

Land Use and Environmental Analysis for Busbar Mapping

October 22, 2026

Land Use Planning Unit
Siting, Transmission, and Environmental Protection Division
California Energy Commission

Agenda

- Overview of Land Use and Environmental Analysis for Busbar Mapping
- Land Use and Environmental Analysis Results for the 27-28 Busbar Mapping Cycle
  - Solar Results
  - Wind Results
  - Conventional Geothermal Updates and Results
  - Deep Enhanced Geothermal System (EGS) Methods and Results
  - Pumped Storage Hydro (PSH) Results
- CEC Busbar Mapping Web Application

Overview of Land Use and Environmental Analysis for Busbar Mapping

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Land Use and Environmental Analysis in Busbar Mapping

Substation buffer area



Total Resource Potential Area

Lower Implication Land

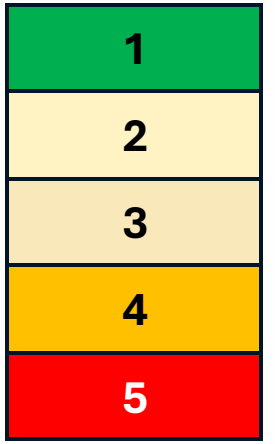
- Identifies areas with fewer implications to alternative land-use and conservation priorities and that, overall, are more favorable for development of the mapped resources
- Uses CEC Core Land Use Screen as well as other land use and environmental factors data[1]

[1] *For more information, please see here. Available at https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2024-2026-irp-cycle-events-and-materials/assumptions-for-the-2026-2027-tpp/mapping_methodology_26-27.pdf*

Factors Considered in Criteria Alignment Analysis

- When allocating MW to substations, the land use and environmental factors listed below are analyzed
- Metrics are based on the percentage of the total resource potential that contains a given environmental factor, as well as MW allocated
- Lower percentages are relatively more favorable and result in lower criteria alignment scores – higher percentages result in higher scores (less favorable)

Scale of Criteria Alignment Thresholds



Most Compliant

Least Compliant

Land Use and Environmental Factors

Criteria 3
- Lower-implication land (as determined by Core Screen)
- High Fire Threat Areas
- High Parcelization Areas (solar only)
- Critically Overdrafted Groundwater Basins
- High and Low Value Cropland Areas

Criteria 4
- High Terrestrial Connectivity
- High Terrestrial Biodiversity Areas
- High Terrestrial Irreplaceability
- Terrestrial Landscape Intactness
- Wetlands
- Combined Areas of Conservation Emphasis (ACE) layers (High Terrestrial Connectivity, Biodiversity and Irreplaceability)

Core Land Use Screen Components

	Core Land-Use Screen
Base Exclusions	Techno-economic exclusion layer (CPUC)
	Protected Area Layer
Land Use and Environmental Constraints	Cropland Index Model* (Threshold: Mean, 7.7**)
	Terrestrial Intactness Model (Threshold: Mean, 0.3**)
	Biological Planning Priorities: • Areas of Conservation Emphasis (ACE) Biodiversity (Rank 5) • ACE Connectivity (Ranks 4 & 5) • ACE Irreplaceability (Ranks 4 & 5) • Wetlands from CA Nature Habitat and Land Cover CALFIRE Fire and Resource Assessment Program Vegetation (FVEG) Derived) • U.S. Fish and Wildlife Service (USFWS) Critical Habitat
	2026 Results (Statewide Resource Potential):
	Utility-Scale Solar: 5.9 million acres
	Land-Based Wind: 363 thousand acres

*Not applied to wind resources
**Areas above the threshold not included in technical resource potential estimates
Power densities of 7 acres/MW and 40 acres/MW are used to convert area to electrical power generation for solar and wind, respectively.

Solar Results

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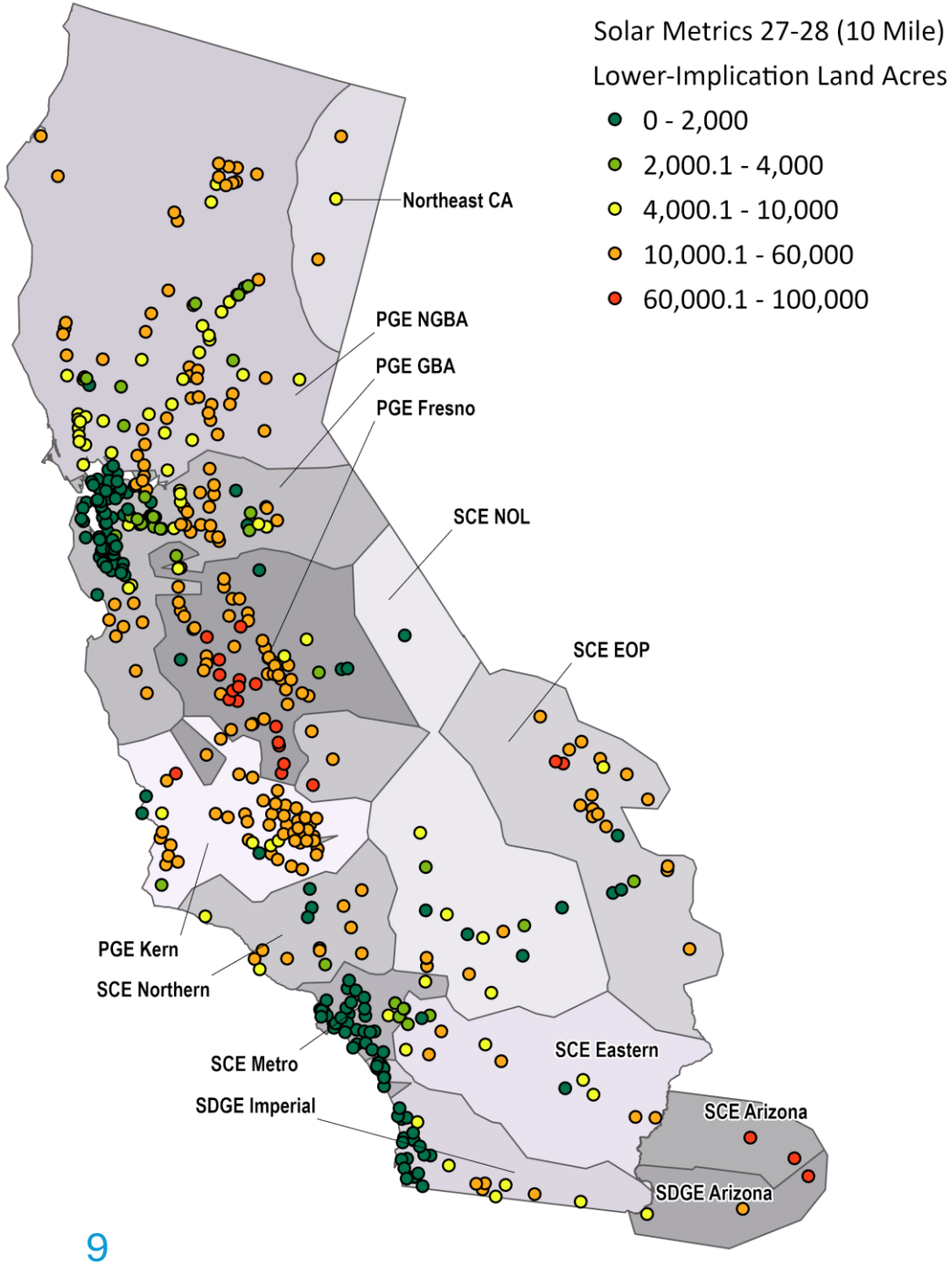
Solar: Lower-Implication Land by RESOLVE Zone

Comparison to Last Cycle's Results

- Staff implemented data processing updates this cycle
- These updates have a small impact on the number of lower-implication acres available at the substation level
- The largest change is a decrease in the SCE Metro and increase in SDGE Arizona and SCE Arizona

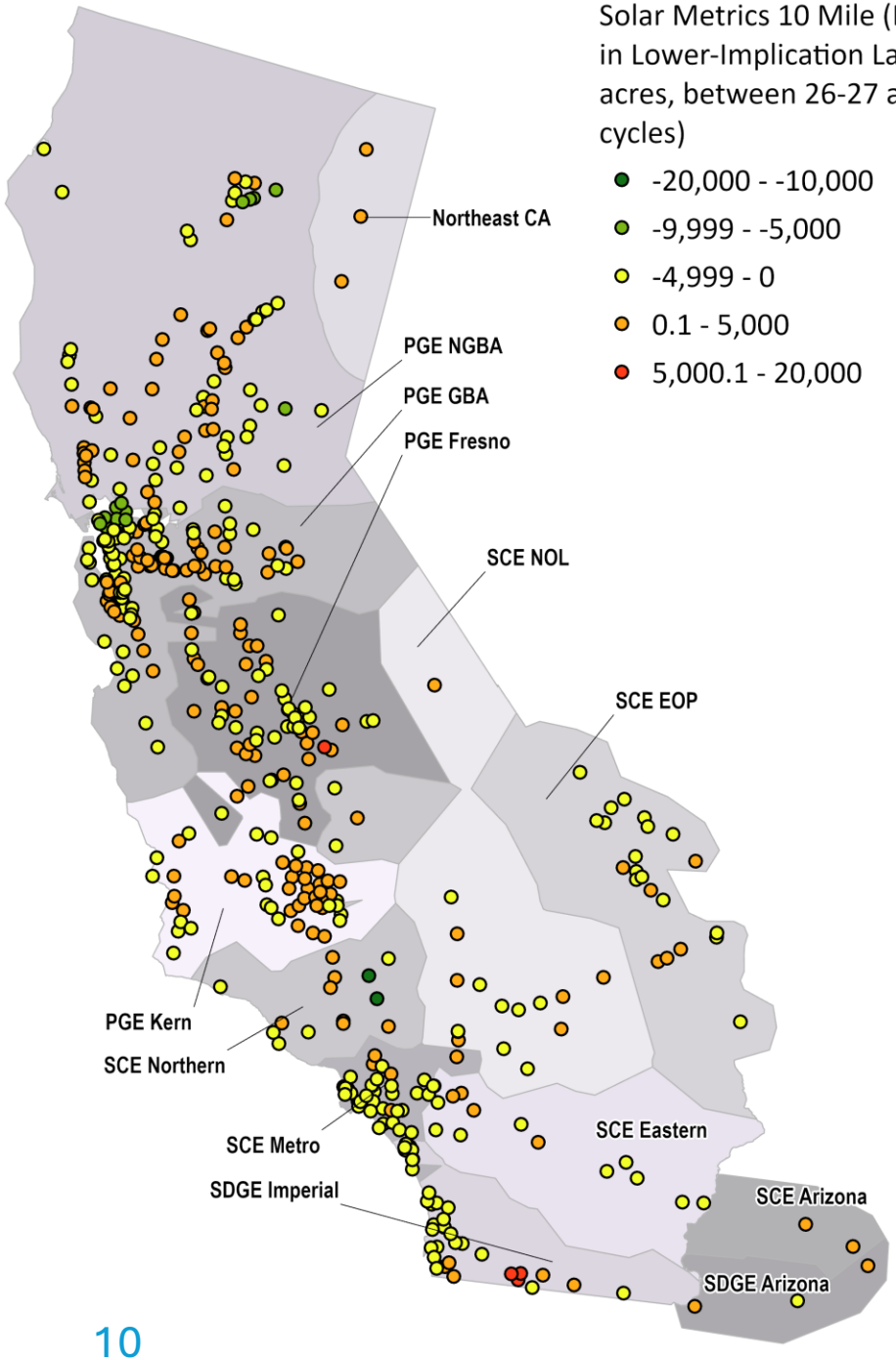
RESOLVE Zone	Number of Substations in Region	Lower-Implication Acres (27-28 TPP)	Lower-Implication Acres (26-27 TPP)	Percent Change
Northeast CA	3	235,347	240,740	-2%
PGE Fresno	63	1,051,425	1,048,454	0%
PGE GBA	115	486,735	494,398	-2%
PGE Kern	52	622,307	597,130	4%
PGE NGBA	84	2,215,098	2,388,281	-7%
SCE Arizona	2	545,176	431,215	26%
SCE Eastern	14	315,852	296,563	7%
SCE EOP	22	494,286	492,240	0%
SCE Metro	37	8,712	11,828	-26%
SCE NOL	16	295,456	301,422	-2%
SCE Northern	18	450,575	501,909	-10%
SDGE Arizona	3	351,184	260,910	35%
SDGE Imperial	33	174,717	181,819	-4%
Total	**462**	**7,246,870**	**7,246,909**	**0%**

Lower-Implication Land Acres (Solar) 27-28 TPP Cycle



- Substations with the highest amount of lower-implication acres* are located in PG&E Fresno, PG&E Kern, and SCE EOP
- Lowest amount of lower-implication land near substations in Bay Area, SCE Metro, and SCE Imperial

*within 10-mile radius of substations available for mapping solar resources



Solar Comparison: 27-28 to 26-27 TPP Cycle

- For approximately three-quarters of substations, the change in lower-implication land relative to last cycle is less than 1% (other substations have greater than 1% change)
- A few substations experience the largest change in lower-implication acres

Negative values represent a decrease in lower-implication acres relative to last IRP/TPP cycle; positive values represent an increase.

Solar Metrics Summarized by Zone

Average Percent Cover of Selected Environmental Factors

10-mi radius around substations with more than 5,000 acres of total resource potential

RESOLVE Zone	High Cropland	High Fire Threat Tier 3	High Fire Threat Tier 2	High Connectivity	High Biodiversity	High Irreplaceability	High Intactness	Wetlands
Northeast CA	2%	6%	55%	27%	21%	17%	60%	19%
PGE Fresno	39%	3%	23%	31%	16%	21%	16%	6%
PGE GBA	27%	3%	59%	48%	34%	50%	32%	6%
PGE Kern	39%	1%	23%	31%	16%	36%	14%	5%
PGE NGBA	21%	12%	40%	48%	25%	41%	27%	8%
SCE Eastern	14%	9%	32%	26%	25%	36%	32%	4%
SCE Metro	3%	25%	44%	41%	24%	46%	36%	9%
SCE NOL	0%	0%	0%	44%	34%	22%	41%	2%
SCE Northern	19%	12%	30%	31%	21%	27%	30%	5%
SDGE Imperial	10%	39%	32%	29%	52%	56%	34%	5%

- High percentages indicate more overlap of important environmental or land use factors around substations in the region; low percentages indicate less overlap with important land use or environmental factors in area around substations
- Higher-implication environmental, land use, and development feasibility factors vary by region

Wind Results

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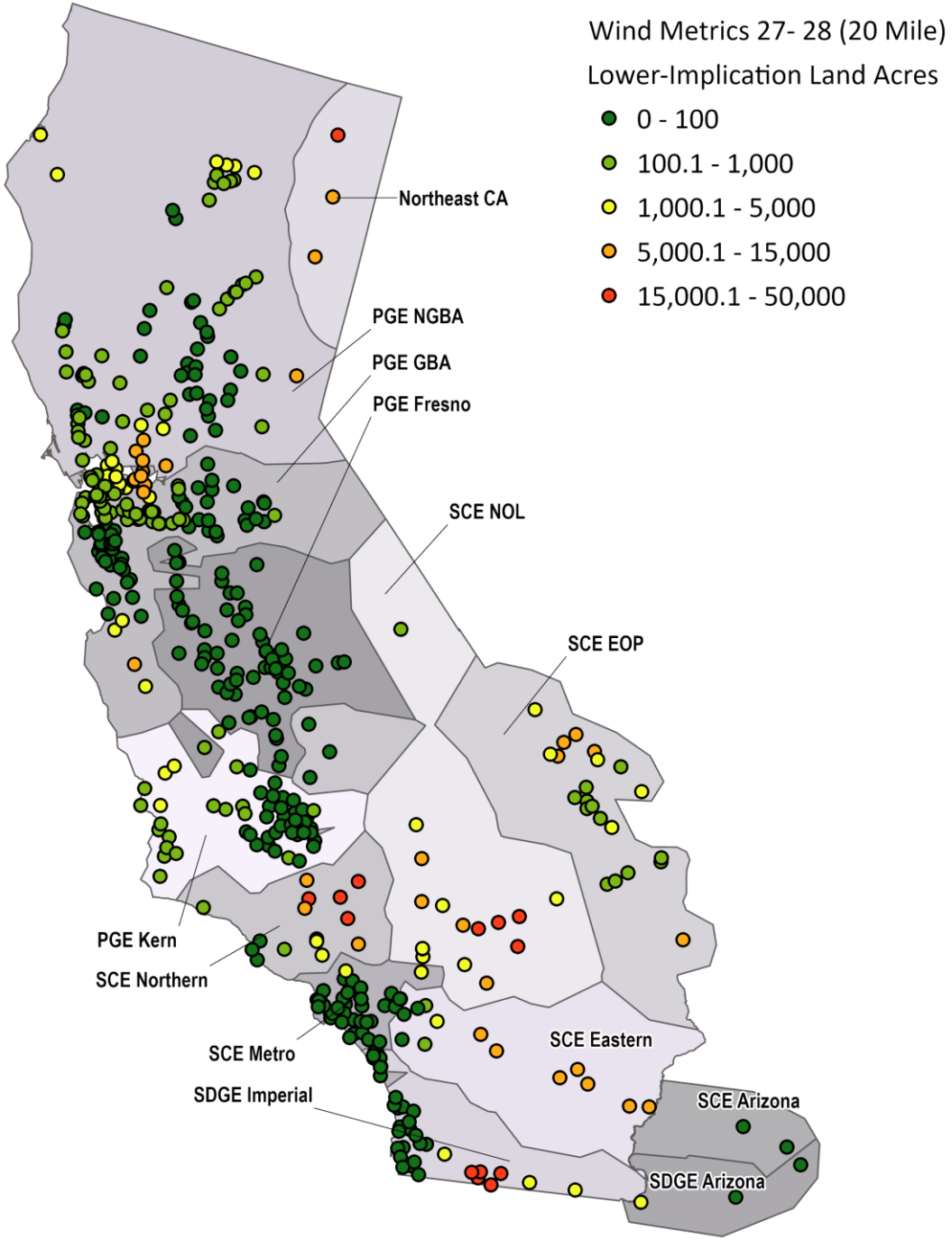
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Wind: Lower-Implication Land by RESOLVE Zone

Comparison to Last Cycle's Results

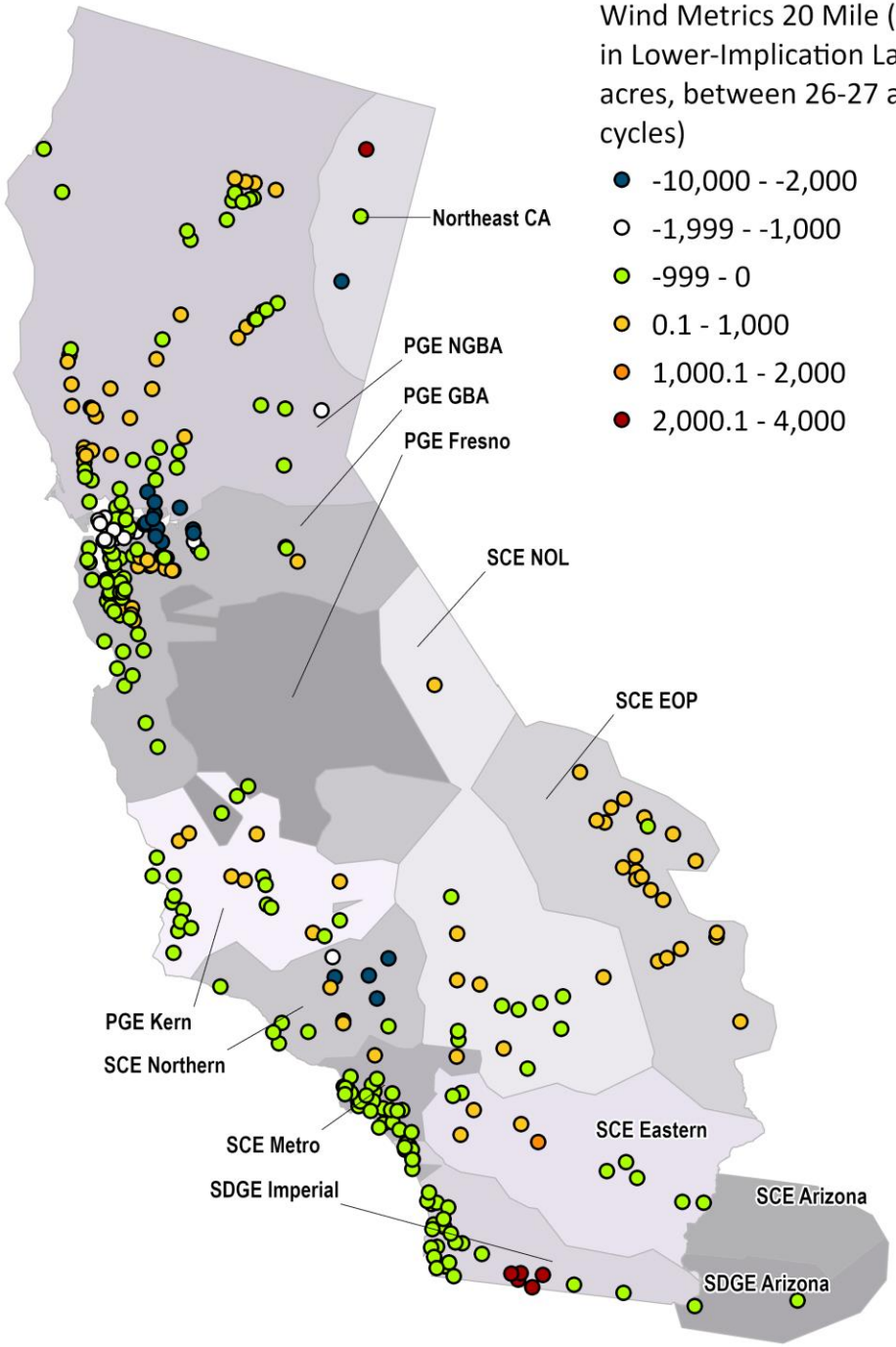
- Staff implemented data processing updates this cycle
- These updates result in a relatively small (4%) decrease in lower-implication acres
- The largest changes are in SDG&E Imperial, SCE Metro, PG&E NGBA, and SCE Northern

RESOLVE Zone	Number of Substations in Region	Lower-Implication Acres (27-28 TPP)	Lower-Implication Acres (26-27 TPP)	Percent Change
Northeast CA	3	39,919	41,231	-3%
PGE Fresno	63	182	186	-2%
PGE GBA	115	11,378	12,883	-12%
PGE Kern	52	5,126	5,233	-2%
PGE NGBA	84	54,386	64,450	-16%
SCE Arizona	2	40	40	0%
SCE Eastern	14	79,796	76,629	4%
SCE EOP	22	28,719	28,612	0%
SCE Metro	37	439	808	-46%
SCE NOL	16	75,530	74,513	1%
SCE Northern	18	64,835	75,480	-14%
SDGE Arizona	3	13	13	0%
SDGE Imperial	33	26,709	23,504	14%
Total	**462**	**387,071**	**403,582**	**-4%**



Lower Implication Land Acres (Wind) 27-28 TPP Cycle

- Most substations have < 1,000 acres of lower implication land within a 20-mi radius
  - Limited high wind resource potential areas
- SCE Northern, SCE NOL, SCE Eastern and Northeast CA have the greatest wind resource potential
- SDG&E Imperial and SCE EOP have moderate wind resource potential



Wind Comparison: 27-28 to 26-27 TPP Cycle

- About half of substations saw a decrease in lower-implication land from 26-27 to 27-28 busbar cycles; other half saw no change or (mostly) small increases
- Decreases in lower implication land around Bay Area and along southern coast
- Increases in SCE EOP, SDG&E Imperial, and PG&E NGBA. SDG&E Imperial saw a significant increase

Negative values represent a decrease in lower-implication acres relative to last IRP/TPP cycle; positive values represent an increase.

Wind Metrics Summarized by Zone

Average Percent Cover of Selected Environmental Factors

15-mi radius around substations with more than 5,000 acres of total resource potential

RESOLVE Zone	High Fire Threat Tier 3	High Fire Threat Tier 2	High Connectivity	High Biodiversity	High Irreplaceability	High Intactness	Wetlands
Northeast CA	11%	54%	41%	18%	13%	71%	15%
PGE GBA	2%	75%	59%	70%	71%	33%	9%
PGE Kern	4%	89%	66%	15%	28%	66%	3%
PGE NGBA	12%	55%	57%	30%	45%	56%	5%
SCE Eastern	1%	3%	29%	25%	17%	58%	0%
SCE NOL	1%	2%	52%	34%	21%	58%	1%
SCE Northern	17%	34%	40%	36%	31%	46%	2%
SDGE Imperial	30%	29%	14%	25%	29%	46%	2%

- Presence of higher-implication environmental, land use or development feasibility factors vary by region
- Substations tend to have more higher-scoring environmental factors than solar, indicative of wind resource potential areas that are in more remote areas

Conventional Geothermal

Updates to Environmental Evaluation

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Updates to Conventional Geothermal Mapping Method (1 of 2)

Overview of method

- Staff applied updated methodology for environmental evaluation of conventional geothermal in this cycle
  - **Last cycle:** Conventional and near-field geothermal used Protected Area Layer (PAL) only; deep EGS used both PAL and techno-economic exclusions (TE)
  - **This cycle:** All geothermal technologies (conventional, near-field EGS, deep EGS) use both PAL and TE
  - Goal is consistency in land use / environmental analysis across geothermal technologies

Updates to Conventional Geothermal Mapping Method (2 of 2)

Overview of method

- **Last cycle's method:** If 99% or more of the conventional geothermal field is covered by the PAL, exclude the whole field

- **This cycle's method:**
  - First step is same as above
  - Apply additional screen: if 90% or more of the remaining conventional geothermal field is covered by the TE layer, exclude the whole field

- Results on next slide

Geothermal Technical Resource Potential by RESOLVE Zone

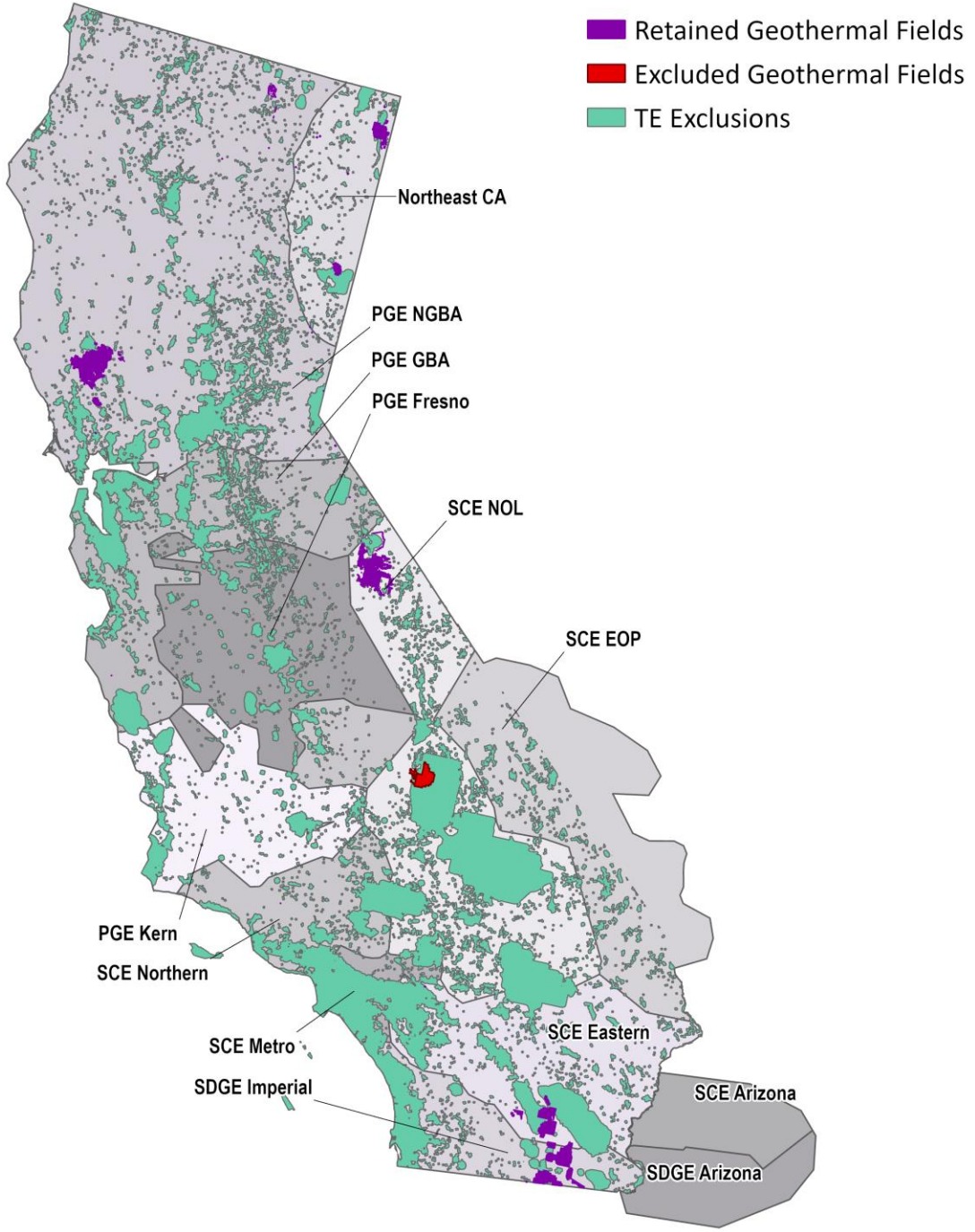
RESOLVE Region	Last Cycle MW Potential (Conventional)	This Cycle MW Potential (Conventional)	Last Cycle MW Potential (Near-Field)	This Cycle MW Potential (Near-Field)	Difference Between Last Cycle and This Cycle
Northeast CA	185	173	185	173	-13
PG&E GBA	6	6	6	6	0
PG&E Kern	3	0	3	0	-3
PG&E NGBA	687	685	687	685	-2
SCE Eastern	1,887	1,877	1,887	1,877	-10
SCE EOP	0	0	0	0	0
SCE NOL	141	25	141	25	-117
SCE Northern	0	0	0	0	0
SDG&E Imperial	569	569	569	569	0
Total	**3,479**	**3,334**	**3,479**	**3,334**	**-145**

- Approximately 145 MW of technical resource potential excluded with new method; applies separately to both conventional resources and near-field EGS
- Note: Values in table show MW for conventional geothermal and near-field EGS. These values are the same, so this cycle there is a total of 3,334 x 2 = 6,668 MW of technical resource potential for conventional geothermal plus near-field EGS

Map of New Method Results

By specific geothermal field

- Purple fields represent those “retained” after applying PAL and TE exclusions with this cycle’s method
- Red fields on map show 145 MW excluded by new method, relative to last cycle.
  - Note: Coso Hot Springs (117 MW) is the only field visible on map; other fields are small (<15 MW) and thus not visible at this scale.



Deep Enhanced Geothermal Systems (EGS)

Environmental Evaluation Results

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How does environmental evaluation of EGS compare with conventional geothermal?

- Conventional geothermal, near-field EGS*, and deep EGS have different potential locations, as well as different environmental impacts

- **Conventional geothermal and near-field EGS** are both in existing geothermal fields
  - These resources have the same environmental evaluation methods; no significant changes since last cycle (see slide 17 of the June MAG deck and page 35 of the busbar mapping methodology document)

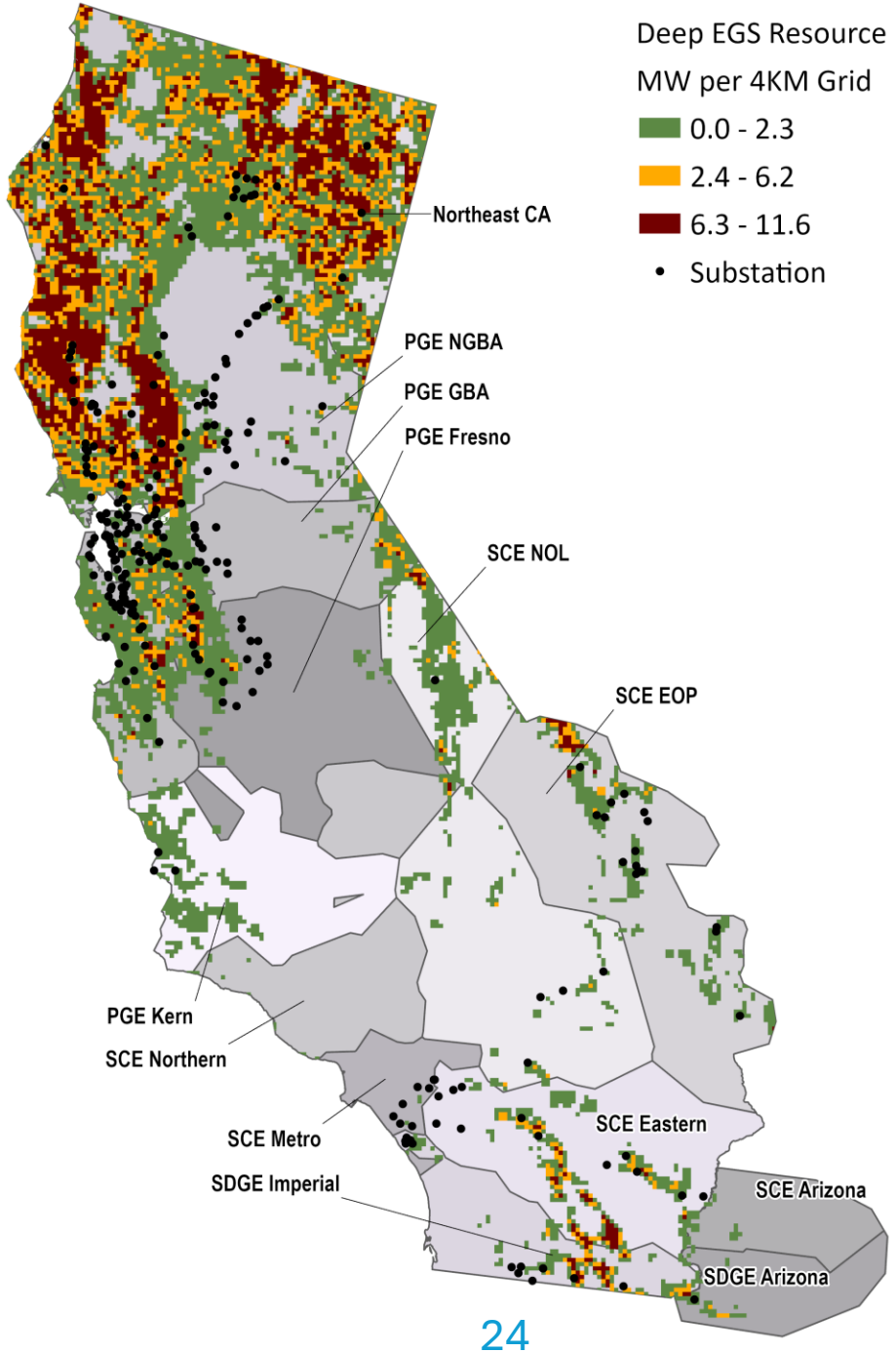
- **Deep EGS potential is less locationally constrained**
  - This necessitates a different environmental evaluation approach for this resource
  - Analyzes the same environmental factors as conventional and near-field, but also includes Aquatic Rare Species Richness
    - This factor was added to analysis because areas of high aquatic rare species richness overlap with many substations allocated EGS capacity in the 2026-2027 busbar mapping cycle

**Note: In the context of IRP modeling, EGS resources are assumed to encompass both enhanced geothermal and other next-generation geothermal technologies.*

Deep EGS Resource and Substation Overview

Substations with Resource Potential within 15 miles

- 222 substations of 471 substations (approximately half) have deep EGS TRP
- Within RESOLVE areas, this is about 10,577 MW



Deep EGS Land Use Results

Average Percent Cover for Environmental Factors, 15-mi radius around substations with deep EGS potential

Heat map below shows magnitude of percent covers; larger value = darker shade.

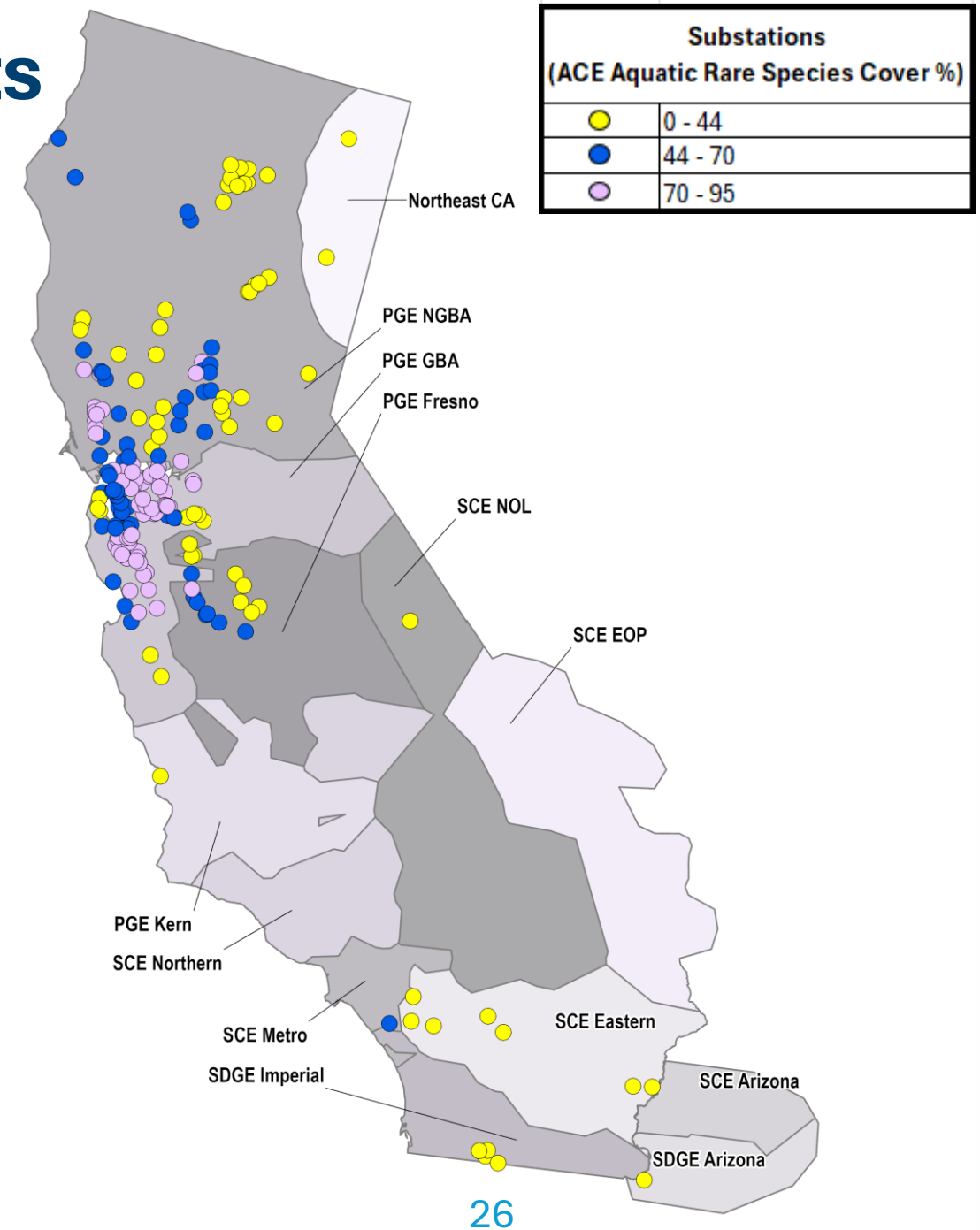
RESOLVE Zone	Fire Threat Tier 2 and 3	ACE High Connectivity	ACE High Biodiversity	ACE Terrestrial Irreplaceability	ACE Combined	Terrestrial Intactness	Wetlands	ACE Aquatic Rare Species Richness
Northeast CA	62%	39%	19%	15%	55%	69%	13%	6%
PGE Fresno	38%	53%	21%	28%	62%	26%	12%	46%
PGE GBA	33%	33%	30%	42%	55%	21%	7%	70%
PGE Kern	51%	23%	21%	33%	46%	31%	5%	44%
PGE NGBA	45%	43%	27%	42%	69%	31%	9%	49%
SCE Arizona								
SCE Eastern	19%	36%	24%	30%	59%	54%	2%	27%
SCE EOP	0%	0%	2%	5%	5%	22%	0%	0%
SCE Metro	48%	36%	24%	51%	66%	34%	7%	63%
SCE NOL	3%	40%	19%	23%	48%	84%	3%	16%
SCE Northern								
SDGE Arizona	0%	3%	12%	11%	15%	18%	3%	6%
SDGE Imperial	21%	10%	11%	14%	27%	45%	2%	21%

Deep EGS Land Use Results

Aquatic Rare Species Richness

- Substations with high percent overlap in and around Bay Area
- Many other areas have lower percent overlap
  - Southern CA and far Northern CA

RESOLVE Zone	Mean Aquatic Rare Species Richness Percent in 15-mile radius (%)
PGE GBA	70%
SCE Metro	63%
PGE NGBA	49%
PGE Fresno	46%
PGE Kern	44%
SCE Eastern	27%
SDGE Imperial	21%
SCE NOL	16%
Northeast CA	6%
SDGE Arizona	6%
SCE EOP	
SCE Arizona	
SCE Northern	

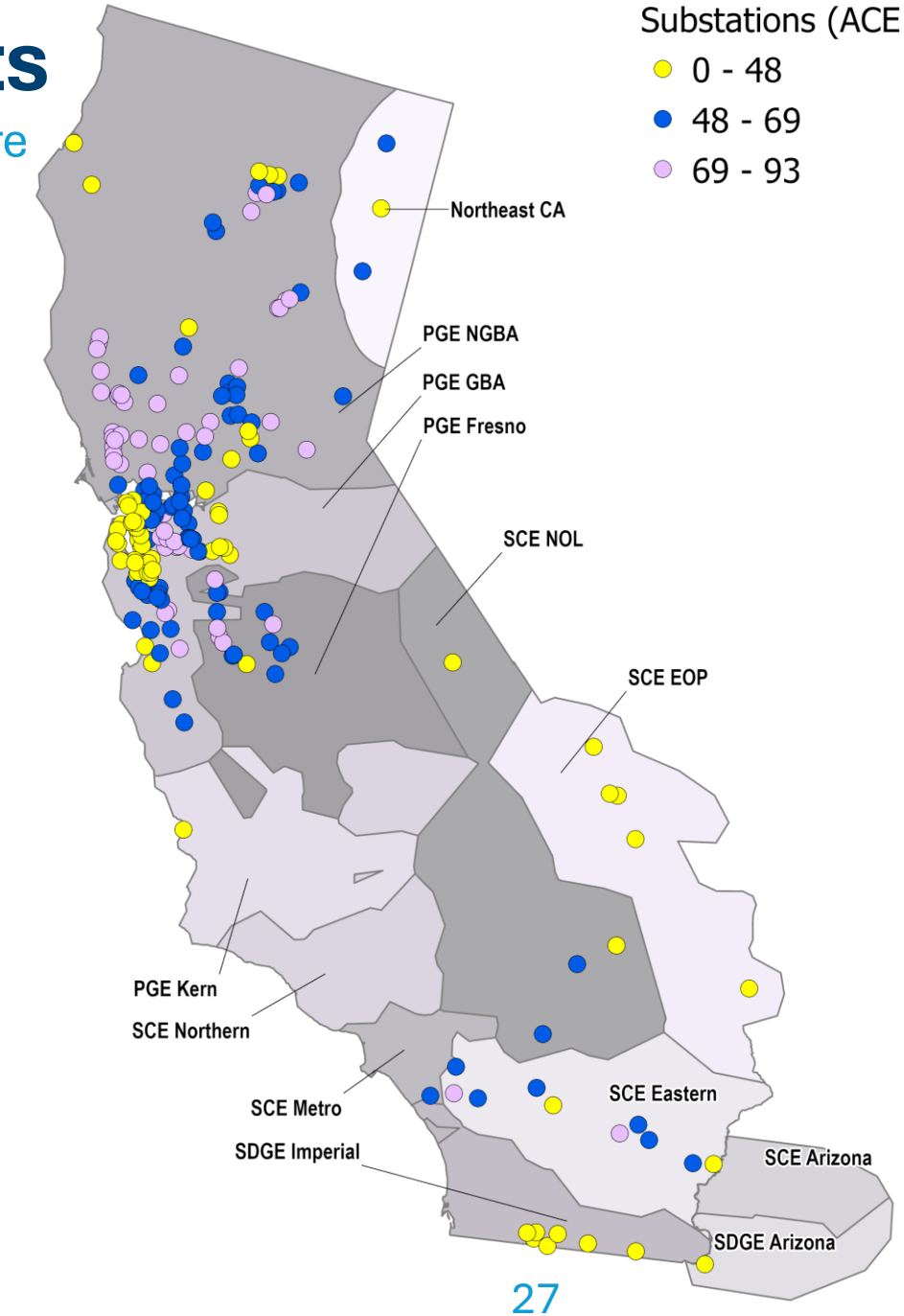


Deep EGS Land Use Results

Areas of Conservation Emphasis (ACE) Combined Score

- Many substations with high percentages of ACE are in Northwest CA
  - Near areas of strong resource potential
- SDG&E and Southwest CA have lower ACE percentages

RESOLVE Zone	Mean ACE All Percent in 15-mile radius (%)
PGE NGBA	69%
SCE Metro	66%
PGE Fresno	62%
SCE Eastern	59%
PGE GBA	55%
Northeast CA	55%
SCE NOL	48%
PGE Kern	46%
SDGE Imperial	27%
SDGE Arizona	15%
SCE EOP	5%
SCE Arizona	
SCE Northern	



Deep EGS Caveats

- Deep EGS resource potential subject to high degree of uncertainty
  - Temperature data is based on estimates derived via computer modeling, not on-site measurements
  - Little is known about the specific subsurface geology in many areas with deep EGS potential (type of substrate, rock formations, heat conductivity differences, etc); this will affect areas suitable for heat extraction

- CEC is leading a process to create new land use screens for both near-field and deep EGS
  - Planning for CEC-led workshop in Q4
  - Details will be posted here
  - Feedback welcome from IRP participants; could inform construction of EGS screens for future cycles

PSH Results

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Updates to PSH Mapping Method

- CEC presented a revised PSH approach in June 2026 (slides 30 onward)
- Revisions to previous method:
  - **Area of evaluation:** Use project boundary (rather than previous 5-mi radius)
  - **Landscape (GIS) metrics:**
    - Eliminate redundant metrics (average similar metrics)
    - Add drought forecast
    - Average multiple alignment levels into single alignment level
    - Flag areas with 100% Protected Area Layer coverage
  - **Project metrics**: No change to metrics
    - Average multiple alignment levels into single alignment level (weighted average)
  - **Final PSH environmental alignment level:**
    - Average project and landscape alignment levels into a final alignment level, using 70/30 weighting, respectively

PSH Landscape (GIS) Results: Landscape Metrics Comparison

- Changes highlighted in cells with colors; white means no change
- Results similar to those from 2026-2027 TPP cycle
- Drought forecast was not used in the 2026-2027 busbar cycle
- **Bold projects at bottom are new for this cycle**

Change from 2026-2027 Cycle

Lower	Same	Higher

	27-28 Cycle	26-27 Cycle	27-28 Cycle	26-27 Cycle	27-28 Cycle	26-27 Cycle	27-28 Cycle	26-27 Cycle	27-28 Cycle	26-27 Cycle	27-28 Cycle	26-27 Cycle	27-28 Cycle	26-27 Cycle	27-28 Cycle	26-27 Cycle
Potential Pumped Storage Site (FERC Application Name)	PAL		Terrestrial Biodiversity		Terrestrial Connectivity		Terrestrial Irreplaceability		High Intactness		Aquatic Rare Species Richness		Aquatic Irreplaceability		Drought	
Bison Peak	1	1	1	1	**5**	**3**	1	1	**4**	**3**	1	1	1	1	3.0	NA
Eagle Mountain	**1**	**2**	1	1	1	1	1	1	3	3	1	1	1	1	5.0	NA
Haiwee Pumped Storage	5	5	**1**	**2**	**2**	**1**	1	1	3	3	1	1	1	1	4.9	NA
Isabella Pumped Storage	1	1	**1**	**2**	1	1	2	2	1	1	1	1	1	1	5.0	NA
LEAPS	1	1	1	1	1	1	1	2	1	1	1	1	1	1	5.0	NA
Maxwell Pumped Storage	1	1	1	1	**3**	**2**	1	1	**5**	**2**	1	1	1	1	4.9	NA
Mokulumne Pumped Storage	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2.8	NA
MQR Pumped Storage	1	1	**5**	**3**	**5**	**3**	**5**	**3**	1	1	5	5	5	5	3.9	NA
Nacimiento Pumped Storage	1	1	1	1	**1**	**2**	1	1	1	2	1	1	1	1	4.8	NA
Salt Springs Pumped Storage	1	1	**3**	**1**	1	1	**2**	**1**	1	2	1	1	1	1	2.8	NA
San_Vicente	**5**	**1**	**5**	**3**	**5**	**3**	**5**	**2**	1	1	**5**	**3**	**5**	**2**	5.0	NA
Swan Lake North Pumped Storage																
Tehachapi Pumped Storage	1	1	**4**	**3**	**4**	**3**	**4**	**3**	2	2	1	1	1	1	4.8	NA
Twitchell Pumped Storage	1	1	1	1	1	1	1	1	2	2	1	2	1	1	4.8	NA
Vandenberg Pumped Storage	1	1	1	1	2	2	1	1	2	2	1	1	1	1	4.0	NA
Whale Rock Pumped Storage	1	1	1	1	3	3	1	1	2	2	**5**	**4**	1	1	3.9	NA
San Onofre Pumped Storage Project	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	5.0	N/A
Lake Shasta Pumped Storage Project	5	N/A	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	2.9	N/A
Barrett Lake Pumped Storage	1	N/A	1	N/A	1	N/A	4	N/A	3	N/A	3	N/A	3	N/A	5.0	N/A
Camp Pendleton Pumped Storage Project	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	1	N/A	5.0	N/A
Lake Casitas Pumped Storage	1	N/A	1	N/A	1	N/A	3	N/A	1	N/A	1	N/A	1	N/A	4.8	N/A
Whiskeytown Pumped Storage	5	N/A	1	N/A	1	N/A	3	N/A	1	N/A	1	N/A	1	N/A	3.0	N/A
Lake Oroville Pumped Storage Project	5	N/A	1	N/A	1	N/A	5	N/A	1	N/A	1	N/A	1	N/A	2.9	N/A
Fish Creek Pumped Storage	1	N/A	1	N/A	1	N/A	2	N/A	4	N/A	4	N/A	4	N/A	2.8	N/A

PSH Results: Project metrics

- No change in individual alignment levels since last cycle; only new metric is weighted average (rightmost column)
- Note: for project characteristics, on average, the upper reservoir has the least favorable criteria alignment levels

PSH Site	Lower Reservoir Alignment Level	Upper Reservoir Alignment Level	Water Source alignment level	Weighted Average of Project Alignment Levels
Isabella Pumped Storage	2	3	2	2.2
Mokelumne Pumped Storage	2	2	2	2.0
Whale Rock Pumped Storage	1	3	1	1.4
Vandenberg Pumped Storage	4	3	5	4.4
Twitchell Pumped Storage	2	3	2	2.2
San Onofre Pumped Storage Project	4	3	5	4.4
Nacimiento Pumped Storage	2	3	2	2.2
MQR Pumped Storage	3	3	1	1.8
Maxwell Pumped Storage Project	2	3	1	1.6
Lake Shasta Pumped Storage Project	2	3	2	2.2
Barrett Lake Pumped Storage	2	3	2	2.2
Camp Pendleton Pumped Storage Project	4	3	5	4.4
Haiwee Pumped Storage Project	2	3	2	2.2
Lake Casitas Pumped Storage	1	3	1	1.4
Whiskeytown Pumped Storage	2	3	2	2.2
Lake Oroville Pumped Storage Project	1	3	1	1.4
Fish Creek Pumped Storage	3	3	2	2.4
San Vicente Pumped Storage Project	1	3	1	1.4
Salt Springs Pumped Storage	2	3	2	2.2
Eagle Mountain Pumped Storage	2	2	3	2.6
Tehachipi Pump Storage Hydro	3	3	3	3.0
Bison Peak Pump Storage Hydro	3	3	3	3.0
LEAPS Pump Storage Hydro	1	3	1	1.4
Swan Lake Pump Storage Hydro	3	3	3	3.0

Note: Weighted average is calculated using weights of 20% for the upper reservoir, 20% for the lower reservoir, and 60% for the water source.

PSH Results: Final Alignment Level Comparison

Comparison of alignment levels between 26-27 and 27-28 TPP cycles

PSH Site	Project Footprint Boundary (Acres) 27-28 Cycle	5-Mile Buffer Around Project (Acres) 26-27 Cycle	Landscape Alignment Level	Project Alignment Level	Weighted Average Alignment Level
Barrett Lake Pumped Storage	479	50,265	2.8	2.2	2.4
Bison Peak Pump Storage Hydro	508	50,265	2.0	3.0	2.7
Camp Pendleton Pumped Storage Project	5,272	50,265	1.8	4.4	3.6
Eagle Mountain Pumped Storage	29,401	50,265	2.2	2.6	2.5
Fish Creek Pumped Storage	3,590	50,265	2.2	2.4	2.3
Haiwee Pumped Storage Project	10,147	50,265	3.0	2.2	2.4
Isabella Pumped Storage	10,987	50,265	1.8	2.2	2.1
Lake Casitas Pumped Storage	456	50,265	2.2	1.4	1.6
Lake Oroville Pumped Storage Project	152	50,265	3.0	1.4	1.9
Lake Shasta Pumped Storage Project	364	50,265	2.2	2.2	2.2
LEAPS Pump Storage Hydro	11,463	50,265	1.8	1.4	1.5
Maxwell Pumped Storage Project	2,127	50,265	2.6	1.6	1.9
Mokelumne Pumped Storage	4,143	50,265	1.4	2.0	1.8
MQR Pumped Storage	503	50,265	3.2	1.8	2.2
Nacimiento Pumped Storage	6,987	50,265	1.8	2.2	2.1
Salt Springs Pumped Storage	1,414	50,265	1.6	2.2	2.0
San Onofre Pumped Storage Project	829	50,265	1.8	4.4	3.6
San Vicente Pumped Storage Project	1,936	50,265	4.2	1.4	2.2
Swan Lake Pump Storage Hydro	2,004	50,265	1.2	3.0	2.4
Tehachipi Pump Storage Hydro	13,480	50,265	2.6	3.0	2.9
Twitchell Pumped Storage	2,843	50,265	2.0	2.2	2.1
Vandenberg Pumped Storage	11,220	50,265	1.8	4.4	3.6
Whale Rock Pumped Storage	3,181	50,265	2.0	1.4	1.6
Whiskeytown Pumped Storage	2,111	50,265	2.6	2.2	2.3

For weighted average: 70% Project-Level, 30% Landscape-Level

CEC Web Application for IRP 27-28 Busbar Mapping Dashboard

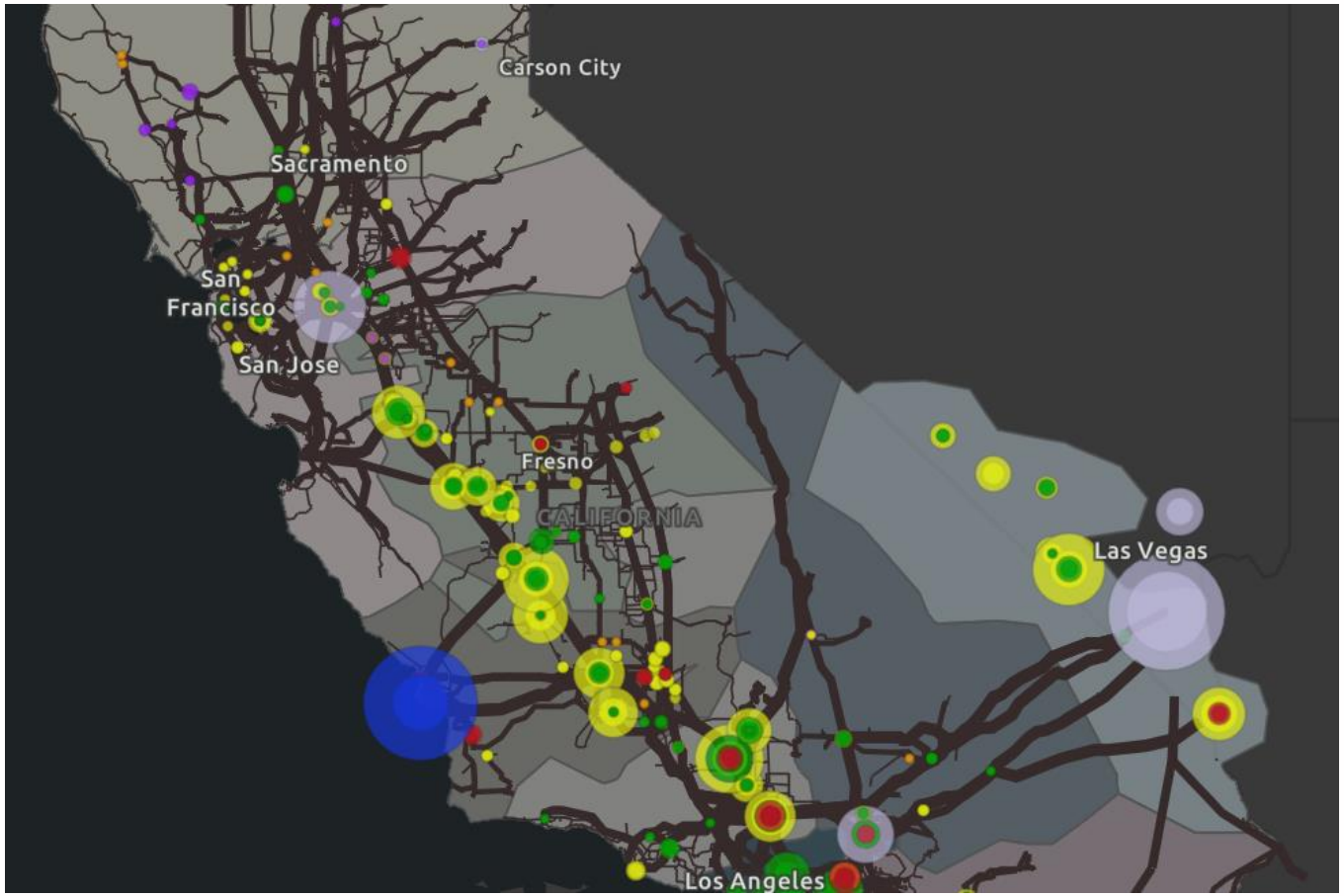
Paul Deaver

Siting, Transmission, and Environmental Protection Division

California Energy Commission

CEC Web Application for Displaying Busbar Mapping Results

- Interactive geospatial visualization of 27-28 IRP Draft Busbar-Mapping Results (Excel workbook) for the Base and Sensitivity Cases
- Contains easily searchable and viewable details on:
  - Capacity allocated (MW) at each substation and individual busbar, distinguished by resource type
  - Criteria alignment levels for substations with mapped resources
  - Raw environmental and land use metrics and supporting datasets
- Will be updated for the Proposed Decision and Final Decision Busbar Mapping results

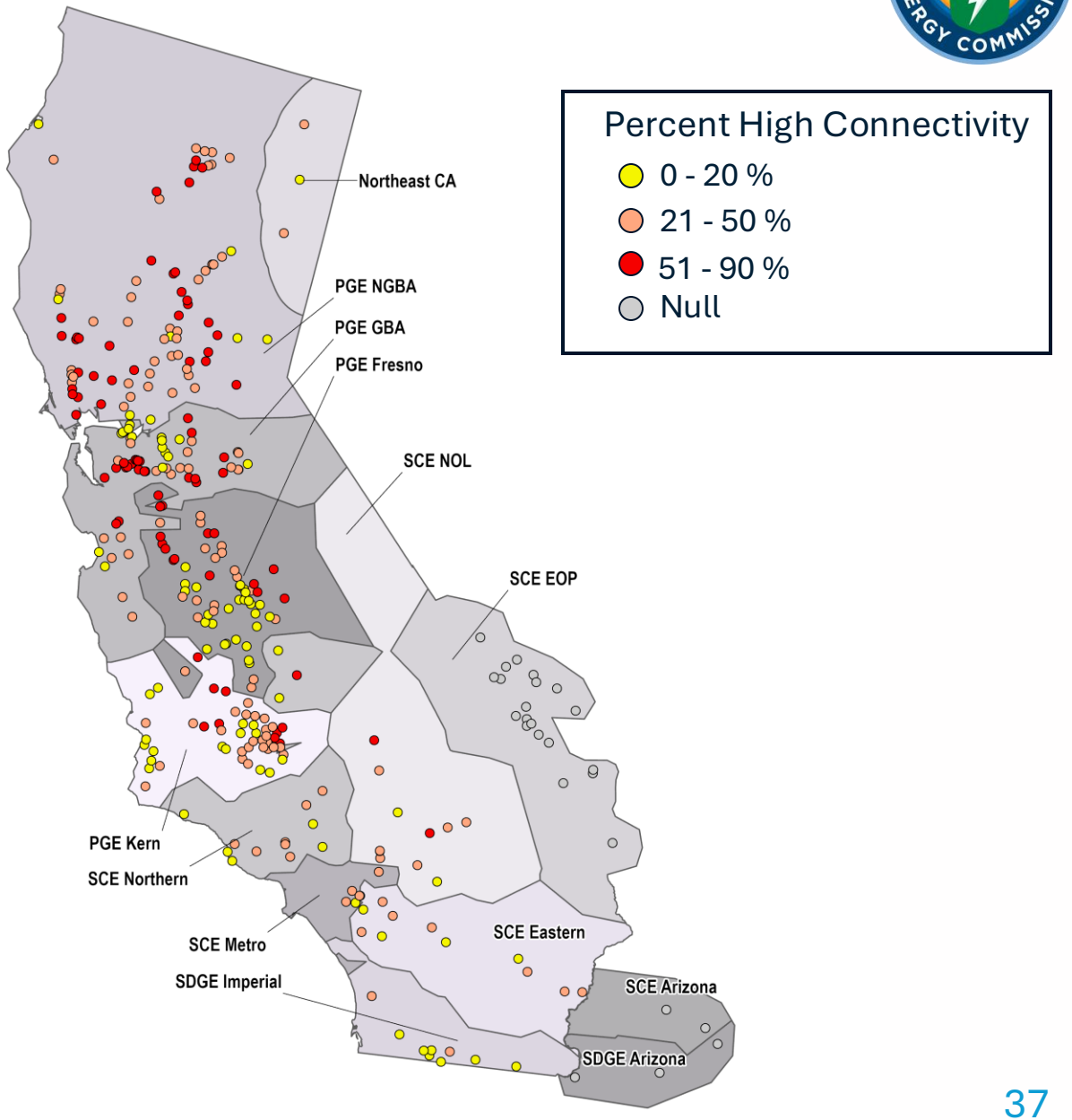


Appendix Slides

Solar Results: High Connectivity Metric

All substations greater than 2,000 acres of lower implication land, 10-mile radius

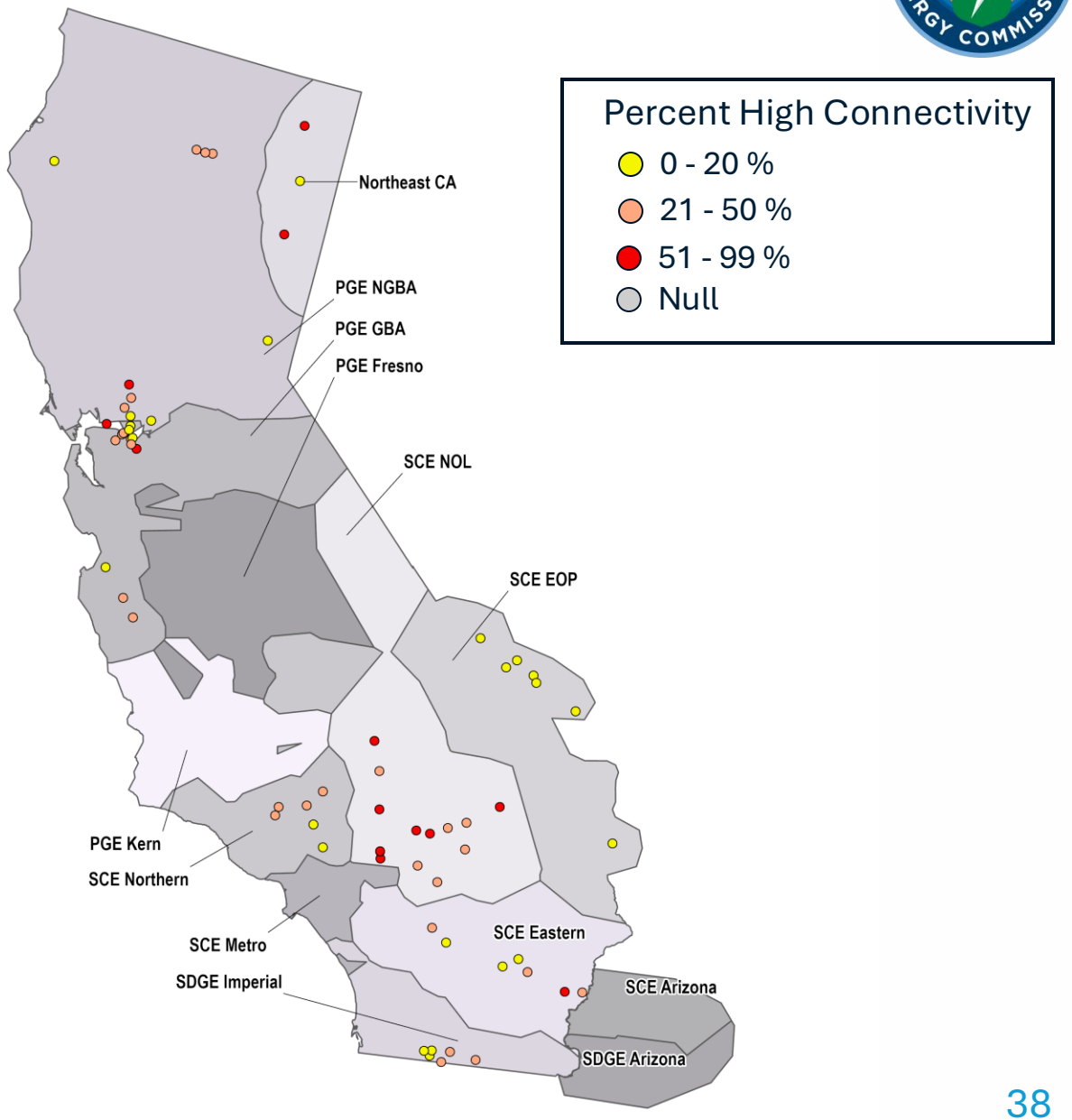
- Map on left shows percent cover of high connectivity within the total resource potential around each substation
- Criteria alignment level depends on this percent coverage metric as well as percent utilization of lower implication land of the allocated MW
- Large variability of high connectivity conditions around substations within each RESOLVE Zone or CAISO Study Area



Wind Results: High Connectivity Metric

All substations greater than 1,000 acres of lower implication land, 15-mile radius

- Limited number of substations are nearby large swaths of wind resource potential
- Presence of high connectivity in the vicinity of these substations varies even within RESOLVE zone



Conventional Geothermal Environmental Factors

Selected Environmental Factors Summarized by RESOLVE Zone

RESOLVE Zone	Average Acres of Geoth. Fields (# of fields)	Total Undeveloped Resource Potential (MW)	Fire Threat Tier 2	Fire Threat Tier 3	High Connectivity	High Biodiversity	High Irreplaceability	High Intactness	Wetlands
Northeast CA	14,100 acres (6)	174.5	62%	0%	21%	48%	7%	26%	22%
PGE GBA	73 acres (2)	5.9	50%	50%	50%	0%	0%	99%	12%
PGE NGBA	42,900 acres (10)	665.6	31%	13%	39%	13%	16%	44%	19%
SCE Eastern	53,700 acres (2)	1,782.1	0%	0%	0%	26%	22%	23%	17%
SCE NOL	283,000 acres (2)	141.6	31%	0%	3%	19%	14%	64%	3%
SDGE Imperial	37,900 acres (5)	616.7	0%	0%	0%	14%	14%	9%	8%

- Average percent overlap of selected environmental metrics within the geothermal field area that remains after applying the Protected Area Layer
- Imperial Valley geothermal fields (SCE Eastern and SDGE Imperial) are within Imperial Irrigation District (IID) territory and are often busbar mapped as an out of CAISO inter-tie at Imperial Valley and Mirage Substations

List of Geothermal Fields Excluded by New Method

Geothermal Field Name	Net Undeveloped Resource Potential (MW)	Acres of Technical Resource Potential Not Covered by PAL	Acres Covered by TE Exclusions	% of Field Covered by TE Exclusions
Coso Hot Springs	117	82,217	78,018	94.90%
West Valley Reservoir	13	204	186	91.30%
Arrowhead HS	7	175	164	93.60%
Paso Robles	3	84	84	100.00%
Hot Mineral Spa	3	4,024	4,024	100.00%
Brockway Hot Springs	2	49	49	100.00%
Total	145	86,753	82,525	

Note: None of the excluded fields were allocated new build MW in the 26-27 busbar mapping cycle

PSH Results: Project-Level (New Method) Metrics

- Most PSH sites are assigned a weighted average alignment level less than 2.5

- Three PSH sites have average alignment levels above 4:
  - Vandenberg
  - San Onofre, and
  - Camp Pendelton

  - These three sites use the ocean as their water source

PSH Site	Lower Reservoir Alignment Level	Upper Reservoir Alignment Level	Water Source alignment level	Weighted Average Alignment Level
Isabella Pumped Storage	2	3	2	2.2
Mokelumne Pumped Storage	2	2	2	2.0
Whale Rock Pumped Storage	1	3	1	1.4
Vandenberg Pumped Storage	4	3	5	4.4
Twitchell Pumped Storage	2	3	2	2.2
San Onofre Pumped Storage Project	4	3	5	4.4
Nacimiento Pumped Storage	2	3	2	2.2
MQR Pumped Storage	3	3	1	1.8
Maxwell Pumped Storage Project	2	3	1	1.6
Lake Shasta Pumped Storage Project	2	3	2	2.2
Barrett Lake Pumped Storage	2	3	2	2.2
Camp Pendleton Pumped Storage Project	4	3	5	4.4
Haiwee Pumped Storage Project	2	3	2	2.2
Lake Casitas Pumped Storage	1	3	1	1.4
Whiskeytown Pumped Storage	2	3	2	2.2
Lake Oroville Pumped Storage Project	1	3	1	1.4
Fish Creek Pumped Storage	3	3	2	2.4
San Vicente Pumped Storage Project	1	3	1	1.4
Salt Springs Pumped Storage	2	3	2	2.2
Eagle Mountain Pumped Storage	2	2	3	2.6
Tehachipi Pump Storage Hydro	3	3	3	3.0
Bison Peak Pump Storage Hydro	3	3	3	3.0
LEAPS Pump Storage Hydro	1	3	1	1.4
Swan Lake Pump Storage Hydro	3	3	3	3.0

For weighted average: 20% upper reservoir, 20% lower reservoir, and 60% water source

PSH Results: Final Alignment Level Metrics: Comparison

- Table below compares final alignment levels for PSH sites allocated MW in the 26-27 TPP cycle
- Most landscape alignment levels increase in 27-28 vs the 26-27 TPP cycle
- The project alignment levels are the same
- The final, weighted-average, alignment levels are generally similar
  - A few PSH sites (Maxwell and San Vicente) have higher alignment levels

Change from 2026-2027 Cycle		
Lower	Same	Higher

PSH Site	Project Footprint Boundary (Acres): 27-28 Cycle	Project Footprint Boundary (Acres): 26-27 Cycle	Landscape Alignment Level (27-28 Cycle)	Landscape Alignment Level (26-27 Cycle)	Project Alignment Level (27-28 TPP)	Project Alignment Level (26-27 TPP)	Weighted average Alignment Level (27-28 Cycle)	Weighted average Alignment Level (26-27 Cycle)
Mokelumne Pumped Storage	4,143	50,265	1.4	1.3	2.0	2.0	1.8	1.8
Whale Rock Pumped Storage	3,181	50,265	2.0	2.1	1.4	1.4	1.6	1.6
Twitchell Pumped Storage	2,843	50,265	2.0	1.7	2.2	2.2	2.1	2.1
Maxwell Pumped Storage Project	2,127	50,265	2.6	1.7	1.6	1.6	1.9	1.6
San Vicente Pumped Storage Project	1,936	50,265	4.2	2.5	1.4	1.4	2.2	1.7
LEAPS Pump Storage Hydro	11,463	50,265	1.8	1.6	1.4	1.4	1.5	1.5

For weighted average: 70% Project-Level, 30% Landscape-Level

PSH Results: Final Alignment Level Comparison

Comparison of alignment levels between 26-27 and 27-28 TPP cycles

Change from 2026-2027 Cycle		
Lower	Same	Higher

- Most alignment levels increased in 27-28 vs the 26-27 TPP cycle, due to:
  - Using project boundary instead of 5-mile buffer
  - Using a drought forecast in the 27-28 cycle

PSH Site	Project Footprint Boundary (Acres) 27-28 Cycle	5-Mile Buffer Around Project (Acres) 26-27 Cycle	Weighted average Alignment Level 27-28 Cycle	Weighted average Alignment Level 26-27 Cycle
Barrett Lake Pumped Storage	479	50,265	2.4	NA
Bison Peak Pump Storage Hydro	508	50,265	2.7	2.6
Camp Pendleton Pumped Storage Project	5,272	50,265	3.6	NA
Eagle Mountain Pumped Storage	29,401	50,265	2.5	2.3
Fish Creek Pumped Storage	3,590	50,265	2.3	NA
Haiwee Pumped Storage Project	10,147	50,265	2.4	2.3
Isabella Pumped Storage	10,987	50,265	2.1	1.8
Lake Casitas Pumped Storage	456	50,265	1.6	NA
Lake Oroville Pumped Storage Project	152	50,265	1.9	NA
Lake Shasta Pumped Storage Project	364	50,265	2.2	NA
LEAPS Pump Storage Hydro	11,463	50,265	1.5	1.3
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For weighted average: 70% Project-Level, 30% Landscape-Level

PSH Results: Map of Final Environmental Alignment Levels

