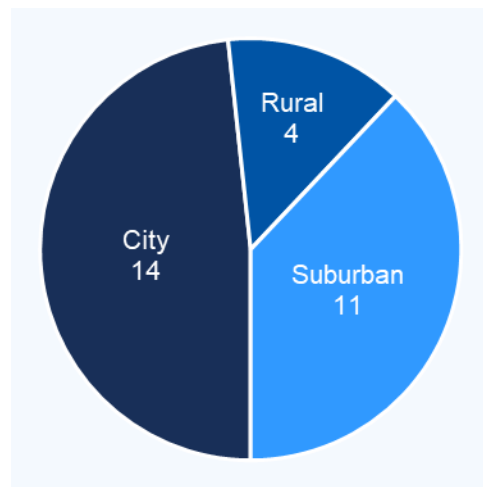


Table 104. PG&E EV Fast Charge Program Summary of Ports and Capacity Observed during Site Visits

Site Visit	Ports	Installed Capacity	Number of Sites
EY2024 Sites	68	7,050	11
PTD Sites	152	12,170	29

Six of the 2024 sites are located around the San Francisco Bay Area. One is outside Sacramento, one is near Stockton, two are in the southern Central Valley, and one is located on the Central Coast. Many sites are at gas stations; a few are at grocery stores and big box retail centers; two are at bowling alleys; and one is a public parking lot serving nearby restaurants, stores, and a public library. In total, six 2024 sites were classified as city; four as suburban; and one as rural. Figure 197 shows the distribution of the 29 PTD sites according to NCES Locale classifications¹⁰⁶.

Figure 197. PG&E EV Fast Charge Program Count of Site Urbanization



During site visits, the Evaluation Team documented construction layouts, connector types, parking elements, and the physical chargers including any available pricing information. Sites this year continue to have ADA-compliant parking spaces adjacent to the main group of chargers unlike the initial sites in the program.

Charging speeds (capacity in kilowatts) range from 62.5 kW to 350 kW per port for EY2024 activated sites. The Team noticed that a number of these installations make use of hardware that could share demand in pairs. For example, if only one vehicle is charging (and is capable of higher-speed charging), one charger model can increase its charging speed from 90 kW to 180 kW while another can go from 175 kW to 350 kW.

This reflects a general increase in charging capacity identified

in previous years, typically from 50 kW to 60 kW per port at older sites and up to 180 kW to 350 kW per port. All EY2024 sites either have EVSE with two ports (examples shown in Figure 198) or are paired to enable higher power per port when only one vehicle is connected.

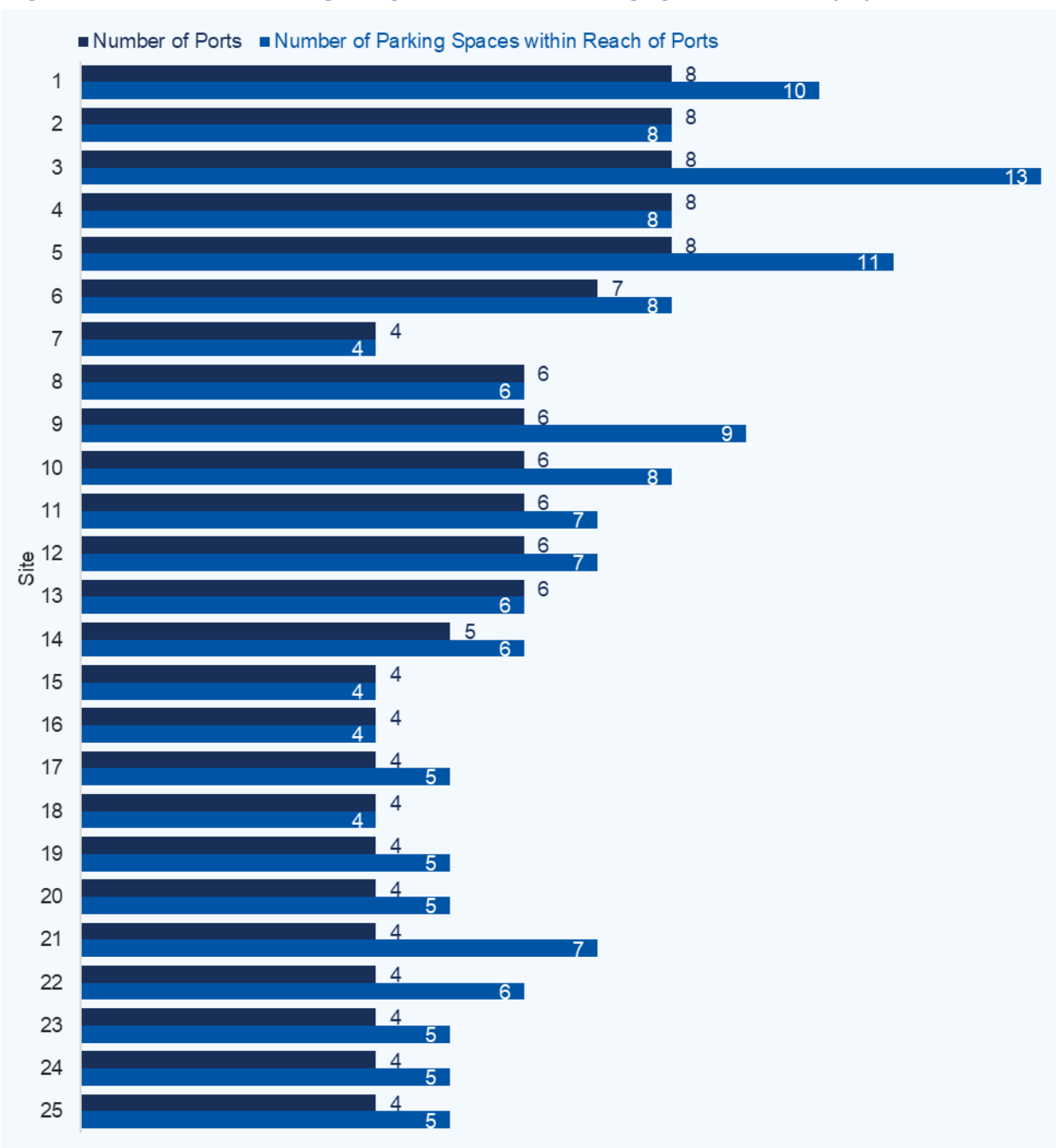
¹⁰⁶ A locale classification is a general geographic indicator that describes the type of area where a school is located. The National Center for Education Statistics (NCES) classifies all territory in the U.S. into four types – City, Suburban, Town, and Rural. <https://nces.ed.gov/programs/edge/Geographic/LocaleBoundaries>

**Figure 198. PG&E EV Fast Charge Program EY2024 Sites with Dual-Port EVSE
(Left: 350 kW, Right: 180 kW)**



To highlight the value of having multiple parking spaces within reach of cords, Figure 199 shows the number of ports and the number of spaces that can access these ports for the sites the Evaluation Team visited. As illustrated by the figure, most sites offer nearly a one-to-one ratio of parking spaces-to-charging ports; however, more than one-quarter of the sites have two to four additional parking spaces within reach of charging ports. This allows additional vehicles to use a charging port without moving the first vehicle, which can improve charger utilization.

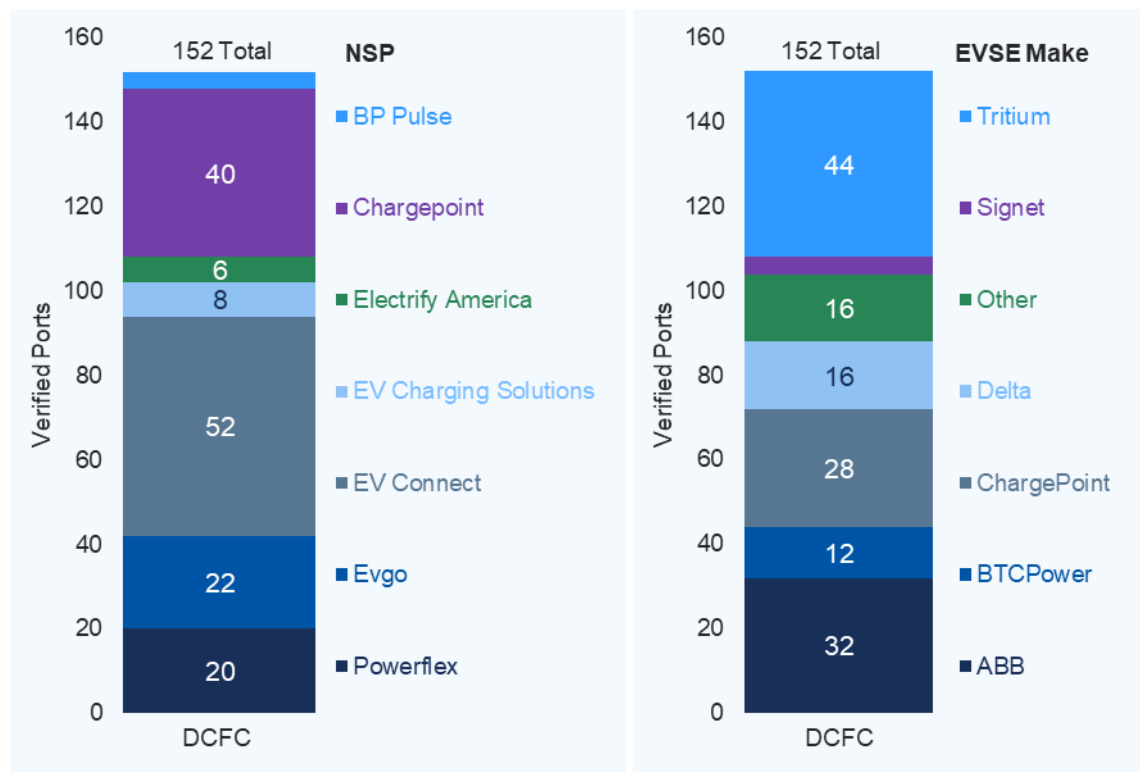
Figure 199. PG&E EV Fast Charge Program Visited Sites Charging Port Availability by Site for PTD Sites



Two sites were observed to have suffered from vandalism. One site had all eight cords cut soon after installation, which had not been repaired many months after the incident. Another site saw about half of its cords cut and then repaired before suffering more vandalism, according to website reports.

Site visits revealed one new NSP, while the other sites were additional locations from existing NSPs. The 29 activated sites in the program comprise seven NSPs and seven EVSE makes as shown in Figure 200.

Figure 200. PG&E EV Fast Charge Program NSPs and EVSE Makes for PTD Sites



The Evaluation Team reviewed the pricing structure available to EV drivers, including for idle time to encourage turnover and for encouraging charging when energy emissions and costs are low and discouraging when not (such as from 4 p.m. to 9 p.m.). PG&E rates offer the lowest cost of electricity daily from 9 a.m. to 2 p.m., but the majority of sites do not communicate this to their customers. In addition, only a quarter of all activated sites exhibited retail pricing to EV drivers based on TOU rates. High TOU prices across these sites ranged from an increase of 10% to more than double a given site's prices for low TOU rate periods. Six sites also employed a flat per-session fee of \$1; one site with per-session fees also used a flat rate for energy.

Most sites had posted energy priced between \$0.42/kWh and \$0.69/kWh. Several network operators offer subscription plans that can reduce the effective cost to as low as \$0.25/kWh. There are also Subscription specials are sometimes offered for rideshare drivers, and some vehicle manufacturers offer free charging with the purchase or lease of a new vehicle. It is not possible to determine how much charging was done using discounted subscriptions.

Idle fees were seen on a third of sites. This ranged from as low as \$2/hour to as high as \$60 (\$1 a minute). High rates for idle time send a strong message to EV drivers to move their vehicle when charging is completed so that others can make use of the resource. One EY2024 activated site exhibited pricing for energy delivery of \$0.59/kWh and an idle parking time rate of \$10.00/hour starting 10 minutes after charging completion.

Highlights

- The Evaluation Team visited all 11 EY2024 activated sites and observed 68 DCFC ports and 7,050 kW of installed capacity. The Team has also visited all 29 PTD activated sites and has observed 152 DCFC ports and 12,170 kW of installed charging capacity.
- EY2024 sites show increased charging speeds (capacity in kW) including 180 kW and 350 kW per port. All EY2024 sites either have EVSE with two ports or are paired to enable higher power per port when only one vehicle is connected.
- Only 25% of sites provide TOU rates to EV drivers to encourage consumption when electrical grid congestion and electricity generation emissions are low, such as in the early afternoon per PG&E tariffs.
- One-third of sites set idle fees to encourage turnover and improve access to charging ports.

Site Costs

The Evaluation Team conducted a cost analysis on the 19 activated EY2021, EY2022, EY2023, and EY2024 EV Fast Charge sites with fully closed out finances as of December 31, 2024. The set of fully closed out sites is smaller than the set of activated sites because of the time lag involved in performing activities such as collecting receipts, paying invoices, and obtaining administrative approvals. Cost estimates presented here are in nominal dollars. The 19 sites all have DCFC ports, with an average of nearly 310 kW of installed capacity and 4.7 ports per site.

Figure 201 shows the distribution of site-level costs for the 19 sites. The horizontal lines of the boxes show the 25th, 50th, and 75th percentile of sites; the “x” represents the mean site cost; and the three panels are defined as follows:

- **Utility Infrastructure Costs.** Site costs borne by the Utility for TTM and BTM.¹⁰⁷
- **Ratepayer-Funded Costs.** All site costs paid for by the Utility, including TTM, BTM (or BTM incentive if infrastructure is customer owned), and EVSE rebate.
- **Estimated All-in Costs.** The total estimated cost of installing the site, including capital and labor costs for the Utility and the customer. The value is calculated by summing all of the TTM,¹⁰⁸ BTM, and EVSE costs.¹⁰⁹

¹⁰⁷ Utility Infrastructure Costs are the same as the Ratepayer-Funded Costs except they do not include the EVSE rebates.

¹⁰⁸ The Utility pays 100% of the TTM costs and therefore reports actual TTM costs to the Evaluation Team.

¹⁰⁹ Because actual EVSE costs are not known by the Utility, The Evaluation Team estimates EVSE equipment costs using an assumption of \$3,000 per port for L2 ports.

**Figure 201. PG&E EV Fast Charge Program Per-Site Costs
Organized by Three Perspectives, Across 19 Closed-out PTD Sites**

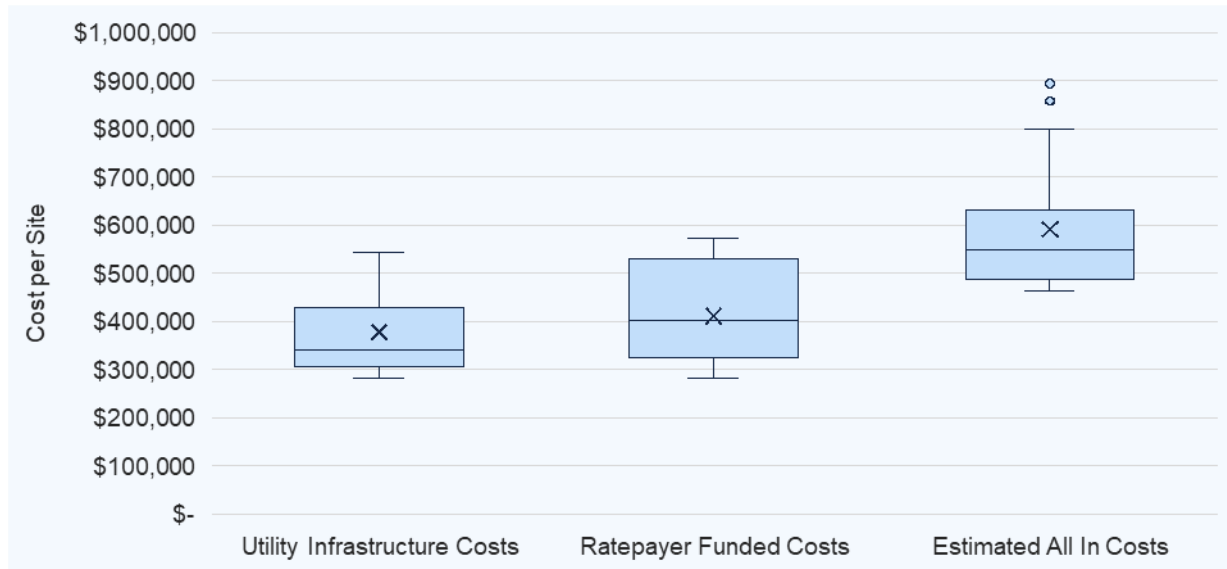


Figure 202 shows average all-in costs for the 19 sites. EVSE has the largest cost across the sites, followed by BTM, then TTM. Together, the average all-in TTM, BTM, and EVSE cost is \$590,658 through 2024 PTD.¹¹⁰

**Figure 202. PG&E EV Fast Charge Program
Average All-In Costs, Across
19 Closed-out PTD Sites**

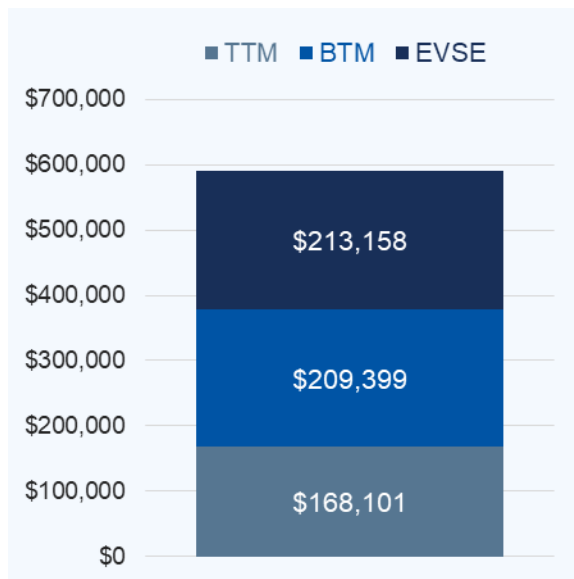


Figure 203 shows the distribution of Utility infrastructure costs (corresponding to the far-left panel in Figure 201) presented per site and per kilowatt. The average Utility infrastructure cost, including TTM and BTM borne by PG&E through 2024 PTD, was \$377,501 per site, and \$1,284/kW of installed charging capacity.

¹¹⁰ Calculated by summing all TTM, BTM, and EVSE costs borne by PG&E and the customer and dividing by 19 sites.

Figure 203. PG&E EV Fast Charge Program Cost per Site and per Kilowatt Across 19 Closed-out PTD Sites



Highlights

- Estimated all-in costs paid by the customer and PG&E vary widely between sites, with an average of \$590,658 through 2024 PTD per site. On average, EVSE was the largest cost across the sites, followed by BTM and TTM costs.
- The average utility infrastructure cost, including TTM and BTM borne by PG&E through 2024 PTD, was \$377,501 per site, and \$1,284 per kilowatt.

Grid Impacts

This section describes grid impacts for the PG&E EV Fast Charge program based on an analysis of energy consumed by charging stations activated through 2024.

Data Sources

The primary data source used in this section is the energy usage data, provided in regular 15-minute intervals from the AMI. Other data sources include customer bills, LCFS credit information, and data provided by NSPs. There are several important differences between AMI and NSP data. Whereas the AMI data is only energy usage, NSP data includes energy usage, session start and stop time, duration a vehicle is connected to a charging port, duration a vehicle actively pulls power, and the specific port used for a session. Additionally, NSPs typically do not have the ability to track standing loads (such as those used by the EVSE for communications, cooling, active power converters, solenoids, and screens), which an AMI meter does capture. In the event AMI data is missing from the dataset, the Evaluation Team filled in gaps using NSP data.

Summary of Grid Impacts

Table 105 presents a summary of the estimated EV Fast Charge program grid impacts.

Table 105. PG&E EV Fast Charge Program Grid Impacts

Impact Parameter	Actual 2024	Actual PTD	10-Year Projection PTD
Operational Sites	11	29	29
Installed Capacity (kW)	7,050.0	12,270.0	12,270.0
Electric Energy Consumption, MWh			57,902
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)	782 (24.7%)	1,105 (25.2%)	14,390 (100.0%)
Maximum Demand, kW (with date and time)	1,985 (12/28/24 2:00 PM)	1,985 (12/28/24 2:00 PM)	N/A
Maximum On-Peak Demand, kW (with date and time)	1,686 (11/11/24 5:15 PM)	1,686 (11/11/24 5:15 PM)	N/A

Consumption and Maximum Demand

Sites in the EV Fast Charge program reached a total consumption of nearly 3,200 MWh in 2024, bringing the PTD total to nearly 4,500 MWh. Eleven sites were activated in EY2024 bringing the PTD total to 29 sites. Figure 204 plots daily monthly energy consumption and maximum demand values for the program. Consumption of the portfolio increased by approximately 200% compared to a year ago and showed steady and steep growth during all of 2024. Consumption from the fourth quarter of 2023 dropped significantly in January of 2024, but recovered throughout the spring and grew consistently for the rest of 2024. A peak demand of nearly 2 MW occurred in December 2024.

Figure 204. PG&E EV Fast Charge Program Monthly Energy Consumption and Maximum Demand

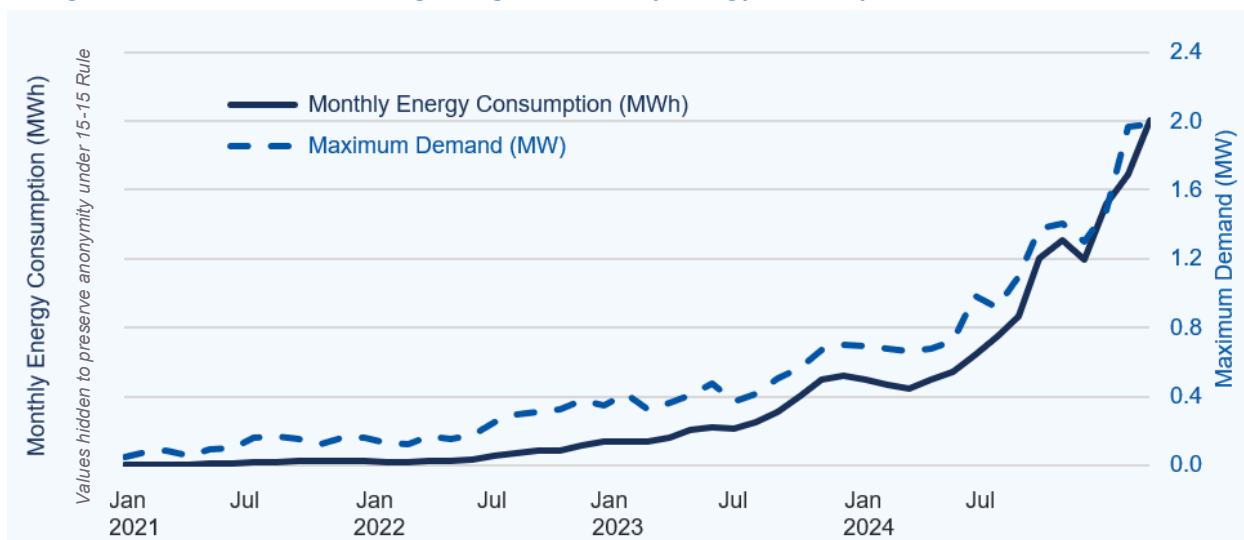


Figure 205 shows daily energy consumption and maximum demand of PTD sites. Daily maximum demand rose consistently throughout 2024, increasing from 600 kW in January 2024 to nearly 2 MW in December 2024.

Figure 205. PG&E EV Fast Charge Program Daily Energy Consumption and Maximum Demand PTD Sites

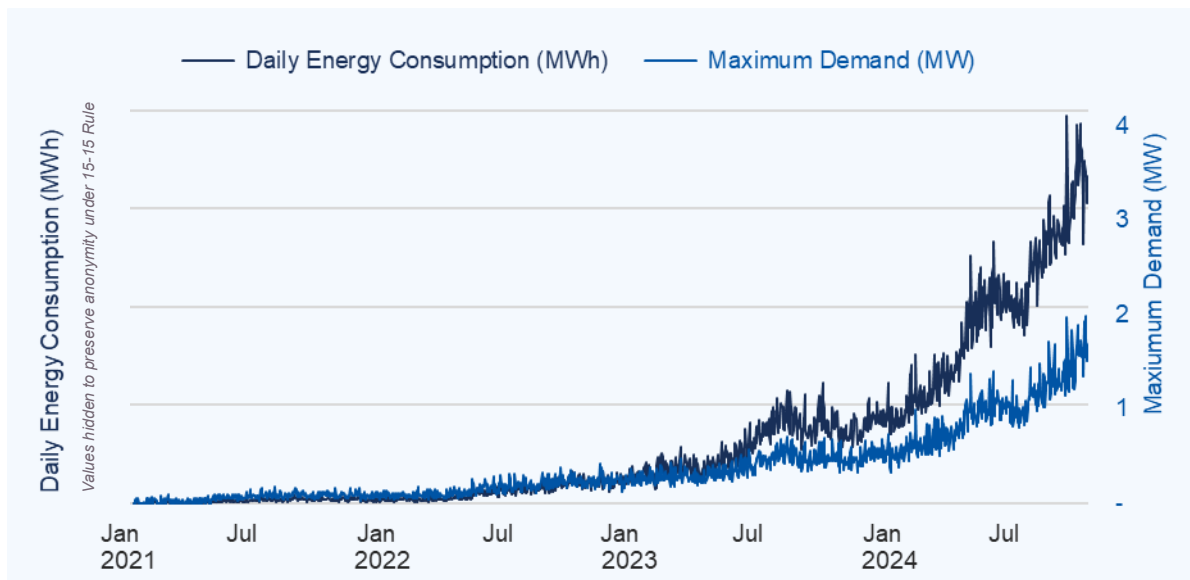


Figure 206 shows similar shaped average weekday and weekend load curves. However, weekends show a higher load peak during the midday period and approximately 30% higher demand from 9 a.m. through 5 p.m. TOU rates, which are approximately double the rate from 4 p.m. to 9 p.m., do not seem to have any influence over charging behavior. This is no surprise given that only 25% of these sites pass on any TOU pricing to EV drivers, as noted in *Site Visit Findings*.

Figure 206. PG&E EV Fast Charge Program Average Weekday and Weekend Q4 2024 Load Curves

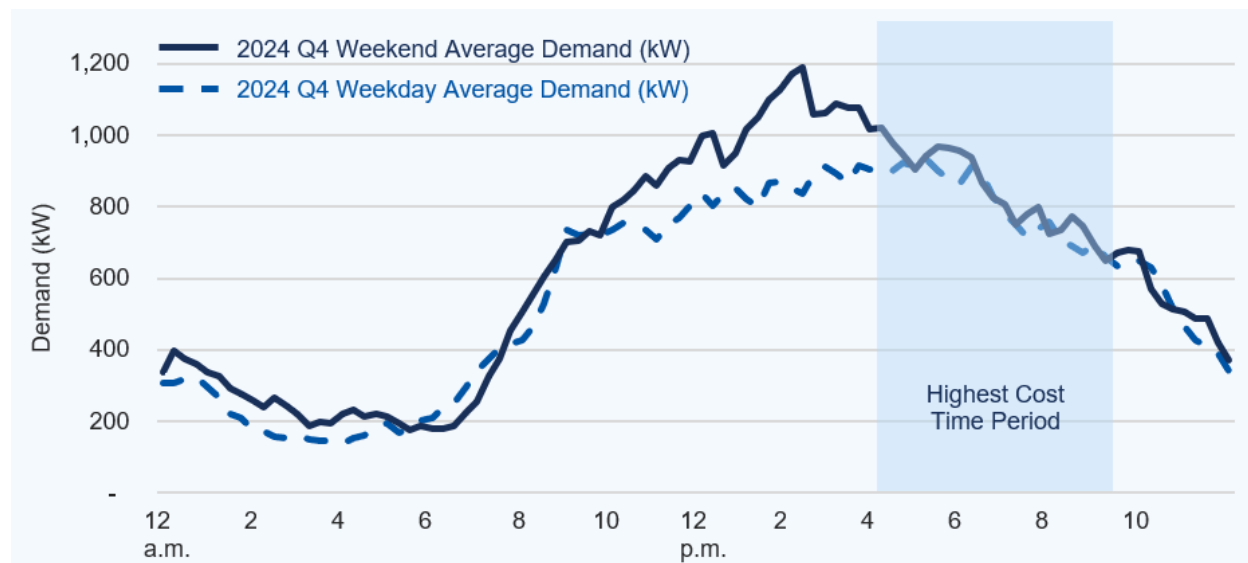


Figure 207 highlights two of the highest utilization days for the portfolio in 2024. Both represent a maximum of 2 MW at a very similar time (2 p.m. to 3 p.m.) with a slight variation in consumption, both nearing 20 MWh. Both of these high utilization days also occurred during major holiday periods, indicating the potential use of charging to enable long distance trips. Examples of charging late on both nights (9 p.m. until 4 a.m.) show how DCFC stations are used round-the-clock, which indicates that if TOU rates were passed on drivers who use the 75% of the sites that currently offer flat rates, this charging flexibility might incentivize drivers to charge with cheaper and cleaner energy. At present, the sites with retail TOU costs do not appear to be influenced by TOU.

Figure 207. PG&E EV Fast Charge Program Comparing Utilization Days



Sites in the EV Fast Charge program approximately doubled the number of charging sessions year on year to over 75,000 in 2024, as shown in Figure 208, and over 120,000 sessions in the program to date. The number of charging sessions grew consistently in the second half of the year, and December saw fluctuations regularly from 250 to 350 sessions daily.

Figure 208. PG&E EV Fast Charge Program Daily Charging Sessions for PTD Sites

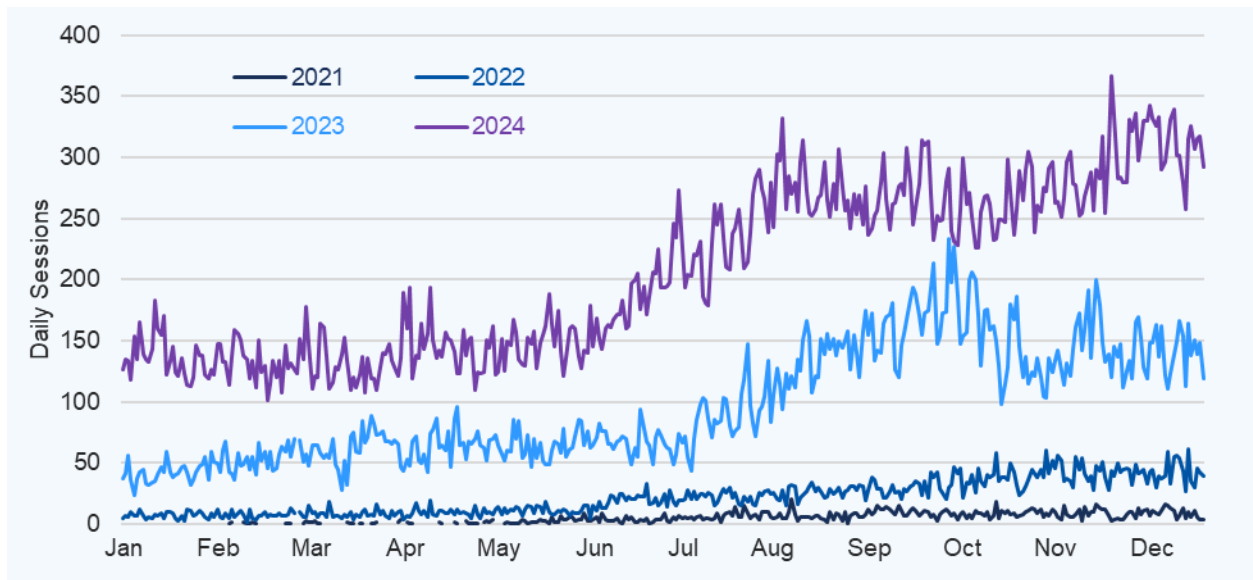


Figure 209 presents the distribution of charging sessions by size (kilowatt-hours consumed) and year for all sites in the EV Fast Charge program to date. The Evaluation Team did not include erratic charging sessions (below 1 kWh). Percentages represent the portion of total charging PTD sessions by size category.

Charging session energy consumption has grown compared to previous years. For example, sessions with 25 kWh to 50 kWh consumed have increased from 30% of all sessions in 2023 to 40% in 2024. 50 kWh to 75 kWh sessions have increased from 5% to 13%. Larger sessions (>75%) were not shown in the first year, accounted for approximately 1% of charging sessions in the previous two years, and approached 2% in 2024.

Larger sessions (>75%) were not shown in the first year, accounted for approximately 1% of charging sessions in the previous two years, and approached 2% in 2024. This could be an indicator of the larger battery vehicles that have hit the market in recent years.

Figure 209. PG&E EV Fast Charge Program Charging Session Count by Consumption Size PTD

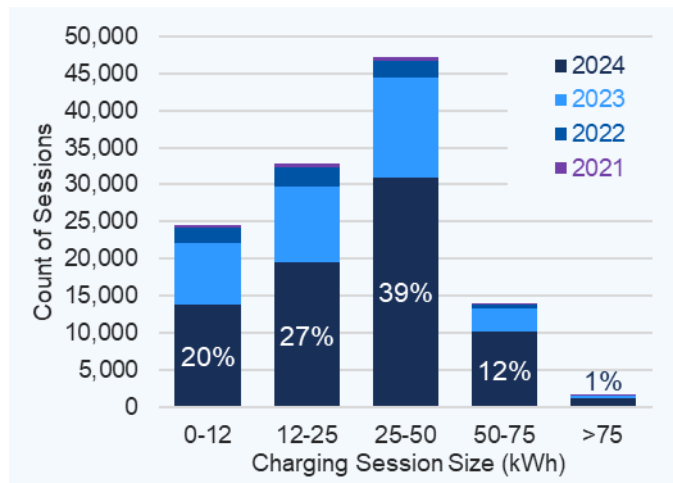
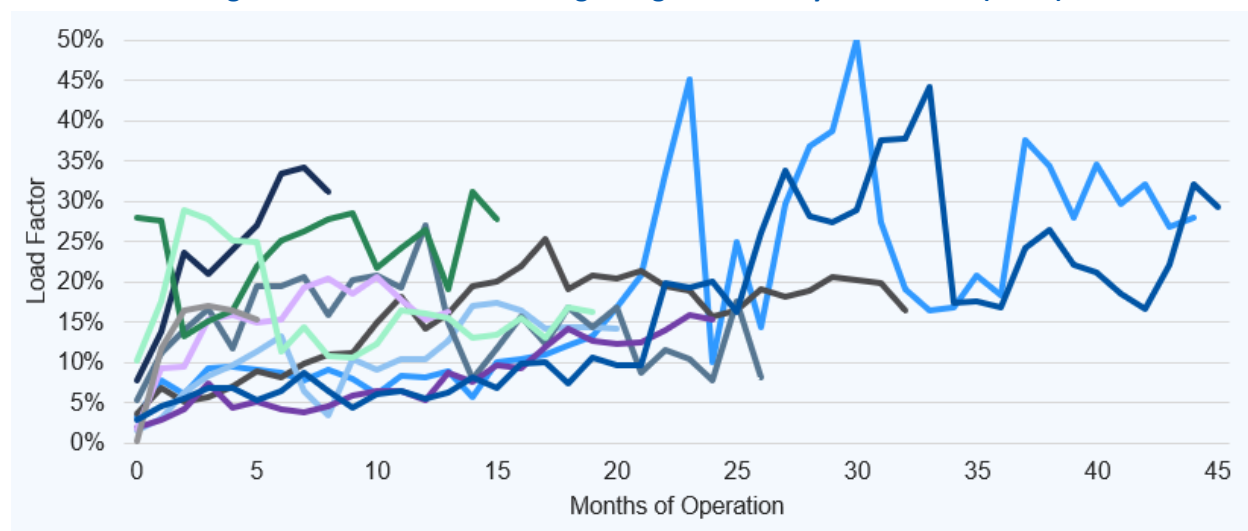


Figure 210 and Figure 211 show the monthly load factor of each site based on number of months from activation. Load factor compares a site's actual monthly energy consumption to what its consumption might be if maximum-demand were consistent throughout the entire month. For example, a constant maximum demand would result in a 100% load factor (which is highly unlikely in practice). Such data may help site and Utility program staff better understand the level of demand on a public charging site and how long it takes site to reach full operation and utility. This understanding can also facilitate planning of future sites in terms of charging-parking layout and capacity.

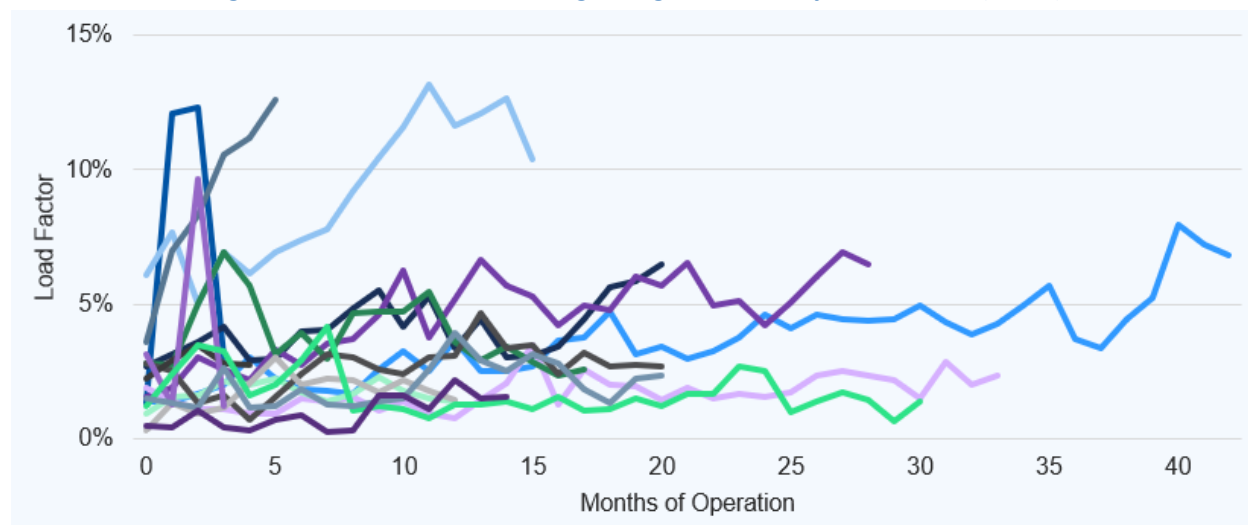
To make load factor data easier to view, sites are grouped by whether they had achieved a 15% load factor. Load factor for a large portion of sites currently ranges from 6% to 12% with a few sites reaching as high as 15% to 30% for a few months. High load factor sites have fairly consistent growth over the first one to two years. Load factor skyrocketed early for one of the sites (along with consumption) before flattening out between 20% and 30%.

Figure 210. PG&E EV Fast Charge Program Monthly Load Factor (>15%)



Load factor for the remaining sites hovers between 2% and 5% with a more gradual increase in later months. Load factor for two sites increased quickly initially and has remained around 10%, after one year of operations. With many sites remaining between 2% and 5%, this indicates consistent but low usage, leaving substantial room to increase utilization.

Figure 211. PG&E EV Fast Charge Program Monthly Load Factor (<15%)



Similarly, Figure 212, Figure 213 and Figure 214 show the monthly energy consumption of sites in the EV Fast Charge program, grouped by sites that have and have not achieved a load factor of 15%.

Approximately half of the sites have surpassed 10 MWh monthly. These are primarily sites that have also achieved over 15% load factor, and three that have not. The highly utilized sites have typically achieved monthly consumption of over 10 MWh within the first year of operation and have continued this level of consumption consistently over time. However, several sites that took a year or more to reach this level of consumption have also displayed consistently high consumption after their initial ramp up. Approximately half of the sites have load factor that has remained below 5 MWh monthly with a few of those below 1 MWh. It may be worth reviewing these sites further in terms of geography, demographics, and pricing policy. As stated in the *Site Visit Findings* section, retail prices range from \$0.35/kWh to \$0.75/kWh; the high side could be a deterrent to repeat EV driver customers but warrants further investigation.

Figure 212. PG&E EV Fast Charge Program Monthly Energy Consumption (>15% Load Factor and above 25 MWh)

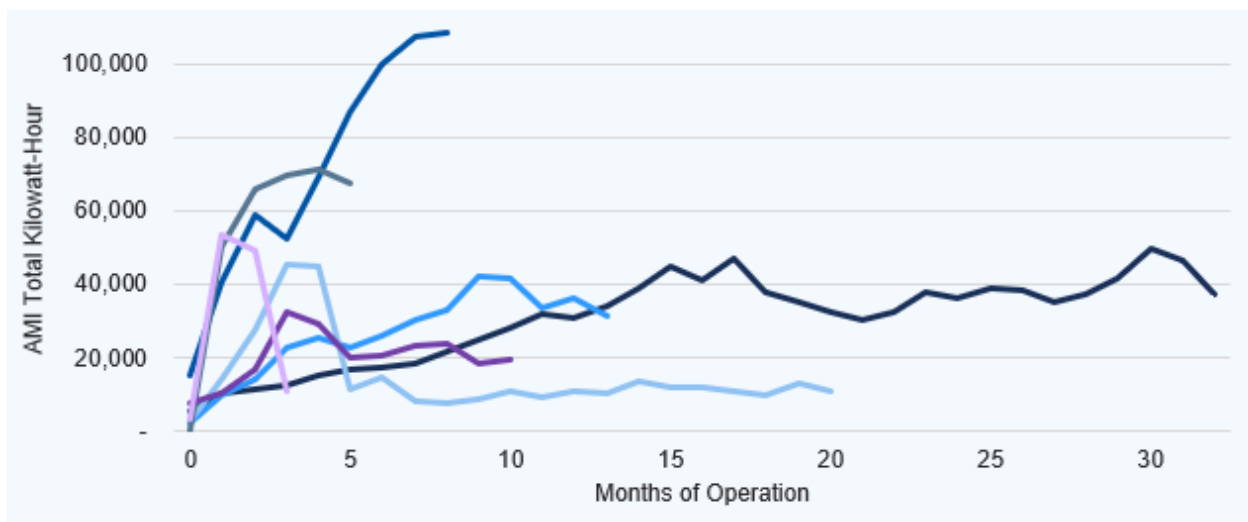


Figure 213. PG&E EV Fast Charge Program Monthly Energy Consumption (>15% Load Factor and below 25 MWh)

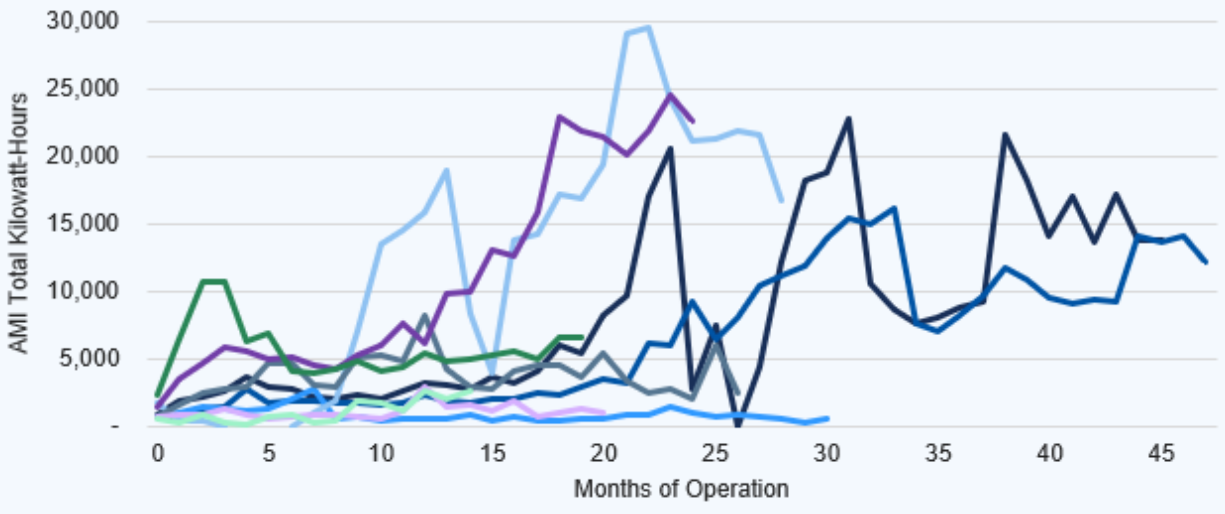
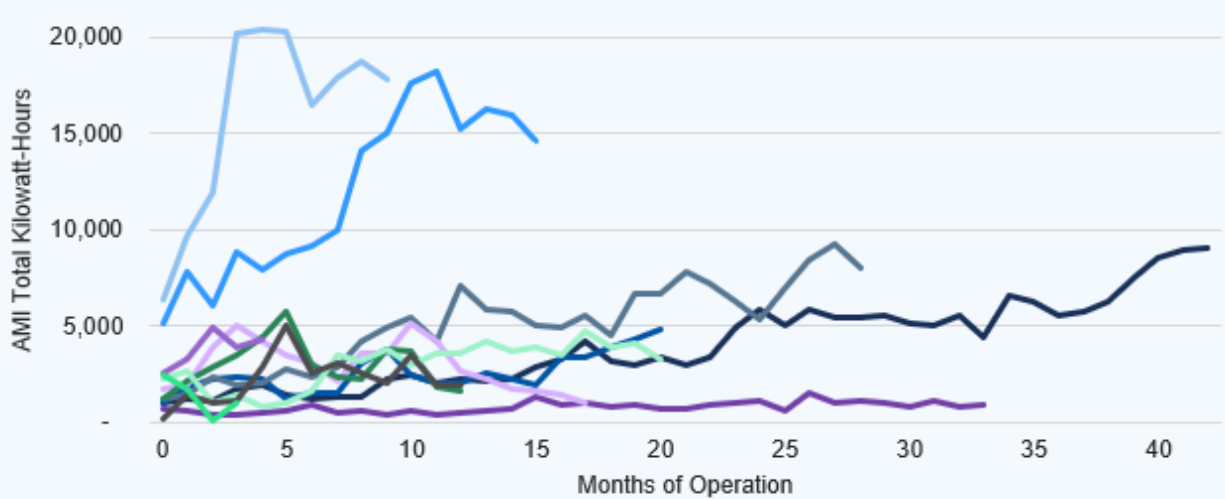


Figure 214. PG&E EV Fast Charge Program Monthly Energy Consumption (<15% Load Factor)



Highlights

- One-third of sites have shown considerable public utilization, with site load factors over 15% and monthly consumption over 10 MWh.
- A third of sites show lower usage at or below 5 MWh monthly; six consume approximately 1 MWh a month, though two are in early operations.
- High utilization sites typically show high load factor within a year of operations, which remains consistent over time.
- The number of daily charging sessions has continually increased. Daily charging sessions surpassed 100 in summer 2024 and peaked in October 2024 with nearly 250 sessions in a day.
- Monthly consumption grew throughout 2024 and peaked at 500 MWh in December.
- While weekday and weekend day charging have similar hourly trends, chargers had higher usage on weekends. Most demand occurred from mid-afternoon into the evening, coinciding with the highest-cost time period of the day.
- Most sites do not pass TOU rates onto drivers, limiting the influence of TOU rates on VGI which may limit the grid benefits this program provides.

Petroleum Displacement

The Evaluation Team estimated program-induced petroleum displacement related to the 29 operational sites using three key pieces of information: electricity used for EV charging, resulting EV annual miles traveled, and equivalent annual counterfactual vehicle petroleum fuel consumption. From this information, the Team estimated the reduction in equivalent gallons of petroleum attributable to the PG&E EV Fast Charge program. Table 106 presents petroleum displacement impacts for the EV Fast Charge program sites through 2024, including estimated actual impacts for 2024, actual impacts for all sites PTD, and a 10-year forecast for PTD sites.

Table 106. PG&E EV Fast Charge Program Petroleum Displacement Summary

DAC	Usage				Petroleum Displacement (GGE)		
	2024 Actual ^a (kWh)	PTD Actual ^b (kWh)	2023 Actual Use (miles)	PTD Actual Use (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC			5,116,741	6,267,865	129,436	162,810	2,240,506
Outside DAC			4,201,178	6,669,800	109,404	177,054	1,440,912
Total			9,317,919	12,937,665	238,840	339,865	3,681,418

^a “2024 Actual” represents the data from all activated sites from program inception for the calendar year 2024.

^b “PTD Actual” represents the data from all activated sites from program inception for all program years.

Highlights

- All 29 operational sites collectively achieved a PTD impact of nearly 340,000 gallons of petroleum, with 44% within DACs.
- Over a 10-year period, the sites will displace more than 3.6 million gallons of petroleum.

Greenhouse Gas and Criteria Pollutant Impact

The Evaluation Team calculated reduced emissions from displaced fossil fuel use from ICE vehicles that were not in service because of the EV Fast Charge program. The Team first developed an ICE counterfactual baseline and then calculated the emissions associated with this vehicle under conditions that otherwise matched the EVs to provide a baseline. Although EVs have no tailpipe emissions, the fossil-fuel power plants that supply electricity to the vehicle chargers still release some GHGs and criteria pollutants.

Table 107 presents the GHG reductions resulting from the Program in 2024, along with the program-to-date and 10-year totals, by impact location. Overall, the Program resulted in an 80% reduction of GHG emissions (2,678 MT total) relative to the counterfactual to date (3,534 MT, not shown in table) with 48% of the impact within DACs.

Table 107. PG&E EV Fast Charge Program GHG Reductions Summary

DAC	Usage (n=29)				GHG Reduction (MT)		
	2024 Actual ^a (kWh)	PTD Actual ^b (kWh)	2024 Actual Use (miles)	PTD Actual Use (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC			5,116,741	6,267,865	1,053	1,292	19,778
Outside DAC			4,201,178	6,669,800	884	1,386	12,630
Total			9,317,919	12,937,665	1,937	2,678	32,408

^a “2024 Actual” represents the data from all activated sites from program inception for the calendar year 2024.

^b “PTD Actual” represents the data from all activated sites from program inception for all program years.

Overall, of the local emissions, the program had the highest impact in reducing CO, resulting in an estimated annualized reduction of 5,509 kg (Table 108).

Table 108. PG&E EV Fast Charge Program Local Emissions Reductions

Emissions	EY2024 Net Reduction (n=11)			PTD Net Reduction (n=29)	
	Inside DAC	Outside DAC	Total ^a	Actual	10-Year Projected Impact
PM ₁₀ (kg)	8.22	3.36	11.58	13.94	163.0
PM _{2.5} (kg)	7.56	3.09	10.65	12.82	149.9
ROG (kg)	104.15	42.64	146.79	218.83	2956.0
CO (kg)	3,909	1,600	5,509	7,562	105,220

^a Columns may not sum to total due to rounding.

Figure 215 shows the current mix of electricity generation sources from the CAISO grid used to support the PG&E EV Fast Charge program sites.¹¹¹ Based on the real-time grid conditions when the EV charging occurred, the overall energy mix contained about 57% zero-emission or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 32% natural gas. With the CAISO

¹¹¹ The power associated with imports comes from a mixture of hydro, nuclear, coal, and natural gas power plants located outside the CAISO grid.

grid adding more renewables to meet the Renewable Portfolio Standard, the GHG and criteria pollutant emissions will continue to decrease, though the mix supporting this charging already exceeds RPS goals.

Figure 216 shows how program GHG reductions have increased to date and how these reductions are expected to grow over time for all activated sites. The analysis period ranges from the date that the first site in the program was activated through the end of 2024. The analysis incorporates the net reduction (counterfactual emissions minus utility emissions) for each site within the PG&E EV Fast Charge. PTD emissions reductions appear in dark navy while anticipated benefits based on annualization appear in royal blue. Because each site has its own starting date of operation, the 10-year sunset for each site can be observed as a gradual tapering off of program benefits between 2031 and 2034. While each year's operations appear similar, there are several key factors driving the variations, such as seasonality of utility generation sources (high utility emissions will appear as a dip on the curves), holidays occurring on weekends versus weekdays, and sites that became operational late in 2024 having predicted operations year-round in future years.

Figure 215. PG&E EV Fast Charge Program Net Electricity Mix, Program to Date

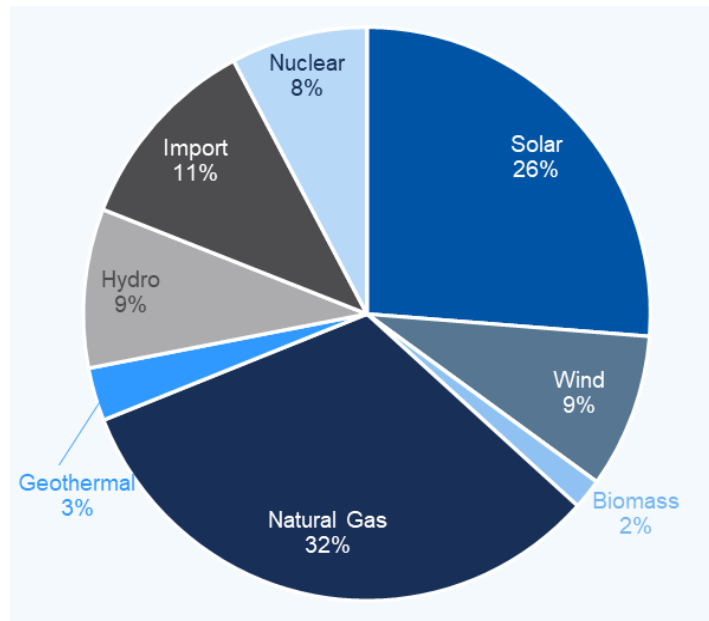
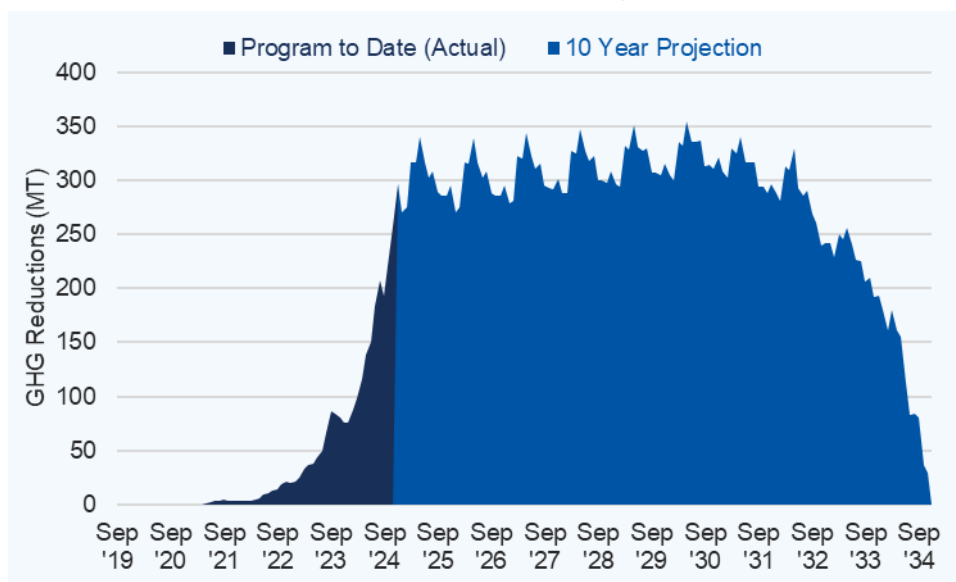


Figure 216. PG&E EV Fast Charge Program Historical and Forecasted GHG Reductions, PTD Sites



Highlights

- In 2024, the EV Fast Charge program sites resulted in a 80% reduction of GHG to date with 48% of the impact occurring within DACs.
- The greatest reduction in local emissions was CO with projected 10-year period reduction of more than 105,000 kg.
- Based on the real-time grid conditions when the EV charging occurred, the overall energy mix contained about 57% zero-emission or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 32% natural gas.

Health Impacts

The Evaluation Team calculated public health impacts (as benefits and costs) of reductions in criteria pollutants from vehicle electrification. The pollutants we included in the analysis are primary PM_{2.5} and precursors of secondary PM_{2.5}, including NO_x, SO₂, NH₃, and VOCs. The analysis considers only tailpipe emissions reductions rather than full lifecycle emissions (such as power plant emissions). The Team used the EPA's COBRA to evaluate the health benefits associated with the emissions reductions. COBRA estimates the county-level benefits for the county in which emissions are reduced. It also estimates the effect of the transport of emissions on all counties in the United States; however, this analysis includes only the effects of the emissions reductions in California. The Evaluation Team disaggregated the county-level effects to estimate the potential health benefits of sites for DACs and non-DACs.

Economic value depends on the health effects associated with the emissions, that is, whether they are associated with illnesses or death. The monetary value of the morbidity reductions associated with emissions reductions include avoided lost wages, avoided medical costs, and the amount of money people are willing to pay to avoid an illness or condition like respiratory disease. The value of the reduced mortality associated with emissions reduction is measured by the value of a statistical life, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low and high impact for mortality, representing the uncertainties in the estimates.

The total value of the health benefits associated with emissions reductions is between \$49,095 and \$69,047. Table 109 shows the cumulative health benefits in California associated with the emissions reductions realized by the electrification of PG&E EV Fast Charge sites for the program to date.

Table 109. PG&E EV Fast Charge Program California Health Benefits for PTD Sites in 2024

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Mortality	0.003	0.004	\$43,476	\$63,428
Avoided Medical Care				
Hospitalization, Respiratory	< 0.000	< 0.000	\$5	\$5
Hospitalization, Cardiovascular	< 0.000	< 0.000	\$5	\$5
Hospitalization, Other	< 0.000	< 0.000	\$11	\$11
ER Visits, Respiratory	0.006	0.006	\$10	\$10
ER Visits, Cardiovascular	< 0.000	< 0.000	\$1	\$1
Out of Hospital Heart Attacks	< 0.000	< 0.000	\$1	\$1
Nonfatal Heart Attacks	0.001	0.001	\$69	\$69
Stroke	< 0.000	< 0.000	\$5	\$5
Lung Cancer	< 0.000	< 0.000	\$4	\$4
Asthma	3.122	3.122	\$2,524	\$2,524
Hay Fever	0.126	0.126	\$145	\$145
Lost Productivity				
Minor Restricted Activity Days	1.153	1.153	\$149	\$149
Work Loss Days	0.196	0.196	\$64	\$64
School Loss Days	1.502	1.502	\$2,624	\$2,624
Total Health Effects	-	-	\$49,095	\$69,047

As part of this analysis, the Evaluation Team also examined health benefits within DACs, which may be disproportionately burdened by sources of pollution (including air pollution from ICE vehicles). Because COBRA estimates effects only at the county level, the Evaluation Team disaggregated the health benefits by census tract using the relative population of each tract from the most recent American Community Survey. For example, we allocated 10% of the value of the health benefits to a census tract with 10% of the county's population. The evaluation then estimated the total benefits allocated to DACs and non-DACs.¹¹² This approach assumes that the benefits of emissions reductions are distributed evenly throughout the county. If the sites are located in DACs, and the emissions reductions are greater in the tracts near the sites, this approach understates the potential benefit to DACs. Additional information about emissions dispersion within counties would provide more-precise estimates of the health benefits to DACs and non-DACs.

Most of the health benefits were in Alameda County which had 14% of the total benefits, followed by Contra Costa County (12%), Sacramento County (10%), Santa Clara County (9%), and San Joaquin County (8%). Overall, 18% of the health benefits were in DACs.

¹¹² DAC Census Tracts are defined as those included in in the SB535 Disadvantaged Communities List (2022), this includes the DAC categories for CalEnviroScreen 4.0 Top 25%, CalEnviroScreen 4.0 High Pollution Burden Score and Low Population Count, and 2017 Disadvantaged Community (CalEnviroScreen 3.0 only).

Highlights

- The monetary health benefits from PG&E EV Fast Charge sites range from a low estimate of \$49,095 to a high estimate of \$69,047.
- Most of the health benefits were in Alameda County which had 14% of the total benefits, followed by Contra Costa County (12%), Sacramento County (10%), Santa Clara County (9%), and San Joaquin County (8%).
- Overall, 18% of the benefits were in DACs.

Utility Staff Insights

In addition to monthly check-in calls with key PG&E staff to discuss the status of the EV Fast Charge program, the Evaluation Team conducted a close-out interview with staff in March 2025 to review overall program challenges and successes in 2024.

Starting in 2021 and through 2024, PG&E staff reported that a continued challenge with the program was that site construction costs were higher than anticipated, compounded by labor constraints, material costs, and supply chain delays. Being several years into implementation and dealing with the reality of increasing costs, PG&E staff try to address these increased costs when planning; however, they continue to strain program budgets:

- **Construction Labor and Material Costs.** Staff noted that construction labor and site material costs continued to increase in 2024 and have been more expensive than originally anticipated in 2018 (when the program funding cap was decided). In 2024, this challenge was exacerbated when PG&E staff determined that they needed to stop working with their lowest-cost contractor because of reported safety concerns. Additionally, one of the two remaining contractors requested a significant increase in rates before their contract ended at the end of 2024.
- **Incorrect Assumptions.** PG&E staff first noted in the 2021 evaluation report that during the program design in 2018, they had underestimated assumptions about site needs, such as trench length or proximity to a PG&E power source. This trend continued, with staff calling out that permitting costs have been higher than expected. These initial incorrect assumptions have continued to burden the program throughout its implementation.

In 2024, PG&E staff identified two additional challenges to site implementation:

- **Fire Sprinkler Code Changes.** In 2023, San Francisco updated its fire code, which affected two sites in the EV Fast Charge program portfolio during the 2024 evaluation year. This change required an upgrade to overhead sprinkler systems, resulting in increased costs, additional work, and permitting requirements at both sites. There was also debate over who should pay for the sprinklers as the sprinklers were needed because of the chargers, but they were also considered a capital upgrade to the buildings. Ultimately, the site hosts paid to upgrade the sprinkler systems. One site was able to finish construction in 2024, although its activation was delayed by six months, while the other has continued to experience timeline delays.

- **Vendor Accountability.** PG&E staff highlighted a situation with a customer who was concerned that their EVSE vendor was planning to install chargers that were not code compliant. Program staff effectively communicated both with the customer and vendor and helped ensure that compliant chargers were installed at the site.

Despite these challenges, 2024 for the EV Fast Charge program was mostly smooth, with program staff mostly focusing on site construction, resolving site-specific issues, and improving program processes. The successes in 2024 centered on the ability of PG&E staff to remain nimble while refining forecasts to serve as many customers as possible with the available funds:

- **Securing Additional Sites After Budget Reassessment.** In 2023, PG&E staff conducted a detailed analysis of the program's budget and identified additional funds. This resulted in an additional solicitation in late 2023 and into 2024, targeting customers who were already engaged in the program and could move quickly to select new sites. To ensure that the new sites would work within the program, PG&E required participants to contribute \$10,000 to the proposed site before the site walk. This resulted in three secured sites, with anticipated construction in 2025, and a tentative fourth site depending on the available budget.
- **Program Sunsetting.** Though the program is still several years from being fully closed out, due to the complex nature of EV infrastructure programs and length of maintenance agreements, PG&E staff are already preparing for program sunsetting. In 2024, PG&E staff began to anticipate potential pain points in the process and started discussing what will happen with the assets after the end of the term. Sunsetting efforts are likely to expand in 2025 and onward.

Highlights

- By leveraging the 2023 additional funds, program staff was able to open funding for up to four additional sites to the Pilot and are planning for construction to begin for three sites in 2025.
- Similar to previous evaluation years, site costs continue to be a challenge; in particular, securing construction labor as well as rising labor and materials costs. These challenges were compounded by the loss of a contractor; requests for higher contractor rates; permitting delays; site specification requirement such as utilizing bollards and back-up batteries; and incorrect program design assumptions from 2018 such as trench length or proximity to a PG&E power source.
- In addition to budget concerns, PG&E successfully managed several site-specific issues, including managing the effects of fire code changes on site design and ensuring that EVSE vendors adhere to compliance standards.

5.3.3. Lessons Learned

Although site costs continue to be a challenge, over the last three years PG&E staff have identified several effective strategies to mitigate costs.

PG&E began the EV Fast Charge program just as the COVID-19 pandemic started, which had unprecedented economic impacts across nearly every market, driving up costs for materials and labor and disrupting supply chains. These changes were so significant that the estimates originally used for Decision 18-05-040 (which mandated the EV Fast Charge at determined funding levels) did not reflect the actual costs for implementing EV Fast Charge. In 2022, after discussions with staff in the CPUC Energy Division, PG&E staff shifted the program design to allow partnering site hosts to contribute to site costs if the costs exceeded the program funding limits. Staff also worked to obtain approval to adjust the program goal from 52 to between 30 and 40 sites. In addition, staff added more phone screening steps to try to mitigate the attrition of site hosts in later stages of the application process.

Continuing from previous years, staff reflected that in 2023 site costs remained a challenge, noting that securing construction labor and materials costs were compounded by permitting delays, site specification requirements such as bollards and back-up batteries. To help address budget concerns, PG&E staff conducted budget exploration in Q4 2023 and determined that about five more sites could be built. In 2024, PG&E staff conducted outreach to existing customers due to their previous commitment and ability to contribute to construction costs, which included asking customers to put down a deposit of \$10,000 before a site is walked. Ultimately, the program executed contracts for four additional sites in 2024. Other challenges in 2024 include losing one contractor (of their three) and negotiating a price increase for another contractor, resulting in increased construction costs. The average Utility infrastructure cost of TTM and BTM borne by PG&E across PTD sites through 2024 was \$377,501 per site and \$1,284 per kilowatt of installed charging capacity, and the average all-in cost across PTD sites is \$590,658 through 2024, which is distributed evenly between EVSE, BTM and TTM costs.

The EV Fast Charge program is on track to meet its activated sites, installed ports and DAC site goals.

The 29 activated sites to date in the PG&E EV Fast Charge Program achieves 97% of the program's *per se reasonableness* minimum goal of 30 sites and 73% of the program's maximum goal of 40 sites. The sites support 152 DCFC ports, which meets 97% of the program's *per se reasonableness* minimum goal of 156 charging ports and 76% of the program's maximum goal of 200 ports. The 39 customer contracts signed to date would satisfy 100% of the program's minimum site goal and 98% of the maximum site goal, and would support 204 DCFC ports, which would meet 100% of the program's minimum and maximum DCFC port goals. In 2024, 73% of activated sites were in a DAC, bringing the cumulative percentage of DAC sites to 55%, which far exceeds the program's *per se reasonableness* DAC goal of 25% of sites.

The demand, energy consumption, and number of charging sessions is increasing in the EV Fast Charge program.

Eleven new sites were activated in 2024, overall demand reached nearly 2 MW compared to 700 kW in 2023, an 182% increase. Consumption from PTD sites increased to over 3,000 MWh in 2024, up from nearly 1,000 MWh in 2023. The number of daily charging sessions doubled to over 75,000 in 2024, and

over 120,000 charging sessions have been seen PTD. Charging session energy consumption has grown also compared to previous years; sessions with 25 kWh to 50 kWh consumed have increased from 35% of all sessions in 2023 to 39% in 2024. Sessions of 50 kWh to 75 kWh have increased from 8% to 12%. Sites also see very similar use across weekdays and weekends.

PG&E's EV Fast Charge program has a nominal, but growing, influence on neighborhood EV adoption.

In 2024, the EV Fast Charge program increased the number of operational sites by 11 to bring the pilot-to-date site total to 29. The model's output shows that the EV Fast Charge program may have contributed to PTD EV adoption by 40 EVs for households neighboring the infrastructure.

The EV Fast Charge program sites are helping to displace petroleum and reduce GHG and local emissions and achieve nominal health impacts overall and within DACs.

The EV Fast Charge sites accounted for a PTD impact of nearly 340,000 gallons of petroleum, with 48% of the impact within DACs. In addition, the program resulted in a 76% reduction of GHG, with 48% occurring within DACs PTD. These sites all positively contributed to lowering local emissions, with CO reduction showing the most prominent projected reductions of over 105,000 kg over a ten-year period. Overall, 18% of the health benefits are in DACs, and the total monetized health benefits range from \$49,095 to \$69,047.

6. San Diego Gas & Electric Transportation Electrification Programs

6.1. Power Your Drive for Fleets

6.1.1. Overview

This overview provides a detailed description of the San Diego Gas & Electric (SDG&E) Power Your Drive for Fleets (PYDFF) program; summaries of the program implementation process, performance metrics, materials, and budget; and a timeline of major milestones. Following the overview, the Evaluation Team presents the EY2024 findings, highlights, and lessons learned.

Program Description

Per Decision 19-08-026, SDG&E's PYDFF program provides infrastructure for fleet electrification at a low cost or at no cost to participants who purchase, lease, or convert at least two medium- or heavy-duty (MDHD) EVs. SDG&E launched the PYDFF program in September 2020 to accelerate the adoption of MDHD EVs by providing infrastructure for fleet electrification and working with fleets from initial

PYDFF Program Target

Achieve a minimum of 300 sites with 3,000 MDHD EVs supported.

planning and design to construction and ongoing site maintenance phases. PYDFF has an approved budget of \$107.4 million and is designed to enroll and assist a minimum of 300 sites supporting the electrification of 3,000 MDHD on-road and off-road vehicles.

Customers participating in the PYDFF program can choose either Utility ownership or customer ownership of BTM infrastructure. With Utility ownership, SDG&E will pay for, construct, own, and maintain all infrastructure up to the EVSE. The customer will then pay for, construct, own, and maintain the EVSE. If the customer decides to own the BTM infrastructure, then SDG&E will pay for, construct, own, and maintain all TTM infrastructure, and the customer will pay for, construct, own, and maintain all BTM infrastructure and receive an incentive payment for up to 80% of the resulting costs. Additional charger rebates of up to 50% of the cost of the chargers are available for transit agencies, school districts, and fleets located in DACs that are not operated by Fortune 1000 companies.

To participate in the PYDFF program, fleets must meet specific criteria. The program requires participating customers to purchase, lease, or convert at least two MDHD EVs. MDHD EVs are defined as Class 2 through Class 8 on-road and off-road vehicles, including MDHD trucks and vans, transit buses, commuter buses, school buses, TRUs, airport GSE, port equipment, forklifts, and other equipment. Additionally, fleets must own or lease the property, operate and maintain the infrastructure for 10 years, provide data related to EV usage, use approved vendors for the EVSE, and use qualified/state-

PYDFF Program Design Goal

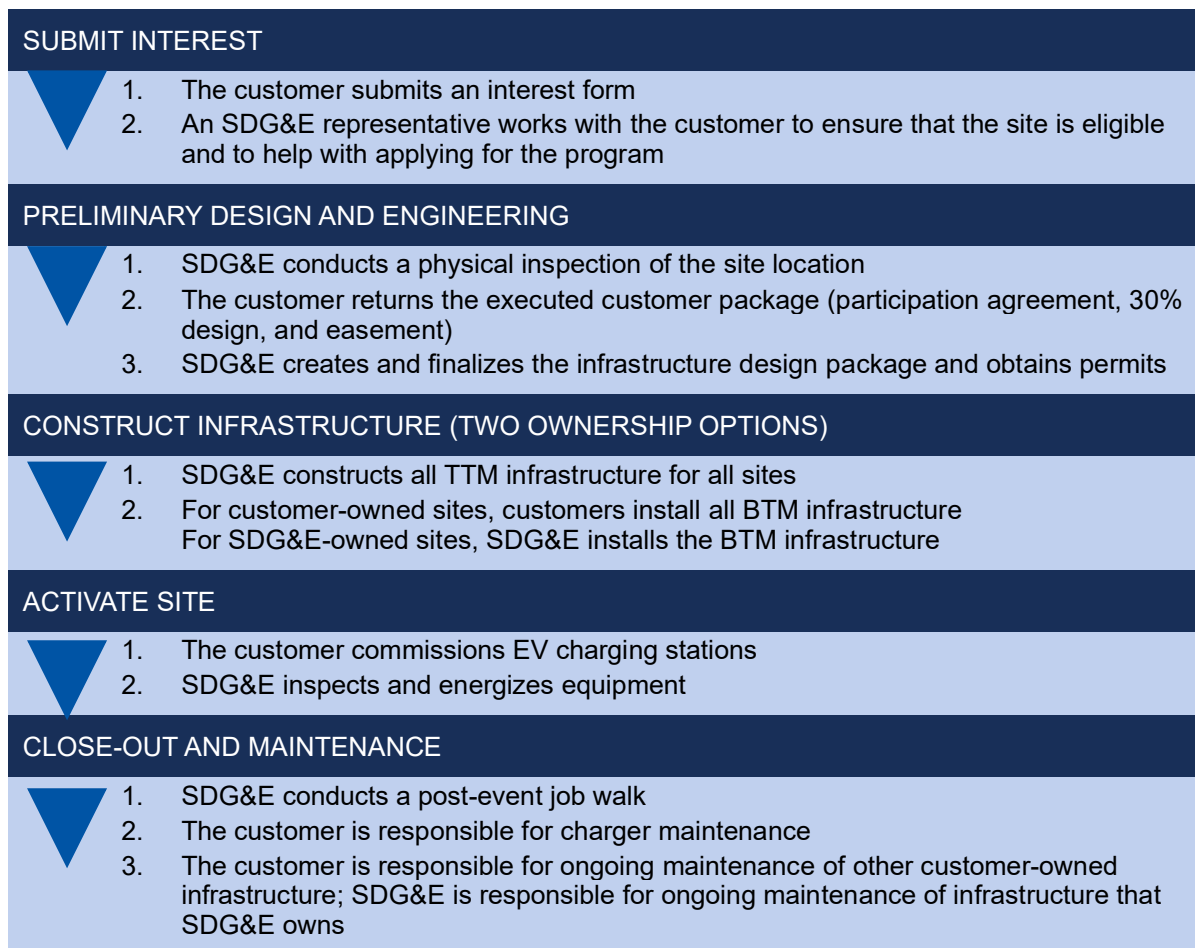
Accelerate the adoption of MDHD EVs by providing infrastructure for electrification while working with fleet operators from the initial planning phases to design, construction, and ongoing site maintenance.

licensed labor for all work, among other requirements. Specific terms and conditions listed in *Appendix B* and section 6.4 of Decision 19-08-026 require that a minimum of 30% of the infrastructure budget for PYDFF be allocated to deploy infrastructure in DACs.¹¹³ As allowed by the Decision, SDG&E submitted an Advice Letter in September 2023 requesting to change the DAC definition to be CalEnviroScreen service territory definition. The CPUC initially denied this Advice Letter but approved the refiled request in August 2024. The Decision also states that at least 10% of the infrastructure expenditures must support the deployment of transit buses and school buses, and no more than 10% can support the deployment of electric forklifts.

Implementation

Figure 217 shows the key steps in the PYDFF program implementation process. There were no major changes to the implementation process in 2024.

Figure 217. SDG&E PYDFF Program Implementation Process



¹¹³ DAC census tracts are defined as those included in the SB 535 Disadvantaged Communities List (2022).

Program Performance Metrics

The Evaluation Team reviewed the sites participating in the PYDFF program and organized them by status. Table 110 shows the number of sites in the program by completion status as of December 31, 2024.

Table 110. SDG&E PYDFF Program Complete Site Count by Status

Site Status	EY2024	Program to Date
Utility Construction Complete	3	26
Activated ^a	4	25
Operational	4	25
Closed Out	11	23

^a Note, the Evaluation Team only considers a site as activated in a given Evaluation Year if the site has completed the final program phase or has electricity usage in that year. The Activated status includes both currently active and decommissioned sites that were activated in the program.

In EY2024, the SDG&E PYDFF program received 26 additional applications, signed contracts with eight sites and activated four sites that supported 91 MDHD vehicles. This increased the total number of applications received to date by the SDG&E PYDFF program to 140 and the total number of contracts executed to date to 45.¹¹⁴ As shown in Table 111, 50% (two of four) of the MDHD activated sites in EY2024, and 44% (11 of 25) of sites activated in the program to date are located within a DAC.

Table 111. SDG&E PYDFF Program Activated Sites by Market Sector in EY2024 and Program to Date

Market Sector	EY2024		Program to Date	
	Number of Sites in DAC	Number of Sites in Non-DAC	Number of Sites in DAC	Number of Sites in Non-DAC
Airport GSE	–	–	–	1
Heavy-Duty Vehicle	–	1	–	1
Medium-Duty Vehicle	2	1	6	4
School Bus	–	–	3	7
Transit Bus	–	–	1	1
Truck Stop Electrification	–	–	1	–
Total	2	2	11	14

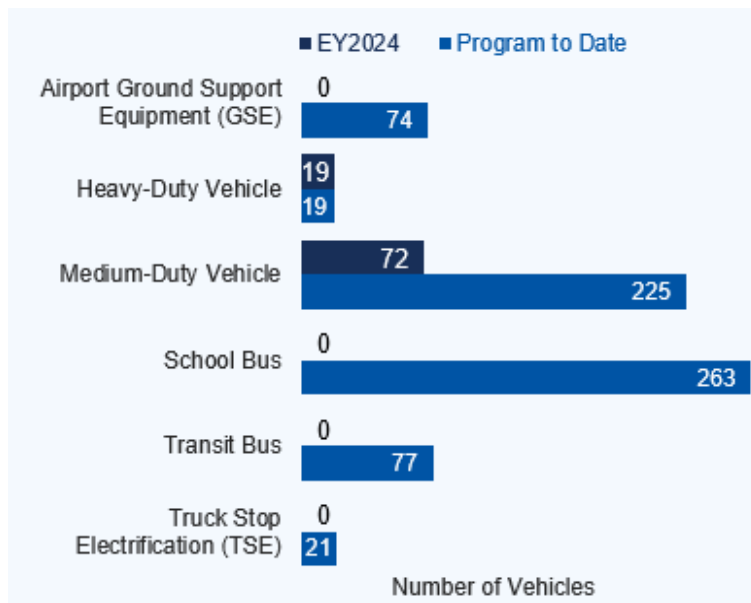
In EY2024, three of the four activated sites in the SDG&E PYDFF program came from the medium-duty vehicle fleets while one site came from a heavy-duty vehicle fleet, a first for SDG&E PYDFF program.

The largest percentage of activated sites in the SDG&E PYDFF program to date are medium-duty vehicle and school bus sites, each with 10 or 40% of activated sites. The transit bus market sector has two activated sites, or 8% of activated sites in the PYDFF program to date, while the airport GSE and truck stop electrification market sectors each have only one site, or 4% of all activated sites.

¹¹⁴ Note, applications received to date by SDG&E PYDFF program is inclusive of sites that have been put on hold or cancelled.

SDG&E installed infrastructure in EY2024 to support 91 MDHD vehicles in the medium-duty vehicle (72) and heavy-duty vehicle (19) market sectors based on 10-year VAPs submitted by customers at the time of program participation agreement signing. This brings the total number of MDHD vehicles electrified in the PYDFF program to date to 679.¹¹⁵ Figure 218 shows the breakdown of the MDHD electrified vehicles by market sector for EY2024 and PTD sites. SDG&E submitted Advice Letter 4349-E requesting to modify the PYDFF program to alter the vehicle procurement requirements at truck stops; CPUC issued Resolution E-5335

Figure 218. SDG&E PYDFF Program Vehicles Supported by Market Sector



on July 16, 2024, approving the Advice Letter. This modification allows vehicle operators besides the site host to meet the vehicle purchase requirement for program participation.

As displayed in Table 112, by the end of 2024, the PYDFF program had activated 25 sites satisfying 8% of the program's *per se reasonableness* goal of 300 sites. These sites support the electrification of 679 MDHD vehicles (per customers' VAPs), which achieves 23% of the program's *per se reasonableness* goal of electrifying 3,000 MDHD vehicles. The total 105 customer applications received to date could meet 35% of the program's site goal.¹¹⁶ Of these 105 applications, 45 had contracts signed in the PYDFF by the end of 2024, which could meet 15% of the program's *per se reasonableness* goal for sites and could support 1,024 MDHD vehicles, meeting 34% of the program's vehicle *per se reasonableness* goal. While the *per se reasonableness* goals in the CPUC Decision results in a ratio of 10 MDHD EVs per site (3,000 divided by 300), the ratio in the program to date is 27 MDHD EVs per site, which is more than twice this ratio.

Table 112. SDG&E PYDFF Program *Per se Reasonableness* Site and Vehicle Goal Progress

Program Goal	<i>Per se Reasonableness</i> Goal	Program to Date
Activated Sites	300	25
MDHD EVs	3,000	679

¹¹⁵ MDHD vehicles electrified to date in the PYDFF program will not align with past evaluation year reporting because sites activated in past evaluation years have updated their 10-year VAPs with additional MDHD EVs.

¹¹⁶ Note, 105 total applications excludes cancelled applications for goal comparison. The Evaluation Team does not have sufficient vehicle data for comparison against the goal.

Table 113 displays the median durations per program phase (measured in calendar days) for EY2024 and PTD activated sites. The column labeled EY2024 refers to sites activated in 2024. The “Program to Date” column refers to all 25 sites activated from the initiation of the program through December 31, 2024.

Values in Table 113 provide insight into program phase length trends over time. Sites did not necessarily pass through each phase in the same calendar year. For example, EY2024 activated sites may have passed through Design and Permitting in 2023 while others passed through in 2024. Across all program phases, Activation has the shortest median duration, while Design and Permitting has the longest median duration.

Table 113. SDG&E PYDFF Program Median Calendar Days per Phase for EY2024 and PTD Sites

CPUC Program Phase	Median Calendar Days	
	EY2024	Program to Date
Application Review	59	32
Site Assessment	139	129
Contract Issuance	166	112
Design and Permitting	334	313
Construction Complete	217	176
Activation	11	5

Figure 219 expands the analysis of program phase duration for EY2024 by displaying the average number of calendar days per phase (denoted by X), calendar day median (middle line inside of box), the first quartile (bottom of box), third quartile (top of box), minimum (bottom tail), maximum (top tail), and outliers (dots). The distributions per program phase provide deeper insight into program phase completion, showing that the Contract Issuance, and Construction Complete phases took the most calendar days to complete and had the greatest variation in completion time. Site Assessment, Design and Permitting, and Activation are the phases in which the customer applications spend the shortest amount of time. These phases also had the least variation in completion times in EY2024.

Figure 219. SDG&E PYDFF Program Calendar Days per Phase for EY2024 Sites

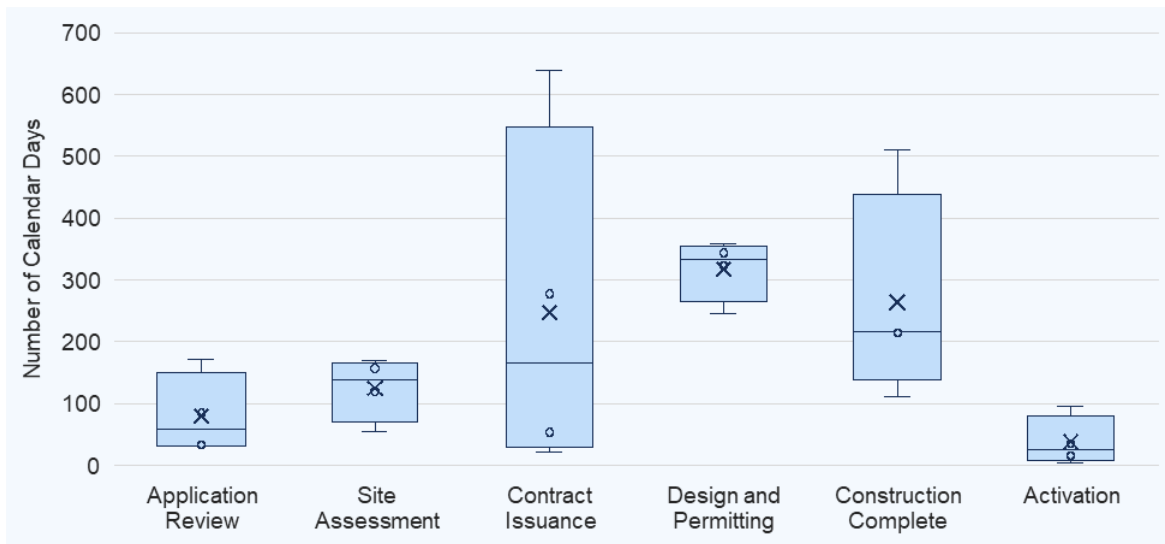


Table 114 displays the median number of calendar days that PYDFF program applicants took from program start to finish (Application Review to Activation) for the four activated sites in the medium-duty vehicle market sector in EY2024, and the 25 activated sites to date. The four activated sites in EY2024 had a median start-to-activation duration of 1,106 calendar days, up 61 days from the median in EY2023 (1,045 days). The 25 activated sites in the program to date had an overall median start-to-activation duration of 731 calendar days, ranging from 477 calendar days for truck stop electrification applications to 1,229 days for transit bus applications.

Table 114. SDG&E PYDFF Program Median Duration for Site Activation by Market Sector, EY2024 and PTD Sites

Market Sector	EY2024		Program to Date	
	Median Duration Start-to-Finish (Calendar Days)	Number of Activated Sites	Median Duration Start-to-Finish (Calendar Days)	Number of Activated Sites
Airport GSE	–	–	570	1
Medium-Duty Vehicle	1,106	4	871	11
School Bus	-	-	682	10
Transit Bus	-	-	1,229	2
Truck Stop Electrification	–	–	477	1
All Market Sectors	1,106	4	731	25

Program Materials Summary

Throughout 2024, SDG&E staff coordinated multitouch marketing activities, including activities geared to DAC audiences; created locally focused outreach materials; and hosted hands-on, collaborative events to increase program participation and share program successes. This section highlights key

findings and successes from the review of program materials and ME&O activities SDG&E conducted in 2024.

- **DAC Outreach.** SDG&E staff conducted multiple waves of targeted DAC outreach in 2024. For example, SDG&E staff conducted a sales pitch in Spanish at a Chamber of Commerce event and presented at a port tenant group with English and Spanish handouts. Staff viewed the presentation in Spanish as successful, as the sector audience included border crossing fleets in the Otay Mesa community and generated additional enrollment and interest in the program. SDG&E staff also implemented a marketing campaign to generate awareness in DAC areas through mail, email, and phone outreach.
- **Hands-On Events.** SDG&E staff are particularly proud of their success hosting an annual “EV Fleet Day,” which encourages fleet owners to engage with a multitude of industry players with booths, displays, and ride-and-drives. Staff noted that the event also provides an opportunity to identify and discuss any concerns from a variety of stakeholders during panels in the morning on policy regulations, grant funds, or previous participants sharing their experience with the program. EV Fleet Day resulted in additional program vehicle enrollments and opportunities for SDG&E to continue building relationships with customers.
- **Industry Partner Network Webinars.** In 2024, SDG&E staff partnered with EV manufacturers to host a joint webinar to reach their shared audiences (example slide shown in Figure 220 below). While the webinar collaboration was successful, staff reported declining interest in webinars compared to earlier years of the program because more fleets are choosing to participate in EV Fleet Day.

Figure 220. SDG&E PYDFP Program Joint Webinar Slide for Pilot Education

Transportation Electrification Advisory Services (TEAS)
Complimentary Support

SDG&E is dedicated to helping fleets transition to EVs
Small businesses, educational institutions, tribal communities, transit agencies, and municipalities may receive dedicated help electrifying medium and heavy-duty fleets.

GET STARTED TODAY
Begin the journey to electrification by filling out the [TEAS interest form](#). This quick step allows SDG&E to better understand your needs and schedule personalized consultation.

TAILORED RESOURCES
Whether you're looking for specific solutions, education on electrification, or have unique challenges, SDG&E is ready to provide assistance precisely for you.

TRUSTED ENERGY ADVISORS
SDG&E has TEAS advisors standing by to support every aspect of your electrification journey, as well as tools and other electric vehicle experts to work through any roadblocks.

sdge.com/TEAS

- ❖ Fill out the [TEAS interest form](#)
- ❖ Get quick resources for starting your electrification journey
- ❖ Learn how to overcome common electrification roadblocks

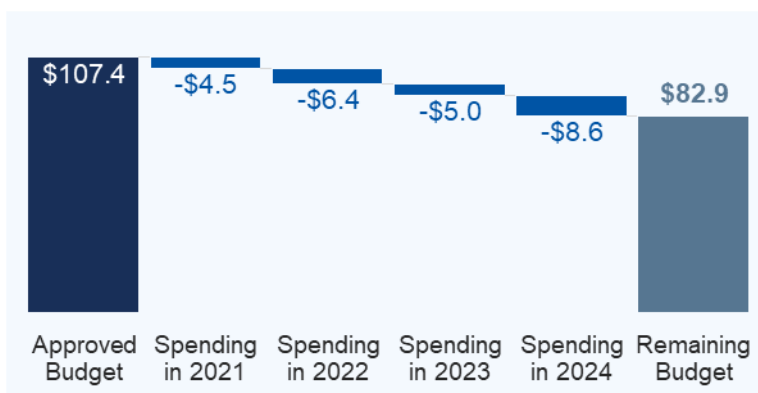
I LOVE ELECTRIC

- Relationship Driven Engagement:** In 2024, SDG&E staff shifted outreach efforts to build longer-term relationships and support continued electrification for their customers. SDG&E staff take a relationship-centered approach to outreach by first focusing on understanding their customers' energy needs. For example, marketing staff attempt to "get out in front" of the program to reach fleets and generate leads likely to participate in the program through established relationships with customers. In 2024, SDG&E staff also experimented with using FleetSeek (now RigDig) and the DOT website to identify trucking and transportation companies to engage additional audiences. Part of SDG&E's relationship-centered approach is its program-neutral stance to a customer's broader electrification goals. The SDG&E marketing team presents customers with all potential offerings, such as Rule 45, so customers can determine which programs align best with their goals. This approach helps potential participants trust that SDG&E is guiding them to programs best suited for their needs. Additionally, the relationship-driven approach allows SDG&E to serve customers better by inviting engagement from participants even after site completion. For example, staff noted that previous participants have returned when interested in adding additional chargers or new sites and reach out to program staff if issues arise, demonstrating the trust the Utility is building with customers.
- Direct Outreach.** In former implementation years, SDG&E staff conducted direct outreach via cold calling to garner awareness for the program. However, traditional phone and email outreach awareness methods had mixed results, so in 2024 program staff started moving away from broad awareness outreach and focused more on direct interaction with fleet owners through account executives. For example, if they believe that a customer has a genuine interest in the program, an account executive will alert the customer solutions team, which will reach out over email or phone to the fleet owner to assess if the program aligns with their goals. SDG&E also continues to conduct direct outreach at local events, such as by trading business cards with potential participants and following up with emails and calls.

Budget Summary

As shown in Figure 221, from program inception through December 31, 2024, SDG&E spent \$24.5 million of the approved \$107.4 million (constant dollars). In EY2024, program spending was \$8.6 million. Figure 221 does not include spending on sites that were not fully closed out as of December 31, 2024.

Figure 221. SDG&E PYDFF Program Spend



Timeline

Since the beginning of the PYDFF program SDG&E staff have filed several Advice Letters.

On September 30th, 2019, SDG&E filed AL 3437-E to request CPUC approval to establish balancing accounts for the MDHD Program and V2G Pilot and to outline its cost recovery approach.

In August 2020, SDG&E filed AL 3587-E, its first cost tracking update, and AL 3588-E, a status update ahead of the Q3 2020 program launch. At that point, staff had engaged 28 interested customers, including six beta sites with 63 EVs and 43 charging ports. SDG&E finalized rebate structures and introduced the new EV-High Power (EV-HP) rate. Staff also identified early participation barriers, including the required 10-year customer commitment and COVID-19-related budget constraints.

In August 2021, SDG&E filed AL 3825-E with its second cost tracking update and AL 3829-E to provide a broader program status update. By July 2021, SDG&E had engaged 155 customers, with 24 in early design and one operational site. In August 2022, SDG&E submitted Advice Letter 4056-E, its third cost tracking update, which documented actual expenditures and compared them with the approved budget.

In 2024, SDG&E received approval for the resubmitted AL 4436-E originally filed on September 30, 2022. This Advice Letter requested an expansion of the definition of DACs in the service territory application to match the definition approved in AL 2876-E.¹¹⁷ AL 2876-E, approved in March 2016, outlined SDG&E's initial DAC definition for the EV Vehicle-to-Grid Integration (VGI) Pilot Program. This earlier definition had served as the basis for the expanded approach in AL 4086-E. The CPUC initially rejected AL 4086-E, indicating that SDG&E did not have enough evidence of its outreach to state-defined DACs. As a result, in 2023 and 2024 SDG&E continued to prioritize outreach to state-defined DACs and increased the rigor of documentation for this outreach. As the additional outreach did not garner additional participation, in May 2024, SDG&E resubmitted the request via Advice Letter 4436-E with updated information on its state DAC outreach efforts, and the CPUC approved this Advice Letter in July 2024.

In addition, though it did not file a formal Advice Letter, SDG&E submitted a request through Rule 16.6¹¹⁸ to extend program enrollment through December 2026.¹¹⁹

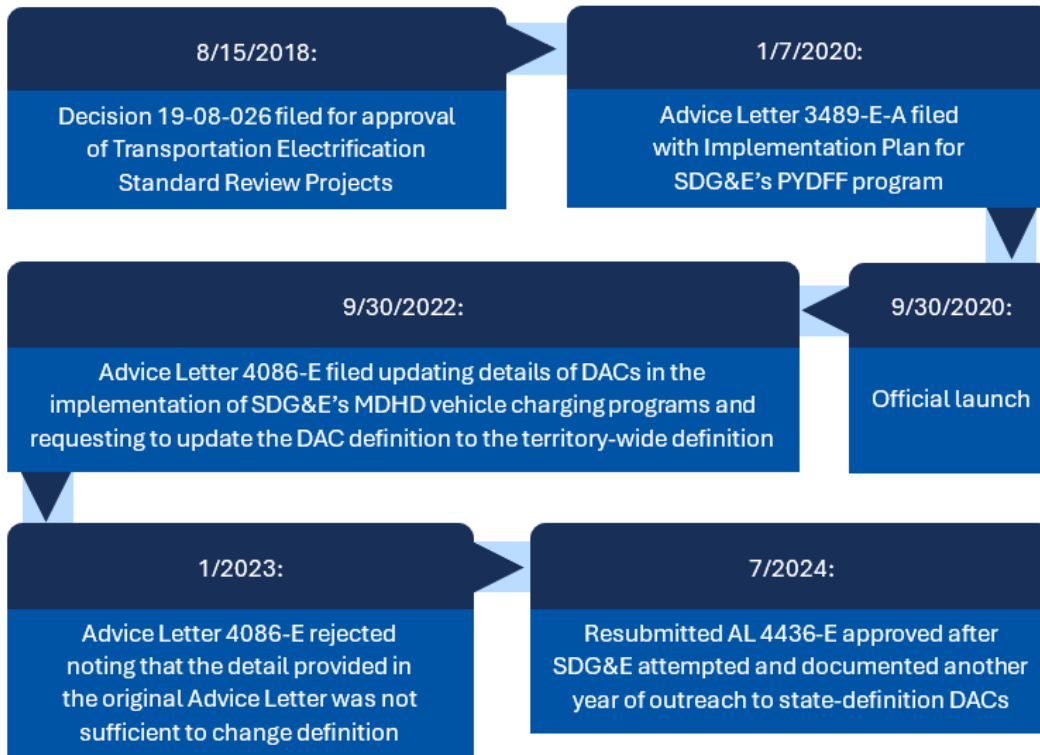
Figure 222 shows all major milestones since the beginning of the program.

¹¹⁷ SDG&E submitted AL 2876-E for the EV-Grid Integration (VGI) Pilot Program to allow SDG&E to define DACs using the CalEnviroScreen service territory definition rather than the CalEnviroScreen state DAC definition.

¹¹⁸ Rule 16.6 provides an extension to comply with commission decision or order. See [Cal. Code Regs. Tit. 20, § 16.6 - \(Rule 16.6\) Extension of Time to Comply | State Regulations | US Law | LII / Legal Information Institute](#) for further information.

¹¹⁹ SDG&E submitted an extension request in 2024, which was not approved until 2025.

Figure 222. SDG&E PYDFF Program Key Milestones



6.1.2. Findings

The following sections provide findings from the Utility staff interviews, as well as from surveys, site visits, and deep dive sites. The Evaluation Team also provides insights from the co-benefits and co-cost analysis, site costs, grid impacts, petroleum displacement, GHG and criteria pollutant reductions, health, and net impacts.

Table 115 summarizes key impact parameters for EY2024 and the program to date and provides estimates of impacts for goals as part of the impact evaluation. Additionally, the table provides estimates of impacts across all sites included in the program population through the end of 2024.

Table 115. SDG&E PYDFF Program Impacts Summary

Impact Parameter	EY2021 Sites ^a	EY2022 Sites ^a	EY2023 Sites ^a	EY2024 Sites ^a	EY2024 Sites Percentage in DAC	PTD Sites Actual	PTD Sites Actual Percentage in DAC
Population of Activated Sites (#)	1	12	8	4	50%	25	44%
Sites Included in Analysis (#)	1	12	8	4	50%	25	44%
Ports Installed in Analyzed Sites (#)	2	180	78	43	65%	303	34%
EVs Supported (#) ^b	2	246	227	91	31%	679	42%
Electric Energy Consumption (MWh)	N/A				88%		42%
Petroleum Displacement (DGE)	N/A	109,285	113,530	16,934	87%	562,783	38%

Impact Parameter	EY2021 Sites ^a	EY2022 Sites ^a	EY2023 Sites ^a	EY2024 Sites ^a	EY2024 Sites Percentage in DAC	PTD Sites Actual	PTD Sites Actual Percentage in DAC
GHG Emission Reduction (MT GHG) ^c	N/A	947	790	140	89%	4,813	33%
NO _x Reduction (kg)	N/A	1,274	None	103	100%	4,029	6%
PM ₁₀ Reduction (kg)	N/A	8.0	0.32	0.4	85%	207	1%
PM _{2.5} Reduction (kg)	N/A	7.4	0.30	0.4	85%	191	1%
ROG Reduction (kg)	N/A	71.9	30.85	2.1	61%	285	16%
CO Reduction (kg)	N/A	2,101	23,782	65	54%	44,707	68%

^a Energy consumption, petroleum displacement, and emissions reductions are based on annualized data. Program to date results in the table are based on actual data (see *Appendix B* for more details).

^b The Team derived the EVs supported value from applicants' VAPs. This value represents the maximum number of vehicles expected to be supported by the charging infrastructure.

^c GHGs include CO₂, CH₄, and N₂O multiplied by their respective GWP as defined by IPCC AR5 (see *Appendix B* for more details).

Utility Staff Insights

In addition to monthly check-in calls with key SDG&E staff to discuss the status of the PYDFP program, the Evaluation Team also conducted a close-out interview with staff in March 2025 to review overall challenges and successes in 2024. The following bullets summarize specific uncertainties experienced in 2024 by the customers and SDG&E:

- Supply Chain and Materials Costs.** Staff indicated a continued long-term impact from COVID-19 supply chain interruptions, which increased material costs and slowed site development. As in 2022 and 2023, staff reported that equipment and material lead times continue to be a challenge. For example, staff noted one equipment shipment that took around 15 months to arrive. However, staff also mentioned being able to reduce project timelines by ordering BTM equipment earlier in the process—currently, this equipment is ordered when the customer selects SDG&E ownership for sites instead of later in the design process. SDG&E has shared this lesson with customers to encourage them to place orders earlier, which has reduced timelines in customer-owned sites as well.
- Small Business Barriers.** Because 83% of commercial customers in SDG&E's territory are classified as small businesses (based on SDG&E's analysis of their energy demand), SDG&E staff emphasized that they must consider the specific needs and challenges of small business fleet electrification. Continued from previous years, as the program has progressed, SDG&E staff have observed that small businesses have more challenges with program awareness, education, and program design requirements than medium- and large-size businesses:
 - Awareness and Education:** SDG&E staff have found that the most effective way to engage small business customers in a meaningful way is to answer specific questions on electrification possibilities during one-on-one conversations. Staff noted that although this takes significant time and effort from the SDG&E outreach staff, it is a priority for reaching small business customers. In addition, staff indicated that they meet biweekly with customers as appropriate, but remain mindful of the resources available for customer

solutions. In particular, helping customers choose the right charger takes time, as staff must understand each customer's business model, vehicle types, and end-use needs.

- *Design Requirement Limitations:* Staff indicated that the program requirement of a two-vehicle minimum continued to be challenging for small fleets in 2024. The program requires two vehicles on hand, or evidence of invoices for two vehicles. As previously mentioned in the 2023 report, smaller fleets may not be able to afford more than one vehicle or to own a dedicated parking space (or two). In 2024, this concern was exacerbated by vehicle arrival delays for customers that committed to and purchased the minimum two vehicles.
- **Border Region Challenges.** Staff noted that the region they service is unique as it is close to the southern national border, which requires different outreach and language strategies for program engagement. In addition, staff surmised that complications with international tariffs may impact the program's performance in the coming year. Staff also noted that SDG&E is working carefully with border communities to build and maintain trust with these customers.

As described above, PYDFF program staff focused on crafting tailored solutions to specific programmatic challenges throughout 2024. In addition to these solutions, SDG&E noted other successes in 2024:

- **VAP Tracking:** SDG&E has been developing a system to track site hosts' progress to their VAP targets. In 2024, SDG&E hired one staff member who is dedicated to monitoring the growth and maintenance of sites and acts as the bridge between the Utility and the customer.
- **Peer-Led Engagement.** SDG&E staff reported multiple successes where former and current participants shared experiences with peer organizations, driving participation in the program.
 - **Former Participant Advocates.** Staff said that customers who are enrolled in the program have become strong advocates for the PYDFF program. For example, on road shows, SDG&E invites participants to share a two-minute progress report on their site that highlights the positives, negatives, and lessons learned for prospective customers. SDG&E staff noted that after previous participants share the program journey from a perspective other than SDG&E's, potential customers seem more receptive to the program. Some former participants have shown continued interest in electrifying through PYDFF by taking advantage of the program's extension to apply for additional sites.
 - **Buddy System.** Staff said they had increased their communication with potential participants in 2024, particularly with customers who have hesitations about EV regulations and requirements, and electrification in general. To mitigate these concerns, SDG&E has connected these potential customers with peer organizations, such as small school districts that already had EVs. Staff also encourage EV-owning customers to reach out directly to potential participants to share what is and is not working for them and provide input as requested. This method builds trust by offering sector-specific, peer-led insights that do not come directly from the Utility.

Highlights

- Similar to previous evaluation years, site costs continue to be a challenge. To mitigate material costs and delays with power sources SDG&E staff and participants have started equipment procurement earlier in the process.
- Small fleets, which represent a large percentage of the SDG&E customer base, continue to have additional challenges with program awareness, education, and limits with program design requirements.
- SDG&E staff learned that connecting prospective customers with current or previous program participants builds trust through sharing both the positive benefits of the program as well as transparency in industry specific lessons learned.

Survey Results

The Evaluation Team did not receive survey responses for this year.

Site Visit Findings

In 2024, the Evaluation Team completed four site visits in the SDG&E territory, all in the medium-duty vehicle sector, though different vehicle types and uses. During the site visits, the Evaluation Team collected qualitative and quantitative information that provided an understanding of fleet composition and operations. The Evaluation Team used site visits to verify information about sites such as the number of installed chargers, the EVSP the fleet uses, types of EVs in use or scheduled for delivery, and physical influences on construction designs.

Table 116 provides a summary of charging site characteristics by market sector, including number of site locations visited, number of L2 and DCFC ports, and total charging capacity. In total, the SDG&E PYDFF program activated sites added 17 L2 ports and 26 DCFC ports in 2024 with 700 kW of EV charging capacity. This brings the total PTD site installed charging capacity to more than 9 MW.

Table 116. SDG&E PYDFF Program Quantity of Ports by Type and Installed Capacity by Market Sector, EY2024 Sites and PTD Sites

Market Sector	EY2024 Sites Visited	EY2024 Sites Ports	EY2024 Sites Capacity (kW)	PTD Sites Visited	PTD Sites Ports	PTD Sites Capacity (kW)
Airport GSE	0	0	0	1	78	840
Medium-Duty Vehicle	4	43	701	11	77	1,978
School Bus	0	0	0	10	112	3,332
Transit Bus	0	0	0	2	32	2,675
Truck Stop Electrification	0	0	0	1	4	250
Total	4	43	701	25	303	9,075

Figure 223 is a visual representation of Table 116 showing charging port and charging capacity of PYDFF program site visit locations by market sector for EY2024 sites and PTD sites.

Figure 223. SDG&E PYDFF Program Site Visit Ports and Capacity, EY2024 and PTD Sites

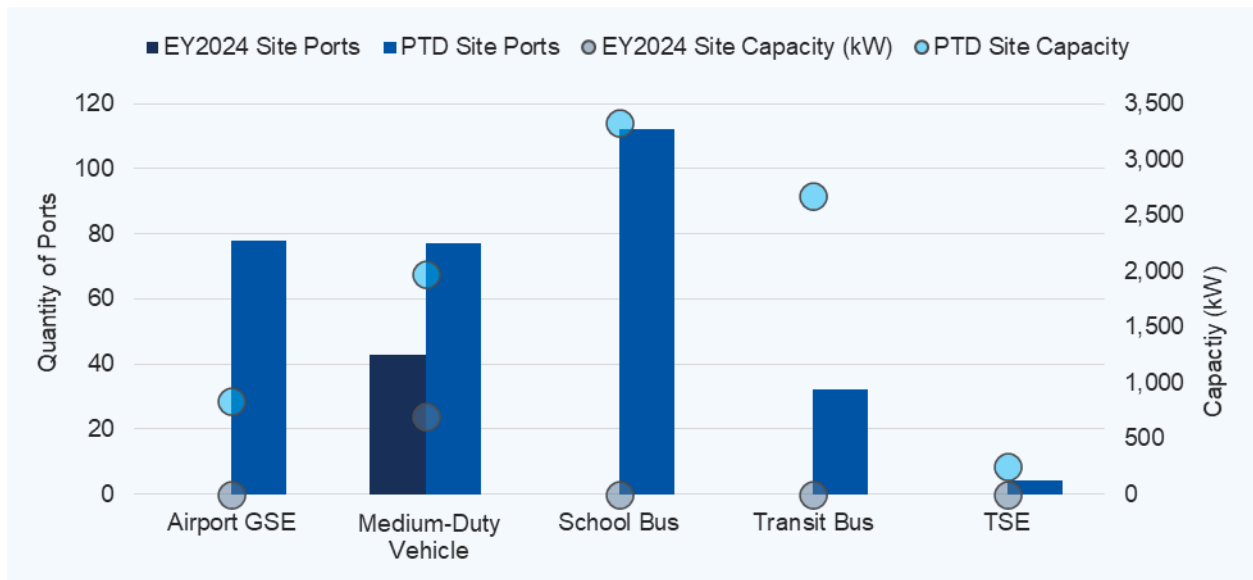
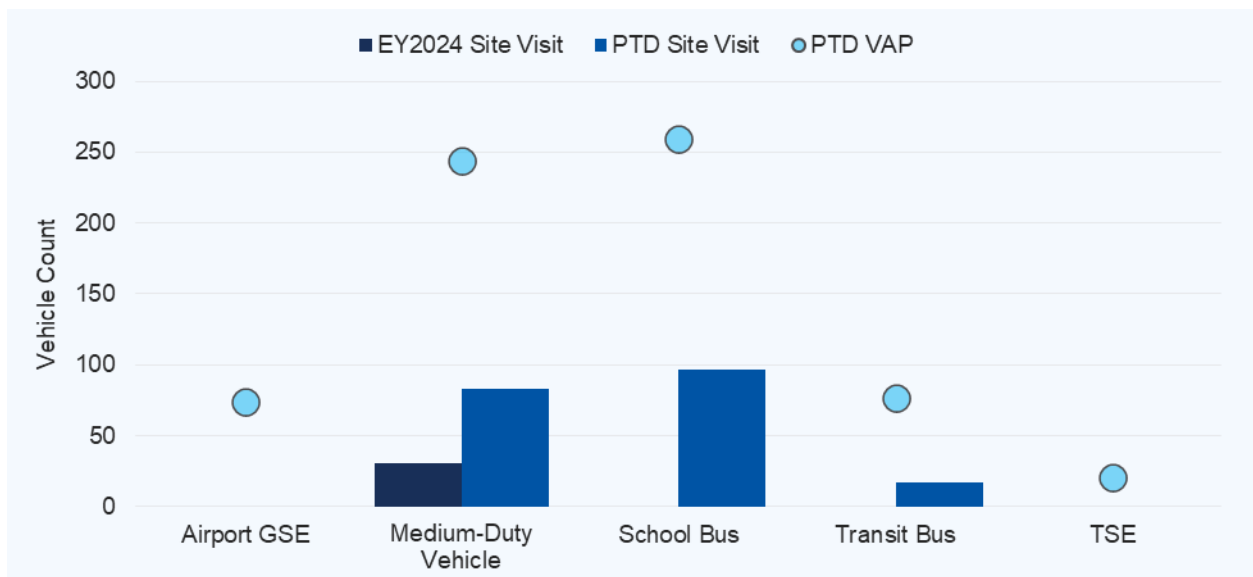


Figure 224 shows the count of vehicles noted through site visits compared with the number on 10-year VAPs. The figure and analysis suggest that vehicle deliveries are not running on schedule and therefore most of the fleets in the program have not yet acquired the vehicles specified in their agreement with SDG&E. Utility staff continue to follow up with sites from previous years to determine if they have acquired more vehicles.

Figure 224. SDG&E PYDFF Program Comparison of Verified Vehicles to Long-Term VAP



During site visits, the Evaluation Team reviewed charge management capabilities and electrical infrastructure, discussed future vehicle/equipment replacement plans (including future vehicle adoption) and public funding sources, and investigated whether fleets had an interest in on-site solar and/or battery storage. Site visits allowed the Evaluation Team to obtain direct feedback from the

individuals involved with operations and to identify EVSP points of contact to obtain charging session data.

The Evaluation Team noted some challenges this year across sites. Site staff reported maintenance, service, and reliability issues with both nascent and established vehicle and charging equipment manufacturers. Multiple fleets managers expressed feelings of uncertainty around the reliability of their charging equipment and inability to schedule load management in a sustainable and effective manner. Although the delivered vehicles performed well, fleet managers expressed uncertainty about the ability to go fully electric when other heavy-duty vehicles such as dump trucks will be required to transition to ZEVs.

Despite these challenges, multiple sites explicitly noted that their communication with SDG&E program staff was excellent, and that they felt they had been equipped with the tools and context needed to understand their site's progress through the PYDFF program. Similarly, site staff consistently cited their vehicles' low noise and high performance.

The following section provides a summary of key observations and data collected during site visits.

Common Site Visit Findings Across Utility Programs

Logistics providers were a large contingent of the program's EY2024 activated sites that the Evaluation Team visited this year, representing MDHD vehicles. Dealership sites began to appear across Utility programs; these typically have low charger utilization, unless the dealership also operates a leasing service, in which case the leased vehicles and chargers are used regularly. National fleets also were more evident across the state in EY2024 than in previous years.

An interesting finding was that several sites across MDHD programs had a significant amount of light-duty charging. This stems from a variety of reasons including public access, logistics services in which the sites support any client vehicle needs, and use of LDVs to make up for limited availability or reliability of medium-duty vehicles.

Several vehicle manufacturers have filed for bankruptcy recently. This affects operators of transit bus, school bus, medium-duty vehicle, and heavy-duty vehicle market sectors. Some of these entities are parts suppliers to other vehicle manufacturers, amplifying negative impacts across market sectors.

Many fleets do not review their utility bills, energy use, or charging statistics (from NSPs). Often a site host's finance office receives all the utility bills but does not share relevant information with fleet managers. Therefore fleet managers do not know the costs of their EV operations, the extent to which those costs could be reduced, or how those costs compare with conventional fleet vehicle costs.

Medium-Duty Vehicle

In EY2024, the Evaluation Team conducted site visits to four medium-duty vehicle sites, encompassing 17 L2 ports and 26 DCFC ports and 671 kW of installed capacity. These sites operate a diverse variety of vehicles: EY2024 sites include Class 2 pickup trucks, as shown in Figure 225, cargo vans, and package delivery trucks.

One site has experienced difficulties with its selected EVSE vendor, reporting that chargers had questionable reliability and the manufacturer's follow-up service was unsatisfactory. Chargers installed at the site in Figure 226 were an older generation not intended for the vehicle type ultimately put into use, and interoperability testing had not been conducted on the site's specific pairing. This manifested in the common issue of scheduled sequential charging failing to initialize as expected. Additionally, at one point, one of the site's charging power cabinets became stuck in a potentially energized state, with its internal fans running constantly, leading to the shutdown of the entire station.

Figure 225. SDG&E PYDFF Program Medium-Duty Vehicle



Figure 226. SDG&E PYDFF Program Site Overhead Low-Power DCFC Charger



Despite the site communicating the problem to the charging manufacturer, the issue was only addressed on an unrelated manufacturer visit to the site with direct intervention from the fleet manager. Other sites in previous evaluation years have reported similar issues with this manufacturer's post-sale service and maintenance. Overall, the project took longer than expected, with the site experiencing an infrastructure lag of approximately six months between the delivery of vehicles and the completion of the charging infrastructure. Some vans destined for this site were moved to a nearby location with the ability to charge them. Some vehicles, which sat unused for an extended period of time needed to be jump started due to drained 12 Volt batteries, though at the time of the site visit, all of these issues had been resolved. The site also expressed a desire for access to a central visualization showing the status of its operating vehicles and chargers, as the fleet manager was aware of an increase in the site's electric bill but lacked a way to understand and manage the electrical load from either the

vehicle or charger side. However, the site notes that vehicles have been performing as expected and that drivers are satisfied with their capabilities, range, and capacity.

Another site noted the ease of working with SDG&E on installing two DC Fast chargers (DCFCs) at its location, stating that while the charging units have not seen substantial use, the procurement and installation process was overall fairly streamlined. Figure 227 shows the transformer and meter pedestal at the site.

Figure 227. SDG&E PYDFP Program Site Transformer and Meter Pedestal



However, the fleet manager did say that the vehicles they procured had inadequate range for most of their clients' duty cycles, reducing the overall number of electrified miles directly enabled by the program. The chargers at the site will be used to support additional vehicles deployed at a nearby affiliated rental and dealership business, which is likely to improve the overall number of electric miles. While the site's chargers are currently access-controlled to allow charging from only a limited selection of vehicles leased and purchased through the dealer, the chargers will ultimately be available to any fleets utilizing the dealer's lease program, fleet owners who purchased vehicles from the affiliated dealership, and potentially third-party vehicles outside the sales and leasing network.

The third site has significant medium-duty vehicle deployment, with a mixture of both L2 and DCFC chargers serving medium-duty fleet vehicles. The site experienced some issues with its infrastructure delivery and installation, as the switchgear order took longer than expected to arrive and staff turnover at the EVSP increased the time between issue reporting and EVSP response when issues arose. To mitigate this, the site procured portable solar-supplemented chargers (BEAM EV-ARC units) to charge its vehicles while the permanent chargers were being installed and commissioned. Commissioning also presented issues requiring a two-to-three month wait after chargers were first energized to complete the process. Additionally, DCFCs were installed at a narrow facility entrance, causing extended-length vehicles to partially block ingress and egress to their site during charging. As such, the site is considering either relocating its chargers (or adding new DCFCs) to the rear of the site to allow for additional access

by HD BEVs, such as dump trucks, loaders, and other heavy equipment. The L2 units are more than adequate for the site's typical overnight charging patterns, but the DC chargers are frequently used for more immediate charging needs over the course of a vehicle's typical duty cycle. At the time of the site visit, the load management functionality built into the chargers was not being used to reduce charging power during the highest-cost hours of the day, resulting in a significant spike around 5 p.m. when vehicles return from their duty cycles.

Highlights

- The Evaluation Team visited all four medium-duty sites that were activated in EY2024, accounting for 17 L2 and 26 DCFC ports with nearly 700 kW of installed charging capacity.
- At the time of the site visits, two sites were in the process of ramping their chargers to full usage, with vehicle deployment expected to continue through 2025.
- MDHD sites experienced several issues with Utility communication during construction, with two of the four sites reporting delays with installation (both procurement and commissioning), resulting in vehicles arriving before chargers were installed. One site installed a temporary charger, while the other relocated or idled vehicles until chargers were deployed.
- Multiple fleets managers expressed feelings of uncertainty around the reliability of their charging equipment and inability to schedule load management effectively.
- Despite challenges, multiple sites explicitly noted that SDG&E communication was excellent.

Deep Dives

The Evaluation Team conducted deep dives in EY2024 for two sites in the PYDFF program. The Evaluation Team selected deep dives from sites completed in 2023 that had significant demand, energy consumption, or installed charging capacity. The Evaluation Team was also interested in sites with a demonstrated ability to expand charging infrastructure, the presence of load management, unique vehicles or charging equipment, a large fleet size, and a fleet manager who was willing to participate in the deep dive process.

The two sites selected were a regional public transit agency operating 40-foot electric transit buses and a school district operating Type C and D electric school buses. The Evaluation Team conducted in-depth fleet manager interviews and analyzed AMI and EVSP data as part of the deep dives. During fleet manager interviews, the Evaluation Team requested permission to conduct fleet driver surveys and received responses from one of the participating fleets.

Findings presented in this section are based on the fleet manager interviews and data analysis. The *Appendix A. Deep Dives* section presents more-detailed case studies on both of these fleets.

Transit Bus Site

The Evaluation Team selected a transit operator with multiple discrete sites because of the site's plans for expanding electrification at its locations, unique charging hardware, and excellent load management given its high electrical usage.

As of December 31, 2024, the operator had 11 electric 60-foot transit buses, with 12 additional 40-foot buses expected in 2025. The operator charges the vehicles using 24 top-down pantograph EVSE, powered by eight Heliox 180 kW power cabinets (with each power cabinet supplying three chargers). Charging primarily takes place in two shifts—one during normal operations, and one overnight. Since mid-2024, the site has been using BP Pulse software and active load management to reduce energy consumption between 4 p.m. and 9 p.m. to less than 10% of total consumption. The fleet is scheduled to add three charging islands and 78 electric buses in 2031.

The fleet manager expressed that in general their vehicles function as expected, but mentioned that the vehicles' range is a limiting factor that forces the buses to charge midday to complete their routes. The fleet manager also noted their appreciation for the modularity of the battery packs on the newer buses, which allow them to replace smaller portions of their batteries rather than the entire "string" of cells in the event of an issue.

Overall, the fleet manager said that their electric buses reduced operating costs by between \$0.20 and \$0.50 per mile. The site is also able to generate LCFS credits from its usage of renewable electricity under California's Direct access program and has chosen to stockpile credits in the wake of a decline of credit value on the LCFS spot market.

Using the lessons learned from this site, the fleet has elected to replicate many of the structural elements (such as gantry, overhead charging, and bus models) at future sites. The next site planned for electrification will include 30 overhead pantographs and supporting Heliox cabinets.

School Bus Site

The Evaluation Team selected a school bus site for a deep dive due to its variety of vehicles, V2G charging setup, and plans for expansion in the coming years.

As of December 31, 2024, the site operated 13 EVs: three Type C Bluebird Visions with V2G capability and 10 Type D IC Bus CEs without V2G capabilities. The vehicles have largely been able to fulfill their duty cycles, though the fleet manager noted that at times, software updates and patches to either the vehicles or chargers have caused miscommunications between the vehicles and chargers that prevent vehicles from charging until the software issues are resolved.

The vehicles charge on a combination of units—12 Nuvve V2G-capable L2 units and three V2G-capable DCFC Rhombus units—all running Nuvve Fleetbox software. The Rhombus chargers are specifically meant to charge the Bluebird buses as a primary usage and to top off or opportunity charge all the buses as a secondary usage. The Fleetbox software can report data and status, which it transmits to a third-party agency working with the site to analyze vehicle operations as part of a larger project. However, the site has mentioned that this data is difficult to get from the third-party agency. The site also highlighted that the load management is nonfunctional on their side via the NSP, which provides only the times the vehicles are connected and disconnected from the charger. However, Nuvve is actively working on adding functionality to its L2 chargers that will allow them to be load-managed.

The site is one of only a few sites in the PYDFF program with V2G functionality. The fleet manager estimated that in the summer of 2024, the vehicles had been able to discharge back to the grid six times during ELRP events. However, they also discovered some quirks with the vehicles. The buses periodically experienced multiple back-to-back ELRPs. Vehicles participating in ELRP events also required 30% to 60% of their batteries' to be available to accommodate shifts energy during events. Therefore, vehicles that were fully charged would occasionally need to be driven before ELRP events to discharge the battery enough to participate in the events. The site also encountered issues with buses not automatically changing back to charging mode from dispensing mode.

This site purchased its IC Bus vehicles from a dealership in Southern California, which offers vehicle support via maintenance technicians who patrol the greater San Diego area for rapid response. The fleet obtained the Bluebirds from a different dealership, which offers centralized technicians but support is limited by lack of diagnostic access to the proprietary Cummins powertrain integrated into the vehicle. Site personnel have attended maintenance trainings offered by both dealerships, and received a laptop with diagnostic software to help support the IC Bus vehicles. The site has found that its electric buses require significantly less maintenance than its diesel vehicles but did not provide specific numbers during the interview. Early observations of the vehicles revealed potentially accelerated wear of brakes and tires, but the fleet manager stated that it was too soon to make a concrete assessment of the wear at the time of interview.

Fleet Driver Survey

As part of the deep dives, the Evaluation team surveyed three fleet drivers from a school bus site that participated in SDG&E's PYDFF program to get feedback about their experience driving an EV and using the associated charging infrastructure. Two of the three drivers had begun operating EV equipment for their organization in 2024 and the other had started in 2023.

Training

All three drivers said that they had received on-site training to operate the vehicle. Two drivers reported also receiving training on how to charge the vehicle, a training manual on how to operate the vehicle, and a training manual on how to charge the vehicle. All three said the training was provided by their company. The two drivers who had received the additional training and manuals said they had found the training to be *very helpful* while the other driver found the training to be *somewhat helpful*.

Operational Experience

Drivers provided satisfaction ratings for various elements of operating their EVs.

- **Experience operating the EV:** One driver was *very satisfied* and two were *somewhat satisfied*. Of the two who reported being *somewhat satisfied*, one said the battery drains too quickly while the other said the bus has certain "quirks, [such as] the bus rolling back at a small incline and having to use both feet to proceed."
- **Range of the EV:** One driver was *very satisfied*, one was *somewhat satisfied*, and one was *not too satisfied* with their vehicles' range. The driver who was *very satisfied* reported typically covering 25 to 74 miles per day, and the latter two said they typically covered 75 to 124 miles per day.

- **Experience using the EVSE:** One driver was *very satisfied*, one was *somewhat satisfied*, and one was *not too satisfied*. The drivers who were *somewhat satisfied* and *not too satisfied* both explained that chargers did not always work.
- **Reliability of EV:** Two drivers said the EVs were *very reliable*, while one said their EV was *not too reliable*, specifically because “there are always electrical problems with the bus itself or the chargers, making it an unreliable source of transportation.”

All three fleet drivers stated that refueling their EV was easier than with an ICE vehicle. When asked to compare EVs to ICE buses on driving, two said EVs were easier, and one said they were about the same.

When asked how their job has changed now that they are driving an EV, the most frequently mentioned benefits were *quieter ride/operation* (all three), *better driving experience* (all three), and *less air pollution* (two of three). One driver specifically mentioned that range is now a factor they need to consider. This driver specifically noted that “overall, [the] EV school bus is a better option to use for better air quality and performance. However, range use and charging equipment could use improvement.”

Driver/Fleet Characteristics

All three respondents charge their bus twice a day. All three said they charge their bus in the evening/night, two said in the morning, and one said in the middle of the day.

When asked how long it typically takes to charge their bus enough to be ready for their shift, two drivers said one to three hours, and the other driver said three to five hours. When asked how long it typically takes to fully charge their bus, two drivers said three to five hours, and the other driver said more than seven hours.

Highlights

- Both fleets have found their vehicles to be adequate in terms of reliability and said they planned for significant expansion within the next several years.
- One fleet has found significant success working with its NSP to avoid consuming energy between 4 p.m. and 9 p.m.; the other has had difficulty getting load management set up and consumes a much higher percentage of their energy during the highest-cost periods.
- EV maintenance costs were lower than those for diesel vehicles at both sites.
- One site reported experiencing minor issues with both vehicles and chargers after software updates and patches. However, these tended to be short-lived and did not significantly interfere with the vehicles’ duty cycles.

Co-Benefits and Co-Costs

Through deep dive fleet manager interviews, fleet driver surveys, and site visits, the Evaluation Team identified several co-benefits and co-costs associated with the PYDFF program’s vehicle electrification sites as discussed below.

Fleet Manager Surveys

The Evaluation Team did not receive survey responses for this year.

Deep Dive Fleet Manager Interviews

The Evaluation Team conducted deep dive interviews with two SDG&E fleet managers to assess the co-costs and co-benefits of transportation electrification for fleets and fleet drivers. During the interviews, fleet managers noted two primary costs:

- **Limited vehicle range.** Both fleet managers noted that their buses require midday charging, which has varying levels of impact on their duty cycles. The transit fleet must remove a bus from service for multiple hours for charging, effectively reducing the size of the fleet at that time. The school bus fleet's vehicles can leverage the midday downtime inherent to their duty cycle, which provides a more convenient opportunity for charging sessions.
- **Lack of charging management capability.** One fleet manager noted that they lacked control over their chargers and were unable to implement load management on their own. This led to a high proportion of consumption during the 4 p.m. to 9 p.m. period, which increased charging cost and reducing charging flexibility. The site's NSP is actively working to set up the fleet's chargers to allow for automated load management.

Fleet managers also cited significant benefits from electrifying their vehicles, including a reduction in per-mile maintenance costs, additional power and torque from the vehicles, and the generation of LCFS credits to sell later. Both fleet managers the Evaluation Team interviewed had overall positive experiences with the PYDFF program, with both fleets maintaining reliable operations throughout the deployment process, and, in both cases, plan to continue expanding their electrification efforts.

Fleet Driver Surveys

The Evaluation Team fielded surveys with participating fleet drivers to examine co-costs and co-benefits as part of the deep dive effort and received three responses from one fleet. All three drivers reported a *quieter ride/operation*, especially when idling, *less air pollution*, due to less fumes/exhaust from combustion engines, and a *better operating experience*, because the EVs have "more power" and are "better at handling hills" than ICE buses. When asked for other benefits, one driver said that the buses can remain on at drop zones instead of needing to be turned off, like ICE buses. Another driver said the bus has "instant torque" and offers a "fun ride."¹²⁰ While two drivers had concerns with the buses, specifically related to range and *unreliable charger operations*, the third driver did not have any concerns with the buses.

¹²⁰ The third driver did not provide additional benefits.

Highlights

- Two interviewed fleet managers expressed limited vehicle range and lack of load management capability as co-costs. They noted a reduction in per-mile maintenance costs, additional power and torque from the vehicles, and the generation of LCFS credits as co-benefits.
- All three surveyed fleet drivers reported a *quieter ride/operation* and a *better operating experience* than with ICE buses.

Site Costs

The Evaluation Team conducted a cost analysis of 23 EY2022, EY2023, and EY2024 sites with fully closed out finances as of December 31, 2024. The set of fully closed out sites is smaller than the set of activated sites because of the time required to perform tasks such as collecting receipts, paying invoices, and securing administrative approvals. Additionally, rebate costs are only reflected in this report once they have been fully processed by the Utility. The 23 sites comprised 10 school bus sites, eight medium-duty vehicle sites, three transit bus sites, one truck stop electrification site, and one airport GSE site. Sites had installed a mix of L2 and DCFC ports and averaged 12 ports and 383 kW of installed capacity per site in the program to date.

Figure 228 shows the distribution of site-level costs of the 23 sites. The horizontal lines of the boxes show the 25th, 50th, and 75th percentile of sites; the “x” represents the mean site cost; and the three panels are defined as follows:

- **Utility Infrastructure Costs.** Actual site costs borne by the Utility for TTM and BTM (or BTM incentive if infrastructure is customer owned).
- **Ratepayer-Funded Costs.** Site costs paid for by the Utility, including actual TTM, BTM (or BTM incentive if infrastructure is customer owned), and estimated EVSE rebates.¹²¹
- **Estimated All-in Costs.** Full costs of installing the site when summing costs borne by the Utility and customer. Costs include actual capital and labor costs for TTM,¹²² BTM, and EVSE.¹²³

¹²¹ Ratepayer-Funded Costs are the same as Utility Infrastructure Costs with the addition of the EVSE rebates.

¹²² The Utility pays 100% of the TTM costs and therefore TTM costs are actuals.

¹²³ Since the full, actual EVSE cost is not known by the Utility, the Evaluation Team estimates EVSE equipment costs using an assumption of \$3,000 per port for L2 ports and \$45,000 per port for DCFC ports.

Figure 228. SDG&E PYDFF Program Per-Site Costs Organized by Three Perspectives, Across 23 Closed-out PTD Sites

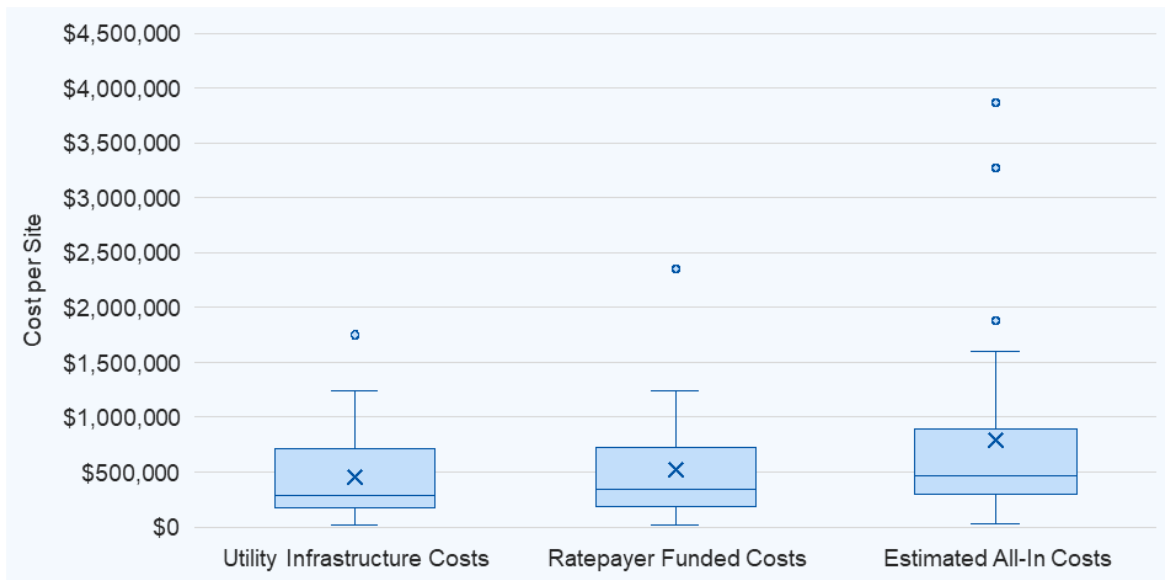


Figure 229 shows average per site all-in costs for the 23 sites. EVSE has the largest cost across the sites, followed by BTM, then TTM. Together, the average estimated all-in TTM, BTM, and EVSE cost is \$890,741 PTD.¹²⁴

Figure 230 shows the distribution of utility infrastructure costs (corresponding to the far-left panel in Figure 228) presented per site, per vehicle, and per kilowatt. The average Utility infrastructure cost of TTM and BTM borne by SDG&E PTD across sites was \$455,777 per site,¹²⁵ \$24,262 per vehicle, and \$2,135 per kilowatt.¹²⁶ Although not shown, 46% of the SDG&E PYDFF program spending on infrastructure for financially closed out sites to date has been on DAC sites, exceeding the 30% program target.

Figure 229. SDG&E PYDFF Program Average Estimated All-In Costs, Across 23 Closed-out PTD Sites

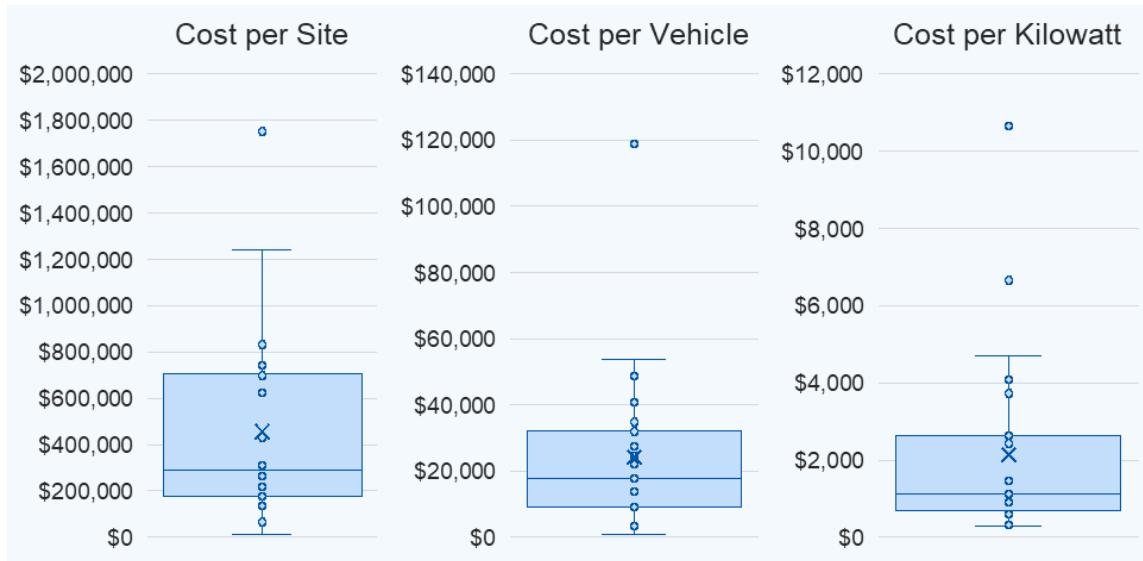


¹²⁴ Calculated by summing all TTM, BTM, and EVSE costs borne by SDG&E and the customer, then dividing by 23 sites. BTM costs for the six customer-owned sites are synthesized using cost curves generated by all Utility-owned BTM sites.

¹²⁵ Calculated by summing all TTM and SDG&E-sponsored BTM costs and dividing by the number of sites. Number reflects maximum infrastructure rebate offered for sites that have not yet applied for rebates, which may vary significantly from actual infrastructure rebate amount paid.

¹²⁶ Calculated by summing all TTM and SDG&E-sponsored BTM costs and dividing by the sum of installed capacity.

Figure 230. SDG&E PYDFF Program, Utility Infrastructure Cost per Site, per Vehicle, and per Kilowatt for 23 Closed-out PTD Sites



Highlights

- All-in costs paid by the customer and SDG&E vary widely between sites, with an average of \$890,741 PTD per site.
- The average cost of SDG&E-sponsored TTM and BTM across sites PTD was \$455,777 per site, \$24,262 per vehicle, and \$2,135 per kilowatt.

Grid Impacts

This section describes grid impacts for the PYDFF program based on an analysis of energy consumed and customer bills by operational charging stations installed through the program in EY2024.

Data Sources

The primary data source used for the analyses detailed in this section is the energy usage-related data provided in regular 15-minute intervals from the AMI. Other data sources include customer bills, LCFS program information, and charging session-specific data provided by NSPs. There are several important differences between AMI and NSP data. While AMI data only provides energy usage, NSP data also includes session start and stop time, the duration of a vehicle's connection to a charging port, the duration of a vehicle actively pulling power, and the specific port used for a session. AMI meters track standing loads (such as those the EVSE uses for communications, cooling, active power converters, solenoids, and screens), which NSPs typically cannot do. In instances where AMI data is missing from the dataset, the Evaluation Team uses NSP data to fill the gaps.

Summary of Grid Impacts

Table 117 presents the estimated PYDFF program grid impacts.

Table 117. SDG&E PYDFF Program Grid Impacts

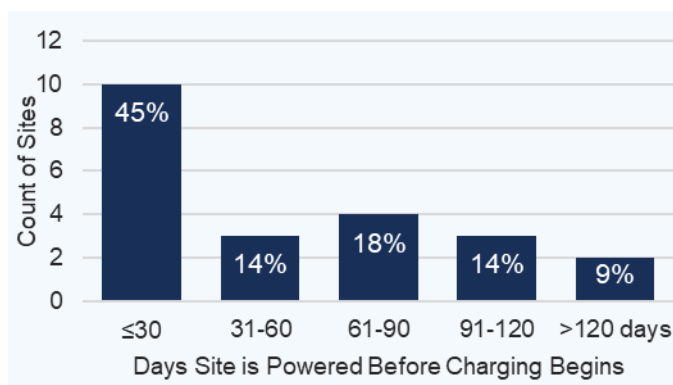
Impact Parameter	Actual 2024	PTD Actual	10-Year Projection PTD
Operational Sites	4	25	25
Installed Capacity (kW)	671	9,213	9,213
Electric Energy Consumption, MWh			37,037
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)			N/A
Maximum Demand, kW (with date and time)	1,781 (2/9/24 9:30 a.m.)	1,781 (2/9/24 9:30 a.m.)	N/A
Maximum On-Peak Demand, kW (with date and time)	1,157 (5/1/24 5:30 p.m.)	1,157 (5/1/24 5:30 p.m.)	N/A

Energy Trends

Site Startup

The Evaluation Team examined the duration between PYDFF site activation and operational status to illustrate the timing relationship between readiness of charging infrastructure and actual vehicle charging. AMI data demonstrates that over 75% of sites had significant operations within 90 days of activation, as illustrated in Figure 231. However, as shown in the final column, over 20% of sites are not in use at least three months after activation. At least one site may take a full year before any vehicles are delivered and available to charge.

Figure 231. SDG&E PYDFF Program Percentage of Sites by Days between Activation and Operation for PTD Sites



Consumption and Maximum Demand

Figure 232 depicts the growth of SDG&E's monthly energy consumption and maximum demand for all operational sites in the PYDFF program to date. In EY2024 consumption continued to grow while maximum demand was relatively stable.

The PYDFF program sites collectively reached 1.8 MW of demand in early 2024, with installed capacity of 9.2 MW, a modest increase of 0.7 MW. While maximum demand and capacity were relatively consistent compared to 2023, consumption continued to climb consistently with previous years. Maximum demand remained relatively stable throughout much of the year. A drop in July demand aligns with summer when school district bus operation is limited. Nearly half of sites in the PYDFF portfolio are school bus sites, having a significant impact on overall demand. As shown in Figure 232, demand returned to pre-summer levels in August when schools are back in session.

Figure 232. SDG&E PYDFF Program Monthly Energy Consumption and Maximum Demand

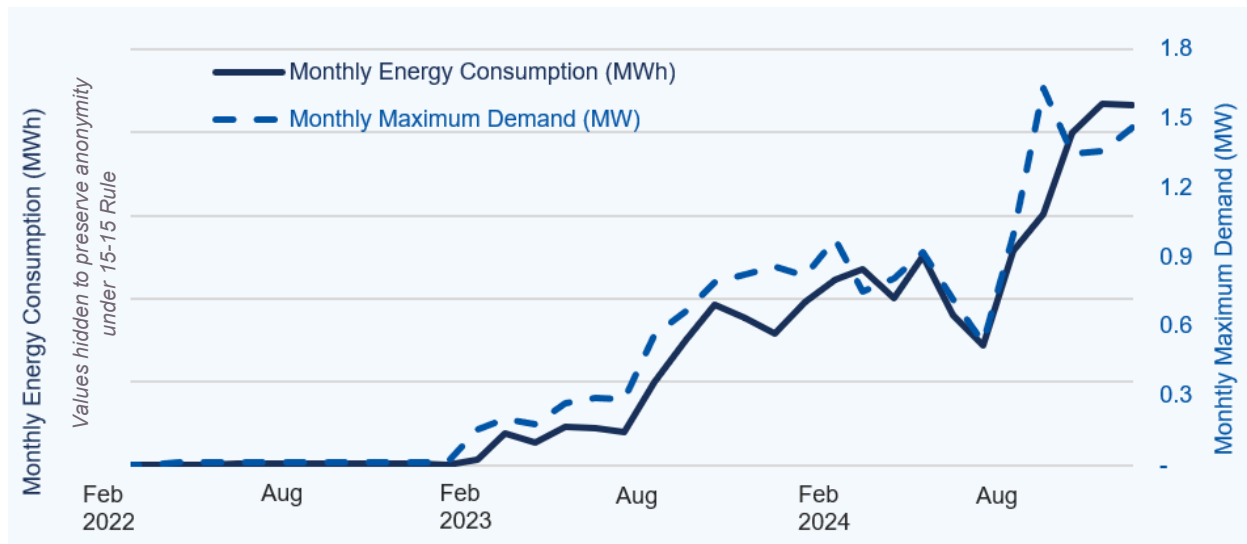
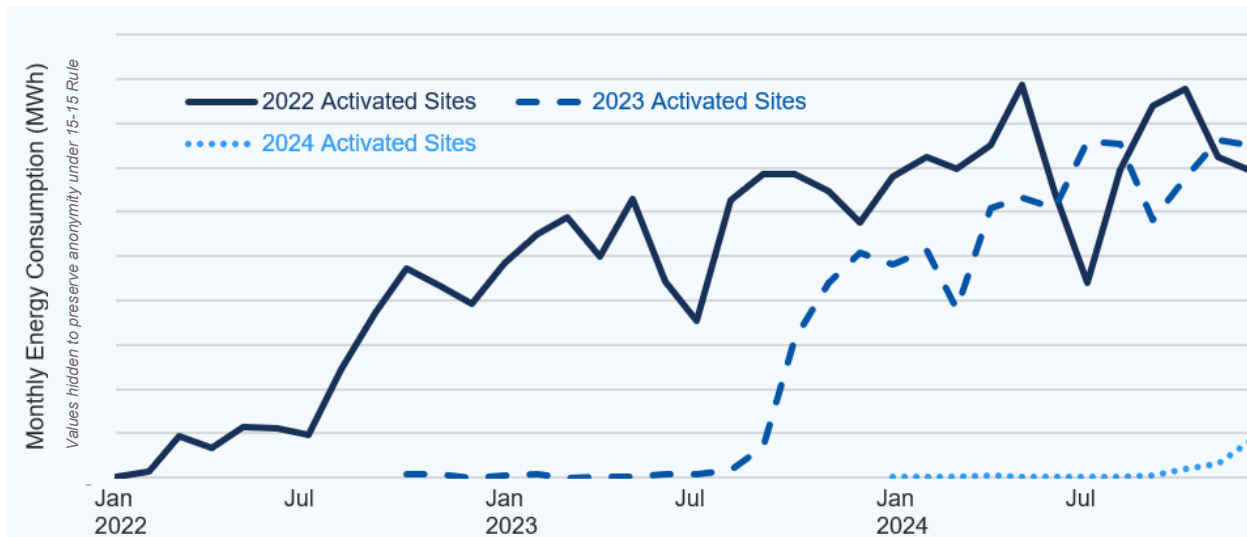


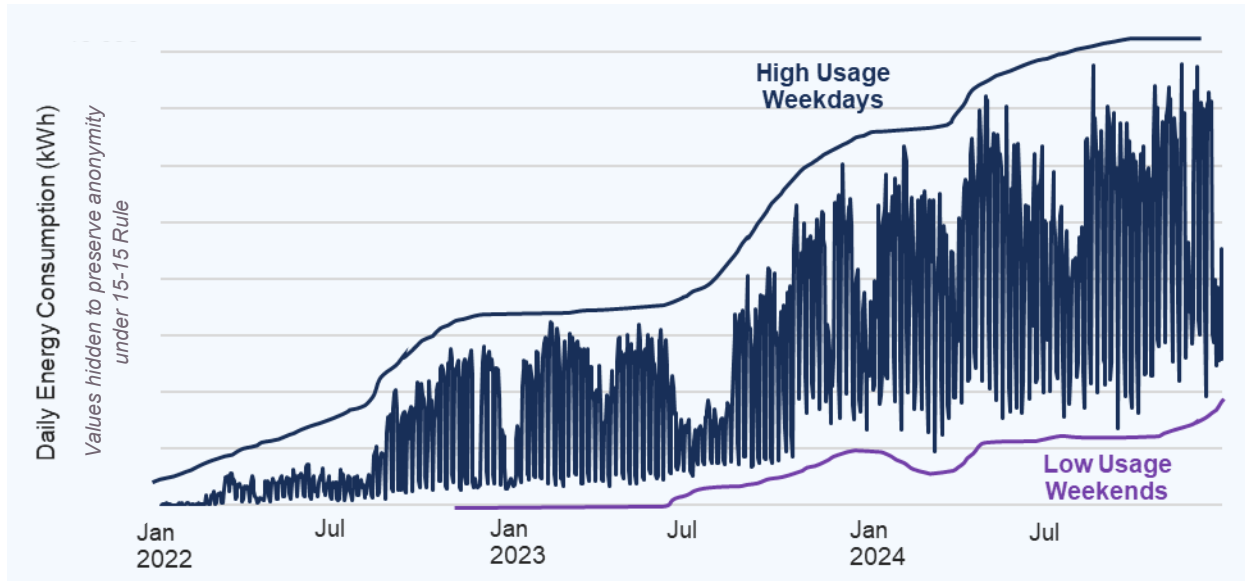
Figure 233 provides insight into monthly energy consumption trends of activated sites by program reporting year. Monthly energy usage of sites activated prior to 2023 continue to show slow growth in monthly energy consumption. The 2024 activated sites plateaued at the end of the year but are expected to grow as their operations mature. Based on the historical trends of activated sites not reaching maturity for 12 to 18 months, monthly energy use of sites activated in 2024 is likely to continue to increase throughout 2025.

Figure 233. SDG&E PYDFF Program Monthly Energy Consumption of Activated Sites Grouped by Initial Reporting Year PTD



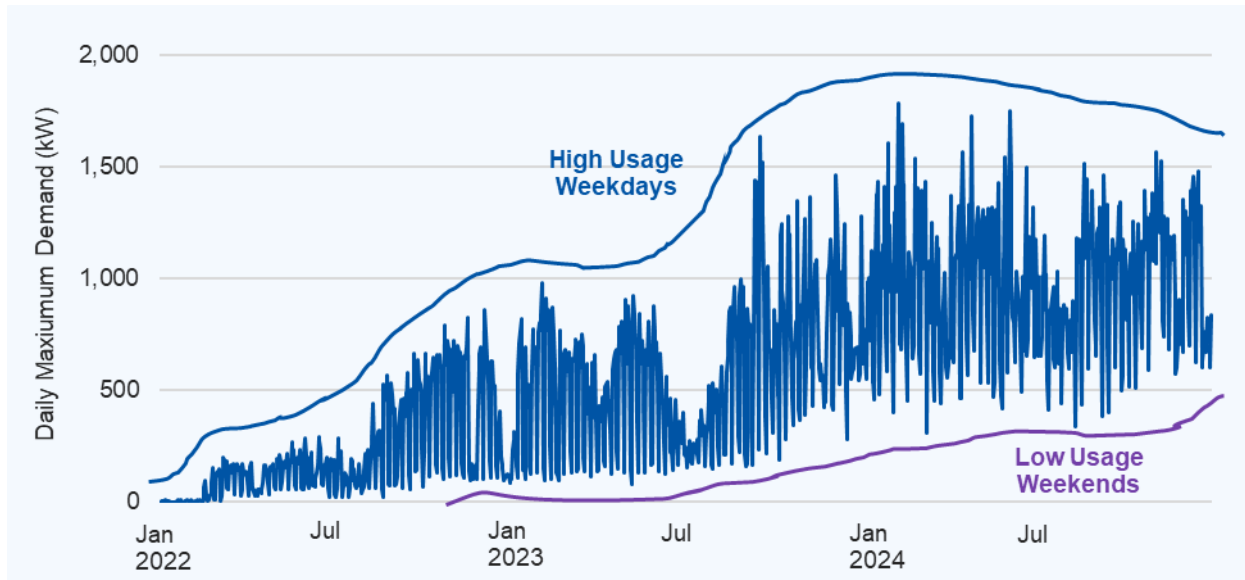
Daily energy consumption and demand across all sites continue to increase. However, there are wide variations in daily energy consumed, as well as consumption between weekdays and weekends as shown in Figure 234. Maximum daily energy fluctuated between 10 and 20 MWh toward the end of the year while weekends appear to represent 30% to 40% of the energy consumption of weekdays.

Figure 234. SDG&E PYDFF Program Daily Energy Consumption for PTD Sites



Though maximum demand of nearly 1.8 MW was seen in the first half of year, the second half averaged closer to 1 MW likely due to one or more sites engaging load management to mitigate demand-capacity costs as shown in Figure 235. The maximum demand represents approximately 15% of the 8.6 MW installed capacity.

Figure 235. SDG&E PYDFF Program Maximum Demand for PTD Sites



The final quarter of 2024 exhibited the most consistent consumption (and demand) of the year at over for each group of sites within Figure 233 (above). Figure 236 (below) compares the average weekday and weekend day demand during that quarter. The average weekday for the period reaches near maximum demand at 9 a.m. and again at 9 p.m. when the highest pricing period ends and fleets using

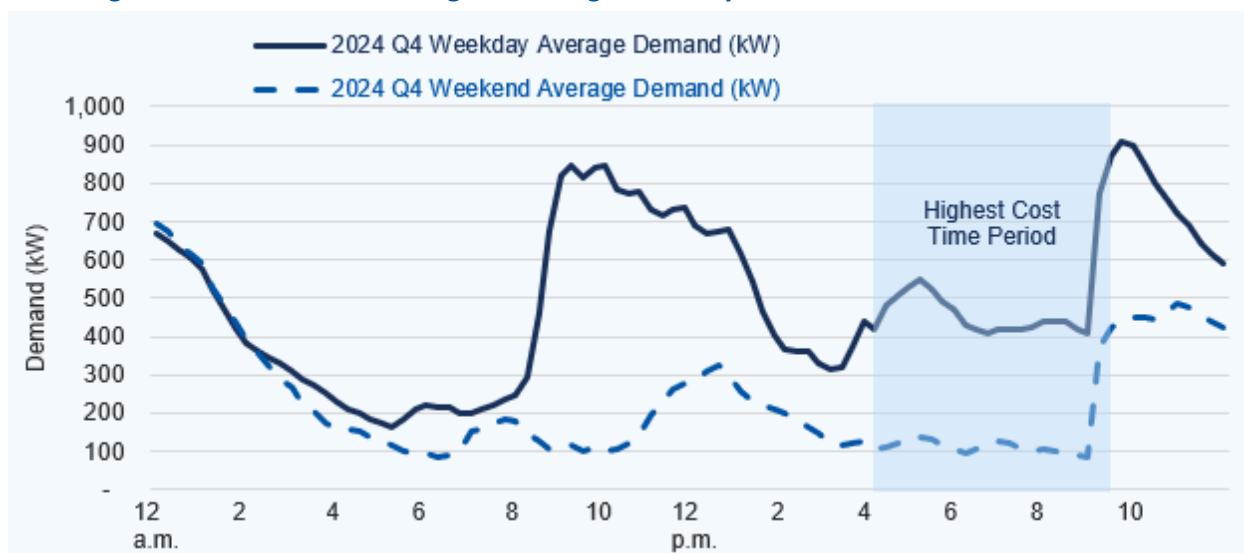
load management start their evening charging. Fleets with load management may be reducing maximum demand between 4 p.m. and 9 p.m. by 50%.

Most fleets exhibit higher consumption and demand on weekdays than on weekends. This is heavily influenced by school buses and delivery trucks which typically have little to no activity on the weekends. However, some fleets, such as transit buses, may also operate on weekends, creating more consistent demand.

There is evidence of load management during both weekday and weekend operation, evidenced by demand spikes beginning at 9 p.m., though average load is 35% to 50% lower on weekends than on weekdays. The load starts ramping down after 9 p.m., continues through midnight and is at minimum around 5 a.m. Fleets resemble this on Saturdays (reflected in the average weekend load) completing recharging from Friday operations. Sundays (not pictured) have further reduced demand at night and throughout the day.

School bus fleets' operation inherently makes charging availability midafternoon when utility costs and often energy emissions are lowest. For other types of fleets, the weekends may provide an opportunity they otherwise do not have to charge during Super off Peak from 10 a.m. to 2 p.m. Load management can enable this opportunity, especially given significantly increased charging flexibility for many fleets that have all weekend to charge before Monday instead of just overnight.

Figure 236. SDG&E PYDFF Program Average Weekday and Weekend Q4 2024 Load Curves



Load Management and Charging Flexibility Analysis

This section describes analyses around load management and charging flexibility. Load-managed sites are those that adopt techniques to avoid charging vehicles during periods of peak energy prices. The analyses consider sites to be load-managed if they exhibited consistent or long periods of load management during the year regardless of when load management was implemented during the year; otherwise, they are labeled as non-load-managed.

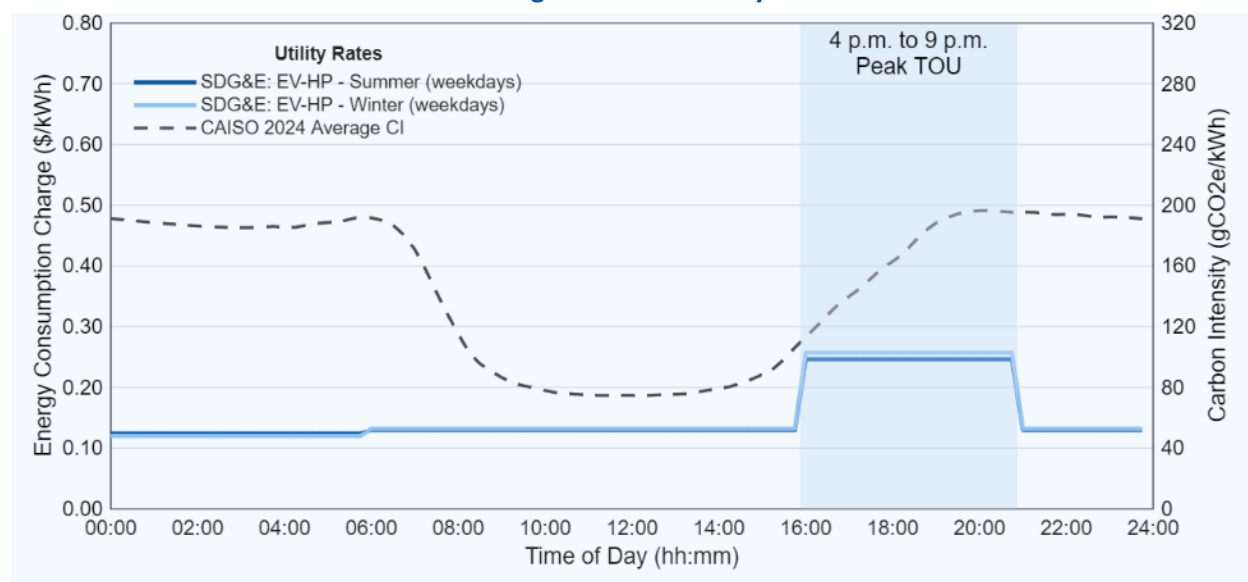
SDG&E's on-peak TOU period occurs each day from 4 p.m. to 9 p.m. During those peak hours, energy costs in 2024 for sites under the EV-HP rate structure in SDG&E's PYDFF program were approximately \$0.25/kWh and were half that during all other time periods (off-peak TOU rates were \$0.13/kWh and super off-peak rates were \$0.12/kWh, with only slight differences for summer and winter periods). Figure 237 displays these TOU rates as they apply to summer and winter weekdays for SDG&E EV-HP. In many cases, lower-cost TOU periods correlate with relatively lower carbon intensity of the grid, as indicated by the dashed line in the figure, which shows the CAISO 2024 average carbon intensity (gCO₂e/kWh). As the actual carbon intensity of the grid varies continuously by time of day and day of year, this reference line indicates the time-of-day average across all days in 2024.

What is Load Management?

Load Management is an effort to control vehicle charging for several purposes:

- Mitigation of electricity costs through time-of-use periods or demand (rate of consumption)
- Participation in special programs (Demand Response or California LCFS)
- Compensation for limited electrical capacity

Figure 237. SDG&E PYDFF Program Hourly TOU Electricity Rates and Average Carbon Intensity in 2024



The Evaluation Team periodically reviews data on a site-by-site basis throughout the year to identify load-managed sites. Visiting sites in person and speaking to fleet managers also provides context around load management intent. When accounting for demand-related costs, charging flexibility can aid in estimating how much more slowly a vehicle can be charged to mitigate and minimize demand.

Of the 26 operational sites, six sites appeared to be using load management throughout EY2024, in comparison to only one site that showed consistent load management in EY2023. This was evident in either or both of the following ways:

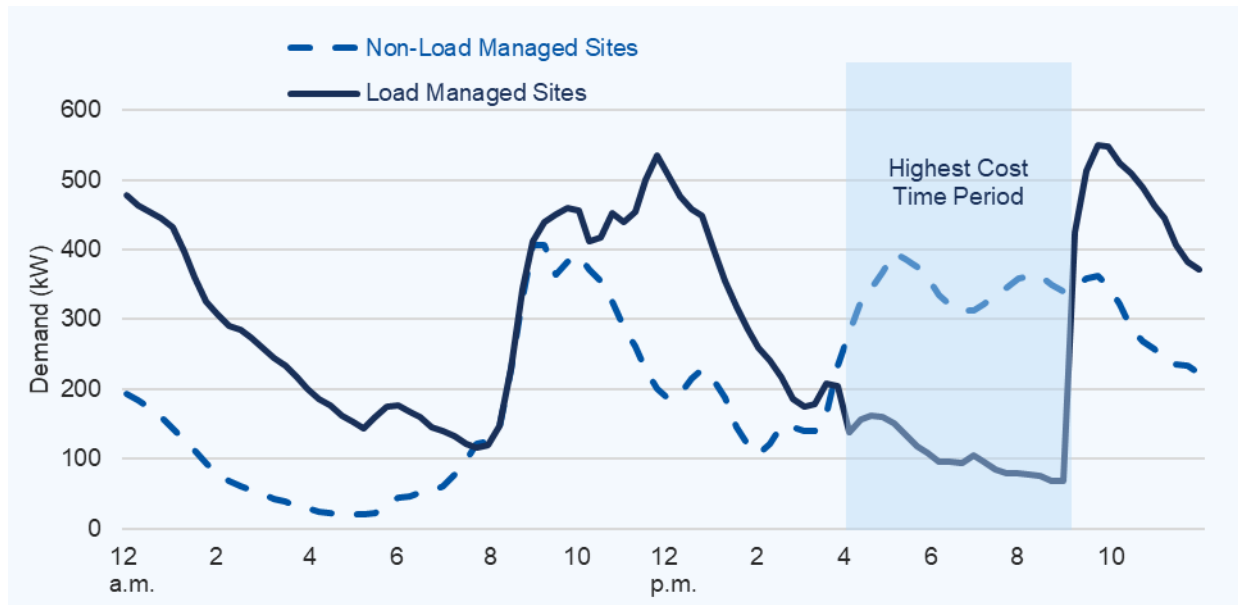
- Load spiked quickly around 9 p.m. after minimal consumption from 4 p.m. to 9 p.m.
- The proportion of total monthly energy consumption that occurred between 4 p.m. and 9 p.m. was often below 20% and sometimes below 5%

The Evaluation Team assessed consumption trends for sites that had implemented load management and those that had not. In general there is a more consistent trend of load-managed sites compared to the previous year with often close to 5% of consumption from 4 p.m. to 9 p.m. throughout 2024. Sites without load management averaged closer to 30% from 4 p.m. to 9 p.m., though individual sites did surpass 50% certain months. As noted in the *Site Visit Findings* section, SDG&E sites represent ecosystems of hardware and software that at least in theory provides load management as an option.

Figure 238 illustrates the differences in electricity demand for load-managed and non-load-managed sites' (determined using consumption data). While the maximum demand is similar, demand trends in different directions for the two groups at 4 p.m., showing that non-load-managed sites have much higher total and proportional energy consumption when energy prices are highest. As detailed further in the *Charging Flexibility* section below, nearly all of this high-cost charging is unnecessary and could be shifted to lower-cost time periods.

Several of these sites showed inconsistent use of load management in EY2024 and some of this is included in the load-managed data where their trends impact the "Load-Managed" load curve. These inconsistencies are due to issues including testing software, vehicle or charging reliability issues, or starting load management mid-year.

Figure 238. SDG&E PYDFF Program Load-Managed and Non-Load-Managed Site Demand, 2024 Q4 (High Consumption and Demand Months), PTD Sites



Charging Flexibility

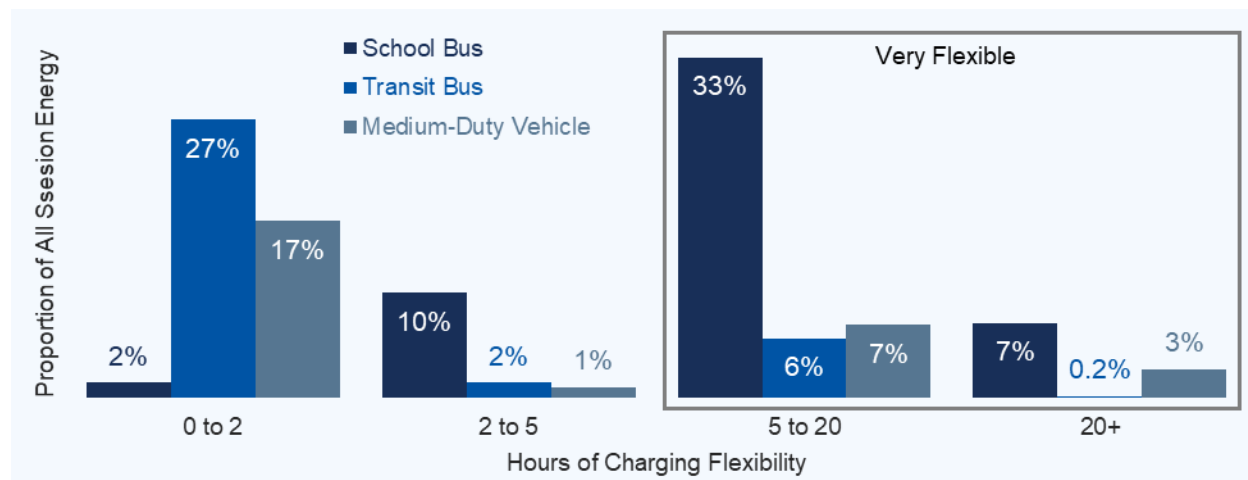
The Evaluation Team used site charging data to determine the amount of time vehicles are connected to a charging port but not actively consuming energy. This allowed the Evaluation Team to assess charging flexibility, or the ability for a vehicle to shift charging from periods of high-cost electricity to low-cost electricity without impacting vehicle operations. This is the amount of time vehicles are connected to a charging port but not consuming electricity.

In addition, site visits allowed the Evaluation Team to confirm vehicles' make, model, and battery size, all of which affect charging flexibility as well as operational characteristics. For instance, many school bus charging sessions use less than half of the vehicle's battery capacity. Providing feedback to operators about historical usage trends like charging session size in relation to battery size and available time to charge may help inform charging plans.

Figure 239 shows the relative charging flexibility of various vehicle market sectors and includes charging sessions that took place partially or entirely during periods of highest cost electricity and omits charging sessions that did not overlap with the period between 4 p.m. and 9 p.m. Each category has significant charging overlap with the highest-cost period, including 52% for school bus, 34% for transit bus and 28% for medium duty vehicle sectors. However, these vehicles have enough flexibility to allow them to shift a proportion of their energy consumption to a lower-cost period. For example, school buses have nearly 40% of their total energy unnecessarily in the highest-cost time period. Medium duty vehicles show close to 10% of charging time that could be shifted, and transit buses show a smaller proportion. Because the period of highest-cost electricity lasts for five hours (4 p.m. to 9 p.m.), a charging session with up to five hours of charging flexibility can fully shift consumption from on-peak to off-peak periods. However, vehicles with less than five hours of charging flexibility (almost 25% of all sessions) will still

benefit from adopting load management by shifting a portion of consumption to periods of lower-cost electricity.

Figure 239. SDG&E PYDFF Program Charging Flexibility for PTD Sites in Sessions Overlapping the Time Period Between 4 p.m. and 9 p.m.



Another form of this type of flexibility analysis could look at daily consumption relative to vehicle-fleet on-board energy storage capacity. For example, if a fleet has 100 kWh batteries but uses 65 kWh daily, the fleet will have a 35 kWh buffer. This stored energy could be used to charge the vehicle on days with extra low pricing or allow the vehicle to charge less on days when the chargers are having technical issues.

Costs and Billing

Previous sections have focused on energy trends and on charging flexibility, identifying that significant charging is taking place from the peak period of 4 p.m. to 9 p.m. and that much of this load could be shifted to periods of lower demand. The following section will examine utility cost and billing trends and identify how sites may reduce costs based on charging flexibility. The Evaluation Team's review of billing data focuses on the average unit cost of a kilowatt-hour for a given site-billing month compared to the TOU-based tariff cost of energy.

A unique component of the PYDFF program is that it includes three school bus sites with V2G capability. The Evaluation Team has not observed that these sites have sent energy back to the grid in EY2024. In the future, evaluation of billing for sites that have participated in energy arbitrage (similar to Net Energy Metering with solar) or special programs (such as emergency load reduction or demand response programs) will be more complex. Additionally, at least one site has solar generation capability; however, the Evaluation Team understands that this generation is metered on a separate account. While this may impact customer fleet behavior, it does not impact the Evaluation Team's billing analysis.

It should also be noted that SDG&E filed a General Rate Case in January of 2023, which included a request to classify the 10 a.m. to 2 p.m. time period as a super off peak period (lowest-cost energy time)

year-round, similar to the rate structure offered by SCE and PG&E.¹²⁷ As of mid-2025, this midday super-off peak period is available only during the months of March and April.

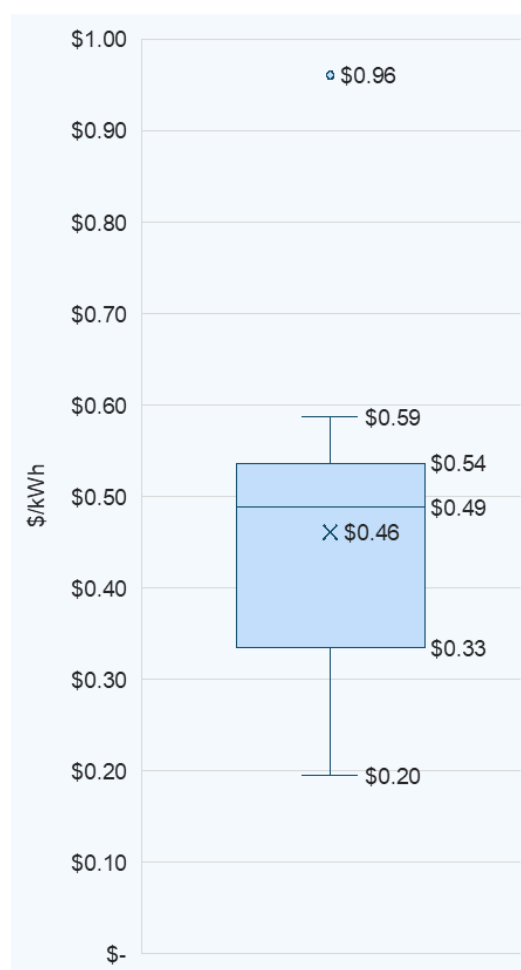
NSPs' load management capabilities and fleets' adoption rate of load management impact costs and energy trends. As of the end of 2024, each of approximately 30 NSPs involved in the PYDFF purportedly offered load management as a service on its platform as either a base offering or tiered-cost package, depending on the provider. However, interoperability between hardware, software, and vehicles presents challenges that can make load management impractical or difficult to implement.

An influential factor in the billing analysis is that many fleet operators are unaware of their energy use and charging costs even though most NSPs make this data available. Often a site host's finance office receives utility bills but does not share information with fleet operators that would enable them to compare energy costs with other fuel types in their fleets. The Evaluation Team uses energy trends as discussion points during site visits if operations have started. Many fleet operators said they had not seen these data trends prior to the evaluation site visits.

Figure 240 shows the distribution of average monthly billing cost per kilowatt-hour for sites in the PYDFF program for which at least six months of billing data was available in EY2024 (n=23). SDG&E base rates range between \$0.12/kWh and \$0.25/kWh, on top of which are added demand capacity bucket fees, services and taxes. Overall, PYDFF sites have an average billing cost of \$0.31/kWh. The best results appear to show monthly billing between \$0.20/kWh and \$0.33/kWh through use of load management to avoid charging from 4 p.m. to 9 p.m.) and limits on peak demand, combined with a high volume of energy consumption. Fleets using load management appear to pay between \$0.27/kWh and \$0.32/kWh, whereas nearly two-thirds of billing months do not show load management and reflect well over average costs.

The following figures are broken out by high, medium and low billing months to better highlight energy and billing trends.

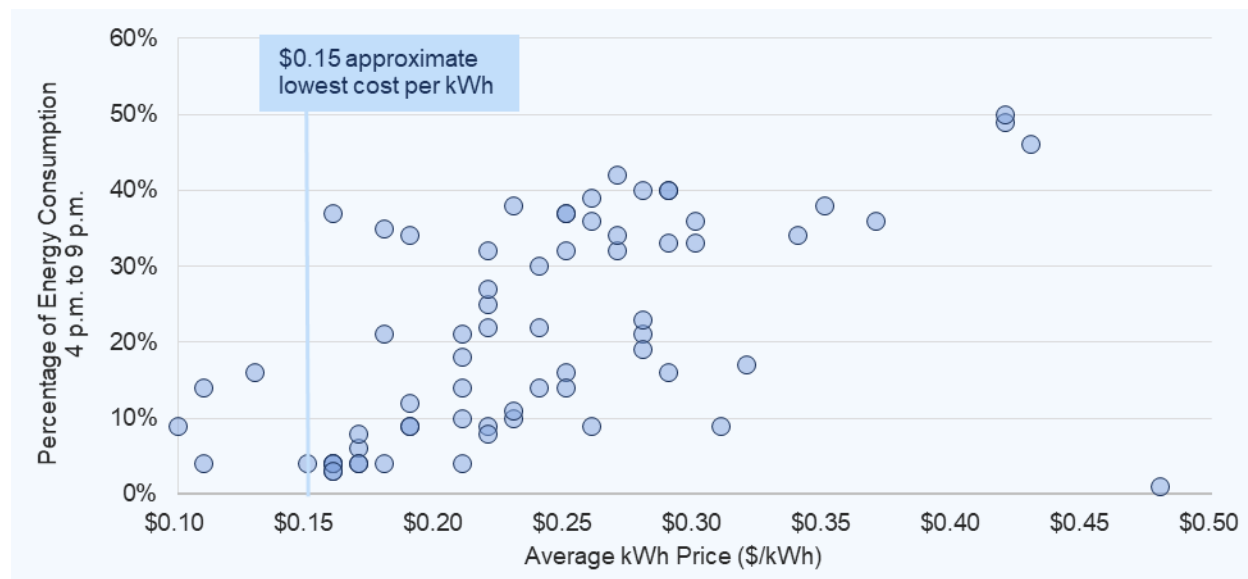
Figure 240. SDG&E PYDFF Summary of Average Monthly Electricity Cost (n=23)



¹²⁷ Application of San Diego Gas & Electric Company (U 902 E) for Authority to Update Marginal Costs, Cost Allocation, and Electric Rate Design: Prepared Direct Testimony. January 17, 2023. [Microsoft Word - 2024 GRC Phase 2 - Chapter 3 \(Rate Design\) \(sdge.com\)](#)

Figure 241 provides a comparison of the average energy price for sites with the largest billing months (greater than 15 MWh) and the proportion of energy consumed during the peak period of 4 p.m. to 9 p.m. High billing months for SDG&E start lower than for the other Utilities for this analysis due to smaller sites overall and many fewer large months than with the other Utilities. As shown, these sites show a trend of higher average cost per kilowatt-hour along with increased proportion of charging occurring between 4 p.m. and 9 p.m.

Figure 241. SDG&E PYDFF Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for High Consumption Billing Months (>15 MWh) for PTB Sites



Plotting the same data by monthly consumption in Figure 242 appears to indicate that sites with the largest billing months receive some of the lowest average unit costs, establishing a base floor of \$0.15-\$0.2/kWh as a target cost for other operators. Large sites that have implemented load management tend to have the lowest cost energy (top left of figure).

Figure 242. SDG&E PYDFF Program Total Monthly Energy Consumed vs. Average Energy Price for High Consumption Billing Months (>15 MWh) for PTD Sites

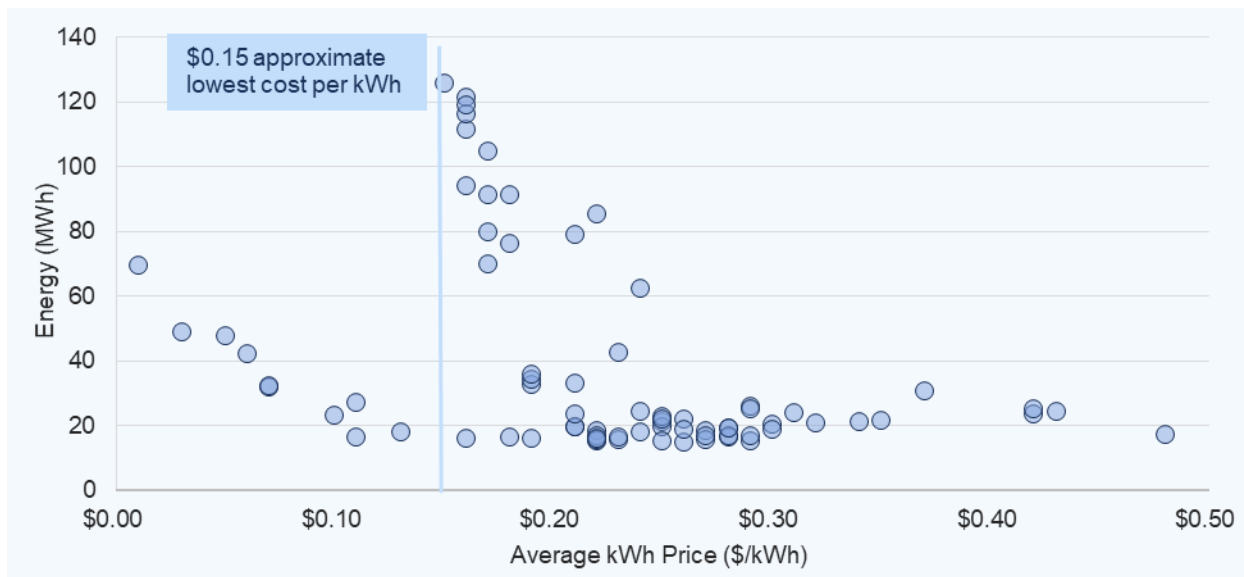


Figure 243 compares proportion of consumption from 4 p.m. to 9 p.m. to average unit of energy costs. Overall this batch of billing months shows fairly low energy usage and costs usually below \$0.35/kWh.

Figure 243. SDG&E PYDFF Program Percentage of Monthly Energy Consumed from 4 p.m. to 9 p.m. vs. Average Energy Price for Medium Consumption Billing Months (5 MWh to 15 MWh) for PTD Sites

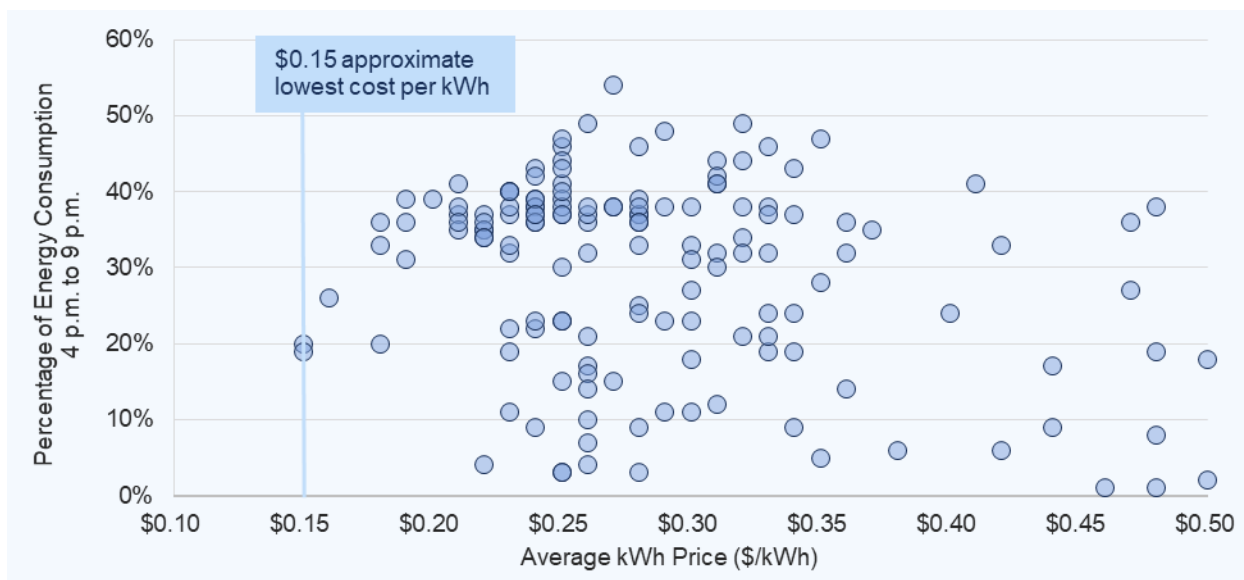


Figure 244 illustrates the relationship between the percentage of on-peak energy consumption and the average monthly customer bills for medium-size monthly consumption from 5 MWh to 15 MWh (each dot represents a month). Figure 244 shows a slight trend of the average cost per kilowatt-hour being inversely related to energy consumption. Higher monthly consumption seems to result in lower average cost. This is possibly due to fixed costs being spread over greater volume, or increased consumption at

lower-cost time periods (that is, other than 4 p.m. to 9 p.m.). Most billing points in this group are between \$0.25/kWh and \$0.35/kWh with a subgroup up to \$0.7/kWh and a few higher outliers.

Figure 244. SDG&E PYDFF Program Total Monthly Energy Consumed vs. Average Energy Price for Medium Consumption Billing Months (5 MWh to 15 MWh) for PTD Sites

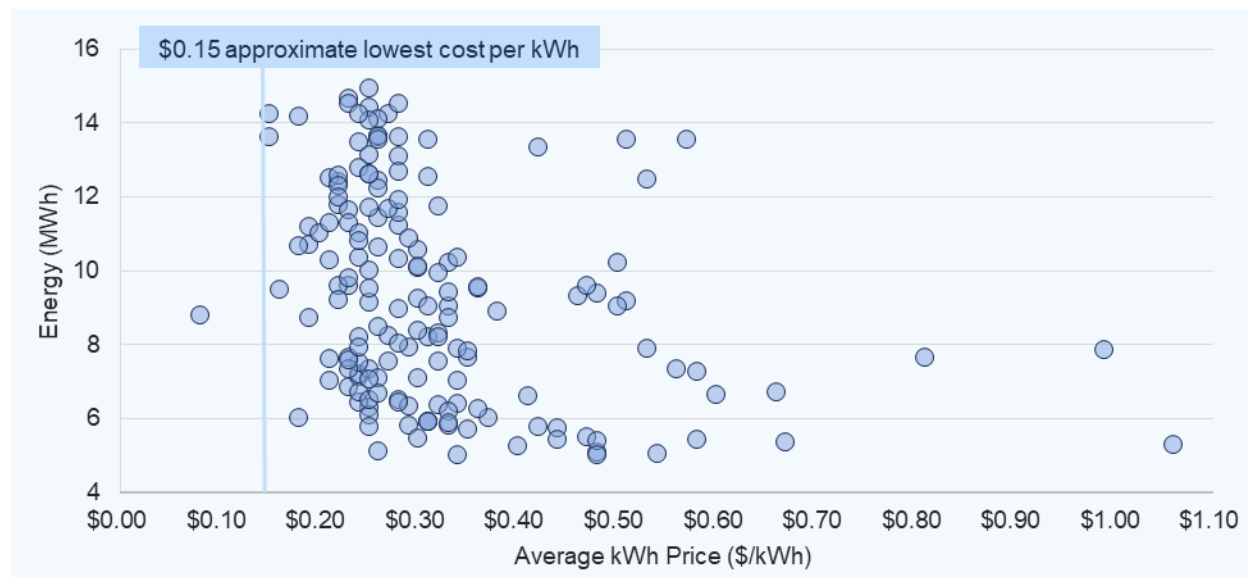
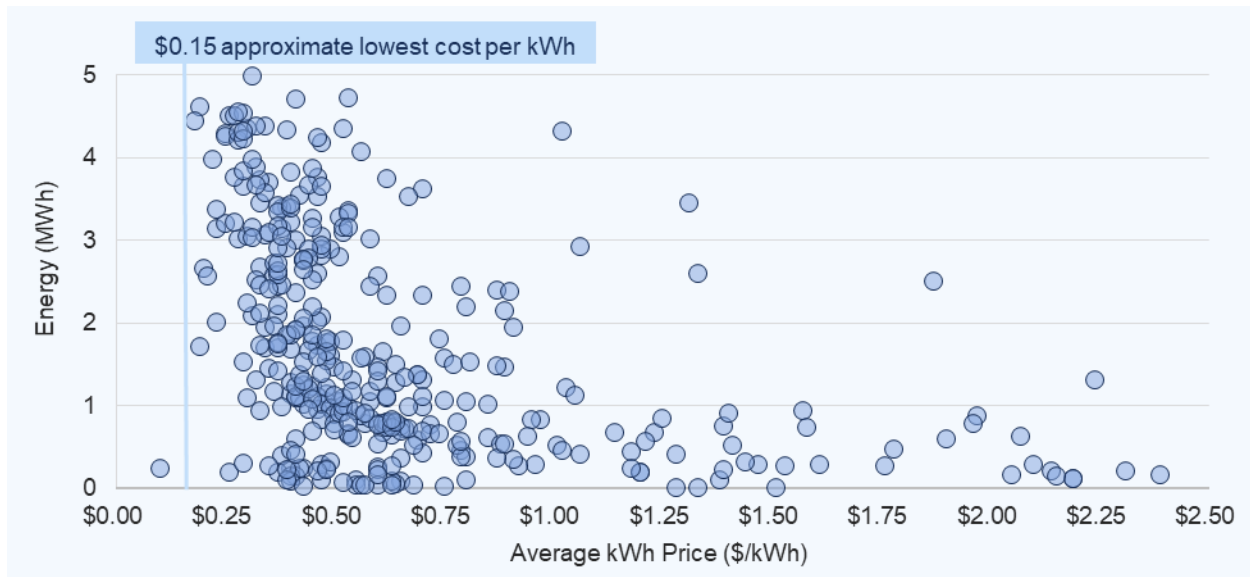


Figure 245 shows that low billing months (<5 MWh) demonstrate an inverse relationship between consumption and average billing prices; higher consumption produces a lower average cost per kilowatt-hour. Conversely, sites with the lowest monthly energy consumption often have the highest electricity costs per kilowatt-hour. This is due to fixed fees, which are spread across the total kilowatt-hour consumed and therefore have a greater impact on sites with lower total consumption. Months with the lowest billing are often early months of site operations, which often consist of charger commissioning activity and/or charger standby load before regular vehicle operations and charging begin.

It should be noted that SDG&E uses capacity subscriptions, meaning that instead of billing demand at a per-kilowatt fee, SDG&E uses increments of either 10 kW or 25 kW allotments and includes overage fees. SDG&E continues to support customers by avoiding overage fees by automatically enrolling customers in the next highest capacity tier to improve customer experience. This has helped to mitigate the overall average unit cost of energy.¹²⁸

¹²⁸ A single site incorporates solar generation on its EV account, and those data points were not included here.

Figure 245. SDG&E PYDFF Program Total Monthly Energy Consumption vs. Average Energy Price for Low Consumption Billing Months (<5 MWh), PTD Sites



Electricity Cost and Emissions Optimization Analysis

This section builds upon the grid impact findings above to include an analysis of hypothetical customer bills and emissions under an optimal load management scenario, assuming perfect load management across all sites. While real-world constraints—such as technology, operations, and education—currently prevent ideal load management, the findings shed light on the long-term potential of load management. To quantify the potential benefits of using load management, the Evaluation Team analyzed observed outcomes of sites with and without existing load management practices and conducted a load-shifting optimization exercise to estimate the total potential cost savings and emissions reductions. This optimization analysis utilizes NSP data, where available, to assess charging flexibility for each site. For sites without sufficient NSP data reported, the analysis uses AMI data and a charging session availability template to assess charging flexibility. The template is derived for each market sectors based on the charging behavior of sites with NSP charging session data within each sector. *Appendix B* provides additional methodological notes.

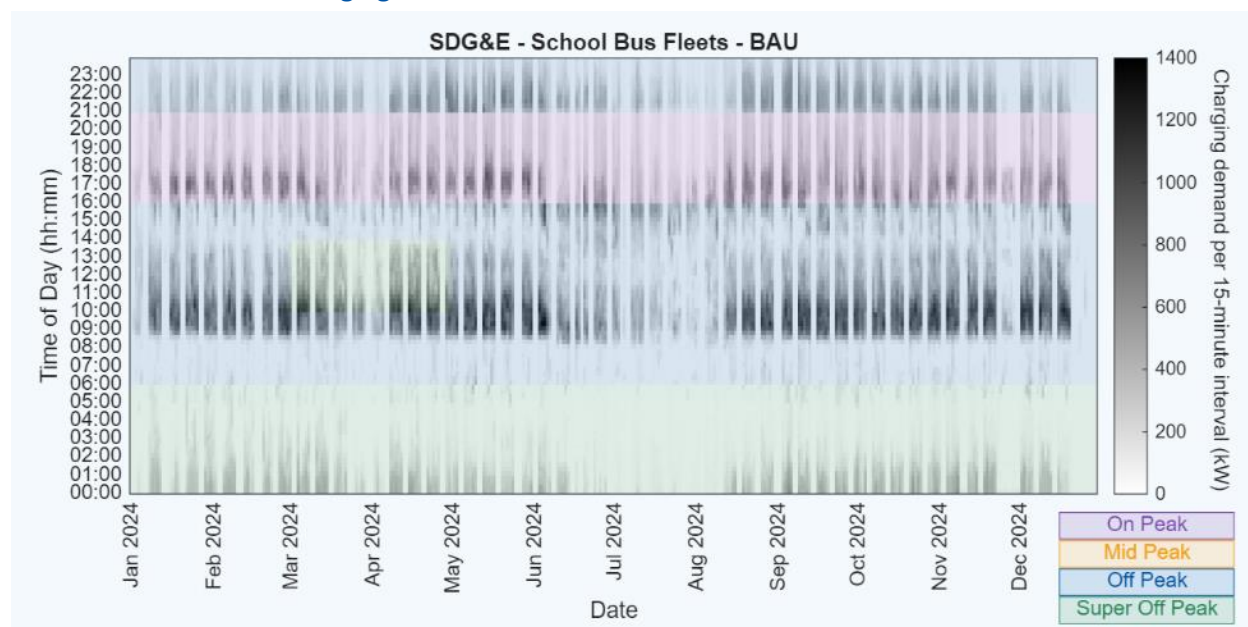
Load Management Outcomes Observed in EY2024

The Evaluation Team assessed a subset of all PTD sites that had the necessary AMI and NSP data—a total of 17 SDG&E PYDFF program sites. This analysis uses data not from all 25 operational sites in the PYDFF program to date, but only from those sites with AMI and NSP data that met analysis requirements. Of these 17 sites, 11 were school bus sites and six were sites in other market sectors, including transit bus and medium-duty vehicle.

Figure 246 and Figure 247 depict the BAU historical energy consumption of school bus fleets and non-school bus fleets, respectively, in aggregate during 2024. BAU represents the current charging behavior of the 17 sites represented in this analysis. The areas in the figures with darker shading correspond to times of day (y-axis) and days throughout the year (x-axis) with higher collective charging demand, as

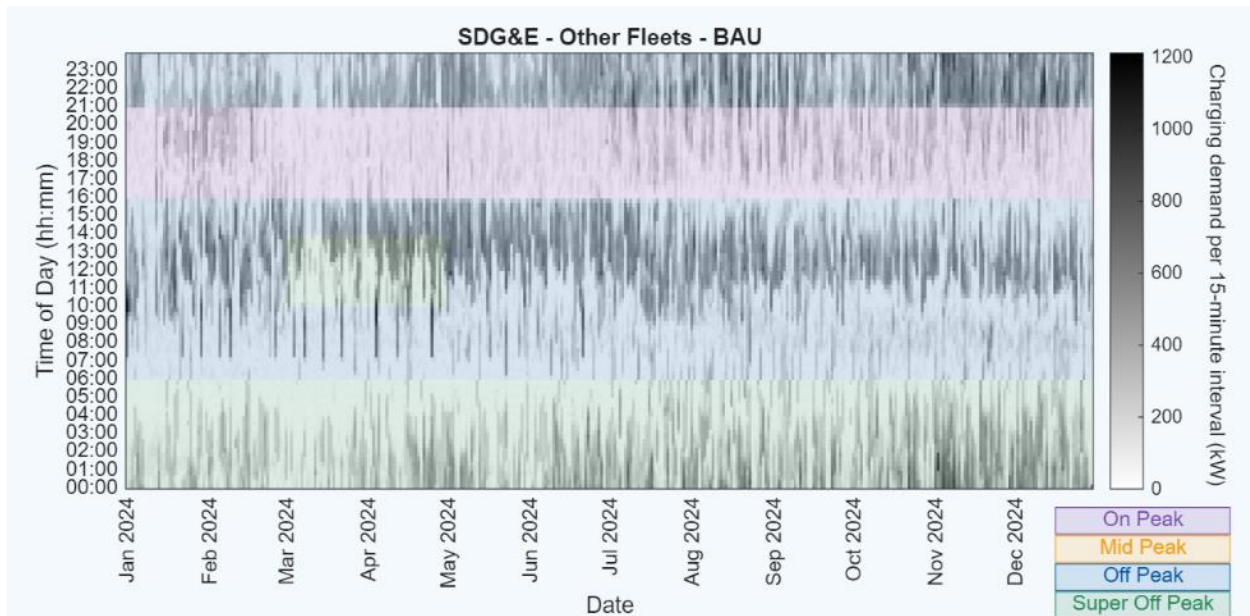
measured by the scale on the right of the plot. Areas with no shading represent no energy demand. School bus fleets (Figure 246) show a consistent trend of charging twice per day. First, beginning around 9 a.m., after the morning routes to pick up students are completed and the buses charge throughout the middle of the day. Secondly, many school bus fleets charge again around 4 p.m. to 5 p.m. after buses complete afternoon runs. This second charging session directly coincides with higher TOU rates. Some sites using load management, however, are clearly delaying the second charging event until 9 p.m. to avoid peak TOU energy costs. The figure also clearly shows lower demand during winter break, spring break, and summer vacation periods when school bus operation is minimal. For comparison, Figure 247 presents the BAU charging demand for all other SDG&E fleets in non-school bus market sectors for 2024. This figure shows many fleets beginning to charge in the middle of the day, and some waiting until 9 p.m., but the vast majority demonstrating effective load management to avoid the higher cost 4 p.m. to 9 p.m. time period.

Figure 246. SDG&E PYDFF Program Heatmap of the Collective BAU Charging Demand for All SDG&E School Bus Fleets in 2024



Dark shading intensity indicates average charging demand (in kilowatts) per 15-minute interval.
Colored regions indicate TOU periods.

Figure 247. SDG&E PYDFF Program Heatmap of the Collective BAU Charging Demand for All Non-School Bus SDG&E Fleets in 2024



Dark shading intensity indicates average charging demand (in kilowatts) per 15-minute interval.
Colored regions indicate TOU periods.

The Evaluation Team compared NSP charging sessions which utilized load management strategies to non-load-managed sessions for the school bus and non-school bus fleets in this analysis to evaluate the effectiveness of the existing load management at minimizing energy during the 4 p.m. to 9 p.m. peak TOU period.

The box plots in Figure 248 compare the distributions of daily on-peak (4 p.m. to 9 p.m.) energy consumption, as a percentage of daily total energy, between load-managed and non-load-managed days. On average, non-load-managed school buses have 26.9% of daily consumption occurring between 4 p.m. and 9 p.m., but it can be as high as 80% for some days. For the average load-managed day, the percentage drops significantly to 8.0% of overall consumption. For other market sectors (shown in the right subplot of Figure 248), the average non-load-managed day has 23% of consumption during the peak TOU period, compared to a very low 2.7% for load-managed days. These comparisons help guide the Evaluation Team's estimates of how much energy from non-load-managed days (and fleets) can shift to potentially save money and emissions for the fleets.

Figure 248. SDG&E PYDFF Program Distribution of the Fraction of Daily EV Charging Load Occurring in the Peak TOU Period



The box and whisker plot represents the distribution of daily total energy consumed from 4 p.m. to 9 p.m. across one operating day by group, and the average value for all operating days per group is indicated by an X.

This analysis strongly suggests that existing load management programs effectively reduce the fraction of energy consumed between 4 p.m. and 9 p.m. and thereby reduce the energy consumption costs.

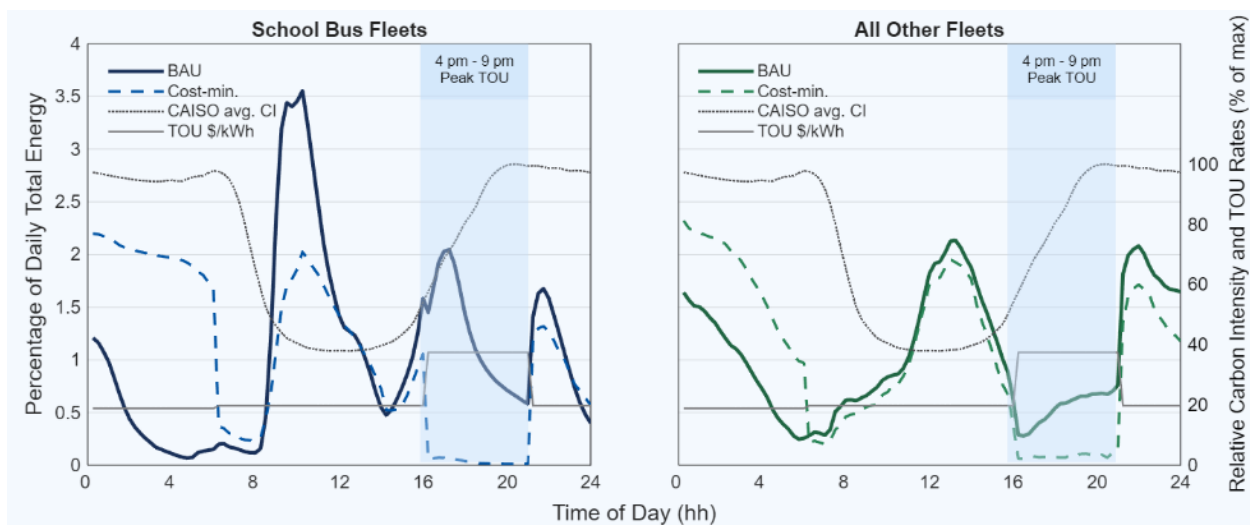
Potential Benefits of Optimal Load Management

The Evaluation Team analyzed charging session data to estimate the potential value of optimal load management, considering each site's observed operating patterns and potential ability to shift vehicle charging loads. This analysis included 11 school bus sites and 6 sites in other market sectors which had sufficient AMI and NSP data reported for 2024 to complete the optimization.

The Evaluation Team developed and executed an optimization routine that reviews each site's daily charging behavior and shifts energy consumption from the peak time period (4 p.m. to 9 p.m.) into the lowest-cost periods of the day whenever there was both unused charging capacity and vehicle charging availability during those periods. The Evaluation Team used NSP charging session data to ascertain how many vehicles were plugged in and how many kilowatt-hours of energy could be shifted during each time period. For hours in the same TOU rate period, the Evaluation Team used carbon intensity of the electric grid (evaluated from CAISO 2024 GHG emissions factors) and BAU charging load as tiebreakers to determine vehicle charging priorities. The optimization algorithm also incorporates any monthly demand charges that may be incurred at the site from vehicle charging and minimizes the total charging costs in the optimization. After completing the load-shifting to minimize costs, the resulting costs and GHG emissions were calculated for the load-shifted case, and the results were compared to the BAU case to determine cost-reduction and GHG-reduction potential for each site.

Figure 249 illustrates how optimally shifted loads differ from BAU loads, averaged across EY2024. For both school bus sites and other market sector sites, the average day's load can be mostly shifted out of the high-cost 4 p.m. to 9 p.m. window (peak TOU period year-round). For school bus sites, the midday charging is spread out over the available charging period—lowering the peak demand and reducing incurred demand costs—and the charging that occurs during the peak TOU period (4 p.m. to 9 p.m.) is redistributed to overnight charging, also reducing incurred TOU energy consumption costs. For non-school bus sites, the load is shifted to the overnight charging period, as there appears to be little flexibility to charge more during the middle of the day (when the CI of the grid is lower), and the current TOU rate structure does not incentivize midday charging with lower TOU costs, thereby reducing potential reduction in GHG emissions.

Figure 249. SDG&E PYDFF Program Fraction of Daily EV Charging Load Occurring at Each 15-Minute Interval for the Average Day in this Analysis, BAU Compared to Cost-Minimization



Note: Line color indicates site market sector and dashed versus solid lines indicate whether the load is BAU or shifted.

The Evaluation Team estimated the cost reduction potential of this daily load shifting, within the following context:

- This analysis considers the volumetric (cost per kilowatt-hour) component of each site's electricity costs as well as any demand charges that may apply under the utility's rate structure. Optimal load management has the potential to also reduce demand charge subscriptions, which could especially impact costs in lower-volume months. The cost-minimization approach developed in this analysis ensures that the monthly total cost (energy consumption plus demand charges) will be minimized. This allows for an increase in monthly peak demand so long as the increased demand charges (where they apply) are more than offset by TOU cost savings resulting from load-shifting to less expensive TOU time periods. In most cases, monthly peak demand was either maintained, having no impact on costs, or it was decreased, resulting in additional cost savings.

- These results reflect only the portion of the year in which each fleet operated and provided charging data; annualized projections of these cost reductions could be substantially higher, in absolute terms, for fleets that have less than a full year of charging data included in this analysis or that have not yet reached mature operations.
- These results reflect only the portion of each site's vehicle fleet that it electrified in EY2024. A fully electrified vehicle fleet would see higher cost reduction potential from load management.
- This analysis considers the cost-saving potential of load management, but it does not consider the potential of load management to generate revenue via LCFS Smart Charging credits.
- This analysis examined the actual charging behavior at each site (using actual recorded plug-in and unplug times) to determine charging opportunities and does not account for other operational or scheduling improvements for charging electrified fleets, which could enable more-effective load management, resulting in higher potential cost reduction.

Although actual charging session data were used to inform this analysis, some operations and/or driving days do not allow for use of load management at some sites. When load management is possible and still not used by fleets, it can be due to a variety of reasons such as lack of clarity of actual versus potential electricity costs or concern over vehicles not fully charging unless under the watchful eye of staff still on site. Starting to charge vehicles later in the evening when limited staff are available to check status provides some fleets a concern over reliability and represents an operational risk.

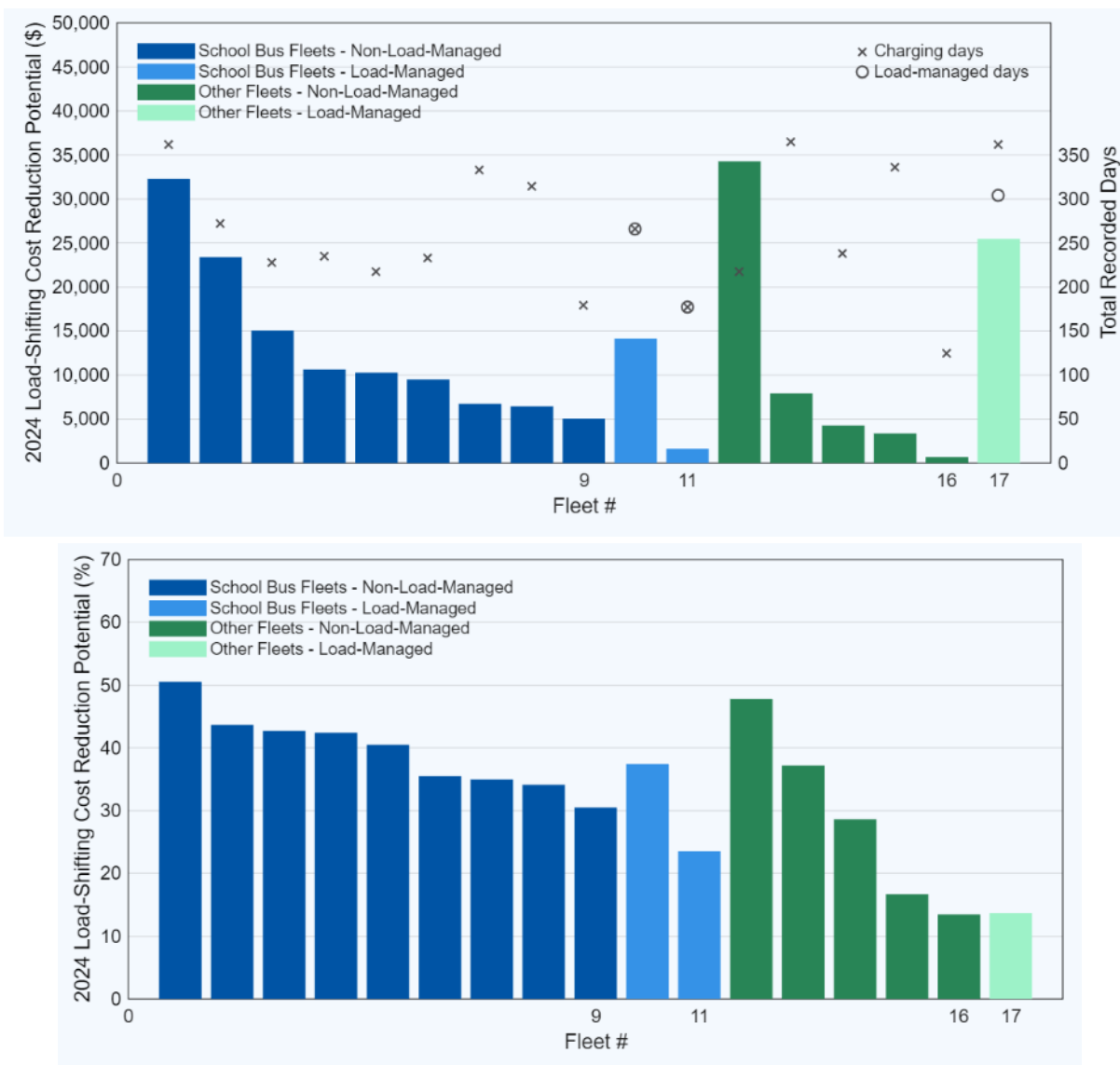
Figure 250 provides several insights. The figure shows that even load-managed sites have the potential to save energy by better utilizing their load flexibility. For example, as shown on the top graph, sites that are already using load management have cost reduction potential ranging from almost \$15,000 in the school bus market sector and up to \$25,000 for sites in other market sectors. In general, sites that are implementing load management have less opportunity to realize additional savings than sites that have not implemented load management to date. Many of these sites can capture additional savings by improving consistency of load management operations and better coordinating load management scheduling if their EVSP is capable and their operations allow.

Non-load-managed sites have cost reduction potential approaching \$35,000 for non-load-managed sites with school buses for other market sectors. The greatest potential savings are typically seen at large sites with high energy consumption and therefore higher overall costs. For example, as shown in the bottom graph, the non-load-managed fleet with \$35,000 cost reduction potential is equivalent to 45% cost reduction potential—a similar magnitude as many other fleets regardless of market sector of load management.

Although actual charging session data was used to inform this analysis, some operations and/or driving days do not allow for use of load management at some sites. When load management is possible and still not used by fleets, it can be due to a variety of reasons such as lack of clarity of actual versus potential electricity costs, or concern over vehicles not fully charging unless under the watchful eye of

staff still on site. Starting to charge vehicles later in the evening when limited staff are available to check status provides some fleets a concern over reliability and represents an operational risk.

Figure 250. SDG&E PYDFF Program Total Annual Cost Reduction Potential of Each Site with Use of Optimal Load Management

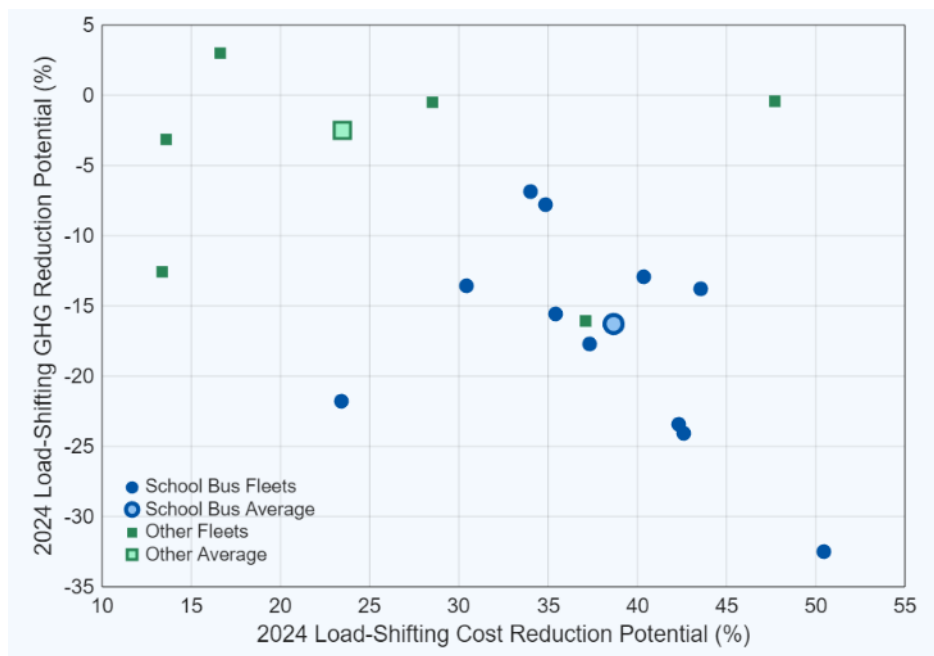


Each bar represents one site. Bar colors indicate the market sector and if the site uses load management.

Because lower-cost TOU periods often correspond to periods with lower carbon intensity for grid electricity, optimizing load management for energy cost savings can have a secondary effect of reducing the resulting carbon emissions from vehicle charging. Figure 251 shows estimated cost reductions and corresponding GHG emissions reductions for each site resulting from a cost-minimizing load management strategy (considering carbon intensity only as a tiebreaking factor when there is sufficient charging flexibility). Because the TOU rate structure slightly dis-incentivizes midday charging (the midday Off-Peak rate is slightly higher than the Super-Off-Peak rate period from midnight to 6 a.m.), the cost-minimization optimization seeks to redistribute charging load throughout the night, when possible, to

minimize the peak charging load, thereby reducing incurred demand costs. However, this has the negative effect of reallocating charging to time periods with higher CI and leading to potential increases in GHG emissions (seen in the figure as negative values for GHG Reduction Potential). This primarily affects the school bus sites, rather than sites in other market sectors.

Figure 251. SDG&E PYDFF Program Potential Percentage Cost Reduction and Attributed GHG Emissions Reduction of Optimal Load Management, Cost Minimization



In addition to the cost-minimization load-shifting analysis, the evaluation team wanted to evaluate the maximum achievable reduction in GHG emissions with load-shifting. Thus, the evaluation team re-ran the load-shifting optimization routine on the same data set with the objective to minimize GHG emissions at each site. This approach maximizes the amount of charging that can take place during the middle of the day when the carbon intensity of grid electricity is the lowest, given there is additional charging capacity and vehicle charging availability at each site. Figure 252 shows how the average charging load profile for the GHG-minimization approach compares to the Cost-minimization and BAU average load profiles. Figure 253 displays the resulting combination of cost-reduction potential and emissions-reduction potential for each site when load-shifting is employed to minimize GHG emissions. There is clearly a tradeoff between minimizing costs and minimizing GHG emissions, as these figures show substantially higher GHG reduction potential, but at the expense of increased costs (seen in the figure as negative values for Cost Reduction Potential) because some of the charging occurs during the start of the high-cost Peak TOU period and/or because the peak charging load is allowed to increase. The results vary on a site-by-site basis, however, and some sites may be able to effectively decrease both costs and GHG emissions with effective load management.

Figure 252. SDG&E PYDFP Program Fraction of Daily EV Charging Load Occurring at Each 15-Minute Interval for the Average Day in this Analysis, BAU Compared to Cost-Minimization and GHG-Minimization

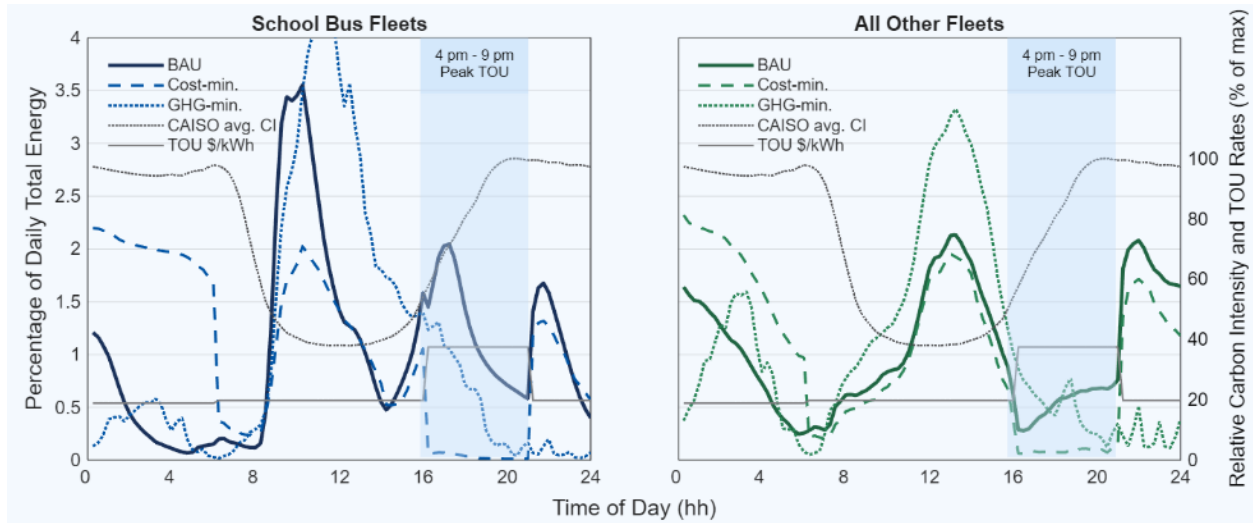


Figure 253. SDG&E PYDFP Program Potential Percentage Cost Reduction and Attributed GHG Emissions Reduction of Optimal Load Management, GHG-Minimization

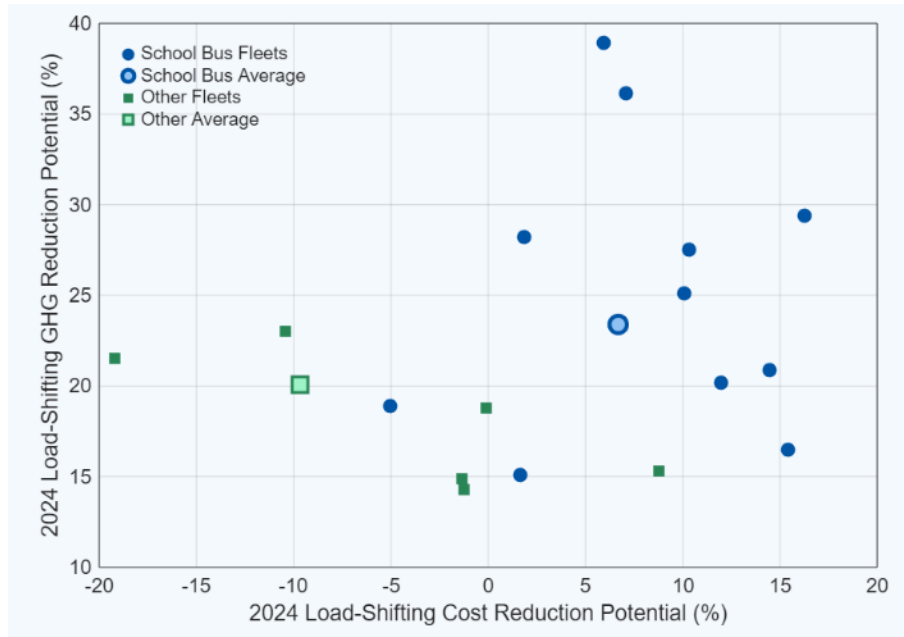


Table 118 aggregates these results across all sites included in the analysis. Overall, cost-minimization load shifting could reduce school bus sites' collective energy consumption costs by 38.7% but would lead to an increase in attributed electricity grid GHG emissions by 16.2%; for other market sectors, it could reduce energy consumption costs by 23.56% and the resulting increase in attributed electricity grid GHG emissions would be only 2.5%. Alternatively, load shifting to minimize GHG emissions could significantly reduce GHG emissions, but it would come at the expense of cost savings. Across all school bus sites, load

shifting for GHG-minimization could achieve up to 23.4% reductions in GHG emissions, but could increase overall costs by 6.7%. Load shifting for GHG-minimization at all other sites could reduce GHG emissions by 20.1% and increase costs by 9.6%.

Table 118. SDG&E PYDFF Program Summary of Potential Cost and Attributed GHG Emissions Reductions, Aggregated across All Included Fleets

	School Bus Fleets	All Other Fleets	All Fleets Combined
Total number of fleets	11	6	17
Total count of 2024 operating days	2,825	1,646	4,471
Cost-minimization load-shifting			
Cost Reduction Potential (\$)	134,547	75,678	210,225
GHG Reduction Potential (kg CO ₂ e)	-26,033	-5,363	-31,395
Cost Reduction Potential (%)	38.7%	23.5%	31.4%
GHG Reduction Potential (%)	-16.2%	-2.5%	-8.4%
GHG-minimization load-shifting			
Cost Reduction Potential (\$)	23,256	-31,043	-7,787
GHG Reduction Potential (kg CO ₂ e)	37,567	43,129	80,696
Cost Reduction Potential (%)	6.7%	-9.6%	-1.2%
GHG Reduction Potential (%)	23.4%	20.1%	21.5%

Highlights

- Charging data indicates that there is significant opportunity for most fleets to shift their charging energy use to lower-cost time periods depending on a site's operating patterns, charging flexibility, and implementation of load management software.
- Sites activated EY2022 have slow growth in consumption, while EY2023 saw more growth before leveling off in mid-2024.
- Sites activated in EY2024 had considerable growth through the year before leveling off in the fall.
- Overall demand in comparison peaked around 1.8 MW in early 2024 and remained relatively consistent for the rest of the year, although consumption ticked up slightly in the fall.
- Nearly 40% of school bus charging sessions overlapped the 4 p.m. to 9 p.m. peak-rate period but have enough flexibility to delay charging to lower-cost time periods with effective load management.
- The number of load-managed sites grew from two in EY2022 to seven in EY2023; however, no EY2024 sites displayed load management, and some older sites displayed intermittent load management implementation.
- Most sites can achieve a 20% to 35% reduction in costs or GHG emissions, but generally cannot reduce both given current rate structures. If SDG&E is authorized to add a midday Super Off-Peak rate period, some fleets could shift charging to that time period to reduce both cost and emissions.

Petroleum Displacement

The Evaluation Team estimated petroleum displacement that is attributable to the vehicle electrification enabled by SDG&E's PYDFF program. The Evaluation Team used DGE for reporting purposes. Since the transit bus market sector primarily uses CNG fuel, the Evaluation Team converted transit bus natural gas consumption into DGE units based on the CNG fuel's energy content.

Table 119 presents petroleum displacement impacts for the PYDFF Program through 2024, including estimated actual impacts for 2024, actual impacts for all PTD sites, and a 10-year forecast for PTD sites. The results include impacts for the five market sectors represented in the program, the majority of which were for the school bus sector followed by the transit bus sector. The PTD actual usage is over 3.2 million electric miles. This translates into the displacement of over 560,000 DGE. Although the program classifies one site as a heavy-duty vehicle site, it is a hybrid site with both MDHD vehicles in the VAP. Because all operational vehicles at this site in 2024 were medium-duty vehicles, petroleum displacement and GHG reductions attributed to this site are included in the medium-duty vehicle market sector.

Table 119. SDG&E PYDFF Program Petroleum Displacement Summary

Market Sector	Usage (n=25)				Petroleum Displacement (DGE)		
	2024 Actual kWh	PTD Actual kWh	2024 Actual Use	PTD Actual Use	2024 Actual	PTD Actual	10-Year Projection
Airport GSE			37,159 hours	68,449 hours	70,974	130,737	579,394
Medium-Duty Vehicle			236,734 miles	446,792 miles	20,837	41,754	318,513
School Bus			1,000,022 miles	2,064,950 miles	109,811	226,629	852,093
Transit Bus			585,426 miles	693,062 miles	134,089	158,719	1,316,899
Truck Stop Electrification			28,497 miles	33,745 miles	4,178	4,945	41,382
Total			1,850,679 miles 37,159 hours	3,238,549 miles 66,449 hours	339,889	562,783	3,108,282

Note: "2024 Actual" represents the data from all activated sites from program inception for the calendar year 2024. "PTD Actual" represents the data from all activated sites from program inception for all program years.

Highlights

- All operational sites in 2024 collectively achieved a PTD impact of more than 550,000 gallons of petroleum displaced.
- The transit bus sector accounted for more than 134,000 gallons of displaced petroleum in EY2024 and is projected to account for 43% of the petroleum displaced over 10 years.
- Over a 10-year period, all operational sites will displace more than 3,000,000 gallons of petroleum.

Greenhouse Gas and Criteria Pollutant Impact

The Evaluation Team calculated reduced emissions from displaced fossil fuel use from ICE vehicles that were not in service because of the PYDFF program. First, we developed ICE counterfactual equivalents

for each market sector, then calculated the emissions associated with these vehicles under conditions that otherwise matched the EVs, which provided a baseline. Although EVs have no tailpipe emissions, the mix of generation sources from the electric grid used includes renewable as well as fossil fuel power to supply electricity to the charging stations, with the latter primarily responsible for emitting GHGs and criteria pollutants into the atmosphere.

Table 120 shows GHG impacts from PYDFF for three time periods across market sectors: estimated reductions that reflect what program sites saved in 2024, PTD reductions from all sites, and a 10-year projection based on annualized data from all sites.

Table 120. SDG&E PYDFF Program GHG Reductions Summary

Market Sector	Usage (n=25)				GHG Reduction (MT)		
	2024 Actual ^a kWh	PTD Actual ^b kWh	2024 Actual Use	PTD Actual Use	2024 Actual	PTD Actual	10-Year Projection
Airport GSE			37,159 hours	68,449 hours	745	1,359	6,198
Medium-Duty Vehicle			236,734 miles	446,792 miles	147	283	2,545
School Bus			1,000,022 miles	2,064,950 miles	995	1,987	7,972
Transit Bus			585,426 miles	693,062 miles	977	1,140	9,966
Truck Stop Electrification			28,497 miles	33,745 miles	37	43	380
Total			1,850,679 miles 37,159 hours	3,238, 549 miles 66,449 hours	2,900	4,813	27,601

^a “2024 Actual” represents the data for EY2024 from all sites activated in the program to date.

^b “PTD Actual” represents the data from all activated sites from program inception for all program years.

Table 121 shows estimated reductions in local tailpipe emissions from ICE vehicles that the PYDFF program displaced. The transit bus sector shows the highest reduction in CO emissions due to the assumption that the displaced buses run on CNG. In addition, our analysis confirmed that airport GSE sites can achieve notable savings due to the poor emissions profile of a conventional GSE.

Table 121. SDG&E PYDFF Program Local Emissions Reductions, PTD Actual

Market Sector	PTD Sites Actual ^a (n=25)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Airport GSE	176.0	201.0	184.9	213.0	8,145.3
Medium-Duty Vehicle	-	0.7	0.7	6.9	1,019.5
School Bus	-	4.7	4.5	20.9	596.1
Transit Bus	-	0.3	0.3	42.8	34,926.0
Truck Stop Electrification	-	0.5	0.5	1.5	19.9
Total	176.0	207.2	190.8	285.1	44,706.9

^a “PTD Actual” represents the data from all activated sites from program inception for all program years.

Table 122 shows the same information as Table 121 for 2024 actual. These are the localized emissions reductions that occurred based on actual PYDFF program operations this year.

Table 122. SDG&E PYDFF Program Local Emissions Reductions, 2024 Actual

Market Sector	2024 Actual ^a (n=4)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Airport GSE	101.0	110.7	101.9	122.3	4,461.1
Medium-Duty Vehicle	-	0.4	0.3	3.5	477.0
School Bus	-	2.3	2.2	10.3	291.3
Transit Bus	-	0.2	0.2	36.1	29,502.1
Truck Stop Electrification	-	0.5	0.4	1.3	16.9
Total	101.0	114.1	105.1	173.5	34,748.4

^a “2024 Actual” represents the data for EY2024 from all sites activated in the program to date.

Table 123 provides an estimate of savings over the 10-year period. These are the annualized reductions from all sites to date extended over a decade. Again, the airport GSE sector shows very high reductions of all pollutants due to the poor emissions profile of off-road equipment. Transit buses show very high CO reductions but low PM reductions compared to CNG-powered buses.

Table 123. SDG&E PYDFF Program Local Emissions Reductions, 10-Year Projection for PTD Sites

Market Sector	PTD Sites 10-Year Projected Impact (n=25 sites)				
	HC (kg)	PM ₁₀ (kg)	PM _{2.5} (kg)	ROG (kg)	CO (kg)
Airport GSE	1,197.5	1,002.0	921.9	1,449.0	38,996.4
Medium-Duty Vehicle	-	6.9	6.5	59.2	4,698.9
School Bus	-	20.4	19.5	88.2	2,407.2
Transit Bus	-	2.5	2.4	359.5	293,539.8
Truck Stop Electrification	-	6.1	5.8	16.0	208.1
Total	1,197.5	1,037.9	956.0	1,971.9	339,850.3

Table 124 shows counterfactual vehicle GHG emissions, emissions from the electricity used to charge the EVs, GHG emissions reductions, and percentage differences. Table 125 shows the net reductions of NO_x emissions from using EVs based on the counterfactual and Utility emissions. The Evaluation Team estimated a total annualized GHG reduction of 80% for medium-duty vehicle but a 79% reduction in NO_x from the use of EVs compared to counterfactual vehicles for sites completed in EY2024. Reviewing the program to date reveals an estimated 85% actual reduction in GHG emissions and NO_x emissions.

Table 124. SDG&E PYDFF Program Counterfactual GHG Reductions

Market Sector	EY2024 Sites Annualized GHG (MT) (n=4)				PTD Sites GHG (MT) (n=25)			
	Counter factual	Utility	Reduction	% GHG Reduction	Counter factual	Utility	Reduction	% GHG Reduction
Airport GSE	–	–	–	–	1,464.0	104.6	1,359.4	93%
Medium-Duty Vehicle	173.7	33.9	139.7	80%	359.3	75.8	283.4	79%
School Bus	–	–	–	–	2,397.6	410.6	1,987.0	83%
Transit Bus	–	–	–	–	1,396.6	256.3	1,140.3	82%
Truck Stop Electrification	–	–	–	–	52.3	9.0	43.3	83%
Total	173.7	33.9	139.7	80%	5,669.8	856.3	4,813.5	85%

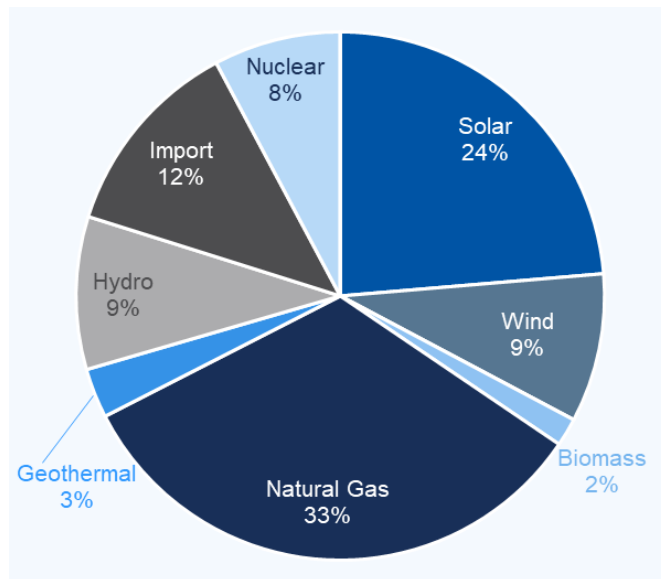
Table 125. SDG&E PYDFF Program Counterfactual NO_x Reductions

Market Sector	EY2024 Sites Annualized NO _x (kg) (n=4)				PTD Sites NO _x (kg) (n=25)			
	Counter factual	Utility	Reduction	% NO _x Reduction	Counter factual	Utility	Reduction	% NO _x Reduction
Airport GSE	–	–	–	–	2,391.1	86.0	2,305.1	96%
Medium-Duty Vehicle	130.6	27.3	103.3	79%	43.8	62.2	(18.4)	None
School Bus	–	–	–	–	2,165.3	345.0	1,820.3	84%
Transit Bus	–	–	–	–	67.0	209.0	(142.1)	None
Truck Stop Electrification	–	–	–	–	71.6	7.6	64.0	89%
Total	130.6	27.3	103.3	79%	4,738.8	709.8	4,028.9	85%

Figure 254 shows the annual program net electricity generation mix matching the hours when the EVs were charging. The CAISO grid mix continually changes depending on factors such as the level of total demand for power on the grid and the availability of fossil generation and variable renewable resources such as solar.

At this stage of the program, it appears that the vehicles were charging predominantly outside of peak hours of solar output when grid emissions are the lowest. More than 12% of the grid mix comprises electricity imports, which do not vary by time of day for analysis purposes but match the resource mix purchased for the California grid.¹²⁹

Figure 254. SDG&E PYDFF Program Net Electricity Mix, Program to Date



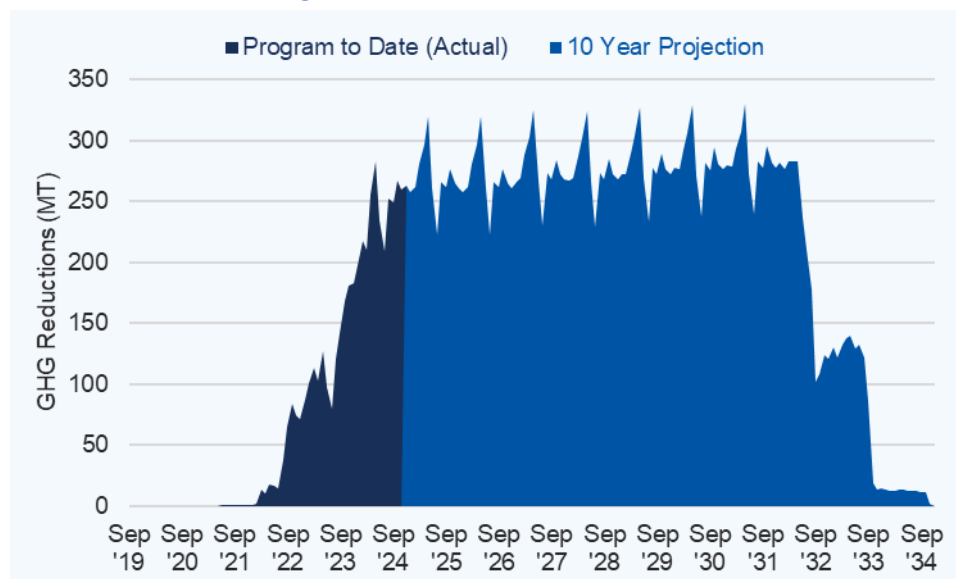
Based on the real-time grid conditions when the charging occurred, the overall energy mix was about 55% zero-emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 33% natural gas. The Evaluation Team expects emissions reductions from these sites over 10 years to increase as the grid becomes cleaner. Additionally, the increased use of managed charging, where possible, would reduce emissions as EVs charge at off-peak times and grid power is supplied with greater amounts of renewable generation. The *Electricity Cost and Emissions Optimization Analysis* in the Grid Impacts section above identified the potential for fleet to further reduce GHG through shifting the time and rate of charging. Finally, emissions will further decrease with the addition of more charging sites and EVs in future evaluation years.

Figure 255 shows how program GHG reductions have increased to date and are likely to grow over time for all active sites. The analysis period ranges from the activation date of the first site in the program through the end of EY2024. The analysis incorporates the net reduction (counterfactual emissions minus utility emissions) for each fleet within the SDG&E PYDFF program. PTD emissions reductions appear in dark navy while anticipated benefits based on annualization appear in royal blue. As each site has its own starting date of operation, the 10-year sunset for each site appears as a gradual tapering off of program benefits between 2031 and 2034. This taper reflects that benefits are no longer counted after 10 years, although fleets will likely continue to use the infrastructure. While each year's operations appear similar, there are several key factors driving the variations such as seasonality of utility generation sources (high utility emissions will appear as a dip on the curves), holidays occurring on

¹²⁹ The power associated with imports comes from a mixture of renewables, hydro, nuclear, and natural gas power plants located outside of California (<https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation>).

weekends versus weekdays, and sites that became operational late in 2024 and will operate year-round in future years.

Figure 255. SDG&E PYDFF Program Historical and Forecasted GHG Reductions for PTD Sites



Highlights

- PTD results show an 85% reduction in GHGs and in NO_x emissions.
- The greatest reduction in local emissions was for CO with more than 34,000 kg in 2024 and a projected 10-year reduction of more than 240,000 kg.
- Based on the real-time grid conditions when EV charging occurred, the overall energy mix contained about 55% zero emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 33% natural gas.

Health Impacts

The Evaluation Team calculated public health impacts (as benefits and costs) of reductions in criteria pollutants from vehicle electrification. The pollutants we included in the analysis are primary PM_{2.5} and precursors of secondary PM_{2.5}, including NO_x, SO₂, NH₃, and VOCs. This analysis considers only tailpipe emissions reductions rather than full lifecycle emissions (such as power plant emissions). The Evaluation Team used the U.S. Environmental Protection Agency's (EPA) COBRA to evaluate the health benefits associated with emissions reductions. COBRA estimates the county-level benefits for the county in which emissions are reduced. It also estimates the effect of the transport of emissions on all counties in the United States; however, this analysis includes only the effects of the emissions reductions in

California. The Evaluation Team disaggregated the county-level effects to estimate the potential health benefits of sites for DACs and non-DACs.¹³⁰

Economic value depends on the health effects associated with the emissions, that is, whether they are associated with illnesses or death. The monetary value of the morbidity reductions associated with emissions reductions include avoided lost wages, avoided medical costs, and the amount of money people are willing to pay to avoid an illness or condition like respiratory disease. The value of the reduced mortality associated with emissions reduction is measured by the value of a statistical life, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low and high impact for mortality, representing the uncertainties in the estimates.

The total value of the health benefits associated with emissions reductions is between \$399,409 and \$526,446. Table 126 shows the cumulative health benefits for counties in California associated with the emissions reductions realized by the electrification of the SDG&E PYDFF sites for the program to date.

Table 126. SDG&E PYDFF Program California Health Benefits for PTD Sites in 2024

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Mortality	0.023	0.032	\$346,422	\$473,460
Avoided Medical Care				
Hospitalization, Respiratory	0.003	0.003	\$48	\$48
Hospitalization, Cardiovascular	0.001	0.001	\$35	\$35
Hospitalization, Other	0.004	0.004	\$93	\$93
ER Visits, Respiratory	0.049	0.049	\$81	\$81
ER Visits, Cardiovascular	0.002	0.002	\$5	\$5
Out of Hospital Heart Attacks	< 0.000	< 0.000	\$8	\$8
Nonfatal Heart Attacks	0.005	0.005	\$448	\$448
Stroke	0.001	0.001	\$33	\$33
Lung Cancer	0.001	0.001	\$28	\$28
Asthma	28.34	28.34	\$23,736	\$23,736
Hay Fever	1.16	1.16	\$1,330	\$1,330
Lost Productivity				
Minor Restricted Activity Days	7.497	7.497	\$970	\$970
Work Loss Days	1.278	1.278	\$416	\$416
School Loss Days	14.738	14.738	\$25,755	\$25,755
Total Health Effects	-	-	\$399,409	\$526,446

¹³⁰ DAC Census Tracts are defined as those included in in the SB 535 Disadvantaged Communities List (2022), this includes the DAC categories for CalEnviroScreen 4.0 Top 25%, CalEnviroScreen 4.0 High Pollution Burden Score and Low Population Count, and 2017 Disadvantaged Community (CalEnviroScreen 3.0 only).

At the site level, the airport GSE and school bus market sectors cumulatively accounted for 96% of the monetary value from health benefits, respectively accounting for 62% and 34% of the value from benefits.

As part of this analysis, the Evaluation Team also examined health benefits within DACs, which may be disproportionately burdened by sources of pollution (including air pollution from ICE vehicles). Because COBRA estimates effects only at the county level, the Evaluation Team disaggregated the monetized health impacts by census tract using the relative population of each tract from the most recent American Community Survey. For example, we allocated 10% of the value of the health benefits to a census tract with 10% of the county's population. The Evaluation Team then estimated the total benefits allocated to DACs and non-DACs. This approach assumes that the benefits of emissions reductions are distributed evenly throughout the county. If the sites are located in DACs, and the emissions reductions are greater in the tracts near the sites, this approach understates the potential benefit to DACs. Additional information about emissions dispersion within counties would provide more-precise estimates of the health benefits to DACs and non-DACs.

In our analysis, San Diego County had the highest share of health benefits, with 55% of the total benefits, followed by Riverside County (20%), Los Angeles County (8%), Orange County (7%), and San Bernardino County (6%). San Diego County has the highest health benefit allocation because sites were located in the SDG&E territory; however, counties outside of the SDG&E territory also accrued health benefits when we accounted for air dispersion and transport of emissions. Overall, 14% of the total benefits were in DACs.

Highlights

- Cumulative monetary health benefits for counties in California realized by PYDFF sites in terms of monetary benefits range from \$399,409 for the low estimate and \$526,446 for the high estimate.
- Sites in the airport GSE and school bus market sectors cumulatively accounted for 96% of all benefits.
- San Diego County had the highest share of health benefits, with 55% of the total benefits, followed by Riverside County (20%), Los Angeles County (8%), Orange County (7%), and San Bernardino County (6%).
- Overall, 14% of the health benefits were in DACs.

Net Impacts

As part of the EY2024 net impacts analysis, the Evaluation Team planned to survey SDG&E participant fleet managers to estimate program effects on participants to exclude impacts from actions that participants would have taken without the program (freeridership) and to include any program-attributable indirect impacts on participants (participant spillover). No SDG&E participating fleet managers responded to the Evaluation Team's EY2024 survey that used contact information provided by

SDG&E. As a result, the Evaluation Team was unable to estimate a fleet manager-based NTG ratio from EY2024 primary research.

6.1.3. Lessons Learned

Staff remain focused on adjusting the program to respond to market conditions, including high site costs and that the majority of their commercial customers operate small fleets.

Similar to previous evaluation years, high site costs continue to be a challenge particularly materials costs which have been compounded by supply chain delays. SDG&E staff identified small fleets (which represent a majority of the SDG&E fleet customers) have more challenges with program awareness, available infrastructure capacity, and program design requirements (such as VAP requirements) than do medium- and large-size fleets. Staff have adjusted outreach approaches to more direct and in-person tactics to reach these small businesses to foster program participation and longstanding relationships.

Building on activities from previous years, SDG&E focused outreach in 2024 to meet the current audience market needs, including language accessibility, in person outreach, and leaning on former participant advocacy.

In 2024, staff prioritized direct engagement over webinars, which have been dropping in attendance in comparison to in person events, such as EV Fleet Day, one of the program's most successful outreach events. Staff have also continued to expand their outreach in Spanish through in-person presentations and translated program materials to build engagement and trust with border communities, which are prominent within SDG&E's territory. Additionally, program staff have expanded outreach to build long term relationships to support customers with ongoing opportunities for electrification beyond the PYDFF program. Finally, SDG&E heard potential participants appreciate hearing from former participants. In response, SDG&E set up a "buddy system" to direct potential participants to similar former participants to advise them in their electrification journey. This effort is intended to build transparency and trust and receive confirmation of program benefits outside of SDG&E.

While the average installed charging capacity per site did not change significantly in 2024, per-site costs were over 38% higher.

The average utility infrastructure cost, including TTM and BTM was \$455,777 per site for PTD sites through 2024, up from \$331,122 for PTD sites through 2023. This increase in the average utility infrastructure cost was driven by two transit sites added in EY2024 with costs of \$1.8 million and \$1.2 million. The average utility infrastructure cost was \$23,262 per vehicle for PTD sites through 2024, which was slightly lower than the average cost of \$24,648 for PTD sites through 2023. The average utility infrastructure cost was \$2,135/kW of installed charging capacity for PTD sites through 2024, which was higher than the average costs of \$1,528/kW for PTD sites through 2023. These values include both L2 and DCFC sites and aggregate multiple market sectors. Sites had a higher average installed capacity of 383 kW per site for PTD sites through 2024, compared to 353 kW for PTD sites through 2023. All-in costs paid by the customer and SDG&E vary widely between sites, with an average of \$890,741 per site for PTD sites through 2024, compared to \$904,606 for PTD sites through 2023.

Overall site activation timelines have remained similar in 2024 relative to earlier evaluation years.

The median timeline for application to activation was 1,106 days in 2024, similar to 1,045 days in 2023, though 51% higher than 731 PTD. An important change was that in 2024 SDG&E made an adjustment in the end date of Design and Permitting, which coincides with the start date of Construction Complete. This resulted in a significant increase in days occurring in the Design and Permitting phase, but a similar reduction in days in the Construction Complete phase.

The PYDFF program lags behind its activated site and vehicle deployment goals, and program spending remains low. However, this is the first year the program has reached DAC targets.

In 2024, four sites with 43 charging ports were activated supporting 91 vehicles, based on VAPs of activated sites. The program saw the activation of the first Heavy-Duty site, and three Medium-Duty sites, bringing the total market sector count supported by the program to six. The 25 total activated sites (303 charging ports) in the program to date meets 7% of the program's *per se reasonableness* goal of 300 sites and support 679 vehicles which meets 23% of the program's *per se reasonableness* goal of 3,000 additional vehicles electrified.

The PYDFF program will make additional progress toward these goals as more sites reach activation. For example, the 45 contracts signed in the PYDFF program to date could support 1,015 MDHD vehicles, which would meet 15% of the program's site goal and 34% of the program's vehicle goal. As shown in Figure 256 below, SDG&E is not on track to meet either its site or vehicle goals. However, while the *per se reasonableness* goals in the CPUC Decision results in a ratio of 10 MDHD EVs per site (3,000 divided by 300), the ratio in the program to date is 27 MDHD EVs per site, which is more than twice this ratio.

Figure 256. SDG&E PYDFF Program Historical and Forecasted Progress Toward Site and Vehicle Goals



SDG&E spent \$8.6 million of the EV Fleet program budget in 2024, bringing total spending to \$24.5 million out of \$107 million of the approved program budget, or 23% of available funding. In prior program years, the PYDFF program did not see any sites located in a DAC. However, Advice Letter 4436-E was approved in July 2024 allowing SDG&E to change the DAC definition to the CalEnviroScreen service territory definition instead of the statewide definition. This change has resulted in 44% of sites

being in a DAC, which exceeds the Pilot's *per se reasonableness* goal of 30%. The total spending does not include funding reserved for contracted sites that have not yet been spent.

Though overall consumption increased significantly, peak demand represents a small portion of installed charging capacity, and the majority of fleet operators are not implementing load management.

Across 2024 operational sites, 671 kW of new charging capacity was installed, bringing total capacity for the PTD sites to over 9.2 MW. Overall consumption in 2024 more than doubled the observed consumption in 2023. Peak demand was similar in 2024, reaching 1.8 MW compared to 1.6 MW in 2023, while utilization remained constant at approximately 19.6%. Overall, SDG&E program sites have an average total monthly billing cost of \$0.36/kWh. Sites that avoid charging during the highest-cost time period though load management appear to show an average total monthly billing cost between \$0.20/kWh and \$0.33/kWh.

The number of load-managed sites grew from two out of 21 activated sites (10%) in 2023 to six out of 25 activated sites (24%) in 2024. On a monthly basis approximately 30% of charging has enough flexibility to be shifted to lower cost and lower emissions time periods using load management. Potential savings through use of load management are as much as \$3,500 per site annually for non-load-managed sites, and \$5,900 for sites already using load management through optimization. On average, sites can reduce GHG emissions by 20% by avoiding consumption from 4 p.m. to 9 p.m.

Not all EVSPs offer load management capability, and not all fleet operators have direct access to their utility bills to understand TOU cost impacts. During site visits we observed that most operators had a disconnect between what they expected the electricity to cost versus their actual costs. However, most fleet operators were aware of TOU pricing, regardless of knowing usage trends and costs.

The PYDFF program sites continue to help displace petroleum, reduce GHG and local emissions, and provide health impacts.

The PYDFF program sites have displaced more than 550,000 gallons of petroleum PTD. Specifically, the transit bus sector accounted for more than 134,000 gallons of displaced petroleum in 2024 and is projected to account for 42% of the displaced petroleum over 10 years. In addition, the Program resulted in a reduction of nearly 5,000 MT of GHG emissions to date. These sites all contributed to lowering local emissions, with CO reduction being the most prominent, achieving a reduction of nearly 45,000 kg to date. Overall, 14% of the PTD health benefits are in DACs with the monetary health benefits from sites ranging from \$399,409 to \$526,446.

6.2. Schools and Parks Pilots

6.2.1. Overview

This overview provides a detailed description of the SDG&E Schools and Parks Pilots; summaries of the Pilot implementation process, performance metrics, program materials, and budgets; and a timeline of major milestones. Following the overview are detailed findings, highlights, and lessons learned.

Pilot Description

Schools Pilot: Through its Schools Pilot, SDG&E has offered direct installation of and incentives for installing 184 L2 chargers and 12 DCFCs at 30 schools and educational institutions.¹³¹ SDG&E is aiming for 40% of

Schools Pilot Design Goal

Empower schools to offer public charging to staff, students, parents, and the greater community.

installations

to be within DACs.¹³² The Pilot has a turnkey ownership model, with which SDG&E offers to install, own, operate, and maintain the EVSE. The charging stations are required to use TOU rate pricing. Site hosts who opt to own the chargers are eligible for a rebate equivalent to the cost that SDG&E would

pay to install EVSE under the SDG&E turnkey model.

Parks Pilot: Through its Parks Pilot, SDG&E will aim to install 74 light-duty public chargers in 12 state parks and beaches within its service territory and 66 light-duty public chargers at 10 city and county park sites. SDG&E will build, own, operate, and maintain the

Parks Pilot Design Goal

Encourage parks and beaches to charge their own fleets and offer charging to staff and patrons.

EVSE, which will use a TOU rate.

SDG&E

developed an awareness campaign to inform the public of the availability of these chargers.

Schools Pilot Targets

- 184 L2 and 12 DCFC charging ports
- 30 schools
- 40% in DAC locations

Parks Pilot Targets

- 74 charging ports at 12 state parks and beaches
- 66 charging ports at 10 city and county parks
- 50% overall in DAC locations (all city and county sites must be in DACs)

¹³¹ In the EY2024 closeout interviews, SDG&E staff reported that they will not achieve the 30-site goal; however, they are installing more ports than expected and will still reach the port goal (which is the primary goal for the program), so they have not made a formal regulatory filing to change the Schools Pilot goals.

¹³² As per AL 2876-E, SDG&E found that only 27 census tracts in its territory were considered DACs (using the top quartile in CalEnviroScreen statewide definition). However, the service territory definition produces a broader definition and leads to a calculated 180 DAC census tracts in SDG&E service territory.

Implementation

As interested customers became aware of the Schools Pilot—through SDG&E marketing efforts, word of mouth, or directly from an account manager from SDG&E—they could choose to submit an application as the first step in the implementation process. For the Parks pilot, SDG&E identified eligible sites and reached out to the customers managing those sites directly. Starting in 2022 and continuing through 2024, SDG&E staff were focused on implementing the pilots.

Figure 257 shows the implementation process for the Schools and Parks Pilots. The customer agreement step is slightly different for state parks than for municipal parks and for the Schools Pilot, since the DPR expects to approve the MPA that will apply to all state parks in SDG&E service territory participating in the Parks Pilot. Each individual site will have site addendums to the master agreement based on specific site needs and designs.

Figure 257. SDG&E Schools and Parks Pilots Implementation Process

IDENTIFYING POTENTIAL SITES	
	1. SDG&E uses Google Earth to identify good candidates for the pilot 2. SDG&E asks an eligible school district or municipality to pick its top five sites for EVSE 3. SDG&E conducts desktop reviews of the top five sites to narrow the choice to two
PARTICIPATION AGREEMENT AND PERMITTING	
	1. Based on a desktop review, SDG&E drafts the participation agreement and contract 2. The customer reviews and signs all documents 3. SDG&E begins the permitting request process
SITE WALK AND DESIGN	
	1. SDG&E completes site walks of the two potential sites 2. SDG&E assesses both sites; the customer and SDG&E determine the best fit for the pilot 3. SDG&E drafts the design 4. The customer reviews and approves the design 5. SDG&E finalizes both design and environmental considerations 6. SDG&E secures any remaining permits ahead of construction
CONSTRUCTION AND ACTIVATION	

Program Performance Metrics

The Evaluation team reviewed sites participating in the SDG&E Schools and Parks Pilots and analyzed them by status. Table 127 and Table 128 provide the count of sites by completion status in SDG&E's Schools Pilot and Parks Pilot, respectively, in EY2024 and for the pilot to date.

Table 127. SDG&E Schools Pilot Complete Site Count by Status

Site Status	EY2024	Pilot to Date
Utility Construction Complete	4	19
Activated	4	19
Operational	4	19
Closed Out	13	17

Table 128. SDG&E Parks Pilot Complete Site Count by Status

Site Status	EY2024	Pilot to Date
Utility Construction Complete	2	11
Activated	2	11
Operational	2	11
Closed Out	3	11

In EY2024, all SDG&E Schools and Parks Pilots sites that had been activated became operational. Neither pilot signed any additional contracts in EY2024, so the total number of contracts signed to date remains 27 for the Schools Pilot and 11 for the Parks Pilot.

Table 129 presents site-level data by each pilot, showing DAC status and number of ports for the sites activated in EY2024 and in the pilots to date. The cumulative percentage of DAC sites in the Schools Pilot is 53%, which exceeds the Pilot's *per se reasonableness* DAC metric of 40%. The Schools Pilot deployed an additional 40 L2 charging ports in EY2024, bringing the total number of ports installed in the pilot to date to 174 (167 L2, 7 DCFC).

As displayed in Table 129, in EY2024 the Parks Pilot installed 25 additional charging ports (23 L2, 2 DCFC), increasing the total number of charging ports installed to 90 (82 L2, 8 DCFC) in the pilot to date. The two SDG&E Parks Pilot sites activated in EY2024 are located in DACs, bringing the percentage of DAC sites to date to 91%. The only Parks Pilot site that sits outside of a DAC is located on tribal land. SDG&E's Parks Pilot has separate *per se reasonableness* DAC goals for charging sites located in city or county parks (100%) versus state parks or beaches (50%).

Table 129. SDG&E Schools and Parks Pilots Activated Site Data in EY2024 and Pilot to Date

Pilot	EY2024				Pilot to Date			
	Activated Sites inside DAC	Activated Sites outside DAC	L2 Charging Ports	DCFC Charging Ports	Activated Sites inside DAC	Activated Sites outside DAC	L2 Charging Ports	DCFC Charging Ports
Schools	2	2	40	-	10	9	167	7
Parks	2	-	23	2	10	1	82	8

As shown in Table 130, the 19 activated sites to date in the SDG&E Schools Pilot is 63% of the pilot's *per se reasonableness* goal of 30 sites. The activated sites support 167 L2 ports, which is 91% of the pilot's *per se reasonableness* goal of 184 L2 charging ports. The activated sites also support seven DCFC ports,

which are 58% of the Pilot's *per se reasonableness* goal of 12 DCFC charging ports. The 27 customer contracts signed to date could satisfy 83% of the SDG&E Schools Pilot site goal.

Table 130. SDG&E Schools Pilot Site and Port *Per se Reasonableness* Goal Progress

Pilot Metric	<i>Per se Reasonableness</i> Goal	Pilot to Date
Activated Sites	30	19
L2 Ports	184	167
DCFC Ports	12	7

As displayed in Table 131, the 11 activated sites to date in the SDG&E Parks Pilot are 50% of the Pilot's *per se reasonableness* goal of 22 sites. The activated sites support 82 L2 ports, which are 50% of the Pilot's *per se reasonableness* goal of 164 L2 charging ports. The activated sites also support eight DCFC ports, which meet 62% of the Pilot's *per se reasonableness* goal of 13 DCFC charging ports.¹³³ The 11 customer contracts signed to date could satisfy 50% of the SDG&E Parks Pilot site goal.

Table 131. SDG&E Parks Pilot Site and Port *Per se Reasonableness* Goal Progress

Pilot Metric	<i>Per se Reasonableness</i> Goal	Pilot to Date
Activated Sites	22	11
L2 Ports	164	82
DCFC Ports	13	8

The CPUC established six phases in the program timeline per the SB 350 reporting template. Table 132 shows the median durations by program phase for EY2024 and pilot-to-date activated sites in the SDG&E Schools Pilot. In EY2024, the median number of calendar days by phase for the Schools Pilot ranged from 22 days for Contract Issuance to 382 days for Design and Permitting. Median durations for the Application Review, Construction Complete, and Activation phases were significantly longer in EY2024 than those for the pilot to date. In total, sites activated in EY2024 took an average of 1,084 days from the Application Review phase through Activation, compared to 686 in the program to date. The Site Visit Findings section below describes possible causes of the long activation timelines, including delays in the NSP commissioning process.

Table 132. SDG&E Schools Pilot Median Calendar Days per Phase

CPUC Program Phase	Median Calendar Days	
	EY2024	Pilot to Date
Application Review	140	24
Site Assessment	197	196
Contract Issuance	22	22
Design and Permitting	382	352
Construction Complete	316	89
Activation	27	3

¹³³ DCFCs are limited to colleges and universities.

Table 133 shows the median durations by program phase for EY2024 and pilot-to-date activated sites in the SDG&E Parks Pilot. The median number of calendar days per phase for the Parks Pilot sites in EY2024 ranged from 12 days for Contract Issuance to 664 days for Design and Permitting. The Site Assessment, Design and Permitting, Construction complete, and Activation phases for the EY2024 activated sites took significantly longer than the pilot-to-date median. In total, sites activated in EY2024 took 1,312 days from the Application Review phase through Activation, compared to 555 in the pilot to date. Since only two sites were activated in 2024, the Evaluation Team cannot draw conclusions about the longer than average activation timelines for these sites.

Table 133. SDG&E Parks Pilot, Median Calendar Days per Phase

CPUC Program Phase	Median Calendar Days	
	EY2024	Pilot to Date
Application Review	18	24
Site Assessment	439	204
Contract Issuance	12	22
Design and Permitting	664	220
Construction Complete	114	77
Activation	65	8

Program Materials Summary

Schools Pilot and Parks Pilot: SDG&E maintains webpages with information on the pilots, including program highlights, equipment ownership options, and program eligibility requirements. In 2024, SDG&E reported a total of 306 total visitors to the Power Your Drive for Schools, Parks and Beaches Pilot landing page and 382 total page views. For the Schools Pilot page, there were 253 visitors and 337 page views. For the State Parks & Beaches Pilot page, there were 105 total visitors and 119 page views. For the City & County Parks Pilot page, there were 79 total visitors and 90 page views.

Schools Pilot: For the Schools Pilot, SDG&E staff mentioned that most participating customers have multiple sites suitable for program enrollment. In EY2024, SDG&E was focused on developing new sites operated by existing customers, rather than recruiting new participants. As a result, the majority of marketing activities took place in EY2023, with no new initiatives in EY2024.

In EY2024, SDG&E donated an out-of-commission charger to an elementary school to give students an opportunity to explore and learn about EV technology. The school placed the charger in its library, where students can interact with it.

Parks Pilot

The primary marketing activity for the Parks Pilot was the #LOVEELECTRIC campaign, which was less robust in EY2024 than in EY2023 due to program enrollment closing as projects were already established. There were no ribbon-cutting ceremonies for the Parks program in 2024.

Budget Summary

As shown in Figure 258, from inception through the end of 2024, SDG&E spent \$9.0 million of the \$9.9 million approved budget for the Schools Pilot and \$5.9 million of the \$8.8 million approved budget for the Parks Pilot. Parks Pilot spending continues to be lower than expected because the primary activities have focused on negotiations with the DPR for state park sites and ongoing maintenance for established local municipal parks sites.

Timeline

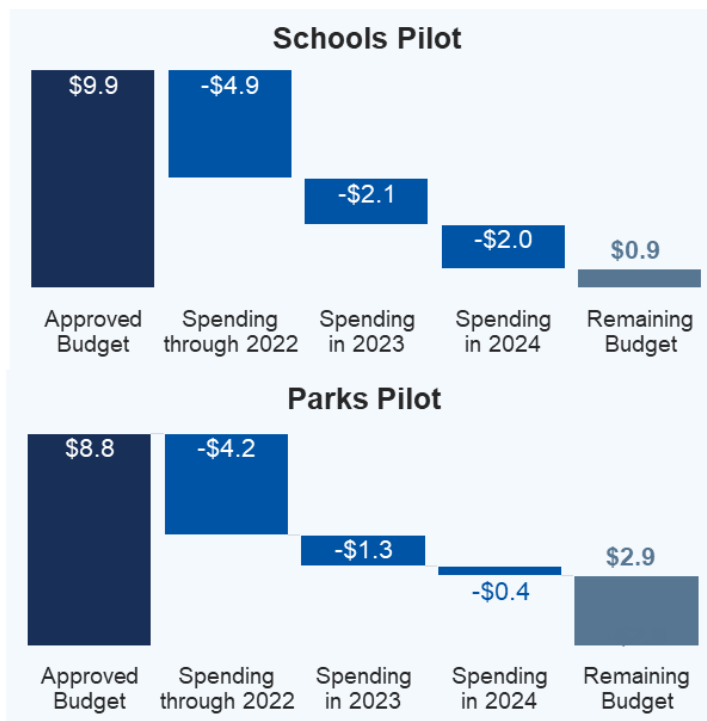
Since the launch of the Schools and Parks Pilots, SDG&E has filed several Advice Letters to propose program changes, report progress, and meet regulatory requirements. On January 6, 2020, SDG&E filed AL 3490-E proposing updates to the Schools Pilot, including the option for school sites to choose between utility- and site-owned EVSE, with utility provided rebates to make the two options for site ownership financially comparable. In June 2020 SDG&E filed AL 3551-E, which outlined specific rebate amounts for EVSE equipment, maintenance, and network fees. This filing complies with Decision 19-11-017.

In February 2020, SDG&E and the joint Utilities filed AL 3504-E, seeking CPUC approval for a survey designed to measure EV adoption at Schools Pilot sites among faculty, parents, and students.

On April 23, 2021, SDG&E filed AL 3748-E, requesting to expand the statewide definition of DACs in the service territory to match SDG&E's DAC definition. The CPUC approved this filing in May 2021.

In June 2021, SDG&E filed AL 3781-E to confirm its plan to install DCFCs across state, city, and county parks. The filing included signed site designs for three parks, confirming host approval for DCFC installation. SDG&E had selected these sites based on features that support shorter dwell times, such as freeway access and multiuse amenities. The filing also met CPUC requirements by documenting site host approval and summarizing the design options presented. In October 2021, SDG&E filed AL 3864-E to confirm its plan to install DCFCs at three educational institutions as part of the Schools Pilot. The filing included signed designs confirming host approval. SDG&E had selected these locations based on commuter-focused use and freeway access. The filing also satisfied CPUC requirements by documenting site host approval and summarizing design options. Although these early filings established the foundation for implementation, staff faced challenges related to construction costs, permitting, and timelines.

Figure 258. SDG&E Schools and Parks Pilots Budget (Millions USD) as of December 31, 2024



Toward the end of 2021, SDG&E filed two key updates. On November 8, the Joint Utilities filed AL 3890-E providing a status update on implementation. The filing confirmed that the Parks Pilot had launched on April 8, 2021, and that the Schools Pilot had launched in October 2021, with the first construction site beginning on October 25, 2021. On November 30, SDG&E filed AL 3902-E, which included an attestation confirming compliance with safety requirements for both pilots. The filing verified that all EV infrastructure installed met federal, state, and local safety standards, as required by Decision 19-11-017.

In April 2022, SDG&E filed AL 3985-E, reporting on efforts to deploy the pilots in Tribal communities. The filing detailed interest from two Tribal Nations and confirmed that one had submitted a complete participation package for the Parks Pilot.

SDG&E did not achieve any major milestones or submit any filings in 2024 and focused its efforts on securing a MPA and constructing sites.

In addition, though it did not file a formal Advice Letter, SDG&E submitted a request through Rule 16.6¹³⁴ to extend program enrollment through December 31, 2025, for the Parks Pilot and through May 30, 2025, for the Schools Pilot.¹³⁵

Figure 259 shows all major milestones since the beginning of the pilots.

¹³⁴ Rule 16.6 provides an extension to comply with commission decision or order. See [Cal. Code Regs. Tit. 20, § 16.6 - \(Rule 16.6\) Extension of Time to Comply | State Regulations | US Law | LII / Legal Information Institute](#) for further information.

¹³⁵ The second Rule 16.6 extension for the Schools program is under review, with a proposed deadline of December 30, 2025.

Figure 259. SDG&E Schools and Parks Pilots Key Milestones



6.2.2. Findings

This section provides findings from analyses of incremental EV adoptions, site visits and site costs, grid impacts, petroleum displacement, GHG and criteria pollutant reductions, and health impacts, as well as insights from Utility staff interviews.

Table 134 summarizes key impact parameters for EY2024 as well as for the program to date. Annual estimates of impacts are provided for metrics calculated as part of the impact evaluation. The table also provides estimates of impacts across all sites included in the program population through the end of 2024.

Table 134. SDG&E Schools and Parks Pilots Impacts Summary

Impact Parameter	EY2021 Sites ^a	EY2022 Sites ^a	EY2023 Sites ^a	EY2024 Sites ^a	EY2024 Sites Percentage in DAC	PTD Sites Actual	PTD Sites Actual Percentage in DAC
Population of Activated Sites	5	10	9	6	67%	30	67%
Sites included in analysis	3	10	9	6	67%	30	67%
Charging Ports Installed	16	89	76	65	63%	264	62%
Electric Energy Consumption (MWh)	30	147	212	118.9	96%	1,627	69%
Petroleum Displacement (GGE)	2,643	12,167	16,048	8,068	96%	133,475	71%
GHG Emissions Reduction (MT GHG) ^b	18	94	126	70.5	96%	1,043	70%
PM ₁₀ Reduction (kg)	0.10	0.48	0.68	0.37	96%	5.2	69%
PM _{2.5} Reduction (kg)	0.09	0.44	0.63	0.34	96%	4.8	69%
ROG Reduction (kg)	1.69	8	9.72	4.7	96%	89.2	72%
CO Reduction (kg)	54	253	343	177	96%	2,984	71%

^a Energy consumption, petroleum displacement, and emissions reductions are based on annualized data. Pilot-to-date results in the table are based on actual data (see *Appendix B* for more details). The one site in EY2021 was not included in the EY2021 Evaluation Report due to insufficient data but is included in PTD impact results in this report.

^b GHGs include CO₂, CH₄, and N₂O multiplied by their respective GWP as defined by IPCC AR5 (see *Appendix B* for more details).

Incremental EV Adoption

The Evaluation Team estimated the effect of the public charging stations on household EV adoption for neighboring populations with a two-state analysis.¹³⁶ In Stage 1, we looked at historical impacts of public EV charging on vehicle ownership. See *Appendix B* for the details of Stage 1 analysis.

Using the impact estimates from the Stage 1 analysis,¹³⁷ the Evaluation Team estimated the impact of SDG&E investments in public charging on EV ownership. By the end of 2024, 19 charging stations in SDG&E's Schools Pilot and 11 charging stations in its Parks Pilot were activated. We estimated the impact of these stations based on annual EV registrations as well as pilot-to-date cumulative EV registrations.

SDG&E Schools Pilot

Based on the composite measure of public charging access, the Evaluation Team calculated the change in access to public charging due to SDG&E's Schools Pilot investment for each CBG for which investments affected access. Table 135 shows that the pilot-to-date average change in access per affected CBG was 16.79, and the average change in the number of chargers (ports) was 8.12 per affected CBG. For reference, the average change in access across all CBGs in California was 1.05 between 2015 and 2023. The average normalized EV annual registration per 1,000 households was 30 in the affected CBGs in the 2020 baseline year.

¹³⁶ There are two main channels through which the availability of public charging networks may affect EV purchases. The first is a network effect, through which EV owners gain increased access to the public charging stations because of the stations' placement at destinations such as workplaces, commercial establishments, schools, and parks. The Evaluation Team expects the availability of EV charging equipment at convenient locations (for midday charging away from home) to increase the convenience of owning an EV (such as lessening range anxiety) and to increase the probability of EV ownership. The second channel is a neighborhood effect on the driving population living in areas neighboring the public EV charging stations. The Evaluation Team expects the availability of nearby charging infrastructure to reduce the cost of EV ownership by providing alternatives to home charging. We expect that public EV charging will have the biggest impact on residents of multifamily buildings, many of whom will have limited access to EV charging equipment, or on low-income households, who may be unable to afford home EV charging equipment. The public charging access may boost EV ownership through both channels and there may be positive interactive effects between the channels that boost the overall impact of public charging networks. The Evaluation Team focused on analyzing the second channel and will analyze the impacts for the first channel separately when data become available.

¹³⁷ The Stage 1 analysis used vehicle registration data from 2015 to 2023, the most recent period with complete information at the CBG level. The EY2024 estimates assume the impact of Utility-specific stations remains unchanged over time, which may not reflect actual market and technological changes in 2024.

Table 135. SDG&E Schools Pilot Summary Statistics of Effects on CBGs

Pilot	CBG Mean (Standard Deviation)			
	Change in Composite Measure of Access ^a	Change in Number of Chargers ^a	Normalized Annual EV Registrations ^b	Number of Households ^c
SDG&E Schools Pilot	16.79	8.12	30.29	486.50
	(38.85)	(4.17)	(29.85)	(244.72)
CBGs (N)	23	23	23	23

These values are averages for the CBGs whose access to public charging was affected by SDG&E's investments.

^a Change in composite measure of access and number of chargers is from 2020 to 2024.

^b Normalized annual EV registrations are average annual values in the affected CBGs in 2020 per 1,000 households.

^c Number of households is based on 2015–2019 American Community Survey (ACS).

Sample standard deviations are in parentheses.

The Evaluation Team calculated the impact of the Schools Pilot Utility charging investments on neighboring EV ownership. This involved combining the OLS and IV-2SLS regression estimates of the impact of public charging access on EV registrations from Stage 1 with the estimates of the CBG changes in public charging access and household counts.¹³⁸ The impacts of the SDG&E investments on EV registrations will depend on the extent to which investments increased access in the affected CBGs and the number of households in the CBGs.

Table 136 shows estimates of the annual and pilot-to-date EV registrations attributable to the SDG&E Schools Pilot charging investments. Based on the OLS long differences model,¹³⁹ SDG&E School Pilot investments in charging facilities increased EY2024 annual EV registrations by 23 vehicles and pilot-to-date cumulative EV registrations by 35 vehicles. Based on the IV-2SLS long differences model, the School Pilot investments increased annual EV registrations by 45 vehicles and pilot-to-date cumulative EV registrations by 100 vehicles. The Evaluation Team prefers the IV-2SLS-based estimates because they account for the potential endogenous siting decisions of public charging (i.e., siting public charging infrastructure in locations likely to have above- or below-average expected rates of EV adoption). These estimates reflect the 19 activated Schools Pilot facilities operating for a full year.

¹³⁸ In Stage 1, the Evaluation Team estimated the impact of public EV charging access on EV ownership. For Stage 2, we built on the Stage 1 analysis and conducted an attribution analysis of Utility-specific investments. A notable benefit of this approach is that it also applies to evaluations of other programs that lead to increased EV charging access, which ensures methodological consistency.

¹³⁹ The long differences model estimates indicate the impact of public charging on EV registration over eight years. The team divided these estimates by eight to annualize them.

Table 136. SDG&E Schools Pilot EV Registrations Attribution

EY2024 Annual Increase of EV Registrations Driven by the Utility Program		PTD Cumulative Increase of EV Registrations Driven by the Utility Program	
OLS	IV-2SLS	OLS	IV-2SLS
23.17	45.08	34.96	99.89
(4.63)	(15.11)	(5.73)	(22.60)

Note: The table shows the EV registrations attributable to the utility investments in public charging infrastructure. The left panel shows the impacts of utility investments since 2020 on registrations in EY2024. The right panel shows the cumulative impacts of Utility investments since 2020 on EV registrations in EY2021, EY2022, EY2023, and EY2024. The Evaluation Team based these estimates on the OLS and IV-2SLS long differences models. The Team estimated the OLS long differences model using data for all CBGs in the analysis sample. We estimated the IV-2SLS long differences model for CBGs in the 20 largest California cities. The long differences are five-year estimates, which the Evaluation Team annualized by dividing the results by five. For each affected CBG, the Team calculated the increase in annual registrations as the product of the regression-based access coefficient divided by eight, multiplied by the change in composite public charging access from utility investments (between baseline 2020 and EY2024), multiplied by the number of CBG households (in thousands). Robust standard errors clustered at the CBG level are in parentheses.

As in past evaluation years, the SDG&E Schools Pilot investments in public charging had economically meaningful impacts on EV ownership in EY2024. Across all 23 affected CBGs, the total number of EV registrations is about 697 (23*30.29), so the preferred IV-2SLS regression estimates the cumulative impact of the SDG&E Schools Pilot to date to be an increase in EV registrations of about 14.3% (99.89/697). An average of 30 EV registrations per CBG puts these CBGs in the 57th percentile of the EV registration distribution of CBGs, implying an average level of baseline EV registration.

SDG&E Parks Pilot

The Evaluation Team used the same approach as for the Schools Pilot to calculate the change in public charging access due to SDG&E's Parks Pilot investment for each CBG where the investments affected access. Table 137 shows that the pilot-to-date average change in the composite measure of access was 13.76 per affected CBG, and the average change in the number of chargers was 3.91 per affected CBG. The average normalized EV annual registration per 1,000 households was 15 in the affected CBGs in the 2020 baseline year.¹⁴⁰

¹⁴⁰ Averages of the median income and percentage of multifamily housing units in affected CBGs puts the CBGs in the second median income quartile and the third multifamily housing quartile.

Table 137. SDG&E Parks Pilot Summary Statistics of Effects on CBGs

Pilot	CBG Mean (Standard Deviation)			
	Change in Composite Measure of Access ^a	Change in Number of Chargers ^a	Normalized Annual EV Registrations ^b	Number of Households ^c
SDG&E Parks Pilot	13.76	3.91	15.08	407.40
	(6.69)	(5.64)	(12.01)	(177.35)
CBGs (N)	21	21	21	21

These values are averages for the CBGs whose access to public charging was affected by SDG&E's investments.

^a Change in composite measure of access and number of chargers is from 2020 to 2024.

^b Normalized annual EV registrations are average annual values in the affected CBGs in 2020 per 1,000 households.

^c Number of households is based on 2015–2019 American Community Survey (ACS).

Sample standard deviations are in parentheses.

Table 138 shows estimates of the annual and pilot-to-date EV registrations attributable to the SDG&E Parks Pilot charging investments.¹⁴¹ Based on the OLS long differences model, SDG&E's investments in Park Pilot charging facilities increased EY2024 annual EV registrations by four vehicles and pilot-to-date cumulative EV registrations by 11 vehicles. Based on the IV-2SLS long differences model, SDG&E's investments increased EY2024 annual EV registrations by eight vehicles and pilot-to-date cumulative EV registrations by 33 vehicles. The Evaluation Team prefers the IV-2SLS-based estimates because they account for the potential endogenous siting decisions for public charging infrastructure (i.e., siting infrastructure in locations likely to have below- or above-average rates of EV adoption). These estimates reflect the operation of nine activated Parks Pilot facilities over one year.

Table 138. SDG&E Parks Pilot EV Registrations Attribution

EY2024 Annual Increase of EV Registrations Driven by the Utility Program		PTD Cumulative Increase of EV Registrations Driven by the Utility Program	
OLS	IV-2SLS	OLS	IV-2SLS
4.33	8.42	10.81	32.82
(0.49)	(1.58)	(0.73)	(3.10)

Note: The table shows the EV registrations attributable to the utility investments in public charging infrastructure. The left panel shows the impacts of utility investments since 2020 on registrations in EY2024. The right panel shows the cumulative impacts of Utility investments since 2020 on EV registrations in EY2021, EY2022, EY2023, and EY2024. The Evaluation Team based these estimates on the OLS and IV-2SLS long differences models. The Team estimated the OLS long differences model using data for all CBGs in the analysis sample. We estimated the IV-2SLS long differences model for CBGs in the 20 largest California cities. The long differences are five-year estimates, which the Evaluation Team annualized by dividing the results by five. For each affected CBG, the Team calculated the increase in annual registrations as the product of the regression-based access coefficient divided by eight, multiplied by the change in composite public charging access from utility investments (between baseline 2020 and EY2024), multiplied by the number of CBG households (in thousands). Robust standard errors clustered at the CBG level are in parentheses.

¹⁴¹ The long differences model estimates indicate the impact of public charging on EV registration over eight years. The Evaluation Team annualized these estimates by dividing the results by eight.

As in previous evaluation years, the SDG&E Parks Pilot investments in public charging had less impact on EV ownership than the Schools Pilot investments in public charging. Across all 21 affected CBGs, the total annual number of EV registrations is about 689 (21×15.08), so the EY2024 impact of the SDG&E Parks Pilot boosts EV registrations by 1.2% ($8.42/689$), and the pilot-to-date impact boosts EV registrations by 4.8% ($32.82/689$). The Evaluation Team expected the Parks Pilot to have a smaller impact than the Schools Pilot, as metrics reflecting charging facility access (number of stations, number of chargers, and distance to the stations) were about 18% lower for the Parks Pilot than those for the Schools Pilot. Compared to EY2023, the percentage increase in EV registration has not changed significantly, and has even decreased slightly, primarily due to the minimal increase in active charging stations in affected CBGs, as well as the higher EV registration baseline level of newly influenced CBGs.

Highlights

- The model's output shows that the Schools and Parks Pilots may have contributed to the PTD EV adoption of 100 and 22 EVs respectively for households neighboring the infrastructure.
- As in the previous evaluation year, the Schools Pilot had a greater impact than the Parks Pilot, mainly due to the accessibility to the Schools Pilot charging facilities, which had more charging stations and chargers and shorter distances to the stations.

Site Visit Findings

The Evaluation Team visited all sites activated in 2024 including four School Pilot sites and two Park Pilot sites. During these site visits, the Evaluation Team documented the number of ports installed in EY2024 (63 L2 and two DCFC), amount of installed charging capacity (541 kW), number of parking spaces within reach of charging cords (65), and number of parking lots that include one or more Americans with Disabilities Act (ADA)-compliant spaces per site. This brings the total port count to 264 and installed capacity to nearly 2.5 MW. Figure 260 and Table 139 show ports and capacity based on site visits in 2024 and prior years.

Figure 260. SDG&E Schools and Parks Pilots Ports and Capacity Observed in 2024 and Prior Years

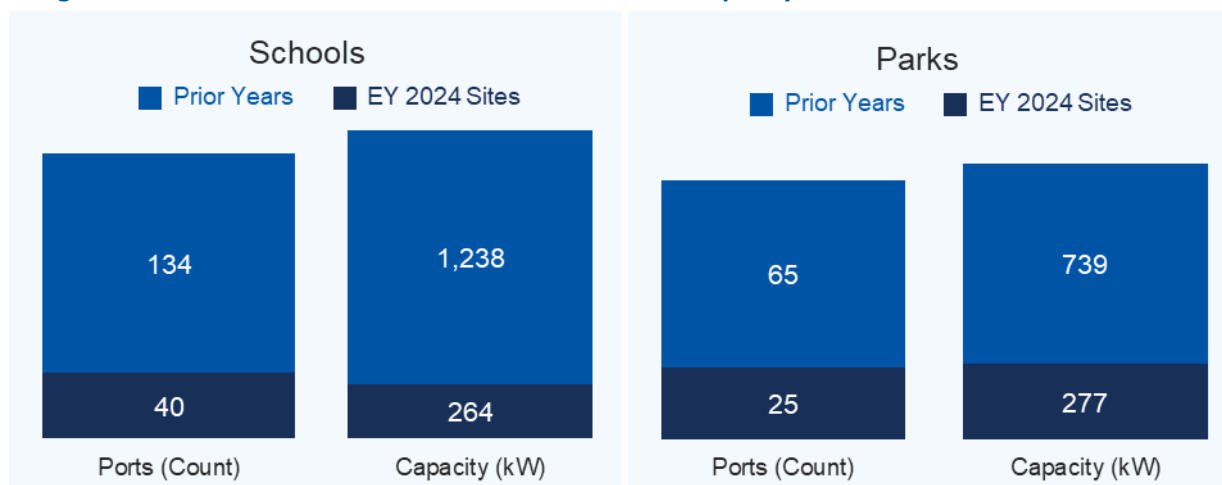


Table 139. SDG&E Schools and Parks Pilots Ports and Capacity Observed during 2024 Site Visits

Pilot	L2 Ports	DCFC Ports	Capacity (kW)	ADA Spaces	Connector
School 1	8	-	53	2	J1772
School 2	12	-	79	2	J1772
School 3	12	-	79	2	J1772
School 4	8	-	53	2	J1772
Park 1	14	-	92	2	J1772
Park 2	9	2	185	3	J1772, CCS, CHAdeMO
Total	63	2	541	13	J1772, CCS, CHAdeMO

SDG&E activated six sites this year, representing a mixture of sites primarily in urban-suburban portions of San Diego County as shown in Figure 261. Across the six sites that were activated, an additional 541 kW of charging capacity was installed, two of which were high schools that included L2 ports.

Figure 261. SDG&E Schools and Parks Pilots Charging Location



Many of SDG&E's sites continue to offer higher access to charging by increasing the ratio of parking spaces within reach of charging ports. This is often achieved by installing charging in the center of two rows of parking spaces, an example of which is shown below in Figure 262.

Another site the Evaluation Team visited provided both L2 and DCFC chargers for greater charging flexibility (Figure 263). The Evaluation Team will consider the benefits of this type of installation in the coming years of EV market development through energy trends.

Figure 262. SDG&E Schools and Parks Pilots Example of High Access L2 Charging Layout

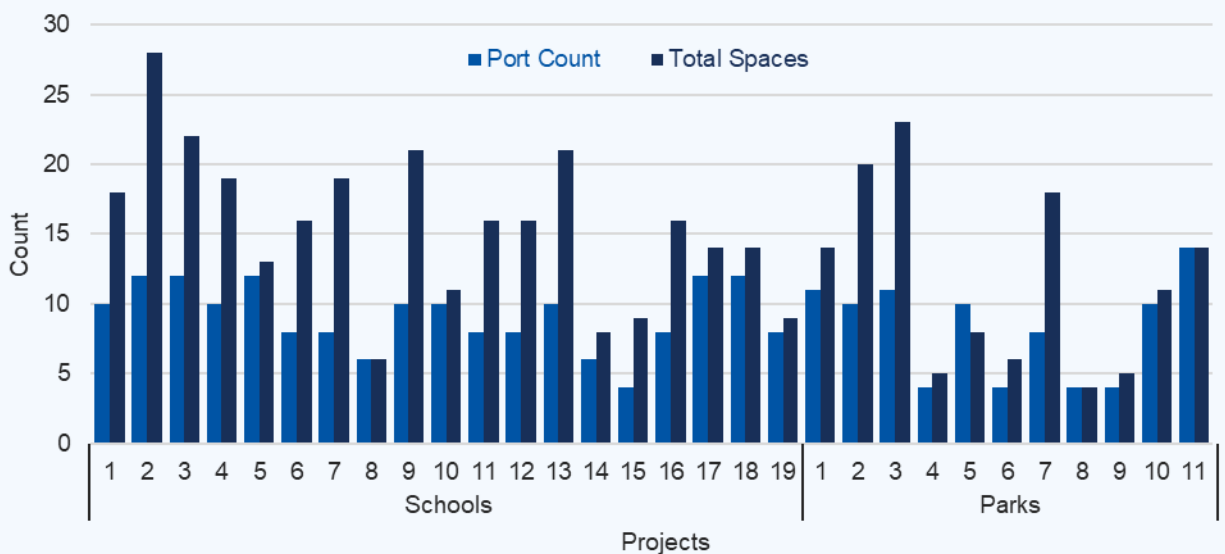


Figure 263. DCFC and L2 Chargers at an SDG&E Schools and Parks Pilot Site



Figure 264 shows the number of ports and the number of parking spaces that can access these ports for the sites the Evaluation Team visited. Higher access ratios may increase utilization of charging infrastructure through facilitating turnover of charging ports and enabling resiliency if one or more ports are unavailable for use. Overall, these sites average 1.6 parking spaces within reach of a charging port. One EY2024 site the Evaluation Team visited achieved a ratio of two parking spaces that can be reached by a single port.

Figure 264. SDG&E Schools and Parks Pilots Visited Sites Charging Port Availability by Site for PTD Sites



Unique to SDG&E's portfolio of Schools and Parks Pilots sites is that the Utility owns all the site infrastructure. The Utility contracts with a single NSP, which acts as customer-of-record for all the sites. As in previous years, at the time of site visits, many EVSE were energized but unavailable for public access due to significant delays in commissioning. However, the brand of hardware the sites use is

programmed to allow several free charging sessions per EVSE (L2 and DCFC), and some EV drivers have learned that key fobs are able to begin charging sessions, even when the stations are not fully commissioned on the network.

The Evaluation Team does not typically ask site hosts questions about the background for these sites. However, since two sites had not been commissioned at the time of the site visit (many months after the chargers were energized), hosts for these sites made an effort to connect with the evaluator staff during the site visits with hopes of learning when charging would be available for their staff or to otherwise expedite their already lengthy wait. According to Utility staff, the NSP has experienced extensive staff turnover, which has led to poor communications, but NSP expected commissioning times to improve. However, the Evaluation Team has been unable to determine the causes of the significant commissioning delays as the Evaluation Team has not communicated directly with the NSP staff responsible.

Given that SDG&E owns the infrastructure, the Utility's NSP passes its TOU rates directly to EV drivers. All EV drivers therefore receive a message via charging rates on the EVSE display or through the NSP phone application that may help influence their charging habits in a way that benefits VGI. Idle fees were not noted at the time of this report. Additional details can be found in the *Grid Impacts* section below.

Highlights

- SDG&E installed 65 new ports: 63 L2 ports and 2 DCFC ports, totaling an additional 541 kW of charging capacity. This brings program to date totals to 249 L2 and 15 DCFC ports resulting in nearly 2.5 MW of installed charging capacity.
- As in past years, extended commissioning delays at times approaching 18 months have led to low use for the community, questionable perception impacts, and free energy to some drivers.
- Using a single NSP to operate these sites in addition to past SDG&E sites (network and maintenance) may have created a vacuum allowing commissioning delays.
- All sites provide TOU pricing to drivers, potentially improving and benefiting VGI.

Site Costs

The Evaluation Team conducted a cost analysis on 17 school sites and 11 park sites activated in EY2022, EY2023, and EY2024 with fully closed out finances as of December 31, 2024. The set of fully closed out sites is smaller than the set of activated sites because of the time required to perform tasks such as collecting receipts, paying invoices, and obtaining administrative approvals. Cost estimates presented here are in nominal dollars. The 28 sites had a mix of L2 and DCFC ports, with an average of approximately nine ports and 85 kW of installed capacity.

Figure 265 shows the distribution of site-level costs for the 28 sites. The horizontal lines of the boxes show the 25th, 50th, and 75th percentile of sites; the “x” represents the mean site cost; and the three panels are defined as follows:

- **Utility Infrastructure Costs.** Site costs borne by SDG&E for TTM and BTM.¹⁴²
- **Ratepayer-Funded Costs.** All site costs borne by SDG&E, calculated by summing actual TTM costs paid by SDG&E, BTM costs paid by SDG&E, and estimated EVSE rebates paid by SDG&E.
- **Estimated All-in Costs.** The total cost of capital and installation borne by SDG&E and the customer, calculated by summing actual TTM costs paid by SDG&E, BTM costs paid by the customer or by SDG&E, and estimated EVSE costs.¹⁴³

Figure 265. SDG&E Schools and Parks Pilots Program Per-Site Costs Organized by Three Perspectives, Across 28 Closed-out PTD Sites

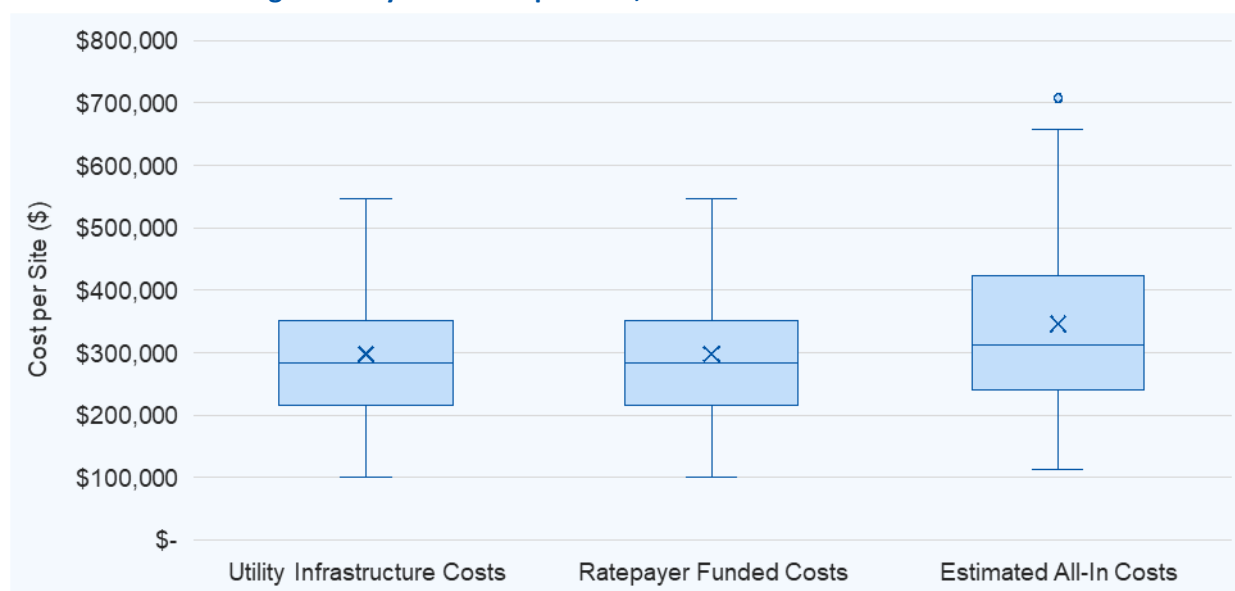


Figure 266 shows average all-in costs for the 28 sites. BTM has the largest cost across the sites, followed by EVSE and then TTM. Together, the average all-in TTM, BTM and EVSE cost is \$346,253 PTD.

¹⁴² Values are the same as the Ratepayer-Funded Costs, without the inclusion of the EVSE estimates.

¹⁴³ EVSE equipment costs are estimated by the Evaluation Team using an assumption of \$3,000 per port for L2 ports and \$45,000 per port for DCFC ports.

Figure 266. SDG&E Schools and Parks Pilots Average All-In Costs, Across 28 Closed-out PTD Sites

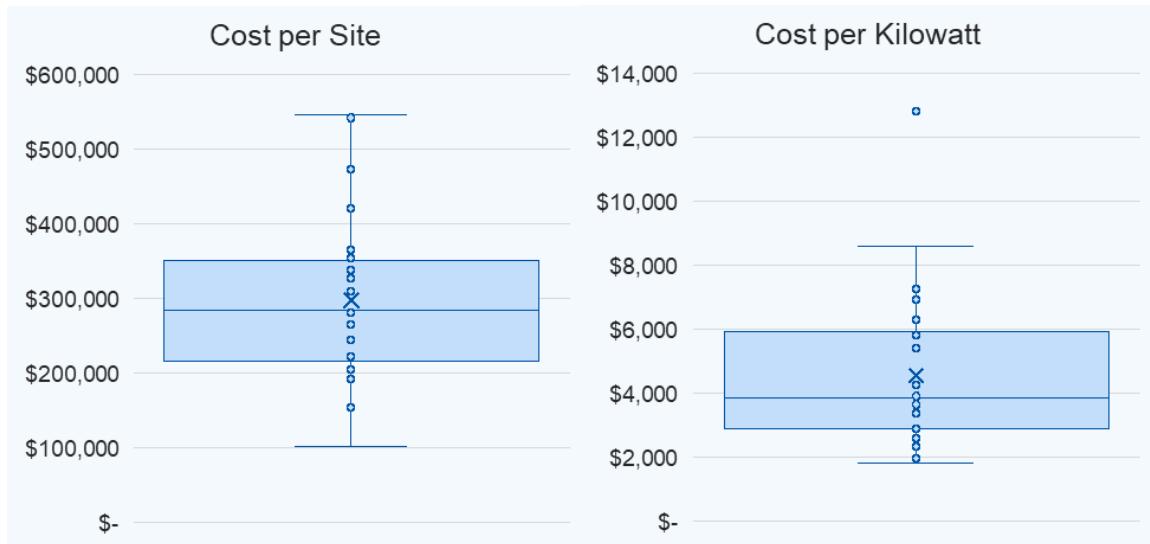


Figure 267 shows the distribution of Utility infrastructure costs (corresponding to the far-left panel in Figure 265) presented per site and per kilowatt. The average Utility infrastructure cost of TTM and BTM borne by SDG&E across sites PTD was \$297,610 per site¹⁴⁴ and \$4,545 per kilowatt.¹⁴⁵

¹⁴⁴ Calculated by summing all TTM and SDG&E-sponsored BTM costs and dividing by the number of sites. Number reflects maximum infrastructure rebate offered for sites that have not yet applied for rebates, which may vary significantly from actual infrastructure rebate amount paid.

¹⁴⁵ Calculated by summing all TTM and SDG&E-sponsored BTM costs and dividing by the sum of installed capacity.

Figure 267. SDG&E Schools and Parks Pilots Cost per Site and per Kilowatt Across 28 Closed-out PTD Sites



Highlights

- All-in Costs paid by SDG&E vary widely between sites, with an average PTD of \$346,253 per site. BTM was the largest cost across the sites, followed by TTM, then EVSE.
- The average cost of SDG&E-sponsored TTM and BTM across sites PTD was \$297,610 per site and \$4,545 per kilowatt.

Grid Impacts

This year, the SDG&E Parks and Schools Pilots reporting is broken into separate sections with this first section dedicated to school sites. The Evaluation Team determined grid impacts for the SDG&E Schools Pilot based on the analysis of energy consumed by operational charging stations installed through the pilot through the end of 2024, combined with charging session data from the NSP

Data Sources

The primary data source used in this section is the energy usage data provided in regular 15-minute intervals from the AMI. Other data sources include customer bills, and data provided by NSPs. There are several important differences between AMI and NSP data. While the AMI data reflects only energy usage, NSP data includes energy usage, session start and stop time, the duration of a vehicle's connection to a charging port, the duration of a vehicle actively pulling power, and the specific port used for a session. An AMI meter does however track standing loads (such as those the EVSE uses for communications, cooling, active power converters, solenoids, and screens), which NSPs typically cannot do. When AMI data is missing from the dataset, the Evaluation Team uses NSP data to fill the gaps.

Summary of Schools Pilot Grid Impacts

Table 140 presents the estimated SDG&E Schools Pilot program grid impacts.

Table 140. SDG&E Schools Pilot Program Grid Impacts

Impact Parameter	Actual 2024	PTD Actual	10-Year Projection PTD
Operational Sites	4	19	19
Installed Capacity (kW)	264	1,502	1,502
Electric Energy Consumption, MWh	450	788	5,746
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)	68 (15.0%)	127 (16.1%)	N/A
Maximum Demand, kW (with date and time)	381 (9/9/24 10 a.m.)	381 (9/9/24 10 a.m.)	N/A
Maximum On-Peak Demand, kW (with date and time)	251 (9/12/24 7:15 p.m.)	251 (9/12/24 7:15 p.m.)	N/A

The remainder of this section offers detailed findings on actual consumption, demand, and charging session-oriented trends of the combined sites for EY2024.

Energy Trends

Sites in the SDG&E Schools Pilot reached 450 MWh of total consumption in 2024, bringing the PTD total consumption to 788 MWh. A few new sites came online in 2024 whose contribution to overall consumption was fairly small. However, peak demand was 380 kW (at 10 a.m.), nearly double that of the previous year (199 kW). Maximum demand was approximately one-third of the total installed capacity of nearly 1,200 kW. The Evaluation Team attributes the gap between installed capacity and maximum demand to the adoption rate of these charging stations by EV drivers; most sites are not yet heavily used, and significant delays in commissioning them for use may be a contributing factor. We investigate this factor below by assessing monthly consumption and/or load factor on a per-site basis. Figure 268 plots daily energy consumption and maximum demand values for the Schools Pilot.

Figure 268. SDG&E Schools Pilot Monthly Energy Consumption and Maximum Demand

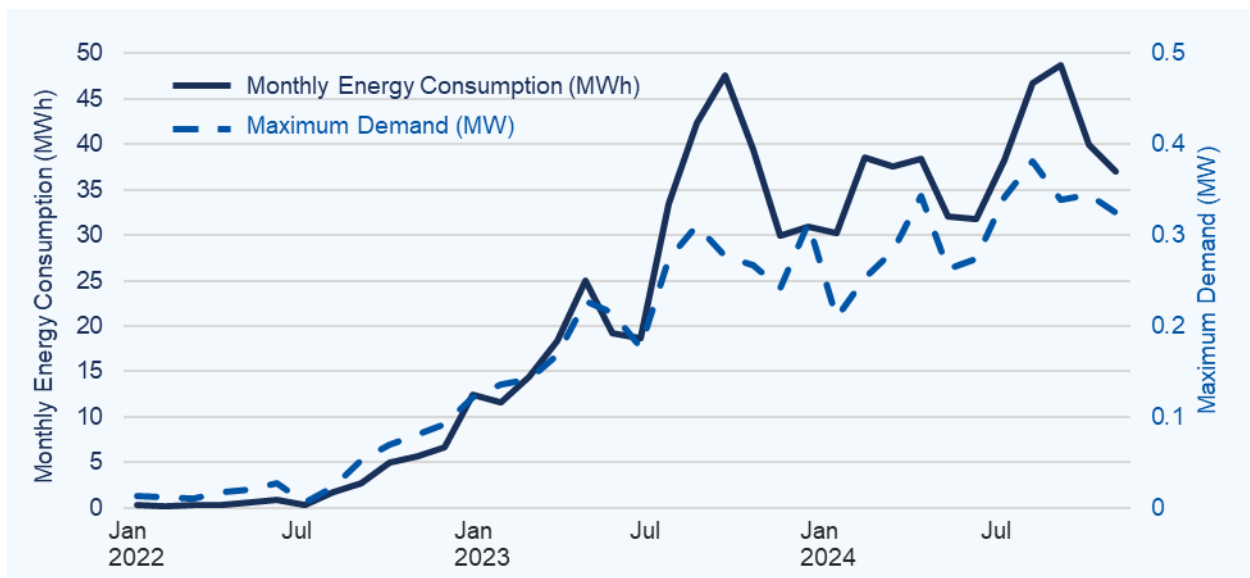
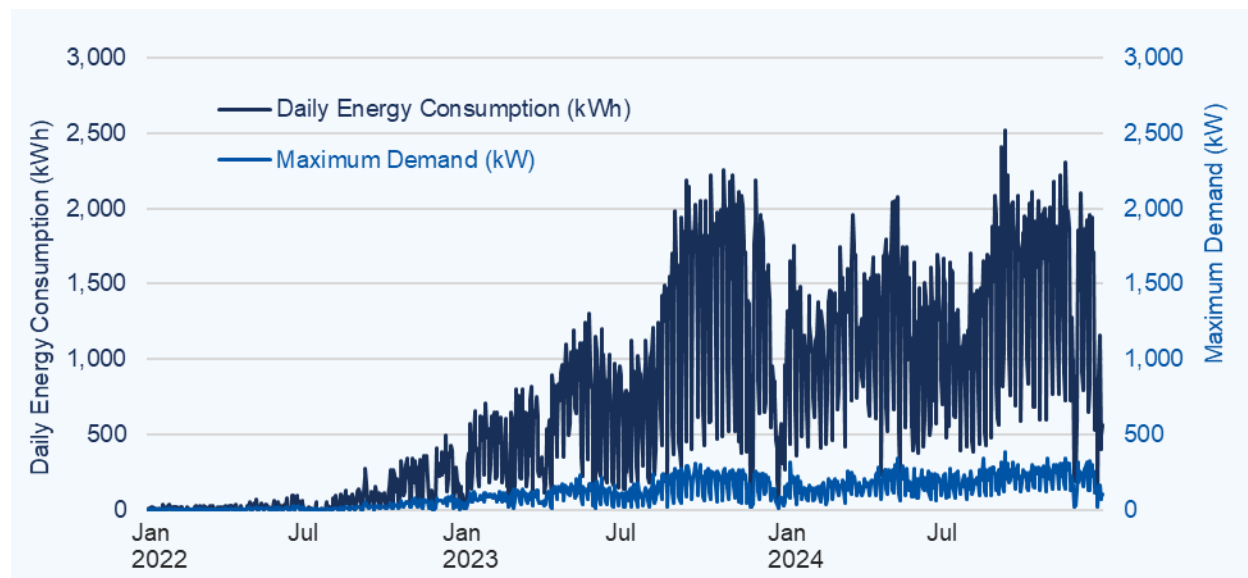


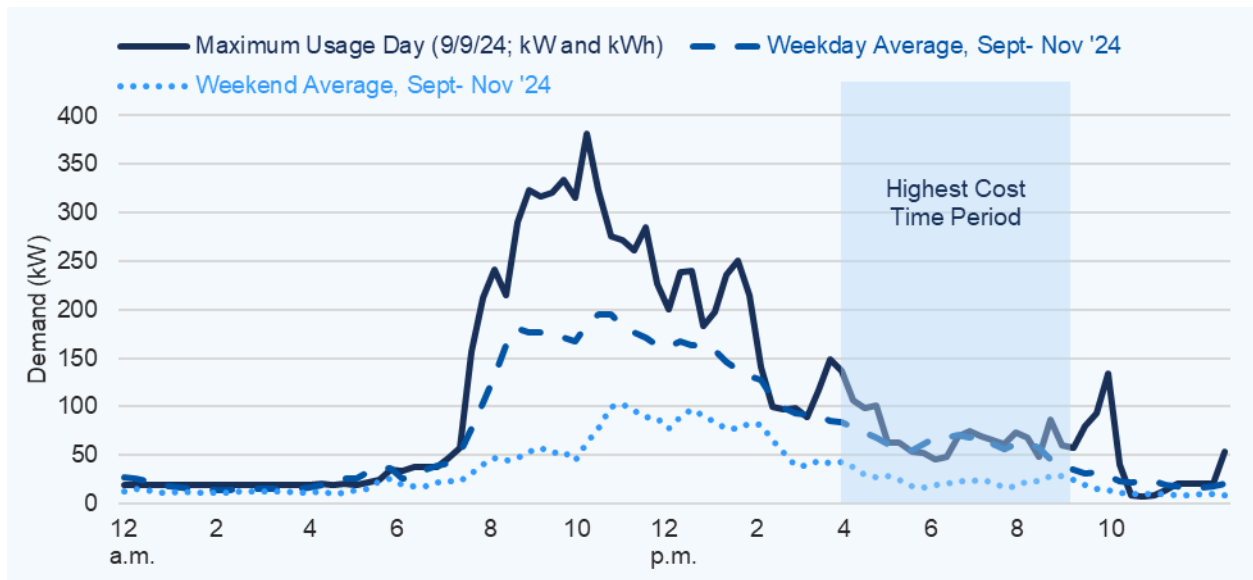
Figure 269 shows daily consumption and maximum demand for 2024 and PTD sites. Daily consumption appears to have been fairly stable, averaging between 1,500 kWh and 2,000 kWh throughout the second half of 2023 and throughout 2024, with dips in consumption aligned with summer and winter school breaks. Daily maximum demand increased from 150 kW in January to over 300 kW in December 2024, but overall maximum demand was similar between the second half of 2023 and the second half of 2024.

Figure 269. SDG&E Schools Pilot Daily Consumption and Maximum Demand, Pilot-to-Date Sites



Though these are workplace-oriented sites that would expect to see activity during workdays, Figure 270 also shows activity during evenings and weekends. As expected, weekend charging is less consistent than weekday charging, with demand ramping more slowly and falling more quickly in the evenings. Weekends average out to a relatively flat period from 10 a.m. through 4 p.m. as shown in Figure 270. Weekdays show a pattern of demand aligning closely with workday activities, with a strong ramp up from 7 a.m. to 9 a.m. and then slowly tapering off for the rest of the day.

Figure 270. SDG&E Schools Pilot Average Weekday and Weekend Q4 2024 Load Curves



The day with the highest demand and consumption in 2024 was September 9. The day exhibits a bit more energy usage after the workday through the evening, with a spike in demand at the 9 p.m. off-peak period.

Three school sites show very little usage in 2024; however, their charging pattern suggests that they may be used by a school staff member or nearby residents who charge overnight.

Usage Trends

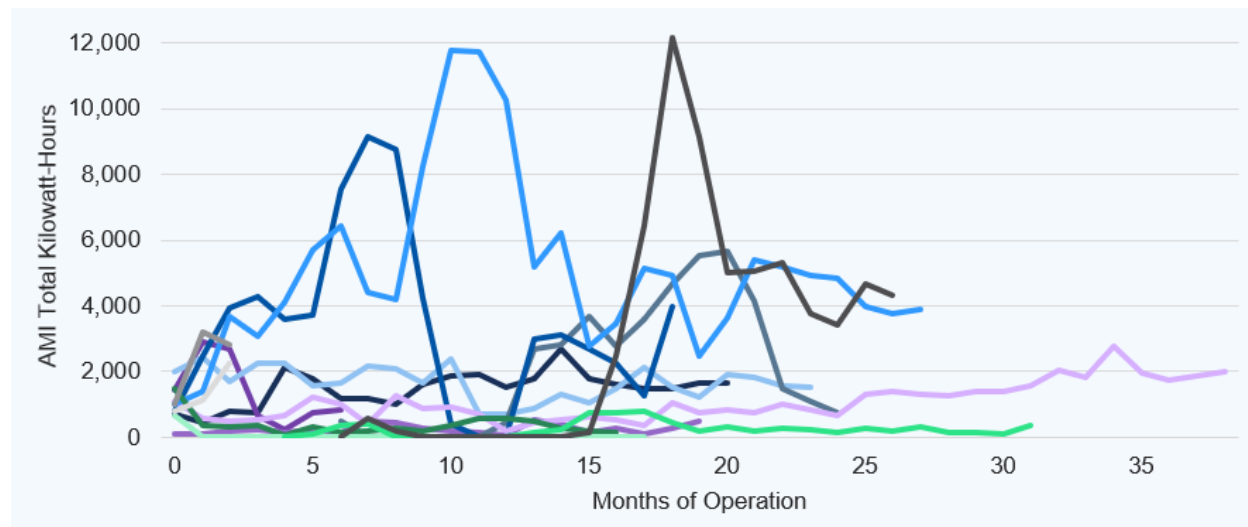
Growth in consumption and number of charging sessions may indicate that EV drivers are becoming more aware of these EVSE and are incorporating them into their charging habits, or that the new charging availability is influencing drivers of conventional vehicles to trade their vehicle for a PEV. Figure 271 and Figure 272 (kilowatt-hour by month and load factor by month) show sites' monthly trends by their operational age. This allows analysis at a site level compared to overall pilot reporting of how often sites are used over time. Complicating the analysis is that a small subset (three of 19) schools offer DCFC in addition to L2 charging. Unlike a well-defined workplace charging trend (demand often peaking between 8 a.m. and 9 a.m. and then tapering off), DCFC public charging presents a less well-defined pattern. Most K–12 public schools do not promote public charging; however, their chargers are generally accessible during non-school hours, such as on weekends or overnight. At least one school displays signage encouraging the public to charge during non-school hours.

As discussed in the *Site Visit Findings* sections of this and previous years' reports, many of these school sites struggled with delays in commissioning. The following charts begin at the time each site appeared to be commissioned and accessible to users based on evidence of significant charging.

Figure 271 highlights energy consumption of the PTD activated school sites. Six sites have achieved high utilization (over 5 MWh monthly), while six had relatively low utilization (less than 1 MWh monthly) with the remaining sites in the middle. The high utilization sites show steep but inconsistent early growth in

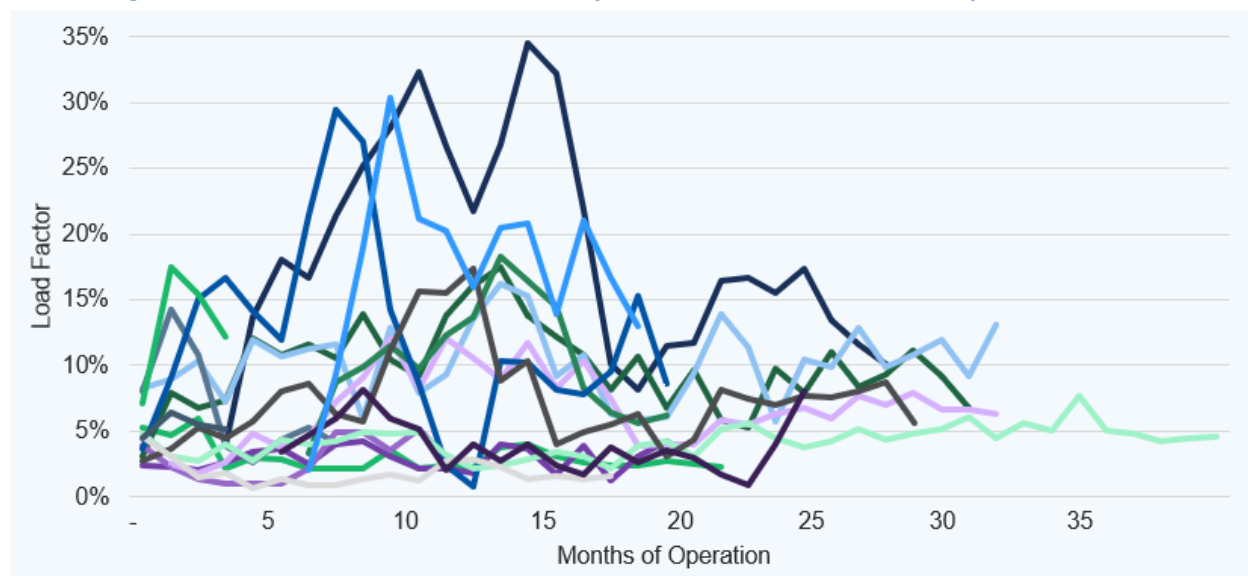
consumption. This pattern could be due to commissioning issues whereby EV drivers learned that they could receive free charging for a period and stopped using the chargers once they were fully commissioned and billing occurred.

Figure 271. SDG&E Schools Pilot Monthly Energy Consumption Based on Site's Operational Time



Load factor directly looks at consistency of charging throughout a given month by comparing total consumption to maximum demand. Upward trending for individual sites indicates most sites appear to grow slowly, trending toward 15% after one to three years. Most sites' load factor appears to range from 5% to 15% as shown in Figure 272.

Figure 272. SDG&E Schools Pilot Monthly Load Factor Based on Site's Operational Time



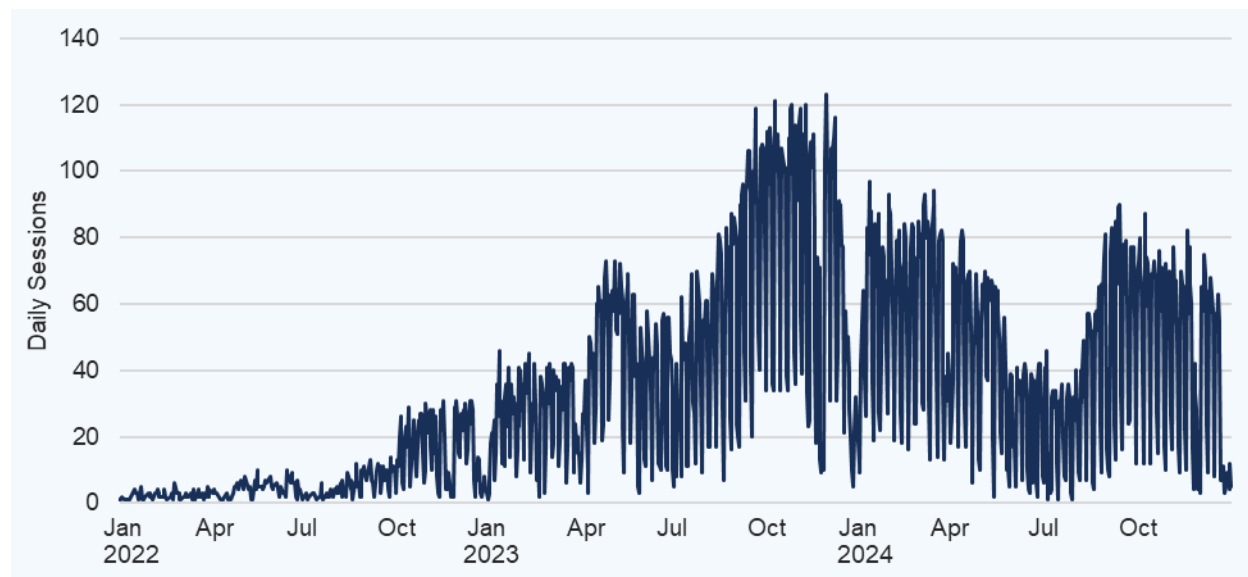
Given that the sites are all at school district workplaces, sites generally show demand starting with the workday (around 7 a.m.) and tapering off beginning in the late morning (11 a.m.). Three sites have

strong L2 usage and higher load factors than the others. The colleges with DCFC show much higher overall demand and consumption, partially due to more use on weekends. One site also shows considerable weekend activity.

In terms of consumption and load factor, many sites appear to be in the process of growing their charging audience. The majority of program sites are slowly growing in demand and utilization over time, though a small number have plateaued or are experiencing very slow uptake.

Figure 273 shows daily charging sessions PTD. Throughout 2024 the pilot averaged between 60 and 80 daily charging sessions, with high use days growing to 80 to 90 average sessions and much less usage in the summer. However, the number of daily charging sessions never exceeded 100, which was consistently achieved throughout late 2023.

Figure 273. SDG&E Schools Pilot Daily Charging Sessions for PTD Sites



This spike in 2023 was likely a result of EV drivers with radio frequency identification (RFID) key fobs charging for free at sites that spent exceptional amounts of time waiting to be commissioned.¹⁴⁶ Many of the Schools and Parks Pilots sites take up to a year to commission after being fully constructed. In 2024, some sites were energized but not able to be used for many months. Severely delayed commissioning had several adverse effects:

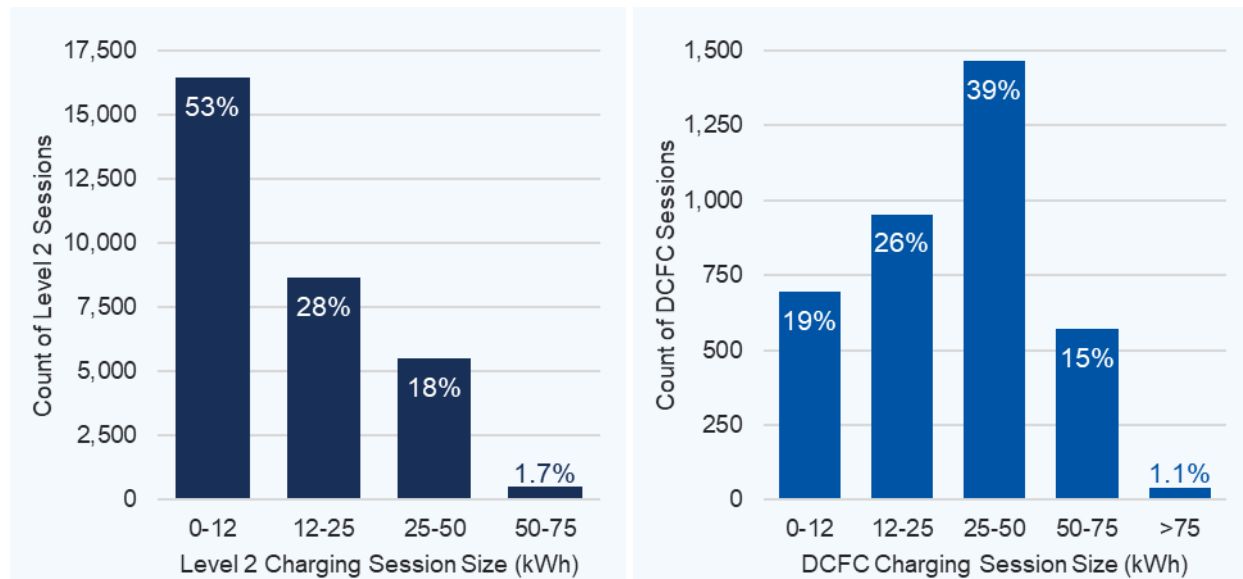
- EV drivers without RFID key fobs are unable to make use of the charging resource while unfairly some with RFID cards are able to charge and at no cost to themselves
- Once token sessions have been fully utilized by EV drivers with RFID key fobs, the EVSE will no longer charge EVs, although some EVSE have continued to allow free charging

¹⁴⁶ As part of the commissioning process, the hardware and network provider SDG&E uses provisions each EVSE (L2 and DCFC) with several token sessions that can be accessed simply by swiping an RFID key fob.

- Prospective users may be frustrated by the inability to use EVSE
- The hardware and network provider must pay for electricity costs from the free charging activity
- Ratepayer return on investment, in terms of GHG reduction, EV uptake, downward pressure on rates, could be limited or delayed

As seen in Figure 274 over half of all L2 charging sessions were fairly small (up to 12 kWh), and almost 30% were between 12 kWh and 25 kWh. In comparison, DCFC charging had over twice as many 25 kWh to 50 kWh sessions and ten times as many large sessions (over 50 kWh).

Figure 274. SDG&E Schools Pilot Charging Session Count by Consumption Size for PTD Sites



Summary of Parks Pilot Grid Impacts

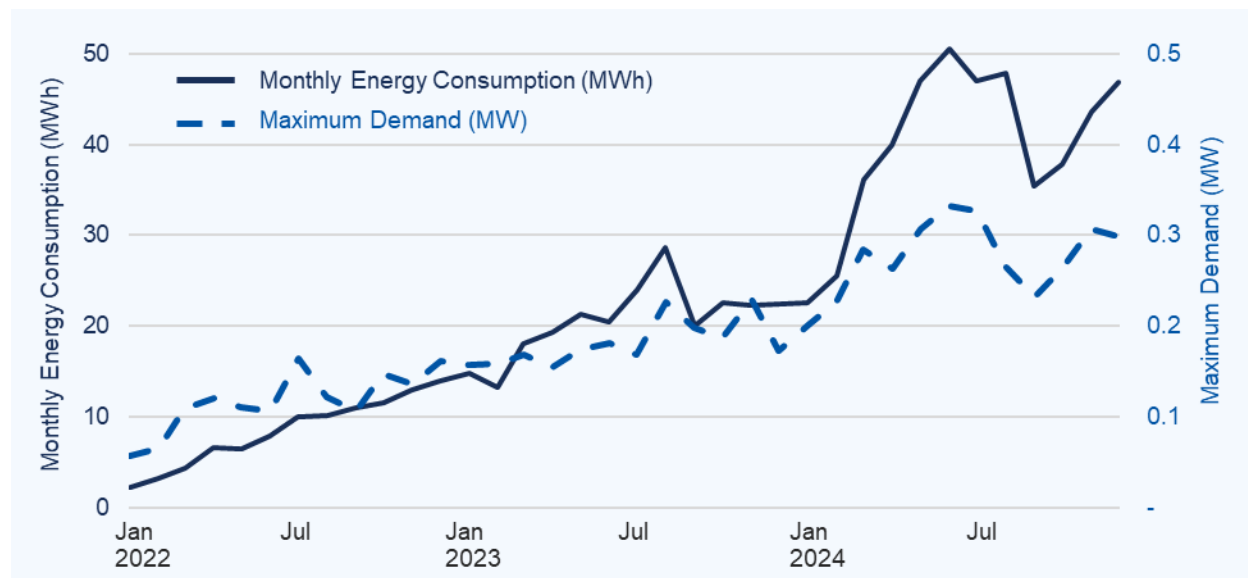
Table 141 presents the estimated SDG&E Parks Pilot program grid impacts.

Table 141. SDG&E Parks Pilot Grid Impacts

Impact Parameter	Actual 2024	Actual Program to Date	10-Year Projection PTD
Operational Sites	2	11	11
Installed Capacity (kW)	277	1,016	1,016
Electric Energy Consumption, MWh	480	839	5,725
On-Peak (4 p.m. to 9 p.m.) MWh (and % of total)	81 (16.8%)	151 (18.0%)	N/A
Maximum Demand, kW (with date and time)	332 (6/23/24 10:15 a.m.)	332 (6/23/24 10:15 a.m.)	N/A
Maximum On-Peak Demand, kW (with date and time)	235 (8/20/24 6:45 p.m.)	235 (8/20/24 6:45 p.m.)	N/A

Parks Pilot sites consumed over 20 MWh in each month of 2024, and exceeded 40 MWh in five of those months. Maximum demand averaged around 200 kW, peaked at 223 kW in June, and fell below 150 kW in September, similar to EY2023. The peak demand was approximately 25% of the installed capacity of 880 kW. Total consumption grew throughout 2024 with a dip in the fall, while peak demand remained relatively flat after a significant ramp in January and dropped in September, as shown in Figure 275.

Figure 275. SDG&E Parks Pilot Monthly Energy Consumption and Maximum Demand



As shown in Figure 276, daily consumption appears to peak in the summer, as does the rate of charging sessions (detailed further below). Consumption averaged around 1.5 MWh throughout the year with an average daily demand of 200 kW to 250 kW. Mid-summer and late winter (holidays period) show the highest demand and consumption (approaching 2 MWh daily) that may correlate with EV drivers spending more free time near these parks sites.

Figure 276. SDG&E Parks Pilot Daily Consumption and Maximum Demand, Pilot-to-Date Sites

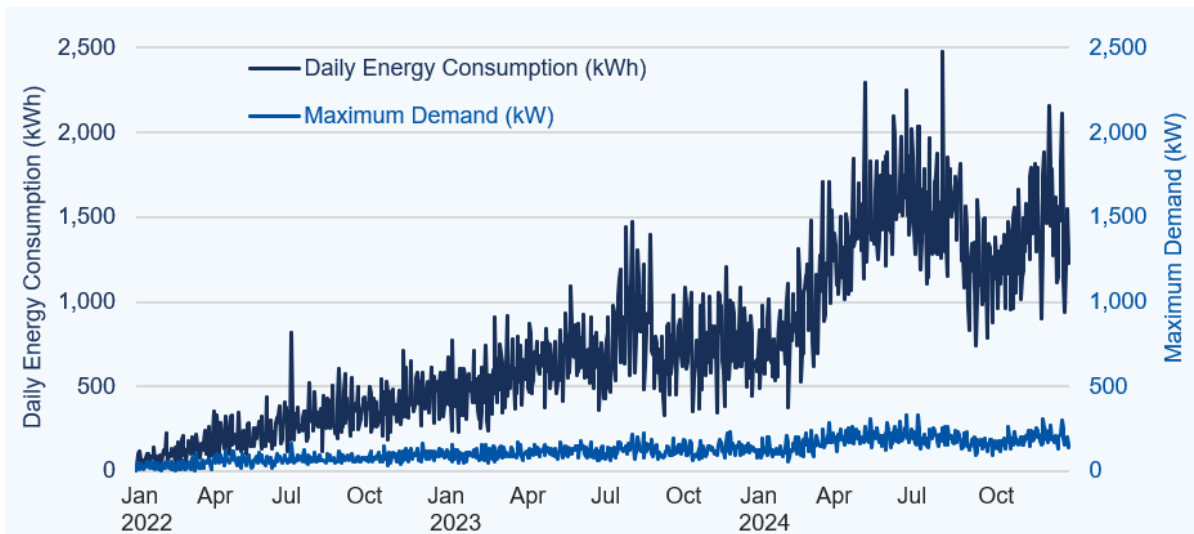
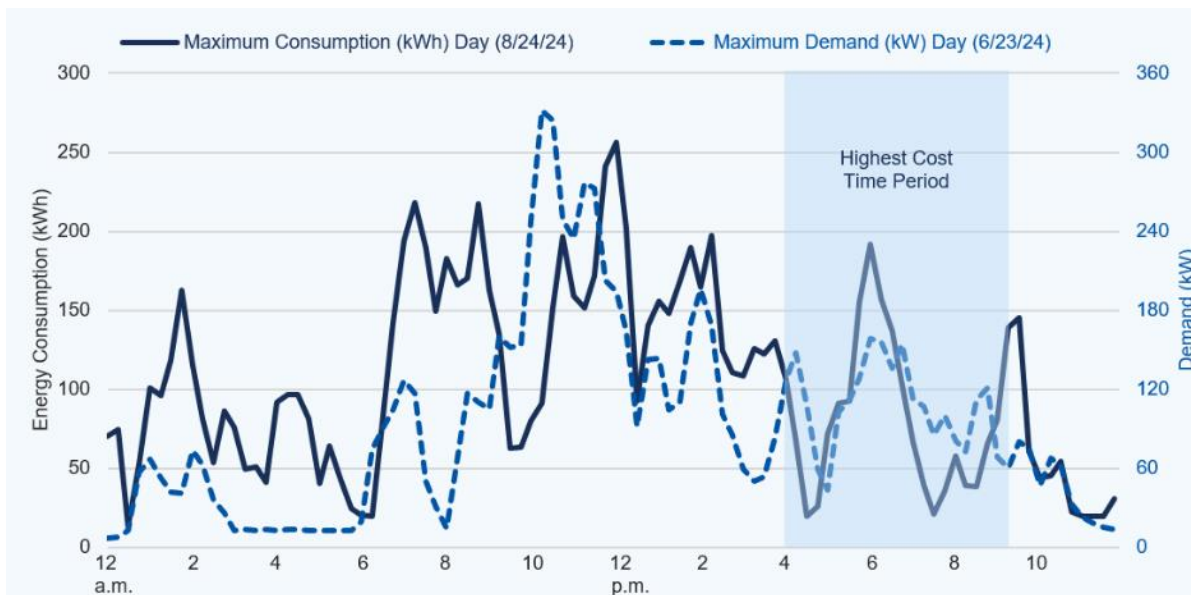


Figure 277 highlights two of the most utilized days. A handful of days reached over 300 kW of demand, with the highest 6/23/24 (2.25 MWh; 10:15 a.m. 332 kW). The highest consumption day was 8/4/24 (2.5 MWh; 255 kW), both of which were Sundays. Each day also shows charging very late at night, highlighting public use at all times of the day.

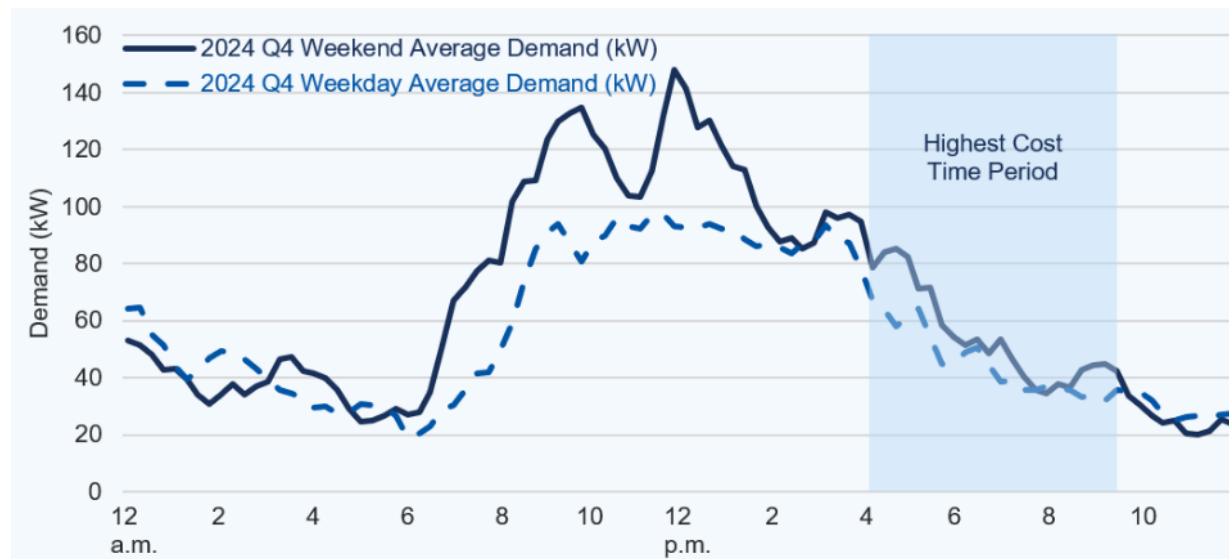
Figure 277. SDG&E Parks Pilot Load Curves on Days of Maximum Demand and Consumption



All of these sites bill EV drivers based on SDG&E's EV-oriented TOU tariff. In theory, this should influence when EV drivers charge at these sites. Speaking with EV drivers could be an effective means of assessing how TOU rates apply to a broad demographic and to better understand their needs. As shown in Figure 278, the average demand for charging on weekdays and weekends shows tapering off from 3 p.m. through the end of day. Parks Pilot sites show a less dramatic drop off than sites in the PYDFF program, which display obvious shifts indicating use of load management. Though 4 p.m. to 9 p.m. has lower

demand than midday, EV driver behavior overall does not appear to be impacted by TOU rates. The figure also shows that in Q4 2024, average demand was 20% higher on weekends than on weekdays, which is similar to 2023 (25%). On weekends the lowest TOU period runs until 2 p.m.

Figure 278. SDG&E Parks Pilot Average Weekday and Weekend Q4 2024 Load Curves



Usage Trends

Figure 279 shows sites' monthly consumption based on operational age (the figure is organized by first month of operations for each site, as opposed to the calendar month). This allows a comparison of sites based on their age and illustrates how long it takes for a public charging location to mature and see greater driver use. Three sites, which have a mix of L2 and DCFC charging, show the most dramatic growth, having reached over 4 MWh monthly around the one year mark. These higher-utilization sites also saw over 500 charging sessions per month throughout 2024. The remaining eight lower-utilization sites rarely reached 250 sessions, and each site has achieved close to 1 MWh monthly.

Figure 279. SDG&E Parks Pilot Monthly Consumption Based on Sites' Operational Age

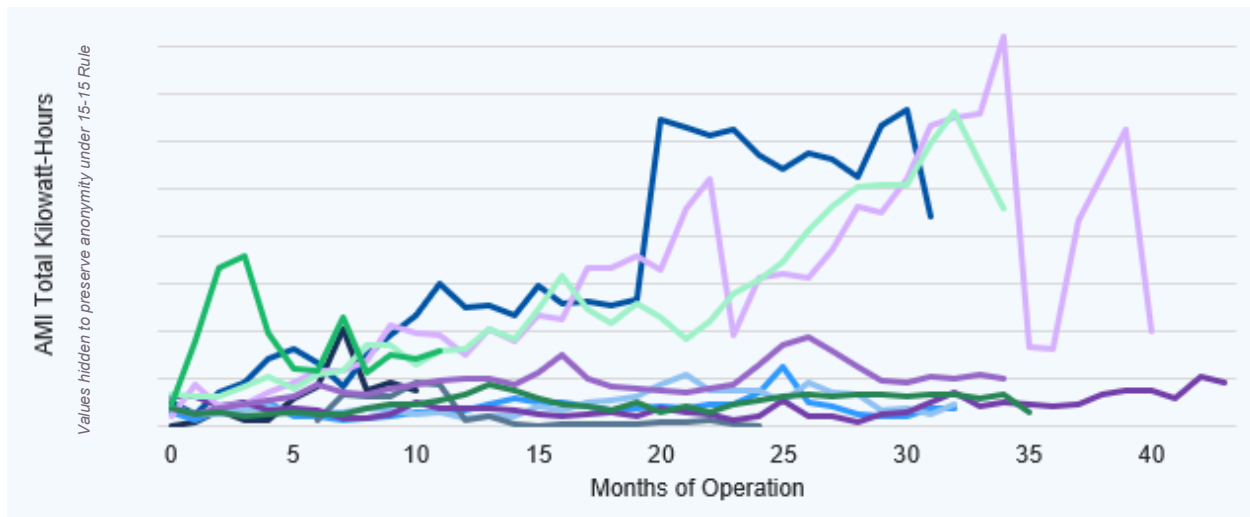


Figure 280 shows sites' monthly load factor also based on their operational age. Two lower-utilization sites are in the 5% to 10% range with the rest mostly achieving 10% to 15%.

Figure 280. SDG&E Parks Pilot Monthly Load Factor Based on Sites' Operational Age



Building on growth rates of monthly consumption, Figure 281 shows that the number of daily charging sessions for the population of sites is increasing every year. While significant fluctuation is evident throughout the year, monthly charging displays a general upward trend with specific peaks occurring during the summer months of 2022, 2023, and 2024.

Figure 281. SDG&E Parks Pilot Daily Charging Sessions for PTD Sites

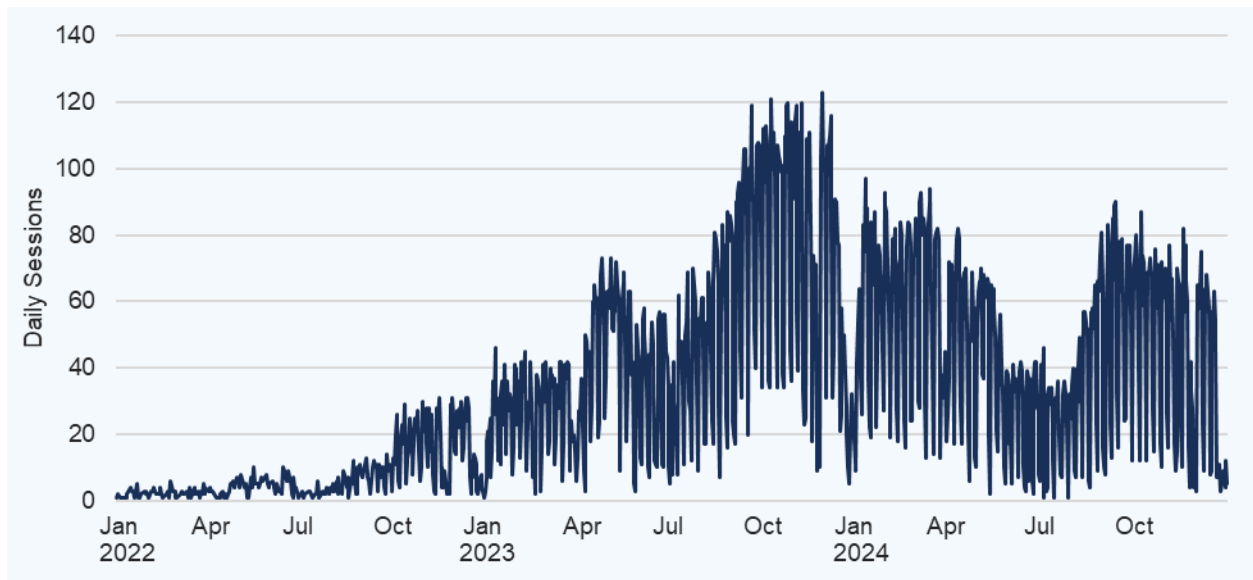
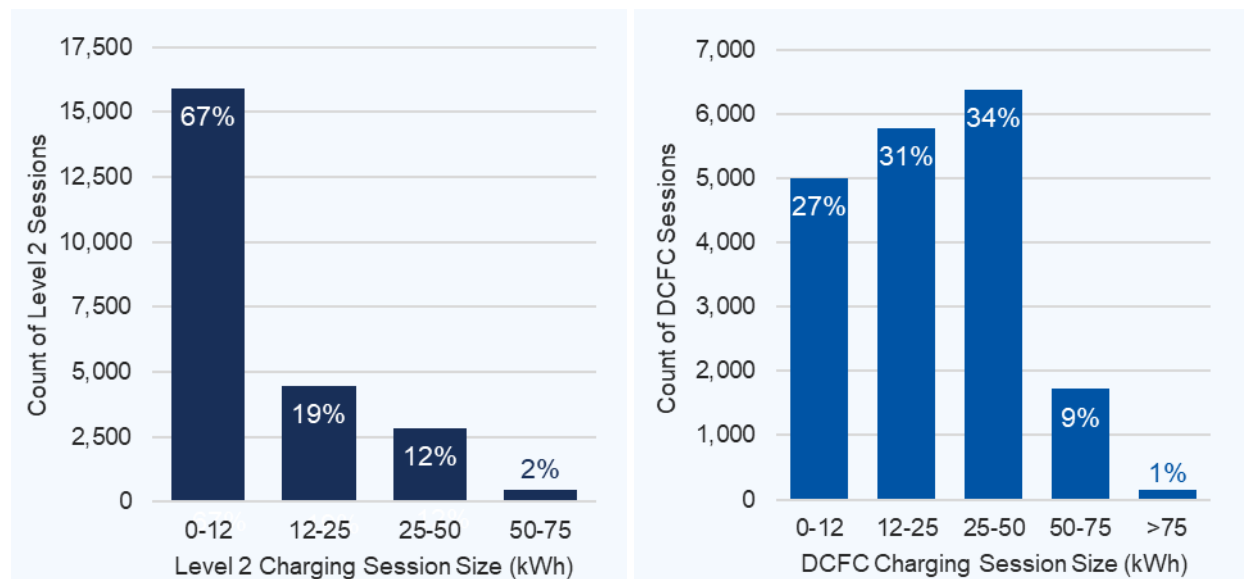


Figure 282 shows that two-thirds of L2 charging consumed less than 12 kWh per session while a similar proportion of DCFC charging consumed between 12 kWh and 50 kWh per session. When determining charging time by dividing total consumption by charging speed, L2 charging shows relatively short dwell times (two to three hours) regardless of the charger power rating.

Figure 282. SDG&E Parks Pilot Charging Session Count by Consumption Size for PTD Sites



Highlights

- Consumption data indicate that most parks sites are still growing their user base, and the summer season shows the highest usage. Schools sites show a drop in usage during the summer
- TOU rates seem to be influencing charging behavior based on an abrupt load drop at 4 p.m. and higher usage before 2 p.m. on weekends
- Delays in commissioning charging stations and setting pricing may influence usage trends.

Petroleum Displacement

The Evaluation Team estimated pilot-induced petroleum displacement attributable to the 19 Schools Pilot and 11 Parks Pilots sites using three key pieces of information: electricity used for EV charging, calculated annual EV miles traveled, and equivalent annual counterfactual vehicle petroleum fuel consumption. From this information, we estimated the reduction in equivalent gallons of petroleum attributable to the Schools and Parks Pilots. Table 142 presents the Schools and Parks Pilots' petroleum displacement impacts through 2024, including estimated actual impacts for 2024, actual impacts to date for all pilot sites, and a 10-year forecast for pilot-to-date sites.

Table 142. SDG&E Schools and Parks Pilots Petroleum Displacement Summary

DAC	Usage (n=30)				Petroleum Displacement (GGE)		
	2024 Actual (kWh)	PTD Actual (kWh)	2024 Actual (miles)	PTD Actual (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC	589,593	1,092,406	1,743,790	3,235,543	49,387	92,178	454,079
Outside DAC	340,970	534,465	1,013,503	1,589,549	26,013	41,297	267,142
Total	930,564	1,626,871	2,757,293	4,825,092	75,400	133,475	721,222

Note: "2024 Actual" represents the data from all activated sites from program inception for the 2024 calendar year. "PTD Actual" represents the data from all activated sites from program inception for all program years.

Highlights

- The 30 operational Schools and Parks Pilot sites collectively achieved a PTD impact of over 133,000 gallons of petroleum, with 69% within DACs.
- Over a 10-year period, these 30 sites will displace more than 720,000 gallons of petroleum.

Greenhouse Gas and Criteria Pollutant Impact

The Evaluation Team calculated reduced emissions from displaced fossil fuel use from ICE vehicles that were not in service because of the SDG&E Schools and Parks Pilots. The Evaluation Team first developed one ICE counterfactual, then calculated the emissions associated with these vehicles under conditions that otherwise matched the EVs to provide a baseline. Although EVs have no tailpipe emissions, the fossil-fuel power plants that supply electricity to the vehicle chargers still release some GHGs and criteria pollutants.

Table 143 presents the GHG reduction resulting from the 19 operational Schools Pilot sites and 11 operational Parks Pilot sites in 2024, along with the PTD and 10-year totals, by impact location. Overall, the Pilots resulted in 82% reduction of GHG emissions (1,043 MT total) relative to the counterfactual to date (1,269 MT, not shown in table), with 68% of the impact within DACs.

Table 143. SDG&E Schools and Parks Pilots GHG Reductions Summary

DAC	Usage (n=30)				GHG Reduction (MT)		
	2024 Actual ^a (kWh)	PTD Actual ^b (kWh)	2024 Actual Use (miles)	PTD Actual Use (miles)	2024 Actual	PTD Actual	10-Year Projection
Inside DAC	589,593	1,092,406	1,743,790	3,235,543	391	706	3,784
Outside DAC	340,970	534,465	1,013,503	1,589,549	219	337	2,348
Total	930,564	1,626,871	2,757,293	4,825,092	610	1,043	6,132

^a "2024 Actual" represents the data from all activated sites from program inception for the calendar year 2024.

^b "PTD Actual" represents the data from all activated sites from program inception for all program years.

Of the local emissions, the pilots had the highest impact in reducing CO, resulting in an estimated annualized reduction of 177 kg and a projected 10-year reduction of more than 14,000 kg (Table 144).

Table 144. SDG&E Schools and Parks Pilots Local Emissions Net Reductions

Emissions	EY2024 Sites (n=5)			PTD Sites (n=30)	
	Inside DAC	Outside DAC	Total ^a	Actual	10-Year Projection
PM ₁₀ (kg)	0.357	0.015	0.37	5.20	29.27
PM _{2.5} (kg)	0.328	0.013	0.34	4.78	26.91
ROG (kg)	4.526	0.186	4.71	89.20	608.75
CO (kg)	169.9	6.98	176.84	2,983	21,131

^a Columns may not sum to total due to rounding.

Figure 283 shows the current mix of electricity from the CAISO grid used for charging vehicles in the SDG&E Schools and Parks Pilots sites.¹⁴⁷ Based on the real-time grid conditions when EV charging occurred, the overall energy mix comprised about 62% zero emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear), 29% natural gas, and 9% imports. With the CAISO grid adding more renewables to meet the Renewable Portfolio Standard, the GHG and criteria pollutant emissions will continue to decrease over time.

¹⁴⁷ The power associated with imports comes from a mixture of hydro, nuclear, and natural gas plants located outside the CAISO grid.

**Figure 283. SDG&E Schools and Parks Pilots
Net Electricity Mix, Pilot to Date**

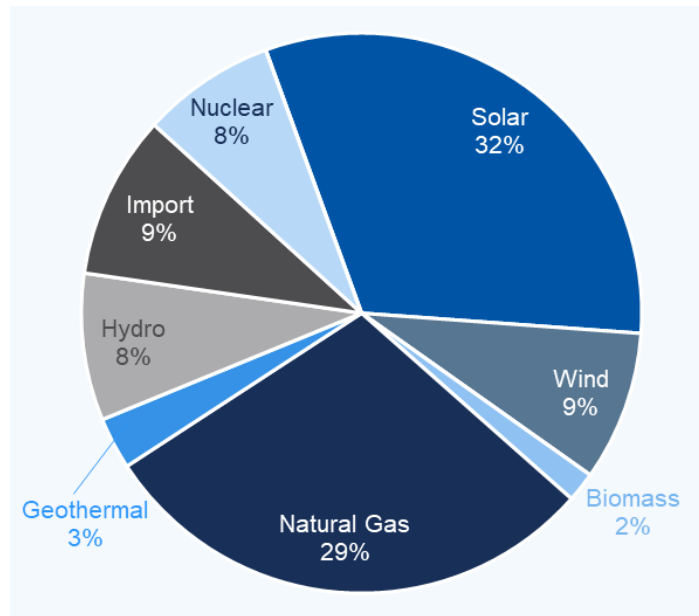
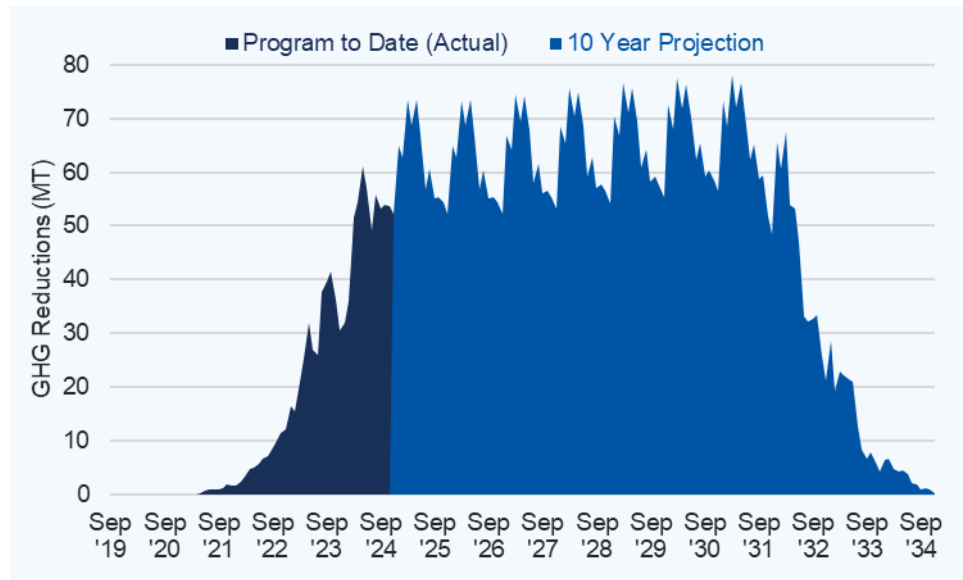


Figure 284 shows how pilot GHG reductions have increased to date and how these reductions are expected to grow over time for all activated sites. The analysis period ranges from the date that the first sites in the pilots were activated through the end of 2024. The analysis incorporates the net reduction (counterfactual emissions minus utility emissions) for each site in the Schools and Parks Pilots. Pilot-to-date emissions reductions are shown in dark navy, and anticipated benefits based on annualization are presented in royal blue. As each site has its own starting date of operation, the 10-year sunset for each site is observed as a gradual tapering off of pilot benefits starting in 2032. This taper reflects that benefits are no longer counted after 10 years, as this is beyond the useful life of the chargers. The sites could continue to use the infrastructure beyond 10 years. While each year's operations appear similar, there are several key factors driving the variations such as seasonality of Utility generation sources (high Utility emissions will appear as a dip on the curves), holidays occurring on weekends versus weekdays, and inaccuracies in predicted operations for sites that became operational late in 2024.

Figure 284. SDG&E Schools and Parks Pilots Historical and Forecasted GHG Reductions, Pilot-to-Date Sites



Highlights

- In 2024, the Schools and Parks Pilots sites resulted in an 82% reduction of GHG to date with 68% of the impact occurring within DACs.
- The greatest reduction in local emissions in 2024 was CO with a projected 10-year period reduction of more than 14,000 kg.
- Based on the real-time grid conditions when the EV charging occurred, the overall energy mix contained about 62% zero emissions or renewable sources of electricity (including solar, wind, hydro, geothermal, biomass, and nuclear) and 29% natural gas.

Health Impacts

The Evaluation Team calculated public health impacts (as benefits and costs) of reductions in criteria pollutants from vehicle electrification. Pollutants included in the analysis are primary PM_{2.5} and precursors of secondary PM_{2.5}, including NO_x, SO₂, NH₃, and VOCs. This analysis considered only tailpipe emissions reductions rather than full lifecycle emissions (such as power plant emissions). The Evaluation Team used the U.S. EPA's COBRA to evaluate the health benefits associated with the emissions reductions. COBRA estimates the county-level benefits for the county in which emissions are reduced. It also estimates the effect of the transport of emissions on all counties in the United States; however, this analysis includes only the effects of the emissions reductions in California. The Evaluation Team disaggregated the county-level effects to estimate the potential health benefits of sites for DACs and non-DACs.

Economic value depends on the health effects associated with the emissions, that is, whether they are associated with illnesses or death. The monetary value of the morbidity reductions associated with emissions reductions include avoided lost wages, avoided medical costs, and the amount of money

people are willing to pay to avoid an illness or condition like respiratory disease. The value of the reduced mortality associated with emissions reduction is measured by the value of a statistical life, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low and high impact for mortality, representing the uncertainties in the estimates.

The total value of the health benefits associated with emissions reductions from the SDG&E Schools and Parks sites is between \$12,140 and \$15,809. Table 145 shows the cumulative health benefits for all impacted counties in California associated with the emissions reductions realized by the electrification of SDG&E Schools and Parks Pilot sites for the program to date.

Table 145. SDG&E Schools and Parks Pilots California Health Benefits for PTD Sites in 2024

Health Endpoint	Change in Incidence (Annual Cases)		Monetary Value (Annual, 2024 Dollars)	
	Low	High	Low	High
Mortality	0.001	0.001	\$10,505	\$14,174
Avoided Medical Care				
Hospitalization, Respiratory	0.003	0.003	\$48	\$48
Hospitalization, Cardiovascular	0.001	0.001	\$35	\$35
Hospitalization, Other	0.004	0.004	\$93	\$93
ER Visits, Respiratory	0.049	0.049	\$81	\$81
ER Visits, Cardiovascular	0.002	0.002	\$5	\$5
Out of Hospital Heart Attacks	< 0.000	< 0.000	\$8	\$8
Nonfatal Heart Attacks	0.005	0.005	\$448	\$448
Stroke	0.001	0.001	\$33	\$33
Lung Cancer	0.001	0.001	\$28	\$28
Asthma	28.34	28.34	\$23,736	\$23,736
Hay Fever	1.16	1.16	\$1,330	\$1,330
Lost Productivity				
Minor Restricted Activity Days	0.217	0.217	\$28	\$28
Work Loss Days	0.037	0.037	\$12	\$12
School Loss Days	0.457	0.457	\$799	\$799
Total Health Effects	-	-	\$12,140	\$15,809

As part of this analysis, the Evaluation Team also examined health benefits within DACs, which may be disproportionately burdened by sources of pollution (including air pollution from ICE vehicles). Because COBRA estimates effects at only the county level, the Evaluation Team disaggregated the health benefits by census tract using the relative population of each tract from the most recent American Community Survey. For example, we allocated 10% of the value of the health benefits to a census tract with 10% of the county's population. The Evaluation Team then estimated the total benefits allocated to DACs and non-DACs. This approach assumes an even distribution of emissions reduction benefits throughout the county. If the sites are located in DACs, and the emissions reductions are greater in the tracts near the sites, this approach would understate the potential benefit to DACs. Additional information about emissions dispersion within counties would provide more precise estimates of the health benefits to DACs and non-DACs.

In our analysis, San Diego County had 54% of the total benefits, followed by Riverside County (20%), Los Angeles County (8%), Orange County (8%), and San Bernardino County (6%). San Diego County has the highest health benefit allocation because sites were located in the SDG&E territory; however, counties outside of the SDG&E territory also accrued health benefits when we accounted for air dispersion and transport of emissions. Overall, 15% of the total benefits were in DACs.

Highlights

- Cumulative monetary health benefits for counties in California realized by PYDFF sites in terms of monetary benefits range from \$12,140 for the low estimate and \$15,809 for the high estimate.
- San Diego County had the highest share of health benefits, with 54% of the total benefits, followed by Riverside County (20%), Los Angeles County (8%), Orange County (7%), and San Bernardino County (6%).
- Overall, 15% of the health benefits were in DACs.

Utility Insights

In addition to monthly check-in calls with key SDG&E staff to discuss the status of the Schools and Parks Pilots, the Evaluation Team conducted a close-out interview with SDG&E staff in March 2025 to review overall pilot challenges and successes in 2024. The following section presents challenges and successes that apply to both pilots, followed by those that apply to only one or the other.

Schools Pilot and Parks Pilot

Starting in 2021 SDG&E staff reported that site construction costs were higher than anticipated. These costs were compounded by labor constraints, material costs, and permitting changes. Several years into implementation, pilot staff have learned to deal with the reality of increased costs when planning; however, these costs continue to strain program budgets:

- **Material and Equipment Costs.** SDG&E staff reported that most site materials have generally been more expensive than originally anticipated in 2018 (when the pilots' funding caps were established). In 2024, staff also noted that infrastructure equipment, including the chargers themselves, have become both more costly and harder to acquire.
- **Changes in Permitting.** In 2024, SDG&E staff said that new permitting requirements and ADA-related upgrades have continued to complicate the construction process and increase program costs. As in previous years, these jurisdiction-specific parameters have led to permitting delays and increased administrative burdens. Although the ADA requirements were less robust for Parks Pilot sites than for Schools Pilot sites, the lack of consistency across jurisdictions has made it challenging for the program to accurately anticipate costs.

Schools Pilot

Despite these challenges, SDG&E staff reported success in engaging, enrolling, and constructing school sites for a few key areas:

- **Interest Beyond Light Duty.** Since 2022 and continuing into 2024, SDG&E Schools Pilot staff have been integrated into managing other EV customer offerings such as PYDFF. Therefore, when customers expressed interest in fleet electrification, SDG&E staff have been able to promote the PYDFF program alongside the Schools Pilot to help schools participate in both offerings.
- **School Curriculum.** After launching the school curriculum and the children's book in 2023, SDG&E has continued to make both available to participating schools in 2024.
- **Strong Relationships and Trust Built with School Districts.** SDG&E staff have built a strong, mutually beneficial relationships with school districts and have received positive feedback from staff of participating schools, with some expressing interest in additional sites. The districts also often help SDG&E find the correct decision-makers to address permitting issues and serve as cheerleaders for the pilot. Additionally, SDG&E staff stated that including school staff in the process has increased some school staff's willingness to allow construction outside of holiday and/or summer breaks.
- **Dedicated Construction Crews.** Since site construction started for the Schools Pilot, SDG&E has used specific crews from construction contractors. In 2024, SDG&E staff observed that as the Schools Pilot has progressed, the dedicated construction crews have developed extensive site-building experience, which has accelerated the construction of the civil components of sites and has enabled all stakeholders to work together more efficiently.
- **Expanded Interest in EVs.** Starting in 2022 and continuing into 2024, SDG&E staff said that several K–12 schools that had already completed site installations through the Schools Pilot reached back out to SDG&E hoping to acquire more private (non-public-facing) Utility-owned EVSE infrastructure. School staff noted that now that they have on-site chargers, they are seeing an increase in charger usage--not just from existing staff that purchased EVs since the chargers were installed, but also from new hires that were attracted to the district in part because of the availability of charging. In addition, previous participants have been actively recommending the Schools Pilot to staff at other schools, which SDG&E staff cited as being especially effective at gaining traction within the same school district.

Parks Pilot

Negotiations with the DPR on the MPA that covers general terms of participation for the State Parks component of the program continued into 2024. Although legal teams for the Parks Pilot and the DPR approved the language in the MPA in 2024, the MPA was not fully executed until April 2025. In addition to concerns about increasing costs mentioned above, SDG&E staff mentioned additional issues that continued into 2024:

- **Negotiations Between Legal Teams.** SDG&E's and DPR's legal teams continued in 2024 to negotiate which parties would assume responsibility for costs, liabilities, and risks in 2024.

- **Competing Priorities.** SDG&E staff reflected that DPR staff are often strained on time and had competing priorities that delayed the signing of the MPA.
- **Additional Extension.** Although SDG&E secured approval in 2024 to extend the Parks Pilot until December 2025, program staff are considering if another extension of the program timeline will be needed because of the delays caused by the MPA negotiations. Because the Parks Pilot has already been extended twice, it is unclear whether program staff will be able to secure a third extension.

Though the MPA contract was not signed at the end of 2024, in 2024, SDG&E program staff were able to successfully negotiate terms of the MPA. With the terms decided, SDG&E program staff began to successfully coordinate with district-level State Park offices again:

- **Refreshed Engagement with District-Level State Parks Sites.** Before the MPA was signed, SDG&E continued to work with the three districts that had already been selected for the pilot. SDG&E staff responded to some staff turnover at the districts by holding a refresher meeting to brief new district staff on the pilot, its offerings, and the planned site designs. Based on conversations with these staff, SDG&E revised some of the designs and secured approval for the changes.

SDG&E's unique experience serving local parks¹⁴⁸ through the Parks Pilot has already been successful in that this effort allowed SDG&E staff to foster committed, positive, long-term relationships with local customers:

- **Strengthened Connections.** Though most local construction was completed in 2021, in years since 2024, SDG&E staff continued to work with local park participants to respond to site host requests to repair installed equipment and answer questions about the technology, usage, and other transportation electrification topics. Program staff reported that site hosts have been happy with repair times, as well as the overall performance of the sites. This positive experience has encouraged some local site hosts to help accelerate SDG&E's permit requests, which in turn has improved SDG&E permitting experience in certain municipalities.
- **Identify Opportunities for Further Engagement.** As in previous years, SDG&E staff reported that trusted relationships have continued to allow them help customers fast-track sites (both EV and non-EV) that require SDG&E's approval, insight, or support, further strengthening the relationship beyond the Parks Pilot. Additionally, by maintaining a positive reputation through its performance at these sites, SDG&E has received interest from municipalities in non-DAC territories, who are not included in the Pilot, signaling opportunities for future programs.
- **Fulfilling Multifamily Needs.** In 2024, SDG&E staff observed an emerging trend that areas with multifamily units nearby tend to experience more overnight charging than areas that do not have multifamily unit dwellings nearby (but still allow overnight charging). Some local parks have explicitly approved of this extended overnight charging, as it is serving their community's needs.

¹⁴⁸ Local parks are defined as city or county parks.

Highlights

- **Schools & Parks:** Similar to previous evaluation years, site costs continue to be a challenge. In particular, rising equipment and material costs, decreasing availability of infrastructure, and increased permitting costs have strained the program's budget.
- **Schools:** SDG&E has successfully built strong relationships with school districts, which has led to the site hosts supporting SDG&E through the permitting process and sharing the success of the program with other districts. This outreach helped generate additional interest in the PYDFP program.
- **Schools:** Having dedicated construction crews working on Schools sites has allowed SDG&E and its contractors to become experts, leading to quick building times for the civil components of the sites.
- **Parks:** Though multiorganizational coordination remained a challenge, ultimately, SDG&E was able to make progress toward a master agreement for state sites by finalizing the terms in 2024. Program staff have continued to work with district staff at the selected sites to ensure that they remain engaged.
- **Parks:** SDG&E staff remain committed to building and maintaining strong customer relationships and fostering local champions through continued support such as repairing installed equipment, answering questions about the technology, usage, and other transportation electrification topics as needed.
- **Parks:** SDG&E staff observed that sites located near multifamily dwellings tended to experience higher levels of overnight charging. Some municipalities chose to permit extended overnight charging to accommodate local needs.

6.2.3. Lessons Learned

Schools and Parks Pilots

Long-term engagement with customers interested in the Schools and Parks Pilots allows SDG&E staff to leverage positive relationships with site hosts to improve implementation processes.

In 2024, SDG&E staff said that their efforts to keep site hosts involved throughout the application process have resulted in strong relationships with engaged customers. For example, SDG&E staff reported that these mutually beneficial relationships have resulted in positive participation feedback from schools, with some schools participants expressing interest in acquiring more private (non-public-facing) Utility-owned EVSE infrastructure once they have on-site chargers. Staff also noted that these positive relationships extend to school districts, where district staff can help SDG&E find the correct decision-makers to address permitting issues and promote the pilot internally within the district. SDG&E staff also stated that, despite the earlier challenges at the State-level, their efforts to build trusted relationships in the Parks Pilot have continued to facilitate fast-tracking local sites that require SDG&E's approval, insight, or support, further strengthening the relationship. In 2024, staff indicated that they remain committed to building and maintaining strong customer relationships and fostering local champions through continued support such as repairing installed equipment and answering questions about the technology, usage, and other transportation electrification topics as needed.

Higher-than-expected equipment, material, and permitting costs combined with delays continue to be challenges to implementing the Schools and Parks Pilots.

SDG&E initiated the Schools and Parks Pilots during the COVID-19 pandemic, which caused unprecedented economic impacts across nearly every market. As reported in previous years, staff indicated that these changes were so significant that the estimates originally used for Decision 19-11-017 (which mandated the Schools and Parks Pilots at their determined funding levels) did not reflect actual costs for implementation. In 2024, staff reported that school and park site costs continued to present challenges, specifically calling out that site materials and infrastructure equipment (including the chargers themselves) have become both more costly and harder to acquire. Staff also said that new permitting requirements and ADA-related upgrades have continued to complicate the construction process and increase program costs. As in previous years, these jurisdiction-specific parameters have led to permitting delays and increased administrative burdens. Staff reflected that these site related costs continue to be compounded by labor constraints. The average Utility infrastructure cost of TTM and BTM borne by SDG&E for the Schools and Parks Pilot for PTD sites through 2024 is \$297,610 per site and \$4,545 per kilowatt of installed charging capacity.¹⁴⁹ The average all-in cost paid by SDG&E across PTD sites through 2024 is \$346,253 with BTM costs accounting for 67% of all site costs.

SDG&E Schools and Parks Pilots continued to successfully promote regional EV adoption.

In 2024, the Schools and Parks Pilots increased the number of operational sites by four and two respectively to bring the total to 19 and 11 for the pilots to date. The model's output shows that the Schools and Parks Pilots may have contributed to the EV adoption of 100 and 22 EVs respectively in the pilot to date for households neighboring the infrastructure.

The Schools and Parks Pilots sites are helping to displace petroleum and reduce GHG and local emissions and achieve nominal health impacts overall and within DACs.

The SDG&E Schools and Parks Pilots sites to date have displaced over 133,000 gallons of petroleum, with 69% of the impact within DACs. Since their inception the pilots have resulted in an 82% reduction of GHG, with 68% of the impact and 15% of the health benefits in DACs, and total monetized health benefits ranging from \$12,140 to \$15,809. These sites all contributed to lowering local emissions, with CO reduction showing the most prominent projected reductions of more than 21,000 kg over a ten-year period.

Schools Pilot

Demand and consumption are increasing across Schools Pilot sites, but the number of daily charging sessions has dropped.

Energy demand steadily increased throughout 2024, peaking at over 381 kW at the end of the year. Four new sites were activated in 2024, increasing overall consumption to 450 MWh from 312 MWh in 2023, which is a 44% increase. Six PTD sites have monthly consumption above 5 MWh, while eight have less

¹⁴⁹ The Evaluation Team calculates per-site costs by summing all TTM and SDG&E-sponsored BTM costs and dividing by the number of sites. This number reflects the maximum infrastructure rebate offered for sites that have not yet applied for rebates, which may vary significantly from the actual rebate amount.

than 1 MWh. Throughout 2024, the pilot averaged between 60 and 80 daily charging sessions. However, the number of daily charging sessions never exceeded 100, which was consistently achieved throughout late 2023. It should be noted that this spike in 2023 was likely a result of EV drivers with RFID key fobs charging for free at sites that spent exceptional amounts of time waiting to be commissioned. Over half of all L2 charging sessions were fairly small (up to 12 kWh), and almost 30% were between 12 kWh and 25 kWh. In comparison, DCFC charging had over twice as many 25 kWh to 50 kWh sessions and ten times as many large sessions (over 50 kWh).

Parks Pilot

SDG&E and DPR staff finalized terms of the MPA in 2024, paving the way for a signed agreement and site construction.

The original plan for the Parks Pilot in 2021 was for the Utilities to enter into a collective participation agreement with the DPR; however, the Utilities ultimately determined that they had distinctive needs and pursued separate MPAs. SDG&E staff continued their own negotiations about terms to the agreement in 2022, 2023, and into 2024. In 2024, both the SDG&E and DPR legal teams approved the language in the MPA.¹⁵⁰ SDG&E staff noted that their persistence and patience has been key to making progress with the DPR toward a signed MPA.

Demand, consumption, and daily charging sessions are increasing across program sites.

Two new sites were activated in 2024, increasing overall consumption by 96% to 480 MWh from 245 MWh in 2023. Consumption data indicate that most parks sites are still growing their user base, and the summer season has consistently shown the highest usage. Energy consumption and demand steadily increased throughout 2024, with peak consumption reaching 50 MWh and peak demand reaching 332 kW in June 2024, unlike 2023 when consumption and demand never exceeded 30 MWh and 250 kW respectively. The number of daily charging sessions has also grown steadily, rising from approximately 40 in January to over 90 during the summer in 2024. Three sites have both L2 and DCFC charging ports and have seen the most dramatic growth, reaching over 4 MWh of consumption per month and over 500 monthly charging sessions. The remaining eight sites averaged around 1 MWh per month and never exceeded 250 monthly charging sessions.

¹⁵⁰ The SDG&E and DPR legal teams completed and signed the agreement in March 2025.

7. Liberty Utilities Transportation Electrification Programs

7.1. Schools and Parks Pilots

7.1.1. Overview

This overview provides a detailed description of the Liberty Schools and Parks Pilots; summarizes the pilot implementation process, materials review, performance metrics, and budget; and provides a timeline of major milestones. Following the overview are detailed findings, highlights, and lessons learned.

Pilot Description

Schools Pilot: Through its Schools Pilot, Liberty aims to increase access to available charging at schools and educational facilities throughout its service territory. Liberty provides charging infrastructure to support electric school buses and light-duty charging for parents,

teachers, and students. At the time of Decision 19-11-017, Liberty had identified 17 potential sites, with

Schools Pilot Design Goal

Enable schools to offer public charging to staff, students, parents, and the greater community.

15 at K–12 schools, one at Lake Tahoe Community College, and one (a bus barn) for the Lake Tahoe School District. There are no DAC requirements for the Liberty Pilots, as there are no CES 4.0–defined DACs in the service territory.¹⁵¹ Per Decision 19-11-017, Liberty plans to install 56 L2 charging ports and two DCFCs across all sites.¹⁵² Liberty’s ownership model for all

charging stations in the Schools Pilot covers the cost of EVSE, network software, transformers, permitting, electrical work, and trenching. Liberty also installs safety bollards and snow melt and lighting equipment, where appropriate.

Parks Pilot: Because the Tahoe region is a destination for many nonresidents, Liberty staff designed the Parks Pilot to increase access to available charging at state parks throughout its service territory for park staff fleet

Parks Pilot Design Goal

Encourage staff at state parks and beaches to charge their own EV fleets and offer charging to staff and patrons with LDVs.

vehicles and visitor vehicles. Prior to Decision 19-11-017, Liberty staff worked with parks staff to determine the most attractive sites for EVSE by considering the needs of the parks and their

Schools Pilot Targets

- 56 L2 and 2 DCFC charging stations
- 17 school sites

Parks Pilot Targets

Five dual-port pedestal EVSE at three sites.

¹⁵¹ The bus barn for Lake Tahoe School District is included in the Schools Pilot as a part of Liberty’s goal to replace 50% of the district’s diesel bus fleet (as of 2019) with electric school buses.

¹⁵² To meet the overall desired timeline for the project, Liberty’s cutoff date for accepting applications for the Schools Pilot was April 29, 2024. Ultimately, Liberty secured participation agreements with three schools and is planning to install three chargers (two L2 and one DCFC) at the remaining two sites. As of May 2025, these sites were still in design.

proximity to town and regional centers, retail centers, beaches, recreation areas, education facilities, and large marinas. Through the Parks Pilot, Liberty planned to install five dual-port pedestal EVSE, at three California park locations. Similar to the Schools Pilot, Liberty's ownership model for all charging stations covers the cost of EVSE, networking software, transformers, permitting, electrical work, and trenching.

Liberty designed both pilots to help meet the growing demand for EV charging from residents and visitors to the Lake Tahoe region. Through these pilots, Liberty will increase the share of EV miles traveled in the Tahoe region, which supports the community's move toward its sustainability and environmental improvement objectives, including reducing GHG and criteria air pollutant emissions.

Implementation

Liberty staff began site recruitment in 2019 in preparation for Decision 19-11-017 by directly engaging with potential sites prior to filing AB1082-3. In 2021 and through 2023 staff focused their efforts on trying to gain interest in site construction from schools and parks. In 2024, Liberty completed all recruitment for the Schools Pilot, securing two additional projects, while the Parks Pilot is planning to install one site.¹⁵³

Figure 285 describes Liberty's implementation process for both the Schools and Parks Pilots.

¹⁵³ To meet the overall desired timeline and budget for the project, Liberty expects to have one site for the Parks program. As of May 2025, Liberty plans to finalize the number of sites and secure site-specific addendum agreement(s) after the MPA with the State Parks Department is signed.

Figure 285. Liberty Schools and Parks Pilots Implementation Process

SITE SELECTION	
	1. Liberty contracts with eligible school district administration 2. Liberty completes an initial site walk
PRELIMINARY DOCUMENTS	
	1. Liberty provides the customer with a contract and program documents (including a 10% site design) for discussion with decision-makers 2. Customer reviews documents
PARTICIPATION AGREEMENT	
	1. Liberty and the customer execute the Participation Agreement with only the preliminary design
CONTRACTOR AND EQUIPMENT SELECTION	
	1. Liberty develops an RFP for procurement of hardware and software and for electrical and construction work 2. Liberty selects a contractor and equipment for site construction
FINAL DESIGN AND PERMITTING	
	1. Liberty and the customer finalize site designs 2. Liberty submits requests for and acquires permits
CONSTRUCTION AND ENERGIZATION	
	1. The site is constructed and energized 2. Liberty owns, operates, and maintains the charging stations

Program Materials Summary

Liberty did not develop any new program materials in 2024.

Program Performance Metrics

Liberty did not secure any School or Park Pilot sites in 2024 but did activate one Schools Pilot site.

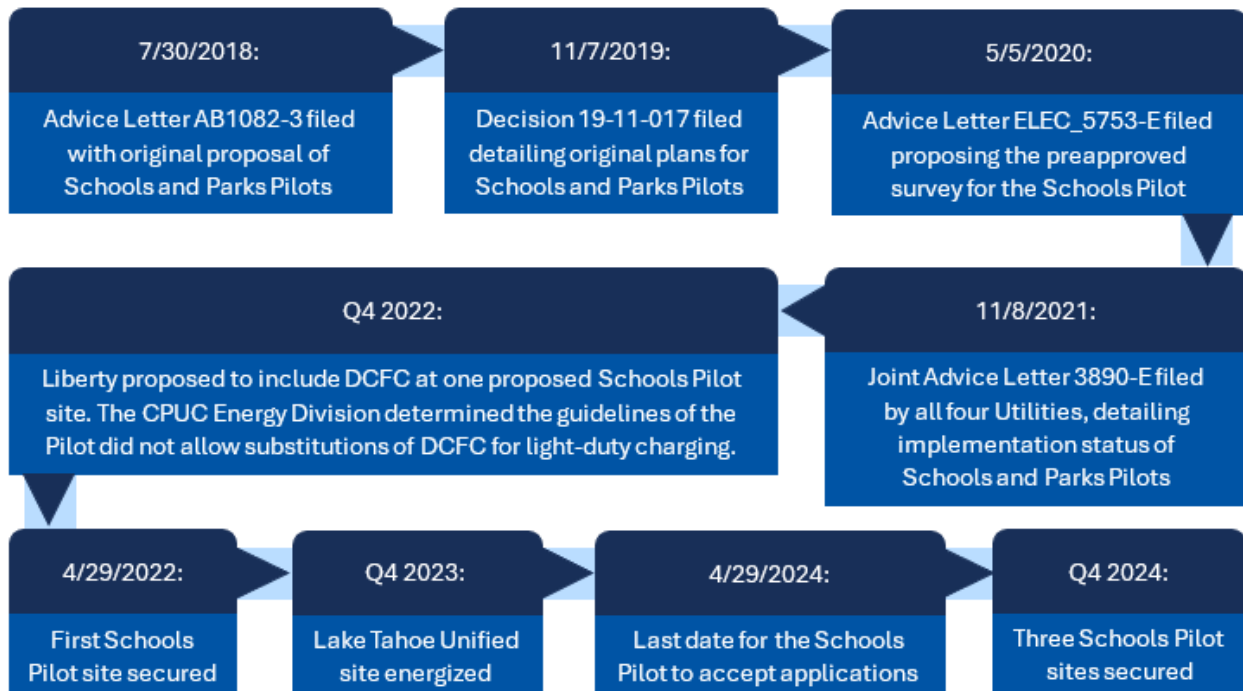
Budget Summary

Through 2024, Liberty spent \$308,180 of \$3.9 million on the Schools Pilot and has spent none of the approved \$0.78 million Parks Pilot funds.

Timeline

Since the beginning of the Schools and Parks Pilots, Liberty has filed three Advice Letters: one pertaining to the Schools Pilot and two to both the Schools and Parks Pilots. In 2023, the Lake Tahoe Unified site was energized. In Q2 2024, Lake Tahoe Community College signed an agreement for one DCFC site and one L2 charging site, and the Colville district signed a contract to install one L2 bus charger. Figure 286 shows all major milestones since the pilots' inception.

Figure 286. Liberty Schools and Parks Pilots Key Milestones



7.1.2. Findings

As discussed in the *Overview* section, Liberty activated one Schools Pilot site, while the Parks Pilot had no activated and operational sites in 2024. As a result, the Cadmus team did not complete an impact analysis. The subsections below provide limited insights based on Utility staff interviews.

Utility Staff Insights

In addition to monthly check-in calls with Liberty staff to discuss the status of the Schools and Parks Pilots, the Cadmus team conducted a close-out interview with staff in March 2025 to review overall pilot challenges and successes in 2024. The following sections present these challenges and successes organized by pilot.

Schools Pilot

Just before the application period closed in mid-2024, Liberty had secured two additional sites for the Schools Pilot and expected to start construction in 2025. Although all schools in Liberty’s service territory are eligible to participate in the Schools Pilot, Liberty staff reported limited interest in the pilot’s prescriptive design, citing more interest in DCFC than L2 charging and safety concerns with public chargers:

- **Limited Interest in the Pilot.** Continuing from previous evaluation years, despite ensuring that all eligible Schools Pilot customers were aware of the pilot, Liberty staff observed limited interest in the Schools Pilot in 2024. Liberty staff noted that they had heard through extensive contact with school staff that the complications of installing chargers at K–12 school parking lots outweigh the perceived value of the chargers.

- **Preference for DCFC Charging.** As first noted in 2022, Liberty staff continued to hear in 2024 that schools were most interested in DCFC over L2 charging. In 2022, Liberty’s request to expand the Schools Pilot to fund DCFC chargers was rejected by the CPUC.
- **Safety Concerns and Liability.** Continuing from 2023, Liberty staff noted that many K–12 schools in its territory expressed concerns about making the chargers accessible to the public during or after hours, despite the pilot’s flexibility, which allowed schools to opt for private chargers.

Despite the lack of interest in the Schools Pilot, Liberty staff were able to secure two additional Schools Pilot sites in 2024. Staff continue to remain optimistic about the future of transportation electrification within schools, and highlighted the long-term positive customer relationships they have created with school staff:

- **Completed and Planned Sites.** In 2024, Liberty staff secured two signed contracts for sites with expected construction in 2025, adding to the one Schools Pilot site that was energized in 2023. One of these sites plans to install light duty charging, likely near its bus chargers to leverage the same back-end infrastructure. Liberty staff shared that the new sites have completed their preliminary designs and are moving to the procurement stage of the pre-construction process.
- **Fostering Positive, Long-Term Relationships with Schools.** Although Liberty saw limited participation in the Schools Pilot, Liberty staff have reported making valuable connections with school personnel beyond typical customer interactions. In 2024, Liberty staff expressed satisfaction with the outreach they conducted for the Schools Pilot, noting that every customer who wanted to participate in the program was able to do so. For customers who opted not to participate, Liberty staff saw value in learning more about their needs and visiting school properties to build long-term relationships. Because of Liberty’s communication and transparency, staff became aware that some schools customers turned down participating in the Schools Pilot because they knew that there would be future opportunities for EV charging. Overall, Liberty staff stated that they are satisfied with the level of outreach they conducted and the depth of the relationships they built with schools customers.

Parks Pilot

Liberty had initially intended to sign on to a collective Utility MPA with the DPR in 2021. However, in 2022, the Utilities separated their negotiations to ensure that all legal team requirements could be met. Liberty staff opted to wait until the other Utilities had signed their own agreements and planned to leverage the acceptable terms that DPR established.

As a result, Liberty maintained limited communication with DPR throughout most of 2024 as other MPAs were still being drafted. However, by the end of 2024, Liberty was able to start the process of drafting its own MPA after the other three Utilities completed their agreements. In 2024 Liberty staff noted concerns with the number of sites and timing for the Parks Pilot:

- **Site Consolidation.** Although the initial plans for the Parks Pilot included three sites, Liberty staff noted that as time has gone on, they have had growing concerns about the available budget. While Liberty staff have sought to minimize the administrative burden of multiyear negotiations for MPA terms by waiting and then leveraging the other Utility agreements, base costs for

materials and services have risen since 2019 (when budgets were determined through Decision 19-11-017). Additionally, while finalizing their terms for the MPA and upcoming construction, Liberty staff will need to manage and coordinate with both state- and district-level staff, who provide limited attention to the Parks Pilot due to competing priorities. Therefore, Liberty is currently considering consolidating the proposed three sites into one site with more ports. While they will make a final decision after the MPA is signed, Liberty has started discussions to prepare for this path forward.

- **Pilot Design and Timeline.** While Liberty staff is hopeful that they will be able to sign a MPA by the end of 2025, given the additional coordination that will be necessary at the site level, Liberty staff expressed potential concerns about the two-year time period allowed for the Parks Pilot if the clock starts after the MPA is signed.

Although Liberty staff noted potential challenges after the MPA is signed, they remain optimistic about the Parks Pilot due to the successful signing of the other Utilities' participation agreements and improved communication and coordination with the State Parks Department:

- **Other Agreements Completed.** Continuing from previous years, Liberty monitored the progress of the participation agreements for the other Utilities to ensure that Liberty can adopt contract terms and move forward as soon as possible. In 2024, all of the other Utilities concluded their negotiations with DPR and finalized their agreements, allowing Liberty to begin developing its own MPA. Liberty anticipates that by leveraging other MPAs as a starting point, its own negotiations with DPR will be much more efficient and cost-effective. Liberty staff remain optimistic about the progress of the Parks Pilot because they have been able to maintain momentum since other MPAs were signed.
- **Improved Communication with State Parks.** In previous evaluation years, Liberty staff reported that staff turnover and conflicting priorities at the State Parks Department caused communication and coordination issues for the Parks Pilot. However, in 2024, Liberty staff observed that the issue of staff turnover had been fully resolved and said that communication and alignment with State Parks had improved, allowing the Parks Pilot to continue more smoothly.

Highlights

- **Schools:** In addition to the one site that was energized in 2023, Liberty secured two sites for the Schools Pilot in 2024 and are planning for construction in 2025.
- **Schools:** Despite limited interest in the Schools Pilot, schools have expressed interest in EVs and prefer DCFC over L2 charging.
- **Schools:** Liberty's continued engagement with schools has led to positive relationships, which may support long-term electrification when schools are ready.
- **Parks:** To mitigate the cross-jurisdiction coordination challenge, Liberty is leveraging acceptable terms of the MPA that DPR established with the other Utilities in 2024 and is hopeful for its own signed MPA in 2025.
- **Parks:** Liberty staff communicated concerns about the Park Pilot's timeline and planned number of sites, particularly in relation to the site-level coordination that will be necessary.

7.1.3. Lessons Learned

Schools Pilot

Despite limited interest from eligible schools, Liberty staff continued engagement during the enrollment period, ultimately enrolling two additional sites for the Schools Pilot in 2024.

As noted in previous years, Liberty's Schools Pilot serves a specific market sector with the clear intention of increasing public charging in the Lake Tahoe area. However, from the beginning of the pilot Liberty staff have encountered barriers unique to K–12 schools that have delayed Schools Pilot activity. Specifically, most schools continued to express concerns about public access to school property for charging, ADA requirements, snow removal, and liability for charger damage or misuse. Despite these concerns, Liberty staff continued to engage school staff around general long-term electrification interests and maintained positive relationships with school staff. Ultimately, this collaborative, ongoing engagement resulted in one school site activated in 2024 and two schools enrolling in the pilot in the spring of 2024 when Liberty put out the last call for Schools Pilot applications.

Parks Pilot

Though cross-jurisdiction coordination remains a challenge to implementing the Parks Pilot, now that other Utility MPAs have been signed and executed, Liberty has re-engaged in planning for Parks sites.

As noted in previous years, the original plan for the Parks Pilot in 2021 was for all Utilities to enter into a collective participation agreement with the DPR. Throughout the joint negotiations Liberty staff followed the path set forward by the other Utilities. In 2022, when the Utilities decided to pursue independent agreements with the DPR, Liberty staff began to cultivate a relationship and engage with the state office of the DPR. Because most Utilities' MPA terms were negotiated in 2024 (or earlier), Liberty staff started engaging with state- and district-level DPR staff again in 2024 to determine the terms of their MPA (based on the other MPAs). Though Liberty staff are hoping for a signed MPA with State DPR staff in 2025, concerns have been surfacing about the number of sites possible given the available budget and the amount of coordination necessary to achieve those sites.

Appendix A. Deep Dives

- Freight Operator (SCE)
- Freight Operator (SCE)
- School Bus Operator (SCE)
- Freight Operator (PG&E)
- Transit Operator (PG&E)
- Transit Operator (PG&E)
- School Bus Operator (SDG&E)
- Transit Operator (SDG&E)

Case Study: Freight Operator (SCE)

Fleet Focus Points: Charger Rotation, Megawatt+ Charging, Vehicle-Charger Ratios

Vehicle Deployment and Operational Data

This fleet is a large heavy-duty semi-truck operator within SCE territory in Southern California. At the time of the site visit, the fleet operated 92 electric semi-trucks—all Freightliner eCascadia Class 8 tractors with 400 kWh batteries.

The fleet deploys the electric semi-trucks on routes that are at most 180 miles round-trip. To stretch their range slightly, the fleet operator has come to an agreement with a public charging company to allow access to truck-specific public charging, although the fleet pays a per kilowatt-hour

surcharge, which increases electricity costs by 40% to 50% of the cost at its own depot. The trucks operate two shifts most days; one in the morning and one at night. The night shift routes cover longer distances than the day shift routes, and approximately 60% of night shifts involve switching trucks during the shift to ensure that drivers can complete their shift requirements. The fleet has significant weekend operations though these are minor compared to weekday operations.

Fast Facts

Site Type: Heavy Duty Freight Operator

Electric Vehicles: 92 Freightliner eCascadia semi-trucks with 400 kWh batteries

Non-Electric Vehicles: 10 diesel Freightliner Cascadia tractors

Charging Stations: 16 1.5-MW dual-port Power Electronics chargers

ICE Fuel Type: Diesel



The fleet manager noted that all drivers are trained to operate and charge the electric semi-trucks, and that a single early adopter of the trucks within the company was instrumental in developing a curriculum from their initial experiences using the trucks to bolster over 100 drivers' operational familiarity and troubleshooting skills. The site found that the vehicles' fuel economy depended largely on the drivers themselves—while trucks commonly return to the depot having used 65% to 70% of their onboard battery, they occasionally run out of charge due to inoperable public charging at sites operated by the fleet's partner.

The fleet manager noted that electric truck reliability has been adequate for the most part and that Daimler, the truck manufacturer, has minimized downtime as much as possible by increasing its regional stock of EV parts to accommodate frequent replacements. However, the electric trucks have experienced more downtime greater than 24 hours than their diesel counterparts, with estimates of 10% versus 2% of downtime exceeding a day, respectively.

In comparing the EVs to their diesel counterparts, another crucial measure of vehicle performance is the amount of weight the trucks can haul. The fleet has experienced challenges with the additional weight inherent to electric trucks, estimating that the electric trucks require sacrificing 4,000 pounds of cargo load capacity compared to their diesel truck counterparts. In intermodal operations such as those the site conducts, loads are naturally heavier than over-the-road operations, so this weight limitation can pose issues if the cargo load exceeds federal allowances.

Chargers and Charging Usage Patterns

The fleet had to alter its planning when the manufacturer switched power cabinets from 1.2 MW to 1.5 MW. The four 1.5 MW power cabinets onsite are derated by 300 kW each to operate within the limits of utility electrical capacity, which was initially designed for the lower-power setup. The power cabinets support 16 dual-port dispensers and operate on Place To Plug software.

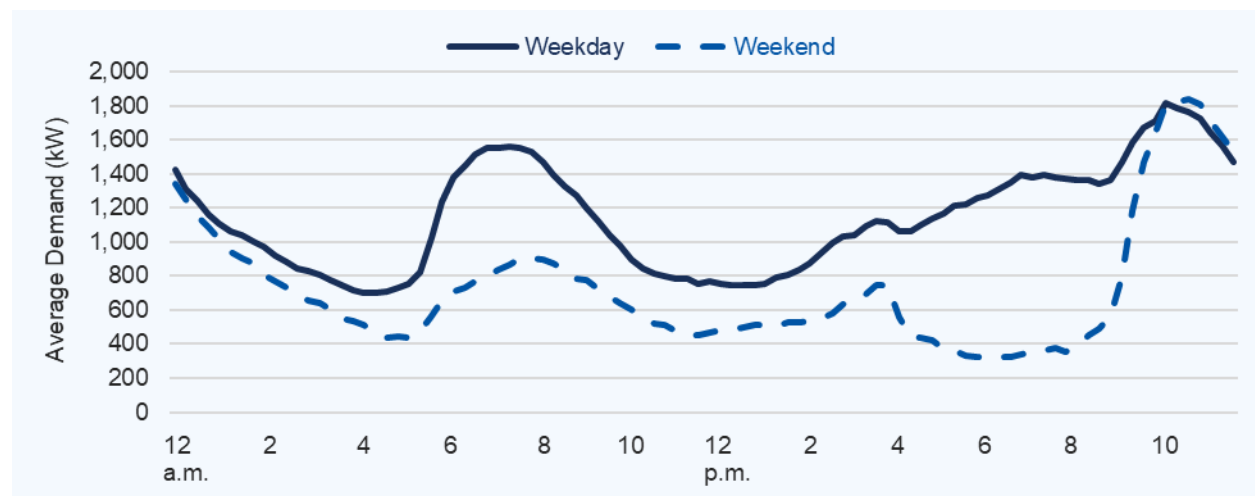


Trucks charge whenever possible: generally once after the morning shift and once after the trucks complete their night shift routes. Each truck can maximize charging power by using both ports on the dispenser. On the truck, one inlet accepts 300 amps and the other 500



amps. When both ports are available, drivers are instructed to use the 500-amp port first to compensate for a truck-to-port ratio of nearly 3:1, and the site maintains dedicated on-site staff to coordinate the constant rotation of charging on the higher amperage ports, which maximizes the total level of charging for all vehicles. Sites with more trucks than charging ports are rare. This site showed one of the highest monthly load factors in the portfolio of roughly 30%.

The site also manages charging by using a combination of manual and software-based efforts. Signage posted at the site requests that drivers avoid plugging vehicles in to charge between the hours of 6 p.m. and 9 p.m., and the Place To Plug software limits charging to only a few kilowatts. With this approach, the site has been successful at minimizing energy consumption during the highest-cost 4 p.m. to 9 p.m. time period, to only 15% to 20% of its total consumption. Additionally, weekend days have significantly less load than weekdays, indicating that some vehicles are not used on the weekend shifts and allowing for the potential movement of Friday charging sessions to Saturday midday, which is a lower-demand, lower-carbon time period.



The site's high load factor of around 30% is about 10% higher than that of other heavy-duty vehicle sites and other types of fleets, indicating that the chargers have very consistent usage. Slight variations in usage indicate that charging operations could be further optimized to take full

advantage of the site's capacity. For example, 15% of charging sessions (20% of energy) have more than five hours of flexibility. The fleet manager acknowledged this opportunity for optimization and noted that the site is willing and able to support additional trucks even though no additional ports were scheduled for installation as of June of 2025. Coupled with the ability of the fleet to complete its routes without significant downtime for charging, this provides a compelling case study on the efficacy of providing fewer charging ports to consistently support a rotation of vehicles as opposed to a dedicated port per vehicle as fleets are often advised to install.

Final Takeaways

This site is an example of a large deployment of Class 8 semi-trucks operating many vehicles on fewer charging ports (with an approximate ratio of 3:1). Successful operations require significantly more attention to charger scheduling and reliability than with sites that maximize redundancy via a 1:1 ratio of vehicles to chargers. This site has shown that it can make the most of the installed infrastructure with careful planning. The fleet manager said that training and quickly familiarizing drivers with the quirks, benefits, and considerations specific to the EVs were key parts of a seamless rapid adoption and rollout. The fleet manager is also interested in exploring options such as battery backups and a generator set (potentially hydrogen) to help offset the site's peak load and provide resilience.

Case Study: Freight Operator (SCE)

Fleet Focus Points: Turnkey Service Practices, Scaling and Adapting, Reliability

Vehicle Deployment and Operational Data

This fleet is a heavy-duty freight fleet operator that leases its trucks to sites across the United States, with a strong EV presence in California. The primary focus of this deep dive is a utility customer with multiple sites activated prior to 2024, mostly within SCE territory and in PG&E territory in Northern California, which we discuss in this deep dive to provide context to the fleet's operations. Though focused on their own properties, the fleet operator can and has supported other site operators. They have found that most fleet operators are new to EVs and inexperienced in planning charging. Their own portfolio of these projects has provided education that will better inform future infrastructure planning. While the fleet operator has been involved in charging planning, they have less insight into actual fleet operations such as with load management.

Fast Facts

Site Type: Landlord/ property owner that supports client-fleets' electrification

Electric Vehicles: Range from medium-duty box trucks to heavy-duty semi-trucks

Charging Stations: L2 and DCFC; from a few to dozens of ports

DMUS

At the time of the visit, the site operator had 18 Volvo VNR Class 8 semi-trucks on site. Eight of these are first-generation trucks with 375 kWh batteries, and 10 are second-generation models with 565 kWh batteries. Other sites owned by the same fleet use a combination of VNR and Freightliner eCascadia trucks, and one also uses Lion Electric Class 6 box trucks. The fleet operator highlighted that in many cases, customers overestimate the range and capability of the trucks and the number of required ports. To address this issue, the fleet operator tries to match each site's vehicle electrification plans to appropriate chargers and management strategies, providing feedback as appropriate to coalesce around a final course of action.

Trucks are used in two shifts at the facility the evaluation team visited, making repeated trips between the ports of Los Angeles and Long Beach and the site in Los Angeles. Trucks depart at around 9 a.m. and return at around 2 p.m., depart again at around 9 p.m., and return again at around 1 a.m.

Planning Infrastructure

Client fleets (tenants) include a range of operators. Existing operators use L2 or DCFC charging and represent projects of only a few ports or dozens of ports. The company pays close attention to how these projects may align with current site leases, building in contingency clauses in the event that tenants relocate before the project reaches its full term. One challenge is to ensure program obligations, such as

quantity of vehicles, are met as contracted with the utility. Another is to ensure that client fleets procure vehicles and chargers which adequately serve the fleet use cases.



Chargers and Charging Usage Patterns

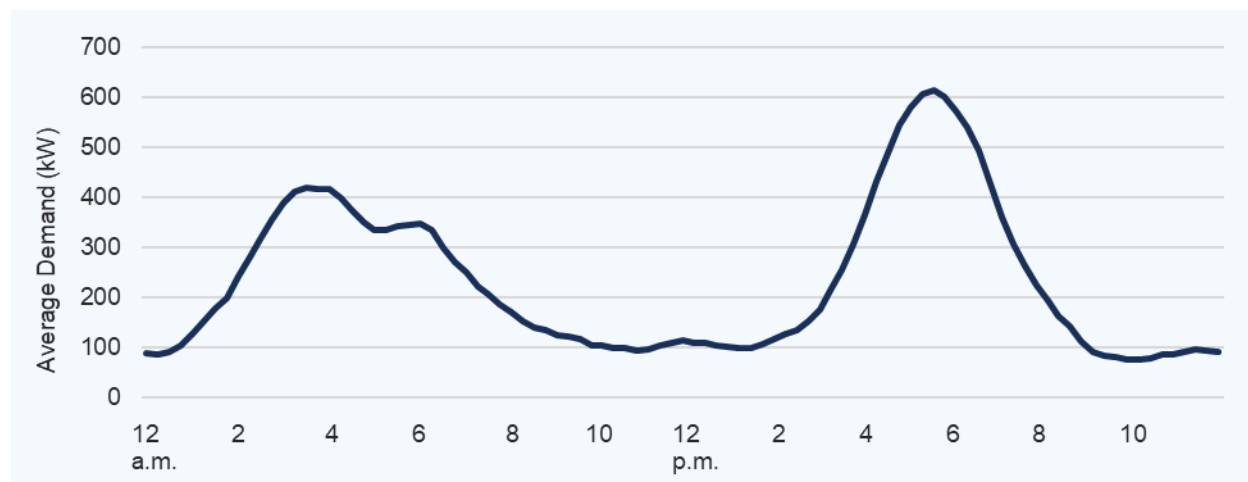
The trucks at the examined SCE site charge in two blocks: one from approximately 1 a.m. to 7 a.m. and the second from 4 p.m. to 9 p.m., with average loads peaking at 300 kW and 400 kW in the morning and evening blocks, respectively. Trucks are supported by eight 180 kW ABB Terra 184 dual-port DCFCs and six dual-port 175 kW ABB Terra 175 DCFCs, both operating on Synop network software. The site has experienced mild charging demand growth since January 2023, with maximum demand stabilizing around 2 MW in mid-2024. The fleet has executed multiple projects under SCE's EV Infrastructure Rule 29, which allows for SCE to coordinate and fund the behind-the-meter infrastructure (transformer, utility conduit, switchgear, and meter) required for independently metered EVSE. The fleet operator noted that two of their recent sites had been completed quickly under this rule (within approximately 18 months), while another SB 350 project had required nearly two and a half years to progress from application to completion. There may be several explanations for this discrepancy in timelines, as the process for project execution differs between the Rule 29 and Charge Ready Transport programs. For example, the



Charge Ready Transport program tasks the utility with site design. As the Rule 29 program, conversely, keeps that responsibility with the site, there is a possibility that this time on site design is not accounted for when the site conducts it themselves. Additionally, the site's ability to apply their lessons learned from the Charge Ready Transport program to the process for Rule 29 may also explain the accelerated timeline.

The fleet manager said that their client selected the ABB units, a departure from the Pihong and Power Electronics units the fleet has installed at other locations throughout SCE territory. However, most of the fleet's other sites feature chargers providing power at between 150 kW and 180 kW, which is a standard recommendation for all the fleet's clients who lease heavy-duty vehicles.

The fleet does not use load management at any of its sites, so the trucks consume a high percentage of their energy between 4 p.m. and 9 p.m. (consistently between 30% and 40% over most of 2024) as shown in the chart below.



The site's duty cycles do not lend themselves to avoiding the highest-cost energy periods under SCE tariffs; this is a common finding across the fleet's multiple sites. The fleet operator prioritizes preserving the duty cycle over minimizing the cost of charging, which is also the case at some of the other sites operated by the fleet but to a lesser degree.

Final Takeaways

This fleet operates under an unusual site arrangement, acting as a third party to support client fleet operators in executing their electrification plans. The fleet can carefully size trucks and chargers to client duty cycles and site electrical capacity. Vendor standardization across the organization has emerged as a possible solution to reduce both installation complexity and the time to project completion. Future fleet plans include supplying additional resiliency and capacity by integrating on-site generation when the charger capacity exceeds the rating of the proposed utility connection.

Case Study: School Bus Operator (SCE)

Fleet Focus Points: Charger Reliability, Charge Scheduling, Load Management

Vehicle Deployment and Operational Data

This site is a medium-size school bus fleet within SCE territory in Southern California. At the time of the site visit, the fleet operated 38 EVs, eight International CE3402 76-passenger school buses and 30 International CE2608 42-passenger school buses. All vehicles are equipped with 210 kWh batteries. The manufacturer estimates that the buses have a range of around 135 miles on a full charge, which is equivalent to 1.6 kWh per mile.

The vehicles are deployed twice daily on round-trip routes averaging approximately 50 miles, though the longest route is 120 miles. The fleet manager reports that in practice, vehicles achieve about 2 kWh per mile, giving the buses a total range of around 105 miles on a full charge. The fleet manager said that during the procurement process, they decided to size the buses to allow for charging overnight on alternating days, and noted that the batteries are actually slightly oversized for the district's duty cycle.

The fleet manager reported that vehicles have been reasonably reliable and that any issues have generally been quickly resolved. However, the fleet manager stated that the buses wear through tires twice as quickly as their CNG-powered counterparts (due in part to heavier vehicles and rear-biased regenerative braking), which has increased the fleet's recurring maintenance costs. The fleet manager has been exploring routes to mitigate this increased wear, including using retreaded tires on the rear wheels and conducting real-world trials of tire compounds specifically designed for heavy-duty-EVs. The site expects to acquire additional vehicles over the next three years, including 43 buses from allocated state funding and 28 to 34 buses through tentative federal funding.

Fast Facts

Site Type: School Bus

Electric Vehicles:

- 30 battery-electric 42-passenger school buses
- 8 battery-electric 76-passenger school buses

Non-Electric Vehicles: 83 diesel buses

Charging Stations: 38 30 kW single-port InCharge chargers

ICE Fuel Type: Diesel

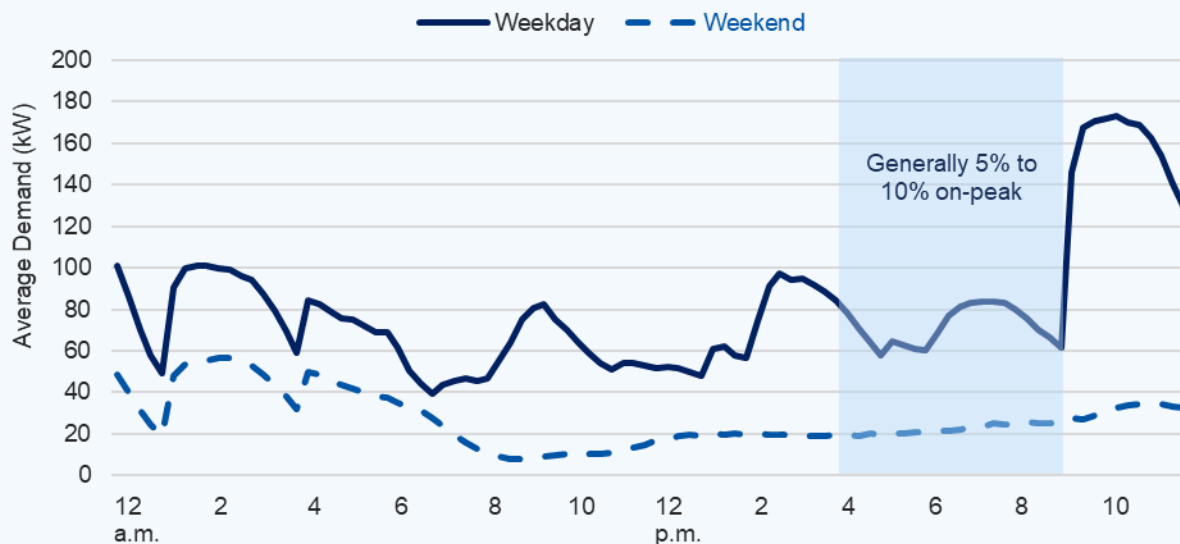
Chargers and Charging Usage Patterns

The site operates 38 InCharge 30 kW DCFC units. Six additional EVSE are scheduled for installation in 2025. These EVSE will use the make-ready conduit that was completed during the installation of the first 38 units, so only a transformer upgrade (from 1,000 kilovolt-amperes (kVA) to 1,500 kVA) and a wire pull will be required to install the additional EVSE. Load management was implemented in late 2023 via the onboard InCharge software to limit charger power during the 4 p.m. to 9 p.m. peak demand period to reduce the energy the site consumes during peak pricing periods. The fleet manager maintains an active hand in managing load and has fine-tuned the software parameters to ensure the site's success in accomplishing this goal. Since the software's installation, the site has consumed less than 15% of its energy during the 4 p.m. to 9 p.m. peak period, and over the 2024 period, the site's energy during this period was at or under 10%.



Vehicles typically charge twice each day: once after they return from their morning routes and once overnight after they return from their afternoon routes. The charger reduces power to the vehicles (which keeps the buses' electrical systems "awake") until 9 p.m., after which charging immediately ramps up, resulting in a large increase in demand from 9 p.m. to 10 p.m. The chart below depicts the 2024 average daily load curve for the site.

In the following figure, the weekend line (shown in light blue) shows a significantly lower average load than that of weekdays. This indicates an opportunity to potentially shift edge-day charging (Monday/Friday) to Saturday and Sunday, taking advantage of the load "headroom" offered by the reduction in drawn power.



According to the fleet manager, charger reliability has been good, with only one charger removed from service for an extended period of time. However, the network control has sometimes caused issues with scheduled charging and has limited the site's ability to access and control the chargers themselves. Site staff expressed regret about the site's lack of an integrated solar photovoltaic system and backup battery, which the site has advised fleets in other jurisdictions to include. The fleet plans to build and implement a solar microgrid and battery back-up using Carl Moyer funding, and anticipates that this system will offset up to 60% of the site's daily consumption.

Final Takeaways

This site was an early adopter of electric school buses at scale, and the fleet has been proactive about sharing their experiences and lessons learned with many other school bus operators seeking to electrify their fleets. The fleet manager's proactive, hands-on approach to charge management, the fleet's early commitment to a large quantity of electric buses, and the site's role as an active beacon for other fleets made it an interesting subject for a deep dive. As the site expands and pairs its microgrid and battery system with the active load management capabilities, we expect to see further improvements to the site's 4 p.m. to 9 p.m. consumption proportion and a reduction in overall electricity costs.



Case Study: Freight Operator (PG&E)

Fleet Focus Points: Simplicity, Reliability, Charge Management, Future-Proofing

Vehicle Deployment and Operational Data

This fleet is a small heavy-freight operator within PG&E territory in Northern California. The operator has procured two Volvo VNR electric Class 8 tractor trucks with 450 kWh batteries. The vehicles' daily duty cycle consists of one 70-to-80-mile out-and-back trip, hauling specially permitted overweight trailers (totaling 80,000 to 88,000 lbs. gross vehicle weight). This represents one of the hardest working vehicles in the portfolio. While

the tractors are rated for around 150 miles of range, the fleet has elected to keep its vehicles on routes of less than 100 miles. This is due to observations of the vehicles' real-world range, which the fleet manager stress-tested early in fleet operations by gradually increasing the driven range of the tractor-trailer combination until the truck fully depleted its battery at a route distance of approximately 100 miles.

The vehicles are charged on two dual-port, 150 kW BTC Power DCFCs, which operate on BP Pulse software. The site implemented load management early on in its operations and has been able to significantly reduce the amount of energy consumed during the high-cost 4 p.m. to 9 p.m. period. Overall, the site consumes less than 10% of its energy during this time period. The fleet serves as an excellent of load management and achieves utility costs averaging between \$0.25/kWh and \$0.30/kWh. The fleet manager reported that the BTC Power units have been very reliable and that the most common problems involve the vehicle-charger "handshake" to establish communication, which can be remedied by power cycling the chargers.

Chargers and Charging Usage Patterns

The site began using BP Pulse software in mid-2023 to limit charger power during the 4 p.m. to 9 p.m. peak demand period, which is designed to reduce the amount of total peak-pricing energy the site consumes. The software has been successful in accomplishing this goal: since the software's installation, the site has consumed less than 10% of its energy during the 4 p.m. to 9 p.m. peak period, as shown in the graph on the next page.

Fast Facts

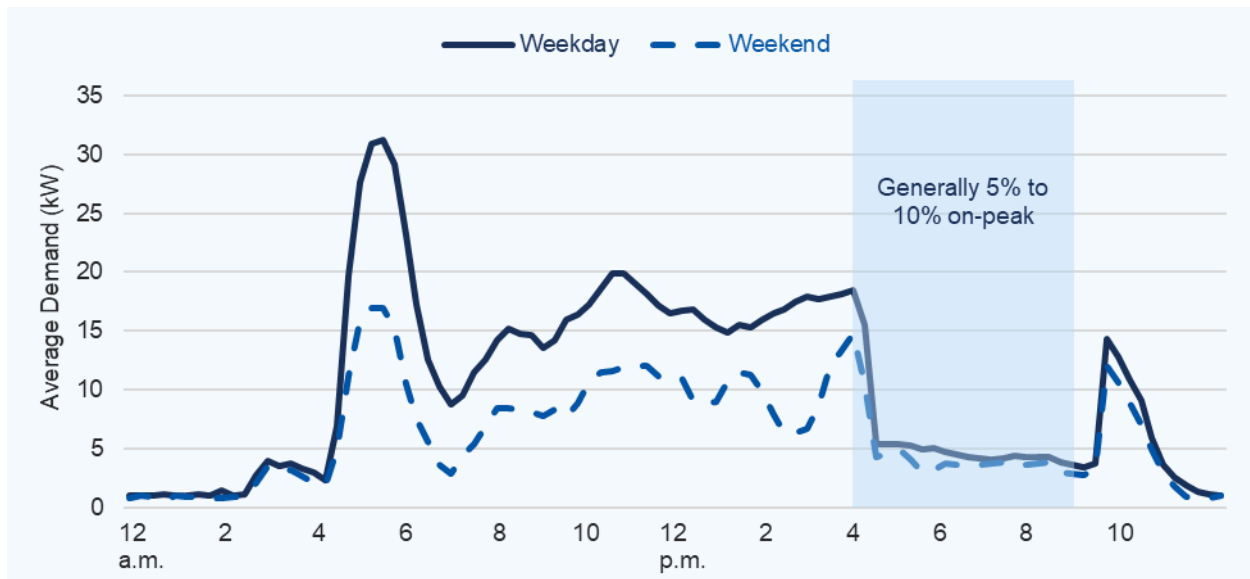
Site Type: Freight Operator

Electric Vehicles: Two Volvo VNR electric tractor trailer trucks with 450 kWh batteries

Non-Electric Vehicles: 97 Class 8 diesel trucks, 98 Class 7 diesel trucks

Charging Stations: Two dual-port 150kW DCFC

ICE Fuel Type: CNG



After the 4 p.m. to 9 p.m. peak period, the trucks finish charging, and sessions are generally completed by 11:00 p.m. The vehicles take between 125 kWh and 200 kWh of energy in 70% of their charging sessions, indicating that on the majority of trips, the vehicles are using approximately half of their nominal battery capacity before recharging.

Modeling indicates that the operator has achieved excellent results in terms of cost. However, modeling results also suggest that the fleet may be able to reduce emissions by around 25% by moving charging to portions of the day with lower carbon intensity. This could in turn increase benefits from LCFS. Given that most charging sessions are less than 50% of the vehicles' maximum battery capacity, the operator could potentially further delay charging to maximize midday energy to achieve the minimum cost and lowest emissions. For instance, the fleet could theoretically shrink the typical 4 a.m. load spike substantially by shifting the load to use higher-power charging during business hours—although this may be difficult to put into practice due to fleet duty cycles and route requirements.

The site has multiple stubouts present on site, which indicates the potential for additional EV buildout in the short term. The fleet manager is currently in discussions with a truck supplier to obtain longer-range vehicles, which are better suited to the fleet's duty cycles and may allow for additional flexibility in their charging schedule and daily routes.

Final Takeaways

The fleet is operating its trucks on an overweight permit, unique among the sites assessed as part of the project thus far. Given this designation and the extreme duty cycle associated with their routes, the fleet's vehicles fall short of expectations. However, the fleet expects to procure second-generation vehicles with longer ranges that should expand the fleet's route capabilities. The site may be able to spread charging loads across the business-hour period, depending on fleet operations, and by doing so decrease greenhouse gas emissions.

Case Study: Transit Operator (PG&E)

Fleet Focus Points: Reliability, Adaptability, En-Route Charging

Vehicle Deployment and Operational Data

This fleet is a large transit operator in PG&E territory in California's Central Valley. Under the EV Fleet program, the operator procured 10 Gillig transit buses: nine with 440 kWh batteries and one with a 686 kWh battery. The fleet manager had some fleet electrification experience with 15 Proterra buses from two previous non-EV Fleet program projects at the same location. The fleet deploys the EVs daily and tends to operate the buses for as long as possible. Once deployed, the buses run until the battery reaches a 10% state of charge (which generally occurs after about 115 miles), resulting in days when vehicles operate for 18 hours. The fleet manager estimated that the vehicles leave the depot between 5:30 a.m. and 6 a.m. and return by 11 p.m. The vehicles have generally been reliable, though the batteries for two of the buses were replaced by the manufacturer under warranty for unclear reasons. While the site has found some success with its new Gillig buses, its electrical infrastructure is at capacity and cannot support any additional EV chargers.

Though the fleet is interested in continuing to pursue electrification, its current focus has shifted to hydrogen fuel cell vehicles, as the gaseous mobile refueler on site does not require additional electrical capacity to operate and supply the fleet's new hydrogen vehicles. An additional component of the move to hydrogen is the fuel's operational familiarity and speed, because the high utilization of the buses requires either extremely rapid refueling or reliable enroute charging. Finally, the site has agreed with its utility to forego further expanding its electrical infrastructure for EV charging, and thus is exploring the feasibility of building a permanent

Fast Facts

Site Type: Transit

Electric Vehicles:

- Nine Gillig electric buses (440 kWh batteries)
- One Gillig electric bus (686 kWh battery)

Non-Electric Vehicles:

- Five 2018 Proterra electric buses
- 10 2016 Proterra electric buses
- Five New Flyer hydrogen buses
- 244 diesel buses

Charging Stations:

- Eight DCFC 62.5 kW ChargePoint CPE250
- Five Proterra/Rhombus 60 kW chargers
- Two 2 Proterra 500 kW overhead chargers (Proterra vehicles only)
- Two Siemens 500 kW overhead chargers (Proterra vehicles only)

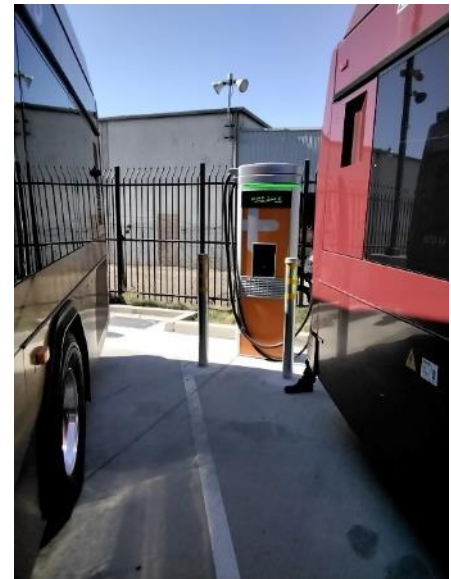
hydrogen dispenser at its depot site. The fleet manager anticipates that the fleet will eventually split its operations between hydrogen and BEVs.

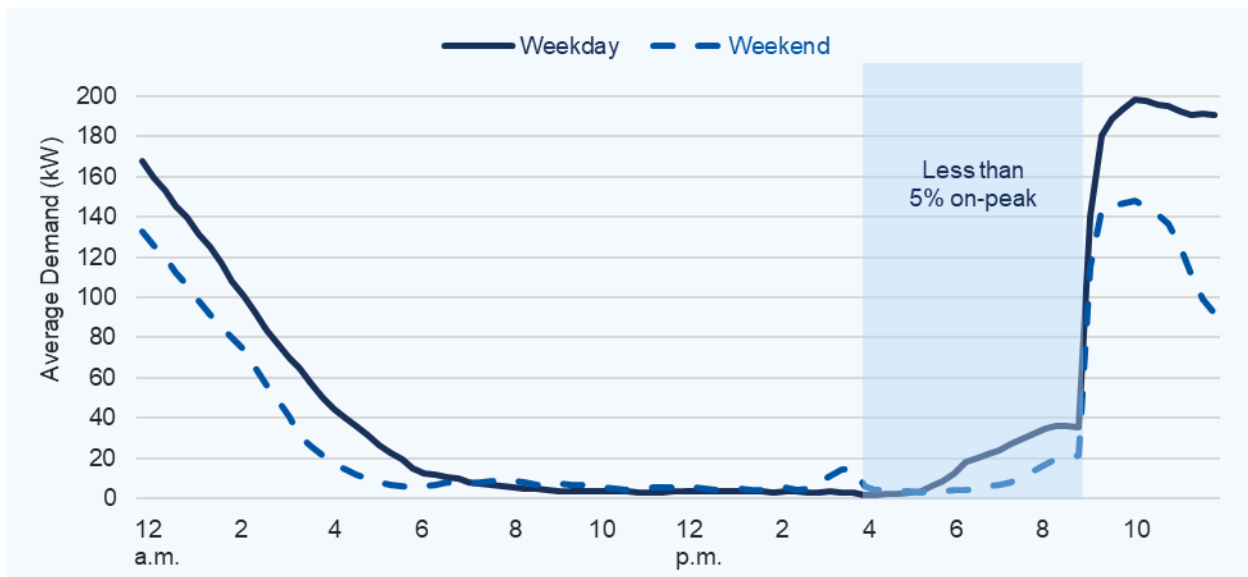


Chargers and Charging Usage Patterns

This site added eight 62.5 kW ChargePoint CPE250 units equipped with pairing kits that allow the chargers to dispense up to 125 kW to four vehicles concurrently. Existing chargers include five 60 kW Proterra depot chargers, two 500 kW Proterra overhead chargers, and two 500 kW Siemens overhead chargers. The Siemens chargers are supplemented by an Engie battery energy storage system.

The site's ChargePoint chargers, installed as part of the EV Fleet program, have been reliable and have maintained a generally steady uptime, which the fleet manager attributes partly to the extended warranty the fleet purchased at the time of procurement. The depot ChargePoint units operate on ChargePoint's network and are programmed to start charging the buses at 9 p.m. to keep most of the energy consumption outside of the 4 p.m. to 9 p.m. peak period. Approximately half of the charging sessions replenish 50% or more of the vehicles' nominal battery capacity. Spreading smaller sessions over longer periods of time or delaying charging to lower-usage days (i.e. weekends) could allow the fleet to further mitigate demand or to consume lower-emissions, lower-cost energy. However, the length of time these vehicles spend in transit (approximately 6 a.m. to 11 p.m.) and the fleet manager's hesitation to postpone charging to much later than the current schedule limit opportunities for load shifting during normal operations. As is, this fleet has maintained a relatively high load factor, approaching 20% since mid-2023. Weekend load tends to be approximately 25% lower than that the load on weekdays.





The fleet manager noted that the site does not have enough chargers for all of the buses to charge concurrently and that staff rotate the buses between chargers to prepare them for their duty cycles. As the buses often operate until around 11 p.m., charging power output is high. Maximum charging demand hovers between 400 kW and 500 kW at the depot. Because of the fleet's tight schedule and strategy of pushing charging back as late as possible, the site is unable to reduce power to spread demand over a longer period. However, the fleet's load management does an excellent job of minimizing peak period energy consumption. Utility data show that approximately 1% of the site's energy was consumed between 4 p.m. to 9 p.m. through the end of 2024.

A key lesson learned for this site has centered around the existing Proterra vehicles and chargers that were not procured as part of the EV Fleet program. Proterra declared bankruptcy and was dissolved in 2023, at which point charger warranties were voided. As a result, at the time of the fleet manager interview in late 2024, three of the five Proterra depot chargers were out of commission and the fleet was having trouble obtaining service to repair them. Additionally, problems with the Proterra overhead chargers led the fleet manager to procure spare and sold-off Proterra gear from other fleets to maintain a supply of parts to keep the chargers operational for as long as possible.

Final Takeaways

This site is an excellent case study of a site pursuing multiple pathways to enhance electric bus operations. The site's peak period charging energy consumption is extremely low for the fleet's high duty cycles, and the firm cap on electrification expansion has led the fleet to explore other solutions for operating EVs. While the fleet has found success with its new Gillig electric buses, it has no current plans for additional electrification since the site has reached its electrical infrastructure limit on its existing service.

Case Study: Transit Operator (PG&E)

Fleet Focus Points: Fleet Diversity, Charger Diversity, Load Management

Vehicle Deployment and Operational Data

This fleet is a private commuter shuttle operator within PG&E territory in Northern California. The fleet operates a wide variety of coaches across a 44-vehicle electric fleet: 21 BYD motor coaches (15 45' models and six 35' models, all of which predate the EV Fleet site), four MCI 45' coaches; eight VanHool 45' coaches, 10 VanHool double-decker coaches, and a single Starcraft Ford/Lightning Motors shuttle. The electric buses are charged at two adjacent parking lots at the employer's corporate campus: an expansion of Lot A, most of which was constructed prior to the PG&E site, and Lot B, which was constructed as part of the site along with an upgraded transformer for Lot A. The table below presents the charger quantities by type and site phase with total ports in parentheses.

Fast Facts

Site Type: Transit

Electric Vehicles:

- 43 battery-electric motor coaches
- One battery-electric E450 shuttle
- MCI 544 kWh, BYD C8 313 kWh, BYD C10MS 446 kWh

Non-Electric Vehicles:

- 36 diesel buses

Charging Stations:

- 37 180-kW dual-port ABB chargers
- 4 62.5-kW dual-port ChargePoint chargers

Site Phase	62.5 kW Dual CPE250	80 kW Single BYD	100 kW Dual ABB	200 kW Dual BYD	180 kW Dual ABB	Total
(Pre-EV Fleet)	11 (22)	6 (6)	1 (2)	15 (30)		33 (60)
(EV Fleet)	4 (8)				37 (74)	41 (82)
Total	15 (30)	6 (6)	1 (2)	15 (30)	37 (74)	74 (142)

These chargers are connected to three 2,500 kVA transformers, two of which were installed as part of the EV Fleet site. As the number of available ports greatly exceeds the number of vehicles the fleet operates, the fleet has opted to support other regional shuttle vehicles in the area. The fleet estimates that it serves approximately 15 partner vehicles, all of which are double- and single-deck motor coaches approximately 40 feet in size.



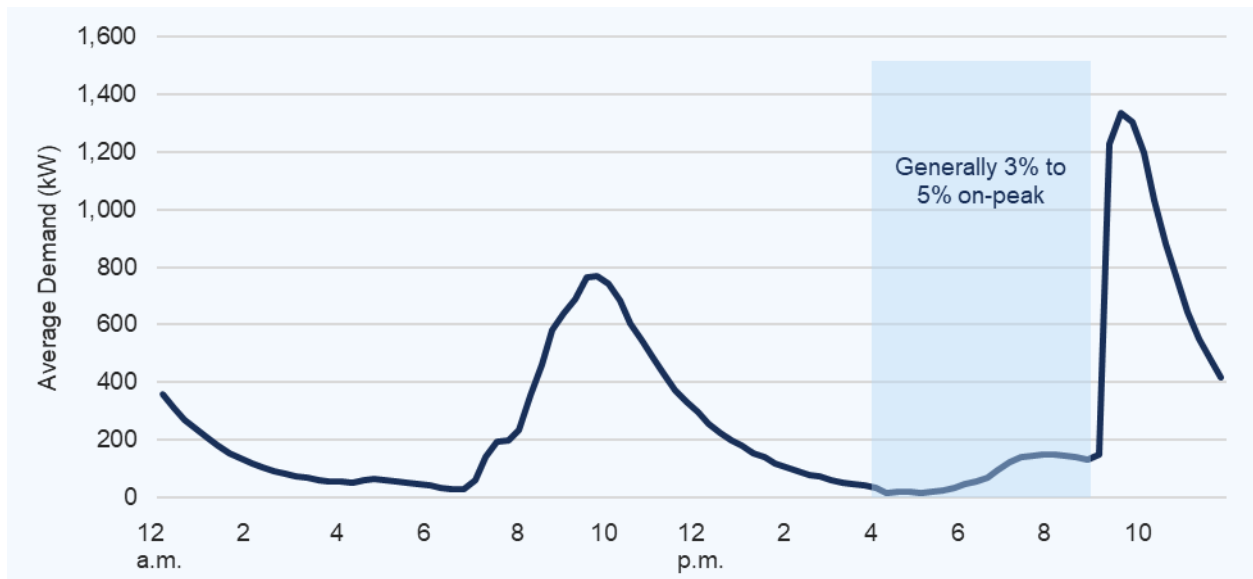
The electric buses are operated by a third party and are used to transport employees between regional pickups and the site's corporate campus using a hub-and-spoke model. Twice daily, vehicles start at the campus, travel to terminals at various regional locations throughout the San Francisco Bay area, then return to campus. Approximately 20% of the employees at the site use these buses for commuting. During the site visit, the fleet manager reported that the electric buses were generally functioning as expected and able to complete their duty cycles without issue, with the longest roundtrip route being 120 miles into the Central Valley.

The fleet manager did note that some of the buses have had issues with moisture intrusion affecting fire suppression systems in the lower portion of the body (for example, from routine vehicle washing). The fit and finish of earlier generation buses (BYD) are degrading somewhat more rapidly than expected, and the fleet is worried that the vehicles will not meet their 10-year life expectations. However, mechanical issues with the buses remain small and generally limited in scope. The fleet has actively prioritized using the EVs on the longest routes to maximize electric miles and anticipates that its vehicle procurement roadmap will consist of around 60% EVs moving forward.

Chargers and Charging Usage Patterns

Despite being assigned to the fleet's longest routes, the vehicles at the site consistently recharge around 50% of their nominal rated capacity, indicating that there is a significant amount of potential headroom for route expansions or a more flexible charging strategy. The site began using BP Pulse software in 2021 to limit the chargers' power during the 4 p.m. to 9 p.m. peak demand period to reduce the amount of total peak-pricing energy the site consumes. The BP Pulse software has been successful in accomplishing this goal: over the EY2024 period, the site has consumed less than 10% of its energy during the 4 p.m. to 9 p.m. peak period, as shown in the graph below. Overall, the site averaged \$0.23 per kWh during 2024, which is among the lowest observed average energy costs in the EV Fleet program.

After the 4 p.m. to 9 p.m. peak period, buses plugged in at the depot immediately ramp up charging speed simultaneously, resulting in a large increase in demand from 9 p.m. to 10 p.m. In the morning, buses return to the site at different times to begin charging, which helps mitigate the maximum charging demand at that time. Evening maximum demand is much higher, representing the highest 15-minute demand on which the utility bases demand charges. Charging session data reveals that most of the evening sessions could be extended over a longer period at lower power, which could reduce the average 15-minute demand and thus the fleet's demand costs. The fleet has a load factor of around 20%—one of the highest in the EV Fleet program—which would further improve if the fleet were to reduce its evening peak demand. Furthermore, much of the Friday evening charging could be delayed to midday Saturday, when emissions are approximately half of the Friday evening level.



Charger reliability has been fair, with the fleet expressing disappointment with one manufacturer's difficulties with resolving a recurring issue. This issue ultimately affected every EVSE from this manufacturer, requiring months of communication to replace affected components totaling over \$600,000 in parts alone, a cost that was covered by the charging manufacturer. As a result, the fleet transitioned to using EVSE from a second manufacturer, which proved to be more reliable, but not immune to similar issues with its internal components. The fleet managers believe that a major cause of the chargers' issues is corrosion, resulting from the fleet's position near San Francisco Bay. The fleet retains an on-site EVSE technician to quickly identify issues and help pair vehicles with appropriate chargers to ensure that all charging operations are completed smoothly. The fleet has also opted into an extended warranty program for charging hardware.

Final Takeaways

This site has deployed a significant number of high-powered EV chargers and is unique among the fleets examined thus far in that it actively prioritizes the use of its electric buses on its longest routes. Additionally, the very low (<10%) consumption of expensive 4 p.m. to 9 p.m. peak electricity is indicative of excellent load management practices. Overall, this is an impressive example of a large, high-power fleet effectively operating EVs and responding to pricing signals that benefit the grid. The fleet operator has been attentive to the development and refinement of its charging hardware and associated vehicles, and is proactively increasing the EV portion of the fleet in line with its company goal of reaching 75% zero-emission vehicles by 2029.

Case Study: School Bus Operator (SDG&E)

Fleet Focus Points: Vehicle-to-Grid, Operational Reliability, Expandability

Vehicle Deployment and Operational Data

This large school bus fleet operator is located within SDG&E territory in Southern California. At the time of the visit, the fleet was operating 13 electric school buses: three Blue Bird Type C school buses with 155 kWh batteries and vehicle-to-grid (V2G) capability and 10 IC Bus Type D buses with 210 kWh batteries.

The school buses are deployed twice per day for student pick-up and drop-off routes averaging approximately 20 miles roundtrip (40 miles per day). The fleet manager noted that the electric buses have

Fast Facts

Site Type: School Bus

Electric Vehicles:

- 10 210 kWh battery-electric Type D IC Bus school buses
- 13 155 kWh battery-electric Type C Blue Bird school buses with V2G capability

Non-Electric Vehicles:

- 400+ diesel buses

Charging Stations:

- 12 16.6 kW single-port L2 chargers
- 3 60-kW single-port DCFC chargers

ICE Fuel Types: Diesel



been able to fulfil their duty cycles but are still working toward full proficiency.

The fleet purchased the buses from two separate dealerships in Southern California. One manufacturer's vehicles were sourced from a dealer that dispatches maintenance technicians in San Diego County for rapid response, troubleshooting, and support. The manufacturer also supplied a laptop with simple diagnostic software to enable site mechanics to pull the codes. The second OEM's buses came from a different dealership that dispatches technicians from the dealership locations. Despite some challenges, the site won a federal grant and is navigating the process of obtaining another 30 buses and install 20

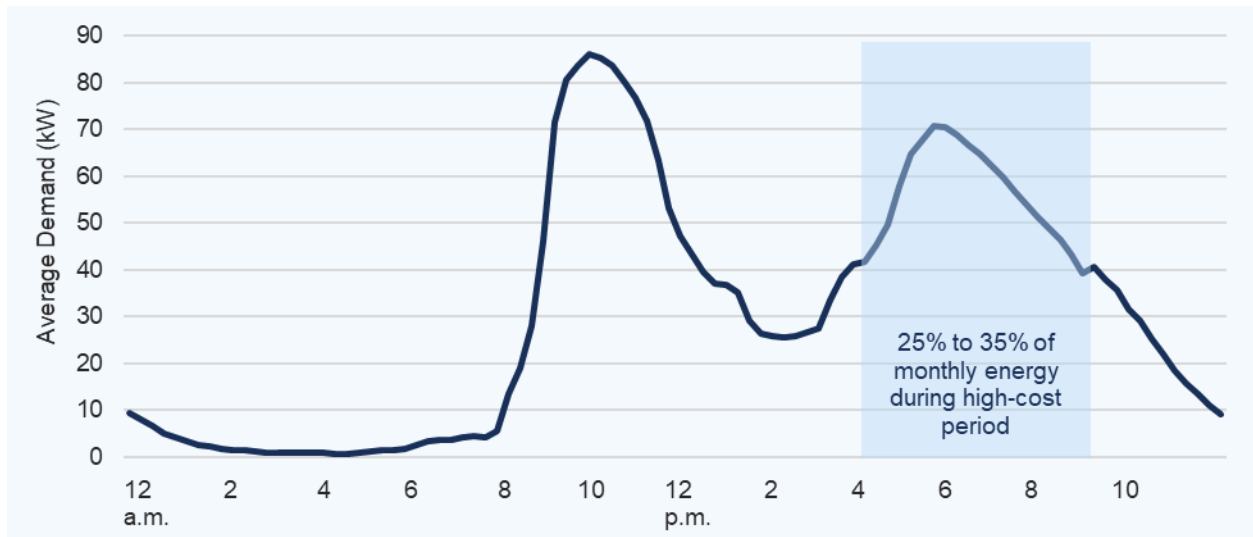
additional L2 chargers and at least three DCFCs, all using existing installed capacity.

Chargers and Charging Usage Patterns



The site operates 12 16.6 kW L2 chargers and three 60 kW DCFCs capable of V2G (discharging the vehicles back to the grid). The vehicles from one manufacturer primarily charge on the L2 chargers and use the DCFCs to top off occasionally, while the buses from the second manufacturer primarily use the DCFCs.

The electric school buses typically charge twice per day: once after they return from their morning routes and again after they return from their afternoon routes. At the time of the site visit, no charger load management was in place. At the time of the interview, district staff members reported that the site's NSP was working to give the fleet the ability to implement charge scheduling on its L2 chargers. The unrestricted charging pattern is evident in the daily load curve below, which represents weekday charging during the school year and shows significant energy consumption during the high-cost 4 p.m. to 9 p.m. peak period.



According to the fleet manager, charger reliability has been good overall, with the L2 units slightly more reliable than the DCFCs. Both EVSE manufacturers have been communicative about and responsive to issues as they arise. The fleet’s most significant expressed issue has been with software and hardware updates on both the chargers and the vehicles, which have disrupted the “handshake” communications that occur when a vehicle plugs in to charge.

The summer of 2024 provided six opportunities for the DCFC V2G-capable chargers to allow the buses to feed power back to the grid, designated under the CPUC as Emergency Load Reduction Program (ELRP) events. The fleet manager reported that two of the three DCFC EVSE were able to reliably discharge energy back to the grid; they also noted that the buses sometimes had difficulty automatically transitioning back to charge mode from discharge mode.



Final Takeaways

This is one of the few sites with an active V2G deployment. The site has encountered minor challenges with its vehicle-charger communications after software updates. The site’s future-proofing efforts (installing extra capacity on transformers and switchgear) and careful testing of vehicle-charger interoperability has allowed quick expansion of its electrification capabilities without sacrificing reliability or incurring redundant costs. The fleet manager has been involved in sharing their experiences with their site implementation including lessons learned, and the fleet is an excellent case study for other school bus fleet electrification efforts.

Case Study: Transit Operator (SDG&E)

Fleet Focus Points: Simplicity, Reliability, Charge Management, Future-Proofing

Vehicle Deployment and Operational Data

This fleet is a large transit operator within SDG&E territory in Southern California. Over the past two years, the operator has procured 12 60-foot articulated buses with 610 kWh batteries and expected to add 13 40-foot buses to the fleet in 2025. The fleet operator had some previous experience with vehicle electrification, with 11 40-foot buses from an older project at an ancillary location. A second project phase is expected to be awarded in early 2025, which will add 78 buses to the site and expand the charging infrastructure by installing three additional charging islands on existing scaffolding framework, with expected completion in 2031.

The current gantry was designed to use the space efficiently and accommodate charging for up to 24 buses. At the time of the site visit, the site was operating eight Heliox 180 kW cabinets powering 24 top-down pantograph chargers with RFID authentication on the BP Pulse network. The site had also connected two legacy ChargePoint units originally procured for a

Fast Facts

Site Type: Transit

Electric Vehicles: 12 60' Articulated Transit Buses (610 kWh)EVs

Non-Electric Vehicles: 150+ CNG buses

Charging Stations: 24 overhead pantographs (Heliox 180 kW split three ways)

ICE Fuel Type: CNG

previous project to the new service.

This site is the fleet's second major foray into electrification. The success of this project was a major influence for the design of the operator's upcoming renovation to a separate site in southern San Diego County, which will install 30 overhead pantograph and supporting Heliox cabinets and chargers.



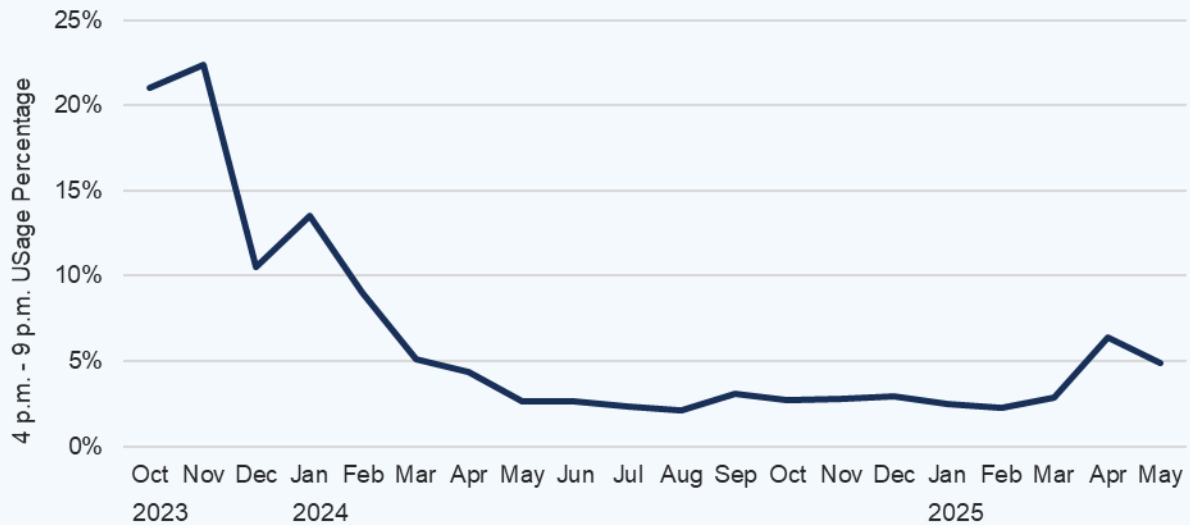
During the site visit, the fleet operator reported that electric buses were functioning as expected and able to complete their duty cycles without issues, though the fleet managers did cite range as a limiting factor that requires the buses to charge twice daily—once during normal operations and again overnight. Overall, the electric buses are marginally less expensive to operate than the fleet's previous CNG vehicles, with operators estimating cost reductions of between \$0.15 and \$0.25 per mile. However, the cost



advantage of operating BEBs may decrease or disappear as more vehicles are incorporated into the fleet, as larger expenses may begin occurring (including battery replacements) and less flexible scheduling may force additional charging during the expensive peak demand period. The fleet operations lead expressed appreciation for the modularity of the battery packs on the newer buses; whereas the older models required the removal of the entire “string” of battery cells for maintenance activities, the batteries in the newer models are broken into multiple smaller sections, making maintenance and replacement significantly easier.

Chargers and Charging Usage Patterns

The site began utilizing BP Pulse software in March 2024 to limit the chargers' power during the 4 p.m. to 9 p.m. peak demand period. The software has proven to be successful in reducing the energy the site consumes during this peak pricing period: since the software's installation, the site has consistently consumed less than 10% of its energy during the 4 p.m. to 9 p.m. peak period, as shown in the graph below.



After the conclusion of the 4 p.m. to 9 p.m. peak period, buses fully charge overnight. The installation of distributed energy resources at the site was anticipated to move forward in early 2025. The site had originally planned to add a photovoltaic system, CNG backup generator, and battery storage as additional alternatives in their bidding process, but prohibitive costs at the time of construction led them to delay installation. The site had received federal funding to install demand response equipment at its second project site; however, given federal claw backs, the site's status is uncertain as of mid-2025.

The project generates LCFS credits from its usage of renewable electricity from an Energy Service Provider under California's Direct Access program. In the past, the fleet had purchased renewable energy credits to reduce the overall carbon intensity of its electricity consumption to 0 kWh, but recent changes (including the increase in the cost of renewable energy credits) made this approach financially unfeasible. The operator has been stockpiling LCFS credits for at least the past two years in response to the decline in credit value on the LCFS spot market, but has restarted discussions about when to begin selling those credits.

Final Takeaways

The site has served as a bellwether for the rest of the operator's sites. The operator has been replicating the expandable gantry framework design coupled with automated, RFID-enabled pantographs and 180 kW chargers paired with three EVSE at other depots throughout its territory. Additionally, the low (<10%) consumption of expensive 4 p.m. to 9 p.m. peak electricity is indicative of excellent load management practices. The fleet operator has been involved in and attentive to its procurement process, and is poised to further reduce its grid dependence by installing distributed energy resources as a subsequent phase at the site, and at the time of installation at their upcoming site in southern San Diego. The operator serves as an excellent case study for other transit systems to consider as they initiate their own deployments of zero-emissions buses.

Appendix B. Methodology

This section describes the evaluation methodologies for the MDHD programs and Public Charging programs (AB 1082 [Schools Pilot], AB 1083 [Parks Pilot], and EV Fast Charge program), including data collection and analysis activities. The Evaluation Team collected primary or secondary data (data collection) and transformed that data to produce findings (analysis). Some methodologies are identical across programs, while others are specific to a given program.

Table B-1 lists the evaluation activities conducted for each program for EY2024. The individual program chapters discuss the evaluation activities, methodology, and findings

Table B-1. EY2024 Data Collection and Analyses by Program

Type of Data Collection and Analysis	Liberty	PG&E			SCE		SDG&E	
	Schools and Parks Pilots	MDHD	Schools and Parks Pilots	EV Fast Charge	MDHD	Schools and Parks Pilots	MDHD	Schools and Parks Pilots
Program Data and Materials	X	X	X	X	X	X	X	X
AMI/EVSP Data	X	X		X	X	X	X	X
Site Visits	X	X	X	X	X	X	X	X
Site Costs		X	X	X	X	X	X	X
Interviews	X	X	X	X	X	X	X	X
Surveys		X			X		X	
Delphi Panel		X			X		X	
EV Adoption			X	X		X		X
Grid Impacts		X	X	X	X	X	X	X
Counterfactual Development	X	X	X	X	X	X	X	X
Petroleum Displacement		X	X	X	X	X	X	X
GHG and Criteria Pollutant Emissions Reductions		X	X	X	X	X	X	X
Health Impacts		X	X	X	X	X	X	X
Site Costs		X	X	X	X		X	X
Site Visit Findings		X	X	X	X	X	X	X
Co-Benefits and Co-Costs		X			X		X	
Interviews and/or Survey Findings	X	X	X	X	X	X	X	X
Market Effects		X			X		X	

The Evaluation Team developed an evaluation methodology for data collection and analysis to address three research objectives:

- **Research Objective 1.** Determine whether transportation electrification investments accelerated widespread transportation electrification, reduced petroleum dependence, helped meet air quality standards, reduced GHG emissions, and achieved the goals of the Charge Ahead California Initiative.¹⁵⁴
- **Research Objective 2.** Determine whether transportation electrification investments maximized benefits (including co-benefits) and minimized costs (including co-costs) and the extent to which the costs and benefits accrued to DACs.
- **Research Objective 3.** Maximize lessons learned from analyzing data collected during program implementation.

The scope of activities was designed to address the specific characteristics of each program at an appropriate level of rigor and to produce findings with a meaningful level of detail. The evaluation activities conducted for each program were largely influenced by the number of sites in the participant population for that program and within the market sector.

The Evaluation Team reviewed program participation and adjusted the sampling methodology, scope, and timeline of activities to maximize efficiency. This report provides impact and process evaluation findings that the Team derived by attempting a census approach to gather site-level inputs from AMI and EVSP data, site visits, or surveys from activated sites. For activities that involved a more granular approach to data collection and for which program or market sector participation levels were insufficient to allow reporting at any meaningful level of detail, the Evaluation Team updated the scope and timeline of activities to be reported as part of the next evaluation cycle.

Sites in Evaluation Report

Throughout this report, we use the following terminology to describe participating sites or sites included in the evaluation effort:

- **Utility Construction Completed:** Sites for which the Utility has completed its scope (TTM, TTM and BTM, and turnkey installation)
- **Activated:** Sites with charging stations installed and available for use
- **Operational:** Sites for which AMI and/or EVSP energy usage data have been received from the Utility or EVSP
- **Closed Out:** Sites for which financial documentation has been finalized by the Utility and rebates for the installed chargers have been paid

¹⁵⁴ Environment California. December 17, 2021. "Charge Ahead California Budget Request 2022." <https://environmentcalifornia.org/programs/cae/charge-ahead-california>

Medium-Duty Heavy-Duty Programs Evaluation Methodology

This section outlines the data collection and analysis methodologies for the MDHD programs.

Data Collection Methodology

To assess the MDHD programs the Evaluation Team collected program performance metrics, program materials, AMI and EVSE data, and site visit data and conducted surveys and interviews.

Program Performance Metrics

Data on program performance metrics included information about program applications such as count of charging ports, number of EVs procured, site status (inside a DAC or outside a DAC), time in each program phase, and site costs, where available. These data support an understanding of program performance, such as the median number of days sites spent in different program phases, the percentage of applicants from different market sectors, and program spending.

The Evaluation Team collected and securely transferred this data between the Utilities' secure SharePoint sites or other secure file transfer systems and our own Microsoft Azure cloud-based environments. We completed this transfer monthly for most data, with some variation in timing among PG&E, SCE, and SDG&E. Once we received data from each Utility, we moved it to a secure data warehouse for storage and retrieval.

Program Materials

To understand how the programs operate and communicate with customers, the Evaluation Team reviewed available program-related materials, such as Decisions, Advice Letters, and Program Advisory Committee (PAC) presentations. We reviewed the changes in program design and implementation and the legal and regulatory environments that impact the programs, including site and vehicle requirements, outreach and onboarding approaches, and required materials from participating fleets. The program material review allows the Team to establish a foundational understanding of program design, track changes in design over time, and understand the implementation progress.

Table B-2 shows a list of the types of data (both program performance metrics and program materials) the Evaluation Team reviewed.

Table B-2. Medium-Duty Heavy-Duty Program Materials Reviewed

Program Materials Reviewed
• PAC presentations • Program data such as number and type of EVSE installed, and VAPs • Regulatory documents such as Decisions and Advice Letters • Public reports such as the Joint IOU EV Load Research and Charging Infrastructure Cost Report • Utility websites: ▪ Programs and handbooks ▪ Application and application preparation and information documents ▪ Fact sheets and case studies ▪ Funding information ▪ OEM information • Marketing materials: ▪ Emails and other collateral ▪ Webinars • Program documents: ▪ Agreements and contracts ▪ Technical requirements ▪ Registration forms • Utility information: ▪ EV rate schedules ▪ EVSE maps ▪ DAC maps

AMI/EVSP Data

The Evaluation Team used AMI data to estimate charger usage, a key input for subsequent analyses and estimations of program impacts such as impacts to the grid, petroleum displacement, emissions reductions through EV adoption, and associated health impacts.¹⁵⁵ The Evaluation Team collected and securely transferred all AMI data between the Utilities and Microsoft Azure cloud-based environments. The Team used Azure Databricks to transform and standardize the data, which we then imported into an SQL server data warehouse. We performed these transfers monthly, with some variation in timing among the Utilities. Once we received this data, we input it into the Cadmus data warehouse for secure storage and retrieval and aggregated it for subsequent calculations and analysis. Time-stamped energy consumption data were recorded in 15-minute intervals.

¹⁵⁵ Liberty Utilities does not use AMI, so the Team collected regular meter data instead.

A second critical data source was EVSE data provided by participating EVSPs. The electric Utilities developed a process for screening and approving EVSPs based in part on their ability to provide essential monthly charging data of EVSE sessions, intervals, stations, and ports.

Together, AMI and EVSE data provided the basis for analyzing at a granular level program performance such as customers' ability to shift loads to off-peak times in response to time-varying rates. The Evaluation Team used data from EVSPs to examine port utilization, which is based on the time a vehicle is parked at a charger and consuming energy. Port utilization rates can be expected to rise as programs mature and consumers and fleets acquire more vehicles.

The Evaluation Team worked to obtain complete AMI and EVSE data from the Utilities and EVSPs for every charging session. In some limited cases when AMI data were not available from the Utility, the Team worked with the Utility to obtain these data and incorporate them into future analyses. In some cases when AMI data were not available, either a customer provided a sub-metered dataset or the Team synthesized data from existing EVSE data.

Synthesized Data

Some AMI data was missing, or hourly distributions were unavailable, for brief periods of time for a limited number of sites across the Utilities. Consequently, the Evaluation Team generated representative AMI data for these sites based on available EVSP data through a synthesis process using a conversion factor of the ratio between EVSP data and AMI data. We derived specific conversion factors for each site by evaluating the ratio of total kilowatt-hours delivered as reported by EVSPs, which in most cases existed for the same site at a different time period, or for similar EVSE and vehicles.

Annualized Data

The Team considered all operational sites for annualization.¹⁵⁶ In the EY2021 annual evaluation, we annualized all sites with greater than six months of usage data and considered annualizing sites with between three and six months of usage data depending on observed usage patterns. For EY2022 to EY2024, the Evaluation Team annualized all sites to provide a more complete picture of the entire program to date and the impacts of the existing program performance over a full 10-year life. Our experience has shown that sites that have an abbreviated period of performance (less than six months) will inherently have lower utilization than fully developed sites. As a result, annualized sites with an operational time of six months or less will underrepresent the full 10-year impact; however, excluding those sites would create an even greater underrepresentation.

The Team annualized each site by creating a representative 12-month operation period, which could be projected into the future to the point when the site will reach its 10-year life. We determined the 10-year life by evaluating when the operational use of the EVSE would begin and projecting forward 10 years from that date. For sites that had more than 12 months of operating data without a significant

¹⁵⁶ The Evaluation Team annualized electricity usage data for sites with operational AMI data (data indicating that EVs were actively being charged). We extrapolated partial year site electricity usage data out to a full year to make site-to-site and year-over-year comparisons.

increase in use in the most recent 12 months, we used those 12 months as an annual profile. For sites with less than 12 months of fully developed usage data, we removed the months of data before the date the site reached 75% of the maximum monthly use and replaced that data with a synthesis of all months of data following 75% of the maximum utilization.

Site Visits

Site visits are an important part of the data collection process as they provide an on-the-ground view of the sites and access to stakeholders such as fleet and facility managers who may participate in surveys and in-depth interviews. Site visits help answer questions related to the integration of infrastructure- and vehicle-focused programs. They also allow us to confirm which vehicles and charging hardware were delivered and are in operation and how routes, utilization, and duty-cycles impact performance and electricity demand.

During the site visits, the Team collected qualitative and quantitative information that provided us with an understanding of fleet composition and operations. We compared this data against Utility-provided information for individual sites. The Team collected the make, model, and number of EVs on site and information about types of conventional vehicles or equipment replaced, charging equipment, charge management capabilities, electrical infrastructure, future vehicle/equipment replacement plans (including future vehicle adoption), public funding sources, and interest in on-site solar and/or storage at the site. The Team held meetings with facility managers and other personnel to learn about the particulars of each site. At sites where the site host was able to answer our questions and the fleets had more than three months of operational experience, the Team asked about satisfaction with the Utility program, charging infrastructure, and EVs. We also asked about any co-benefits or co-costs the site host had experienced or anticipated. Additionally, we inquired about the availability of telematics or fleet usage records to characterize site operations. The Team used a similar process for each visit, asking the same questions and starting the same conversations. After each site visit, we entered data into an in-house web-based tool for site visit data collection to compile notes and photos for aggregate analysis.

Site Costs

The Evaluation Team collected site-level costs from the Utilities via their annual SB 350 report.

Deep Dives

The Evaluation Team engaged with participants from different sites for deep dive assessments across SCE, PG&E, and SDG&E territories. Our deep dives included detailed examinations of site usage metrics and assessments of vehicle and charging performance, user experience with EVs and EVSE, and site characteristics. The deep dives allowed the Team to gather insights based on projects that had potential to provide significant learnings for stakeholders. This data collection provided a secondary, more in-depth conversation between the Evaluation Team and site host than occurred during site visits. The Team based its site-specific questions about vehicle operations, reliability, and behavior on observed utility and session data.

We selected potential deep dives from MDHD sites evaluated during previous years based on several criteria. Sites of interest included those with significant demand, consumption, or installed charging

capacity; a demonstrated ability to expand EV infrastructure; the presence of load management; unique vehicles or charging equipment; a large fleet size; and a fleet manager who was willing to participate.

We asked site hosts who had agreed to participate in the deep dive process to share additional site data and to discuss their experiences with the electrification process and operation of EVs. We also asked these site hosts to administer a survey to their vehicle operators to gauge feedback on EV and charger performance during normal operations.

Interviews, Surveys, and Expert Opinions

Interviews

This section describes the approach, data sources, and analyses performed for the EY2024 Utility interviews. The Team conducted staff interviews for SCE, PG&E and SDG&E to provide insight into program design and implementation and context to analysis outputs and findings.

The Team developed interview guides outlining a variety of key topic areas and questions for discussion to ensure that we covered each topic area during phone interviews with Utility program managers about their respective programs:

- Status updates and changes from EY2023 (and previous years)
- Program design
- Key milestones
- Key barriers to implementation and solutions
- Preliminary areas of success and lessons learned

The Evaluation Team tailored each interview guide based on information previously provided by the Utilities to ensure an effective use of time. A group of Evaluation Team members with various areas of expertise conducted the interviews to ensure coverage across all relevant evaluation areas.

The Team reviewed verbatim notes taken during each interview as the basis of our analysis. We integrated those findings throughout the report, informing many sections including program overviews, materials reviews, and Utility interview analysis findings.

The Evaluation Team also interviewed site hosts who withdrew from the PG&E, SCE, or SDG&E program (known as withdrawn fleet managers). In EY2023, these were conducted as surveys. However, due to the low response rate for the survey and the small population, the Evaluation Team decided that interviews would be a better approach in EY2024 to gather richer data. During the sample selection process, the Evaluation Team worked with the PG&E, SCE, and SDG&E program managers to ensure that only sites that were eligible for and withdrew from the program were interviewed—not sites that applied but were not eligible. Interviewing only eligible sites strengthened the insights gathered through and allowed the Team to focus on the reasons for withdrawal that PG&E, SCE, or SDG&E might be able to address.

The interview was designed to address specific objectives, several of which were similar to the fleet manager survey:

- Identify the factors that facilitate successful fleet electrification and lessons learned
- Explore the benefits and costs of transportation electrification for fleets
- Gauge market impacts and trends and identify market barriers
- Understand the reasons for withdrawing from the program

For EY2024, the Evaluation Team attempted to reach all the sites that withdrew from the PG&E EV Fleet, SCE Charge Ready Transport, and SDG&E PYDFF programs. For initial outreach, we invited withdrawn fleet managers to schedule an interview via email and sent several follow-up emails. The Evaluation Team conducted phone calls to fleets that did not respond to the email and fleets without an email address.

Surveys

The Evaluation Team surveyed fleet managers of activated sites that participated in the program who had complete contact information. The purpose of the survey was to gather information to address several objectives:

- Identify factors that facilitated successful fleet electrification and lessons learned
- Explore the benefits and costs of transportation electrification for fleets
- Assess the experience of fleet managers with the program and infrastructure
- Gauge market impacts and trends and identify market barriers
- Assess program attribution

The Evaluation Team conducted the survey via an online survey platform, Qualtrics, and delivered the survey link via email to the site hosts through contact information provided by PG&E, SCE, and SDG&E. To encourage participation, the Evaluation Team sent several follow-up emails to contacts, made phone calls to nonrespondents when phone numbers were provided, and followed up with additional points of contact through contact information collected from site visits. For EY2024, the Evaluation Team developed a sample frame based on available contact information and attempted to reach all sites in the sample frame.

Delphi Panels

To support the estimation of market effects, the Evaluation Team conducted Delphi panels to develop baseline electrification adoption curves.

A Delphi panel is a method of reaching a group consensus by aligning the range of opinions from a panel of subject matter experts. Certain components are particular to Delphi panels including the use of a group of anonymous experts with opinions collected through a series of two or three sequential, structured questionnaires. Opinions from the first round are summarized and provided to the experts for the second round so they can re-evaluate their original responses. Panelists can either agree with the overall opinion or provide evidence or argument for their own opinion. The rounds continue until a

majority consensus is reached. The Delphi method is particularly useful in cases with limited data. A panel moderator controls and manages interactions among the experts, with communication typically conducted remotely.

The Evaluation Team conducted three Delphi panels for the EY2024 report on the transit bus, delivery vehicle, and electric transport refrigeration unit (eTRU) markets. The transit bus and delivery vehicle panels followed up on a previous Delphi panel conducted in EY2022. For both panels, we recruited experts within each respective vehicle market to develop a consensus forecast of the market baseline for electrification in California through 2035.

The Evaluation Team conducted the three panels concurrently, recruiting a total of 23 panelists in January through March of 2025, who provided two rounds of structured feedback in April 2025. The Evaluation Team provided all panelists with the same background information, such as projections of vehicles under the ICT and ACT regulations. In the first round, we asked the panel of experts to provide a forecast of the electric market share for their respective vehicle market assuming no intervention by the Utilities along with a rationale for the shape of their forecast. The Evaluation Team aggregated the first-round results, calculated the median forecast,¹⁵⁷ and shared the anonymized market predictions with the panel in the second round. The experts then reviewed all forecasts and had the opportunity to either agree with the median estimate or submit a new estimate. This process typically continues until convergence occurs (when over half of panelists agree). All three panels achieved convergence in the second round.

The Evaluation Team recruited experts from different organizations to provide input. The composition of the panels is shown in Table B-3. Because every expert and organization carries its own biases, it was crucial for the Delphi panels to feature individuals from a variety of backgrounds. We also required that experts on the panel have a background in and recent experience (in the last two years) with their respective vehicle market or transportation electrification policy in California and no conflicts of interest (financial or otherwise) that would impact their objectivity. We did not permit more than one expert from the same organization to participate in the panels.

Table B-3. Delphi Panelist Composition

Panelists	Academia	Nonprofit	Manufacturer	Industry	Third-Party Evaluator	Regulator	Total
Transit Bus	2	3	0	3	0	0	8
Delivery Vehicle	2	5	0	1	0	0	8
eTRU	1	2	0	4	0	0	7

¹⁵⁷ Although Delphi panels typically use an average of experts’ responses, for this study we employed the median to mitigate the impact of outlier responses.

Truck Choice Model

The Evaluation Team used a modified version of the TCM developed at UC Davis to establish a baseline for ZEV truck adoption and thereby enable assessment of the NTG impacts of the Utility MDHD programs.¹⁵⁸ The TCM is a multinomial logit model that predicts vehicle choice by fuel type and vehicle application via a generalized cost equation. The model has been used extensively in recent years to better understand how California policies and programs impact fleet operator purchase decisions of alternative fueled MHDVs. We used the TCM to predict the likelihood that each fleet would adopt MDHD EVs in its next procurement in the absence of the Utility programs.

The model draws on multiple inputs including vehicle purchase price, maintenance costs, fuel costs, nonmonetary costs (such as aversion to new and uncertain technologies and low availability of fuel infrastructure), and incentives or subsidies. UC Davis has compiled the information for model inputs over several years. Additional data specific to this analysis includes Utilities' MDHD program data, specifically the rebates and incentives provided for EVSE installation. The Utilities report these data directly as part of the SRP evaluation and as part of their SB 350 reporting. The Evaluation Team adhered to Utility guidance regarding which data were reliable enough to be used for model inputs. The Evaluation Team applied data from the completed projects to estimate the average TTM and BTM utility investment or incentive.

Analysis Methodology

The following subsections provide an overview of the analyses for the MDHD bundle. These analyses include determining the characteristics of counterfactual vehicles¹⁵⁹ and assessing grid impacts, petroleum displacement, GHG and criteria pollutant emissions reductions, and health impacts. The Evaluation Team also estimated the TCO and addressed research objectives using data collected from site visits, Utility interviews, and surveys. As discussed below, we conducted additional calculations for the petroleum displacement, emissions reductions, and health impact analyses to consider these impacts on DACs in particular.

Site and Vehicle Target Graphs

In the *Introduction* Section and the *Lessons Learned for the MDHD programs*, we present curves showing progress toward the Utilities' vehicle and site targets for each of the MDHD programs. The original and revised vehicle and site targets are shown in Table B-4 and Table B-5.

¹⁵⁸ Miller, Marshall, Qian Wang, Lewis Fulton, NCST Research Report: Truck Choice Modeling: Understanding California's Transition to Zero-Emission Vehicle Trucks Taking into Account Truck Technologies, Costs, and Fleet Decision Behavior, Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-17-36, 2017.

¹⁵⁹ Counterfactual data are used to establish a counterfactual fuel economy (miles per gallon) and vehicle emissions factors to estimate petroleum displacement, emissions reductions, and health impacts.

Table B-4. Original Vehicle and Site Targets

Program	Vehicle Goal	Site Goal	Program Launch	Program End
SCE Charge Ready Transport	8,490	870	May 2019	December 2024
PG&E EV Fleet	6,500	700	June 2019	December 2024
SDG&E PYDFF	3,100	300	November 2020	November 2025

Table B-5. Revised Vehicle and Site Targets

Program	Vehicle Goal	Site Goal	Program Launch	Program End
SCE Charge Ready Transport	8,490	500	May 2019	December 2026
PG&E EV Fleet	6,500	375	June 2019	December 2026
SDG&E PYDFF	3,100	300	November 2020	November 2025

The figures in the Evaluation Report use seven lines to show actual and projected VAPs and sites:

Vehicle Targets

- **Full VAP for Contracted Sites (solid blue line).** This line reflects the full value of the VAP associated with sites in the year in which the site is contracted. For example, if a site has a five-year VAP with 100 vehicles total, all 100 vehicles appear in the year the site is under contract.
- **Projected Full VAP for Contracted Sites (dashed blue line).** This line projects line #1 into the future using a linear trend line for all historical years of data.
- **Projected Deliveries of Vehicles for Contracted Sites (dashed purple line).** This line shows the Evaluation Team's projection of when vehicles will actually be delivered to the contracted sites. This line accounts for the lag between contract signing and activation and the lag between site activation and vehicle deliveries. This line uses the acquisition schedule in the VAP and accounts for differences in program design (i.e., the five-year VAP for PG&E EV Fleet and 10-year VAPs of SCE Charge Ready Transport and SDG&E PYDFF). We do not show an actual vehicle delivery line because we conduct only one site visit per site (and therefore do not track actual vehicle deliveries each year).

Site Targets

- **Actual Contracted Sites (solid blue line).** This line shows the number of contracted sites over time based on project performance data.
- **Projected Contracted Sites (dashed blue line).** This line uses a linear trend line of the actual contracted sites to project contracted sites into the future. We assume that 10% of contracted sites will withdraw from the programs prior to activation.
- **Actual Activated Sites (solid purple line).** This line shows the actual number of activated sites. This line is slightly lower than line #4 and line #5 because of site withdrawals.
- **Projected Activated Sites (dashed purple line).** This line shows a projection of activated sites based on a linear trend line of all activated sites to date.

Grid Impacts

The Team estimated electric grid impacts for MDHD on-road and off-road vehicles that consumed electricity from charging stations installed through MDHD programs. The following subsections describe the approach, data sources, and analyses performed to estimate grid impacts.

The Team collected, cleaned, compiled, and analyzed site-level, granular (15-minute interval) Utility AMI (meter) data and EVSP data. For the analysis we used the primary and secondary data sources shown in Table B-6.

Table B-6. MDHD Grid Impacts Data Inputs

Category	Source
Primary Data	Utility AMI data, charging session data from EVSPs, site details (capacity of various Utility and charging equipment), site visits, and surveys
Secondary Data	Time-varying Utility rates in effect at sites, historical CAISO data (demand, supply sources, renewable curtailments), and load management plans

We uploaded AMI and EVSP data to the data warehouse and calculated results using an internal Power BI dashboard. Foundational program analysis included total electricity consumption (kilowatt-hours) for on-road and off-road MDHD vehicles, and new demand (kilowatts) added to the grid. The Team established trends based on the proportion of electricity usage during the highest cost period (defined as 4 p.m. to 9 p.m. daily) versus other time periods. We calculated load factors based on usage and determined utilization rates based on the installed capacity for each site.

The Evaluation Team assessed daily and weekly charging behaviors and captured patterns that accounted for differences in weekday and weekend operations. We used load curves by vehicle category to identify trends of operating versus charging. Effectively doing this required filtering out data from periods when vehicles were not in full operation, had ongoing technical problems, or were not fully integrated with the EVSE or other equipment.

We used CAISO data on electricity supply at different times combined with AMI meter data and EVSE charging session information to compare EV program load curves with overall system demand. The 24-hour load curves provided key insights into how the grid was impacted by each program.

The Evaluation Team assessed charging flexibility to determine the extent to which managed charging could increase benefits, such as by lowering electricity prices paid (based on TOU rates and demand charges), reducing emissions by charging when lower-emissions resources were powering the grid, and having the least impact to the grid (minimal new demand). Although the grid impacts analysis used data for all operational sites, the Team annualized AMI data to support analyses that included forecasts for petroleum displacement and GHG and criteria pollutant emissions reductions among others. Through the annualization of AMI data the Team identified the region of stable operation and used this data to generate a statistically representative full year of operation.

Load Shifting Analysis Methodology

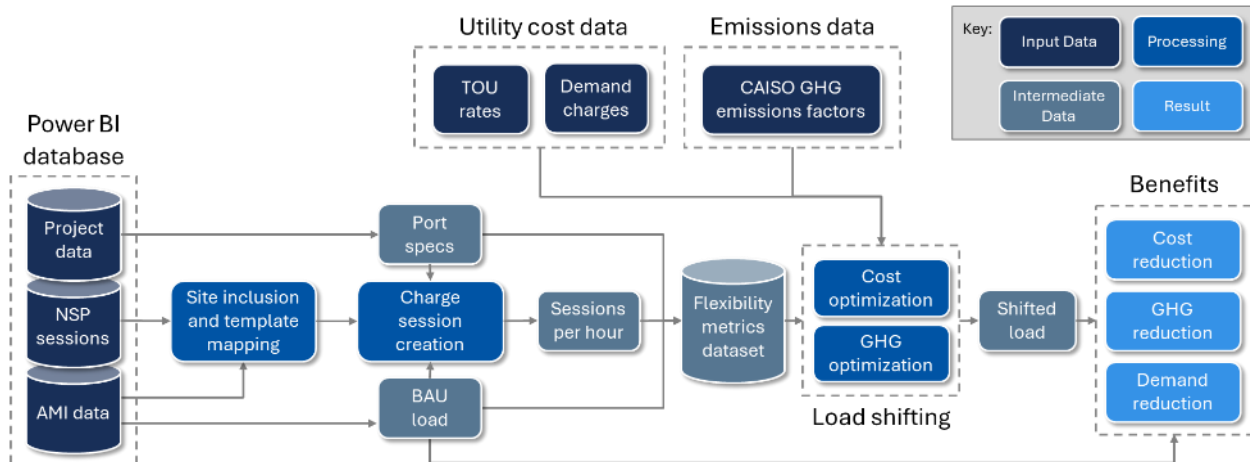
Historical electricity usage data shows that sites participating in the Utility transportation electrification programs consume a substantial fraction of their daily electricity consumption during the high-cost peak period (4 p.m. to 9 p.m.) and underutilize lower-cost off-peak and super off-peak periods for charging—despite often being plugged into chargers during these periods—incurring higher than necessary electricity consumption costs. This is particularly true for electric school bus fleets, which travel short distances during the day and spend a long time parked each day, allowing for considerable flexibility for charging. Off-peak charging periods tend to coincide with a lower average carbon intensity for grid electricity, suggesting the potential to reduce both costs and GHG emissions by load shifting charging sessions.

Implementing load management software/controls that prioritize charging during off-peak periods allows these sites to substantially reduce charging costs, lower carbon emissions, and support grid reliability by helping to rebalance the overall grid demand.

The Evaluation Team analyzed consumption data from EY2024 provided by program participants and developed an optimization routine to reallocate charging energy consumption to lower-cost or lower-emissions times of day, accounting for each participant's flexibility to shift the charging load. This section outlines the approach used to quantify the potential cost and GHG emissions impacts of load shifting for the MDHD transportation electrification programs. Charging energy can be shifted only to intervals for which the NSP session data indicate connected vehicles and additional or unused charging capacity. The Evaluation Team compared the resulting cost-optimized (or shifted) charging loads to the observed daily BAU charging loads to evaluate the cost-reduction and resulting emissions reduction potential of load shifting. This subsection describes how the Team structured the load shifting optimization analysis. The results of this analysis are provided in the Load Shifting Analysis section of each of the respective Utility program sections.

Figure B-1 provides a high-level summary of the analysis approach, including preparing data, applying exclusion filters, performing the load shifting optimization routine, processing the data, and analyzing the results.

Figure B-1. Data Preparation and Load Shifting Analysis Process Diagram



Load Shifting Data Preparation

To model load shifting, the Evaluation Team used data from NSPs and from AMI provided by the Utilities for each site. NSP data include information about the charging sessions as recorded by the charger or NSP software, and AMI data contain the site energy consumption as measured at the utility meter in 15-minute intervals.

Power BI Data Extraction

The Evaluation Team cleaned and stored NSP and AMI data across available sites in a set of Microsoft Power BI database tables. For the load shifting analysis, we downloaded these tables (titled **FACT_PROD_EVSP_Session** and **FACT_PMO_AMI_nonzero**) in full from the Power BI tool as comma-separated value (.csv) files. Table B-7 lists the operations data the Team used for the analysis.

Table B-7. Description of NSP and AMI source data tables

Table Name	Description	Fields Used	Used For
FACT_PROD_EVSP_Session	Data capturing information about each charging session recorded by NSPs	- application_id - station_id - port_id - flag_id - session_start_datetime - session_connection_time_fixed - session_charge_duration_fixed - session_energy_kwh	- Determining analysis dates for each project - Filtering and removing passenger cars - Determining each port's maximum power capacity - Conducting load shifting analysis
FACT_PMO_AMI_nonzero	Data capturing energy consumption in 15-minute intervals as captured by site-level AMI	- site_ami_key - TimeStamp_dt - Demand_kW	Determining BAU demand

Operations Data Filtering and Cleaning

The Evaluation Team included only data within EY2024 in its analysis and carefully reviewed the source data for each project. The Evaluation Team applied an additional set of filters to NSP data:

- NSP sessions with a total energy consumption (ChargeKWH) equal to zero were excluded.
- NSP sessions with a start timestamp (SessionStartDateTime) equal to the end timestamp (SessionEndDateTime) were excluded.
- NSP sessions with a missing value for LocationID or failing certain other quality control checks (incorrect charge duration, incorrect demand values, or irreparable errors in the raw data) were excluded.

Some NSP sessions follow the charging port's prior session with no time gap in between. These zero-gap sessions do not appear to leave time for a new vehicle to be plugged into the port and thus are likely reflecting the same vehicle continuing its prior charging session. To simplify the following analysis steps, we combined each sequence of zero-gap sessions into a single session, with a shared session identifier and computed the combined session's total energy (ChargeKWH) across underlying sub-sessions.

Charging Port Power Capacity Estimation

The maximum potential power output of shifted loads at each charging port is determined not only by the nameplate power capacity of the charging infrastructure, but also by the charge acceptance characteristics of the connected vehicle(s) that are using the charger in any given time period. To infer a realistic potential maximum power output of each charging port, the Evaluation Team analyzed historical NSP data at each port and took the following steps to calculate each port's potential power output:

- **Step 1.** The Team used the total energy output (taken from the ChargeKWH field) and the total time duration (taken from the SessionStartDateTime and SessionEndDateTime fields) for each session at each port to compute an average power output per session. If the session's maximum power demand (ChargeMaxDemandKW) recorded in the NSP data table was higher than the computed average, we used the recorded value.
- **Step 2.** For each port and for each calendar month of EY2024, the Team computed the monthly 80th percentile value of average power output across all sessions that month. The resulting 80th percentile average power output defined each port's monthly potential power output.

The resulting potential power output metric is intended to capture not only the technology of each charger, but also any limits arising from the charge acceptance characteristics of specific vehicles using the port or other operating concerns that may vary over time.

Market Sector Template Creation for Additional Site Inclusion

To maximize the number of projects in the analysis, we included some sites with AMI data but no NSP data (which EY2023's load shifting analysis relied on), and we developed an approach to build market sector templates from available NSP data. For each market sector, all EY2024 NSP data passing the

quality checks described above were aggregated to produce a "market sector template" consisting of several metrics:

- **Maximum charging speed:** Each port's maximum charging speed, weighted by the port's total annual kilowatt-hours. And averaged across charging ports
- **Average session energy:** Average kilowatt-hours per session.
- **Average session plug-in duration by time of day:** Average plug-in duration for each time of day and day of week, weighted by each session's kilowatt-hours. For market sectors with insufficient time-of-day and day-of-week data, a combination of time of day and day of week type (weekday versus weekend) or simply time of day was used to determine average plug-in duration.

These templates define typical behavior for each market sector. For sites with no NSP data, these templates enabled the Team to convert AMI data into a reasonable approximation of discrete charging sessions. The first step in this process was to divide daily energy consumption by the market sector's average session energy (rounding up) to estimate how many charging sessions occurred that day. Next, we chose charging session start times based on the times of day with the largest increase in AMI load. Finally, we assigned a plug-in duration to each synthetic charging session based on the session's starting time and day of week.

Once these synthetic charging sessions had been created for each site, they were passed through the same load-shifting optimization step as the available NSP session data. For months with more synthetic charging session data than available NSP data, these synthetic sessions were used instead.

Flexibility Metrics Dataset Creation

The Evaluation Team combined information across NSP sessions for each site into a flexibility metrics dataset, which includes the following variables for each 15-minute interval within each project's analysis date range:

- Observed (BAU) project-level energy demand from the AMI and NSP tables. NSP demand for each site is summed across NSP sessions for the site that overlap with the interval. To allocate each NSP session's energy across intervals, we assume a constant charge rate for the duration of the session.
- Total unique ports that were connected in each interval.
- Total unique sessions that were connected in each interval.
- Hours of overlapping charge sessions in the interval summed across connected ports. For example, if only one port has a connected vehicle for the full 15-minute interval, there would be a total of 0.25 overlapping session-hours in that interval. On the other hand, if four ports are connected for the full duration of a 15-minute interval, the site would have 1.0 overlapping session-hours in that 15-minute interval.
- Maximum potential energy demand within the 15-minute interval. This value represents the sum of the estimated charging power capacity of each of a site's ports multiplied by the port's overlapping session-hours in the 15-minute interval.

The resulting flexibility metrics dataset forms the basis for the load shifting optimization.

Utility Cost and Emissions Data Preparation

The Evaluation Team prepared a dataset of TOU rates and demand charges for each participating Utility from publicly available data regarding rate structures for each Utility's MDHD transportation electrification program. We converted each set of rates from TOU bins into sub-hourly time series (15-minute intervals) of electricity rates per kilowatt-hour to match the resolution of the AMI data. To simplify downstream analysis, we made a simplifying assumption for the volumetric (dollar per kilowatt-hour) component of utility rates by using each site's maximum demand level in EY2024 (maximum-kilowatt 15-minute interval) to assign a rate category for the project. For example, a PG&E project falls into BEV-1 if its peak demand is below 100 kW or falls into BEV-2 otherwise. Demand charges were also incorporated into this year's analysis, taken from public utility rate data.

GHG emissions carbon intensity values (ton of CO₂-equivalent emissions per kilowatt-hour of delivered energy [ton-CO₂e/kWh]) were taken from CAISO's 2024 historical average emissions in 15-minute timesteps. To reduce the effect of random variations due to weather events or other irregular occurrences, carbon intensity values applied to the analysis were taken as the average at each timestep across each combination of month and day type (weekday versus weekend).

Load Shifting Optimization Model

For each project, the flexibility metrics dataset is merged on unit (volumetric) TOU energy costs, demand charges, and emissions factors. This results in a table with both charging potential (maximum potential energy demand in each 15-minute interval) and objective values for optimization (costs or emissions).

We input the resulting table into a mixed-integer linear programming model to optimize each site's load shifting considering peak demand reduction. Two distinct objective functions were optimized, producing two sets of shifted load curves:

- **Cost minimization objective:** load is shifted to minimize each month's total estimated utility costs, including TOU energy rates and demand charges (assessed monthly).
- **GHG minimization objective:** load is shifted to minimize tonnes of GHG attributable to the site's charging load using the CAISO carbon intensity values described above.

For each of those objective functions, the optimization algorithm computes a mathematically optimal shifted load curve for each month of the year for each site, respecting the following constraints:

- *Energy conservation constraint:* Daily total energy consumption (measured from 6 a.m. one day to 6 a.m. the following day) must remain unchanged when the load is shifted.
- *Flexibility constraint:* The energy consumption in each 15-minute timestep may not exceed the flexibility metrics described above.
- *Peak demand increase constraint:* To ensure that load is not unrealistically shifted such that a site has drastically higher peak demand (which could require additional infrastructure buildout), each month's shifted peak demand may not exceed 150% of its BAU peak demand.

- *Demand charge computation constraint:* A separate set of constraints determines monthly peak demand and assigns it a cost that matches posted utility rates.

This optimization is solved once for each site, month, and objective function, producing a dataset of 15-minute shifted interval data that can be compared to BAU outcomes. These results are summarized in total across each site (i.e., percentage reduction in costs equals total BAU cost in comparison to total optimized cost, summed across days). This approach tends to reduce the impact of low-demand days, such as summer and weekend days for school buses, and prioritize the impact of high-energy days. As such, it is weighted in a similar manner as the volumetric component of each project's energy bill.

Counterfactual Development

The Evaluation Team identified the market sectors in each Utility program and the counterfactual vehicle and fuel type associated with each market sector. A counterfactual vehicle is the vehicle type that the fleet would have used in the absence of the program.

Rather than assess the composition of each legacy fleet (conventional ICE vehicles displaced by the program), we established a generic counterfactual vehicle type. In total, the Evaluation Team used 18 counterfactual vehicles defined by weight class and fuel type. The Team assigned all sites an initial counterfactual vehicle type based on Utility program applications. We then refined this information based on additional vehicle information included as part of participants' VAPs submitted to Utilities.

Each counterfactual vehicle type had a corresponding fuel economy (miles per gallon) for on-road vehicles or fuel consumption (gallons per hour) for off-road equipment as well as emissions factors (GHGs and criteria pollutants). We also determined the electricity consumption rate used by the corresponding EV (in kilowatt-hours per mile for on-road vehicles and kilowatt-hours per hour for off-road equipment).

To characterize the counterfactual vehicles, the Evaluation Team processed Emissions Factors (EMFAC) data for on-road vehicles and Off-Road Inventory Online (ORION) data for off-road vehicles as default sources for efficiency and emissions. We input these tables into the Cadmus data warehouse. For cases in which electricity consumption rates were not available for a particular vehicle or equipment type, we used supplemental data sources to determine an appropriate rate. Table B-8 shows the primary and secondary data inputs.

Table B-8. MDHD Counterfactual Data Inputs

Category	Source
Primary Program Data	Utility VAPs, site visits, fleet manager surveys, and OEM interviews
Secondary Data	CARB EMFAC and ORION (default source for efficiency and emissions), Priority Review Projects fleet data (from the final report), ^a other demonstration reports (from CARB, CEC, and the National Renewable Energy Laboratory), MDHD vehicle registration data as available, Department of Motor Vehicles (DMV) Motive Power Report, and California DMV Motive Fuels Report

^a Energetics Incorporated. April 2021. California Investor-Owned Utility Transportation Electrification Priority Review Projects: Final Evaluation Report. <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/sb-350-te/california-te-prp-final-evaluation-report-presentation.pdf>

The final output is a lookup table that maps all the relevant market sectors to each of the CPUC-defined market sectors and the associated counterfactual vehicle type (such as electric Type C school bus and diesel Type C school bus).

Petroleum Displacement

For this analysis, the Evaluation Team estimated the reduction in counterfactual vehicle fuels compared with the electricity usage attributable to the MDHD programs. Expected fuel types and typical end uses included diesel (such as trucks and school bus), CNG (such as transit and shuttle bus), propane (such as forklifts), and gasoline (such as trucks and vans). Based on the *Counterfactual Development* analysis, we presented all displaced fuel as petroleum-based in DGE units.

To conduct the petroleum displacement analysis, the Team converted the electricity used from EVs (based on Utility-provided AMI data) to petroleum displaced using an electricity consumption rate to calculate the EV miles traveled or equipment hours of use. We used the same number of EV miles or hours for the counterfactual ICE vehicle that would have been used in the absence of the MDHD programs. To calculate the petroleum displacement in gallons per site, we divided the ICE vehicle miles or hours by the counterfactual on-road vehicle's fuel economy (miles per gallon) or multiplied by the off-road equipment's fuel consumption (gallons per hour). We then converted the amount of petroleum displaced to DGEs for ease of comparison. Then the Team calculated the petroleum displaced by each MDHD program by Utility, DACs, and market sector.

Data inputs included Utility program data (market sector and vehicle type), data from site visits and fleet manager surveys, historical counterfactual vehicle fuel consumption, data from EMFAC and ORION databases, Utility AMI data, and EVSE charging session data. Table B-9 shows the data collection categories and sources.

Table B-9. MDHD Petroleum Displacement Data Collection

Category	Source
Primary Data	• Utility program data (on vehicle types, quantities, and other details) • Utility electric AMI data (in 15-minute intervals) • EVSE charging session data • Site visit and survey data for site-specific inputs ▪ EV fleet make/model ▪ Daily/annual vehicle utilization (miles) and schedules ▪ EV charging schedules ▪ Counterfactual fleet fuel type and average fuel economy/historical fuel usage ▪ Estimated annual idling hours per vehicle
Secondary Data	EV and counterfactual ICE fuel efficiency (from counterfactual EMFAC lookup table and other sources)

For this analysis the Team leveraged the Cadmus data warehouse and counterfactual lookup tables, Power BI dashboard, and other sources and outputs from the *Grid Impacts* analysis. AMI data are the basis for these calculations. Table B-10 shows the analysis steps.

Table B-10. MDHD Petroleum Displacement Analytical Steps

Step	Description
Identify counterfactuals and secondary data	For each vehicle type, identify gallons per mile or gallons per hour and kilowatt-hours per mile efficiency from the following sources: • MDHD counterfactuals • EMFAC/ORION for both EV and ICE real-world efficiencies
Identify EV energy consumption	Identify annual kilowatt-hours consumed by EVSE at each site from grid impacts analysis
Account for charging losses	Use 15% loss from grid to vehicle battery for vehicle charging; assume no loss for electric truck refrigeration units
Calculate vehicle miles or hours (for off-road applications)	Calculate EV miles or hours based on kilowatt-hours consumed and vehicle efficiency
Estimate petroleum displacement	Estimate petroleum displacement based on ICE vehicle miles or hours and efficiency, converted to a DGE

GHG and Criteria Pollutant Impacts

The MDHD programs are expected to reduce the GHGs and criteria pollutants emitted as EVs replace fossil-fuel-powered on-road and off-road MDHD vehicles. This section describes the approach, data sources, and analyses we performed to estimate these reductions.

The Evaluation Team first calculated GHG and criteria pollutant emissions reductions from the petroleum displaced by the EVs incented through the programs.¹⁶⁰ The GHG emissions estimates included CO₂, N₂O, and CH₄. The criteria pollutant reductions we analyzed included PM_{2.5} and PM₁₀, CO, NO_x, and oxides of sulfur (SO_x). Additionally, the Team estimated the reduction of ROG, which are not criteria pollutants but contribute to the formation of ground-level ozone, which is a criteria pollutant.

Next, the Team examined the increase in emissions attributed to the electricity used by the EVs. We calculated the emissions from EV electricity use by examining the emissions profile of the grid at the time of charging using the published CAISO grid mix at five-minute intervals. Since the electric grid emissions profile varies substantially by time-of-day and season, we estimated reduction using actual 8,760-hour load curves based on Utility AMI meter data.

The difference between the counterfactual vehicles' petroleum emissions and the EVs' electricity emissions is the net reduction in emissions for the more-global-scale pollutants (GHG, NO_x, and SO_x). For criteria pollutants with localized health effects such as CO, PM, and ROG, the emissions are presented as an absolute reduction from the counterfactual.

The Evaluation Team used the GHG and criteria pollutant inputs shown in Table B-11 regarding electricity usage, resource mix, emissions, vehicle types, and petroleum displaced.

Table B-11. GHG and Criteria Pollutant Data Inputs

Category	Unit	Source
Site-level AMI data in 15-minute intervals	kWh	Utility AMI (~1 month delay between measurement and reporting)
Overall electricity demand by five-minute interval	MW	CAISO demand (real time)
CO ₂ grid emissions by five-minute interval	MT	CAISO emissions (real time)
Resource mix by interval	% by generator fuel	CAISO supply (real time)
NO _x , SO _x , CH ₄ , and N ₂ O emission rates	g/kWh	EPA eGRID (2023)
CO ₂ emission rate	kg/kWh	EPA eGRID (2023)
CO ₂ -equivalent emission rate	kg/kWh	EPA eGRID (2023) as derived from emission rates above
Vehicle tailpipe emissions (CO ₂ , CH ₄ , N ₂ O, CO, NO _x , PM ₁₀ , PM _{2.5} , SO _x , and ROG) by vehicle and fuel	g/mile	CARB EMFAC (2021 v.1.0.2 methodology extracted Feb 2025)
Vehicle type (vehicle classification code for linkage to emission tables)	standard category	Evaluation Team analysis in <i>Petroleum Displacement</i> section
Petroleum use by month	unit measure for fuel type	Evaluation Team analysis in <i>Petroleum Displacement</i> section
Petroleum fuel type	fuel type	Evaluation Team analysis in <i>Petroleum Displacement</i> section
Petroleum fuel energy content	MMBtu/unit	U.S. DOE AFDC

¹⁶⁰ The Evaluation Team counted tailpipe emissions for the counterfactual vehicles and electricity grid emissions for EVs. We did not consider upstream emissions for the counterfactual vehicles (such as petroleum refining). Additionally, we did not include emissions from brakes and tires for the counterfactual vehicles and EVs.

The analysis comprised four steps. The Team used the CAISO application programming interface, the EMFAC dataset, and the U.S. EPA's eGRID data to perform this work:

- **Counterfactual emissions:** We determined emissions from counterfactual vehicle fuel usage using EMFAC emissions data for specific displaced fuels in (gallons/mile) along with the determined miles driven from the petroleum displacement methodology.
- **Electricity emissions:** We used CAISO five-minute demand and resource mix data reported by zone to establish an emissions record for each pollutant. We averaged five-minute interval emissions data, applied this to each 15-minute AMI interval, and applied the CAISO-specific emissions factors for that resource provided by the eGRID dataset.
- **GHG calculation:** We used the United Nations IPCC GWPs for CO₂ equivalence (CO₂e) on a 100-year timeframe based on the IPCC AR5. We used GWP-100 factors of 28 for CH₄ and 265 for N₂O. Equation 1 presents the GHG calculation based on CO₂e:

Equation 1. GHG Calculation

$$CO_2e = CO_2 + 28 * CH_4 + 265 * N_2O$$

- **GHG and criteria emissions reductions:** The overall reduction in GHGs, NO_x, and SO_x is net of annual emissions from the displaced counterfactual fossil fuel equipment and the electricity consumed by the adopted electric equipment. The overall reduction in PM_{2.5}, PM₁₀, CO, and ROG is represented by the annual emissions from the counterfactual vehicle, as these pollutants present localized effects on populations rather than the more globalized effects of the other pollutants. The Team calculated these emissions reductions for sites both inside and outside DACs.

For the prediction of future emissions reductions, in alignment with the CPUC IRP process, it is expected that the California Utility grid will further reduce power plant emissions in future years. The Evaluation Team determined the hourly mix of electricity in future years from the most recent IRP RESOLVE models available and applied the changing mix out to 10 years of operation for each site. We treated the emissions factors for these resources as static using the most recent eGRID dataset for CAISO resources.

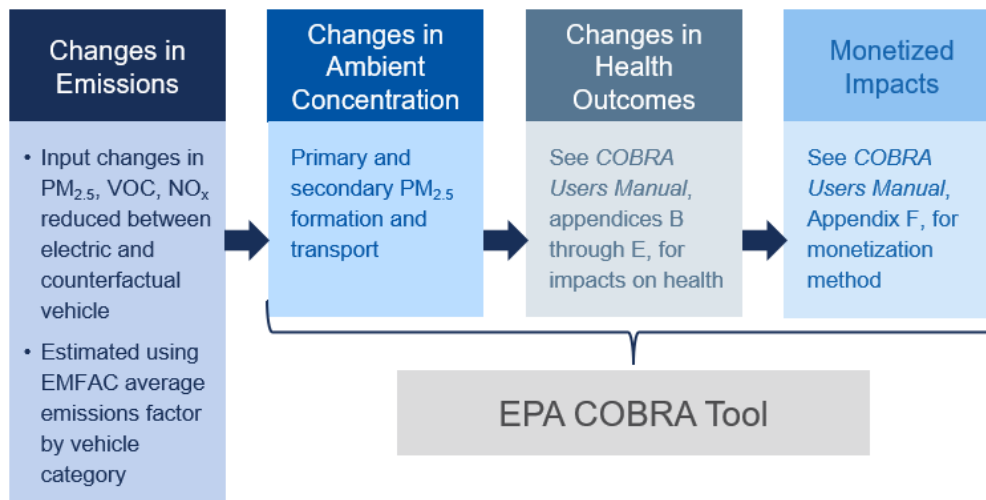
Health Impacts

As EVs replace traditional ICE vehicles, petroleum-based fuels are displaced. These displacements reduce GHG and air pollutant emissions, which may lead to health benefits in regions where EVs are adopted. To understand the effects of the programs on air pollution and related health benefits, the Team estimated the monetized value of health benefits of each individual Utility-funded site by running the emissions reductions through the U.S. EPA's COBRA (COBRA). As part of this analysis, we also examined health impacts on DACs. For Liberty, PG&E, and SCE, DACs are identified in the California Communities Environmental Health Screening Tool, CalEnviroScreen, developed by California's Office of

Environmental Health Hazard Assessment. SDG&E uses a service territory definition of DAC.¹⁶¹ This section describes the approach, data sources, and analyses performed to estimate health impacts associated with the MDHD programs.

The Evaluation Team used a four-stage methodology shown in Figure B-2.

Figure B-2. Four-Step Process for Estimating Health Impacts by Census Tract



Step 1: Changes in Emissions. Estimates of changes in emissions are annualized emission reductions by site for EY2024 in tons for PM_{2.5}, VOCs, and NO_x. The Evaluation Team aggregated emissions reductions by county and used those as inputs into COBRA, which uses several fields:

- **Sector** – Highway or off-highway vehicles
- **Subsector #1** – Diesel for most vehicle applications
- **Subsector #2** – Highway or non-road
- **Discount rate** – 3% assumed, which reflects the interest rate consumers might earn on government-backed securities

Using the COBRA desktop application, the Evaluation Team uploaded the annual reduction in emissions for PM_{2.5}, VOCs, and NO_x, and the tool output estimates as shown in Table B-12. In this analysis VOCs are assumed to be the same as ROG, which are the output from EMFAC.

¹⁶¹ As per Advice Letter 2876-E, SDG&E found that only 27 census tracts in its territory were considered DACs using the top quartile in the CalEnviroScreen statewide definition. However, the service territory definition is broader and produced a calculated 180 DAC census tracts in SDG&E service territory.

Table B-12. Mapping of Vehicle Types to Sector and Subsectors

Vehicle Type	Sector	Subsector #1 (Counterfactual Fuel Type)	Subsector #2 (Counterfactual Vehicle Type)	Discount Rate
LDV (at public charging sites)	Highway	Gasoline fuel	Light duty	3%
Airport GSE	Off-Highway	Non-road diesel	Airport service	3%
Cargo handling equipment	Off-Highway	Non-road diesel	Industrial	3%
Forklift	Off-Highway	Non-road diesel	Industrial	3%
Heavy-duty vehicle	Highway	Diesel fuel	Heavy duty	3%
Medium-duty vehicle	Highway	Diesel fuel	Heavy duty	3%
Other heavy-duty vehicle	Highway	Diesel fuel	Heavy duty	3%
Port cargo truck	Highway	Diesel fuel	Heavy duty	3%
School bus	Highway	Diesel fuel	Heavy duty	3%
TRU	Highway	Diesel fuel	Heavy duty	3%
Truck Stop Electrification	Highway	Diesel fuel	Heavy duty	3%
Transit bus	Highway	CNG	Heavy duty	3%

Step 2: Changes in Ambient Concentration: COBRA has a feature that uses reduction in emissions to estimate the change in ambient concentration. The tool also accounts for transport and transformation of the pollutants (for example, into ozone).

Step 3: Changes in Health Outcomes: COBRA uses epidemiological models to estimate the health impacts of changes in emissions at the county level. COBRA’s estimates reflect the current scientific thinking on the relationship between particulate matter and human health and the economic valuation of these health effects. In particular, the U.S. EPA draws from the Integrated Science Assessment for Particulate Matter.¹⁶² The U.S. EPA’s methodology for characterizing health impacts has been reviewed by two National Academy of Sciences panels and multiple U.S. EPA Science Advisory Boards. Because the health impacts of air pollution and approaches to value health impacts are areas of active research, the selection of studies used in COBRA may evolve over time, as new evidence and studies emerge. More information is available in the online COBRA documentation.¹⁶³ COBRA estimates health impacts for all 3,033 counties in the United States (because of the transport of the pollutants).

Step 4: Monetized Impacts: COBRA estimates the economic value (in 2017 USD) of the change in health impacts from the emissions changes at the county level. These values are converted to current year dollars using a multiplier from the U.S. Bureau of Labor Statistics.¹⁶⁴ Economic value is estimated differently depending on the health impacts. These estimates could include avoided lost wages, avoided

¹⁶² U.S. Environmental Protection Agency. Last updated June 27, 2022. “Integrated Science Assessment (ISA) for Particulate Matter.” <https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter>

¹⁶³ U.S. Environmental Protection Agency. Last updated November 1, 2022. “Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool COBRA.” <https://www.epa.gov/cobra/users-manual-co-benefits-risk-assessment-cobra-screening-model>

¹⁶⁴ U.S. Bureau of Labor Statistics. 2024. “CPI Inflation Calculator.” https://www.bls.gov/data/inflation_calculator.htm

medical costs, the amount people are willing to pay to avoid a negative health impact (such as respiratory symptoms), or the value of statistical lives (VSL) approach, which uses value-of-life studies to determine a monetary value of preventing premature mortality. COBRA reports both a low impact and a high impact, representing uncertainties in the estimates. The low estimate represents results based on an evaluation of mortality impacts of PM_{2.5} by the American Cancer Society.¹⁶⁵ The high estimate represents results based on the Harvard Six Cities mortality study.¹⁶⁶ Rather than average the results of these studies, the U.S. EPA's standard practice has been to report the estimated change in mortality separately as low and high values.

Site Costs

The Evaluation Team used site-level cost data provided by the Utilities to compile summary statistics of the TTM and BTM costs described below:

- **TTM:** Utility-sponsored costs to construct utility-owned TTM infrastructure taken from SB 350 reporting data provided by the Utilities.
- **Ratepayer BTM:** Either Utility-sponsored costs to construct utility-owned BTM infrastructure or the incentive/rebate amount paid by the Utility for customer-owned infrastructure.
- **All-in BTM:** Either Utility-sponsored costs to construct utility-owned BTM infrastructure or costs estimated using a regression on available costs from sites with cost data.
- **Ratepayer EVSE:** Reflects the EVSE rebate amount from the Utility.
- **All-in EVSE:** Reflects the full cost of the EVSE equipment and installation. For simplicity, the Evaluation Team assumes L2 ports cost \$3,000 per port and DCFC ports cost \$45,000 per port.

Cost calculations also include the following assumptions:

- The port counts used in the cost-per-port calculations reflect the number of ports reported from site visits. If a site visit did not occur, the Team used the port counts reported by the Utility.
- The vehicle counts used in the cost-per-vehicle calculations are taken from site VAPs.
- The installed capacity values used in the cost-per-kilowatt calculations are the site capacities observed during site visits. If a site visit did not occur, the Team used port capacity totals reported by the Utility.

¹⁶⁵ Krewski, Daniel et al. May 2009. "Extended Follow-Up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality." *Res Rep Health Effects Institute* (140): 5–114. <https://pubmed.ncbi.nlm.nih.gov/19627030/>

¹⁶⁶ Lepeule, Johanna, Francine Laden, Douglas Dockery, and Joel Schwartz. March 28, 2012. "Chronic Exposure to Fine Particles and Mortality: An Extended Follow-Up of the Harvard Six Cities Study from 1974 to 2009." *Environmental Health Perspective* 120(7): 965–970. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3404667/>

Site Visits

The Evaluation Team visited sites that were activated during EY2024 to provide quantitative and qualitative infrastructure insights. This section describes the approach, data sources, and analyses performed for these site visits.

The Team used detailed notes and photos taken during each site visit as well as data provided by the Utilities. After each site visit, the Team compiled the notes and photos and entered data into the Arkenstone data collection platform. Arkenstone is the custom data management platform developed by Cadmus that houses site visit data. We used these data to support grid impacts and petroleum displacement analyses, because these analyses rely on site-specific energy consumption, which can be impacted by the reliability of charging systems for EVs and by the change in energy consumption from integrating EVs into a fleet's operation.

The Team then analyzed the data to document several types of quantitative and qualitative insights:

- Confirm the number and type of conventional vehicles and fuel types to support counterfactual analysis adjustments in future evaluation years
- Confirm the installed charging hardware, whether the site is using an EVSP, and the number and type of EVs delivered compared to the vehicle and EVSE acquisition plans provided by the Utility program data to determine the following information:
 - Total installed charging capacity (kW)
 - Expandability, which may be indicated by the size of transformers, details of service panels (amperage and space for circuit breakers), preinstalled conduit, available parking, and other vehicle types used by fleets
- Visually identify variables leading to final design and construction decisions (such as whether transformers are new, upgraded, or preexisting) with support from on-site hosts or Utility staff for interpreting site costs under TCO analysis
- Confirm co-funding for vehicles and charging infrastructure that helps address ratepayer cost benefits
- Explore lessons learned, challenges, and operability (for EVs and charging hardware) that support the site utilization rates, such as:
 - EV charging infrastructure (software and hardware)
 - Vehicle Operations and Maintenance Staffing
 - Vehicle duty cycle, including routing, cargo and passenger loads
- Compare site visit findings to information provided by each Utility Program Management Office (vehicle/EVSE acquisition plans) and PAC meetings

Co-Benefits and Co-Costs

The Evaluation Team collected information about co-benefits and co-costs for fleet managers through fleet manager surveys and interviews and fleet driver surveys. For the fleet manager surveys specifically, the Team asked both closed- and open-ended questions to understand which co-benefits and co-costs

fleet managers experienced. The survey was designed to build upon data the Team collected in the previous year by using the results to expand the number of co-benefits and co-costs evaluated and retaining a similar survey structure year over year. Given that some fleets have been operating for a short time, the Evaluation Team took a qualitative approach to assessing co-benefits and co-costs, asking respondents to provide a relative rating of size (significant benefits, some benefits, or no benefits). Additionally, the Team worded these questions to focus on what respondents *expected*, not what they experienced, because many of the co-benefits are felt by drivers and the local communities and not by the fleet managers specifically. To supplement survey responses, we incorporated relevant data from the site visits. Although we did not formally ask about co-benefits and co-costs during site visits, the Evaluation Team was able to obtain anecdotal information from site representatives.

Deep Dives

Analysis for deep dives included synthesis of multiple data sources such as site visits, surveys, interviews, and project documentation for selected sites.

- **Fleet Manager Interviews:** The Team interviewed fleet managers via phone in the fall. We focused the interview questions on EV and charger performance, satisfaction with EVs and chargers, and the vehicle acquisition process. During each interview, we also requested data from fleet managers on historical fuel and mileage logs, vehicle telematics data, and historical maintenance costs.
- **Driver Surveys:** The Team distributed driver surveys after discussing logistics with the fleet manager during the interview. At two surveyed sites, we supplied paper surveys per the request of the fleet managers, who distributed the surveys to drivers. The surveys covered the driver experience, benefits of electrification, and operational impacts.
- **Operational Analysis Presentation:** If requested by the fleet manager, the Evaluation Team scheduled a one-hour virtual meeting with each deep dive participating fleet to present the results of the analysis (based on at least the past 12 months of operational data).
- **Activities:** Sites with a significant change in operations (such as sites that added a significant number of vehicles or implemented load management strategies) may require an extended deep dive analysis for another year. The Team asked these fleet managers to participate in a brief follow-up phone interview starting in EY2024 to enable an iterative dialogue.

Net Impacts

MDHD Fleet Manager Self-Report NTG Methodology

The Evaluation Team's approach for MDHD program enhanced self-report NTG analysis relied partly on data obtained via surveys with key site decision-makers such as program participating fleet managers. The Team estimated freeridership and spillover ratios for each program to determine program-specific self-report NTG ratios using the following calculation:

$$NTG\ Ratio = 1 - Freeridership\ Ratio + Participant\ Spillover\ Ratio$$

Freeridership is the percentage of participants who report that they would have adopted the MDHD EVs even in the absence of the MDHD make-ready program. Participant spillover in the MDHD fleet sector is the increase in participants' EV adoption (beyond direct participation in the program) that the Team can attribute to their experience participating in the MDHD program.

For the MDHD fleet manager self-report freeridership analysis, the Team assessed three aspects of program participation:

- **Acceleration from the program:** The extent to which the make-ready and infrastructure savings motivated fleet managers to purchase MDHD EVs sooner than they had originally intended before learning about the MDHD program.
- **Awareness of the program:** The extent to which fleet managers were aware of the program at the time they decided to implement their transportation electrification project.
- **Influence from the program:** The degree of influence the program had on fleet managers' decision to implement the transportation electrification project.

For the MDHD fleet manager participant spillover analysis, the Team assessed three aspects of program participation:

- **Additional electrification after program participation:** The extent to which fleet managers continued electrifying their fleet after participating in the MDHD make-ready program without additional incentives from the MDHD program.
- **Use of outside funding:** The extent to which participating fleet managers received financial support from any other organization for their additional fleet electrification projects.
- **Influence from the program:** The degree of influence MDHD program participation had on fleet managers' decisions to continue electrifying their fleet without Utility program support.

Self-report information was a core component of the Team's analysis of net effects directly attributable to MDHD programs. The Team used the CPUC nonresidential customer self-report NTG framework as the basis for developing the MDHD fleet manager NTG methodology approach.¹⁶⁷ The nonresidential NTG methodology that has been in use since the 2006–2008 energy efficiency program evaluation cycle addresses the unique needs of nonresidential customer projects developed through energy efficiency programs offered by the four California Utilities and third-party implementers. This method relies exclusively on the standardized self-report approach to estimate site- and domain-level NTG ratios, because other available approaches and research designs are generally not feasible.

The Evaluation Team developed the MDHD self-report approach NTG methodology in accordance with the relevant EM&V guidelines, including the California Energy Efficiency Evaluation Protocols (April 2006) and the most recent updates to the nonresidential NTG framework, which incorporated an

¹⁶⁷ California Public Utilities Commission, Energy Division. February 20, 2015. *Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers*.

alternative to a legacy program PAI scoring component (PAI-1 score) of the core NTG calculation.¹⁶⁸ For the purposes of this MDHD self-report approach NTG methodology, the Evaluation Team adopted the alternative scoring structure documented in the referenced evaluation reports—the PAI-1A¹⁶⁹ score—to replace the legacy PAI-1 score.

Recognizing the varying degrees of site complexity and the underlying decision processes, the CPUC framework includes three levels of detail—all built around the same core questions but incorporating additional sources and higher levels of review as the size and complexity of projects increase. Table B-13 presents the potential data sources for use in each of the three levels of NTG analysis.¹⁷⁰

Table B-13. NTG Rigor and Data Sources

NTG Rigor	Program Files ^a	Decision-Maker Survey	Vendor/Dealer Survey	Secondary Research Findings
Basic NTG	X	X	X	
Standard NTG	X	X	X	
Standard NTG – Very Large	X	X	X	X

^a Program files for MDHD make-ready projects can contain data on equipment costs, expected savings, funding sources and amounts, and decision-maker and vendor contact information.

Decision-maker (fleet manager) surveys are a key source of attribution data under all three levels of NTG rigor. The Team used three separate sets of questions to assess three components of the core NTG ratio, placing each score on a 0.0–1.0 scale as an alternate way to characterize Utility program influence.

- **PAI-1A score** captures the type of transportation electrification investment participating fleet managers would most likely have procured if the Utility program had not been available, yielding a score between 0.0 and 1.0.
- **PAI-2 score** reflects the extent to which participating fleet managers perceived the Utility program (rebates, recommendation, training, or other program intervention) as important relative to non-program factors in their decisions to implement the transportation electrification projects they eventually completed. The Team determined this score by asking fleet managers to assign importance values (using a 0–10 scale) to both the program and the most important non-program influences, so that the two values totaled 10, and then dividing the Utility program’s score by 10. We halved the score for fleet managers who said they had already made

¹⁶⁸ Quantum Energy Analytics and DNV-GL. March 26, 2021. *Final Impact Evaluation: NonResidential Lighting Sector Program Year 2019*. Appendix A. Prepared for California Public Utilities Commission.

https://www.calmac.org/publications/PY2019_NonresLgtImpact_FinalRpt.pdf

Itron, ERS, and Tierra Resource Consultants. March 31, 2020. *PY2018 Small/Medium Commercial (SMB) Sector ESPI Impact Evaluation: Final Report*. Prepared for California Public Utilities Commission.

https://pda.energydataweb.com/api/view/2361/2018_Small_Medium_Com_ESPI_Evaluation_Final_with_Appendices.pdf

¹⁶⁹ PAI-1A is the PAI-1 alternative.

¹⁷⁰ Participant fleet manager surveys were the primary source of the SRA NTG ratio in EY2022. When available, the Team incorporated information from other data sources for the final determination of a project’s NTG ratio.

their decision to procure the specific program-qualifying transportation electrification project before they learned about the program.

- **PAI-3 score** captures the likelihood (on a 0–10 scale, where 0 is “not at all likely” and 10 is “extremely likely”) that fleet managers would have taken the same various actions (or might take them in the future) in the absence of the Utility program (the counterfactual). The Team calculated the project’s score by subtracting from 10 the likelihood rating of procuring the exact same program-qualifying transportation electrification project and then dividing by 10 (yielding a score between 0.0 and 1.0).

Core NTG Ratio Scoring

The Team calculated the resulting self-report approach core NTG ratio for a project, prior to accounting for participant spillover, as the average of the PAI-1A, PAI-2, and PAI-3 values. The freeridership ratio for a project was equal to one minus the self-report approach core NTG value.

Participant Spillover Calculation

To measure participant spillover, the Evaluation Team asked fleet managers if they had chosen to electrify more of their fleet without additional incentives from the MDHD Utility fleet electrification program, due to their earlier participation in the MDHD program. We then asked follow-up questions about the type and number of EVs that fleet managers had purchased without support from the MDHD Utility fleet electrification program. The Team asked fleet managers if they had received financial support from any other organization for any of the EV types they reported purchasing after participating in the MDHD program. If they had, we asked what specific organizations had provided that financial support and what amount of financial support fleet managers had received. An electrification project is not considered participant spillover attributable to the MDHD program if a participating fleet manager received financial support from an organization for the additional fleet electrification activity.

The Evaluation Team asked participating fleet managers how important their participation in the MDHD Utility fleet electrification program was to their decision to electrify more of their fleet without MDHD program support. A participant spillover electrification project is one for which the fleet manager rated the importance of their MDHD program participation as 8, 9, or 10 on a 10-point scale, where 0 meant *not at all important* and 10 meant *extremely important*. An electrification project that received a rating of 8, 9, or 10 and did not receive financial support from another organization was eligible to have the full amount of estimated spillover benefits attributed to the MDHD Utility program.

The Team assigned benefits values to spillover projects based on evaluated gross program benefits. A participating fleet manager’s project participant spillover ratio equals the sum of fleet manager-reported additional spillover benefits, divided by the total gross program benefits achieved by the MDHD project:

$$\text{Participant Spillover Ratio} = \frac{\sum \text{Spillover Benefits Reported by Fleet Manager}}{\sum \text{MDHD Program Benefits Reported by Fleet Manager}}$$

Final Self-Report Approach NTG Ratio

The Team separately estimated freeridership and spillover rates for each surveyed project to determine the final project-specific self-report approach NTG ratios using the following calculation:

$$NTG\ Ratio = 1 - Freeridership\ Ratio + Participant\ Spillover\ Ratio$$

Self-Report Approach NTG Integration with TCM to Determine Final NTG Ratio

The Evaluation Team determined the final NTG ratio for a MDHD project by applying the self-report approach NTG ratio or by applying the UC Davis TCM. Figure B-3 describes the situations in which we used the self-report approach NTG ratio.

Figure B-3. Freeridership Determination for MDHD Projects

SURVEY RESPONSE	Fleet indicates with certainty they would not have purchased the EVs without the Utility program	Fleet indicates they were able to purchase more EVs because of Utility program	Fleet survey response is uncertain or contradictory	Fleet indicates with certainty they would have purchased without Utility program
FREERIDERSHIP DETERMINATION	100% attributed (no modeling required)	Attribute 100% of the savings from the incremental purchase supported by program	Apply Truck Choice Model to calculate the probability of EV purchase without Utility program	100% FR (no modeling)

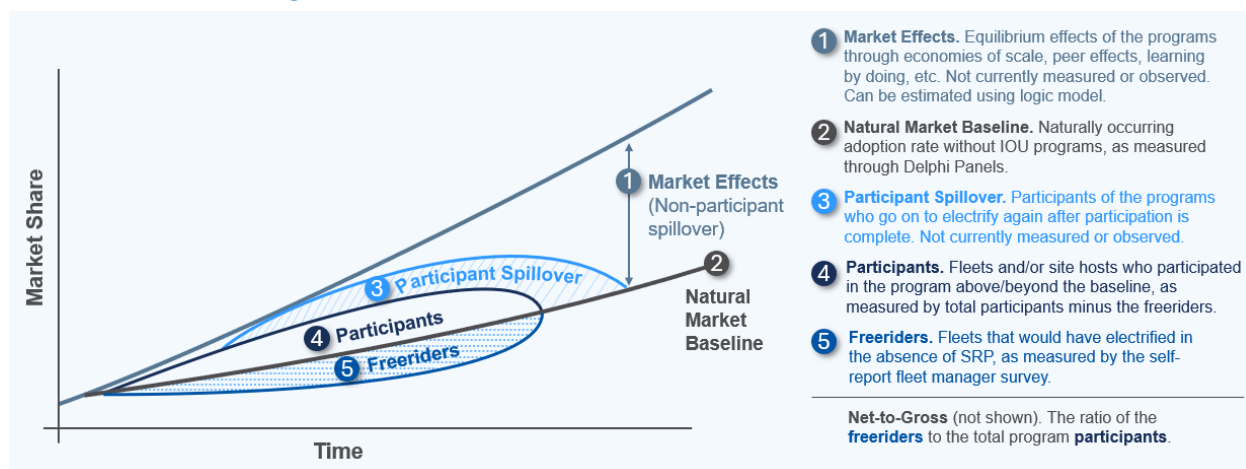
Market Effects: Electrification Market Share Baselines

Measuring market effects informs Research Objective 1: “whether transportation electrification investments accelerated widespread transportation electrification.”

Market effects include changes in market structure or market participant behavior in the form of increased adoption of clean energy products, services, or practices as a result of market interventions (such as program incentives and training events). In the context of the MDHD programs, effects in the MDHD market consist of EV adoption by fleets that did not directly participate in the programs.

Figure B-4 illustrates how market effects capture the difference between actual adoption (dotted line) and the combination of naturally occurring baseline market adoption and direct program participation. Market effects shift the adoption curve upward and to the left, indicating faster and higher levels of EV adoption compared with the baseline scenario in which no Utility market interventions occur.

Figure B-4. Market Effects: Acceleration and Transformation



Estimating market effects requires knowing the actual adoption rate, program participant net impacts, and naturally occurring baseline market adoption. Ideally, measurement of the naturally occurring baseline occurs prior to significant program activity because the baseline represents adoption in a scenario without Utility market intervention.

Market Share Electrification Naturally Occurring Baseline

The Evaluation Team conducted three Delphi panels of two rounds each, with experts in various market sectors to develop a consensus forecast of the market share baseline for the electrification of those sectors in California through 2030. The baseline assumes no market interventions by the electric Utilities. The sectors for the EY2024 report were Transit Buses, Medium-Duty Vehicles (focusing on Class 2b – 6 delivery vehicles), and eTRUs.

The panelists provided their input through an online survey, which the Evaluation Team programmed to capture electrified market share in 2025, 2027, 2029, 2031, 2033, and 2035. The online survey allowed panelists to see their forecasted adoption curve generated in real time and adjust their responses dynamically.

In the first round, we asked experts to provide a forecast of their respective market sector's EV market share assuming no Utility interventions, along with a rationale for the shape of their forecast. The Evaluation Team aggregated the first-round results, calculated the median forecast, and shared the anonymized market predictions with the panel in the second round. The experts reviewed all forecasts and could either agree with the median estimate or submit a new estimate. This process typically continues until convergence occurs, meaning more than half of panelists agree. In this case, both panels reached convergence in the second round.

While the main purpose of these Delphi panels was to develop a consensus market baseline forecast, the panelists' written rationales contained valuable qualitative information. We consolidated this information into a summary of factors panelists believe will accelerate or impede electrification in California.

The panelists also considered the impact of applicable CARB regulations, including the ICT and ACT, with some forecasting trajectories below the CARB requirements (suggesting either incomplete compliance or compliance through alternative technologies) and some forecasting trajectories consistent with full compliance.

Truck Choice Model

The UC Davis TCM is structured as a nested multinomial logit model in a Microsoft Excel spreadsheet. The model represents a discrete choice formulation that includes a number of important factors that will influence individual decision-makers' preferences among a suite of vehicle technology options. These factors include private economic costs, such as vehicle purchase price, maintenance and fuel costs, non-monetary costs (such as aversion to new and uncertain technologies and lower availability of fuel infrastructure), and incentives or subsidies.

For each market sector, the model calculates a total generalized cost by summing the monetary and nonmonetary factors expressed in U.S. dollars. Using these generalized costs, the model calculates the market shares for each vehicle technology, such as EVs or FCEVs. Higher generalized costs result in smaller market shares, although the relationship is nonlinear.

The choice formulation assumes a variation in the utility of trucks for decision-makers.

The Team disaggregated trucks into several categories that encompass specific vehicle types and vehicle use patterns. We then segmented these truck categories into risk groups that have different factors impacting truck purchases. The Team applied the discrete choice model to each of these risk groups to generate the market shares for each vehicle technology.

UC Davis has compiled information for model inputs over several years. Additional data specific to this analysis includes Utilities' MDHD program data, specifically the rebates and incentives provided for charging infrastructure installation. These are reported by the Utilities directly as part of the SRP evaluation and as part of their SB 350 reporting. The Evaluation Team adhered to guidance provided by the Utilities regarding which data was reliable enough to be used for model inputs.

The TCM has been used extensively in recent years to better understand how California policies and programs impact fleet operator purchase decisions of alternative fueled MDHD vehicles. Using the TCM, the Evaluation Team predicted the likelihood that each fleet would adopt MDHD EVs in its next procurement in the absence of the Utility program.

The Evaluation Team developed a version of the TCM with a focus on the market sectors most heavily represented in the Utilities' programs. We incorporated actual program cost data including Utility rebates and incentives. The model produced three trajectories for each market sector: adoption with no Utility investment, adoption with Utility investment only in the TTM infrastructure (as required by AB 841), and adoption with the full suite of Utility programs, rebates, and incentives.

The TCM uses a variety of monetary inputs related to the various choice factors. While some factors are expected to be fairly predictable in future years, projections for vehicle costs and fuel costs vary

considerably. Below we show values used for the baseline vehicle and fuel costs. We also report the values we used for a sensitivity analysis of these factors.

To-the-Meter Infrastructure Costs

Because the Utility programs pay 100% of the TTM costs, **the model uses a value of \$0 for all TTM costs.**

Behind the Meter Infrastructure Costs

The Evaluation Team applied data from completed sites to estimate the average BTM utility investment or incentive. These averages are shown separately for each market sector in Table B-14.

Table B-14. Estimated Cost of BTM Utility Funding on a Per-Vehicle Basis for Each Market Sector

Market Sector	Average BTM Investment per Vehicle
School Bus	\$24,964
Medium-Duty Vehicle	\$24,751
Transit Bus	\$61,902
Short-Haul	\$37,896
eTRU	\$7,550

Short-Haul, Medium-Duty Vehicle, and Transit Bus Vehicle Cost

Baseline costs for short-haul trucks, medium-duty delivery trucks, and transit buses are projected using component cost (e.g. battery, fuel cell, motor/controller) parameterizations taken from a recent UC Davis study¹⁷¹ and shown in Table B-15.

Table B-15. Up-front Cost Assumptions for Short-Haul, Medium-Duty Vehicle, and Transit Bus Sectors

Year	Short-Haul			Medium-Duty Vehicle		Transit Bus		
	Diesel	BEV	FCEV	Diesel	BEV	Diesel	BEV	FCEV
2030	\$155,000	\$290,000	\$245,000	\$80,000	\$145,000	\$559,000	\$690,000	\$713,000
2035	\$1570,00	\$245,000	\$210,000	\$82,000	\$125,000	\$564000	\$614,500	\$616,000

School Bus Vehicle Cost

The World Resources Institute published a study on school bus TCO.¹⁷² The study provides only present costs for diesel and BEV school buses. We assume cost increases for diesel school buses and cost reductions in BEV school buses are similar to those in medium-duty and short-haul vehicles. Table B-16 shows the cost inputs for school buses.

¹⁷¹ Zhao, Jingyuan, Andrew Burke, Marshall Miller, Lewis Fulton (2025) Market Prospects of Fuel Cell vs. Battery-Electric Trucks in Medium- and Heavy-Duty Segments from 2025 to 2040. Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-25-08.

¹⁷² Levinson 2023, Levinson, M., P. Burgoyne-Allen, A. Huntington, and N. Hutchinson. "Recommended total cost of ownership parameters for electric school buses: Summary of methods and data." Technical Note. Washington, DC: World Resources Institute. 2023. Available online at: doi.org/10.46830/writn.22.00024.

Table B-16. Up-front Cost Assumptions for School Bus Sector

Year	Technology	
	Diesel	BEV
2030	\$109,900	\$255,000
2035	\$112,600	\$225,400

Electric Transport Refrigeration Unit (eTRU) Vehicle Cost

The California Air Resources Board produced a technology assessment of TRUs which includes estimates of the capital and operating costs¹⁷³ and Go Electric produced an eTRU factsheet. Table B-17 shows capital costs for TRUs.

Table B-17. Up-front Cost Assumptions for eTRU

Year	Technology	
	Diesel	BEV
2030	\$30,100	\$34,750
2035	\$30,100	\$34,750

The major uncertainty for ZEV capital costs is the expected reduction in component costs over time. Some analyses assume large reductions similar to those seen for LDVs. Other studies project smaller reductions due to the much smaller volume sales of trucks and buses compared to LDVs. The baseline costs above assume lower cost reductions. To explore the possibility of greater cost reductions, the sensitivity analysis reduced the capital costs by 5% in 2030 and by 10% in 2035.

Fuel Costs

Table B-18 shows projected costs for fuels in California. Fossil fuel cost projections are taken from the CEC's 2023 Integrated Energy Policy Report.¹⁷⁴ Electricity costs are taken from data supplied to Cadmus from the utilities. Hydrogen costs are taken from a recent UC Davis report.¹⁷⁵

Table B-18. Diesel, Gasoline, Electricity, and Hydrogen Costs in California

Year	Diesel (\$/gal)	Electricity (\$/kWh)	Hydrogen (\$/kg)
2030	4.69	0.37	10.00
2035	4.77	0.37	8.50

¹⁷³ CARB 2022, 2022 Technology Assessment: Non-Truck Transport Refrigeration Units (TRU), Trailer TRUs, Domestic Shipping Container TRUs, Railcar TRUs, and TRU Generator Sets. October 2022. <https://ww2.arb.ca.gov/sites/default/files/2022-10/CARB%202022%20TRU%20Technology%20Assessment%2010-14-22.pdf>

¹⁷⁴ CEC, 2024, 2023 Integrated Energy Policy Report, Commission Report, CEC-100-2023-001-CMF, February 2024, <https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr/2023-integrated-energy-policy-report>

¹⁷⁵ Fulton, Lewis et al, 2024, California FCEV and Hydrogen Refueling Station Deployment: Requirements and Costs to 2050, Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-24-27, https://itspubs.ucdavis.edu/publication_detail.php?id=4417

A sensitivity analysis was run for both low and high electricity costs. The low costs were reduced by 20%, and the high costs were increased by 20%.

Miles traveled

Table B-19 shows the annual miles assumptions by market sector.

Table B-19. Assumptions for Miles per Year for Various Market Sectors

Market Sector	Miles
Short-Haul	50,000
Medium-Duty Delivery	20,000
Transit Bus	43,000
School Bus	14,000
eTRUs	N/A ^a

^a TRUs do not use annual miles

Vehicle incentives

Vehicle incentives are available through the California HVIP program.¹⁷⁶ Table B-20 shows the maximum incentives by market sector.

Table B-20. Maximum Incentives by Market Sector

Powertrain Type	Short-Haul	Medium-Duty Vehicle	Transit Bus	School Bus	eTRU
BEV	\$120,000	\$60,000	\$120,000	\$140,250	N/A
FCEV	\$240,000	\$60,000	\$240,000	N/A	N/A

Process Evaluation

The following subsections discuss the process evaluation for MDHD surveys and interviews.

Surveys

The Evaluation Team used survey data regarding fleets' motivations for participating in Utility electrification programs and experience with the process, barriers to electrification, costs and benefits, and operational constraints.

To gather the survey data, the Evaluation Team invited respondents to complete surveys via email. We designed the survey questions to align with the evaluation objectives and focused the questions on understanding fleets' experience with the program.

Twenty-four fleet managers responded to the fleet manager survey in EY2024. The Evaluation Team compiled survey data to produce and interpret graphical analysis of the survey responses.

The Evaluation Team analyzed the fleet manager survey primarily at the Utility stratum. For select questions when sample size allowed, we further stratified the sample by DAC status and vehicle type to

¹⁷⁶ HVIP 2025, Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, Incentives for clean trucks and buses. Viewed on June 4, 2025. <https://californiahvip.org/>

provide additional insights to the analysis. The Team created graphical data representations to interpret survey data, draw conclusions about fleets' experiences, and identify trends in fleets' experiences with electrification. In future evaluation years, the Evaluation Team expects a larger sample size, which will allow for a more robust analysis among different strata. Due to the small sample sizes, the Evaluation Team did not apply any significance testing to EY2024 survey data.

Interviews

The Team conducted in-depth interviews with the four participating Utilities to gather qualitative insights regarding Utility experience with the program process, barriers to electrification, program design, costs and benefits, and operational constraints. We used this interview data to provide context to information from other sources, such as PAC presentations.

The Team synthesized Utilities' responses to in-depth interview questions to draw conclusions about the topics covered in the interview. We analyzed each Utility's responses separately but used a mostly consistent set of questions across Utilities.

The Evaluation Team conducted interviews with six withdrawn fleet managers to understand their reasons for withdrawing, satisfaction with their program interactions, barriers to electrification, and actions taken outside of the program. In prior evaluation years (EY2023 and before) the Evaluation Team gathered information from withdrawn fleet managers using surveys. However, due to the small population, it was determined that interviews would yield better quality data for EY2024. The Team synthesized results across the interviews to identify key themes and draw conclusions. As with the utility interviews, we analyzed each respondent's feedback separately but used a consistent set of questions for each interview.

Public Charging (Schools, Parks, and EV Fast Charge) Evaluation Methodology

This section outlines the data collection and analysis for the Public Charging program evaluation.

Data Collection Methodology

The following subsections discuss data collection for the Public Charging program evaluation, including program data, materials, AMI and EVSE data, site visits, and Utility interviews.

Program Performance Metrics

Program data provides essential insights into program performance. The Evaluation Team collected and securely transferred Utility data between Microsoft Azure cloud-based environments and a secure SharePoint site. The Team sought to transfer data monthly, with some variation in timing among PG&E, SCE, and SDG&E.¹⁷⁷ Once we received data from these Utilities, we moved it to the Cadmus data warehouse for secure storage, retrieval, and analysis. The Evaluation Team then unified the data imported from each Utility to provide a single resource output to adhere to SB 350 reporting.

¹⁷⁷ Liberty provided no site data for EY2024 (as no public charging sites were completed).

The data collected included program application status and timing, as well as details such as the number of ports by type/level, site status by DAC, program, application phase timing, and number of applications that were operational and had been activated.

Program Materials

The Evaluation Team reviewed available EY2024 program-related material such as marketing education and outreach documentation, Advice Letters, the *Joint IOU EV Load Research and Charging Infrastructure Cost Report*, and PAC presentations. The annual program material review is important to maintain an understanding of each program, including program changes and implementation progress.

Table B-21 shows a list of the material types the Evaluation Team reviewed by Utility in EY2024.

Table B-21. Public Charging Materials Reviewed

Utility	Program Materials Provided
Liberty	No new materials for EY2024
PG&E	(Schools and Parks Pilots and EV Fast Charge) PAC presentations (Schools and Parks Pilots and EV Fast Charge) Regulatory documents (Advice Letters) (Schools and Parks Pilots and EV Fast Charge) Joint IOU EV Load Research and Charging Infrastructure Cost Report (Schools and Parks Pilots only) Marketing materials
SCE	- Regulatory documents (Advice Letters) - Joint IOU EV Load Research and Charging Infrastructure Cost Report - PAC presentations - Marketing materials
SDG&E	- Joint IOU EV Load Research and Charging Infrastructure Cost Report - Marketing materials

AMI/EVSP

The Evaluation Team used AMI data to estimate charger usage, a key input for subsequent analyses and estimations of program impacts such as impacts to the grid, petroleum displaced, emissions reduced by EV adoption, and associated health impacts. The Team collected and securely transferred AMI data between the Utilities and Microsoft Azure cloud-based environments. We used Azure Databricks to transform and standardize the data, which we then imported into an SQL server data warehouse. We performed these transfers monthly, with some variation in timing among the Utilities. Once we received the data, we input it into our data warehouse for secure storage and retrieval and aggregated it for subsequent calculations and analysis. Time-stamped energy consumption data were in 15-minute intervals.

A second critical data source was EVSE data provided by participating EVSPs. The Utilities developed a process for screening and approving EVSPs based in part on their ability to provide essential charging data of EVSE sessions, intervals, stations, and ports on a monthly basis.

Together, AMI and EVSE data provided the basis for analyzing program performance at a granular level. The Team used data from EVSPs to examine port utilization, which is based on the time a vehicle is parked at a charger and consuming energy. Port utilization rates can be expected to rise as the program matures and consumers and fleets acquire more vehicles.

The Evaluation Team worked to acquire complete AMI and EVSE data for every charging session from the Utilities and EVSPs. When AMI data was not available from the Utility, the Team worked with the Utility to either obtain the data and incorporate them into future analyses, use a customer sub-metered dataset provided by the Utility, or synthesize data from existing EVSE data.

Synthesized Data

For sites with no AMI data or data missing for some periods of times, the Evaluation Team generated representative AMI data based on available EVSP data through a synthesis process using a conversion factor of the ratio between EVSP data and AMI data. Specifically, we derived conversion factors for each site by evaluating the ratio of total kilowatt-hours delivered as reported by EVSPs, which in most cases existed for the same site at a different time period or existed for similar EVSE and vehicles. For the rare case with no specific match, the Team used a standard factor of 0.85 to account for electricity losses between the meter and the EVSE.

Annualized Data

The Evaluation Team considered all operational sites for annualization.¹⁷⁸ In the EY2021 annual evaluation, we annualized all sites with greater than six months of usage data and considered annualizing sites with between three and six months of usage data depending on observed usage patterns. For EY2022 to EY2024, the Evaluation Team annualized all sites to provide a more complete picture of the entire program to date and the impacts of the existing program performance over a full 10-year life. Our experience has shown that sites that have an abbreviated period of performance (less than six months) will inherently have lower utilization than fully developed sites. As a result, annualized sites with an operational time of six months or less will underrepresent the full 10-year impact; however, excluding those sites would create an even greater underrepresentation.

We annualized site data by creating a representative 12-month operation period, which could be projected into the future to the point when the site will reach its 10-year life. We determined the 10-year life by evaluating when the operational use of the EVSE would begin and projecting forward 10 years from that date. For sites with more than 12 months of fully developed utilization, the Team used the most recent 12 months. For sites with less than 12 months of fully developed utilization, we removed the months of data before the date the site reached 75% of the maximum monthly use and replaced that data with a synthesis of all months of data following 75% of the maximum utilization.

¹⁷⁸ The Evaluation Team annualized electricity usage data for sites with operational AMI data (data indicating that EVs were actively being charged). To accomplish annualization, we extrapolated partial year site electricity usage data out to a full year to make site-to-site and year-over-year comparisons.

Site Visits

Site visits to program charging stations are an important data collection element, as they provide an on-the-ground view of installed sites. For EY2024, the Public Charging site visits brought supplemental qualitative insights, especially regarding lessons learned (such as why some sites may have higher usage than others). The Team attempted a census of visits to activated sites for EY2024.

Interviews

In-depth interviews provide critical insight on the original intent, actual implementation, and success of the Pilots and programs and allow us to assess their potential to scale up. For EY2024, we conducted close-out phone interviews with core staff overseeing the public charging programs across the four Utilities.¹⁷⁹ We developed interview guides outlining key topic areas and questions for discussion to ensure that we covered each topic area during the interview. Topics included staff roles and responsibilities, program design and implementation, and areas of challenge and success.

Analysis Methodology

This section provides an overview of the analyses of the Public Charging bundle, including estimating EV adoption and grid impacts; developing the vehicle counterfactual; determining petroleum displacement, GHG and criteria pollutant emissions reductions, and health impacts; and preparing for a TCO analysis, qualitative site visits, and Utility interview analysis. The petroleum fuel reductions, GHG and criteria pollutant emissions reductions, and health impacts analyses assessed impacts on DACs versus non-DACs.

EV Adoption

The Team conducted an EV adoption analysis to estimate the effects of utility investments in public charging infrastructure on household ownership of EVs.¹⁸⁰ Recent research shows that growth in the availability of public charging networks can boost EV purchases.¹⁸¹ However, the mechanism by which public charging availability affects EV purchases is not clear. Understanding this mechanism may help the Utilities and other investors in public EV charging facilities make more-productive investments. This section describes the Evaluation Team's approach, and the data sources used to estimate the impact of public charging programs on EV adoption.

¹⁷⁹ This pertained specifically to the Schools Pilot, Parks Pilot, and PG&E EV Fast Charge program.

¹⁸⁰ PG&E made these investments through Utility EV pilots and programs including the PG&E EV Fast Charge program and Schools and Parks Pilots.

¹⁸¹ Springel, Katalin. 2021. "Network Externality and Subsidy Structure in Two-Sided Markets: Evidence from Electric Vehicle Incentives." *American Economic Journal: Economic Policy*, 13 (4): 393–432.

The Team estimated the effect of public charging stations on EV adoption for populations neighboring public charging stations with a two-stage analysis.¹⁸²

- Historical analysis of public EV charging impacts on vehicle ownership
- Analysis of ownership attributable to specific utility investments in public charging

In the first stage, the Team estimated the effects of access to any neighboring public charging on EV ownership.¹⁸³ The second stage involved an attribution analysis: the Team applied the regression coefficient estimates of public charging access from the first stage to the specific utility public charging investments to estimate their impact on EV ownership (for the EV Fast Charge program, Schools Pilot, and Parks Pilot).

The Utility EV Adoption findings sections provide the end results as the estimated changes in annual EV ownership (EV registration), which are a function of changes in annual access to public EV charging stations, while accounting for potential nonrandom siting of public EV charging infrastructure.

Analysis Data and Sample Selection

The Evaluation Team assembled a CBG panel dataset on annual EV ownership and access to public EV charging for calendar years 2015 through 2023 to perform the EV adoption analysis. The Team assembled the panel data from free, publicly available secondary data sources on EV registrations, public EV charging infrastructure, census demographic data, and census geography (CBG and census block) shape files. Table B-22 lists the data sources for the CBG panel.

¹⁸² There are two main channels through which the availability of public charging networks may affect EV purchases. The first is a network effect, through which EV owners gain increased access to the public charging stations because of the stations' placement at destinations such as workplaces, commercial establishments, schools, and parks. The Evaluation Team expects the availability of EV charging equipment at convenient locations (for midday charging away from home) to increase the convenience of owning an EV (such as by lessening range anxiety) and to increase the probability of EV ownership. The second channel is a neighborhood effect on the driving population living in areas neighboring the public EV charging stations. The Evaluation Team expects the availability of nearby charging infrastructure to reduce the cost of EV ownership by providing alternatives to home charging. We expect that public EV charging will have the biggest impact on residents of multifamily buildings, many of whom will have limited access to EV charging equipment, or on low-income households, who may be unable to afford home EV charging equipment. The public charging access may boost EV ownership through both channels, and there may be positive interactive effects between the channels that boost the overall impact of public charging networks. The Evaluation Team focused on analyzing the second channel and will analyze the impacts for the first channel separately when data become available.

¹⁸³ For the stage one analysis, the Evaluation Team focused on general public charging, not Utility-specific charging; however, for the stage two analysis, we will consider both Utility- and program-specific charging.

Table B-22. EV Adoption Data Collection

Data Element	Description	Source	Reporting Unit
California CBG shapefiles	Polygon shapefile representing CBGs for the state of California from 2010 Census	U.S. Census Bureau: https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2010&layergroup=Block+Groups	CBG
California census block shapefiles	Polygon shapefile representing census blocks for the state of California from the 2010 Census	U.S. Census Bureau: https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.2010.html	Census block
California vehicle registration data	Data on EV ownership for California CBGs by vehicle category, fuel type, fuel technology, and number of vehicles registered at the same address for 2015 through 2023	CARB: https://arb.ca.gov/emfac/fleet-db	CBG
EV charging stations	EV station attributes and location	National Renewable Energy Laboratory AFDC: https://developer.nrel.gov/docs/transportation/alt-fuel-stations-v1/	Fueling station
Population demographics and socioeconomic data	Decennial Census or American Community Survey data (five years) on population, housing, income, race, and ethnicity	U.S. Census Bureau: https://data.census.gov/cedsci/	Zip code tabulation area, census block, or CBG
California DACs	Data on CalEnviroScreen 4.0 scores in census tracts that the Team could use to identify DACs	California EPA Office of Environmental Health Hazard Assessment: https://oehha.ca.gov/calenviroscreen/maps-data	Census tract

Data Element	Description	Source	Reporting Unit
California cities land zoning shapefiles	Polygon shapefile representing land use for the top 20 largest cities in California where land zoning data are publicly available	Anaheim: https://main-anaheim.opendata.arcgis.com/datasets/f40f6f69179a4bccb5d4359a0e054b04_3/about Bakersfield: https://bakersfielddatalibrary-cob.opendata.arcgis.com/ Fresno: https://www.co.fresno.ca.us/departments/public-works-planning/divisions-of-public-works-and-planning/cds/gis-shapefiles Long Beach: https://datalb.longbeach.gov/search?q=zoning Los Angeles: https://geohub.lacity.org/datasets/lahub::zoning/about Oakland: https://data.oaklandca.gov/dataset/Zoning/q8sz-29u5 Sacramento: https://data.cityofsacramento.org/search?q=zoning San Diego: https://data.sandiego.gov/datasets/zoning/ San Francisco: https://data.sfgov.org/Geographic-Locations-and-Boundaries/Zoning-Map-Zoning-Districts/3i4a-hu95 San Jose: https://gisdata-csj.opendata.arcgis.com/datasets/CSJ::zoning-districts/about Santa Ana: https://gis-santa-ana.opendata.arcgis.com/datasets/Santa-Ana::zoning-classifications/explore?location=33.737642%2C-117.887350%2C13.14 Riverside: https://geodata-cityofriverside.opendata.arcgis.com/datasets/edd9eb97a1dd446cb30336d91bc40e8a_2/explore?location=33.945918%2C-117.401342%2C12.00 Stockton: http://www.stocktongov.com/services/gis/mapdatdat.html Chula Vista: https://chulavista-cvgis.opendata.arcgis.com/datasets/a0591cdb609548a182f35bd70a431a20/explore?location=32.631384%2C-117.021350%2C12.73 Fremont: https://fremont-ca-open-data-cofgis.hub.arcgis.com/datasets/25db2e74c6254091a6f340cf01f8f092_0/explore?location=37.529560%2C-122.012239%2C12.00 Fontana: https://data-fontanaca.opendata.arcgis.com/datasets/FontanaCA::zonin-g-2/explore?location=34.104611%2C-117.459495%2C11.66&showTable=true	Land zone

Data Element	Description	Source	Reporting Unit
		Oxnard: https://data-oxnard.opendata.arcgis.com/datasets/Oxnard::zoning/explore?location=34.173578%2C-119.184614%2C13.63 Rancho Cucamonga: https://rcdata-regis.opendata.arcgis.com/datasets/zoning/explore?location=34.106902%2C-117.563238%2C15.16&showTable=true Elk Grove: https://gisdata.elkgrovecity.org/datasets/elkmap::city-of-elk-grove-zoning/explore?location=38.407478%2C-121.378550%2C12.52 Garden Grove: https://ggcity.org/maps/data-portal/#/osm/planning/zoning	
California utility investments in EV charging stations	EV station attributes and location	California Utilities	Fuel station

The Evaluation Team reviewed all data for completeness and accuracy and documented any significant gaps or other issues that might affect the analysis results.

Our analysis sample includes all California CBGs, except those meeting one or more exclusion criteria:

- The CBG was in a rural area.¹⁸⁴
- The CBG did not have any households.
- The CBG was new since the 2010 census.
- The CBG has outlier EV registration numbers (greater than the 99th percentile in EY2023).

After applying these sample exclusion criteria, 17,940 CBG remained in the analysis sample.

Modeling of EV Ownership

The goal of the stage one analysis was to estimate the impact of public EV charging access on EV ownership. During this stage, we constructed a composite measure of CBG access to public charging as a function of the number of neighboring public EV charging stations, the geographic distance from homes to the stations, and the number of chargers (ports) at each station. Next, we performed the EV adoption analysis using annual panel data on California EV registrations at the most granular spatial resolution possible (the CBG level) from 2015 through 2023. We then estimated the impacts of public charging on

¹⁸⁴ We adopted the U.S. Census Bureau’s urban-rural classification, which is based on 2010 Census population and housing unit: <https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html>. Previous literature has found that the inclusion of rural areas could lead to overestimating the effect of chargers on these non-urban residents and that limiting the study to an urban population could reduce variation in population density. See Hsu, Chih-Wei, and Kevin Fingerman. 2021. “Public Electric Vehicle Charger Access Disparities across Race and Income in California.” *Transport Policy* (100): 59–67.

EV ownership using two approaches. We first conducted an OLS estimation of a panel annual regression or long differences regression of normalized EV registrations (annual registrations per 1,000 households), which assumes that the siting of public charging infrastructure was exogenous to EV registrations. The panel model included year-fixed effects, CBG-fixed effects, and county time trends. The Team used CBG-fixed effects and county time trends to control for, respectively, time-invariant CBG and time-varying county characteristics that could correlate with the location decisions of public charging and subsequent EV adoption. The long differences model of the change in annual EV registrations between 2015 and 2023 includes controls for income, building type, and annual EV registrations in 2015.

The Evaluation Team recognized the potential for bias in the estimates from this OLS analysis if public EV charging location decisions drew from unobservable trends in EV registrations, such as locating public charging infrastructure in areas with higher EV demand (we refer to this as the endogeneity of charging location decisions). Thus, with the second approach, the Evaluation Team estimated the public EV charging impacts using IV-2SLS. The IV-2SLS models use the percentage of the neighboring land area zoned for public EV charging facilities (that is, land zoned for commercial use, parking, or public use, such as schools, government lands, and parks) as the instrumental variable while controlling for the income and percentage of multifamily housing units in CBGs.¹⁸⁵

In stage two, the Team took a three-step approach to estimate the impact of California utility investments in public charging on EV adoption in the study period:¹⁸⁶

- **Step 1:** Using the public charging access framework above, we estimated the effect of the Utility charging stations on access for California households. We calculated the change in access for each CBG.¹⁸⁷
- **Step 2:** We used the regression model estimates to determine, for each affected CBG, the impact on EV ownership of the change in public charging access for households.

¹⁸⁵ A valid instrumental variable will be strongly correlated with the location of public charging but uncorrelated with EV adoption conditional on other exogenous explanatory variables. Our approach uses the availability of nearby land zoned for public charging as a source of exogenous variation in the availability of public charging among CBGs with similar income levels and housing types. Specifically, the analysis uses the percentage of CBG land area zoned for commercial use, public use (such as schools or government buildings), or parks and beaches. As public charging infrastructure may exist only on suitably zoned land, and land zoning remains mostly unchanged over time, proximity to space zoned for commercial, public uses, or parking should correlate with the change in access to public charging between 2015 and 2020 but not correlate with EV adoption over this period.

¹⁸⁶ The Team developed the current methodology to study the impact of public EV charging on existing EV adoption. Forecasting the impact in a future period will require a separate approach and additional data on the Utility investments in public charging.

¹⁸⁷ A full accounting of the impact of Utility investments would require considering whether EV charging station developers would build more (or fewer) charging stations if the Utilities had not built charging stations. Incorporating this supply response would diminish (or increase) the effect of the Utility charging network on EV adoption.

- **Step 3:** We summed the changes in ownership across CBGs to determine the total impact on EVs and to estimate the standard error.

A notable benefit of this two-stage approach to assessing EV and EVSE market acceleration is that it can apply to evaluations of other programs that also increase EV charging access, ensuring methodological consistency.

Grid Impacts

The Evaluation Team calculated the associated grid impacts for the Public Charging programs based on the consumed energy from charging stations installed through the programs and charging session data from the EVSPs. As part of this analysis, the Team examined impacts at the program and bundle levels. This section describes the approach, data sources, and analyses we performed to estimate Public Charging grid impacts.

The Team collected, cleaned, and analyzed Utility AMI data, provided at 15-minute increments, to calculate total kilowatt-hour usage, on-peak and off-peak usage, and maximum demand, which we then used to calculate load factors. The Team took a three-step approach to the analysis:

- **Step 1:** Accounted for total consumption (kilowatt-hours), the proportion of consumption during the on-peak time period, and new load on the grid (kilowatts).
- **Step 2:** Targeted issues such as stability versus growth of charging load, charging load by time of day, and charging session flexibility.
- **Step 3:** Projected the extent to which transportation energy use can be integrated with the grid at a least cost to retail consumers and ratepayers.

We report these data by site, in aggregate, and on a daily and monthly basis.¹⁸⁸

The Team used the essential primary and secondary data summarized in Table B-23 for the Public Charging grid impacts analysis.

Table B-23. Public Charging Grid Impacts Data Inputs

Category	Source
Primary Data	Utility AMI data, historical CAISO data (demand, supply sources, renewable curtailments), charging session data from EVSP networks
Secondary Data	Time varying Utility rates in effect at sites, EVSE (interval and charging session) data, site management details (charger capacities), site visits

The Evaluation Team uploaded AMI and EVSP data to the data warehouse and calculated results using the internal Power BI dashboard. Foundational program analysis included total electricity consumption (kilowatt-hours), and new demand (kilowatts) added to the grid. The Team established trends based on the proportion of electricity usage during the highest cost period (defined as 4 p.m. to 9 p.m. daily)

¹⁸⁸ The actual reported results for each Utility are reflected in a way that preserves and masks personally identifiable information.

versus non-highest cost periods. We calculated load factors based on usage and utilization rates, which we based on the installed capacity for each site.

The Team then assessed daily and weekly charging behaviors and captured patterns that account for load growth. We also examined CAISO data on fuel mix at different times of the day to estimate the extent to which EV loads contribute to system demand.

The 24-hour load curves provided key insights into how the grid is impacted by the program. Charging approaches in which EVs consume power during off-peak periods such as when solar output is high (midday) and/or demand is low (night) will become increasingly important as more EV loads are added to the grid and have a different role in each public charging program. Charging flexibility in response to price signals offers a potentially valuable tool to safeguard the grid with new EV loads coming online and to support the growth of renewable energy to provide this power.

The Evaluation Team applied the grid impact analysis to the actual AMI data for the activated sites in EY2024 and annualized AMI data to support analyses with forecasts such as the petroleum displacement and GHG and criteria pollutant emissions reductions. Through the annualization of AMI data the Team identified the region of stable operation and leveraged this data to generate a statistically representative full year of operation.

Emissions calculations require matching the date and time of AMI data with the electric generation mix at the time of use. This approach necessitates normalizing emissions calculations across the whole year to capture daily, monthly, and seasonal variations in electric generation mix. Therefore, we did not annualize data from sites with two months or less of data (as we were unable to determine seasonable variability). For sites with more than two but less than four months of data, we visually inspected the datasets and used expert judgement to evaluate whether the operation was consistent enough to be annualized.

Of the activated Public Charging sites in EY2024, the Evaluation Team annualized AMI data through a four-step process:

- **Step 1: Find the maximum monthly site usage.** The Team identified the month with the maximum total usage in kilowatt-hours for the site by examining the EY2024 AMI data.
- **Step 2: Identify the start month.** The starting month for the actual data used to develop the annualized data was the one in which total usage exceeded 75% of the maximum month's usage.
- **Step 3: Create a representative weekly load curve.** Using the AMI data from the start month to the end of the year, we created an average daily load curve for each day of the week and for each 15-minute interval throughout the day.
- **Step 4: Extrapolate a weekly load curve.** Using the representative weekly load curve, we extrapolated AMI data that was outside the operational period. We then matched weekday load curves for each day of the week (such as matching Monday to Monday).

Counterfactual Development

The Team conducted secondary research to inform the development of the electric LDV and conventional counterfactual for the public charging sites:

- **The electric LDV counterfactual** establishes an average EV efficiency (kilowatt-hours per mile) to convert energy dispensed at charging stations to resulting EV miles.
- **The conventional LDV counterfactual** is the average fuel economy (miles per gallon) for a representative ICE LDV on the road that the electric LDV counterfactual replaces to convert displaced counterfactual vehicle miles to gallons of petroleum displaced.

These counterfactuals are foundational to the public charging evaluation, impacting the EV adoption analysis as well as analyses of petroleum displacement, GHG and criteria pollutant emissions reductions, and grid impacts. The subsections below describe the approach, data sources, and analyses performed to develop the counterfactuals for Public Charging.

The Evaluation Team calculated the electric LDV counterfactual for EY2024 as average EV efficiency (kilowatt-hours per mile) using a weighted average for the most popular new EVs in each Utility territory. Next, the Team calculated the conventional LDV counterfactual for EY2024 as the average fuel economy (miles per gallon) for a representative LDV on the road that the electric LDV counterfactual replaces based on the comparable mix to the EVs available—currently this mix is sedans along with small and mid-size SUVs (some Rivian and Ford light-duty trucks have reached the market, but these currently represent less than 2% of the total EVs on the road), but that mix is expected to change over time. We determined that the counterfactual is a composite of all equivalent new vehicles that could have been purchased instead of an EV over the past five years.

The Evaluation Team used the secondary data presented in Table B-24 to develop the electric and conventional LDV counterfactuals.

Table B-24. Counterfactual Data Inputs by Category

Category	Data Inputs
Electric LDV Counterfactual	New EV sales by county: https://www.energy.ca.gov/files/zev-and-infrastructure-stats-data
	EV efficiency: www.fueleconomy.gov
Conventional LDV Counterfactual	BEV and PHEV registrations by county: https://www.energy.ca.gov/files/zev-and-infrastructure-stats-data
	Popular counterfactual vehicles sold and percentage of their sales: https://www.cncda.org/news/?category=auto-outlook
	Fuel economy: www.fueleconomy.gov

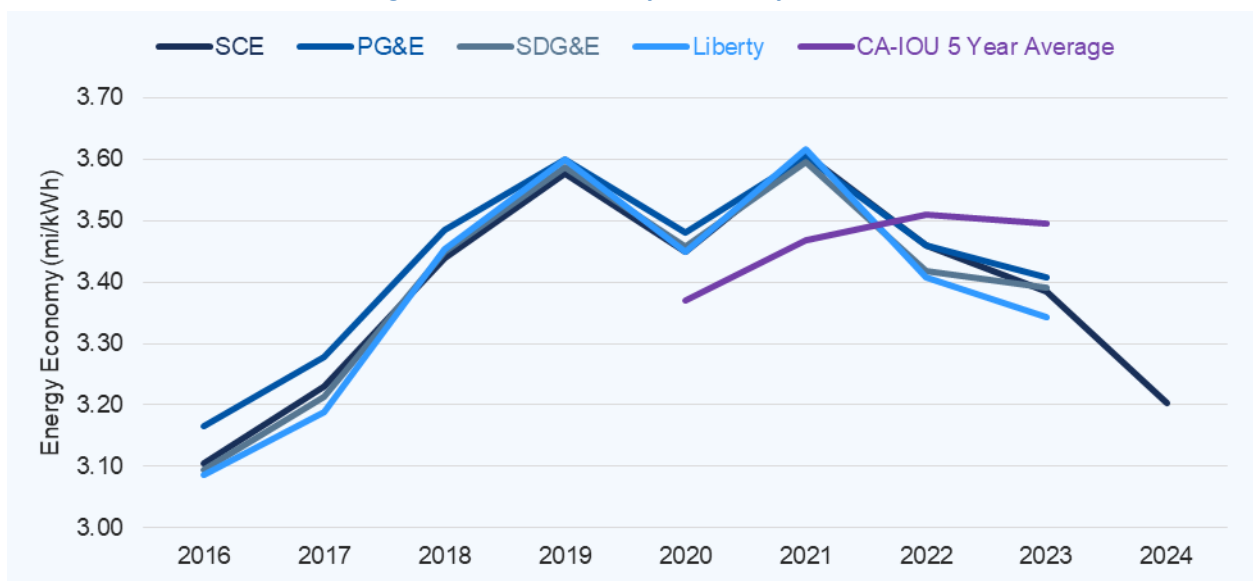
The counterfactual results from 2016 through 2022 are shown in Table B-25.

Table B-25. Electrical Vehicle Efficiency by Year and Utility

Year	Liberty	PG&E	SCE	SDG&E	CA Utility Average (kWh/mile)	Largest Difference	CA Utility 5-Year Average (kWh/mile)	5-Year Efficiency (kWh/mile) Average
2016	3.09	3.17	3.10	3.09	3.11	2.6%	-	-
2017	3.19	3.28	3.23	3.21	3.23	2.8%	-	-
2018	3.45	3.48	3.44	3.45	3.46	1.3%	-	-
2019	3.60	3.60	3.58	3.59	3.59	0.7%	-	-
2020	3.45	3.48	3.45	3.46	3.46	0.9%	3.37	0.297
2021	3.63	3.62	3.62	3.61	3.62	0.5%	3.47	0.288
2022	3.43	3.48	3.48	3.45	3.46	1.6%	3.52	0.284

The Team used the most recent five-year average (accounting for the most likely mix of EVs using these stations) for all participating Utilities because the difference between Utilities (due to the different EV makeup) is not significant, as shown in Figure B-5.

Figure B-5. EV Efficiency Per Utility Per Year



The Team then identified the comparable vehicle type mix, shown in Figure B-6, which resulted in California-wide counterfactual weighted averages for 2017 through 2022, as well as the prior five-year average (as shown in Figure B-6 and Table B-26).

Figure B-6. EV Market Share Penetration Rates to Reach 100% BEV Sales by 2035

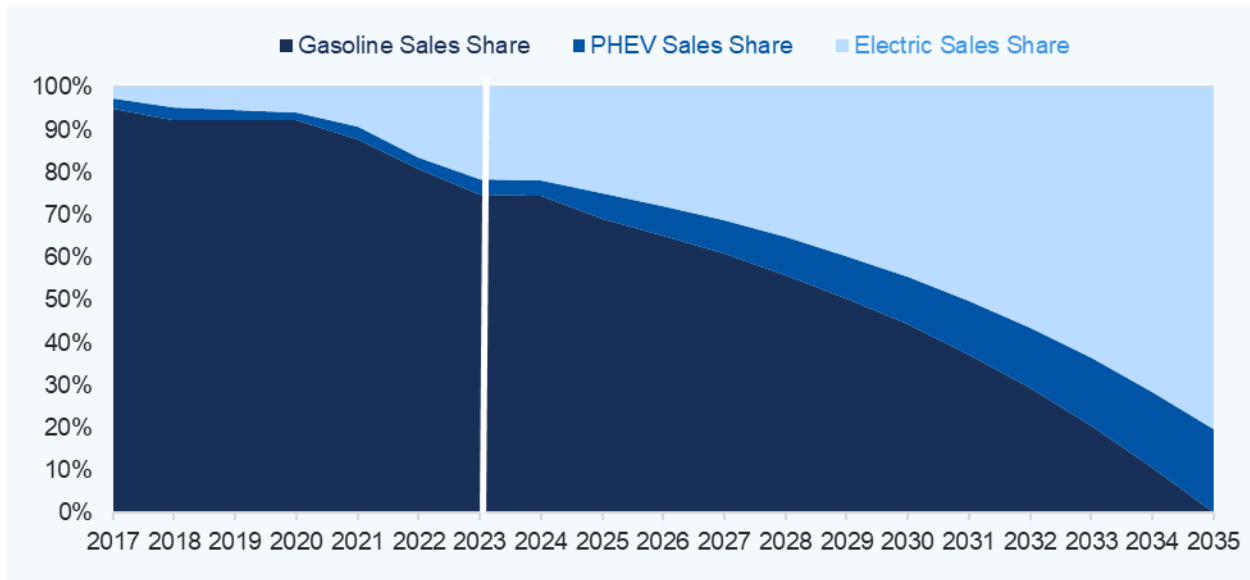


Table B-26. Counterfactual Vehicle Fuel Economy by Year

Year	Gasoline	PHEV	Electric	Weighted Average	Last 5-Year Average
2017	27.00	71.83	109.38	30.21	-
2018	27.06	72.98	111.82	32.33	-
2019	26.90	72.69	117.07	32.64	-
2020	27.46	70.65	115.95	33.76	-
2021	28.13	63.06	121.75	38.18	33.43
2022	28.36	58.14	120.10	44.94	36.37

Petroleum Displacement

One goal of the Public Charging programs is to reduce the amount of petroleum fuel conventional vehicles use as they are replaced by EVs. As part of this analysis, the Team examined petroleum fuel reduction at the program and bundle levels. This section describes the approach, data sources, and analyses we performed to estimate the Public Charging–related petroleum fuel reduction.

The Team determined the reduction in gasoline equivalent gallons of petroleum compared to electric usage as a result of the Public Charging programs. To complete this analysis, we calculated annual energy consumption, EV annual miles traveled, and annual counterfactual vehicle fuel consumption, as described in the *Counterfactual Development* section above.

The Team developed a petroleum displacement tool to estimate EV miles traveled by converting electrical energy use from the EV Public Charging programs in kilowatt-hours from Utility AMI data to petroleum displaced by the use of electricity. We assumed that conventional vehicles would have been driven the same number of miles in absence of the program (the counterfactual). We then calculated the petroleum displacement in terms of the gasoline gallons equivalency using the petroleum displacement equation shown in Equation 2:

Equation 2. Petroleum Displacement Calculation

$$Gallons\_Displaced_{x,y} = \frac{Annual\ kWh_{x,y} * (1 - Charger\_Losses) * Counterfactual\_Efficiency_z}{EV\_Efficiency_{x,y}}$$

The Team used the primary and secondary data presented in Table B-27 for the Public Charging petroleum analysis.

Table B-27. Public Charging Petroleum Displacement Data Inputs

Category	Source
Primary (critical) Data	Utility AMI data, EMFAC database, and counterfactual tables to assign linkages between sites and EMFAC Vehicle Classification Codes
Secondary Data	EVSE (interval and charging session) data

The Team conducted a range of categorical analyses (shown in Table B-28) using tools that include Azure Studio (SQL statements for the resulting calculations), the counterfactual lookup table (populated by the EMFAC and other sources), and outputs from analysis described above. As noted above, Utility AMI data were the basis for much of this analysis.

Table B-28. Analysis of Petroleum Displacement

Category	Analysis
Reference Counterfactuals and Secondary Data	For each vehicle type, referenced gallons per mile and kilowatt-hours per mile efficiency from the following sources: - Vehicle counterfactuals - Five-year weighted average based on California vehicle registrations from CEC^a and individual vehicle DMV fuel economies for both EV and conventional vehicles from the U.S. EPA^b
Determine EV Energy Consumption	Referenced annual kilowatt-hours consumed by EVSE at each site (as described in the <i>Grid Impacts</i> analysis)
Account for Charging Losses	Compared AMI data to EVSP session data
Calculate Vehicle Miles	Determined miles based on kilowatt-hours consumed using reference counterfactual
Estimate Petroleum Displacement	Estimated petroleum displacement based on conventional miles and fuel consumption factor of conventional vehicles

^a California Energy Commission. 2023. "Light-Duty Vehicle Population in California." <https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/light-duty-vehicle>

^b U.S. Department of Energy. 2023. "Fuel Economy." <https://www.fueleconomy.gov/>

GHG and Criteria Pollutant Impacts

This section describes the methods and sources for calculating GHG and criteria pollutant emissions reductions. The Public Charging programs are expected to reduce the amount of GHG and criteria pollutants emitted into the environment as EVs replace conventional ICE vehicles.

The Team calculated reduced emissions from displaced fossil fuel use as a result of ICE vehicles not in service because of the Public Charging programs. We first developed an ICE counterfactual, then

calculated the emissions associated with these vehicles under conditions that otherwise matched the EVs to create a baseline.

The criteria pollutants emissions reduction calculations account for NO_x, PM_{2.5} and PM₁₀, CO, and SO_x. The Evaluation Team also estimated emissions reductions of ROGs, which are not criteria pollutants.

Because the electric grid emissions profile varies substantially by time of day and season, the Evaluation Team estimated reductions using actual 8,760-hour load curves based on Utility meter data and calculated the annual avoided emissions implied by the gallons of fossil fuels that were displaced.

The total program and Pilot emissions impact for key pollutants presented in [Table B-29](#) are net of annual emissions from the displaced counterfactual fossil fuel equipment and the electricity consumed annually by the adopted electric equipment. Local emissions reductions are presented for the remaining pollutants. We developed GHG and criteria pollutants reduction estimates for the overall program, each Utility, and individual DACs.

Table B-29. GHG and Criteria Pollutant Data Inputs

Description	Unit	Source
Site-Level AMI Electric Data in 15-Minute Intervals	kWh	Utility AMI (~1 month delay between measurement and reporting)
Overall Electricity Demand by 5-Minute Interval	MWh	CAISO Demand (Real time)
CO ₂ Grid Emission by 5-Minute Interval	MT	CAISO Emissions (Real time)
Resource Mix by Interval	% by generator fuel	CAISO Supply (Real time)
California Utility Integrated Resource Planning Clean Power System Tool	% by generator fuel	CPUC Developed Clean Power System Tool
Electricity Emission Factors by Resource (details below)	Lb/MWh ^a	EPA eGRID (2023)
NO _x Emissions Rate	grams/kWh	
SO ₂ Emissions Rate	grams/kWh	
CO ₂ Emissions Rate	kg/kWh	
CH ₄ Emissions Rate	grams/kWh	
N ₂ O Emissions Rate	grams/kWh	
CO ₂ Equivalent Emissions Rate	kg/kWh	CARB EMFAC (2021 v.1.0.2 model extracted February 2025)
Vehicle Emissions (ROG, CO, NO _x , CO ₂ , PM ₁₀ , PM _{2.5} , SO _x) by Vehicle and Fuel	g/mi	
Vehicle Type (Vehicle Classification Codes or linkage to emission tables)	Standard category	Petroleum reduction methodology
Petroleum Use by Month	Unit measure	Petroleum reduction methodology
Petroleum Fuel Type	name	Petroleum reduction methodology

^a Units provided by eGRID are in pounds per megawatt-hour and converted to grams per kilowatt-hour (and kilograms per kilowatt-hour for CO₂) for the purposes of this work.

These are multiyear programs, and several input sources are updated periodically. The Team uses newly published resources as they become available.

The Team completed the analysis in four steps using the CAISO application programming interface, the CPUC IRP RESOLVE model, eGRID, and EMFAC:

- **Electricity emissions:** We used CAISO five-minute demand and resource mix data reported by zone to establish an emissions record for each pollutant. We averaged five-minute interval emissions data, applied this to each 15-minute AMI interval, and applied the CAISO-specific emissions factors for that resource provided by the eGRID dataset.
- **Counterfactual emissions:** The Team determined baseline emissions for counterfactual vehicles using EMFAC for specific displaced fuel use. We determined this value based on the application using a standard source for lower heating value energy content available within that fuel on a per unit energy (Btu) basis. This is most often measured in Btus per gallon to derive the grams per gallon and ultimately the tons per year. The factor provided by EMFAC encompasses the estimated number of cold starts and the idling operation.
- **GHG calculation:** We used the United Nations IPCC GWPs for CO₂ equivalence (CO₂e) on a 100-year timeframe based on the IPCC AR5. For EY2024, we used GWP-100 factors of 28 for CH₄ and 265 for N₂O. Equation 3 presents the GHG calculation based on CO₂e:

Equation 3. GHG Calculation

$$CO_2e = CO_2 + 28 * CH_4 + 265 * N_2O$$

- **GHG and criteria emissions reductions:** The overall reduction in GHGs, NO_x, and SO_x was net of annual emissions from the displaced counterfactual fossil fuel equipment and the electricity consumed by the adopted electric equipment. The overall reduction in PM_{2.5}, PM₁₀, CO, and ROG was represented by the annual emissions from the counterfactual vehicle, as these pollutants present localized effects on populations unlike the more globalized effects of the other pollutants. The Team calculated these emissions reductions for sites both inside and outside DACs.

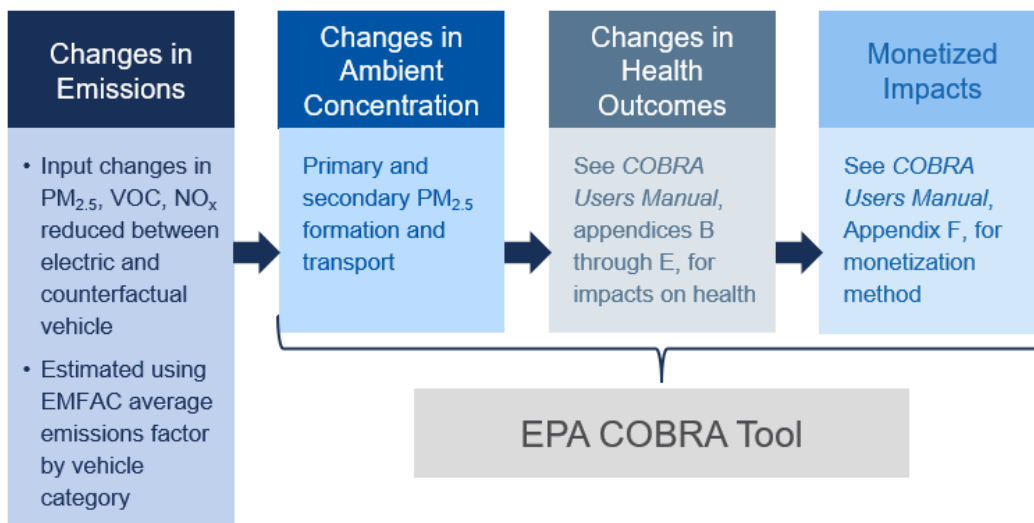
Health Impacts

As EVs replace traditional ICE vehicles, petroleum-based fuels are displaced. These displacements reduce GHG and air pollutant emissions, which may lead to health benefits in regions where EVs are adopted. To understand the effects of the public charging programs on air pollution and related health benefits, the Team estimated the monetized value of health benefits for each individual Utility-funded site by running the emissions reductions through the COBRA. As part of this analysis, we also examined the impact on DACs. For Liberty, PG&E, and SCE, DACs are identified in the California Communities Environmental Health Screening Tool, CalEnviroScreen, developed by California's Office of Environmental Health Hazard Assessment. SDG&E uses a service territory definition of DAC.¹⁸⁹ This section describes the approach, data sources, and analyses performed to estimate health impacts associated with the public charging programs.

¹⁸⁹ As per Advice Letter 2876-E, SDG&E found that only 27 census tracts in its territory were considered DACs using the top quartile in the CalEnviroScreen statewide definition. However, the service territory definition is broader and produced a calculated 180 DAC census tracts in SDG&E service territory.

The Evaluation Team used a four-stage methodology to estimate health impacts, shown in Figure B-7 and described below.

Figure B-7. Four-Step Process for Estimating Health Impacts by Census Tract



Step 1: Changes in Emissions. These estimates are annualized emissions reductions by site for EY2024 in tons for PM_{2.5}, VOCs, and NO_x. The Evaluation Team aggregated emissions reductions by county and used those as inputs for COBRA, which uses several fields:

- **Sector** – Highway or off-highway vehicles
- **Subsector #1** – Diesel for most vehicle applications
- **Subsector #2** – Highway or non-road
- **Discount rate** – Assumed 3%, which reflects the interest consumers might earn on government-backed securities

Steps 2 through 4 are run using the COBRA desktop version. The Evaluation Team uploaded the annual reductions in emissions for PM_{2.5}, VOCs, and NO_x and the tool output estimates as shown in Table B-30. In this analysis VOCs are assumed to be the same as ROG, which are the output from EMFAC.

Table B-30. Mapping of Vehicle Types to Sector, Subsector #1, Subsector #2

Vehicle Type	Sector	Subsector #1 (Counterfactual Fuel Type)	Subsector #2 (Counterfactual Fuel Type)	Discount Rate
LDVs (at public charging sites)	Highway	Gasoline fuel	Light duty	3%

Step 2: Changes in Ambient Concentration. COBRA has a feature that uses the reductions in emissions to estimate the change in ambient concentration. The tool also accounts for transport and the transformation of pollutants (for example, into ozone).

Step 3: Changes in Health Outcomes. COBRA uses epidemiological models to estimate the health impacts of these emissions changes at the county level. COBRA’s estimates reflect the current scientific thinking on the relationship between particulate matter and human health, as well as the economic valuation of these health effects. In particular, the U.S. EPA draws from the Integrated Science Assessment for Particulate Matter,¹⁹⁰ and its methodology for characterizing health impacts has been reviewed by two National Academy of Sciences panels and multiple U.S. EPA Science Advisory Boards. Because the health impacts of air pollution and approaches to value these impacts are areas of active research, the selection of studies used in COBRA may evolve over time as new evidence and studies emerge. More information is available in the online COBRA documentation.¹⁹¹ COBRA estimates health impacts for all 3,033 counties in the United States (because of the transport of the pollutants).

Step 4: Monetized Impacts. COBRA estimates the economic value (in 2017 USD) of the change in health impacts from the emissions changes at the county level. These values are converted to current year dollars using a multiplier from the U.S. Bureau of Labor Statistics.¹⁹² Economic value is estimated differently depending on health impacts (such as by estimating avoided lost wages, avoided medical costs, the amount people are willing to pay to avoid a negative health impact [such as respiratory symptoms], or the VSL approach, which uses value-of-life studies to determine a monetary value of preventing premature mortality). COBRA reports both a low impact and a high impact, representing uncertainties in the estimates. The low estimate is based on an evaluation of mortality impacts of PM_{2.5} by the American Cancer Society,¹⁹³ and the high estimate is based on the Harvard Six Cities mortality study.¹⁹⁴ Rather than average the results of these studies, the U.S. EPA’s standard practice has been to report the estimated change in mortality separately as low and high values.

Site Visits

The Team conducted visual site visits for the Public Charging programs during EY2024 to provide qualitative insights on activated EV infrastructure sites. This section describes the approach, data sources, and analyses performed for the EY2024 Public Charging site visits.

The Team took a census approach in EY2024, visiting all active sites. The Team collaborated with the Utilities and site hosts, as appropriate, to access each site location and complete the EY2024 site visits.

¹⁹⁰ U.S. Environmental Protection Agency. Last updated June 27, 2022. “Integrated Science Assessment (ISA) for Particulate Matter.” <https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter>

¹⁹¹ U.S. Environmental Protection Agency. Last updated November 1, 2022. “Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool COBRA.” <https://www.epa.gov/cobra/users-manual-co-benefits-risk-assessment-cobra-screening-model>

¹⁹² U.S. Bureau of Labor Statistics. 2024. “CPI Inflation Calculator.” https://www.bls.gov/data/inflation_calculator.htm

¹⁹³ Krewski, Daniel et al. May 2009. “Extended Follow-Up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality.” *Res Rep Health Effects Institute* (140): 5–114. <https://pubmed.ncbi.nlm.nih.gov/19627030/>

¹⁹⁴ Lepeule, Johanna, Francine Laden, Douglas Dockery, and Joel Schwartz. March 28, 2012. “Chronic Exposure to Fine Particles and Mortality: An Extended Follow-Up of the Harvard Six Cities Study from 1974 to 2009.” *Environmental Health Perspective* 120(7): 965–970. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3404667/>

For the analysis, the Team used detailed notes and photos taken during each site visit as well as data provided by the Utilities. After each site visit, the Team compiled the notes, photos, and completed data into the Arkenstone data collection platform.

The Team then analyzed the data to document qualitative insights such as critical design elements including the number of dedicated and other parking spots parking spots within reach of charging ports, charger signage, distances from surrounding buildings to charging, optimization of the number of vehicles that can charge at one time, competition for parking (such as at convenience stores), and any upgrades made by the Utilities to comply with ADA rules that require additional space for parking and charging. The Team also compared retail rates for charging by station patrons and determined if TOU charges were in place. Finally, the Team quantitatively compared counts of chargers/ports and installed electrical capacity with Utility-provided information.

Interviews

This section describes the approach, data sources, and analyses performed for the EY2024 Utility interviews. The Team conducted phone interviews with Utility staff at SCE, PG&E, SDG&E, and Liberty to provide insight into program design and implementation and context to analysis outputs and findings. For the Public Charging programs, the Team interviewed all Utility program managers to cover a variety of topics about their respective programs.

The Team developed interview guides outlining key topic areas and questions for discussion to ensure that we covered each topic area during the interview:

- Status updates and changes from EY2023 (and before)
- Program design
- Key milestones
- Key barriers to implementation and solutions
- Preliminary areas of success and lessons learned

The Evaluation Team tailored each interview guide based on information previously provided by the Utilities to ensure an effective use of time. A group of various Evaluation Team members conducted the interviews to ensure coverage across all relevant evaluation areas.

The Team reviewed verbatim notes taken during each interview as the basis of our analysis. We integrated those findings throughout the report, informing many sections including program overviews, materials reviews, and Utility interview analysis findings.

Truck Choice Model Methodology

This section introduces and outlines the data collection and analysis for the TCM, which the Evaluation Team used as one method of assessing the impacts of the Utility MDHD programs.

Introduction

The Evaluation Team used a modified version of the UC Davis TCM, which focuses on factors that influence fleets' purchasing decisions about truck technology. In this study the key variable factor is the

level of funding the California Utilities provide for installing electric infrastructure for fleets that purchase battery electric trucks or buses. By examining the results of varying amounts of funding from the Utilities, including zero level of support, the Evaluation Team can use the model to estimate the effect of infrastructure funding on fleet adoption of BEVs.

The Evaluation Team disaggregated MDHD vehicles (trucks and buses) into several categories that encompass specific vehicle types and use patterns (such as transit buses, short-haul trucks, medium-duty delivery trucks, and others).¹⁹⁵ The Team then segmented these truck categories into ownership categories (early adopter, late adopter, and in-between) that have different impacts on truck purchases. Early adopters are those fleets that may perceive less risk or greater value in new technologies. Late adopters are those fleets that may perceive more risk or less value in new technologies. In-between fleets fall somewhere between the early and late adopters. The Evaluation Team used the model to generate the calculated market sales shares.

The model is structured as a nested multinomial logit model that includes several important choice factors that influence individual fleet decision-makers' preferences among a suite of vehicle technology options. Choice factors include private economic costs, non-monetary costs, and incentives or subsidies. The Evaluation Team used the model to calculate a total generalized cost, which is a numerical value that represents the summation of both monetary and nonmonetary factors, including capital cost, fuel cost, green public relations, uncertainty or risk associated with the new technology, incentives, refueling inconvenience, maintenance cost, carbon tax, and model availability cost. We calculated monetary factors in U.S. dollars and quantified nonmonetary factors according to certain functions so these factors could also be expressed in U.S. dollars.

The Evaluation Team calculated the generalized cost for each truck type (such as long haul, medium-duty urban, transit bus, and so on) for each technology type such as diesel, natural gas, hybrid, FCEV, BEV, and gasoline. We then used these generalized costs to derive the market share for each technology type. The Team applied a monotone transformation on the total generalized costs for each truck and technology type (e.g. fuel cell short-haul trucks, diesel transit buses, battery electric medium-duty delivery trucks, etc.) to yield purchase probabilities; the technology with the highest total generalized cost has the lowest purchase probability, the technology with the second highest total generalized cost has the second lowest purchase probability, and so on.

The Evaluation Team used a variety of methods to project future values for the various factors. We estimated capital cost increases for conventional vehicles assuming increasing after-treatment or engine costs necessary to reduce emissions. We estimated reductions in the cost of BEVs and FCEVs using models of component costs such as batteries, fuel cells, hydrogen storage tanks, and power electronics. We assumed that maintenance costs for conventional vehicles, expressed in dollars per mile, remain

¹⁹⁵ These vehicle categories do not line up exactly with the market sectors the Evaluation Team uses throughout this study, because the Team uses a modified version of the TCM developed by University of California, Davis, which was developed before the start of this evaluation.

constant and that these costs decrease over time for BEVs and FCEVs, based on studies of these advanced technologies in heavy-duty vehicles.

The Evaluation Team modeled nonmonetary costs, such as uncertainty or green public relations, with an exponential reduction in their monetary value based on the assumption that as the technology gains market acceptance, the disincentive (uncertainty) or incentive (green public relations) decreases. The nonmonetary factors have constants that determine the present disincentive or incentive value; however, these constants are difficult to pinpoint due to a lack of real-world data and the corresponding difficulty of properly calibrating the model. The model outputs the sales shares of each vehicle technology as a function of time.

The financial support the Utilities provided for the installation of hardware to charge fleet BEVs included support as required by AB 841 for TTM hardware along with the support available in the current Utility programs, including rebates for EVSE and incentives for BTM hardware. We ran several fleet adoption trajectories for each sector (vehicle type) depending on the level of support we assume the Utilities will provide. The sectors include transit buses, school buses, medium-duty vehicles, heavy-duty vehicles (short-haul), and transport refrigeration units (TRUs).

Model Inputs and Assumptions

The TCM uses a variety of inputs related to the various choice factors. In this section we describe some of the inputs the Team used, provide estimates of the values of those inputs, and discuss assumptions we made.

Vehicle Cost

Vehicle cost estimates tend to vary from study to study, so a complete set of data from a single study will be more consistent than data from separate studies. Different studies may choose slightly different vehicle configurations for a given truck type. For example, medium-duty delivery trucks can be found in Class 4 through Class 6 and can have a variety of components. For each market sector in this report, we first looked for studies that had a complete or nearly complete set of cost data for diesel, BEV, and FCEV technologies for 2023, 2025, and 2030. In some cases, no single study had such a complete set, so we used data from more than one study or used a single study with missing data and extrapolated for years when data was unavailable. In general, when it was necessary to combine data from different studies, we looked for studies that agreed reasonably well on cost estimates. The Evaluation Team also looked for studies that had similar projected costs for EV components for at least one technology type given that some studies assume significantly more rapid reductions than others.

Short-Haul Delivery Trucks

Studies by CARB¹⁹⁶, UC Davis¹⁹⁷, and ICCT¹⁹⁸ had reasonably complete cost estimates for short-haul trucks. In general, the estimates in these three studies agreed fairly closely for most of the costs. We chose to use the UC Davis values for each year and technology type. Table B-31 shows the cost inputs for short-haul trucks. We assumed that only diesel, BEV, and FCEV would have significant sales.

Table B-31. Cost Inputs for Short-Haul Trucks

Year	Technology		
	Diesel	BEV	FCEV
2020	\$119,000	\$275,000	\$312,000
2025	\$121,000	\$225,000	\$182,000
2030	\$123,000	\$160,000	\$144,000

Medium-Duty Vehicles

Studies by CARB¹⁹⁹ and UC Davis²⁰⁰ have fairly complete cost estimates for diesel, BEV, and FCEV medium-duty trucks. The Evaluation Team used the UC Davis costs. Medium-duty vehicles have a significant share of gasoline trucks, so we included gasoline in our costs. Table B-32 shows the cost inputs for medium-duty trucks.

Table B-32. Cost Inputs for Medium-Duty Vehicles

Year	Technology			
	Diesel	BEV	FCEV	Gasoline
2020	\$90,000	\$168,000	\$248,000	\$73,950
2025	\$92,000	\$143,000	\$142,000	\$85,000
2030	\$95,000	\$119,000	\$111,000	\$87,000

¹⁹⁶ Draft Advanced Clean Fleets Total Cost of Ownership Discussion Document. California Air Resources Board. September 9, 2021

¹⁹⁷ Burke, Andrew, Marshall Miller, Anish Kumar Sinha, Lewis Fulton, Evaluation of the Economics of Battery-Electric and Fuel Cell Trucks and Buses. Methods, Issues, and Results, Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-22-88, 2022.

¹⁹⁸ Ben Sharpe and Hussein Basma, A Meta-Study of Purchase Costs for Zero-Emission Trucks, International Council on Clean Transportation, Working Paper 2022-09, February 2022.

¹⁹⁹ Final Regulation Order, Advanced Clean Trucks Regulation, California Air Resources Board. 2021.
<https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf>

²⁰⁰ Burke, Andrew, Marshall Miller, Anish Kumar Sinha, Lewis Fulton, Evaluation of the Economics of Battery-Electric and Fuel Cell Trucks and Buses. Methods, Issues, and Results, Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-22-88, 2022.

Transit Buses

As part of CARB's ICT regulation, CARB created a transit fleet cost model that estimates the cost of diesel, CNG, battery electric, and fuel cell buses.²⁰¹ Table B-33 shows the cost inputs for transit buses.

Table B-33. Cost Inputs for Transit Buses

Year	Technology			
	Diesel	BEV	FCEV	CNG
2020	\$477,409	\$785,000	\$800,000	\$542,896
2025	\$536,281	\$775,000	\$742,760	\$602,445
2030	\$602,412	\$795,000	\$781,000	\$669,337

School Buses

The World Resources Institute published a study about school bus TCO that provides present costs for only diesel and BEV school buses.²⁰² The California HVIP program lists many eligible battery electric school buses but no fuel cell school buses, so we considered only diesel and BEV school buses for this study. We assumed that cost increases for diesel school buses would be similar to the increases CARB estimated for medium-duty delivery trucks. To estimate the cost reductions in BEV school buses through 2030, we assumed the same percentage reduction as seen for medium-duty and short-haul BEVs. Table B-34 shows the cost inputs for school buses.

Table B-34. Cost Inputs for School Buses

Year	Technology	
	Diesel	BEV
2020	\$103,000	\$352,000
2025	\$106,709	\$246,400
2030	\$110,403	\$221,760

Transportation Refrigeration Units

TRUs are refrigeration systems powered by diesel engines or battery packs that are integral to the unit. We considered them as separate systems, and rather than estimating the costs for the entire vehicle we estimated the cost for the units themselves. CARB produced a technology assessment of TRUs that includes estimates of their capital and operating costs but does not include costs for eTRUs.²⁰³ Go Electric produced an eTRU fact sheet that does include costs for both diesel and electric TRUs. The diesel

²⁰¹ California Air Resources Board, Transit Fleet Cost Model, 2023. Accessed on March 27, 2023. <https://ww2.arb.ca.gov/resources/documents/transit-fleet-cost-model>

²⁰² Levinson, M., P. Burgoyne-Allen, A. Huntington, and N. Hutchinson. "Recommended total cost of ownership parameters for electric school buses: Summary of methods and data." Technical Note. Washington, DC: World Resources Institute. 2023.

²⁰³ 2022 Technology Assessment: Non-Truck Transport Refrigeration Units (TRU), Trailer TRUs, Domestic Shipping Container TRUs, Railcar TRUs, and TRU Generator Sets. October 2022. <https://ww2.arb.ca.gov/sites/default/files/2022-10/CARB%202022%20TRU%20Technology%20Assessment%2010-14-22.pdf>

costs from the CARB and Go Electric sources were similar, so we used the capital costs from the Go Electric fact sheet. The sources did not attempt to project costs for 2030, and we assumed constant costs from 2025 through 2030. Only costs for diesel and battery electric TRUs are included in this study. Table B-35 shows capital costs for TRUs.

Table B-35. Costs Inputs for eTRUs

Year	Technology	
	Diesel	BEV
2025	\$30,100	\$34,750
2030	\$30,100	\$34,750

Fuel Costs

Weekly California diesel and gasoline fuel prices are collected by the Energy Information Agency.²⁰⁴ These prices vary somewhat from week to week, and the Evaluation Team chose an average for recent weeks. Electricity costs are taken from data supplied to the Team from the Utilities. These data vary slightly for different sectors, but we chose to use \$0.25 per kilowatt-hour for all sectors. UC Davis researchers have studied hydrogen fueling stations for several years and have produced estimates of future hydrogen costs for vehicles. These costs vary significantly based on a variety of factors. We chose to use \$12 per kilogram for 2025 and \$10 per kilogram for 2030. Table B-36 shows the projected prices for diesel, gasoline, electricity, and hydrogen through 2030. We assume prices will remain constant for all fuels except hydrogen.

Table B-36. Diesel, Gasoline, Electricity, and Hydrogen Costs in California

Year	Diesel (per gallon)	Gasoline (per gallon)	Electricity (per kWh)	Hydrogen (per kg)
2025	\$5.32	\$5.26	\$0.25	\$12
2030	\$5.32	\$5.26	\$0.25	\$10

Fuel Economy

The Evaluation Team used values for fuel economy for short-haul trucks, medium-duty delivery trucks, and transit buses from the UC Davis TCO study.²⁰⁵ The Team modeled each vehicle using the Advisor Simulation Program developed by Argonne National Lab and extensively modified at UC Davis.²⁰⁶ We

²⁰⁴ Weekly Gasoline and Diesel Prices. Accessed on May 8, 2024.
https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_sca_w.htm

²⁰⁵ Burke, Andrew, Marshall Miller, Anish Kumar Sinha, Lewis Fulton, Evaluation of the Economics of Battery-Electric and Fuel Cell Trucks and Buses. Methods, Issues, and Results, Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-22-88, 2022.

²⁰⁶ Burke, A.F. and Zhao, H., Projected fuel consumption characteristics of hybrid and fuel cell vehicles for 2015–2045, paper presented at the Electric Vehicle Symposium 25, Shenzhen, China, November 2010.

used values for school bus fuel economy for 2020 from the World Resources Institute study.²⁰⁷ Because the study did not project fuel economies, we assumed they would increase by the same ratio as the transit bus fuel economies from 2020 through 2030. Table B-37 shows the fuel economies for each sector and technology type over time.

Table B-37. Vehicle Fuel Economy for Each Sector in Miles per Gallon of Gasoline-Equivalent

Year	Diesel	Battery Electric	Fuel Cell	Gasoline	Natural Gas
Short-Haul					
2020	6.16	14.34	9.09		
2025	6.60	14.98	10.00		
2030	7.22	15.97	10.53		
Medium-Duty Vehicle					
2020	9.94	40.60	24.80	7.13	
2025	10.56	42.60	25.50	8.00	
2030	11.18	44.69	27.20	8.25	
Transit Bus					
2020	3.96	16.05	10.00		4.24
2025	4.40	16.85	11.11		5.08
2030	4.84	18.52	12.05		5.30
School Bus					
2020	6.59	22.10			
2025	7.32	23.21			
2030	8.05	25.50			

Note: Grayed out cells were not included in the model

TRUs are not used to propel vehicles and do not have associated fuel economies in energy per mile. Instead, TRU fuel use is calculated as the fuel used per hour multiplied by the expected number of hours in operation. The CARB assessment estimates TRU fuel use for diesel TRUs as \$5,200 per year and for eTRUs as \$3,040 per year.²⁰⁸

Maintenance Costs

Relatively little data exists on maintenance costs for advanced technology trucks. Until more trucks are commercialized and data becomes available, we will have to make assumptions about the expected reductions in cost for BEVs and FCEVs. A study at UC Davis estimated maintenance cost reductions over

²⁰⁷ Levinson, M., P. Burgoyne-Allen, A. Huntington, and N. Hutchinson. "Recommended total cost of ownership parameters for electric school buses: Summary of methods and data." Technical Note. Washington, DC: World Resources Institute. 2023.

²⁰⁸ 2022 Technology Assessment: Non-Truck Transport Refrigeration Units (TRU), Trailer TRUs, Domestic Shipping Container TRUs, Railcar TRUs, and TRU Generator Sets. October 2022. <https://ww2.arb.ca.gov/sites/default/files/2022-10/CARB%202022%20TRU%20Technology%20Assessment%2010-14-22.pdf>

time for heavy-duty vehicles.²⁰⁹ We used the results from that study to project maintenance costs through 2030 for BEVs and FCEVs. The study concluded that BEV maintenance costs are currently roughly 12% lower than those for diesel and will decrease to 29% lower than diesel maintenance costs in 2035. Current FCEV maintenance costs are roughly equal to those for diesel and are expected to decrease to 25% lower than diesel maintenance costs in 2035.

The World Resources Institute study on school buses uses a maintenance cost of \$0.57 for diesel school buses.²¹⁰ The Evaluation Team’s review uses \$0.60 for transit bus maintenance costs.²¹¹ We assumed the same cost reduction results for BEVs and FCEVs as in the UC Davis study. Table B-38 shows the maintenance costs for each sector and technology over time.

Table B-38. Maintenance Costs for Each Sector and Technology in Dollars per Mile

Sector and Year	Diesel	BEV	FCEV
Short-Haul			
2020	\$0.20	\$0.18	\$0.20
2035	\$0.20	\$0.14	\$0.15
Medium-Duty Vehicle			
2020	\$0.20	\$0.18	\$0.20
2035	\$0.20	\$0.14	\$0.15
School Bus			
2020	\$0.57	\$0.50	\$0.57
2035	\$0.57	\$0.40	\$0.43
Transit Bus			
2020	\$0.60	\$0.53	\$0.60
2035	\$0.60	\$0.43	\$0.45

The CARB assessment of TRUs estimates TRU maintenance costs as \$1,900 per year for diesel TRUs and \$1,000 per year for eTRUs.

Miscellaneous Inputs

There are several additional key inputs to the TCM. Table B-39 shows the values for these inputs for each sector.

²⁰⁹ Wang, Guihua, Marshall Miller, Lewis Fulton, Estimating Maintenance and Repair Costs for Battery Electric and Fuel Cell Heavy Duty Trucks. Institute of Transportation Studies, University of California, Davis, UCD-ITS-RR-22-28, 2022.

²¹⁰ Levinson, M., P. Burgoyne-Allen, A. Huntington, and N. Hutchinson. “Recommended total cost of ownership parameters for electric school buses: Summary of methods and data.” Technical Note. Washington, DC: World Resources Institute. 2023.

²¹¹ Third Party Evaluation Report, *Standard Review Projects and AB 1082/1083 Pilots. Evaluation Year 2021*. Cadmus Group, Energetics Incorporated, 2022.

Table B-39. Miscellaneous Inputs for Each Sector

	Short-Haul	Medium-Duty Vehicle	Transit Bus	School Bus	TRU
Discount Rate	7%	7%	7%	7%	7%
Payback Period	4 years	8 years	12 years	12 years	7 years
VMT per Year	50,000 miles	20,000 miles	43,000 miles	14,000 miles	N/A
Maximum Vehicle Incentive					
BEV	\$160,000	\$60,000	\$120,000	\$140,250	N/A
FCEV	\$280,000	\$60,000	\$240,000	N/A	N/A
LCFS Cost Reduction					
Electricity 2025	\$0.1/kWh	\$0.1/kWh	\$0.1/kWh	\$0.1/kWh	\$0.1/kWh
Electricity 2030	\$0.09/kWh	\$0.09/kWh	\$0.09/kWh	\$0.09/kWh	\$0.09/kWh
Hydrogen 2025	\$1.5/kg	\$1.5/kg	\$1.5/kg	\$1.5/kg	\$1.5/kg
Hydrogen 2030	\$1.25/kg	\$1.25/kg	\$1.25/kg	\$1.25/kg	\$1.25/kg

Vehicle incentives come from the California HVIP program and the Federal Commercial Clean Vehicle Credit and can vary somewhat in certain circumstances. An incentive cannot exceed 90% of the cost difference between the ZEV and the diesel vehicle. These incentives are continually updated but projections of future values are not available. We assumed that the present values would hold and reduced the incentive to 90% of the ZEV-to-diesel cost difference as technology costs change into the future.

The LCFS cost reduction is calculated from the LCFS credit price, fuel carbon intensities, and the yearly carbon intensity target. We assumed an average credit price of \$75 for 2025 and 2030.

Assumptions

CARB has passed the ACT²¹² and the ACF regulations,²¹³ which require truck manufacturers to provide ZEV trucks for sale and for fleets to purchase ZEV trucks based on specified timelines. The regulations are quite aggressive and require ZEVs to be sold and purchased starting in 2024. This analysis ignores these regulations and assumes that the sales percentage of ZEVs will be determined solely by the model inputs and purchase decision factors.

²¹² Final Regulation Order, Advanced Clean Trucks Regulation, California Air Resources Board. 2021.
<https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf>

²¹³ Advanced Clean Fleets Regulation and Advisories, California Air Resources Board. Accessed May 2024.
<https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets/advanced-clean-fleets-regulation-advisories>

Appendix C. Survey Instruments

SRP Evaluation: MDHD Fleet Manager Survey (EY2024)

Survey Purpose: This online survey is designed to engage MDHD fleet managers whose fleets participated in one of the SRP-funded transportation electrification programs. The survey will assess their experience in the program, factors that led to successful electrification, the benefits and costs of electrification, and their view on broader market trends. The survey will be conducted via Qualtrics on a yearly basis. Depending on survey participation rates and count of completed sites, the evaluation team may also consider fielding the survey as a phone survey instead of an online survey.

Research Objectives	Corresponding Question Numbers
1. Identify the factors that facilitate successful fleet electrification and lessons learned	
What strategies lead to viable sites and successful deployments?	C3-C9
What would fleet partners or managers have done differently, if anything?	C11
2. Explore the benefits of TE for fleets and for fleet drivers	
Have fleet partners/managers heard from drivers about their experience? Are there benefits associated with air quality, health, stress, and noise?	D1-D2
How did TCO change after the fleet was electrified, if at all? What were the ongoing costs of fueling and maintenance before/after participating in the program?	E1-E3
3. Assess the experience of fleet partners and managers with the program and infrastructure	
How reliable and user-friendly is the electric vehicle charging equipment?	C3-C6
How, if at all, do fleets engage in load management? Why or why not?	C10-C16
Have fleets experienced any operational tradeoffs or loss of flexibility, and if so, how severe are these impacts?	E1
How satisfied are fleet managers with the program overall? How does overall satisfaction vary by market segment?	B1-B4
4. Gauge market impacts, trends, and identify market barriers	
Which vehicle and market segments are seeing the most uptake? To what degree can we expect that to change as other incentives are scaled up or scaled back, and as technology and costs improve?	F1-F2, F7-F8
What are the barriers to fleet electrification and how do these differ by vehicle or market segment?	F3-F4
How did the program change electrification within fleets, and do the fleets plan to accelerate TE-related procurement because of the experience?	F5-F6, F9-F10
5. Assess program attribution	
What type of transportation electrification project would participants have undertaken in absence of the utility program? Have the fleets decided to electrify more of their fleets without incentives from the fleet electrification program or another organization, due to their participation in the fleet electrification program?	G1-G5, H1-H5

Target Audience: Fleet Managers of operational sites

Desired number of completions: Census of all operational sites (sites where AMI and/or EVSP data were received from the Utility or EVSP) per utility. The below are cumulative completion totals across the entire program cycle. We will determine completion targets for each utility

during each fielding wave.

- Liberty: 1
- PG&E: 700
- SCE: 870
- SDG&E: 300

Estimated timeline for fielding: The next wave of fleet manager surveys will be conducted in Q4 2024, with a subsequent wave in Q1 2025.

Variables to be Pulled into Survey:

- Email
- FirstName
- LastName
- UTILITY (SCE/SDGE&E/PG&E/Liberty; read-in)
- PROGRAM_NAME (read-in; do not include “program”)
- Organization

Sample Fleet Manager Contact Info Collection Email

To: [EMAIL – Site Host]

From: [Cadmus]

CC: [SCE/SDG&E/PG&E/Liberty MDHD PM and Customer Account Manager]

Subject: Survey with fleet managers for the [UTILITY] fleet electrification program

Dear [FirstName AND LastName],

Thank you for working with [UTILITY] to expand transportation electrification. As part of our evaluation of the [UTILITY]’s [PROGRAM_NAME] program, we are surveying fleet managers from each activated project about their experience during installation, their fleet operations, and the benefits/costs of transportation electrification. Could you please provide the contact information (name, title, email, phone) for the most appropriate person within your organization so we may reach out to them and invite them to complete the 20-minute online survey?

Survey results are anonymized and the utility will not be able to see respondents’ individual responses.

Thank you,

CADMUS PERSON’S FIRST AND LAST NAME

THEIR TITLE

CADMUS GROUP

CLIENT CONTACT PERSON'S FIRST AND LAST NAME
THEIR TITLE
COMPANY NAME

Email Invitation

To: [EMAIL]
From: [Cadmus]

CC: [SCE/SDG&E/PG&E/Liberty MDHD PM and Customer Account Manager]
Subject: Your experience with the [SCE/SDG&E/PG&E/Liberty] fleet electrification program

Dear [FirstName AND LastName],

As part of [UTILITY]'s fleet electrification program evaluation, we invite you to share your opinion about your experience electrifying your fleet. Your experience can provide valuable feedback about how to improve the program experience for other fleets. Your input is very important to us and will be anonymized and only used for research purposes – utilities will not be able to see individual responses. **The survey will take about 20 minutes to complete.**

Click the link below to take the survey (or copy and paste into your browser):

[auto-generated link]

If you feel that someone else is better positioned to answer this survey, could you please forward the email to that person and copy Liz.Ross@cadmusgroup.com?

If you have any questions about this research, or any difficulties taking the survey, please contact Liz Ross at The Cadmus Group, the national research firm conducting this survey for the utilities. You can reach Liz by replying directly to this email or by calling (703) 516-7713.

Thank you in advance for sharing your experiences and your time.

CADMUS PERSON'S FIRST AND LAST NAME
THEIR TITLE
CADMUS GROUP

CLIENT CONTACT PERSON'S FIRST AND LAST NAME
THEIR TITLE
COMPANY NAME

Reminder Invitation

To: [EMAIL]
From: [SCE/SDG&E/PG&E/Liberty] Feedback

Subject: We still want to hear about your experience with the [SCE/SDG&E/PG&E/Liberty] transportation electrification program!

Dear [FirstName AND LastName],

We recently invited you to tell us about your experience with the [UTILITY] fleet electrification program. Your experience can provide us with valuable feedback that can help improve program experience for participating fleets. Your input is very important to us, will be kept confidential, and only used to improve our programs for customers like you. **Please take 20 minutes today to complete the survey.** Survey results are anonymized and the utility will not be able to see respondents' individual responses.

Click the link below to take the survey (or copy and paste into your browser):

[auto-generated link]

If you feel that someone else would be better positioned to answer this survey, could you please forward the email to that person and copy Liz.Ross@cadmusgroup.com?

If you have any questions about this research, or any difficulties taking the survey, please contact Liz Ross at The Cadmus Group, the national research firm conducting this survey on our behalf. You can reach Liz by replying directly to this email or by calling (703) 516-7713.

Thank you in advance for sharing your experiences and your time.

CADMUS PERSON'S FIRST AND LAST NAME

THEIR TITLE

CADMUS GROUP

CLIENT CONTACT PERSON'S FIRST AND LAST NAME

THEIR TITLE

COMPANY NAME

Survey Introduction and Screener

Welcome! Thank you for sharing your experience with the [PROGRAM_NAME] program, offered by [UTILITY]. This survey will take about 20 minutes to complete and will ask questions about fleet electrification and the benefits of transportation electrification. Your responses will remain confidential.

[SCREEN OUT TERMINATION MESSAGE:] Those are all the questions we have. Thank you.

A. Overview & Background Information

To begin, we'd like to ask you some general background questions.

- A1. What types of vehicles/equipment do you have in your fleet? [SELECT ALL THAT APPLY; FORCE RESPONSE]

1. School bus
2. Transit bus
3. Medium-duty vehicles
4. Heavy-duty vehicles
5. Port cargo trucks
6. Airport ground support equipment
7. Forklifts
8. Truck refrigeration unit
9. Truck stop electrification technology
10. Other (#1) [PLEASE SPECIFY]
11. Other (#2) [PLEASE SPECIFY]
12. Other (#3) [PLEASE SPECIFY]

CREATE EMBEDDED DATA BASED ON RESPONSE TO A1:

IF A1 = 1, school_bus = TRUE

IF A1 = 2, transit = TRUE

IF A1 = 5, port = TRUE

IF A1 = 6, airport = TRUE

IF A1 = 7, forklift = TRUE

IF A1 = 8, distribution = TRUE

A2. Please specify the number of internal combustion engine and electric vehicles **currently in your fleet**:

	(1) Number of internal combustion engine vehicles	(2) Number of electric vehicles
[VEHICLE SELECTED IN A1]		
[VEHICLE SELECTED IN A1]		
[VEHICLE SELECTED IN A1]		
[VEHICLE SELECTED IN A1]		
Other vehicle type; please specify: [OPEN END]		
Other vehicle type; please specify: [OPEN END]		
Total Vehicles	[AUTOSUM]	[AUTOSUM]

A3. Please specify the number of electric vehicles/equipment that you **plan to acquire in the next 5 years and in the next 10 years**.

	(3) Number of electric vehicles you plan to acquire in the next 5 years	(4) Number of electric vehicles you plan to acquire in the next 10 years
[VEHICLE SELECTED IN A1]		
[VEHICLE SELECTED IN A1]		
[VEHICLE SELECTED IN A1]		
[VEHICLE SELECTED IN A1]		
Other vehicle type; please specify: [OPEN END]		
Other vehicle type; please specify: [OPEN END]		
Total Vehicles	[AUTOSUM]	[AUTOSUM]

A4. Are there any other types of vehicles/equipment you plan to electrify in the next 10 years? If so, please state the vehicle/equipment type, the number of vehicles, and the rough timeframe.

1. [OPEN END]

A5. Did your participation in the [PROGRAM_NAME] program change the number of electric vehicles you acquired or planned to acquire? [FORCE RESPONSE]

1. Yes

2. No

A6. [ASK IF A5=1] How did your participation in the [PROGRAM_NAME] program change the number of electric vehicles you acquired or planned to acquire? Please specify the vehicle type, the change in number of vehicles, and the timeframe.

1. [OPEN END]

A7. Since site completion, approximately how many medium- and heavy-duty internal combustion vehicles/equipment have been retired?

A8. Roughly what percent of your fleet's routes are within disadvantaged communities? If you are unsure about which communities are designated as disadvantaged, please reference [this map from the CA State government](#) and try to give your best guess.

1. [DROPDOWN WITH PERCENTAGE RANGES OF 10% INCREMENTS]

B. Program Experience

Now, we'd like to ask you a few questions about your experience in **[UTILITY] [PROGRAM_NAME]** program.

B1. Thinking about your experience with the **[PROGRAM_NAME]** program, how satisfied are you with the following? **[SELECT ONE PER ROW]**

	Very satisfied	Somewhat satisfied	Not too satisfied	Not at all satisfied
[SKIP FOR LIBERTY] Application process (through signing of program participation agreement - includes site assessment and conceptual design)				
Design and permitting process (detailed site design, easement, permitting)				
Construction and installation process (infrastructure construction and installation of customer-side, behind-the-meter infrastructure)				
Rebate process (documentation processing, rebate receipt)				
Amount of the rebate you received or expect to receive from [UTILITY] for the purchase of EV charging equipment, if eligible				
Amount of the rebate you received or expect to receive from [UTILITY] for the installation of customer-side, behind-the-meter infrastructure, if eligible				
Benefits you received through the program (i.e., provision of utility-side, to-the-meter infrastructure by [UTILITY])				
Experience working with [UTILITY] staff				
[PROGRAM_NAME] program overall				

B2. Are there aspects of the **[PROGRAM_NAME]** program that you were particularly **satisfied** with? If so, which ones, and why?

1. **[OPEN ENDED]**

B3. Are there aspects of the **[PROGRAM_NAME]** program that you were particularly **dissatisfied** with? If so, which ones, and why?

1. **[OPEN ENDED]**

B4. On a scale from 0 to 10, with '10' being the most likely, how likely would you be to recommend this program to another company?

1. **[RECORD 0-10 RATING; IF STATING "ALREADY DID RECOMMEND", CODE AS 10]**

B5. Have you shared anything about the program with another company?

1. Yes
2. No
3. Don't know

B6. [IF B5=1] What did you share about the program with them?

C. Factors Leading to Successful Fleet Electrification and Lessons Learned

Now, we'd like to talk to you about the fleet electrification process.

C1. Why did your fleet decide to transition to EVs? (Select all that apply.) **[MULTIPLE RESPONSE]**
[RANDOMIZE 1-10]

1. Regulatory requirement
2. Corporate/organizational sustainability goals or initiatives
3. Expected fuel cost savings
4. Expected maintenance cost savings
5. Better technology
6. Driver comfort/ preference
7. Environmental benefits
8. Rebates/incentives for EVs
9. Rebates/incentives for EV charging infrastructure
10. Operational benefits
11. Other, please specify: **[OPEN ENDED]**

C2. How did you first learn about the **[PROGRAM_NAME]** program? If there were multiple sources, please select the primary source.

1. From **[UTILITY]**
2. From an EV/EVSE manufacturer
3. From a contractor/engineer
4. From another fleet
5. Another source, please specify: **[OPEN ENDED]**

C3. How would you rate the reliability of the electric vehicles that are part of your fleet?

1. Very reliable
2. Somewhat reliable
3. Not too reliable
4. Not at all reliable

C4. How would you rate the reliability of the electric vehicle charging equipment? **[FORCE RESPONSE]**

1. Very reliable
2. Somewhat reliable
3. Not too reliable
4. Not at all reliable

C5. **[IF C4 = 3 OR 4]** What challenges have you had with the reliability of the electric vehicle charging equipment?

1. **[OPEN ENDED]**

- C6. How would you rate the ease of using the electric vehicle charging equipment?
1. Very easy to use
 2. Somewhat easy to use
 3. Not too easy to use
 4. Not at all easy to use
- C7. **Prior to joining the program**, did you know that you needed **upgrades to the electrical infrastructure from the utility grid to your meter** to charge electric vehicles at your site?
1. Yes
 2. No
- C8. Did your site design, procure, install, and maintain the make-ready infrastructure on the customer side of the meter, or did the utility do this work?
1. Our site
 2. The utility
 3. Don't know
- C9. Do you regularly receive information on, or know where to find out how much your electric fuel costs?
1. Yes
 2. No
- C10. Are you aware that the utility charges different rates per kilowatt-hour depending on the time of day?
1. Yes
 2. No
- C11. Are you aware of the cost to your company to charge your fleet?
1. Yes
 2. No
- C12. **[GRID IMPACTS]** What actions, if any, do you take to ensure you are purchasing the lowest cost electricity for charging fleet vehicles? A term you may have heard for this is "load management." (Select all that apply.)
1. By training drivers or other staff to plug in vehicles during off-peak times
 2. By using load management options of my fleet's EVs or EV charging equipment
 3. By using a software program
 4. Our fleet does not engage in load management **[EXCLUSIVE]**
 5. Other, please specify: **[OPEN ENDED]**
- C13. **[GRID IMPACTS]** **[ASK IF C12=1, 2, OR 3]** Why did you implement a load management strategy? (Select all that apply.)
1. Required to implement it; please specify who/what entity required load management:
[OPEN ENDED]

2. Lower cost of charging via charging time management
3. Manage stability of our electrical system
4. Reduce the need to install additional power source(s)
5. Other, please specify: **[OPEN ENDED]**

C14. **[GRID IMPACTS]** **[ASK IF C12=4]** Why do you not currently engage in load management?
(Select all that apply.)

1. Not interested
2. Do not have the capacity to put it into place/manage the process
3. Not required to implement it
4. Too complicated to implement
5. Issues with the software working as intended
6. Compatibility issues with software/chargers/vehicles
7. Site has not been operational long enough
8. Other, please specify: **[OPEN ENDED]**

C15. **[GRID IMPACTS]** **[ASK IF C12=4]** If you don't currently engage in load management, how, if at all, do you plan to? (Select all that apply.)

1. By training drivers or other staff to plug in vehicles during off-peak times
2. By using load management options of my fleet's EVs or EV charging equipment
3. By using a software program
4. Our fleet does not plan to engage in load management **[EXCLUSIVE]**
5. Other, please specify: **[OPEN ENDED]**

C16. What factor(s) were important in your decision regarding which network provider you selected for charging capabilities? (Select all that apply.)

1. The monthly fee charged by the network provider
2. The specific operations and maintenance services offered by the network provider
3. Superior customer service interface and responsiveness of the network provider
4. The network provider was responsible for implementation load management
5. They were the only provider who responded to our RFP
6. Recommended by a contractor/person within the industry
7. Other, please specify: **[OPEN ENDED]**

C17. Thinking about the complete process of electrifying your fleet, what would you have done differently if you were to go through it again, if anything?

1. **[OPEN ENDED]**

D. Additional Benefits of Transportation Electrification

Next, we would like to ask you questions about the benefits of transportation electrification and fleet drivers' experience.

D1. What ancillary benefits do you think will be realized for your community/fleet as a result of

electrifying? These could be benefits to any party, such as your company, your drivers, or your community, among others. **[SELECT ONE PER ROW]**

	I think there will be significant benefits	I think there will be some benefits	I think there will be no benefits	Not sure
Improved air quality/health (i.e., breathing in less pollution)				
Improved driver/passenger comfort/convenience (i.e., easier to drive, smoother to ride in)				
Reduction in noise pollution (i.e., quieter when driving, accelerating)				
Increased fleet flexibility				
Encourages other individuals or fleets to convert to EV				

D2. What other benefits, if any, do you think will be realized for your community/fleet as a result of electrifying? These could be benefits to any party, such as your company, your drivers, or your community, among others.

1. **[OPEN END]**

E. Cost of Transportation Electrification

Next, we will ask about the operational and ownership costs of fleet electrification.

E1. Please think about all the costs associated with operating and maintaining your fleet. For each cost type shown below, please estimate how much the cost has changed since transitioning your fleet to EVs.

Compared to before transitioning to EVs...

	Costs are now lower	Costs are relatively equal	Costs are now higher	Don't know
Vehicle maintenance costs (i.e., purchasing replacement parts, labor to complete repairs, and regular maintenance)				
Vehicle fueling costs (i.e., the cost of fuel)				
Vehicle fueling infrastructure costs (i.e., the costs of the equipment needed to fuel your fleet)				
Training – drivers				
Training – maintenance staff				

Cost of additional support/staff time				
Cost of additional time on warranty or service claims				
Cost of fueling schedule modifications				
Cost of changes to parking lot configuration				
Cost of route modifications to accommodate range limitations of EVs				
Loss of flexibility				

E2. Have these operational and maintenance costs been what you expected?

	Yes	No, lower than expected	No, higher than expected	Don't know
Vehicle maintenance costs (i.e., purchasing replacement parts, labor to complete repairs, and regular maintenance)				
Vehicle fueling costs (i.e., the cost of fuel)				
Vehicle fueling infrastructure costs (i.e., the costs of the equipment needed to fuel your fleet)				
Training - drivers				
Training – maintenance staff				
Cost of additional support/staff time				
Cost of additional time on warranty or service claims				
Cost of fueling schedule modifications				
Cost of changes to parking lot configuration				
Cost of route modifications to accommodate range limitations of EVs				
Cost of needing to maintain ICE vehicles for routes or events that cannot be reliably served by EVs				

E3. Have there been any other impacts/costs you've incurred as a result of electrifying? This could include costs for items such as employee labor, equipment purchases, or space utilization, among others.

1. **[OPEN END]**

F. Market Impacts, Trends, and Market Barriers

Next, we'd like to ask you about the broader market and what may be preventing further electrification.

F1. How well positioned do you think your industry/sector is for electrification?

1. Extremely well-positioned
2. Somewhat well-positioned

3. Neutral
4. Not too well-positioned
5. Not at all well-positioned

F2. Why did you give this rating?

1. [OPEN ENDED]

F3. Which of the following barriers to electrification did your fleet face before participating in the [PROGRAM_NAME] program? [MULTIPLE RESPONSE; RANDOMIZE 1 – 6; FORCE RESPONSE]

1. The cost of the EVs was prohibitive
2. The cost of installing EV charging infrastructure was prohibitive
3. It was challenging to find the right types of EVs for our needs
4. Our routes were too long for the EVs available
5. There was insufficient charging equipment on/near our routes
6. Finding qualified drivers or maintenance technicians for EVs
7. Other, please specify: [OPEN ENDED]
8. None of the above [EXCLUSIVE]

F4. You mentioned that the following were barriers to electrification before participating in the [PROGRAM_NAME] program. Do any of these barriers **still exist after you participated in the program?** [INSERT OPTIONS SELECTED IN F3; MULTIPLE RESPONSE; RANDOMIZE 1 - 6]

1. The cost of the EVs was prohibitive
2. The cost of installing EV charging infrastructure was prohibitive
3. It is challenging to find the right types of EVs for our needs
4. Our routes are too long for the EVs available
5. There is insufficient charging equipment on/near our routes
6. Finding qualified drivers or maintenance technicians for EVs
7. [OPEN-ENDED RESPONSE IF OTHER WAS SELECTED]
8. None of the above

F5. Do you plan to accelerate procurement of EVs and related equipment because of your experience with the program? [FORCE RESPONSE]

1. Yes
2. No change
3. No, we plan to slow procurement

F6. [IF F5= 1] What aspect(s) of the program have impacted your decision to accelerate your procurement of EVs?

1. [OPEN ENDED]

F7. Are you satisfied with current EV options on the market for your sector?

1. Yes
2. No

F8. What are the limitations of current EV options for your sector?

1. [OPEN ENDED RESPONSE]

F9. What types of technologies and processes, if any, have been particularly helpful in electrifying your fleet?

1. [OPEN ENDED RESPONSE]

F10. The purchase price and operating costs (fuel and maintenance) of electric trucks may differ from those of diesel trucks. Given what you know or believe about requirements for fleets to purchase zero-emission medium- and heavy-duty trucks, do electric or diesel trucks seem like a riskier purchase in the **next 3 years**? [RANDOMIZE ORDER]

In the **next 3 years**...

1. **Electric trucks** seem like a riskier purchase
2. **Diesel trucks** seem like a riskier purchase

F11. Given what you know or believe about requirements for fleets to purchase zero-emission medium- and heavy-duty trucks, do electric or diesel trucks seem like a riskier purchase in the **next 10 years**? [RANDOMIZE ORDER]

In the **next 10 years**...

1. **Electric trucks** seem like a riskier purchase
2. **Diesel trucks** seem like a riskier purchase

G. Attribution - Freeridership

G1. If the [UTILITY] fleet electrification program had not been available, which of the following alternatives would your organization most likely have done?

1. Proceeded with a smaller, but similar transportation electrification project (Please specify how much smaller in terms of electric vehicles/chargers (e.g. 10% less, 40% less, etc): _____)
2. Installed/procured an internal combustion engine (ICE) transportation project or whatever was required by regulation
3. Done nothing within 20 years
4. Applied for an exemption
5. Done the same thing as completed through the program
6. Something else (Please specify: _____)

- G2. [ASK IF G1≠3, 6] You said previously that your organization would have [G1 RESPONSE]. In terms of timing, if the [UTILITY] fleet electrification program had not been available, when would your organization have [G1 RESPONSE]?
1. At the same time
 2. Later, but within 5 years
 3. Between 5 and 10 years
 4. Between 10 years and 15 years
 5. Between 15 years and 20 years
 6. More than 20 years
 7. Something else (Please specify: _____)
- G3. Did your organization learn about the [UTILITY] fleet electrification program **BEFORE** or **AFTER** you decided to implement the transportation electrification project that was eventually implemented?
1. Before
 2. After
- G4. Please allocate 10 points on the overall importance of the following utility **program factors** versus the most important **non-program factors** in your organization's decision to procure the transportation electrification project. Using a 0 to 10 rating scale, where 0 means "not at all important" and 10 means "extremely important". **Please ensure that the two ratings total 10.**
1. [Record Program Factors Rating]
 2. [Record Non-Program Rating]

Program Factors

- A. The availability of the utility program incentives, rebates, or discounts
- B. Recommendations or suggestions from utility program staff
- C. Recommendations or suggestions from your utility account representative
- D. Recommendations or suggestions from a program vendor or contractor

Non-Program Factors

- A. Funding sources outside of the utility program
- B. Internal policy or requirements inside your company or organization
- C. [DISPLAY IF transit=TRUE] Transit agency requirements to purchase zero emission buses by January 2023 (for large fleets, acquisition must be 25% for 2023-2025, 50% for 2026-2028, 100% in 2029; for small fleets, 25% for 2026-2028, 100% for 2029)
- D. [DISPLAY IF distribution=TRUE] Distribution fleets requirements to meet CARB's pending zero-emission operation targets in 2024 and 2025 (acquisition must be 100% ZEV starting in 2024 OR hit fleet levels of 10% by 2025, 25% by 2028, 50% by 2031, 75% by 2033, 100% by 2035)
- E. [DISPLAY IF airport=TRUE] Airport group support equipment requirements to meet their

initial 2027 compliance targets

- F. [DISPLAY IF school_bus=TRUE] School bus requirements in consideration to meet potential future compliance targets
- G. [DISPLAY IF port=TRUE] Port cargo truck requirements to meet their initial 2024 compliance targets
- H. [DISPLAY IF forklift=TRUE] Forklift requirements to meet their future compliance targets
- I. Concerns about environmental effects or global warming
- J. Your organization's desire to save money on transportation energy costs
- K. Your interest in the transportation electrification technology
- L. Your desire to reduce operations and maintenance costs
- M. Your desire to have the latest technology
- N. Your desire to procure transportation electrification to attract employees, for your employees or to improve employee morale

G5. If the utility program had not been available, what is the likelihood that you would have procured exactly the same program-qualifying transportation electrification project that you did through the program. Use a likelihood scale from 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely".

1. [Record Likelihood Rating]

H. Attribution – Participant Spillover

H1. Since you started participating in the program, has your organization decided to go beyond the electrification commitments you made in the Vehicle Acquisition Plan (VAP) **without incentives** from the [UTILITY] fleet electrification program?

1. Yes
2. No [SKIP TO CLOSING]
98. Don't know [SKIP TO CLOSING]

H2. [ASK IF H1=1] Please describe the additional electrification your organization has decided to pursue without support from the [UTILITY] fleet electrification program.

1. [RECORD VERBATIM]

	(H2.1) Describe vehicle type:	(H2.2) Specify the number of vehicles:	(H2.3) Specify the number of new chargers you installed:	(H2.4) Additional notes:
First vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]
Second vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]
Third vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]

Fourth vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]
Fifth vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]

H3. [ASK IF H1=1] Did you receive any financial support from **any** organization for **any** of the additional electrification you noted above? [FORCED RESPONSE]

1. Yes
2. No
98. Don't know

H4. [ASK IF H3=1 & IF H2.1 NOT EMPTY] H4.1. What organizations provided the financial support?
H4.2. What type and amount of financial support did you receive from each?

	(H4.1) What organization provided the financial support?	(H4.2) What type and amount of financial support did you receive?	(H4.3) What aspects of the additional electrification did the financial support cover (i.e., chargers, vehicles, both)?
First vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]
Second vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]
Third vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]
Fourth vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]
Fifth vehicle type	[RECORD VERBATIM]	[RECORD VERBATIM]	[RECORD VERBATIM]

H5. [ASK IF H1=1] How important was your participation in the [UTILITY] fleet electrification program on your decision to pursue additional electrification without program support? Please use a scale from 0 to 10, where 0 is “not at all important” and 10 is “extremely important.”

1. [RECORD RATING]

End of Survey Message

Thank you for your responses! In addition to this survey, we are also conducting interviews with a select number of fleet managers to discuss specific topics. We may reach out to you in the future about an interview. We appreciate your time and assistance.

SRP Evaluation: MDHD Fleet Withdrawal Interview Guide, EY2024

This interview seeks to learn more from program applicants (site hosts, fleet managers, or other relevant staff) who ended or indefinitely paused their participation in the California Standard Review Projects to electrify Medium-Duty and/or Heavy-Duty (MDHD) fleet vehicles. Questions in this interview guide seek to understand applicants' experience with the program, including their initial interest and factors that contributed to ending or pausing participation. Additionally, this survey seeks to understand the applicants' perspective on the EV market overall, as well as their fleet readiness for electrification. This interview is designed to take approximately 30 minutes and be administered via telephone.

Research Objectives	Corresponding Question Numbers
1. Identify the factors that facilitate successful fleet electrification and lessons learned	
Why did the applicant decide to pursue electrification initially? What benefits did applicants think they might gain from electrifying?	B1
How satisfied were applicants with the program overall? How does overall satisfaction vary by market segment?	B3-B10
Would applicants who withdrew from the program say that the program provides appropriate financial and non-financial support?	2-C2
Why did applicants decide to drop out of the program?	D1
What factors would have facilitated applicant participation in the program, if any?	D3
What would applicants have done differently, if anything?	D4-D5
What did applicants do instead of pursuing fleet electrification through the program?	C4-C8

Additional questions for funnel analysis:

- B2: How did you first hear about the IOU programs?
- B4: Summarize your path during the application and contract signing?
- D1: What precisely made you drop out?
- D2: How far along were you when you dropped out?
- C3: Did you pursue alternative funding paths (e.g., Rule 29, Energize, federal funds)?
- D3: Are there program changes that would have made you more likely to stay in the program?

Target Audience: Utility customers who submitted an application and subsequently withdrew from the program. This excludes applicants who were deemed ineligible for the program.

Desired number of completions: 10 total interviews, pending available sample; at least one for each utility

Estimated timeline for fielding: To be conducted in Q1 2025 for all withdrawn sites from EY2024.

Variables to be Pulled into Interview

- Email
- FirstName
- LastName

- UTILITY (SCE, SDG&E, PG&E; read-in)
- PROGRAM_NAME (read-in; does not include “program” i.e., “EV Fleet” for PG&E)
- Organization

Email Invitation

To: [EMAIL]

From: [Cadmus]

CC: [SCE/SDG&E/PG&E MDHD PM and Customer Account Manager]

Subject: Interview Regarding Your Experience with the [SCE/SDG&E/PG&E] [PROGRAM_NAME] Program

Dear [FIRSTNAME AND LASTNAME],

Thank you for applying to the [SCE/SDG&E/PG&E] [PROGRAM_NAME] program. Our records indicate you did not complete an EV charging project as a part of [PROGRAM_NAME] program. We would like to conduct an interview with you to gather your feedback about how to improve the program experience for fleets in the future. Your input is very important to us and will be kept confidential and only used for research purposes. **The interview will take approximately 30 minutes to complete via telephone.**

To schedule an interview:

1. Navigate to our Microsoft Bookings page [here](#).
2. Select one of the four available interview services to find a date and time that works best with your availability.
 - a. **Note: If the first interviewer does not have available that matches yours, please check each of the four availability services.** All services pertain to the California Medium- and Heavy-Duty Fleet Electrification Program interview opportunity.
3. Fill in your information and select “Book.”

Once you have booked a time slot, you will receive an email from Microsoft with details. Please reach out to Mark Janett at The Cadmus Group, the national research firm conducting this interview on the utility’s behalf, with any inquiries or if you encounter any difficulties. Mark may be reached at (617) 673-7194 or mark.janett@cadmusgroup.com.

Thank you in advance for sharing your experiences and your time.

CADMUS PERSON’S FIRST AND LAST NAME

THEIR TITLE

CADMUS GROUP

Initial Call Script

[IF CALL ANSWERED] Hello, this is [caller name] calling on behalf of The Cadmus Group to gather insights from [SCE/SDG&E/PG&E] [PROGRAM_NAME] applicants. Our records indicate that you participated in the [SCE/SDG&E/PG&E] [PROGRAM_NAME] and would like to schedule an informational

interview. Your identifying information will remain confidential with Cadmus and [UTILITY]. We understand your time is valuable, therefore we only ask for approximately 30 minutes of your time for a phone interview. Are you available to schedule an interview within the coming weeks?

- **[IF MOVING FORWARD WITH SCHEDULING]** Great, we appreciate your interest! Our informational interviews are scheduled with members of our research team. We have the following time slots available: [USE BOOKINGS PAGE TO SCHEDULE].
 - **[CONFIRM DATE SELECTED]** Thank you, we look forward to your participation. You may expect [explain follow-up steps] [UPDATE TRACKER].
- **[IF SCHEDULING IS NOT CONVINIENT]** Great, we appreciate your interest! Our informational interviews may be scheduled using our Microsoft Bookings page. Is [CONFIRM EMAIL] a good email for sharing the Bookings page? Thank you – please expect an email within the next 24 hours, and feel free to reach out with any questions.
- **[IF INTERVIEW DECLINED]** Not a problem, thank you for your time. [UPDATE TRACKER]

[IF CALL NOT ANSWERED, LEAVE MESSAGE] Hello, this is [caller name] calling on behalf of The Cadmus Group to gather insights from [SCE/SDG&E/PG&E] [PROGRAM_NAME] applicants. Our records indicate that you participated in the [SCE/SDG&E/PG&E] [PROGRAM_NAME] and would like to schedule an informational interview. We value your feedback and would like to schedule a 30-minute informational phone interview; please call me back at [contact info]. Alternatively, you should have received an email from a Cadmus team member with a Microsoft Bookings link that may be used to schedule the interview. Thank you for your time.

Follow-Up Call Scripts

Hello, this is [caller name] following up on behalf of The Cadmus Group to gather insights from [SCE/SDG&E/PG&E] [PROGRAM_NAME] applicants. We value your feedback and would like to schedule a 30-minute informational phone interview. Would you be available to schedule an interview?

- **[IF MOVING FORWARD WITH SCHEDULING]** Great, we appreciate your interest! Our informational interviews are scheduled with members of our research team. We have the following time slots available: [USE BOOKINGS PAGE TO SCHEDULE] [UPDATE TRACKER].
 - **[CONFIRM DATE SELECTED]** Thank you, we look forward to your participation. You may expect [explain follow-up steps] [UPDATE TRACKER].
- **[IF SCHEDULING IS NOT CONVINIENT]** Great, we appreciate your interest! Our informational interviews may be scheduled using our Microsoft Bookings page. Is [CONFIRM EMAIL] a good email for sharing the Bookings page? Thank you – please expect an email within the next 24 hours, and feel free to reach out with any questions. [UPDATE TRACKER]
- **[IF INTERVIEW DECLINED]** Not a problem, thank you for your time. [UPDATE TRACKER]

Interview Introductions

Thank you for taking the time to share your experience with the [PROGRAM_NAME] program, offered by [UTILITY]. For this study, Cadmus is conducting interviews with program applicants who ended or

indefinitely paused their participation in the California Standard Review Projects to electrify Medium-Duty and/or Heavy-Duty (MDHD) fleet vehicles.

The purpose of these interviews is to understand your experience with the program, including your initial interest and factors which may have contributed to ending or pausing your participation. We also seek to understand applicants' overall perspective on the EV market, as well as their fleet readiness for electrification.

This interview will take approximately 30 minutes to complete, and your identifying information will remain confidential.

A. Overview & Background Information

First, we will begin with some general background questions to understand your fleet.

- A1. [IF INTERVIEWEE DATA IS AVAILABLE] Our data indicates that your fleet includes [name types of vehicles/equipment], can you confirm that this information is accurate?
 - 1. [IF INTERVIEWEE DATA IS NOT AVAILABLE] What types of vehicles or equipment do you have in your fleet?
[INTERVIEWER NOTE: Refer to Section E Table 1 to match responses with survey categories]
- A2. For each type of vehicle and/or equipment you mentioned, please specify the number of internal combustion engine vehicles in your fleet, and the number of electric vehicles in your fleet. **[INTERVIEWER NOTE: Record the # of ICE vehicles and # of EVs for each vehicle type]**
- A3. We wish to understand how the [PROGRAM_NAME] program may have influenced your decision to electrify your fleet. Of the internal combustion engine vehicles in your fleet, **how many did you originally plan to electrify through the program?**
 - 1. How many did you originally plan to electrify **outside of the [PROGRAM_NAME] program?**
- A4. Of the vehicles that you originally planned to electrify when you applied to the [PROGRAM_NAME] program, **how many have you electrified to date?** Please specify the number of vehicles per type.
- A5. Are there any other vehicles that we have not discussed which you planned to electrify?
 - 1. [IF YES] Could you specify the vehicle/equipment type, the number of vehicles, and the rough timeframe for electrification?

B. Program Experience

Now we wish to understand your interest and experience specifically with the [PROGRAM_NAME] program.

- B1. Could you describe the reasons why your fleet initially intended to transition to EVs? *(Probe: regulatory requirements, expected savings, environmental benefits, etc.)*
[INTERVIEWER NOTE: Refer to Section E Table 2 to match responses with survey categories]
- B2. How did you first hear about the [PROGRAM_NAME] program?
- B3. We'd like to start by hearing about your overall experience. How satisfied were you with the [PROGRAM_NAME] program **overall?** Please use a scale from 1 to 4, where 1 means *not at all satisfied* and 4 means *very satisfied*.
 - 1. Why did you give that specific rating?

B4. Could you summarize your path through the **application process** and contract signing for the **[PROGRAM_NAME]** program?

1. How satisfied were you with the **application process**? Please use the same scale from 1 to 4, where 1 means *not at all satisfied* and 4 means *very satisfied*.

B5. How satisfied were you with the **application timeline** for the **[PROGRAM_NAME]** program?

1. Why did you give that specific rating?

B6. We would like to know about your experience with the **level of program services** offered as a part of the **[PROGRAM_NAME]** program, such as site planning or provision of to-the-meter infrastructure. First, were you **aware of the services offered** as part of the program?

1. **[IF YES]** Similar to the previous questions, how satisfied were you with the **level of program services**? **[IF NEEDED:** Please use the same scale from 1 to 4, where 1 means *not at all satisfied* and 4 means *very satisfied*.]

B7. Now we turn to the **amount of eligible rebates offered** from **[UTILITY]** as part of the **[PROGRAM_NAME]**. Were you **aware of the amount of the eligible rebates offered** (i.e., the \$ value) as part of the program?

1. **[IF YES]** How satisfied were you with the **amount of the eligible rebates offered** as part of the program? **[IF NEEDED:** Please use the same scale from 1 to 4, where 1 means *not at all satisfied* and 4 means *very satisfied*.]
2. **[ASK IF B7.1=1 NOT TOO SATISFIED OR 2 NOT AT ALL SATISFIED]** What **amount of rebate** would have made you more satisfied?
3. **[ASK IF B7.1=1 NOT TOO SATISFIED OR 2 NOT AT ALL SATISFIED]** If this rebate level were offered, would it have **changed your likelihood to participate** in the **[PROGRAM_NAME]** program? **How much more would it have changed your likelihood?**

B8. Lastly, on a scale from 1 to 4, with 1 being not at all satisfied and 4 being very satisfied, how satisfied were you with your **experience working with [UTILITY] staff**?

The last two questions for this section pertain to your opinion on services and rebates that you believe the **[PROGRAM_NAME]** program should offer.

B9. What **kinds or levels of services** should the **[PROGRAM_NAME]** program offer?

[INTERVIEWER NOTE: Refer to Section E Table 3 to match responses with survey categories]

B10. What **types of costs** should the **[PROGRAM_NAME]** program rebates cover?

[INTERVIEWER NOTE: Refer to Section E Table 4 to match responses with survey categories]

C. Actions Outside of the Program and Nonparticipant Spillover

The next series of questions will ask about actions that you may have taken outside of your participation in the **[PROGRAM_NAME]** program.

- C1. Did you install any EV charging equipment without the rebates offered from **[UTILITY]** as a part of the **[PROGRAM_NAME]** program?
1. Yes **[ASK C2]**
 2. No
- C2. **[ASK IF C1=YES]** Did you receive any rebates or incentives to cover some of the cost of the EV charging equipment? If so, please specify where the rebates or incentives came from.
- C3. **[ASK IF C1=YES]** Did you pursue any alternative funding when you dropped out of the program, such as Rule 29, EnergIIZE, or federal funds?
- C4. Which of the following best describes how your organization proceeded with electrification after deciding not to participate in the **[PROGRAM_NAME]** program?
1. Built project as intended
 2. Built project scaled down from intended plan:
 - (a) What was different from the intended plan? **[OPEN ENDED]**
 3. Decided not to incorporate EVs into the fleet
 4. Put project on temporary hold **[ASK C8]**
 5. Built project through utility's general distribution service planning program (Rule 28/29/45)
 6. Other, please specify: **[OPEN ENDED]** **[INTERVIEWER NOTE: Try to avoid using this answer option if possible.]**
- C5. **[ASK IF C4=1, 2, OR 5]** When was this project completed? Please specify the month and year.
1. **[OPEN ENDED]**
 2. Not completed yet; please specify the expected completion date: **[OPEN ENDED]**
- C6. **[ASK IF C4=1, 2, OR 5]** What were the specifics of the project, such as the number of vehicles by type and number of chargers?
1. **[OPEN ENDED]**
- C7. **[ASK IF C4=1, 2, OR 5]** How important was your experience with the **[PROGRAM_NAME]** program on your decision to build EV charging infrastructure outside of the **[PROGRAM_NAME]** program? Please use a scale from 0 to 10, where 0 is "not at all important" and 10 is "extremely important".
1. **[RECORD RATING 0-10]**

[ASK IF C4=4]

- C8. If project is on temporary hold, which of the following best represents its current status?
1. Pending funding from a specific source (or sources), please specify: **[OPEN ENDED]**
 2. Pending further action from the utility, please specify: **[OPEN ENDED]**
 3. Pending procurement or delivery of electric vehicles or equipment, please specify: **[OPEN ENDED]**
 4. Pending procurement or delivery of EV charging equipment, please specify: **[OPEN ENDED]**

5. Pending for some other reason, please specify: **[OPEN ENDED]**

C9. **[ASK IF C1=YES]** Did discussions with other fleets influence your decision to electrify some fleet vehicles? **[IF YES]** Please describe how these discussions influenced your decision.

D. Reasons for Dropping Out of the Program

Next, we would like to explore why you decided to end your participation in the **[PROGRAM_NAME]** program.

D1. What were the main reasons why your organization decided to stop participating in the program? (*Probe: costs, labor, equipment availability, etc.*)

[INTERVIEWER NOTE: Refer to Section E Table 5 to match responses with survey categories]

D2. What step were you at in the **[PROGRAM_NAME]** program when you decided to drop out?

D3. What factors would have enabled your continued participation in the program, if any? (*Probe: lower costs, greater knowledge and process support, etc.*)

[INTERVIEWER NOTE: Refer to Section E Table 6 to match responses with survey categories]

D4. Based on your experience with fleet electrification so far, what would you recommend to other utility customers who may be going through this process or considering it?

D5. What, if anything, would you recommend **[UTILITY]** change about the program to improve it?

End of Interview Message

Those are all the questions we have. Thank you for your time.

E. Reference categories from original survey questions

Table 1, Question A1. Types of potential vehicles/equipment in fleet.

1. School bus
2. Transit bus
3. Medium-duty vehicles
4. Heavy-duty vehicles
5. Port cargo trucks
6. Airport ground support equipment
7. Forklifts
8. Truck refrigeration unit
9. Truck stop electrification technology
10. Other

Table 2, Question B1. Potential reasons for transitioning vehicle fleet to EVs

1. Regulatory requirement
2. Corporate/organizational sustainability goals or initiatives
3. Expected fuel cost savings
4. Expected maintenance cost savings
5. Better technology
6. Driver comfort/preference
7. Environmental benefits
8. Rebates/incentives for EVs
9. Rebates/incentives for EV charging infrastructure
10. Other

Table 3, Question B11. Kinds or levels of services that [PROGRAM_NAME] program should offer.

1. Increased technical support on electric vehicles
2. Increased technical support on EV charging equipment
3. Increased utility-side make-ready infrastructure support
4. Increased customer-side make-ready infrastructure support
5. Other

Table 4, Question B12. Types of costs that [PROGRAM_NAME] rebates should apply to.

1. Construction costs
2. EVSE costs
3. Vehicle costs
4. Other

Table 5, Question D1. Reasons for ending participation in the [PROGRAM_NAME] program.

1. Vehicle costs
2. Charging equipment costs
3. Behind-the-meter make-ready costs
4. Inability to obtain easements
5. Difficulty hiring contractors to install the behind-the-meter infrastructure or EV chargers
6. Labor costs
7. Lack of availability of electric vehicles/equipment that met my fleet's needs
8. Inadequate incentives
9. Lack of utility support for behind-the-meter make-ready process
10. Required too much time
11. Training requirements
12. Driver hesitancy
13. Reliability concerns with EVs or EV chargers
14. Return-on-investment was too long
15. Timeline to receive vehicles is too long
16. Other organizational priorities for funds/other stakeholder input
17. Other

Table 6, Question D3. Factors that would have enabled continued participation in the program.

1. Lower costs of or higher rebates for charging infrastructure
2. More utility support for behind-the-meter make-ready process
3. More knowledge sharing with other fleet managers electrifying their fleets
4. Ability to obtain easement
5. Lower costs of or more funding for the electric vehicles/equipment
6. More availability of electric vehicles/equipment that meet my fleet's needs
7. Greater interest from drivers
8. Greater interest from other organizational stakeholders or decisionmakers
9. Other

SRP Evaluation: Fleet Driver Online Survey EY2024

This survey is designed to assess participating fleet drivers’ experience driving a Medium-Duty and/or Heavy-Duty (MDHD) Electric Vehicle (EV) as a part of the California Transportation Electrification Standard Review Projects. Questions in this survey pertain to the user experience, observed benefits, and challenges associated with the EV and related charging infrastructure. This survey should take approximately 15 minutes for the driver to complete.

Research Objectives	Corresponding Question Numbers
1. Assess participating driver experience with EV infrastructure	
Did drivers receive training to operate an EV?	A9 - A12
How satisfied are fleet drivers with their EV, including its range, and its charging station(s)?	B1 - B5
How reliable and user-friendly are the charging stations?	B8 - B9
2. Explore the benefits/operational impacts of TE for fleet drivers	
Have drivers observed any benefits of electrification associated with improved air quality and health outcomes?	C2 - C3
Have drivers observed any benefits of electrification associated with comfort or convenience?	C4 - C5
Have drivers observed any benefits of electrification associated with noise pollution?	C6 - C7
Have drivers experienced challenges driving an EV or using the associated EV charging stations? Have the charging stations been sufficient?	D1 - D4
How has a driver's job changed now that they are driving an EV?	D5

Target Audience: Fleet drivers in California Standard Review Projects

Target Quota = Representative sample of drivers from a subset of fleets (final sampling TBD)

General Instructions

- Interviewer instructions are in green **[LIKE THIS]** (the style is “Survey: Interviewer Instructions”).
- CATI programming instructions are in red **[LIKE THIS]** (the style is “Survey: Programming”).
- Items that should not be read by the interviewer are in parentheses like this ().

Variables to be Pulled into Survey

- Company name
- Utility name
- Program Name

Survey Introduction and Screener

[RECOMMENDED: CLIENT-APPROVED LOGO TO APPEAR ON START SCREEN]

Welcome! Thank you for sharing your experience with driving an electric vehicle, whose charging infrastructure was supported through the **[PROGRAM NAME]** program, offered by **[SCE/SDG&E/PG&E/Liberty]**. This survey will take 15 minutes to complete and will ask questions about your experience driving an EV and using the associated charging infrastructure.

Your responses will remain confidential and will only be used for research purposes.

[SCREEN OUT TERMINATION MESSAGE:] Those are all the questions we have. Thank you for taking the time to complete this survey.

A. Background

The following questions pertain to background information on your current role, any relevant training you received, and your level of satisfaction with the EV you drive and its associated charging stations.

A1. What type of electric vehicle do you primarily operate? **[SINGLE RESPONSE]**

1. School Bus
2. Transit Bus
3. Medium-duty vehicles
4. Heavy-duty vehicles
5. Port cargo trucks
6. Airport ground support equipment
7. Forklift
8. Vehicle with an electric transport refrigeration unit (eTRU)

9. Other [WITH WRITE IN OPTION]

10. I do not drive an electric vehicle for [COMPANY NAME].

A2. When (month/year) did you begin **operating the EV/**EV equipment for your company's/organization's fleet?

1. [OPEN ENDED RESPONSE]

A3. How often do you charge the EV/EV equipment you operate for **[COMPANY NAME]**?

1. Less than once per day
2. Once per day
3. Twice per day
4. More than twice per day

A4. What time(s) of day do you typically charge the EV/EV equipment? **[ACCEPT MULTIPLE RESPONSES]**

1. Morning
2. Night
3. Middle of the day
- 4. Other [WITH WRITE IN OPTION]**

A5. How much time is needed to charge the EV/EV equipment to be ready for your shift?

1. Less than 30 minutes
2. 30 minutes – 1 hour
3. 1-3 hours
4. 3-5 hours
5. 5-7 hours
6. More than 7 hours
98. Don't know

A6. How much time is needed to fully charge the EV/EV equipment?

1. Less than 30 minutes
2. 30 minutes – 1 hour
3. 1-3 hours
4. 3-5 hours

- 5. 5-7 hours
- 6. More than 7 hours
- 98. Don't know

A7. How many miles do you typically drive the EV/EV equipment on your shift for **[COMPANY NAME]**? Would you say:

- 1. Less than 25 miles
- 2. 25-74 miles
- 3. 75-124 miles
- 4. 125-174 miles
- 5. 175-224 miles
- 6. 225 miles or more
- 98. Don't know

A8. Did you receive any training to operate your EV/EV equipment?

- 1. Yes **[ASK A10-A12]**
- 2. No

[ASK A10-A12 IF A9 = YES]

A9. What did the training to operate the EV/EV equipment consist of? **[MULTI-SELECT]**

- 1. Received a training manual to operate the vehicle/equipment
- 2. Received a training manual to charge the vehicle/equipment at the charging station
- 3. Received onsite training to operate the vehicle/equipment
- 4. Received onsite training to charge the vehicle/equipment at the charging station
- 5. Other **[WITH WRITE IN OPTION]**

A10. Who provided the training? Was it:

- 1. Your company
- 2. The vehicle/equipment original equipment manufacturer (OEM)
- 3. The vehicle/equipment distributor/supplier
- 4. The charging station provider
- 5. Other **[WITH WRITE IN OPTION]**
- 98. Don't know

A11. How helpful was the training?

- 1. Very helpful
- 2. Somewhat helpful
- 3. Not too helpful
- 4. Not helpful at all

B. User Experience and Satisfaction

The following questions are designed to gain a better sense of your experience driving an EV and using the related charging equipment.

B1. How satisfied are you with the experience of operating the EV/EV equipment?

1. Very satisfied
2. Somewhat satisfied [ASK B2]
3. Not too satisfied [ASK B2]
4. Not satisfied at all [ASK B2]

[ASK IF B1= 2, 3, OR 4]

B2. Why do you say you are [INSERT SELECTED OPTION] with your experience operating the EV/EV equipment?

1. [OPEN ENDED RESPONSE]

B3. How satisfied are you with the range of your EV/EV equipment?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all

B4. How satisfied are you with your experience using the charging stations at your company's site?

1. Very satisfied
2. Somewhat satisfied [ASK B5]
3. Not too satisfied [ASK B5]
4. Not satisfied at all [ASK B5]

[ASK IF B4 = 2, 3, OR 4]

B5. Why do you say you are [INSERT SELECTED OPTION] with using the charging stations?

1. [OPEN ENDED RESPONSE]

B6. How reliable would you say the EV/EV equipment you operate is?

1. Very reliable
2. Somewhat reliable [ASK B7]
3. Not too reliable [ASK B7]
4. Not at all reliable [ASK B7]

[ASK IF B6 = 2, 3, OR 4]

B7. Why do you say the EV/EV equipment is [INSERT SELECTED OPTION]?

1. [OPEN ENDED RESPONSE]

B8. Compared to operating a vehicle with an internal combustion engine, would you say **operating the EV/EV equipment** is overall:

1. Easier to drive
2. About the same driving experience
3. Not as easy to drive

- B9. Compared to refueling a vehicle with an internal combustion engine, would you say **using the charging stations for the EV/EV equipment** is overall:
1. Easier to use
 2. About the same user experience
 3. Less easy to use

C. Benefits of Operating an EV/EV equipment

The following questions pertain to your experience operating the EV/EV equipment compared to an internal combustion engine vehicle/equipment.

- C1. Since you began operating the EV/EV equipment for **[COMPANY NAME]**, what benefits, if any, have you noticed compared to operating an internal combustion engine vehicle or equipment?

1. **[OPEN ENDED]**
2. I have not noticed any benefits

- C2. Based on your experience operating the EV/EV equipment, have you noticed an **improvement in air quality or health**, such as reduced exposure to exhaust, compared to operating internal combustion engine vehicles or equipment?

1. Yes, I've **definitely** noticed this **[ASK C3]**
2. Yes, I've **somewhat** noticed this **[ASK C3]**
3. No, I have not noticed this

[ASK IF C2 = 1 OR 2]

- C3. Which air quality or health improvements have you observed?

1. **[OPEN ENDED RESPONSE]**

- C4. Based on your experience operating the EV/EV equipment, have you noticed an **improvement to your comfort or convenience**, such as better ride or vehicle/equipment performance compared to operating internal combustion engine vehicles or equipment?

1. Yes, I've **definitely** noticed this **[ASK C5]**
2. Yes, I've **somewhat** noticed this **[ASK C5]**
3. No, I have not noticed this

[ASK IF C4 = 1 OR 2]

- C5. What comfort or convenience improvements have you observed?

1. **[OPEN ENDED RESPONSE]**

- C6. Based on your experience operating the EV/EV equipment have you noticed a **reduction in noise** compared to operating internal combustion engine vehicles/equipment?

1. Yes, I've **definitely** noticed this **[ASK C7]**
2. Yes, I've **somewhat** noticed this **[ASK C7]**

3. No, I have not noticed this

[ASK IF C6 = 1 OR 2]

C7. Which noise reduction(s) have you observed?

1. **[OPEN ENDED RESPONSE]**

D. Challenges of Operating the EV/EV Equipment

The following questions pertain to any challenges you have experienced operating the EV/EV equipment compared to internal combustion engine vehicle/equipment and using the associated charging stations.

D1. Have you experienced any challenges operating the EV/EV equipment?

1. Yes **[ASK D2]**
2. No

[ASK IF D1 = YES]

D2. What kind of challenges have you experienced?

1. Difficult to find charging stations
2. Insufficient vehicle/equipment range
3. Requires charging more frequently than I expected
4. Is more challenging to drive/operate
5. Is unreliable or requires more maintenance than I expected
6. Other **[OPEN ENDED]**

D3. Are the current charging stations sufficient for the EV/EV equipment you operate?

1. Yes
2. No **[ASK D4]**

[ASK IF D3 = NO]

D4. In what ways are the EV charging stations lacking?

1. Difficult to find
2. Not enough charging stations
3. Difficult to use/operate the charging stations
4. Charging stations are located out of my way
5. Charging stations take longer to charge the EV/EV equipment than I expected
6. Charging stations are unreliable or require more maintenance than I expected
7. Other **[WITH WRITE IN OPTION]**

D5. How has your job changed now that you are driving an EV? Select all that apply. **[RANDOMIZE 1-8]**

1. More training requirements
2. More concern over range

3. Quieter ride/operation
4. Better driving experience
5. Less air pollution
6. Better towing capability
7. Improved job satisfaction/enjoyment, please specify how: _____ **[WITH WRITE IN OPTION]**
8. Nothing; my job has remained the same
9. Other **[WITH WRITE IN OPTION]**

E. Closing

E1. Do you have any other comments or questions for **[UTILITY NAME]** at this time? Please feel free to share any feedback you have about operating or charging the EVs/EV equipment, whether positive or negative.

1. **[OPEN ENDED RESPONSE]**

Those are all the questions we have. Thank you for your time.