Guidehouse
Outwit Complexity

2025 Potential and Goals Study Draft Workplan (EM&V Group E Sectors)

Submitted by:

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1. Overview

To ensure continued success of California's annual ~$1 billion customer investment in energy efficiency (EE) programs, the CPUC staff periodically develops savings goals to inform EE program planning efforts undertaken by Energy Efficiency Program Administrators (PAs), including the IOUs. The results of this study directly fulfil these needs. This document provides the detailed work scope for the 2025 Potential and Goals Study. This study is funded out of the EM&V for Group E Sectors contract.

2. Objectives and Approach

The objective of this project is to conduct a Potential and Goals (PG) study in support of the EE program goal setting process and other forecasting and statutory activities.

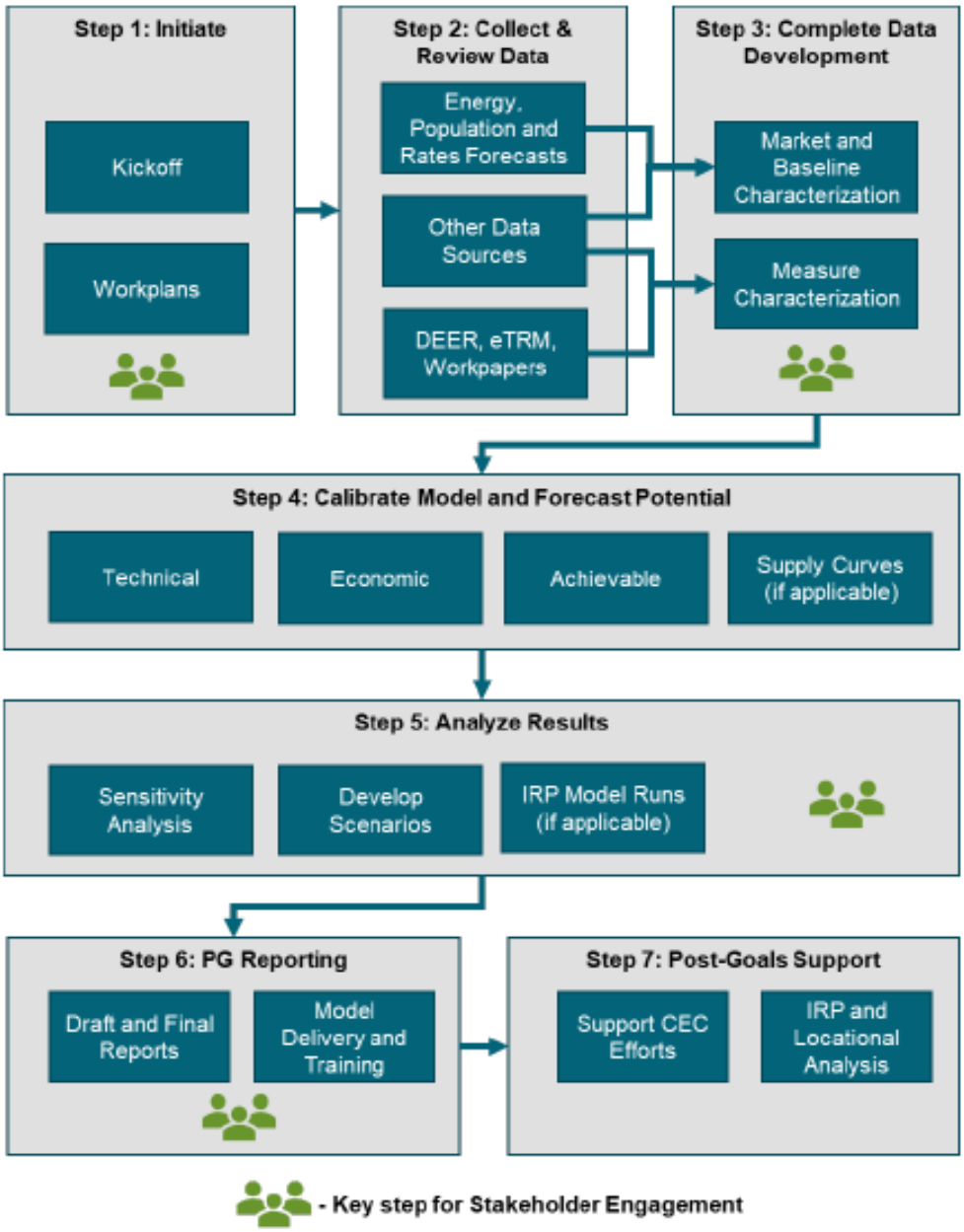
The following subsections provide an overview of the 2025 PG Study Approach, and high-level details of updates being made to the study from the prior 2023 study cycle.

APPROACH OVERVIEW

The approach is designed: 1) to produce results that are consistent with the evidence of historic program achievements and market data, and 2) stretch beyond traditional program delivery mechanisms and past policy assumptions to examine future possibilities that are in line with current statutory activities, including Additional Achievable Energy Efficiency (AAEE) and Additional Achievable Fuel Substitution (AAFS) under the California Energy Commission (CEC)'s bi-annual Integrated Energy Policy Report (IEPR) forecasting process, and doubling of efficiency aspirations under the SB 350 legislation and target setting process.

Figure 1 below illustrates the process and flow of activities planned to implement the various deliverables related to the 2025 PG study over the two-year time horizon for this contract. Each aspect of the chart is summarized in the below graphic.

Figure 1. Potential & Goals Study Process



- **Step 1** is to review the 2023 Potential & Goals Study outcome and assess potential updates and modifications designed to address potential areas for improvement or newly emerging priorities that may be addressed in the 2025 Study. Stakeholder feedback on proposed updates will be solicited through a 2025 Study Updates Webinar and subsequent informal comment period.
- **Step 2** is to launch the project with a kickoff meeting (CPUC Staff and Guidehouse Team), development of a detailed project action plan, and leading two to three internal and external stakeholder workshops to provide a detailed overview of the PG Study process and its objectives to CPUC staff, outline the planned approach for the 2025 Study, and seek public stakeholder engagement on potential improvements.

Step 3 is to collect relevant new data that has emerged since the last PG study conducted in 2023. Guidehouse understands that certain baseline market conditions (including load forecasts, floor stock and number of buildings estimates, equipment densities, etc.) have been refreshed through various statewide activities launched by the CEC and others. A draft eTRM update is also scheduled to be finalized in September 2024 from the CPUC's ex ante team (and project subcontractor DNV) which will help to inform measure characteristics[1]. To adhere to the accelerated 2025 Study timeline Guidehouse will update measure package updates available at the time of Measure Characterization completion. Guidehouse and DNV will work closely together to ensure all available measure detail is incorporated in the Study.

Guidehouse also expects to draw on evaluation studies, recently developed PA data sources such as technology measure packages from DEER, PA-led market studies, and Group E market study on behind the meter electrical infrastructure needs and costs for measures representing electrification of natural gas-consuming technologies. Similar to previous studies, Guidehouse plans to prioritize measure characterization efforts based on the measure contribution to the existing and forecasted portfolio. For example, a subset of measures in the 2023 study were not updated and furthermore, those measures have had minimal or no updates in eTRM. The prioritization process is important to ensure that an appropriate level of effort is included for measures that will have a larger contribution to the portfolio than others. Guidehouse will coordinate with DNV to ensure all the latest measure package updates are reflected in the 2025 measure characterization. Guidehouse will gain access to updates that may not have final approval but are anticipated.

Guidehouse additionally plans to utilize Draft Avoided Cost inputs anticipated to be available by the end of July 2024. As noted above for Measure Characterization, Guidehouse will coordinate actively with DNV and all other parties involved in the processing, calculation, and generation of avoided costs to ensure these preliminary values are able to be incorporated within the Study's planned timeline. Guidehouse will also perform a limited comparison of the draft avoided costs to the final version subsequent to their issuance but prior to releasing initial PG Study results. This analysis will assess whether there are significant changes to the final version and inform whether the analysis should be rerun to reflect the latest avoided cost inputs.

- **Step 4** is to process the data that was collected in the previous step and format the data into various input needs for the PG modeling effort, in particular updating global input files for the model. Further, the project team will refresh the EE measure list to reflect new data sources and information gathered from eTRM updates and IOU measure packages, etc. Along the way, Guidehouse expects to share the progress of the data development efforts through a series of topic-specific public stakeholder engagement workshops and webinars (e.g., baseline, measure lists, etc.).
- **Step 5** is to develop the EE potential forecasts adapting Guidehouse's potential simulation modeling tool, DSMSim™, which is already fully developed and vetted for this study based on our past CPUC PG assignments. Guidehouse will adhere to well-established methodological approaches for estimating technical, economic and market potentials, and incorporate calibration methods to recognize a variety of factors affecting the potential including rolling portfolio budgets, previously accomplished EE results, past PG study results, and anticipated market and policy activities that will affect how EE is carried out. As the various estimates of potential are developed, Guidehouse plans to lead multiple

[1] Final eTRM/DEER update approval is scheduled to occur in November 2024

touchpoints with stakeholders to present results, obtain input, and adjust if warranted. Should Task 12 (IRP Supply Curves) be funded, this step will entail developing supply curves to inform the IRP Model.

For the 2025 PG study, Guidehouse will further modify the DSMSim model structurally to accommodate the target of the EE portfolio in TSB terms in place of the measure level energy impacts. This structural change will impact the algorithms for technical and economic potential.

- **Step 6** is to carefully analyze the results by carrying out several what-if sensitivities and running scenarios that would reflect some of the inherent uncertainty associated with specific parameters including adoption and re-adoption algorithms, consumer awareness parameters, and altered program delivery techniques. During the process of conducting these analyses, Guidehouse expects to lead additional public stakeholder engagement sessions to present results, obtain input, and adjust if warranted. Should Task 12 (IRP) be funded, this step will require coordination with the CPUC's IRP contractor to run the IRP Model.
- **Step 7** is to draft a PG study report that will be oriented toward a non-technical audience. Guidehouse will also produce several public products related to input and output data for the PG study. The project team will work closely with CPUC Staff to ensure that copy-editing objectives are accomplished and that a sufficient level of peer review is accomplished. Further, Guidehouse will hold 1-2 public stakeholder workshops to present the draft report and seek further input.

Section 3 provides detailed workplans of the tasks to be completed as part of the 2025 Potential and Goals Study.

2025 Study Updates

Guidehouse has received feedback and direction from from CPUC Staff and stakeholders[2] regarding several elements of the Potential & Goals Study process and delivery that represent opportunities for improvement or enhancement from past Study cycles. Accordingly, a number of updates are planned for the 2025 PG Study. These are designed to serve evolving and emerging priorities among the entities this effort serves. Notable revisions to the 2025 Study versus those conducted in 2023 and prior include:

- **Study Timeline**. Based on direction from CPUC, Guidehouse plans to initiate the PG study several months earlier in the calendar year compared to the prior study cycle with the goal of informing an earlier release of a final EE Goals Decision.
- **Modification of the PG Model Structure** to better align with Total System Benefit (TSB) as the statewide Energy Efficiency and Fuels Substitution program portfolio goal setting metric. While the 2023 Study calculated TSB and presented it as the final primary study output, this value was calculated only after achievable potential was determined through our modeling process. By contrast, in the 2025 Study Guidehouse will model technical and economic potential based on TSB as opposed to first year energy impacts as has historically been the case. Additionally, market achievable potential will be calibrated using an adjusted historic program TSB. Adjustments will reflect current Avoided Cost inputs to ensure consistency of assumptions across historic and forecasted periods.

[2] CPUC and Guidehouse held a 2025 Potential & Goals Study Updates Webinar on January 24, 2024 to review proposed changes to the PG Study structure, content and delivery as well as to solicit comment and feedback from stakeholders.

Both Guidehouse and CPUC believe this update will serve to better inform our analysis and underscore the Study's emphasis on and utilization of TSB as the current statewide EE and FS goal setting metric.

- **Fuel Substitution** measure characterization and achievable potential refinement including enhancement of behind the meter infrastructure cost assumptions, incorporation of broader program data sources in the calibration process, assessment of alternative incentive structures and policy considerations within defined scenarios.
- **Industrial & Agricultural Sector Analysis** to align to the current program implementation activities and minimize any double counting or miscounting of savings potential. The industrial and agricultural savings estimates are typically conducted top-down using historical program performance as an indicator of the adoption trajectory for future years. Therefore, the realignment of the measure categories should be a more appropriate match than previously potential study analysis.

Section 3 includes additional detail regarding our planned approach for each of these Study areas.

3. Potential and Goals Study (Tasks 8a, 8b, and 13)

The following sections detail the tools and approach planned for the determination of market achievable potential for energy efficiency and fuel substitution measures. This will inform the CPUC goal setting process for IOU-funded programs for the 2026-2027 period.

3.1 Potential and Goals Energy Efficiency and Fuel Substitution Adoption Simulation Model

3.1.1 Analytica Model

The CPUC's current bottom-up PG model last used in the 2023 PG study was developed by Guidehouse.[3] The CPUC has significantly invested in this model over the last 10+ years and it has ample stakeholder buy-in. Guidehouse will continue to leverage this model and is prepared to modify and update the model to meet emerging requirements. The existing model is already capable of achieving the following key outcomes:

- Providing results with measure-level granularity (a key need expressed by external stakeholders)
- Explicitly modeling fuel substitution
- Estimating Technical, Economic and Market Potential using the total system benefits (TSB) as the basis for analysis
- Assessing cost effectiveness of individual measures and report portfolio cost effectiveness
- Distinguishing between rebate program savings, Codes and Standards savings, and Income-Qualified program savings
- Outputting annual and cumulative savings, including the TSB metric
- Outputting supply curves for use in the IRP

The model is built using Analytica, a software platform developed by Lumina. Analytica is a software platform for data analytics, simulation, forecasting, and decision-support, widely used for applications in energy, environment, and economics. Figure 2 shows a screenshot of the model's graphical user interface. This interface contains several features that allow users to easily change inputs and scenario settings, run the model and view outputs.

[3] Model and supporting users guide available at: **https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/energy-efficiency-potential-and-goals-studies/2023-potential-and-goals-study**

Figure 2. Graphical User Interface of 2023 Potential & Goals Study Model

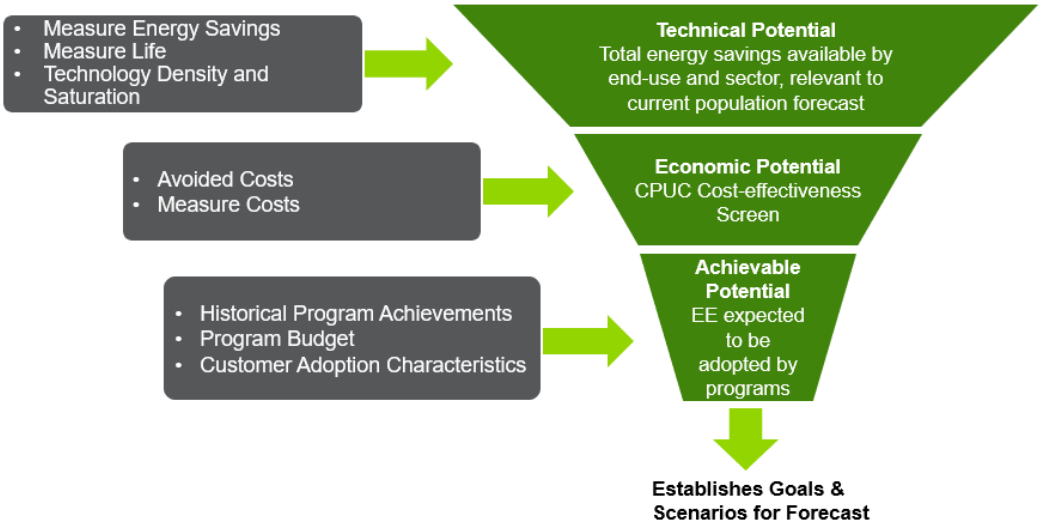
The model will be delivered to the CPUC staff as an executable file that does not require a license to run. Users may need to install a free version of the Analytica Player software. This is consistent with our delivery of models to the CPUC in the past. Furthermore, Guidehouse will train CPUC staff on use of the model. For this study, training will be adapted to the needs of CPUC staff and can consist of the following:

- Documents detailing the modeling methodology and approach.
- User guides describing how to import/export data, run the model, navigate through underlying model logic, change settings, and review results, among others.
- Training exercises (structured similarly to practice problems) providing trainees an opportunity to assess their comprehension and aid in knowledge retention.
- Topic-specific recorded webinars.
- Training sessions; and
- Reasonable technical support post model delivery up until the contract end period.

3.2 Potential and Goals Study

The EE potential forecast is a core activity that informs the CPUC's investor-owned utilities (IOU) goal setting process for 2025 and beyond. This activity will employ a range of analysis methods to meet the changing landscape of energy efficiency in the state of California. Guidehouse will use the Potential and Goals Energy Efficiency Adoption model described in the previous section to calculate technical, economic, and achievable potential across relevant sectors, building types and end uses over an up to 30-year forecast period. **Error! Reference source not found.** illustrates the key inputs and the layers of the potential modelling approach.

Figure 3. Approach to Achievable Potential Analysis



The main tasks that will be carried out to execute the Study are summarized below with additional detail in the following subsections

- Market and Baseline Characterization
    - Obtain market and baseline data. Data will inform total market size, saturation, energy sales, retail rates, avoided costs, etc.
    - Guidehouse staff will obtain data from existing secondary sources: CEC IEPR, CPUC Cost Effectiveness Tool (CET), CA saturation studies, historic program achievements and spending from Program Administrators (PAs)
- Measure Characterization
    - Develop a list of measures to be considered in the potential study, including behavioral, retrocommissioning, and operational (BROs) measures and fuel substitution measures, leveraging the 2023 PG study measure list
    - Revisit and revise the industrial and agriculture measure characterization approach by reclassifying measures
    - Vet and prioritize measure list with stakeholders and finalize measure list
    - Characterize measures, prioritizing CA-specific data sources such as eTRM and IOU measure packages, and leveraging other sources where necessary
    - Consider the impacts on NMEC-based programs on measure level savings characterization

  - Develop a database of measure characteristics to be used by the model

- Technical Potential
  - Use the existing PG model framework developed by Guidehouse to calculate technical potential for EE and Fuel Substitution (FS) measures
  - Account for competing measures and develop instantaneous and annualized technical potential
- Economic Potential
  - Work with CPUC staff to determine appropriate cost effectiveness tests to apply
  - Use the existing PG model framework developed by Guidehouse to calculate instantaneous and annualized economic potential
- Market Achievable Potential
  - Use the existing PG model framework developed by Guidehouse to calculate market potential for EE and Fuel Substitution measures that pass the Economic Potential screen
  - Calibrate base market potential using a combination of historic program activity and research on customer adoption factors such as non-IOU FS programs
  - Work with CPUC staff to develop scenarios beyond the base forecast to model/forecast
  - Provide support integrating results into IRP as appropriate
  - Disaggregate savings as needed
- Develop Hourly Impacts with Load Shape Analysis
  - This task has not been included in the past several PG study cycles and is more applicable to serve other needs such as AAEE and IRP analysis.
  - If there is a decision to develop hourly impacts, load shape data will be from the latest CA-specific sources.
- Codes & Standards Potential
  - Using the existing PG model framework which replicates the Integrated Standards Savings Model (ISSM) methods, Guidehouse will forecast C&S savings
  - The team will review and scope potential C&S for inclusion in the study. Scoping will include interviews with IOU program managers and CEC staff as well as a review of DOE public documents
  - For the selected C&S, Guidehouse will collect data and import to the ISSM framework and forecast savings
- Income-Qualified Potential
  - Characterize the Income-Qualified sector based on available secondary data
  - Identify applicable measures from Income-Qualified program data, such as Energy Savings Assistance Program applications, as well as measures suggested by the CPUC, IOUs, and other stakeholders

    - Use the 2023 PG model framework developed by Guidehouse to calculate technical and market potential

- Reporting and Stakeholder Interaction
    - Develop draft deliverable and vet with stakeholders and CPUC staff
    - Revise deliverables based on feedback
    - Provide a model and web-based Results Viewer in addition to the written report

3.2.1 Market and Baseline Characterization

Market and Baseline Characterization refers to information about the size and characteristics of the population that forms the basis for the potential forecast. (This is also referred to as the *global inputs.*) Much of this data already exists in an easy-to-use format, therefore this task is primarily compiling existing data from California-specific data sources.

Guidehouse will conduct the majority of this task prior to measure characterization, with some aspects being conducted in parallel with measure characterization. As part of this task, Guidehouse will research and identify the building types, end uses and the portion of energy sales to be included (i.e., are any customer groups/types to be excluded from the study) in this study. Guidehouse will also collect, and pre-process non-measure specific data required for these segments.

STEP 1: DEFINE SEGMENTS

Guidehouse will define residential, commercial, agricultural, and industrial building segments and end uses to forecast savings potential for in this study. Table 1 lists the building segments Guidehouse plans to analyze if there exists sufficient data to do so, while **Error! Reference source not found.** lists the end uses associated with each sector.

Table 1. Potential & Goals Study Segments

Sector	Segments	
Residential	Single Family	Multi-Family
Income-Qualified	Single Family Mobile Homes	Multi-Family
Commercial*	College Grocery Health Lodging Office (Large) Office (Small)	Refrigerated Warehouse Restaurant Retail School Warehouse Other
Agricultural	Dairies, Fishing, Hunting Water Pumping	Irrigated Agriculture, Vineyards, Forestry, and Greenhouses
Industrial	Chemicals Electronics Fabricated Metals Food Industrial Machinery Lumber & Furniture Paper Petroleum	Plastics Primary Metals Printing and Publishing Stone-Glass-Clay Textiles Transportation Equipment All Other Industrial

**Potential to separate commercial and public sector via post processing pending available data*

Further consideration will be made to further post process potential analysis for equity segments.

Table 2. Potential & Goals Study End Uses

	Res	Income-Qualified	Com	Ag	Ind
Appliance Plug Loads	●	●	●		
Building Envelope	●	●	●		
HVAC	●	●	●	●	●
Lighting	●	●	●	●	●
Water Heat	●	●	●		
Whole Building	●	●	●		
BROs	●		●	●	●
Commercial Refrigeration			●		
Data Center			●		
Food Service			●		
Machine Drive				●	●
Process Heat				●	●
Process Refrigeration				●	●

STEP 2: IDENTIFY, COLLECT AND PRE-PROCESS NON-MEASURE SPECIFIC DATA

After identifying the relevant segments applicable to this potential study, the next step in this task is to develop macro-level model inputs that apply to market segments or sectors as a whole, rather than specific measures. Guidehouse will use the global inputs shown in Table 3 as a starting point for this study. Guidehouse will update these inputs based on latest updates to historic sources previously used and/or new sources as recommended by the CPUC and other relevant stakeholders.

Table 3. Potential & Goals Study Global Inputs

Global Input	Description	Historic Sources
Retail Rates *($/kWh, $/therm)*	Forecast of energy costs to customers	CEC - Integrated Energy Policy Report (IEPR) CPUC - California Energy Consumption Database (ECDMS)
Sales Forecasts *(GWh, MW, and MM Therms)*	Forecast of energy sold to customers	
Building Stocks *(households, floor space, consumption)*	Forecast of building and/or sales growth	
Avoided Costs	Forecast of avoided energy and capacity costs to utility	CPUC – Cost Effectiveness Tool
Historic Program Accomplishments	Historic program savings and spending, used for model calibration	CPUC – CEDARS Database (Claims) CPUC Income-Qualified Oversight Board Monthly & Annual Reports IOU Business Plans
Non-Incentive Program Costs		
Inflation Rate	2% assumption[4]	CPUC's IRP Model
Discount Rate	Utility after-tax WACC	CPUC CET

3.2.2 Measure Characterization

The overall measure characterization approach will leverage the existing measure characterization database developed for the 2023 PG study. The previous measure list included gas and electric energy efficiency (EE) measures; measures that offer potential for electrification (switching from natural gas to electric); and behavioral, retrocommissioning, and operational (BROs) measures. Guidehouse will review the measure list, determine what measures should be added (or removed), and update the database with the most recent energy savings estimates, market saturation, and measure cost data available.

IDENTIFY MEASURES AND DEVELOP LIST

The first step in the measure characterization process is to select a list of representative technologies to include in the potential study. Historically, the selection process entails identifying high impact technologies with significant savings opportunities across multiple end

[4] Guidehouse recognizes that current/near term inflation in the economy at large is higher (California https://dof.ca.gov/forecasting/economics/economic-indicators/inflation/, average forecasted value for 2023-2027 is 3.5% calculated based on the consumer price index, CPI). We will confirm with CPUC/stakeholders that the value applied in this study is consistent within the model and with concurrent forecasting and energy models in CA external to this study. The IRP uses 2% as an escalation factor, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2023-irp-cycle-events-and-materials/inputs-assumptions-2022-2023_final_document_10052023.pdf.

uses, as demonstrated through historic IOU program activity. Guidehouse expects to implement a similar approach in this study, whereby the list will consist of prescriptive and custom energy efficiency measures. Guidehouse's approach for this study is to use the previous study's measure list as a starting point, considering additional EE, fuel substitution, and BROs measures that could have a meaningful impact on potential over the planning horizon. Examples include emerging technologies or commercially available measures that may or may not be included within other jurisdictions' portfolios. Guidehouse will schedule check-ins with the DNV team, who is currently engaged with the CPUC eTRM/DEER team to develop 2024 measure package updates, to make sure we are aware of development of major new and emerging measure packages.

Upon completion of this in-depth measure review and identification process, Guidehouse will develop a list of recommended measures to present to the CPUC and other stakeholders for review and comment. Guidehouse recommends that the objective of this process should be to create a concentrated final measure list inclusive of only technologies that are believed to have a significant impact on potential over the study period. Part of this review may consolidate or remove measures that have little to no potential or application to streamline the process and reduce unnecessary complexity in the study.

A few specific examples of interest may be residential building envelope measures. The PG study has not updated these measures since 2021. However, the impacts on heat pump potential savings may be significant. As such, the PG study team and Group A (eTRM/DEER) will coordinate if values are updated and to incorporate the update into the 2025 PG study. Furthermore, the prioritization process is important to balance out the level of effort put into the measures that make a difference to the overall potential savings.

Upon both internal and external review of the measure list, Guidehouse will begin the measure characterization process. Guidehouse will source consumption, cost and other measure specific data from California specific data sources including but not limited to eTRM, IOU measure packages, custom measure dispositions, IOU program data, EM&V results, emerging technologies programs, industrial energy assessments, and technology specific studies including the 2023 PG Study's Fuel Substitution Infrastructure Cost Market Study. Guidehouse is working closely with the CPUC Viable Electric Alternative Working Group and will ensure all outcomes of the Fuel Substitution Infrastructure Cost Market Study are incorporated into the 2025 Potential and Goals Study. Figure 4 below details the Study's results and the calculated weighted average Infrastructure cost that will be applied to characterized Fuel Substitution measures.

Figure 4. Fuel Substitution Infrastructure Cost Inputs[5]

Input Parameter to FS Cost Attribution	Residential (SFM/MFM)		Nonresidential *Non*-Food Service		Nonresidential Food Service (Restaurants, Cafeterias, etc.)
	Space Heating	DHW	Space Heating	DHW	
No Upgrade Infrastructure Cost ($InfCost_{NoUp}$) [2]	$1,704	$2,804	$2,099	$3,430	$3,372
Panel Optimization Infrastructure Cost ($InfCost_{Opt}$) [3]	$3,513	$4,613	$4,418	$5,749	$5,691
Panel Upgrade Infrastructure Cost ($InfCost_{Upg}$) [4]	$6,057	$6,911	$13,128	$13,128	$13,624
Panel Upgrade Attribution Factor (AttribF)	0.2	0.2	0.5	0.5	0.3
Calculated Weighted Avg Infrastructure Cost for VEA Determination [5]	$2,046	$2,716	$2,786	$4,659	$4,055

[1] Source data for infrastructure cost values are based on the Opinion Dynamics Market Study: FS Infra MS Data Tool_Draft_20240304_Final.xls.
[2] Infrastructure cost values for no panel upgrades or optimization are based on the cost needed to support simple connections of the equipment to existing panel.
[3] Infrastructure cost values for panel optimization include both the cost of simple connection and electric panel optimization.
[4] Infrastructure cost values for panel upgrades include both the cost of simple connection and electric panel upgrade.
[5] Statewide weighted average infrastructure cost attributed to a single fuel substitution measure end-use is estimated as a function of cost and statistical likelihood from (a) panel optimization; (b) panel upgrade; and (c) simple connection. See Section 8, Equation 1 for details on how these values were calculated.

Where there is insufficient California data for any measures, Guidehouse will consult other technical reference manuals, as well as its extensive database of potential studies performed in other jurisdictions across North America. **Error! Reference source not found.** shows an example data source hierarchy used in the 2023 Potential and Goals Study. This hierarchy will be updated based on the latest available data. Priority of sources may shift based on recency of source and CPUC staff direction. Guidehouse will work with the Group E team for support in the identification and prioritization of data sources for the measures, using their thorough knowledge of the eTRM, DEER, IOU measure package databases, and other sources of measure data.

Table 4. Example Hierarchy of Data Sources for Energy Use Information

Priority	Energy Consumption Source Name	Description	Author	Publication Year
1	California Electronic Technical Reference Manual (eTRM)	According to the website, "the eTRM is a statewide repository of California's deemed measures, including supporting values and documentation." It includes DEER and non-DEER measures and aligns with the latest approved workpapers.	California Technical Forum	2020-2022 (continuously updated)

[5] VEA Working Group Report: Fuel Substitution Infrastructure Cost Attribution, March 2024

Priority	Energy Consumption Source Name	Description	Author	Publication Year
2	IOU workpapers (with CPUC disposition)	The team referred to approved workpapers for additional measure information not contained in the eTRM or for measures that had not yet been added to the eTRM. In some cases, the team referred to expired workpapers for underlying data when those workpapers had not been superseded and no other information was available.	California IOUs	Various
3	IOU program data	The team referred to the CEDARS database for the California IOUs in cases where energy use information was not available from the above-listed sources.	CPUC, IOUs	2021
4	Non-California source examples	In cases where California-specific sources were not available for energy use information	Various	Various
	Regional Technical Forum database	Measure-level savings data from evaluated programs in the Pacific Northwest region, available through the Regional Technical Forum.	Northwest Power and Conservation Council	2015
	Guidehouse potential study database	Guidehouse's archive of characterized measure savings from previous potential studies and projects with other utilities.	Guidehouse	Various

CHARACTERIZE TECHNOLOGIES

From Guidehouse's experience, most potential is driven through a limited number of technologies or measures currently available in the market or expected to be in the market at some point within the planning horizon. Guidehouse expects to source most measure specific data from California specific sources such as the eTRM database. However, where California data is unavailable for specific measures, measure data may be sourced from other sources.

Guidehouse will take a prioritized approach to measure characterization to ensure that measures with the largest impact on savings potential are allocated an appropriately higher level of resources than measures with a negligible level of impact. Level of impact is determined by examining the measure-level results from the 2023 PG study and considering PA claims in CEDARS. Measures may also be classified as "high impact" if they fall under a particular area of focus for the PG study, such as fuel substitution and industrial/agricultural custom and SEM measures. Guidehouse will vet the classification of measures as "high impact" or "low impact" with the CPUC.

The following analysis approach will be taken for each of the following categories of measures:

- For **high impact** measures that are well documented in California specific data sources such as the eTRM or workpapers, Guidehouse will update the measure characteristics from the 2023 PG study using the latest version of the source.
- For **high impact** measures that are not well documented in California data sources (for instance, because they are not included in IOU programs), Guidehouse will review and update the measures if necessary. Savings will be calculated using algorithms that reflect the fundamental physical characteristics of the measures they are intended to represent. When obtaining data from other data sources, Guidehouse will review the sources to ensure that the data is interpreted and applied correctly.
- For **low impact** measures, Guidehouse proposes to review the description and data sources for the measure to verify that they still apply to the measure. If there are no significant changes to the nature of the measure since the previous study, Guidehouse will generally use the measure characterization data from the previous study to streamline the analysis and make funds available for updates to high impact measures.

Next, Guidehouse will produce measure characterization data in a form that can be integrated into the PG model. Key measure characterization fields are expected to include:

- Measure descriptions and baseline assumptions.
- Energy savings or impact (kWh, kW, therms).
- Cost associated with the measure (equipment, operational).
- Lifetime of the measure.
- Applicability factors including initial EE/FS market penetration, total measure saturation, density, and technical suitability.
- Replacement type of measure (normal replacement, accelerated replacement, retrofit add-on, or new construction).
- Documentation of data sources.

Our measure characterization process will also involve assessing current and anticipated Codes and Standards as part of the baseline assessment, as well as cost trends for specific technologies.

CUSTOMISED TECHNOLOGIES – Commercial, Industrial, and Agricultural Measures

The measure characterization process outlined above works well for prescriptive types of measures that have a specific deemed savings and cost value per unit of equipment installed. However, many energy efficiency opportunities are realized through customised solutions whose costs and savings are specific to the installation. This is particularly applicable for larger commercial, and agricultural and industrial customers, where each customer's energy profile and energy efficiency project is unique to that customer.

In previous studies, Guidehouse analyzed two types of custom measures for industrial and agricultural sectors only: characterized custom (technologies that can be readily defined at the end-use and sector level) and generic custom (unique measures or process improvement measures that tend to be specific to an industry segment or production method). Guidehouse plans to introduce a new approach for the 2025 PG study which incorporates Generic Custom and SEM savings into the analysis of these sectors. Claimed and verified impacts from Generic Custom and SEM have grown in recent years, and a significant proportion of total EE program TSB is generated from these two measure types. In reviewing the 2023 PG study results, the

allocation of the TSB savings was disproportionately allocated to the industrial and agricultural generic custom and SEM as exhibited in **Error! Reference source not found.**5.

Figure 5. 2023 PG Study TSB Results

Measure	% of Total TSB in 2024
Res HERs	12.3%
Ind & Ag Generic Custom	11.7%
Ind & Ag SEM	6.5%
177 other measures	69.5%

~18%

Historically, we have characterized generic custom by sector, and we assumed that all of SEM will be BROs type of measures for industrial and agricultural. For the commercial sector, we have not characterized a custom category since most of the savings at an end use level from custom could be allocated across the characterized measure in a bottom-up analysis. The specific categorization into technology groupings for industrial and agricultural was:

- **Characterized custom** measures are identified by the team's review of the records list, focusing on the high impact measures (i.e., those contributing significant amounts of energy savings) and excluding records with negligible savings contributions or those representing niche activities. The characterized custom category includes readily defined measures. They make up the forecast using the Bass diffusion model and savings estimates sourced from the Industrial and Agriculture Market Study (as the primary source) and are supplemented with the Industrial Assessment Center database[6] for measures and segments not included in the 2023 data collection study.[7] Some measures in this category may fall under the custom review process established by the CPUC.
- **Generic custom** measures are those measures included in projects unique to various subsectors that cannot be readily defined at the measure level or forecast using a Bass diffusion model. CEDARS measures that were marked as process improvement or other process, other, or system were considered as generic custom. Additionally, if there were measures with small portfolio savings contribution within the sector that could be considered as characterized custom, then the team aggregated them under the generic custom group. The aggregated savings of these small savers contribute no more than 10% of the sector savings of the characterized custom list. Most of the savings established within generic custom fall under the custom review process.
- **Emerging technologies** measures are by definition considered nascent and cannot be readily defined at the measure level or forecast using a Bass diffusion model. The 2023 study leveraged expansive work beginning in the 2017 study cycle in which emerging technologies were run through a screening process resulting in characterization over 100 measures. The modeled achievable potential for emerging technology has over several Study cycles led to significant questions regarding the assumptions employed, and significant disagreement on the level of impact. Furthermore, emerging technologies

[6] https://iac.university/#database

[7] Industrial and Agricultural Market Saturation Study, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/energy-efficiency/2021-potential-goals-study/industrial-ag-market-saturation-study-final.pdf?sc_lang=en&hash=123825958BE1A39B21ED8E4592D8F665

with meaningful achievable potential will eventually be incorporated into program portfolios. As such these measures are already inherently embedded into the program participation including relevant trends. Emerging Technology will be deemphasized as a separate measure category for the 2025 Study.

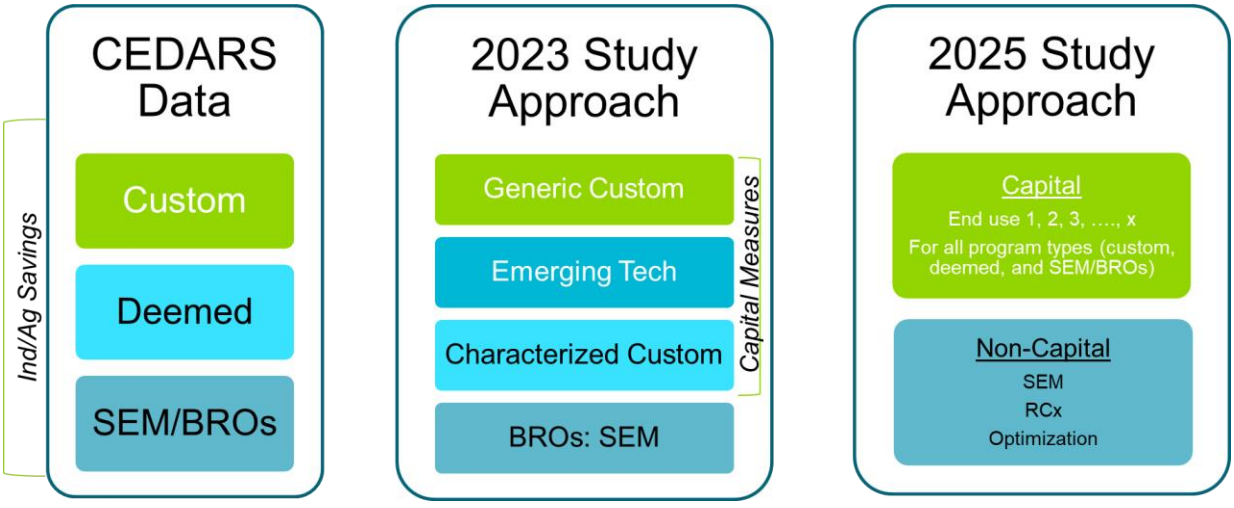
- **BROs or SEM-like** measures that include retrocommissioning (RCx) and some optimization. This group is modeled alongside other BROs measures and cannot be readily forecast using a diffusion model.

Figure 6 illustrates the proposed changes to industrial and agricultural measures characterization. The biggest differences from previous PG study cycles are that we eliminate emerging technology and combine generic and characterized custom. The characterization will only include two categories: capital and non-capital.

To perform the analysis for the 2025 Study, Guidehouse recommends changing the above technology groups. We will follow similar steps using the main data source, CEDARS program data, and how the data is used. The change is in the categories only. The steps are:

1. Extract measure-level data from the reported program data (CEDARS database). The team identified over 1,300 measure-level data points for the industrial and agriculture sectors in the 2021 CEDARS program data. We will append the data with 2022 and 2023 program data. Historical program trends are expected to capture previously assessed emerging technology that eventual show up in program data. Therefore, this category of measure characterization has been removed.
2. Categorize CEDARS data into capital by end use vs. non-capital (RCx, optimization, SEM measures). The capital categorization will also be broken down by sector and end use. The end use breakdown balances the more detailed approach previously conducted by the characterized custom and the one average data point for the generic custom.
3. Use SEM program evaluation to further disaggregate the SEM measures into capital and non-capital categories to ensure proper EUL and measure cost assignments (this is a new step not relevant for the 2023 study). The SEM disaggregation of capital will be appended to the capital from the custom and deemed savings analysis. Combining the capital together independent of program delivery will minimize potential double counting.

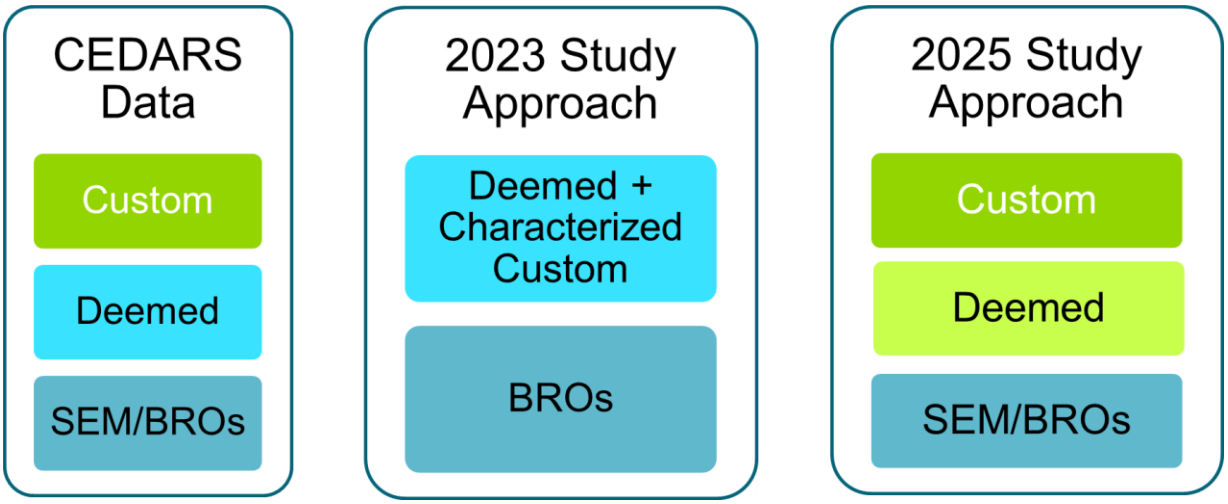
Figure 6. Recategorizing Industrial and Agricultural Measures



For commercial, there has never been a custom measure categorization. Figure Figure provides a more disaggregated structural change to the categories. As the scope of NMEC-type of programs and participation of market access or SEM into the commercial sector, there is a need to capture the savings potential that have not previously been characterized by the existing measure list. Guidehouse acknowledges stakeholder feedback regarding the Normalized Metered Energy Consumption (NMEC) as a specified part of the 2025 PG Study. Within the context of a bottom-up, technology-driven model, we believe NMEC acts as a program delivery mechanism and the measures typically associated with an NMEC participation will be captured within the analysis of Custom or prescriptive commercial sector potential. This new change will capture those "custom" savings.

Since SEM is a fairly new addition to the commercial sector, the data may not be as robust, nor insights from evaluation sufficiently available. Therefore, it is uncertain at the time of the work plan development if the PG study team may be able to disaggregate SEM savings by end use and capital versus non-capital as planned for industrial.

Figure 7. Revisions to the Commercial Measure Categories



Note: If there is sufficient date to disaggregate SEM to capital versus non-capital, the PG study will replicate the approach recommended for industrial.

Given these changes and that certain program trends are showing a substantial decrease in custom projects, the PG study team will explore further the methods of using top-down analysis based on historical program data. The PG study team will be conducting primary research into non-deemed measure savings by seeking market actor (not program participants or non-participants) input to gather information on adjusting the data trends based on real-time insights.

FUEL SUBSTITUTION TECHNOLOGIES

Fuel substitution involves replacing equipment utilizing one regulated fuel with equipment utilizing another regulated fuel. In the context of the PG study, this entails replacing a gas baseline technology with an electric efficient technology. Results for FS measures are expressed in actual energy impact (increased electric load, decreased gas consumption) and in the Total System Benefit metric.

Fuel substitution technologies were newly added to the 2021 PG study, and Guidehouse proposes to leverage the previous measure list and analysis methodology while making additions and improvements where appropriate (Section 5.1 of this document contains further details of the planned Electrification potential analysis). The 2023 measure list included the fuel substitution measures in the below table. When updating the measure list for this study, Guidehouse will consider fuel substitution measures that pass the Fuel Substitution Test implemented in D19-08-009 and to be updated in Q1 of 2024: namely, eligible measures must not increase source energy nor increase CO_2 emissions relative to the baseline technology. The CPUC and key stakeholders including program administrators will be consulted to determine if any fuel substitution measures should be added to or removed from this list. Guidehouse will also incorporate the primary research to identify behind-the-meter infrastructure upgrade costs associated with the installation of residential and commercial measures (to be released in Q1 of 2024).

Table 5. Initial Fuel Substitution Measure List

Sector	End Use	FS Technology	Technology Group
Residential	AppPlug	Heat Pump Clothes Dryer	Clothes Dryers (Gas)
Residential	AppPlug	Heat Pump Pool Heater	Res Pool Heaters
Residential	AppPlug	Induction Cooking	Res Cooking Appliances
Residential	HVAC	Ductless Mini-Split Heat Pump (SEER* 15)	Res Ductless HVAC System – Fuel Sub
Residential	HVAC	Ductless Mini-Split Heat Pump (SEER 16)	Res Ductless HVAC System – Fuel Sub
Residential	HVAC	Ductless Mini-Split Heat Pump (SEER 17)	Res Ductless HVAC System – Fuel Sub
Residential	HVAC	Ductless Mini-Split Heat Pump (SEER 18)	Res Ductless HVAC System – Fuel Sub
Residential	HVAC	Packaged/Split Heat Pump (SEER 15)	Res Central HVAC System – Fuel Sub
Residential	HVAC	Packaged/Split Heat Pump (SEER 16)	Res Central HVAC System – Fuel Sub
Residential	HVAC	Packaged/Split Heat Pump (SEER 17)	Res Central HVAC System – Fuel Sub
Residential	HVAC	Packaged/Split Heat Pump (SEER 18)	Res Central HVAC System – Fuel Sub
Residential	HVAC	Res Furnace Heat Pump Heating Only (SEER 15)	Res Central Furnace Only – Fuel Sub
Residential	HVAC	Res Furnace Heat Pump Heating Only (SEER 16)	Res Central Furnace Only – Fuel Sub
Residential	HVAC	Res Furnace Heat Pump Heating Only (SEER 17)	Res Central Furnace Only – Fuel Sub
Residential	HVAC	Res Furnace Heat Pump Heating Only (SEER 18)	Res Central Furnace Only – Fuel Sub
Residential	Water Heat	Res Heat Pump Water Heater (3.30 UEF - 50 Gal)	Res Gas Water Heaters
Residential	Water Heat	Res Central Heat Pump Water Heater (3.00 COP, 150+ kBtuh)	Res Multifamily Central Gas Water Heaters

Sector	End Use	FS Technology	Technology Group
Commercial	Food Service	ENERGY STAR Combination Oven	Gas Combination Ovens
Commercial	Food Service	ENERGY STAR Convection Oven	Gas Convection Ovens
Commercial	Food Service	ENERGY STAR Fryer	Gas Fryers
Commercial	Food Service	ENERGY STAR Griddle	Gas Griddles
Commercial	Food Service	ENERGY STAR Steamer	Gas Steamers
Commercial	HVAC	Small Packaged Heat Pump (SEER 15)	Com Central HVAC (Small) – Fuel Sub
Commercial	HVAC	Small Packaged Heat Pump (SEER 16)	Com Central HVAC (Small) – Fuel Sub
Commercial	HVAC	Small Packaged Heat Pump (SEER 17)	Com Central HVAC (Small) – Fuel Sub
Commercial	HVAC	Small Packaged Heat Pump (SEER 18)	Com Central HVAC (Small) – Fuel Sub
Commercial	HVAC	Large Packaged Heat Pump (IEER 14.0)	Com Central HVAC (Large) - Fuel Sub
Commercial	Water Heat	Com Heat Pump Water Heater (3.30 UEF - 50 Gal)	Com Small Gas Water Heaters
Commercial	Water Heat	Com Heat Pump Water Heater (4.3 COP - 100+ Gal, 200+ kBtuh)	Com Large Gas Water Heaters

Non-Measure Specific Electrification Costs

The 2023 PG study included a high-level estimate of electrification costs that were specific to the equipment being installed (i.e. cost of the equipment itself and any building upgrades directly related to the equipment change, such as adding an electric outlet or capping a gas line to a removed appliance) and installing a panel on homes needing a panel upgrade (as a separate measure). Measure costs have not historically accounted for non-measure specific upgrades such as the need to upgrade a home's electrical panel. In the 2025 Study, Guidehouse will quantify certain electrification costs:

- Avoided Gas Infrastructure Cost. We will use available cost data from existing CPUC tools.
- Behind-the-Meter Infrastructure Upgrade Cost. We will incorporate findings from the fuel substitution infrastructure cost market study, detailed in Section 3.2.2 within Figure 4.

BEHAVIOR, OPERATIONAL AND RETRO COMMISSIONING (BROS) MEASURES

To estimate the portion of demand and energy savings attributed to behavioral interventions, Guidehouse will work with the CPUC and stakeholders to identify a representative list of behavior and activity-based measures. Guidehouse will start with the 2023 measure list, which included the BROs measures listed below.

- Home Energy Reports (HERs)
- Web-Based Real-Time Feedback (Web RTF)
- In-Home Display Real-Time Feedback (IHD RTF)
- Small Residential Competitions

- Large Residential Competitions
- Universal Audit Tool (UAT)
- Commercial Competitions
- Business Energy Reports (BERs)
- Building Benchmarking
- Strategic Energy Management (SEM)
- Building Energy Information Management Systems (BEIMS)
- Building Operator Certification (BOC)
- Retro commissioning (RCx)

For each program, Guidehouse will review historic participation and if there has been no change in past or planned participation, then the program may be removed from characterization. Based on a preliminary review, it is anticipated that Guidehouse will recommend removing Residential and Commercial Competitions from the BROs measures characterized and included in the 2025 Study.

The team will then define a set of participation forecast scenarios based on data such as existing levels of program participation, either for the California IOUs for existing programs or the program from which data was drawn and applied to California IOU territories. It is important to highlight that participation is a function of either customer adoption for opt-in programs or the number of customers that the utility wants to engage for opt-out programs. Engagement strategies for opt-out programs typically target high value customers first as these customers tend to result in the highest savings. Engagement often happens in waves and utilities may design the program as a means of experimenting with the effectiveness of different program elements. Some of the key assumptions include:

- A typical participation goal for the first year of implementation (or initial program saturation for existing programs)
- The percentage of residential, commercial, and industrial customers enrolled per year following the launch of the program
- The growth rate in participation over 5, 10, 15, and 20 years

In addition to a participation forecast, Guidehouse will define unit energy savings factors (typically expressed as a % of baseline whole building energy consumption) and unit energy cost factors to characterize each BROs program. These factors will be based on actual California IOU impact evaluations for existing programs or from other sources for which data is available and applied to California IOU territories. For 2023, we bifurcated HERs into smaller groups (for example waves, or low vs. high energy users) to be able to better reflect the realities of the market. Guidehouse plans to utilize this approach again in the 2025 Study.

The methodology described above is subject to change depending on data availability and input from the CPUC and stakeholders.

3.2.3 Technical Potential

Technical potential is defined as the amount of energy savings that would be possible if the highest level of efficiency for all technically applicable opportunities to improve energy efficiency

were taken, including retrofit measures, replace-on-burnout measures, and new construction measures. Guidehouse's PG model considers the following in forecasting technical potential:

- Technical potential assumes all eligible customers within a technology group adopt the highest level of efficiency available within the technology group, regardless of cost effectiveness.
- Technical potential represents the savings (to be defined in terms of TSB, defined below) from converting all equipment that is at or below code or standard practice (where applicable and documented) to the highest level of efficiency within a technology group. Technical potential captures cross-measure interactive effects.
- Total technical potential is a sum of all individual technical potential within each technology group excluding whole building packages and BROs. Whole building packages are excluded from the technical potential as doing so would be duplicative. Technical potential for BROs is undefined in our model.

Technical potential can be reported as both instantaneous and annualized potential, distinguished as follows:

- **Instantaneous:** Potential that is unconstrained by stock turnover in existing buildings in any given year.[8] This is the theoretical maximum savings possible from converting all equipment that is at or below code or standard practice (where applicable and documented) to the highest level of efficiency within a technology group.

Annualized: Potential that is constrained by stock turnover in existing buildings in any given year. This is the theoretical maximum savings possible from converting all equipment that is at or below code or standard practice (where applicable and documented) to the highest level of efficiency within a technology group upon burnout of the baseline technology. **Error! Reference source not found.**The calculation of technical potential differs depending on the assumed measure replacement type, since technical potential is calculated on a per measure basis and includes estimates of savings per unit, measure density (e.g., quantity of measures per home), and total building stock in each service territory. Guidehouse will work with the CPUC and other relevant stakeholders to define replacement types suitable for including in the potential study. The replacement types to be included in the 2025 PG study are described below:

TOTAL SYSTEM BENEFIT METRIC

While in previous cycles, technical and economic potential only focused on energy impacts (kWh, kW, therms), this cycle, technical and economic potential will calculate and represent the results in terms of TSB. TSB represents the present value of the total lifetime net benefit that a measure provides to the electric and natural gas systems. In the context of the PG Study, TSB is a metric that quantifies the relative value of each measure compared independent of its measure cost, program cost, or fuel type. While TSB is not a cost-effectiveness test itself, it is calculated (in units of $) from key components of the Total Resource Cost (TRC) and Program Administrator (PAC) cost effectiveness tests.

$$Total\ System\ Benefit =$$
$$Net\ Avoided\ Cost\ Benefits\ (Energy\ and\ Capacity) - Increased\ Supply\ Cost$$

[8] Includes buildings newly constructed in that same year

- Benefits ($) that EE/FS contributes to the electric and gas systems
- TSB relies on:
    - Annual energy savings
    - Avoided costs & measure load shape
    - Measure life (EUL)
- Net present value over the EUL
- Avoided Cost Benefits – Energy and capacity savings of fuels offered by IOUs
- Supply Costs – "negative energy savings" resulting from:
    - Measure interactive effects
    - Increased energy consumption resulting from fuel substitution

As noted in Section 2, Guidehouse will update the DSMSim model structure and function in the 2025 Study to calculate technical potential in terms of TSB. This is defined as the aggregate combined value of the individual measures within each competition group with the highest Total System Benefit. Similarly, the PG Study's economic potential will represent the total TSB of individual *cost effective* measures within each competition group that have the largest modeled TSB. Consistent with the 2023 Study, Guidehouse will present TSB ($) as the primary output of the 2025 PG Study's achievable potential, aligning with its use as the primary metric used by CPUC staff to set IOU goals and track IOU program achievements. Additional detail on the treatment of similar measures within competition groups can be found in the sections below.

EXISTING BUILDINGS

Guidehouse will calculate technical potential for the following replacement types in existing buildings:

- **Normal replacement (NR) (i.e., replace-on-burnout [ROB]):** New equipment needs to be installed to replace equipment that has reached the end of its useful life, has failed, or is no longer functional. Upon failure, normal replacement equipment is generally not repaired by the customer and is instead replaced with a new piece of equipment. Appliance standards are applicable to some types of normal replacement equipment and apply to all new purchases.
- **Accelerated Replacement (AR) (i.e. early retirement):** Programs may influence end users to replace equipment with more efficient units prior to the end of its useful life. The 2023 PG Study did not consider AR within existing buildings. We can consider including AR within the 2025 Study should there be a need and as budget allows.
- **Add-on equipment (AOE):** New equipment installed onto an existing system, either as an additional, integrated component or to replace a component of the existing system. In either case, the primary purpose of the add-on measure is to improve the overall efficiency of the system. These measures cannot operate on their own as standalone equipment and are not required to operate the existing equipment or building. Codes or standards may be applicable to some types of add-on measures by setting minimum efficiency levels of newly installed equipment, but the codes or standards do not require the measure to be installed.

Equation 1 shows the formula for calculating technical potential in existing buildings.

Equation 1. Technical Potential in Existing Buildings

Technical Potential, $_{EXISTING\ BUILDINGS}$ = Existing Building Stock $_{YEAR}$ (e.g., buildings[9]) X Measure Density (e.g., widgets/building) X Savings $_{YEAR}$ (e.g., m^3/widget) X Technical Suitability (dimensionless)

NEW CONSTRUCTION BUILDINGS

In a newly constructed building, equipment that is installed is always relative to code. New building stock is added to keep up with forecast growth in total building stock and to replace existing stock that is demolished each year. Demolished (sometimes called replacement) stock is calculated as a percentage of existing stock in each year. Equation 2 shows the formula for calculating technical potential in new buildings.

Equation 2. Technical Potential in New Buildings

Technical Potential, $_{NEW\ BUILDINGS}$ = New Building Stock $_{YEAR}$ (e.g., buildings[10]) X Measure Density (e.g., widgets/building) X Savings $_{YEAR}$ (e.g., m^3/widget) X Technical Suitability (dimensionless)

TECHNOLOGY GROUPS

Guidehouse's modeling approach recognizes that some efficient technologies will compete against each other in the calculation of potential. The study defines competition as efficient measures competing for the same installation (e.g., SEER 18 AC vs SEER 22 AC) as opposed to competing for the same savings (e.g., window A/C vs. split-system A/C) or for the same budget (e.g., lighting vs. water heating). For instance, condensing water heaters and tankless water heaters would belong to the same competition group because a consumer would install one or the other. General characteristics of competing technologies used to define the competition groups proposed for this study include:

- Competing efficient technologies share the same baseline technology characteristics, including baseline technology densities, costs, and consumption.
- The total (baseline plus efficient) maximum densities of competing efficient technologies are the same.
- Installation of competing technologies is mutually exclusive (i.e., installing one precludes installation of the others for that application); and
- Competing technologies share the same replacement type.

Table shows an example of a competition group, which sees different insulation efficiency levels competing for the same installation.

[9] Units for building stock and measure densities may vary by measure and customer segment (e.g., 1,000 square meters (or feet) of building space, number of residential homes, customer-segment consumption/sales, etc.).

[10] Units for building stock and measure densities may vary by measure and customer segment (e.g., 1,000 square meters (or feet) of building space, number of residential homes, customer-segment consumption/sales, etc.).

Table 6. Example of Technologies within a Technology Group

Competition Group	Technology	Description
Floor Insulation Retrofit	R0 Floor Insulation	Average Below Code Efficiency Level
	R19 Floor Insulation	Code Efficiency Level
	R30 Floor Insulation	High Efficiency Level

To address the overlapping nature of measures within a competition group, Guidehouse's analysis only selects one measure per competition group to include in the summation of technical potential across measures (i.e., at the end-use, customer segment, sector, service territory, or total level). The measure with the largest TSB potential in each competition group is used for calculating total technical potential of the competition group. This approach ensures double counting is not present in the reported technical potential, though the technical potential for each individual measure is still calculated and reported.

Technology groups may also include fuel substitution measures. Table 8 shows a technology group where efficient gas measures compete with fuel substitution measures. In this instance, the customer would choose to install either an efficient gas water heater or an efficient electric water heater instead of a baseline gas water heater.

Table 7. Example of Technology Group Including Fuel Substitution

Technology Group	Technology	Description
Small Gas Water Heaters (normal replacement and New)	Baseline Gas Storage Water Heater	Code Efficiency Level
	Condensing Gas Storage Water Heater	High Efficiency Gas Level
	Instantaneous Gas Water Heater	High Efficiency Gas Level
	Heat Pump Water Heater	High Efficiency Electric Level

Source: Guidehouse

3.2.4 Economic Potential

Using the results of the technical potential analysis, the economic potential is calculated as the Total System Benefit available when limited to only cost-effective measures. All components of economic potential are a subset of technical potential. In addition to the above considerations in modeling technical potential, the following additional considerations are factored into our calculation of economic potential:

- Economic potential assumes all eligible customers within a technology group adopt the highest cost-effective level of efficiency available within the technology group. The technology within the group that has the highest overall TSB may not be cost-effective.
- Various cost effectiveness screens can be applied; thus, economic potential can vary by scenario. Guidehouse plans to analyze economic potential for up to five cost-effectiveness tests, which may include the following:
    - **Total Resource Cost (TRC) Test**: a benefit-cost metric that measures the net benefits of measures from the combined stakeholder viewpoint of the utility (or program administrator) and the customers. Metrics included in the TRC

calculation include the avoided cost benefits, incremental measure costs, non-incentive program administration costs, tax credits (calculated as benefits) for eligible measures and, for fuel substitution measures, the supply cost due to increased electric consumption. The TRC would be analyzed as defined in the California Standard Practice Manual.

- **Program Administrator Cost (PAC) Test:** a benefit-cost metric that measures the net benefits of measures from the viewpoint of the utility (or program administrator). The PAC is similar to the TRC but does not include customer benefits and costs such as incremental measure costs and includes utility incentive costs. The PAC would be analyzed as defined in the California Standard Practice Manual.
- The model is also capable of applying a custom-defined cost effectiveness test, such as a modified TRC test that uses a different set of avoided cost values relative to the reference TRC test. The team would only execute this at the direct request of CPUC staff.

- Various cost effectiveness thresholds can also be set. For example, if the model is set to require individual measures to have a test result of 1.0, those with a result of 0.99 are excluded from the economic potential. This threshold can be set to any value though typically it is limited to a range of 0.85 to 1.25. This threshold can be used as a scenario variable. Past goal setting scenarios apply a TRC of 0.85.
- Whole building packages are excluded from the economic potential as they would be duplicative with the individual measures that make up the whole building packages.
- Economic potential for BROs is undefined in our model, however there is a review of cost effectiveness for these measures within the initial measure screening process.

Like technical potential, our model can calculate both instantaneous and annualized economic potential.

Our model calculates economic potential leveraging the CPUC's avoided cost data and approximates the CET equations. Many simplifying assumptions are required by the Guidehouse Team to compress the massive, avoided cost dataset into something more manageable for the PG model. This includes averaging avoided cost load shapes across building types and selecting representative load shapes to assign to each end-use. Appendix I of the 2023 Potential & Goals Study Report[11] provides a detailed description of the cost effectiveness analysis methodology utilized by the study including a comparison of CET and the PG Model.

The PG model utilized in 2023 did capture avoided cost of refrigerants. The avoided cost of refrigerant leakage is not applied per kWh saved and therefore calculated differently. Refrigerant Avoided Costs (RACs) are quantified at the measure level and are expressed in units of dollars. They are a net present value of the avoided cost over the lifetime of the technology. In the case of FS measures, RAC often is a negative value, implying that it appears as a cost component in the C-E calculations.

[11] https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/energy-efficiency/2023-potential-goals-study/final-2023-group-e-pg-study-report.pdf

3.2.5 Market Achievable Potential

This section demonstrates our approach to calculating market achievable potential, which is fundamentally more complex than the calculation of technical or economic potential. This section covers the following:

- Market potential modeling approach
- Fuel Substitution adoption
- Calibration
- Net-to-Gross ratios and free ridership
- Cumulative savings
- Savings potential in disadvantaged communities
- Scenario Analysis

MARKET POTENTIAL MODELING APPROACH

Guidehouse's PG model employs a stock-turnover-based bass diffusion algorithm to simulate market adoption. Section 3.1 above provides details on the implementation of this algorithm in the model. For brevity, a concise, high-level summary of the algorithm is presented here.

Three key steps are involved in simulating market adoption using Guidehouse's PG model:

- Size population eligible to upgrade equipment in any given year.

  The model sizes the annual, eligible population for measure specific market adoption using building stock as a starting point.
  This eligible population for installation decisions is calculated based on replacement type, using either a measure's burnout rate, number of retrofittable measures, or new building stock.

- Calculate market share split amongst base and efficient measures for eligible population.

  The model calculates the market share, or penetration of measures based on customer awareness of the measure and customer willingness to adopt the measure.
  Consumer awareness is calculated based on two factors:

- Marketing, education, and outreach strength
- Word-of-mouth strength

  Consumer willingness is calculated using the multi-attribute-based approach. This approach predicts consumer behavior by weighting multiple value factors that customers use to decide whether to adopt a more efficient measure. Examples of value factors include lifetime cost and eco impacts). This approach is used for the commercial and residential sectors and applies to both EE and FS measures.

- Calculate TSB attributable to utility program intervention.

The model calculates savings attributable to utility program intervention by multiplying the number of installations that are cost-effective by each measure's unit energy savings, relative to the appropriate baseline. This savings is applied to calculate TSB.
In the case of discrete measures, the eligible population is further constrained by the remaining stock available after accounting for whole building installations.

The industrial and agriculture sectors, as well as commercial custom, are addressed differently in the achievable potential analysis. Most of the savings have historically been calculated using a top-down approach using historical adoption data trends and consumption forecasts. Guidehouse recommends conducting surveys to capture critical market actor insights on the active program experience and expectations for future development of the market. This research will help to inform and refine the top-down approach utilized. Since there are fluctuations in market activities with changing program requirements and program models, the surveys can support the direction and magnitude of the program regressions.

The surveys will collect perspectives on the market based on previous experience and potential customer adoption and implementation engagement with the evolution in NMEC/Custom programs. We will survey the following (but not seeking a statistically significant sample/respondent size):

- Program managers and/or their outreach/field team at both utilities and 3P implementers
- Market participants/stakeholders (researchers, non-profits, etc)

Since the adoption analysis is top-down using a historical trajectory extrapolation, we will use the survey results to adjust the forecasted trajectory based on the survey results.

Since potential analysis is program agnostic, the PG study recognizes that the program costs are differentiated by program model which can be found in CEDARs or TUALs. As such, weighted program costs will be calculated for measure categories (e.g. capital SEM vs. capital custom).

FUEL SUBSTUTION ADOPTION

The PG study is intended to assess achievable potential for IOU portfolios including EE and fuel substitution measures. However, other factors besides IOU rebate programs are expected influence trends in building electrification. These include:

- Programs and interventions other than IOU EE portfolios, e.g., Inflation Reduction Act (IRA) programs and tax incentives and Equitable Building Decarbonization (EBD) program
- Impact of zonal electrification efforts
- California Air Resources Board (CARB) State Implementation Plan (SIP) ruling for natural gas appliances.
- Non-measure specific costs of electrification, such as infrastructure costs

Guidehouse plans to conduct research on these elements to better understand and incorporate their impact. This research may draw from or feed into the fuel substitution measure potential being calculated in the PG study.

Non-IOU Electrification Programs

There are several programs and interventions in California that promote building electrification other than the IOU EE portfolios. The PG Study team will use the data from these programs if warranted. Examples include, but are not limited to:

- Programs developed with funding from SB 1477, a bill to reduce GHG emissions from buildings:

  - The BUILD Program, which incentivizes the construction of new all-electric Income-Qualified residential buildings; and
  - The TECH initiative, which incentivizes the adoption of electric space and water heating technologies in existing homes, including Income-Qualified and disadvantaged communities.
- California Energy Commission EBD
- Department of Energy administered by the CEC IRA-funded programs.
- Rebates for electric heat pump water heaters through the Self-Generation Incentive Program (SGIP)
- POU fuel substitution programs
- Food Production Incentive Program (FPIP), which incentivizes industrial food production facilities to install lower-GHG equipment.
- Additional fuel substitution in the industrial and agricultural sectors; e.g., California Air Resources Board (CARB) or Air Quality Management District (AQMD) requirements
- SCE's Clean Energy Optimization Pilot, a performance-based incentive for GHG reduction targeting large customers.
- Interventions implemented by CCAs, Regional Energy Networks (RENs), and local government ordinances, such as natural gas bans.
- Building electrification achieved by Title 24 building codes.

Many of these programs target the same types of equipment—and potentially even the same installations—as the IOU ratepayer funded programs. Guidehouse will estimate the degree to which programs are enrolling customers who would otherwise be applying for rebates through the IOU programs, thus reducing the potential savings for these measures in the PG study.

The objective of these fuel substitution-specific tasks are to quantify any additional achievable potential being delivered by these programs.

In the bottom-up, technology-based approach, Guidehouse will estimate the additional achievable potential for building electrification that the non-IOU programs could deliver. This method could be used for any non-IOU programs that provide incentives for measures that are also rebated through IOU EE programs. For example, the SGIP program incentivizes the installation of heat pump water heaters replacing gas water heaters, which is also an EE program measure. Under this approach, the analysis would use much of the same measure data as was collected in the core potential study because the measures would be essentially the same technologies, but measure data will be updated as necessary. The analysis will account for measure saturation and penetration in the population eligible for the program, as well as employ current utility program data that can inform the calibration based on differences in fuel substitution impacts between different regions. Further detail on calibration of Fuel Substitution measures is outline below.

CALIBRATION

Forecasting is the inherently uncertain process of estimating future outcomes by applying a model to historical and current observations. As with all forecasts, the Potential and Goals Model (PG Model) results cannot be empirically validated a priori because there is no future basis against which one can compare simulated versus actual results. Despite the fact that all future estimates are untestable at the time they are developed, the forecasts generated through

the PG Study's analysis can still warrant confidence when historical observations can be shown to reliably correspond with generally accepted theory and models.

Calibration refers to the standard process of adjusting model parameters such that model results align with observed data. Calibration provides the forecaster and stakeholders with a degree of confidence that simulated results are reasonable and reliable. Calibration is intended to achieve three main purposes:

- Anchor the model in actual market conditions and ensure the bottom-up approach to calculating potential can replicate previous market conditions.
- Establish a realistic starting point from which future projections are made.
- Account for varying levels of market barriers and influences across different types of technologies.

The PG Model applies general market and consumer parameters to forecast technology adoption. There are often reasons why markets for certain end uses or technologies behave differently than the norm—both higher and lower. Calibration offers a mechanism for using historical observations to account for these differences.

The calibration process is not a regression of savings or spending (not drawing a future trend line of savings based on past program accomplishments). Rather, calibration develops parameters that describe the customer decision-making process and the velocity of the market based on recent history. Once these parameters are set, the model uses them as a starting point for the forecast period.

The process to develop these parameters requires historical market data. When this primary method of calibration is not possible (in cases the market has significantly changed), a secondary method can be used. The secondary method focuses on tuning saturation and penetration rates to observed market conditions rather than relying on historical program savings and spending. Another approach is to survey the market or market participants on their insights. Within the calibration process, any new measures or programmatic aspects not applicable in the historical years will removed from the analysis to optimize the PG Model compatibility to the historical period.

Calibration Period

The Guidehouse team calibrated the PG Model in 2023 based on historical program and market data from 2018 through 2021 for EE measures, and Q1 – Q2 2022 data for fuel substitution (FS) measures. Program accomplishments prior to 2018 were judged by the Guidehouse team as too different in terms of the measures offered by programs and the baselines set by code or policy. Due to the recency of rebated FS parameters, no reliable data on FS adoption prior to 2022 was available. Guidehouse plans to utilize a similar approach for the 2025 PG Study and will base its calibration of data from the period 2020 – 2023 for EE measures.

Fuel Substitution Calibration Data

In addition to IOU program data, Guidehouse will consider the incorporation additional fuel substitution-specific calibration data sets. At the time of the 2023 Study, there was less than one year of IOU program data available calibrating market dynamics in adopting FS from program interventions.

To address the limitation of FS-specific data from IOU program interventions, the 2025 study will include research and data collection from non-IOU programs for FS uptake. Furthermore, as directed by CPUC Staff, Guidehouse may conduct a primary data collection to understand the

current (and forecasted) market state for FS adoption to include in a calibration process. As part of this effort, we intend to answer such questions as:

- Do infrastructure upgrade requirements and associated costs represent a gap in understanding measure adoption and cost effectiveness?
- Do market limits such as technology, work force education, and competing non-IOU programs impact market uptake?

Our approach in intended to inform modeled future adoption of these technologies and seeks a more holistic insight on the propensity for the market to transition away from natural gas technologies where a viable electrified alternative is available. In any of the additional topics and addressing their potential impact on FS adoption, Guidehouse strives to ensure the appropriate data validates the assumptions or informs the assumptions used. If there is data not available, the PG study tends to err on the side of being data driven.

NET-TO-GROSS RATIOS AND FREE RIDERSHIP

Guidehouse's PG model is set up to calculate both gross and net savings attributable to IOU programs. Similar to the 2023 Potential & Goals Study, results from this study will be presented in the form of net savings. Guidehouse will source net-to-gross ratios from appropriate, updated sources such as DEER support tables contained in the eTRM or CEDARs reported program data. Guidehouse will discuss the appropriate sources with experts on the DNV subcontractor team, the CPUC Staff and other relevant stakeholders.

CUMULATIVE SAVINGS

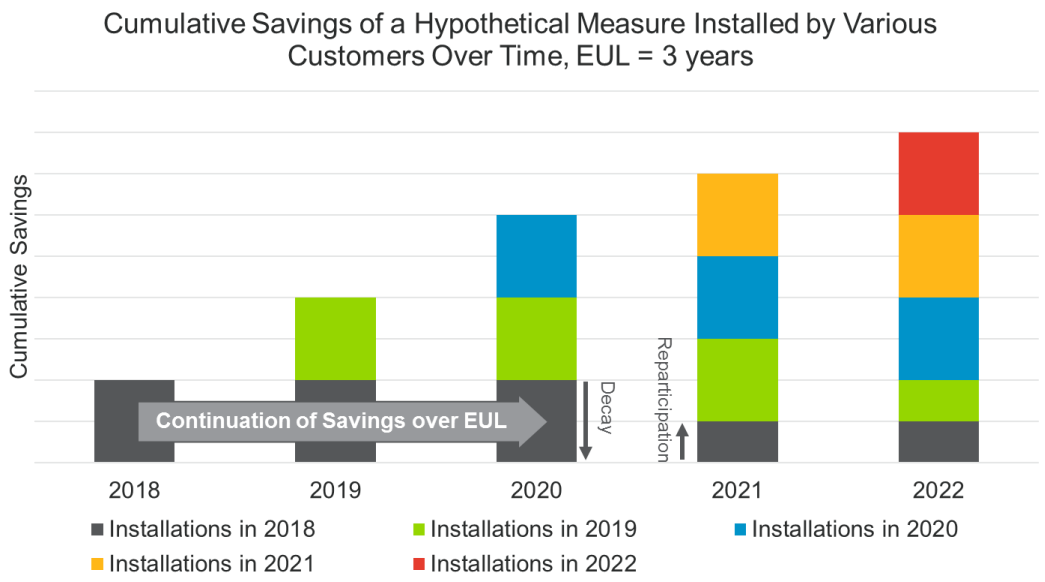
As mentioned in Section 3.1, Guidehouse's PG model calculates both incremental and cumulative savings considering direction provided in CPUC staff adopted methods. Currently, the model is set up to calculate cumulative savings as the total energy efficiency program savings from measures installed since a "start year" and are still "active" in the current year. "Active" savings are calculated by accounting for:

- Cessation of savings (what the CPUC typically refers to as "decay") as measures reach the end of their EUL
- Codes & standards that come into effect over time

The approach to quantifying decay is somewhat debatable. Past CPUC guidance has been to assume 50% of EE savings decay at the end of their EUL. Guidehouse used a modified, stakeholder vetted assumption in the last five potential studies that is based on the market adoption algorithms within the model. Essentially, customers re-enter the decision tree and make their purchase decision based solely on the technology performance and cost rather than experience.

Historically, cumulative savings have primarily been used by the CEC to update their demand forecast (through the AAEE forecast). Going forward it will also be used to inform SB350 targets. For the purposes of AAEE, the model includes savings from re-participants in the cumulative savings calculation. The calculation of cumulative savings is illustrated in Figure 7.

Figure 8. Cumulative Savings Illustration



Source: Guidehouse

SCENARIO ANALYSIS

This assessment will develop combinations of economic and market achievable assessments to produce up to four scenarios of potential for goal setting purposes. In previous studies, Guidehouse identified the first 4 variables presented in Table as candidate parameters to vary across scenarios. Additionally, the 2025 study may consider cost effectiveness-related screening approaches other than TRC, including PAC, to optimize the portfolio's calculated Total System Benefit.

Table 8. Internally Influenced Variables Considered for Scenario Setting

Lever	Description	Potential Impact Applicability	
		Economic	Market
Incentive levels	Varying incentive levels (at a percentage of incremental measure cost) will change the cost effectiveness of measures and their value proposition to customers. This lever includes incentive layering/stacking opportunities.	✔	✔
ME&O	Varying marketing and outreach levels impact the rate at which technologies are adopted by customers.		✔

Lever	Description	Potential Impact Applicability	
		Economic	Market
BROs program assumptions	Enrollment in BROs programs is an input vector. Guidehouse can assume a reference or aggressive rollout of BROs programs.		✓
Financing programs*	IOU financing programs help reduce the cost burden associated with efficient measure adoption.		✓
Cost effectiveness test	Different cost effectiveness screening tests or thresholds yield different amounts of economic potential and cause the achievable potential model to incentivize different sets of measures. The cost effectiveness screening test threshold only applies to rebate programs.	✓	✓
Cost effectiveness measure screening threshold		✓	✓

* Financing was not included in the 2023 Study.

Source: Guidehouse

Guidehouse will work with the CPUC staff to define the reference (or base) scenario for this study (i.e., screening test, avoided cost data, etc.). Guidehouse will calibrate the model using the settings in this reference scenario, and model alternate pathways for up to three additional scenarios, for a total of four. The three additional scenarios will be determined in conjunction with CPUC staff to make sure the results are most useful for policy decision-making.

Guidehouse and CPUC will work together to assess available information that may inform differentiation of incentive levels between EE measure categories. This topic will be presented as well as differing FS/EE measure incentive assumptions during the Scenario Design Webinar prior to our final Achievable Potential results.

Fuel Substitution Scenarios

To expand upon the uncertainties of the program intervention impacts, there are uncertainties on California polices ranging from retail rate structures, CARB SIP implementation timeline, and more. Therefore, FS scenarios may consider these uncertainties and unknowns. Specific items that could be addressed in the 2025 study include:

- Incentive layering from other programs
- Impacts of other programs on IOU program adoption
- Timing of CARB SIP zero emission standard and applicability based on end use and market segment such as the current SIP rollout status and anticipated adoption scenarios

- Impacts of CARB SIP plans to early retirement

Guidehouse will consider similar scenario levers as in the EE potential calculation but may update certain scenario levers with data specific to the programs. Additional levers that are specific to building electrification may also be considered. Some examples of factors that may differ between rebate programs and the non-IOU programs may include:

- **Eligible population:** Some of the non-IOU programs have eligibility criteria that are different from the EE rebate programs. For example, only new construction is eligible for the BUILD program. Guidehouse may explore refining the model to account for PG&E's planned electrification with locally focused (zonal) program delivery, including incorporation of specific ZIP codes or census tracts these efforts are expected to include.
- **Consumer awareness:** Consumers within the eligible population may have different levels of awareness due to increased program marketing. Awareness may also vary across technologies such as the increased marketing channels for heat pumps.
- **Consumer willingness:** In the residential and commercial sectors, the EE study uses a multi-attribute-based approach to predicting consumer behavior by weighting multiple value factors that customers use to decide whether to adopt a more efficient measure. Consumers may use different value factors when deciding whether to electrify a technology, or they may weigh the value factors differently than they would for an EE measure. This was examined in the 2021 PG study through a primary data collection effort.
- **Incentive levels:** Programs may provide incentives for a particular piece of equipment that also receives incentives through the EE rebate programs. This results in incentive layering, defined as "Financial or nonfinancial incentives being offered to the same market segment, customer, or technology measure at the same time."[12] There are several possible ramifications of incentive layering. For example, incentive layering may increase adoption because it would reduce the cost to the consumer of installing the measure. On the other hand, the analysis would have to avoid double counting savings across multiple programs if they were contributing to the same equipment installation. The analysis would also have to determine how to attribute savings to the individual programs. Guidehouse will consult with the CPUC staff and stakeholders who are developing the approach to attribute program costs and savings when multiple programs contribute to savings. Guidehouse is leading the impact evaluation of the BUILD and TECH programs under subcontract to Opinion Dynamics and will ensure that we have the most recent data and information on these programs to assist with this analysis.

3.2.6 Codes & Standards Potential

C&S impacts on energy efficiency potential are modeled two ways:

- C&S impacts the code baseline for IOU rebated measures; as C&S becomes more stringent in the future, above-code savings claimable by IOU programs decreases.

[12] CPUC Incentive Layering Workshop, June 30, 2020, **https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/building-decarb/incentive-layering-workshop_06302020_final.pdf**

- IOUs can claim a portion of savings from C&S that come into effect through the IOU C&S advocacy programs. This component has historically been considered the "C&S Potential." This task describes how the C&S Potential will be calculated. Impacts on rebate programs were described earlier in Section 3.2.2.

C&S potential refers to the forecast savings from current C&S, planned C&S, as well as a set of C&S that are reasonably expected to come into effect. This savings is most comparable to a market achievable potential. C&S potential does not include an estimate of technical or economic potential. A C&S Technical potential would imply C&S are set to their maximum efficiency levels and 100% of customers would comply with them (i.e., every building is ZNE, every air conditioner is SEER 20+, etc.). A C&S technical potential would completely subsume a utility rebate program technical potential. For this reason, C&S technical potential is neither useful nor something we recommend calculating. Similar logic applies to C&S economic potential.

Our study will calculate the C&S "Achievable" potential in multiple formats, each for a different use:

- **Net C&S Savings** are the total energy savings estimated to be achieved from the updates to Codes and Standards since 2006. Net savings calculations account for naturally occurring market adoption (NOMAD) of code-compliant equipment and are used to inform demand forecasting, procurement planning, and tracking against greenhouse gas targets. This informs the CEC forecast (for AAEE and SB350 purposes).
- **Net IOU C&S Program Savings** identifies the portion of the Net C&S Savings that can be attributed to the advocacy work of the IOU's C&S program. This result is used to inform the IOU program goals.
- **C&S Total System Benefit** may be calculated based on the identifiable and end use-specific energy and demand impacts of individual codes. Guidehouse has in the past not calculated TSB for Codes & Standards for reasons similar to those outlined above but doing so is feasible. If this C&S TSB determination is of value to CPUC staff and stakeholders, Guidehouse can include this output in our Study results.

Over the last few cycles of the PG study, Guidehouse has observed CEC staff being the primary user of the C&S savings forecast. While the CPUC sets C&S goals and the PAs use the results to plan their activities, by and large CEC staff make the most detailed use of C&S savings forecasts originating from the PG study. As a result, Guidehouse proposes coordinating with CEC staff from the CEC's Energy Assessments Division to better understand and accommodate their needs while balancing the budget available for this subtask.

MODELING METHOD TO DEVELOP SAVINGS ESTIMATES

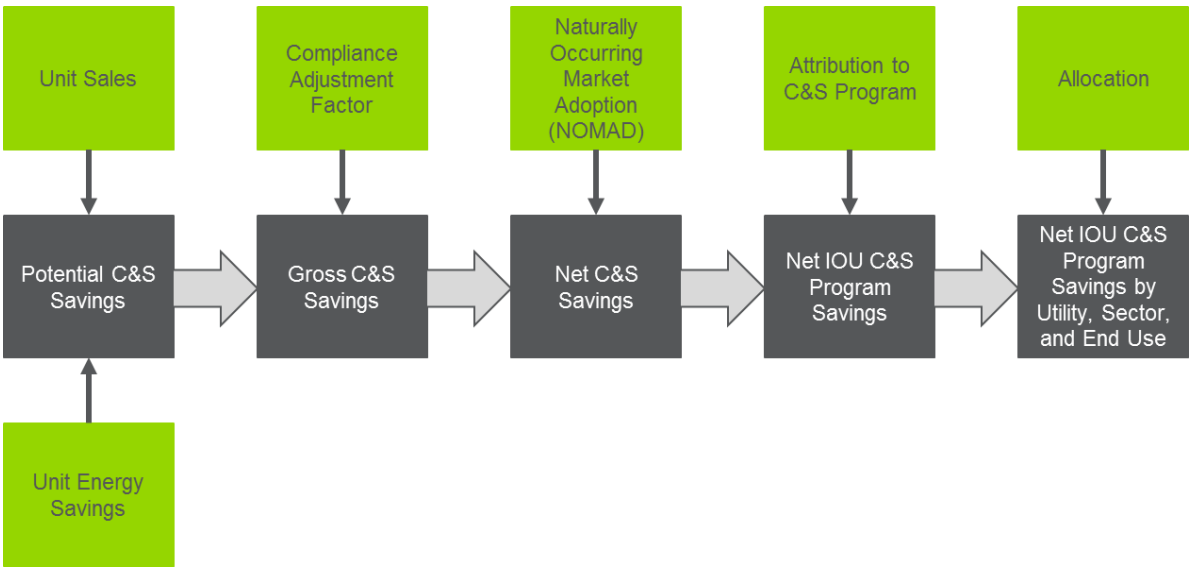
Our model methodology for C&S savings is based on the ISSM[13] developed and used by the CPUC staff in C&S program evaluation. ISSM follows the evaluation methods outlined in the California Evaluation Protocol. In the previous CPUC potential studies, Guidehouse replicated the methodology of ISSM in the Analytica platform for use in the PG Study. Translating the methodology into Analytica allows a single PG modeling platform, enhanced scenario analysis, and ability to develop more granular results (sector and end-use). Our model has been verified to match the outputs of the ISSM.

[13] Cadmus and DNV GL. *Integrated Standards Savings Model (ISSM).* 2017.

Guidehouse plans to continue use the existing ISSM based C&S model and update it to reflect any methodological changes in the latest CPUC-approved ISSM. The core process of calculating C&S potential is illustrated in Figure 9. Key components of the calculation listed include:

- **Unit Sales –** Unit sales are the assumed baseline units sold each year for each measure. They represent the expected population of code-compliant or standard-compliant equipment adopted.
- **Unit Energy Savings –** Unit energy savings are the energy savings (in kWh, kW, or therms) relative to the previous code or standard for the new compliant equipment.
- **Compliance Adjustment Factor (CAF) –** (CAF) is the baseline assumption for the rate at which the population complies with codes or standards.
- **NOMAD –** The naturally occurring market adoption is the fraction of the population that would naturally adopt the code-compliant or standard-compliant measure in the absence of any code or standard.
- **Attribution –** IOU Attribution is the portion of gross C&S savings in California that can be claimed by IOU Code Support programs.
- **Allocation Factors –** Allocation factors are the fraction of the statewide C&S savings that occur in each IOU territory. Additional allocation factors assumed by Guidehouse break down the savings into sectors and end uses.

Figure 9. C&S Savings Calculation Methodology



Incremental savings for C&S are the new savings generated in each year after the code compliance date due to upgrading older equipment or activity in the new construction market. Cumulative savings is the simple summation of incremental savings over time up until the entire market has turned over.[14] This is marked differently from calculating cumulative savings for

[14] For example, a standard that applies to an appliance that has a 7-year EUL will accrue incremental savings for 7 years at which point incremental savings from the retrofit market drops to 0. Savings remain from the new construction market after the 7 years unless the standard is subsumed by a more stringent standard and layering effects are removed.

rebate programs, which requires an estimate of decay (i.e., measures reverting to baseline after the EUL). In the realm of C&S, the baseline is the previous code or standard, thus there is no "reversion to the baseline" since consumers cannot purchase equipment at the old code or standard level.

The PG study forecasts potential in IOU service territories based on the best approximation for where savings are expected to occur. For C&S this means using an IOU allocation factor based on energy sales by fuel type. This is consistent with the methodology used in the 2023 Potential and Goals Study

SCOPING POTENTIAL STANDARDS AND DATA COLLECTION

The IOUs have developed a process of working with the CEC to identify candidate standards they will develop and support in the adoption process. They meet regularly to scope out opportunities for new Codes and Standards and create strategies for pursuing adoption and develop data an estimate of savings potential.

The Guidehouse Team will start with a list of C&S to include in the 2025 PG study leveraging those included in the 2023 PG study. We will then work with the EDPM, IOU program managers and contractors, CEC staff, and CPUC staff and consultants to scope out a list of additional standards to be included in the 2025 PG study C&S potential. This will include a data request to the IOU C&S program managers. Our ability to include new C&S depends largely on the availability of necessary input data. Table summarizes the planned approach and sources of information.

Table 9. Developing Potential C&S for Analysis

Potential C&S	Information Sources
C&S in effect that have been evaluated	Past CPUC staff evaluations will be used to develop the list of C&S to consider. These evaluations will also contain data in the ISSM input format for our team to leverage. Guidehouse expects little need to collaborate with external team members other than confirming the latest evaluation data is being used.
C&S in effect that have not been evaluated	IOU C&S claims will be used to develop this list of C&S to consider. Our team will consult the IOU program managers and their contractors to obtain the list; it is possible these claims will have been submitted to CPUC staff. Guidehouse expects these claims to contain data in the ISSM input format for our team to leverage.
Future C&S	IOU C&S claims may include longer term C&S that have not yet come into effect. We will seek information and data from IOU C&S claims in this regard. For additional future C&S Guidehouse proposes to engage with CEC staff and their contractors as they look to scope and estimate savings from future updates to T20 and T24.

After compiling information from all these sources, Guidehouse will develop a list of Codes and Standards for which we have sufficient data to include in the study. Guidehouse will then focus its research on this list to develop the technical details required in the Potential and Goals analysis.

PRODUCE SAVINGS RESULTS

As mentioned earlier, ISSM requires several inputs to calculate the gross and net savings estimates for individual standards. Guidehouse will use available data sources to develop

estimates of annual unit energy savings for each appliance standard and code change and combined code changes in Title 24.

Where gaps exist, Guidehouse will research current appliance market sales and projections, construction projections, and trends and develop market size estimates over the forecast period. Unit savings and market size estimates will be combined to calculate the potential savings from each standard over the forecast period.

Compliance factors will need to be estimated for future C&S. For building codes, historical data at the building level by building type will be used based on the proportion of projected energy savings achieved. For the appliance standards, Guidehouse will review historical compliance rates for similar standards.

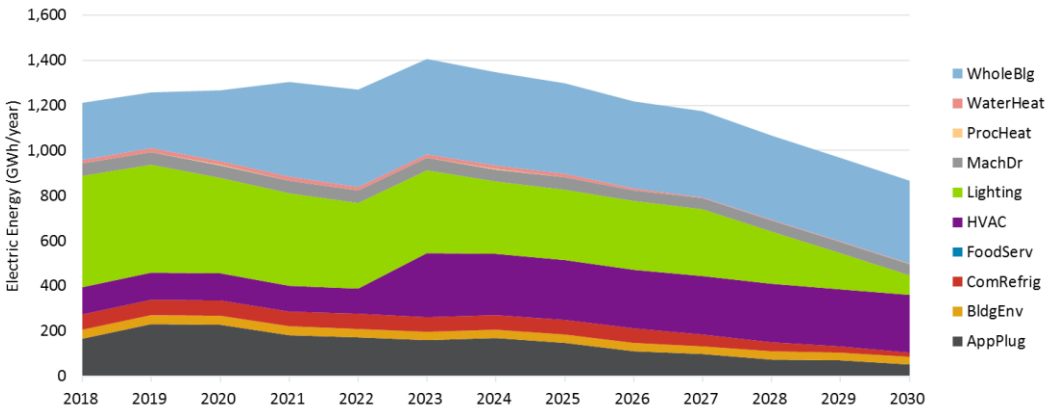
NOMAD factors will also need to be estimated for future C&S. Guidehouse proposes using estimates from prior evaluations in most cases with adjustments to shift the start year as appropriate. For those standards that differ significantly from prior ones, Guidehouse will conduct a Delphi process using knowledgeable experts to develop original estimates.

Once all input values are generated this task will provide savings results with the following granularity:

Yearly Incremental and Cumulative Savings	Net Savings
Net Attributable Savings	IOU
Sector	End-Use
C&S Measure	Applicable Hourly Load Shapes

Model inputs and assumptions will be documented and made available for public discussion. Summary results and a database of detailed results will also be produced for public discussion. An example of past summary graphs can be found in Figure 10.

Figure 10. C&S Example Outputs - Incremental Electric Savings



3.2.7 Income-Qualified Potential

As part of the 2025 Study cycle, the Guidehouse Team will again forecast potential from the Income-Qualified sector and programs such as the IOUs' Energy Savings Assistance (ESA)

programs. This section details Guidehouse's proposed approach to this analysis. Our team plans targeted engagement later in 2024 with stakeholders and may refine this approach prior to it being conducted. A detailed Income Qualified Potential Work Plan will be developed separately with guidance and input from the CPUC and stakeholders including the ESA Working Group.

OVERVIEW

The Income-Qualified potential methodology in the 2021 PG study was significantly different from prior studies. These changes were made to better estimate potential in the Income-Qualified sector. First, the Guidehouse Team worked with CPUC staff to define a measure list specific to the Income-Qualified sector. Guidehouse then used a simplified forecasting approach, leveraging its existing rebate program model to forecast technical and achievable potential from the Income-Qualified sector (specifically from energy efficiency measures eligible to be installed through ESA). ESA programs provide no-cost weatherization measures and other energy efficiency measures to income qualified residential customers to alleviate their energy burden while improving health, comfort, and safety. The ESA program also includes energy efficiency education and referrals to other income qualified programs, as well as fuel substitution measures.

Guidehouse proposes to continue with the same basic approach, while building upon the improvements made in the 2023 PG study which included adding fuel substitution and Multi-family property common area measures (CAM). For the 2025 study, Guidehouse may, for example, conduct more research to inform measure penetration and adoption, and compare data with other states' programs.

The proposed approach to calculating Income-Qualified potential consists of the steps outlined in the following subsections. Given the concerns raised in D.21-06-015 by stakeholders regarding the methodology for the Income-Qualified potential analysis in previous PG studies, Guidehouse has collected initial input from stakeholders and CPUC staff and augmented the methodology outlined here, first implemented in 2021.

DEFINING THE MARKET

The Income-Qualified market first needs to be defined using secondary data. Generally residential customers qualify for ESA programs based on income limits that are tied to federal poverty guidelines. Guidehouse will use this information in conjunction with the most recent IEPR update data and RASS data to estimate the proportion of residential building stocks considered as Income-Qualified. This can be cross referenced with the Athens eligibility estimates.

Guidehouse will consider separate single family, multifamily, and mobile homes subsectors. The 2021 and 2023 PG study lumped mobile homes together with single family.[15] This study may break out mobile homes based on RASS housing stock data. ESA program participants do not need to reside within a Disadvantaged Community (DAC) to participate; similarly, residing within a DAC does not automatically qualify a residential for the ESA program. Any potential locational analysis will be considered in the 2025 Study's Post Goals Support, detailed in Section 4.3.

Guidehouse followed this approach in the previous study and estimated that approximately 15%-20% of single-family households and 30%-40% of multifamily households qualify for Income-Qualified programs. Since the completion of the previous study, the income threshold to participate in ESA is 250% Federal Poverty Level (FPL). Once the Income-Qualified market has been identified, it will be separated into its own "sector" distinct from the residential sector in our

[15] Mobile home parks are a unique category. Mobile homeowners typically are not eligible for EE rebates.

model. The residential sector will represent the portion of non-Income-Qualified customers that are more likely to participate in traditional utility rebate programs while the Income-Qualified sector will represent the remainder of the population that is eligible for ESA. Each population will be treated separately throughout the potential study.

SELECTING MEASURES

As in the previous study, Guidehouse will work with CPUC staff to identify a list of measures to include in this study. Guidehouse will start with the same measure list as the 2023 Study (which contained 83 ESA program measures) and build up on by selecting relevant additional measures from the following sources in collaboration with CPUC staff and stakeholder inputs using the following information:

- Approved ESA measures in the IOU ESA applications for 2021-2026 including fuel substitution measures.
- Any ESA program measures included in the ESA Policy and Procedures (P&P) Manual[16] that IOUs did not include on their applications.
- Any ESA program measures included in the IOU's Income-Qualified monthly and annual reports[17], including the Multifamily program and pilots.
- Cost effectiveness data for proposed new measures. In cases where new measures are being considered we may initially assess their cost effectiveness to consider if they should be included (see additional information below).
- Similar to the 2023 Study - Health, Comfort, and Safety (HCS) measures such as air purifiers will be separately identified in order to estimate the total impact of HCS measures on savings potential and cost.

Guidehouse will aggregate or disaggregate measures where necessary for analysis. For example, in the previous study, the team characterized High Efficiency Clothes Washers instead of multiple options for different clothes washer efficiencies and different types of washers (top loading, front loading, combo washer dryer, etc.). This is necessary as the Income-Qualified forecasting methodology assumed all measures are mutually exclusive and not in competition with each other.

CHARACTERIZING MEASURES

Guidehouse will source measure characteristics from three main secondary data sources:

- **IOU program activity:** Guidehouse will request a database of year-to date ESA program activity from each IOU including number of installations for each measure in each year, unit energy savings, and unit cost among other things. We expect IOU program activity to provide the vast majority of data we need.
- **2021-2026 IOU applications:** Guidehouse may review approved IOU ESA/California Alternate Rates for Energy (CARE) applications for 2021-2026 if additional data is needed (for example, measures that have limited data/information in IOU program databases).

[16] *Statewide Energy Savings Assistance Program 2021-2026 Cycle Policy and Procedures Manual*, revised September 2022.

[17] Sources from the monthly and annual reports on the Income-Qualified Oversight Board website: https://liob.cpuc.ca.gov/monthly-annual-reports/

- **2027 and beyond IOU applications:** Guidehouse may also review proposed IOU ESA/CARE applications for 2027 and beyond if these are available during the data collection process.

Additional information will be considered in this process:

- **Program documentation:** Information sources that govern program operations such as program and policy manuals.
- **Impact evaluations:** Our understanding is that IOU program estimates, and applications use evaluated per-unit energy savings estimates sourced from the most recent ESA program impact evaluations. Thus, we do not plan to review these documents but may cross reference these documents in special cases.

Guidehouse will use the most recent secondary data available for each measure. Each measure will be characterized separately for each of the four IOUs; if data is not available from one IOU, Guidehouse will generally use data from other IOUs as a substitute. Guidehouse will collect data from other sources for any measures or data components not included in current or proposed ESA programs. For these measures, Guidehouse will source the information from the Income-Qualified measure workpaper, if one exists, or the most relevant 2025 Study residential non-Income-Qualified measure. Guidehouse will also account for interactive effects (e.g., where measures save one fuel but increase use of another) and measures that increase energy consumption overall but are still included in the IOUs' portfolios because of their quality-of-life benefits.

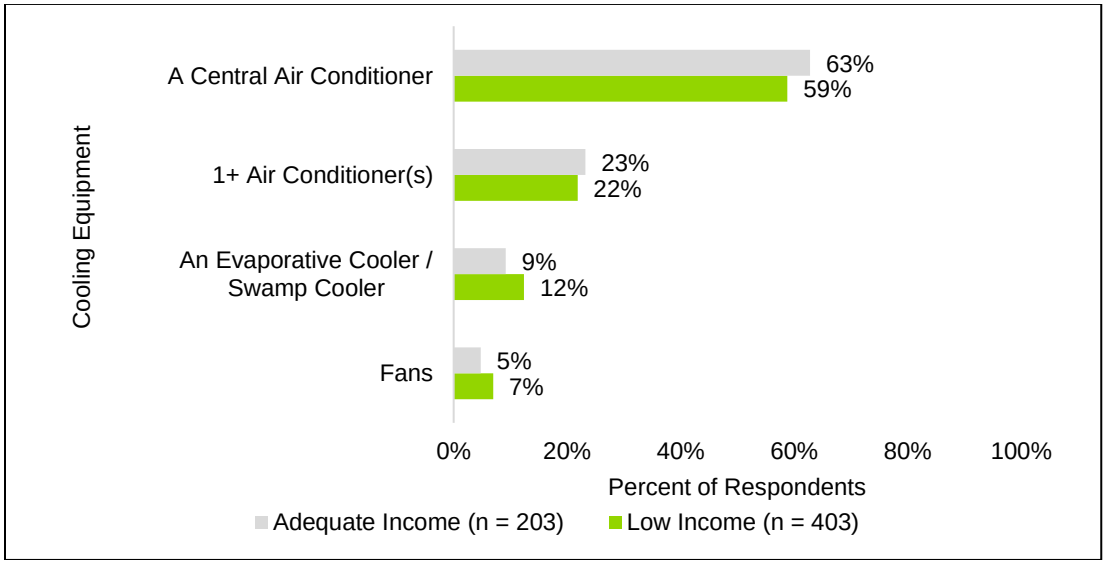
Guidehouse will characterize the following for each measure:

- Measure name
- Annual unit energy impact (kWh, kW, therms) on a per unit basis
- Measure density and saturation
- Equipment and labor measure expenses as defined in the annual IOU ESA reports[18]
- EUL
- (if applicable) Regional eligibility restrictions

Guidehouse will calculate density and saturation in a similar manner as for the residential sector, but where possible, will use density and saturation values specific to the Income-Qualified sector from the 2019 RASS data filtered for income qualified households (accounting for the previously mentioned changes in income thresholds), or other data sources as appropriate. Guidehouse will characterize measures for single family and multifamily building types within the Income-Qualified sector and may consider mobile homes as a separate building type if data is available. The below figure illustrates an example of differences in cooling equipment types between residential and Income-Qualified sectors, which informs the density of cooling measures within each sector.

[18] Some utilities report equipment and labor costs separately, while some utilities combine them. Guidehouse to combine equipment and labor expenses together as measure expenses.

Figure 11. Cooling Equipment Types by Income Group



Source: Evergreen Economics, Income-Qualified Needs Assessment (2016)

ASSESSING TECHNICAL, ECONOMIC AND MARKET ACHIEVABLE POTENTIAL

With a defined population and measure list, Guidehouse will estimate the technical potential for the Income-Qualified sector using the same modeling methods as for non-Income-Qualified programs (though using Income-Qualified specific market and measure data described above). This methodology was described earlier in Section 3.2.3. Our technical potential approaches are agnostic of market sector, income levels, or historic program activity. They depend purely on market size and measure characteristics.

Guidehouse assesses economic potential for the Income-Qualified sector even if ESA programs are not required to pass the same TRC test that non-Income-Qualified programs do. Rather there is a NEBs model that IOUs have layered onto the Cost Effectiveness tool output that has been used to derive an ESA Cost-Effectiveness Test (ESACET) result. Guidehouse will request CPUC staff or the IOUs (via a data request) to provide a list of all ESA measures and their ESACET results. The study will operate with an ESACET threshold of 0.3 (a threshold for consideration set by the recent decision) with appropriate exceptions for health, comfort, and safety measures. The ESACET will be used as a screen so only measures that pass this filter will be included for further modeling beyond technical potential. It is important to note the Guidehouse team will not be operating the ESACET tool itself or attempting to replicate its calculations/results.

Guidehouse proposes to calculate achievable potential for Income-Qualified measures as a percentage of the technical potential using a combination of an initial penetration rate and an adoption curve. This is a new methodology that was developed for the 2021 PG study and offers the flexibility to design scenarios that consider the unique program and measure characteristics in the Income-Qualified sector.

- The **initial penetration rate** is calculated as the number of total installations for a measure in the measure's first effective year (i.e., program activity), divided by the calculated potential installations associated with the technical potential. Guidehouse will plan to use the penetration rate for each measure in the latest year of program activity available from IOU program data. In the absence of IOU program data, we can use data

from the 2021-2026 ESA applications. This alignment of initial penetration rate ensures near term savings forecast for the ESA program in a baseline scenario are generally in line with historic program activity.

- The **adoption curve** defines how the penetration rate changes over time. In the 2021 Study, Guidehouse developed three prototypical adoption curves, which represented the range of barriers and measure attributes that are possible in this sector. The curves are independent of building type, ownership type, and climate zone. The adoption curves were developed leveraging historic program participation data and Guidehouse proposes to continue to leverage these curves but will consider input from CPUC staff and stakeholders should the overall budget allow for a refined or revised approach.
- Achievable potential analysis will be limited only to those measures that pass the ESACET screening, but the 2023 potential tool includes a filter for including measures that pass or do not pass the threshold.

Guidehouse will categorize each measure based on a set of measure criteria: how easy or difficult the measure is to install; whether the measure installation requires property owner or manager approval; and how intrusive the measure installation would be to the resident. All of the measures were grouped into the following three categories:

- Difficult to install, needs property owner or manager approval, intrusive
- Difficult to install, needs property owner or manager approval, non-intrusive
- Easy to install, does not need property owner or manager approval, non-intrusive

Guidehouse will consider updating the categories as needed based on the mix of measures in this study, in consultation with the CPUC staff and stakeholders.

Guidehouse will define up to three prototypical adoption curves for each measure category, which will define the base scenario. The base scenario is intended to reflect current program delivery. Guidehouse will consider up to two additional scenarios for the Income-Qualified sector that will adjust the base adoption curves to simulate more aggressive adoption levels than have been historically observed or to reflect increased adoption of certain measure types, such as fuel substitution or HCS measures. Guidehouse will develop these scenarios in coordination with CPUC staff and stakeholders.

3.2.8 Reporting and Stakeholder Presentations

Guidehouse will prepare a draft report for internal and external review once draft results have been vetted. As has been historically done in the past, Guidehouse expects to publish this draft report, along with draft results and the draft model publicly through the appropriate CPUC staff channels. If possible, Guidehouse will explore delivering preliminary draft results, representing key sectors or results that depart from those of past studies, to stakeholders for review and input in advance of the comprehensive results being distributed. Guidehouse will respond to feedback from external stakeholders and provide a final report.

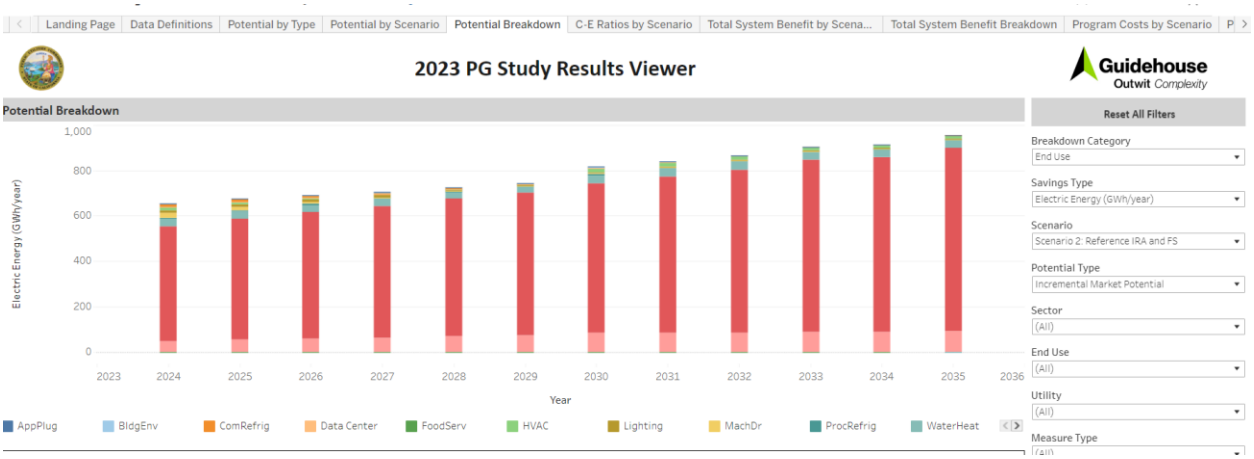
The approach to engaging stakeholders on draft results is as follows:

- Provide an overview of the scope of the study including what was specifically in scope and out of stope
- Provide clear concise information on the methodology of the study
- Clearly state assumptions and areas of uncertainty

- Provide summary results and discuss the implications and conclusions of these results
- Orient stakeholders will tools/databases, so they are empowered to dive deeper into the results
- Ask pointed questions that encourage stakeholder to provide meaningful feedback

In addition to a written report, this task will also provide a model (discussed Section 3.1) and a database of results. Guidehouse understands that model and results delivery is a critical component of this project. Guidehouse has historically presented and circulated results in the form of an Excel-based Results Viewer. The Results Viewer provides stakeholders the ability to manipulate and visualize model outputs. In the 2023 PG study, Guidehouse also provided an online Results Viewer based in Tableau to give the CPUC staff and stakeholders in a more visually compelling and flexible manner. Guidehouse will again provide this online Results Viewer summarizing 2025 Study results in addition to the Excel-based Results Viewer. Figure 12 shows a screenshot of the dashboard Guidehouse developed for the 2023 PG study.[19]

Figure 12. 2023 PG Study Results Dashboard



3.2.9 Schedule and Deliverables

Table 10. Schedule for Potential and Goals Study (Tasks 8b and 13)

Subtask	Milestone/Deliverable	Start Date	Planned Completion Date
1	Collect Global Inputs	4/1/2024	8/1/2024
2	Develop Initial Measure List	4/15/2024	5/7/2024
2	Review Measure List with Stakeholders	5/7/2024	6/1/2024
2	Characterize Measures	5/1/2024	8/15/2024
3	Develop Technical Potential	8/15/2024	9/7/2024
4	Develop Economic Potential	9/7/2024	10/1/2024
5	Develop Base Achievable Potential	10/1/2024	11/1/2024

[19] Dashboard can be accessed at: https://public.tableau.com/app/profile/cpuc.pg.study/viz/2023PGStudyResultsViewerv2_0/LandingPage

Subtask	Milestone/Deliverable	Start Date	Planned Completion Date
5	Develop Scenarios and Produce Results	9/1/2024	1/1/2025
5	Post Process Results	TBD based on CPUC needs	
5	IRP Coordination	TBD based on IRP needs	
7	Develop List of Potential C&S	9/1/2024	10/1/2024
7	Forecast C&S Savings	10/1/2024	12/1/2024
8	Develop Income-Qualified Measure List and Market Data	9/1/2024	11/1/2024
8	Forecast Income-Qualified Potential	11/1/2024	2/1/2025
9	Draft Report and Model		2/15/2025
9	Stakeholder Review	2/29/2024	3/21/2025
9	Final Report and Model		5/1/2025
10	Proposed decision on Goals adoption – 2026 and beyond		TBD
10	Final decision on Goals adoption – 2026 and beyond		TBD

11 lists the schedule for Tasks 8b and 13 assuming a contract activation date of 5/1/2024 and that key data is available by required dates as outlined in Table 11.

Table 10. Schedule for Potential and Goals Study (Tasks 8b and 13)

Subtask	Milestone/Deliverable	Start Date	Planned Completion Date
1	Collect Global Inputs	4/1/2024	8/1/2024
2	Develop Initial Measure List	4/15/2024	5/7/2024
2	Review Measure List with Stakeholders	5/7/2024	6/1/2024
2	Characterize Measures	5/1/2024	8/15/2024
3	Develop Technical Potential	8/15/2024	9/7/2024
4	Develop Economic Potential	9/7/2024	10/1/2024
5	Develop Base Achievable Potential	10/1/2024	11/1/2024
5	Develop Scenarios and Produce Results	9/1/2024	1/1/2025
5	Post Process Results	TBD based on CPUC needs	
5	IRP Coordination	TBD based on IRP needs	
7	Develop List of Potential C&S	9/1/2024	10/1/2024
7	Forecast C&S Savings	10/1/2024	12/1/2024
8	Develop Income-Qualified Measure List and Market Data	9/1/2024	11/1/2024

Subtask	Milestone/Deliverable	Start Date	Planned Completion Date
8	Forecast Income-Qualified Potential	11/1/2024	2/1/2025
9	Draft Report and Model		2/15/2025
9	Stakeholder Review	2/29/2024	3/21/2025
9	Final Report and Model		5/1/2025
10	Proposed decision on Goals adoption – 2026 and beyond		TBD
10	Final decision on Goals adoption – 2026 and beyond		TBD

Critical to executing the above timeline is the timely receipt of key input data. Guidehouse identified timing requirements for several critical model inputs in Table 11 below. These are identified as those for which subsequent tasks have established dependencies, and where delays in receiving or generating final values may impact the overall Study timeline. As noted in the sections above, adhering to the updated and accelerated 2025 Study timeline compared to prior study cycles will require in select instances leveraging preliminary/draft data as well as prioritized subsets of forthcoming final study input sources, notably 2024 Avoided Costs and eTRM Measure Package updates, respectively. Guidehouse is committed to ensuring both the reliability and timeliness of the Study's delivered final results to inform critical CPUC decisions.

Table 11. Critical Model Input Timeline

Input	Planned Finalization Date
End Use Load Shapes (informs C-E analysis)	8/1/2024
Historic Program Accomplishments (informs calibration)	8/1/2024
Avoided Cost Data (draft)	8/1/2024
eTRM updates, measure packages, Primary Data collection studies (saturation studies), and other Measure characterization inputs (informs measure characterization)	7/1/2024

Throughout the PG study Guidehouse plans to engage with stakeholders to collect feedback on key topics. Table 12 lays out our current plan for stakeholder engagement. Additional opportunities for engagement with stakeholders may be considered; feedback on this matter may be sought via discussion and/or written feedback from stakeholders.

Table 12. Planned Stakeholder Engagement

Stakeholder Meeting	Planned Timing
Work Plan (webinar)	April 2024
Stakeholder input on measure list and characterization including fuel substitution & EE	June 2024
Stakeholder input - Income-Qualified approach	TBD

Stakeholder Meeting	Planned Timing
Stakeholder input – primary research data collection studies, if applicable	TBD
Stakeholder input - Preliminary Results & Scenarios	January 2025
Stakeholder input - Post processing tasks	Spring 2025

4. Post Potential & Goals Study Support

These activities will largely occur after the core potential study is completed. Specific schedule and deliverables for each task will depend on their overall priority, availability of supporting data and inputs, stakeholder impact, and funding. Guidehouse will work closely with CPUC staff to determine each Task's specific details, outputs, and delivery timeline.

4.1 Additional Achievable Energy Efficiency Scenarios

The CEC provides a long-term forecast of energy consumption as part of the Integrated Energy Policy Report (IEPR); this forecast is referred to as the California Energy Demand (CED) Forecast.

The CED forecast is updated on a regular basis. In the process of updating the CED, the CEC first issues a baseline forecast which includes historic energy efficiency program and C&S impacts. It also includes some level of future energy efficiency: that which has been "committed." Committed efficiency savings reflect savings from initiatives that have been approved, finalized, and funded, whether already implemented or not.

However, there also exist additional savings from initiatives that are neither finalized nor funded but are reasonably expected to occur though either the IOU programs or C&S. These savings are referred to as achievable and are based on the CPUC bi-annual Potential and Goals Study. Often, a portion of the savings that are quantified in the PG study are already incorporated in the CED baseline forecast, and CEC staff need to estimate the portion of savings from the CPUC potential study that are not accounted for in the baseline forecast. These nonoverlapping savings are referred to as AAEE impacts.

Guidehouse has been supporting the CPUC and the CEC in the development of IOU AAEE scenarios since 2012.

Guidehouse expects to follow a similar process for this study as in years past. This includes:

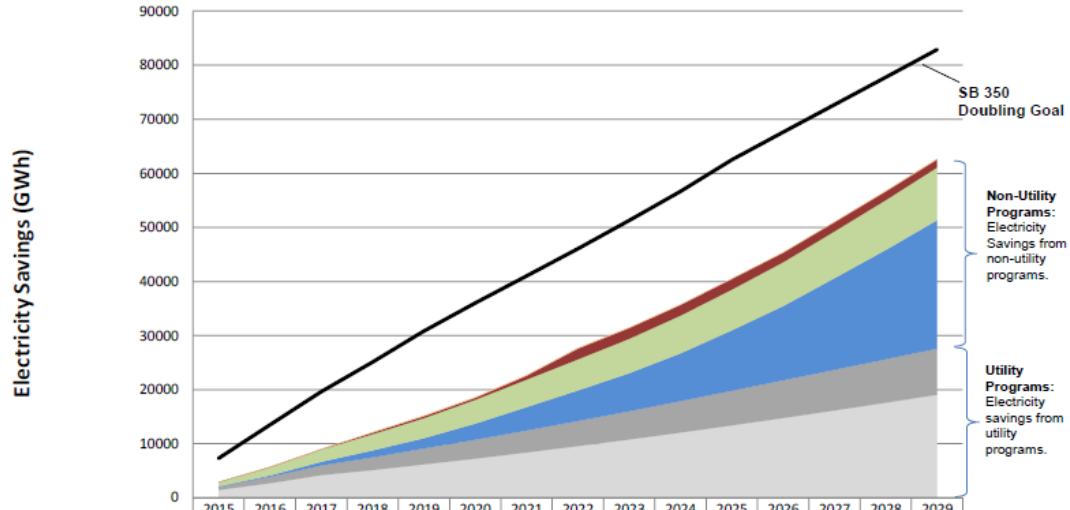
- Holding a series of kickoff and coordination meetings between CPUC staff, CEC and Guidehouse staff
- Developing a scenario framework that meets the specific needs of the CEC
- Producing scenario results at the level of detail/granularity as requested by the CEC
- Providing guidance on hourly impacts (leveraging load shapes) and locational impact at the climate zone level, as needed
- Delivering databases of relevant outputs
- Supporting stakeholder engagement activities
- Potential and Goals Study with Development of Energy Efficiency Supply Curves for IRP

4.2 SB 350 IOU Territory Targets Update

Senate Bill 350, the Clean Energy and Pollution Reduction Act of 2015 requires the CEC to establish annual targets that will achieve a cumulative doubling of statewide energy efficiency savings and demand reductions in electricity and natural gas final end uses. This doubling target is relative to the CEC's 2015 mid-case forecast of the AAEE forecast.

In 2017, the CEC published its first report (referred to here as the "SB350 Report") to establish proposed statewide doubling targets that must be achieved by 2030.[20] It proposed "sub targets" for the portion of projected energy efficiency savings that can be achieved through IOU programs, POU programs. and non-utility programs funded through government, private and utility ratepayer sources (illustrated in Figure 3).

Figure 13: Proposed SB 350 Doubling Target and Sub targets (Electricity)



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Agriculture & Industry	2	33	58	95	118	121	116	109	94	83	76	75	82	99	127
Behavioral & Market Trans.	32	39	47	296	366	375	732	2002	1998	1986	1963	1762	1693	1617	1492
Financing	757	1513	2270	2994	3704	4401	5074	5736	6360	6967	7536	8099	8653	9202	9748
Codes & Standards	93	243	673	1280	1899	2980	4325	5655	7037	8841	11172	13729	16948	20215	23746
POU Programs	596	1190	1790	2360	2945	3501	4069	4645	5232	5822	6406	6977	7520	8042	8540
IOU Programs	1427	2685	4179	5112	6169	7230	8373	9550	10768	12052	13385	14748	16145	17580	19050
SB 350 Doubling Goal	7,286	13,46	19,60	25,10	30,81	36,01	41,03	46,04	51,28	56,66	62,51	67,60	72,69	77,78	82,87

Source: CEC, 2017

This task is scoped with updating the IOU sub target to inform the CEC as it moves forward with updating data reported in the SB350 Report. As part of the 2017 PG study, Guidehouse provided the forecast of IOU program savings to the CEC and its contractors that informed the IOU sub targets in the 2017 SB350 Report. As part of the 2019, 2021, and 2023 PG studies, Guidehouse provided updated IOU program savings forecasts to the CEC to update its tracking of SB350 savings.

Guidehouse expects to follow a similar process for this study as in years past. This includes:

- Holding a series of kickoff and coordination meetings between CPUC staff, CEC and Guidehouse staff
- Conducting the analysis including baseline adjustments and attribution adjustments to remove double counting of impacts from Codes & Standards, BROs, Fuel Substitution, and Financing programs.
- Delivering databases of relevant outputs

[20] Jones, Melissa, Michael Jaske, Michael Kenney, Brian Samuelson, Cynthia Rogers, Elena Giyenko, and Manjit Ahuja. 2017. *Senate Bill 350: Doubling Energy Efficiency Savings by 2030.* California Energy Commission. Publication Number: CEC-400-2017-010-CMF.

- Supporting stakeholder engagement activities

4.3 Potential and Goals Study with Development of Energy Efficiency Supply Curves for IRP (pending funding)

An IRP[21] is a roadmap for utilities to meet forecast annual peak and energy demand, with consideration of an established reserve margin, through a combination of supply-side and demand-side resources over a specified future period. Senate Bill (SB 350) mandates that the CPUC examine the future of California's energy procurement practices through an IRP process.

Up until late 2017, CPUC's IRP modeling efforts have considered EE as a "baseline resource" (i.e., a resource that is included the model as an assumption with a set magnitude rather than being selected by the model as part of an optimal solution).

Starting in 2017, Guidehouse examined various methods to integrate energy efficiency procurement practices into the IRP optimization process. Guidehouse's analysis included collaborating with the CPUC's IRP contractor to explore changes to the existing IRP Model. This consisted of a technical analysis to explore the feasibility of fully optimizing energy efficiency as supply-side resource, considering pros and cons of options, and present lessons learned. This process led to Guidehouse developing EE supply curves out of the 2018 PG model to provide to the CPUC's IRP modeling team.[22] This exercise was repeated in the 2021 PG study cycle comparing IRP Model results to the bottom-up PG model results.

Our approach to this Task for electric measures builds upon our previous support and institutional knowledge of CPUC IRP processes to enhanced modeling and methodology approaches. Our scope and budget assume that Task 12 is conducted overlapping Task 8b as much of the input data and modeling framework to develop supply curves and load modifiers is the same.

The main subtasks that will be carried out to execute this task:

- Task 12.1 - Market Characterization
- Task 12.3 - Conduct Measure Characterization
- Task 12.3 - Technical Potential
- Task 12.4 - IRP Model Coordination
- Task 12.5 - Technical Achievable Potential
- Task 12.6 - Load Shape Collection and Analysis
- Task 12.7 - Energy Efficiency Supply Curve Development
- Task 12.8 - Load Modifiers
- Task 12.9 - Additional Analyses
- Task 12.10 - Reporting and Stakeholder Interaction

Tasks 12.1 through 12.5 will leverage relevant data and model frameworks from Task 8b.

[21] In this section, the acronym IRP is used to denote either an integrated resource plan or the process of integrated resource planning, depending on the context.

[22] Guidehouse. *Developing EE Supply Curves for IRP Models.* April 27, 2018. **http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/Slides%20for%20MAG%20Meeting%202018-04-27%20v2.pdf**

4.4 Impact of Zonal Electrification Efforts (pending funding)

Potential within the PG study is calculated at the level of the utility and climate zone, and potential is implicitly assumed to be evenly distributed across each discrete combination. However, PG&E has implemented zonal electrification efforts that would focus its electrification programs on specific locations in order to achieve economies of scale in infrastructure upgrades—for example, avoiding the need to install gas infrastructure entirely in some neighborhoods. Guidehouse will explore refining model if data, timeline, and budget allows to account for PG&E's planned electrification with locally-focused (zonal) program delivery, including incorporation of specific ZIP codes or census tracts these efforts are expected to be include. These refinements will in turn be used to modify the market achievable potential for electrification measures within the PG study, as needed.