DOCKETED

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Description:	CEC - Presentation slides for the SB100 Inputs and Assumption Workshop on 02/16/2024
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Docketed Date:	2/16/2024

SB 100 Inputs and Assumptions Workshop
February 16, 2024

Instructions

- Workshop is being conducted remotely via Zoom
  - Workshop is being recorded
- Attendees may participate in the workshop by:
  - Making comments during public comment period
  - Submitting written comments due **March 1, 2024**
- Questions and Comments can be entered in the Q&A section of the Zoom application or may asked by raising a hand during the Q&A section

Opening Remarks

Overview

- Introduction
- Description of the models
- Load
- Existing and Planned Resources
- Expansion Candidates
- Additional Assumptions
- Scenario Specific Assumptions

SB 100 Report Requirements

Issue a joint-agency report every four years to include:

A. Policy review (technical, safety, affordability, reliability)
B. Reliability benefits and impacts
C. Financial costs/benefits
D. Barriers/Benefits of achieving the policy
E. Alternative scenarios and costs/benefits of each

2025 SB 100 Report Opportunities:

- Report on current statewide efforts toward clean electricity progress and identify opportunities to enhance state efforts.
- Study alternate scenarios to understand the impact of uncertainty in cost, technology innovation, and project development on achieving SB 100.

Workshop Comment Highlights

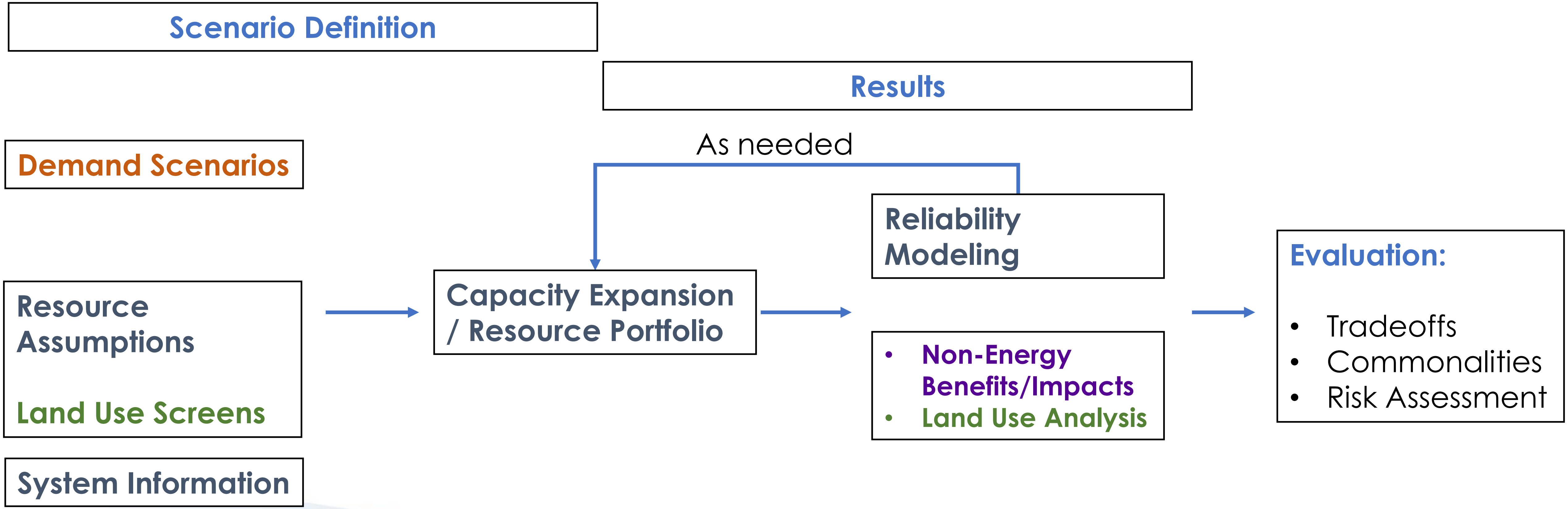
- Desire for more detail on the modeling approach and process.
- Comments around specific technologies Including geothermal, non-lithium battery solutions, long duration energy storage, alternative fuels such as hydrogen. Some commenters were:
  - For and against including hydrogen combustion.
  - For including higher levels of DERs across all scenarios. Study maximum distributed generation.
  - For and against including carbon capture and sequestration.
- Desire for the models to provide a better understanding of cost implications and risks.
- Use modeling results to identify the "break-even costs" for emerging technology to be included in the least-cost reference scenario.
- Study resources individually.
- Use the same land use screen for the DER scenario. Use the most stringent land use screen for all cases.
- Include more analysis on reliability, including power flow, local reliability, more transmission characterization.
- The assumptions around imports need to be crafted with care.

2025 Report Timeline

Anticipated Timing	Workshop	Topics
Today	Inputs & Assumptions	Detailed draft inputs and assumptions to be used to develop and model SB 100 scenarios
2024 Q2	Non-Energy Benefits	Proposed methods for non-energy benefit analysis of the scenarios
2024 Late Q2	Draft Modeling Results	Draft scenario modeling results
2024 Early Q3	Draft NEB and Land Use Results	NEB and land use impact results based on the draft scenario modeling results
2024 Late Q3	Final Analysis Workshop	Final scenario modeling and evaluation
2024 Q4	Report and Recommendations Workshop	Draft report recommendations
2024 Q4	Submit Report the Legislature	

Models

Scenario Analysis



Scenarios

Reference	Existing resource plans replace the base resource, including the CPUC's Preferred System Plan through 2039, and POU Resource Plans.
Base	Least cost model based on current demand scenario and resource cost projections. Existing Resource Plans through 2030.
Minimum Compliance	Base scenario without constraints on GHG emissions. This scenario is focused on SB 100 compliance only.
DER Focus	Higher levels of distributed energy resources, including BTM and FTM generation and storage resources, and demand flexibility.
Resource Diversification	Procurement and technology advancements for a variety of existing and emerging resources able to be used for SB 100 compliance.
Geographic Diversification	Expanded regional transmission allowing for greater energy exchanges between California and the rest of the WECC.
Combustion Resource Retirement	Transition from combustion power plants to only non-combustion power plants.

Sensitivities

- Sensitivities – Modifications to one of the scenarios that will only be evaluated using the first stage of capacity expansion modeling.
  - Sensitivities will be used to estimate how changes to a scenarios input would impact results at a high level, without a full evaluation.

Main Scenario	Sensitivity	Change from Main Scenario
Base	Terrestrial Climate Resiliency Land Use Screen	Replace Core Land Use Screen with Terrestrial Climate Resiliency Land Use Screen
DER Focus	DER Focus- Standard Demand Flexibility	Remove high demand flexibility from augmented demand scenario
Combustion Retirement	CR- Policy Compliance High Electrification Demand Scenario	Remove high demand flexibility and high DER augmentation from the demand scenario

Electricity System Supply Model

Capacity Expansion, Stage 1
- Model: REGEN
- Results:
  - General Resource Build
  - Initial PRM and Capacity Credits

Capacity Expansion, Stage 2
- Model: PLEXOS LT (Capacity Expansion)
- Results:
  - Resource Build
  - Capital and Fixed Costs

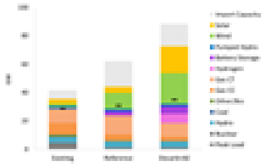
Resource Adequacy
- Model: PLEXOS (Stochastic)
- Results:
  - LOLE

System Dispatch
- Model: PLEXOS (Deterministic)
- Results:
  - GHG emissions
  - Operating Costs

Integration of the Capacity Expansion Models

Inputs
- Technology and input assumptions

REGEN
- Long-term Optimization in CA-REGEN model



Technology Builds
- Subset of input technology options

PLEXOS Inputs
- Discrete candidate technology options

PLEXOS

PLEXOS LT
- Long-term optimization of discrete candidates

Analyzing Resource Builds

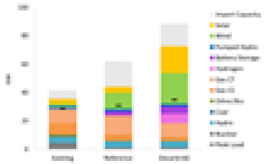
Inputs

- Scenarios components
- Capacity expansion results

PLEXOS

PLEXOS RA

- Resource Adequacy assessment of the portfolio



Reliability Results

- Determine if portfolio adjustments are necessary.

PLEXOS

PLEXOS PCM

- Model System Dispatch and portfolio compliance

Results

- Reported results and input to other assessments

Loads

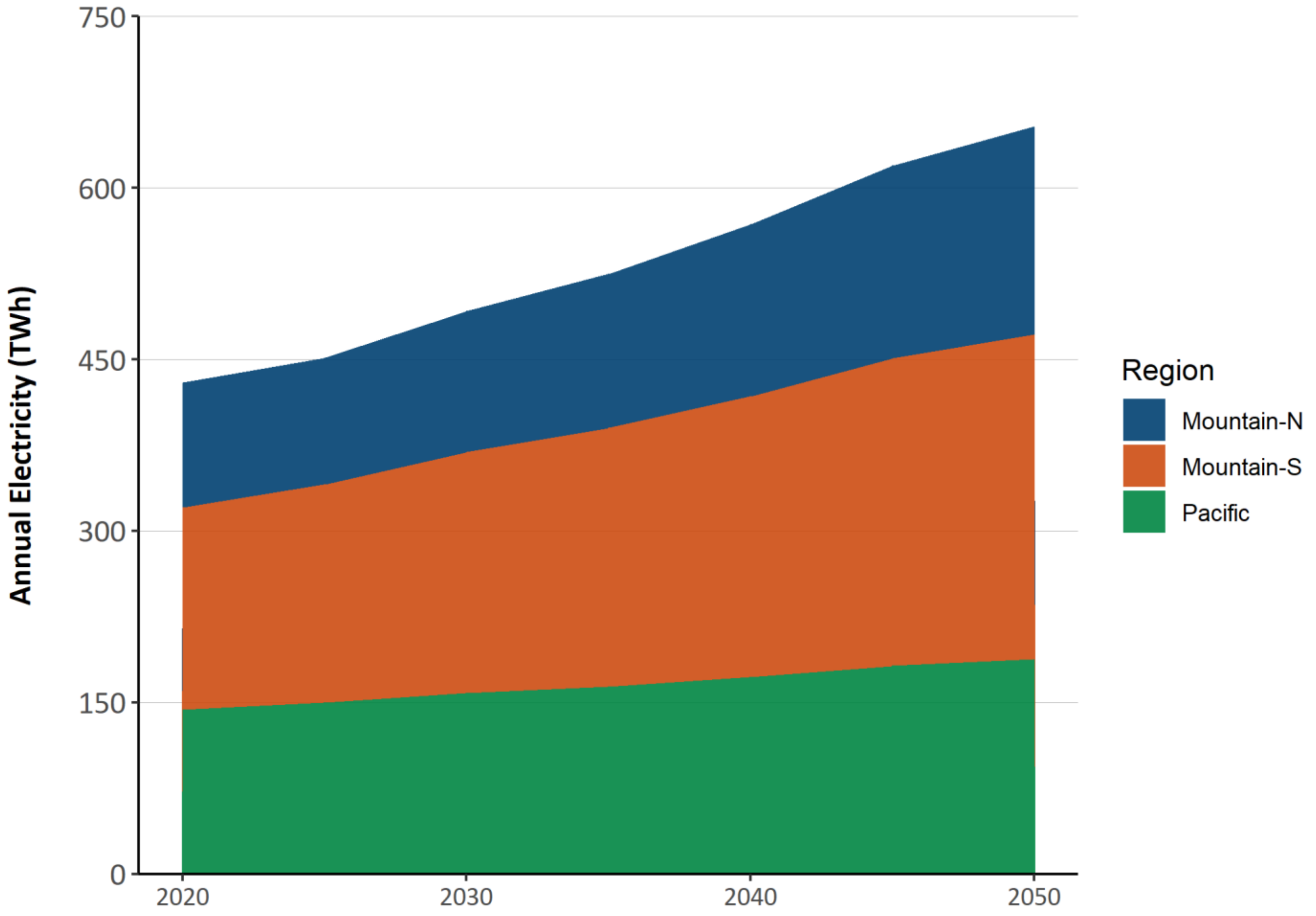
Demand Scenarios

- California demand will be sourced from the CEC's Demand Scenarios project. Workshops on this project and the models will be held this spring. Scenarios *anticipated* to be utilized:
  - Policy Compliance High Electrification Scenario.
  - Policy Compliance High Electrification Scenario augmented by DER & Demand Response/ Flexibility.

Policy Compliance High Electrification Scenario	**Policy Compliance High Electrification Scenario augmented by additional DER & Demand Response/Demand Flexibility**
Reference Base Minimum Compliance Resource Diversification Geographic Diversification	DER Focus Combustion Resource Retirement

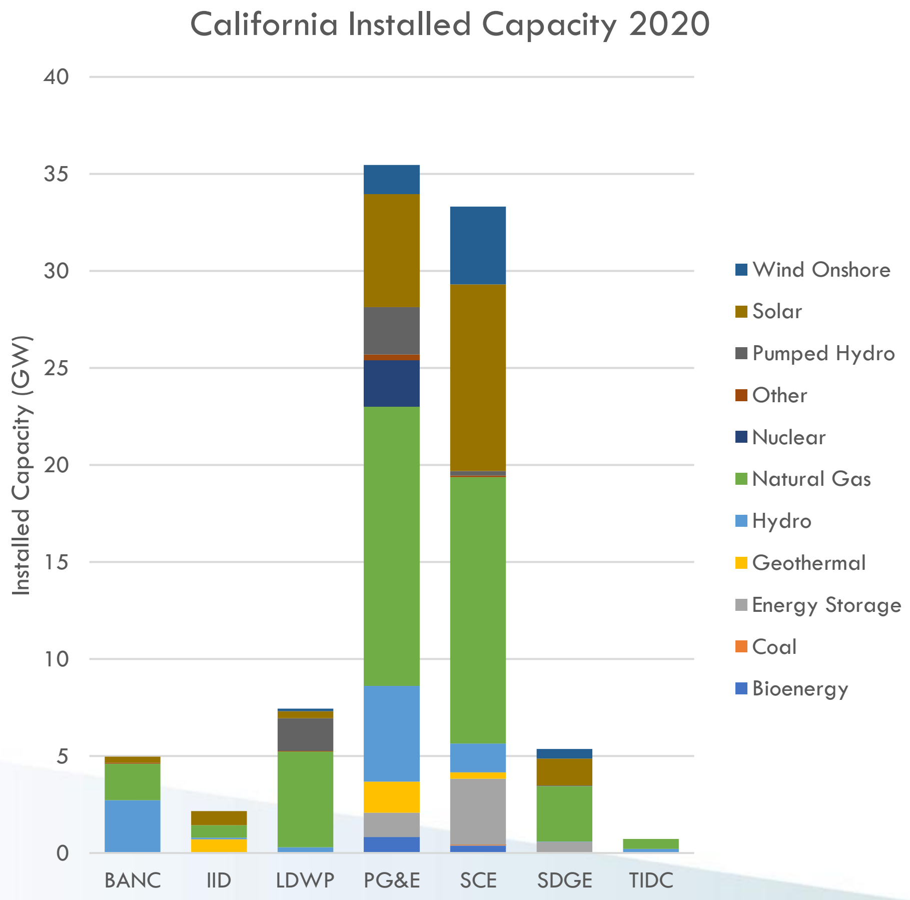
Rest of WECC

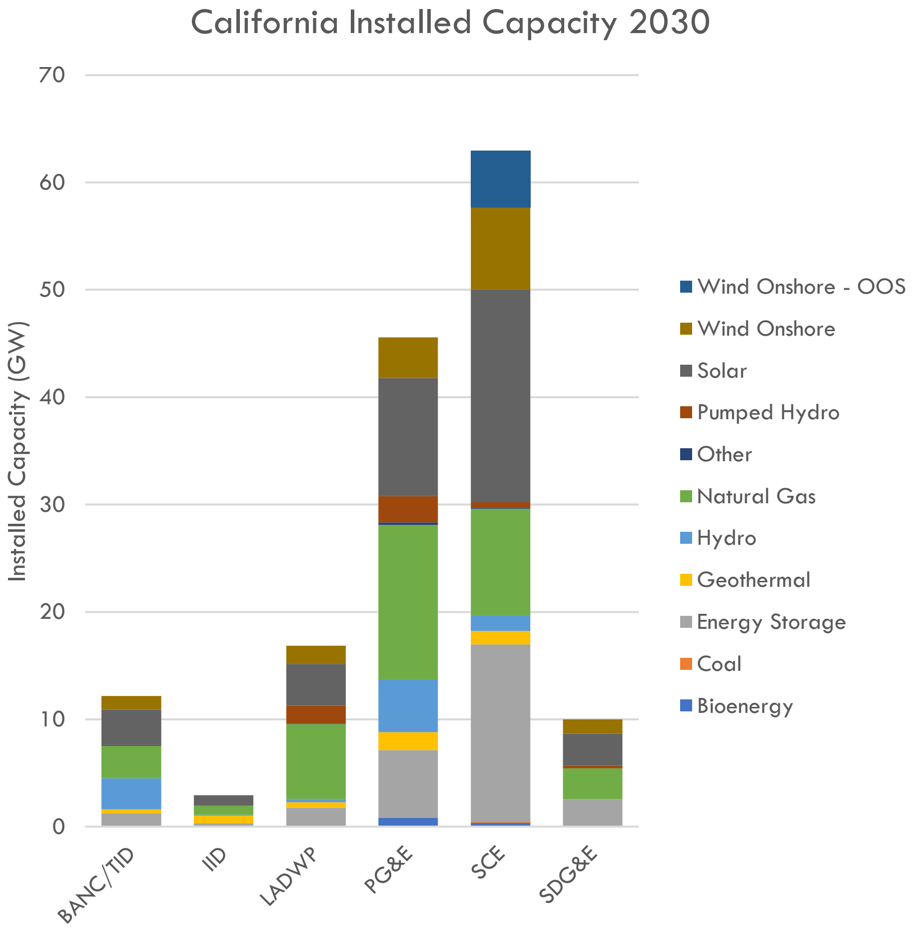
- EPRI's US-REGEN model will be used to generate Loads for the rest of WECC, on a state-by-state basis.
- Assumptions will be designed to align with the Demand Scenarios.



Existing and Planned Resources

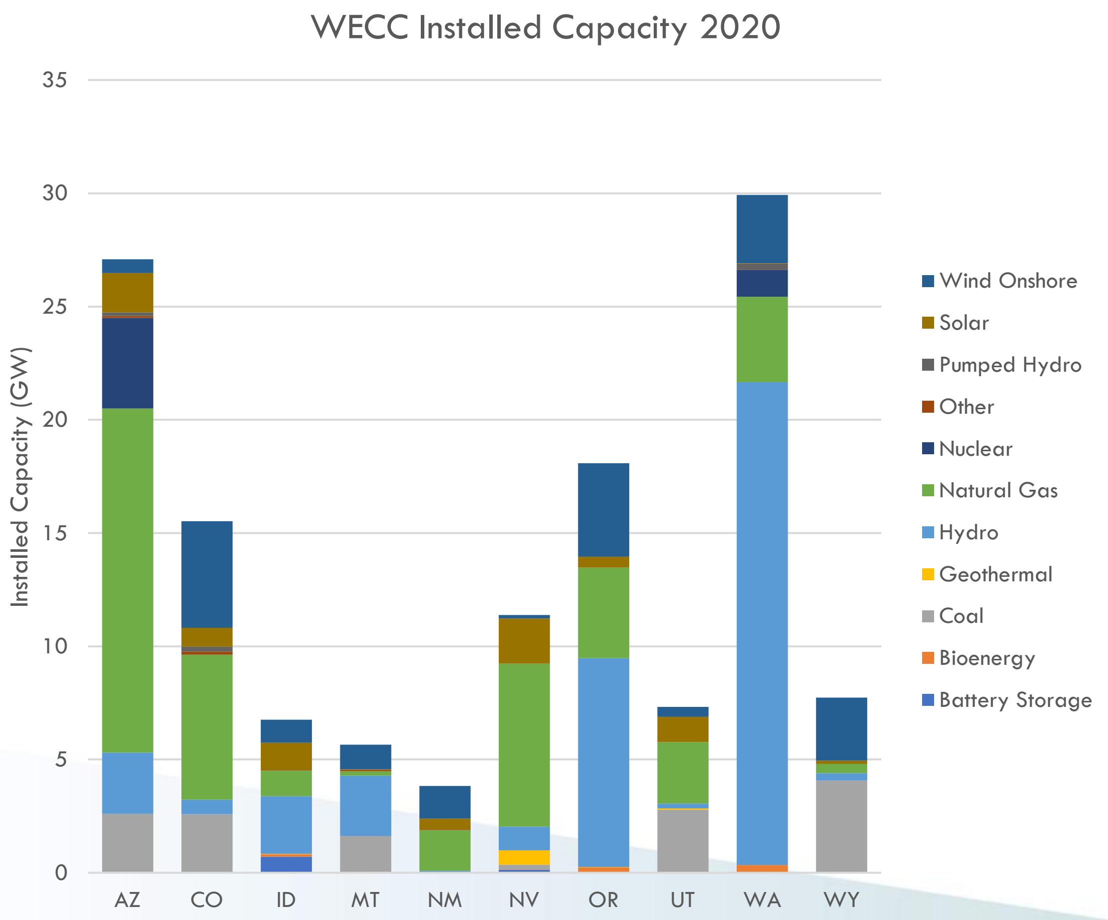
Installed California Capacity

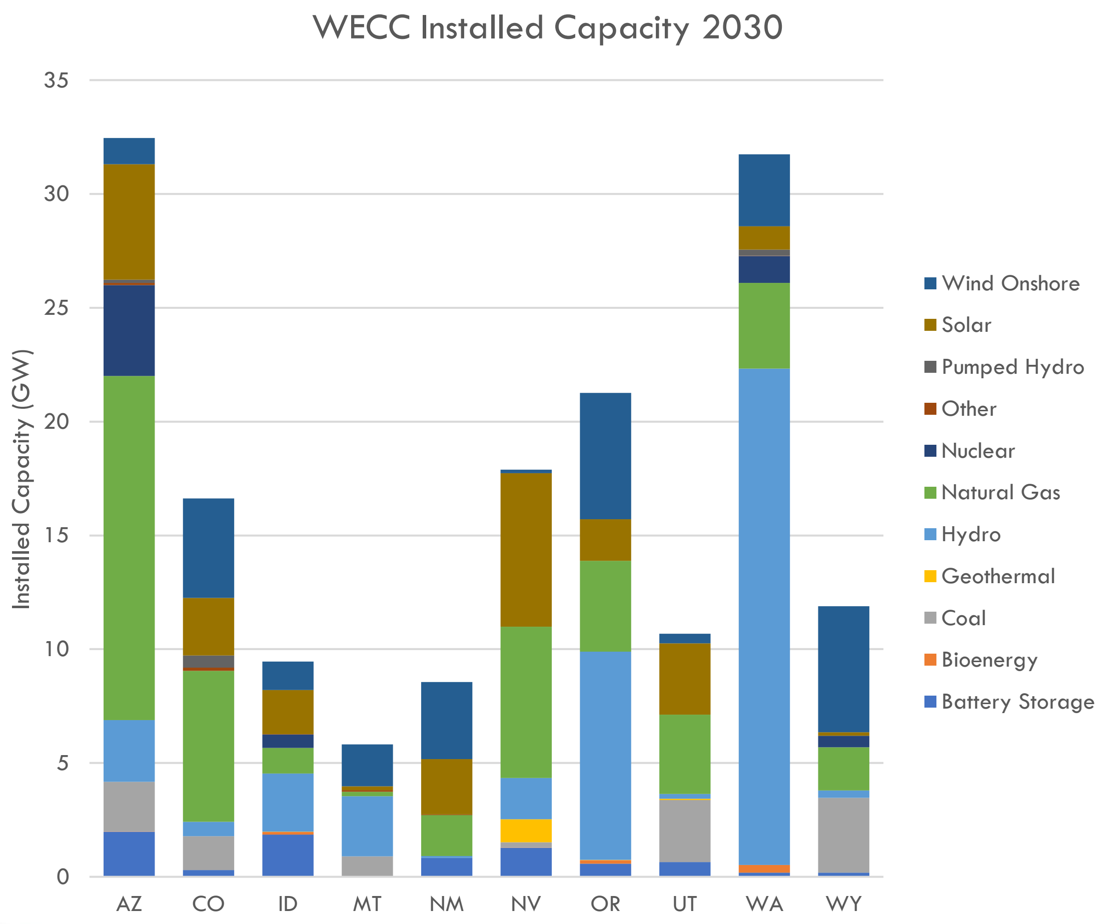




Sources: CEC's Quarterly Fuels and Energy Report, CAISO Master File, Utility Filings, CPUC IRP (October 2023 25 MMT Core Scenario)

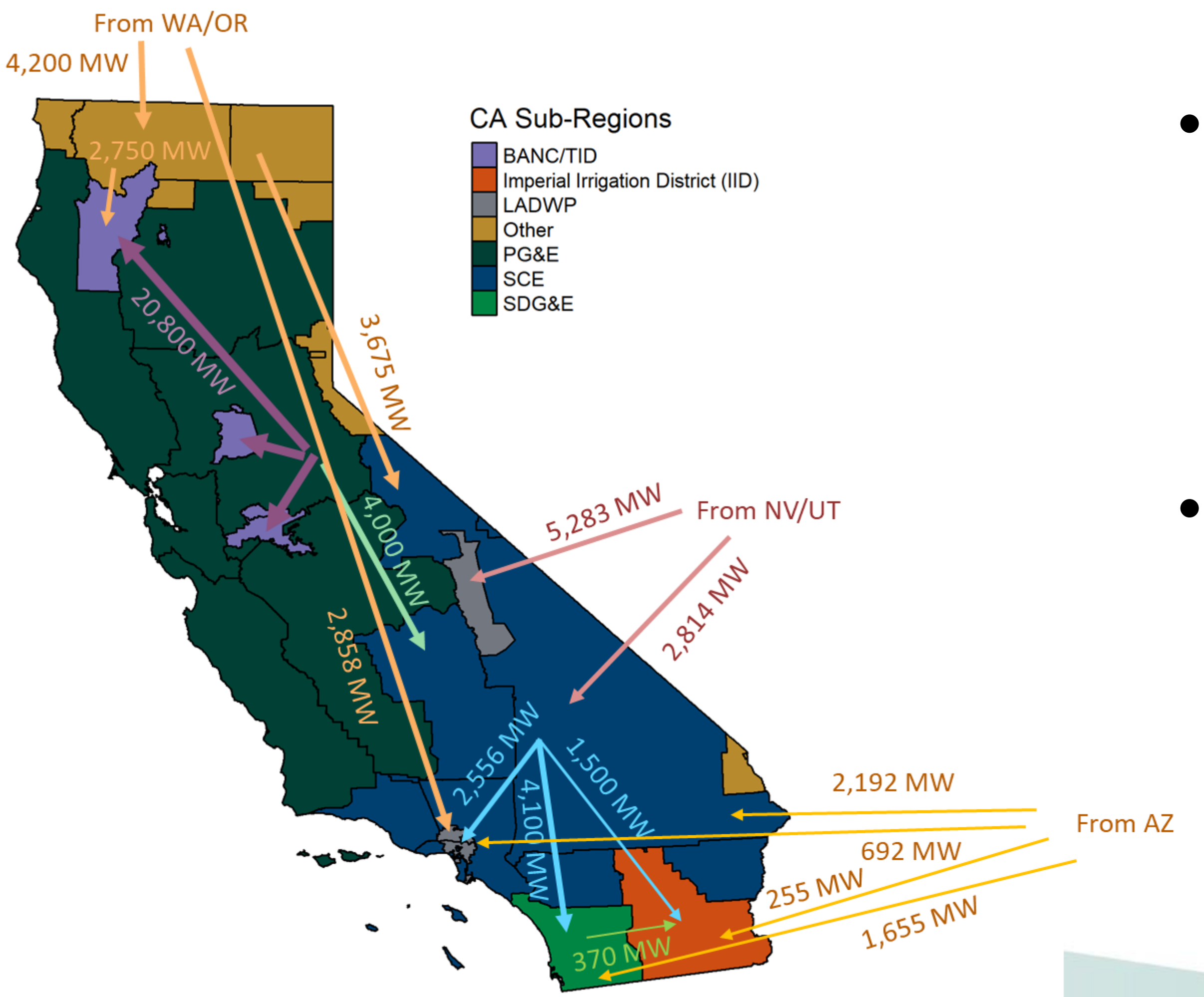
Rest of WECC Resources





Sources: WECC Anchor Dataset

Existing Transmission



- Transmission is modeled with a pipeline model, which aggregates all transmission between regions.
- California related transmission is informed by several existing models, physical system topologies, and various studies.

Expansion Candidates

Expansion Candidates

Technology	Available in California?	Equipment Lifetime
Natural Gas Combined Cycle without CO_2 capture	WECC only	60
Natural Gas Combustion Turbine	WECC only	60
Natural Gas Combined Cycle with 95% CO_2 capture	WECC only	60
Retrofit of Natural Gas Combined Cycle with 95% CO_2 capture	Yes	N/A
Retrofit of Natural Gas Combined Cycle to Hydrogen	Yes	N/A
Hydrogen Combined Cycle	Yes	60
Hydrogen Combustion Turbine	Yes	60
Hydrogen Fuel Cell	Yes	20
Biomass without CO_2 capture	Yes	60
Biomass with 90% CO_2 capture	Yes	60
Nuclear (Generation III)	WECC only	80
Advanced Nuclear	WECC only	60
Geothermal	Yes	30
Onshore Wind	Yes	25
Offshore Wind	Yes	25
Solar Photovoltaic (Single Axis)	Yes	30
FTM Solar	Yes	30
Concentrating Solar Power (CSP)	Yes	60

Federal Policies and Incentives

The following incentives will be layer on top of the economic projections below:

- Clean Electricity Production Tax Credit
- Clean Electricity Investment Tax Credit
- CO2 Capture and Storage Credit
- Clean Hydrogen Production Credit

Capital costs ($/kW)

Technology	2025	2035	2050
Natural Gas Combined Cycle without CO_2 capture	1246	1124	985
Natural Gas Combustion Turbine	1094	1005	872
Natural Gas Combined Cycle with 95% CO2 capture	2396	1944	1611
Retrofit of Natural Gas Combined Cycle with 95% CO2 capture	1365	1062	880
Retrofit of Natural Gas Combined Cycle to Hydrogen*	1203	1106	960
Hydrogen Combined Cycle*	1356	1224	1072
Hydrogen Combustion Turbine*	1203	1106	960
Hydrogen Fuel Cell*	2947	1208	1198
Biomass without CO_2 capture	4708	4340	3871
Biomass with 90% CO_2 capture*	6574	6060	5405
Nuclear (Generation III)	8106	7473	6668
Advanced Nuclear	8853	8164	7289
Geothermal	6469	5559	5156
Onshore Wind	1268	1093	924
Offshore Wind	4941	4321	3903
Solar Photovoltaic (Single Axis)	1248	829	632
FTM Solar	1731	1148	861
Concentrating Solar Power (CSP)	6287	4896	4352

Sources: NREL ATB, (*) indicated technologies not included in the ATB values are from EPRI. Fuel cell costs are sourced from the CEC SB 423 analysis. Values are given in 2021 USD

Fixed O&M Costs($/kW-yr)

Technology	2025	2035	2050
Natural Gas Combined Cycle without CO_2 capture	29.9	26.9	23.9
Natural Gas Combustion Turbine	23.6	22.3	20.3
Natural Gas Combined Cycle with 95% CO2 capture	56.2	45.9	38.6
Retrofit of Natural Gas Combined Cycle with 95% CO2 capture	63.7	56.1	48.1
Retrofit of Natural Gas Combined Cycle to Hydrogen*	26.0	24.5	22.3
Hydrogen Combined Cycle*	32.3	29.1	25.9
Hydrogen Combustion Turbine*	26.0	24.5	22.3
Hydrogen Fuel Cell*	31	30.8	30.5
Biomass without CO_2 capture	157.2	157.2	157.2
Biomass with 90% CO_2 capture*	144.0	144.0	144.0
Nuclear (Generation III)	152.1	152.1	152.1
Advanced Nuclear	118.8	118.8	118.8
Geothermal	110.7	103.6	103.6
Onshore Wind	28.8	26.1	23.3
Offshore Wind	85.6	74.0	65.2
Solar Photovoltaic (Single Axis)	20.5	15.5	13.5
FTM Solar	18	13	10
Concentrating Solar Power (CSP)	61.4	51.8	51.8

Sources: NREL ATB, (*) indicated technologies not included in the ATB values are from EPRI. Fuel cell costs are sourced from the CEC SB 423 analysis. Values are given in 2021 USD

Variable O&M ($/MWh)

Technology	2025	2035	2050
Natural Gas Combined Cycle without CO_2 capture	1.91	1.77	1.61
Natural Gas Combustion Turbine	6.44	6.44	6.44
Natural Gas Combined Cycle with 95% CO2 capture	4.22	3.61	3.23
Retrofit of Natural Gas Combined Cycle with 95% CO2 capture	4.22	3.61	3.23
Retrofit of Natural Gas Combined Cycle to Hydrogen*	1.91	1.77	1.61
Hydrogen Combined Cycle*	1.91	1.77	1.61
Hydrogen Combustion Turbine*	6.44	6.44	6.44
Hydrogen Fuel Cell*	37	37	37
Biomass without CO_2 capture	5.04	5.04	5.04
Biomass with 90% CO_2 capture*	12.66	12.66	12.66
Nuclear (Generation III)	2.47	2.47	2.47
Advanced Nuclear	3.13	3.13	3.13

Sources: NREL ATB, (*) indicated technologies not included in the ATB values are from EPRI. Fuel cell costs are sourced from the CEC SB 423 analysis.
Values are given in 2021 USD

Energy Storage

Technology	Power Capacity (“Door”) Cost ($/kW)	Energy Capacity (“Room”) Cost ($/kWh)	Roundtrip Efficiency	Duration (hours)	Equipment Lifetime (years)
Existing Pumped Hydro	N/A	N/A	83%	20	100
Lithium-ion Battery	288 (2025) 284 (2035) 250 (2050)	287 (2025) 207 (2035) 146 (2050)	92%	Endogenous	20
Long duration Storage	608 (2035) 457 (2050)	154 (2035) 106 (2050)	60%	Endogenous	20
Seasonal Storage	169 (2035)	34 (2035)	40%	Endogenous	30

Sources: NREL ATB and EPRI, costs are reported in 2021 USD

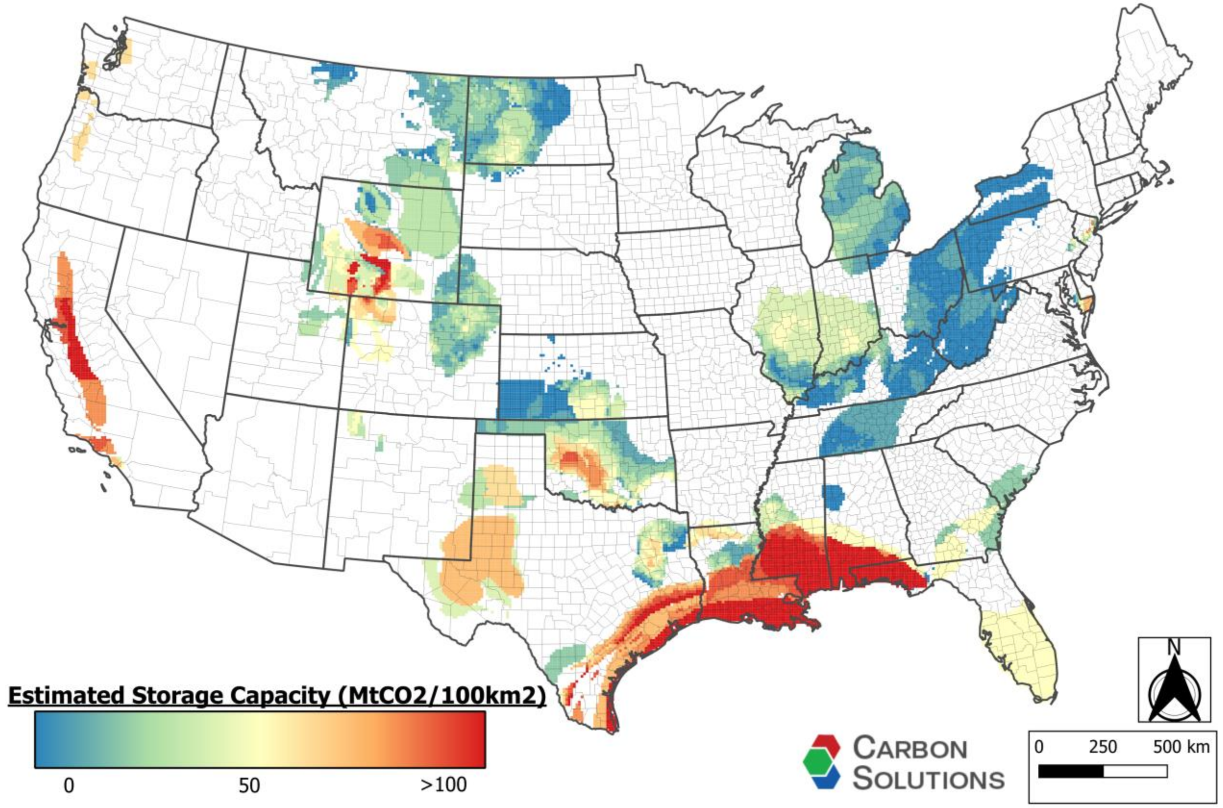
Hydrogen Production

Technology	Capital Cost ($USD per kBtu/h)	Fixed O&M Cost (USD/year per kBtu/h)	Variable O&M Cost (USD per MMBTU)	Efficiency	Equipment Lifetime (years)
Steam methane reformation without CO_2 capture (WECC Only)	172 (2025) 172 (2035) 172 (2050)	14.76	0.28	76.3%	40
Steam methane reformation with 99% CO_2 capture	365 (2025) 365 (2035) 365 (2050)	31.33	0.28	68%	40
Centralized PEM Electrolysis	592 (2025) 334 (2035) 126 (2050)	8.88 (2025) 5.93 (2035) 2.9 (2050)	2.19 (2025) 1.49 (2035) 0.79 (2050)	67.6% (2025) 71.9% (2035) 72.7% (2050)	40

Electricity and feedstock costs associated with hydrogen production are not included above. Those costs will be determined as part of the simulations.

Sources: EPRI, cost are reported in 2021 USD

CCS Storage Capacity



- Sufficient carbon storage capacity exists in California, opening the option for CCS.
- Less storage capacity exists for most of the rest of the WECC.

Sources: EPRI

Natural Gas with CCS

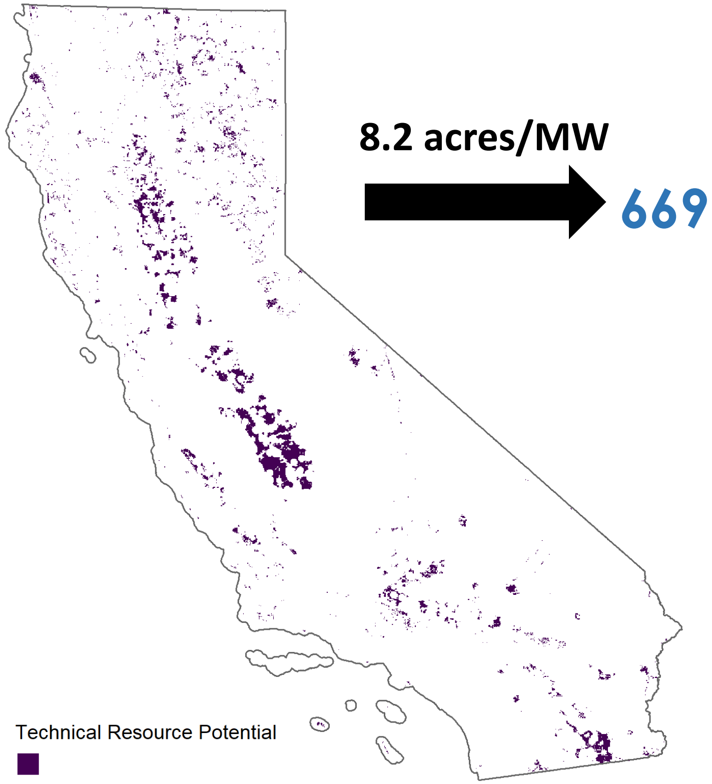
- Only retrofits of existing natural gas generators to include CCS will be a candidate resource within California (i.e. new natural gas facilities with CCS *will not* be a candidate resource).
- CCS is a part of several utilities' resource plans and long-term vision.
- For modeling in this report, generation from resources with CCS may count towards the SB 100 target based on the percent of carbon captured and sequestered.
  - For example: The output of facility that captures 95% of the carbon that is produced would contribute 95% of the total generation to the SB 100 target in the model.

Proposed Capacity Density Metrics

Energy Technology	Capacity Density (Acres/MW)
Solar	8.2
Wind	40
Offshore Wind	49.2

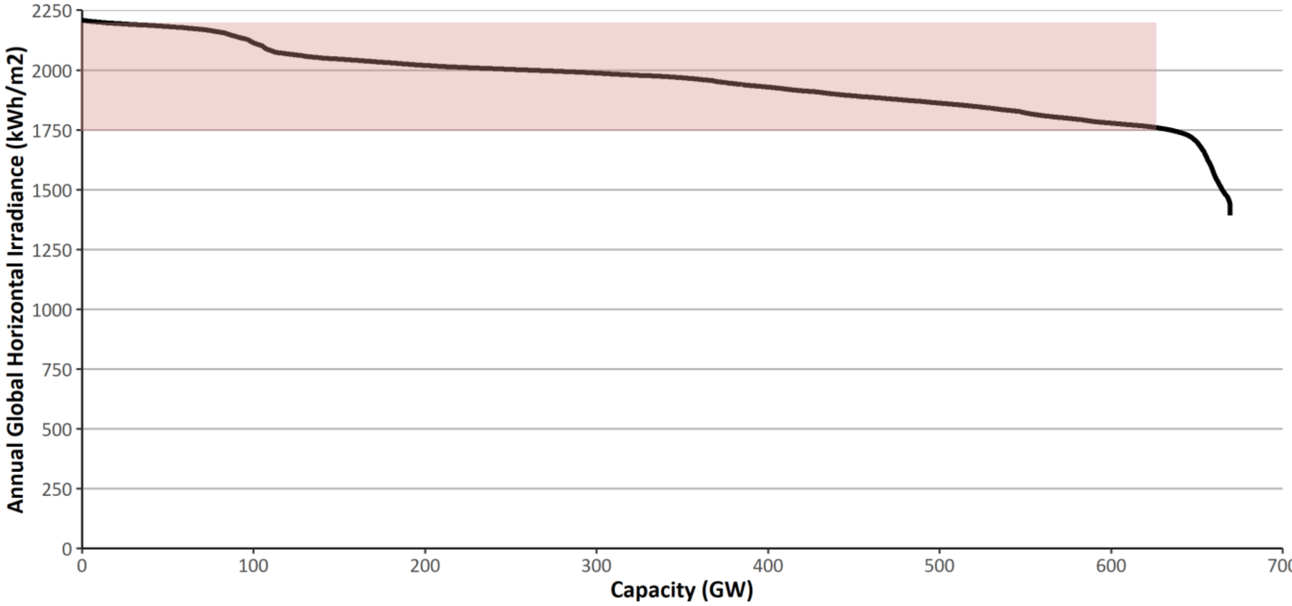
Solar Availability

Solar Core Land Use Screen

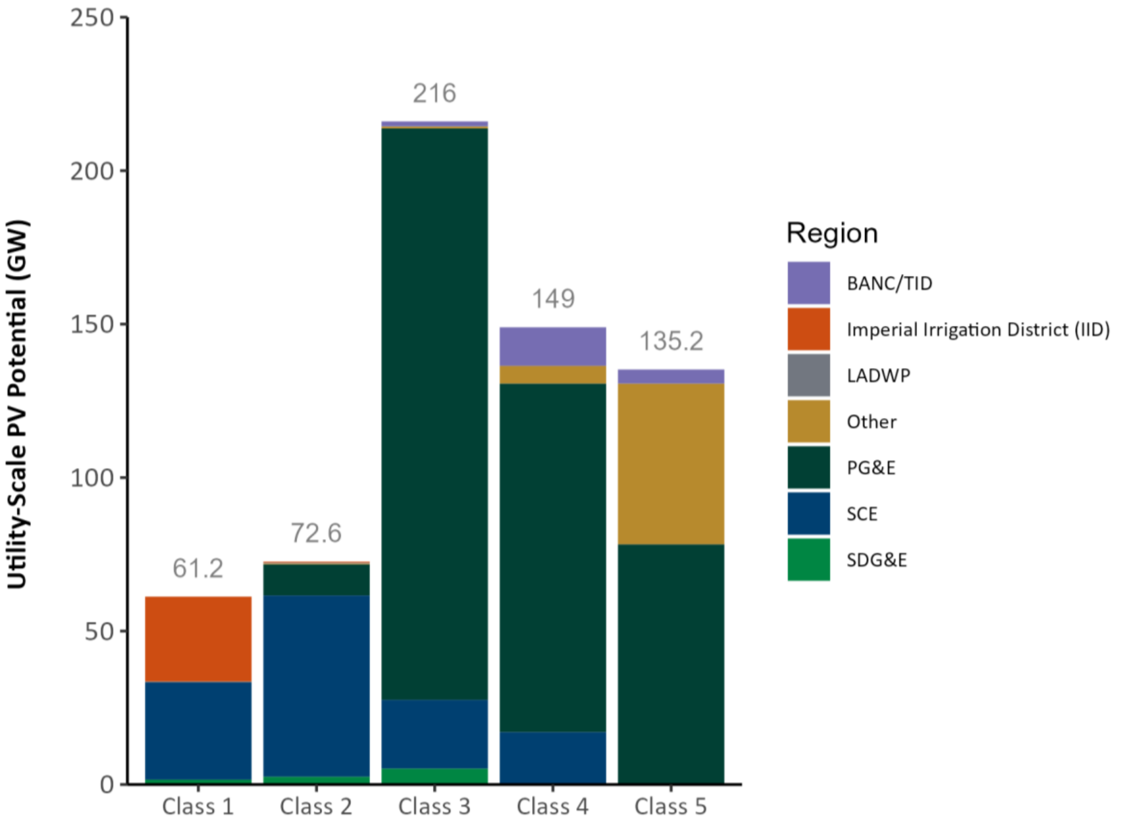


8.2 acres/MW → **669 GW**

634 GW > 1750 kWh/m²



Solar Availability

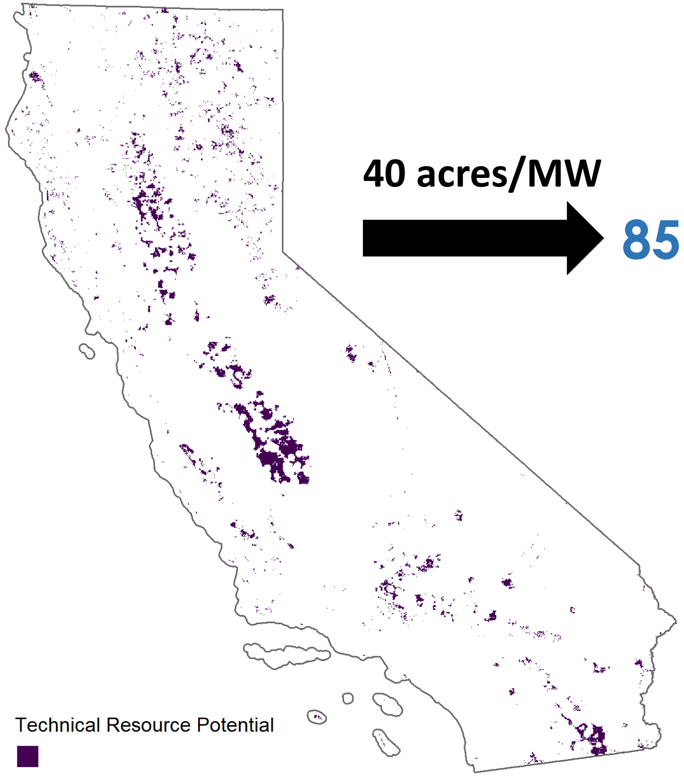


Solar PV resource classes and associated long-run average global horizontal irradiance (GHI)

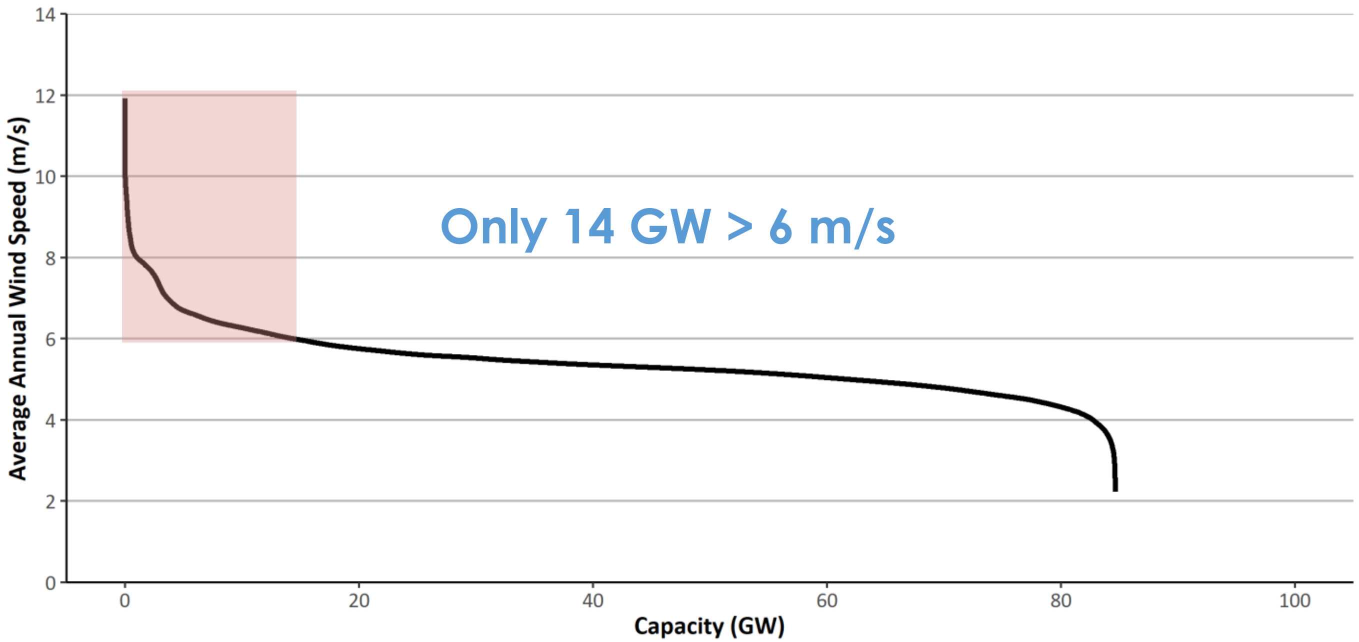
Solar PV Resource	Percentile of national long-run average GHI	Long-run average GHI ($kWh/yr/m^2$)
Class 1 (Best)	Upper 90th	2180 – 2230
Class 2	75 to 90th	2100 – 2180
Class 3	50 to 75th	1990 – 2100
Class 4	25 to 50th	1890 – 1990
Class 5 (Worst)	Lower 25th	1740 – 1890

Onshore Wind Availability

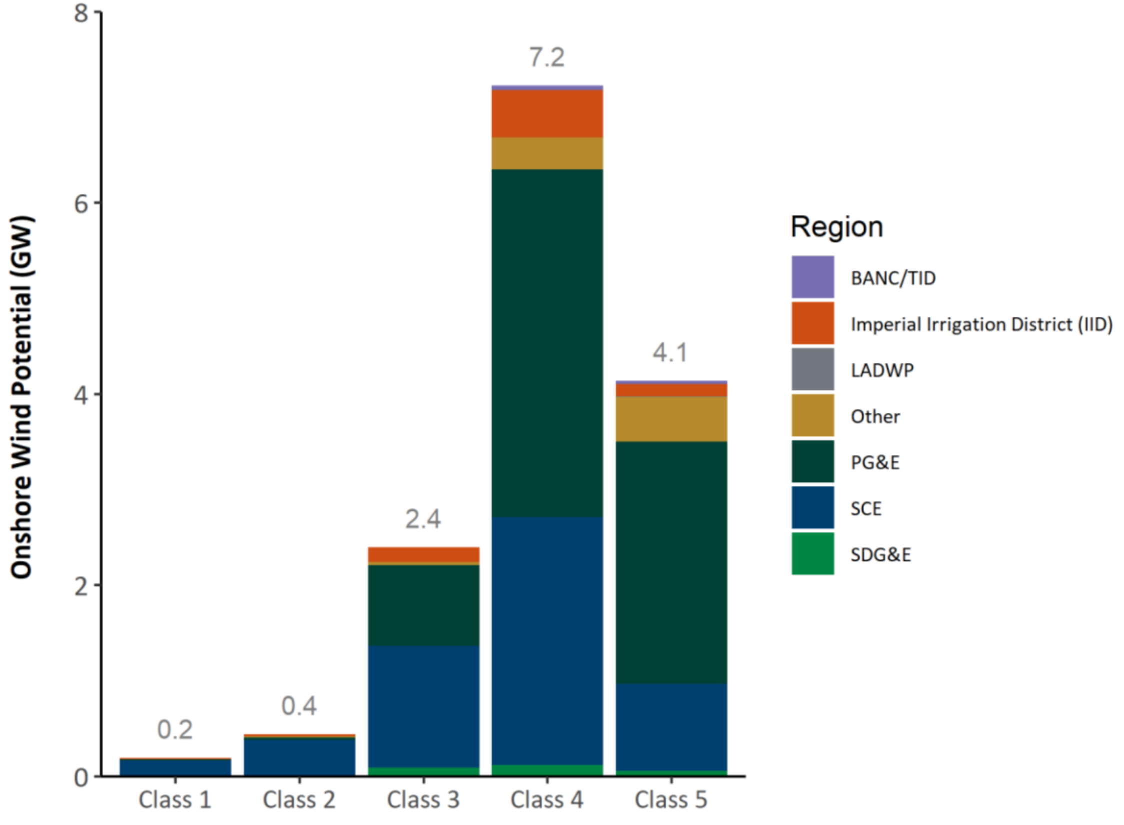
Wind Core Land Use Screen



40 acres/MW → **85 GW**



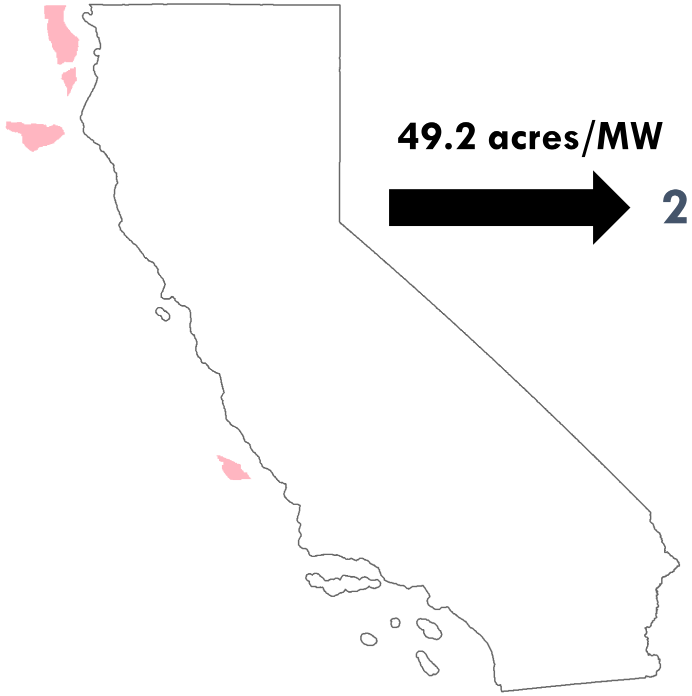
Onshore Wind Availability



Onshore wind resource classes and associated long-run average wind speeds

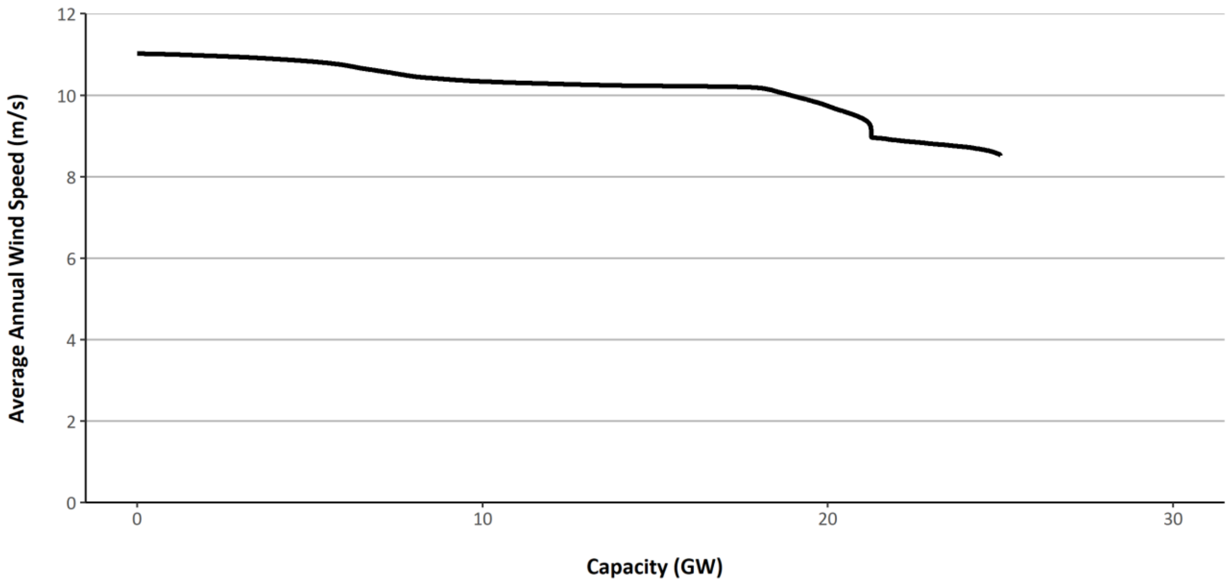
Onshore Wind Resource	Long-run average wind speed (100m hub height)
Class 1 (Best)	9.2 – 12 m/s
Class 2	8.4 – 9.2 m/s
Class 3	7.3 – 8.4 m/s
Class 4	6.3 – 7.3 m/s
Class 5 (Worst)	5.8 – 6.3 m/s

Offshore Wind Availability



49.2 acres/MW

25 GW

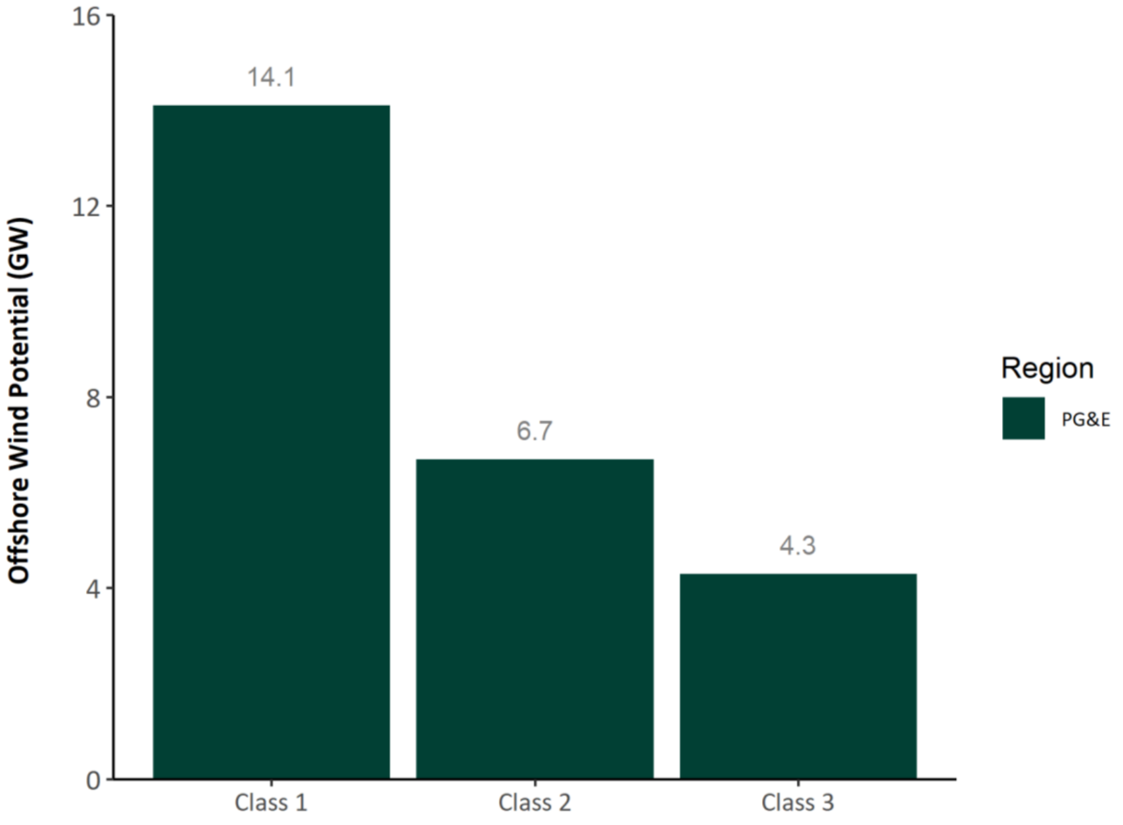


Offshore Wind Availability

All offshore wind is associated with PG&E

Offshore wind resource classes and associated long-run average wind speeds

Offshore Wind Resource	Percentile of long-run average wind speed	Long-run average wind speed (100m hub height)
Class 1 (Best)	Upper 50th	10.3 – 11 m/s
Class 2	25-50th	9.5 – 10.3 m/s
Class 3 (Worst)	Lower 25th	8.5 – 9.5 m/s

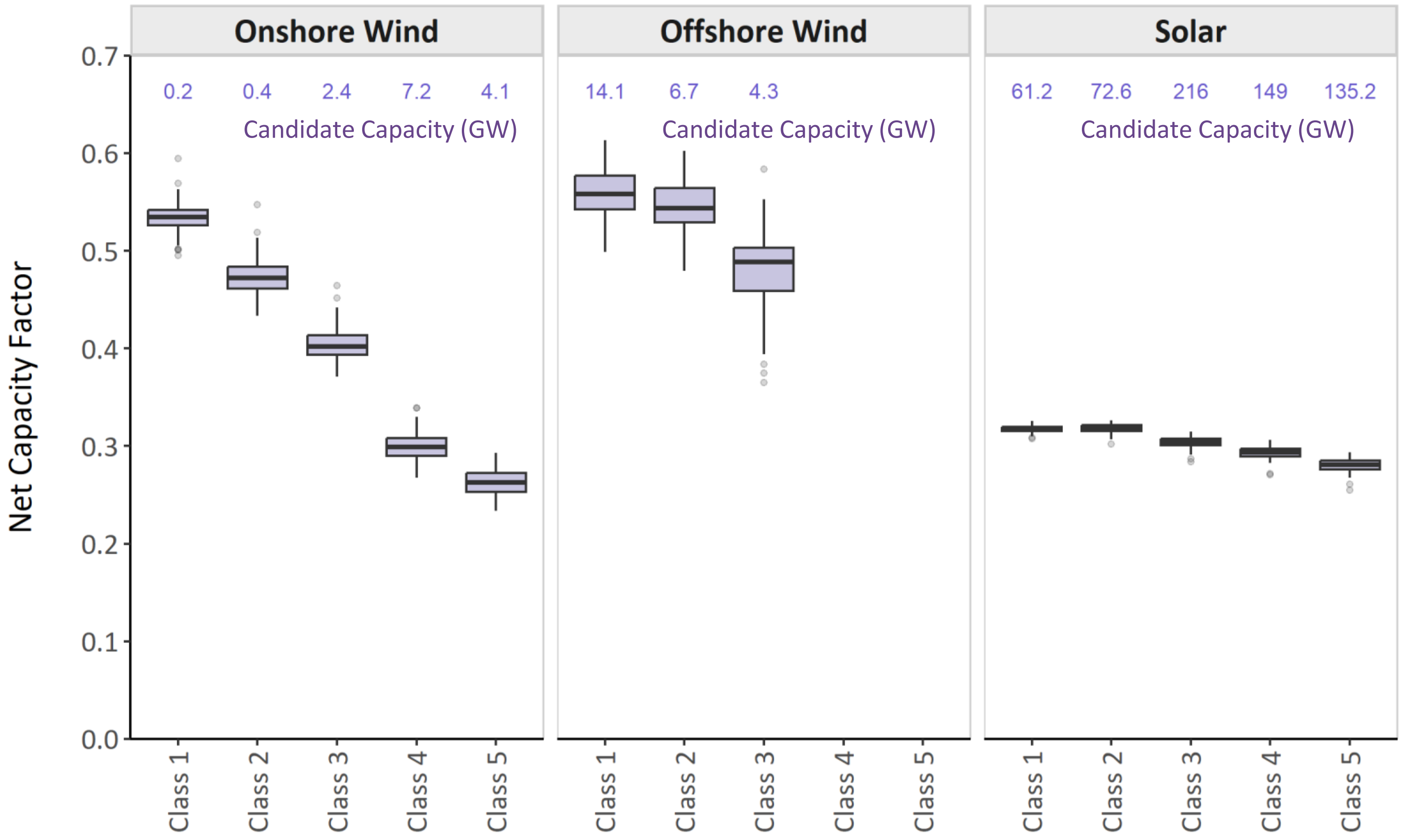


Offshore Wind Planning Targets and Locations

- **20 GW:** Guided by the *2045 Scenario for the Update of the 20-Year Transmission Outlook* (link).
- **Additional 5 GW:** Add 1 GW to the Morro Bay WEA and the remaining 4 GW to areas along the North Coast.

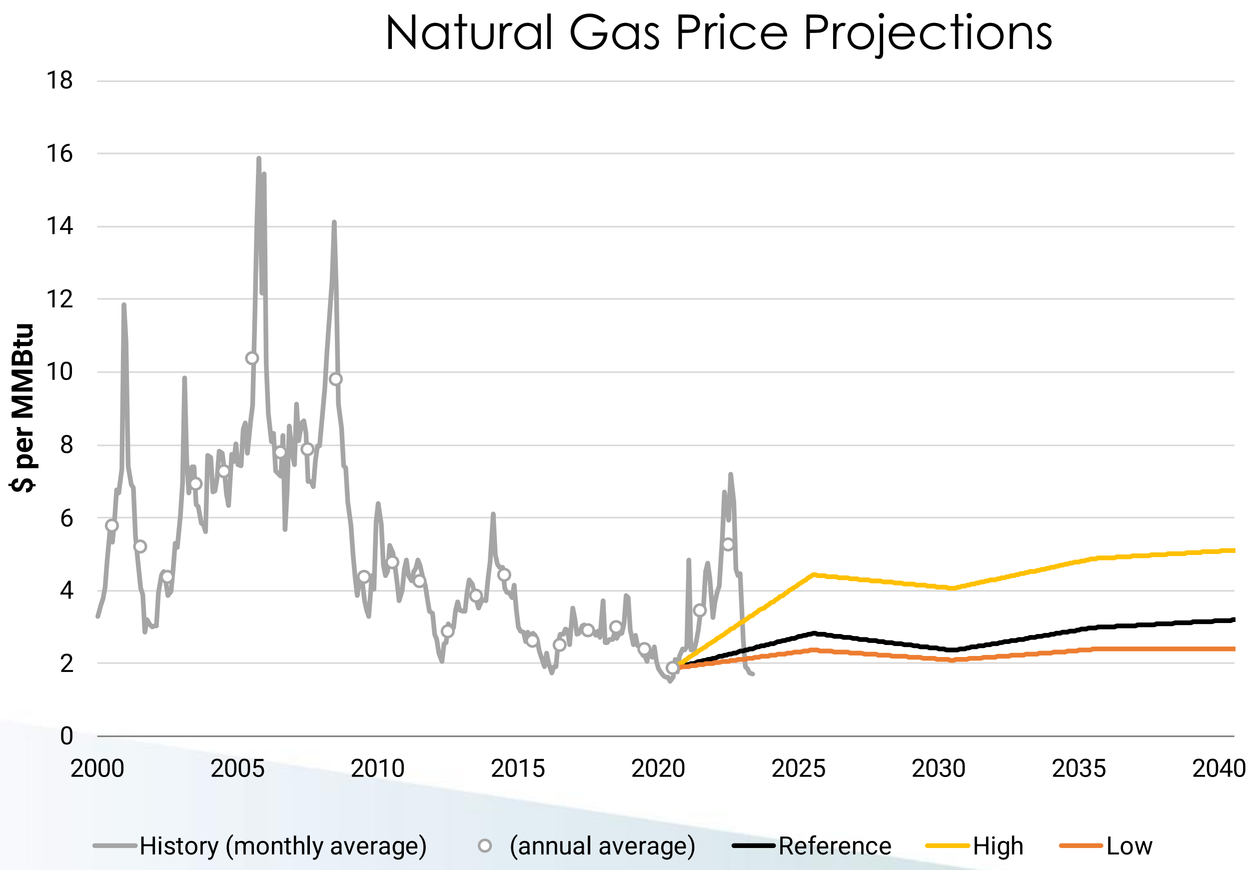
Stochastic Analysis Generation Profiles

- Different weather years have a relatively tight total capacity factor within each class.



Additional Assumptions

Fuel Price Projections

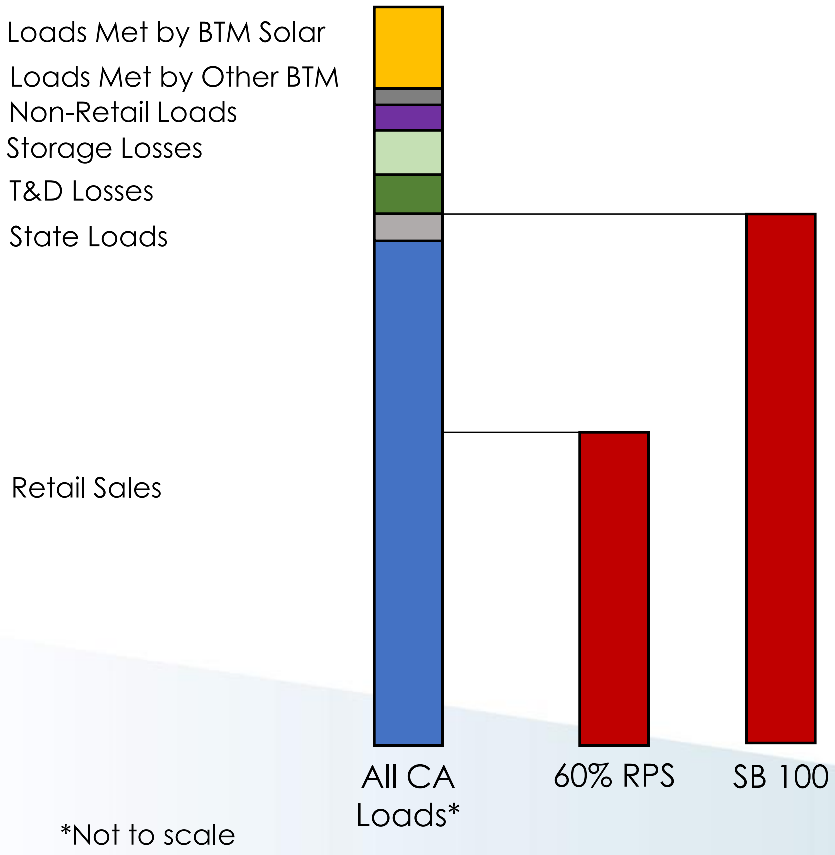


Source: EIA AEO 2023. Prices are shown in real 2015 U.S. dollar terms.

Fuel price projections will be sourced from the Energy Information Administration's Annual Energy Outlook (AEO) 2023:

- Reference case for most models
- High oil and gas supply (low prices)
- Low oil and gas supply (high prices)

Accounting for SB 100 and SB 1020 Targets



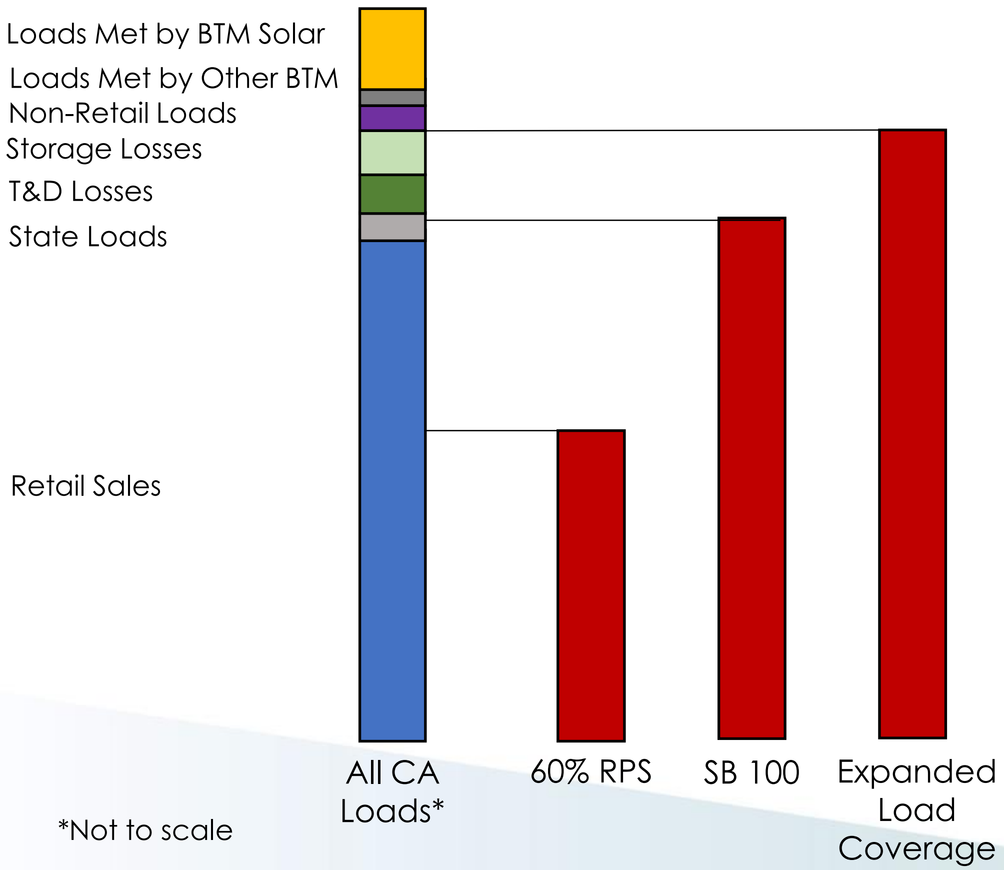
$$SB\ 100\ Progress = \frac{Generated\ SB\ 100\ Energy}{SB\ 100\ Energy\ Need}$$

SB 100 Resource Target

Year	Retail Sales	Energy Procured for State Loads
2030	N/A	N/A
2035	90%	100%
2040	95%	100%
2045	100%	100%

Note: The 60% RPS will be enforced for all years.

Expanded Load Coverage



Only Used for the Combustion Retirement Scenario and associated sensitivity.

$$SB\ 100\ Progress = \frac{Generated\ SB\ 100\ Energy}{Expanded\ Load\ Coverage}$$

SB 100 Resource Target

Year	Storage and T&D Losses	Retail Sales	Energy Procured for State Loads
2030	N/A	N/A	N/A
2035	90%	90%	100%
2040	95%	95%	100%
2045	100%	100%	100%

Note: The 60% RPS will be enforced for all years.

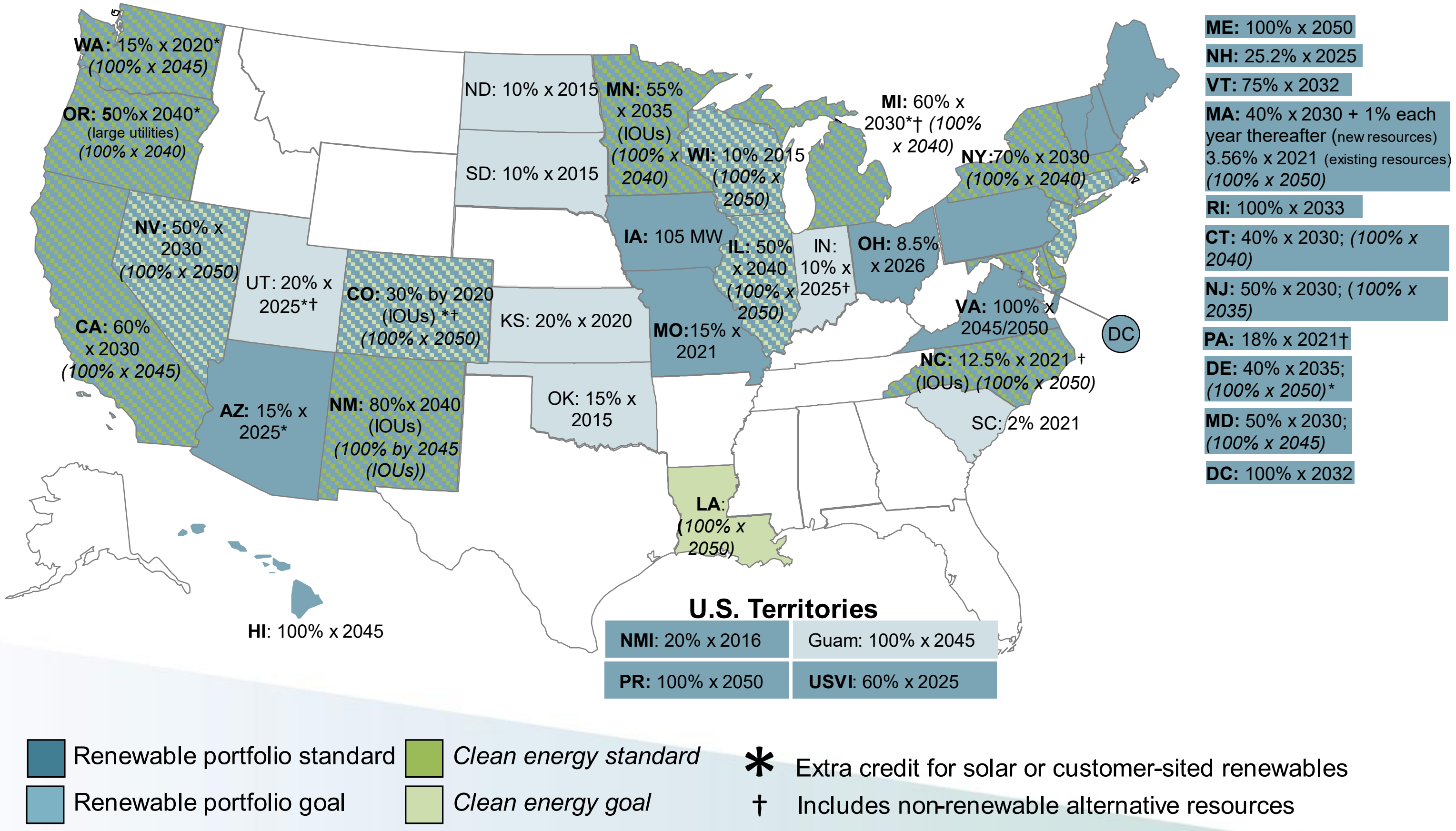
GHG Targets

- The model will include a GHG target consistent with the CARB scoping plan target of approximately 8.7 MMT in 2045.
- Interim targets will align with the CPUC IRP and CARB Scoping Plan targets of:

Year	CAISO GHG Target (MMT)	Statewide GHG Target (MMT)
2030	24.3	30
2035	20.3	25
2040	13.7	16.9
2045	7.1	8.7

Sources: CARB Scoping Plan, CPUC IRP Inputs and Assumptions

WECC Wide Clean Energy Policies



In addition to RPS and CES some states have:

- Solar carve outs for RPS.
- Energy storage mandates.
- Moratorium on new nuclear.

Source: DSIRE (2023), Renewable Portfolio Standards and Clean Energy Standards

Scenarios Specific Assumptions

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Geographic Diversification	Expanded regional transmission allowing for greater energy exchanges between California and the rest of the WECC.
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- Sensitivities – Modifications to one of the scenarios that will only be evaluated using the first stage of capacity expansion modeling.
  - Sensitivities will be used to estimate how changes to a scenarios input would impact results at a high level, without a full evaluation.

Main Scenario	Sensitivity	Change from Main Scenario
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DER Focus	DER Focus- Standard Demand Flexibility	Remove high demand flexibility from augmented demand scenario
Combustion Retirement	CR- Policy Compliance High Electrification Demand Scenario	Remove high demand flexibility and high DER augmentation from the demand scenario

What Has Changed

- The Reference Scenario now incorporates current utility plans out to 2039.
  - This was the Current Resource Plans scenario previously.
- Introducing the following scenarios:
  - Base.
  - Minimum Compliance.
- The DER Focus scenario no longer includes the terrestrial climate resiliency land use screen.
- Introduction of sensitivity to analyze the terrestrial climate resiliency land use screen.
- Added GHG constraints to most Scenarios.

Gold indicates changes from the Reference Scenario

Overview of Scenarios

Assumption Category	Reference	Base	Minimum Compliance	DER Focus	Resource Diversification	Geographic Diversification	Combustion Resource Retirement
Fixed Assumptions	Base	-	-	-	-	-	-
Base Resources	Resource Plans as far as possible, CPUC PSP through 2039	Resource Plans to 2030	Resource Plans to 2030	Resource Plans to 2030	Resource Plans to 2030	Resource Plans to 2030	Resource Plans to 2030
Demand	Policy Compliance High Electrification Scenario	-	-	Policy Compliance High Electrification Scenario, augmented by high DER, DR, and Load Flexibility	-	-	Policy Compliance High Electrification Scenario, augmented by high DER, DR, and Load Flexibility
Land Use	Core Land Use Screen	-	-	-	-	-	-
Compliance	SB 100	-	-	-	-	-	Expanded Load Coverage
GHG Limits	~8 MMT	-	N/A	-	-	-	-
Combustion Retirements	Planned and Economic	-	-	-	-	-	All Combustion Retires by 2045
WECC Assumptions	Economic Transmission Assumptions	-	-	-	-	Increased Interstate Transmission, Reduced Hurdle Rates	-
Offshore Wind	Economic Additions	-	-	-	Increased Offshore Wind	-	Increased Offshore Wind
FTM Solar Resources	Economic Additions	-	-	Increased FTM DER Solar Adoption	-	-	Increased FTM DER Solar Adoption
Carbon Capture and Sequestration	Economic Additions	-	-	-	Increased CCS Adoption	-	-
Long Duration Energy Storage	Economic Additions	-	-	-	Increased Adoption	-	Increased Adoption
Hydrogen	Economic Additions	-	-	-	Increased Adoption	-	Increased Adoption

Approach for Scenario Specific Assumptions

- Various scenarios will include specific changes to assumptions that increase technology selection or change transaction costs.
- These assumptions will be adjusted to characterize different futures represented by scenarios.

DER Focus

Resource Diversification

Geographic Diversification

Combustion Resource Retirement

Resource Minimum Selection Targets

Initial Levels

- Run the scenario without resource minimum selection targets.

Set Targets

- Use initial results and guideposts to set resource minimum selection targets for use in the scenario.

Evaluate Scenario

- Incorporate the resource minimum selection targets.
- Rerun the model.

Assess Results

- Look at how the technology target impacted system builds.
- Estimate cost reductions and external investments needed.

In Front of the Meter Solar

DER Focus

- Front of the meter distributed solar is a utility connected resource located near load.
- Potential guideposts to inform selection:
  - Remaining potential of distributed solar not included in the demand scenario.
  - LSE/POU IRPs.

Hydrogen

- Hydrogen production for electricity generation will be incorporated into the supply models.*
  - Hydrogen production capacity for electricity generation will be optimized along with generation capacity.
  - Hydrogen generation will have many similarities to energy storage technologies in the model.
- Selection could be based on for example "converting X% or Y GW of the natural gas fleet to hydrogen resources."
- Potential guideposts to inform selection:
  - LSE/POU IRPs.
  - Scoping Plan and CPUC IRP results.

*Hydrogen production for other sectors will be included in the demand scenarios. Workshop will occur this spring.

Long Duration Energy Storage

- Long duration energy storage will include at least 8 hours of duration.
- Potential guideposts to inform selection:
  - LSE/POU IRPs.
  - Scoping Plan and CPUC IRP results.

Carbon Capture and Sequestration

- CCS may allow for existing gas resources to continue to be utilized to support reliability needs while significantly reducing emissions from those resources.
- Potential guideposts for selection:
  - Scoping Plan resource mix.

Offshore Wind

Resource Diversification
Combustion Retirement

- Offshore wind is unique in that California has a planning goal for this technology.
- Guidepost to inform selection:
  - AB 525 Draft Strategic Plan for Offshore Wind Development statewide planning goal of 25 GW.

Transmission

Geographic Diversification

- Scenarios looking at increased transmission availability and utilization will include changes to both the quantity of transmission available and the cost of moving energy between regions.
- Proposal:
  - Reduce the wheeling rate prices.
  - Increase all interties that can supply energy to California regions.

Q&A

- Questions and Comments can be entered in the Q&A section of the Zoom application
- Or ask by raising a hand on Zoom

Public Comments

Instruction

- 3 minutes or less per person
- 1 representative per organization

Zoom App/Online

- Click “raise hand”

Telephone

- Press *9 to raise hand
- Press *6 to (un)mute

When called upon

- Zoom host will open your line
- Unmute, spell name, state affiliation, if any

Written comments are due **March 1, 2024**

3-MINUTE TIMER

Closing Remarks

Appendix

Key Inputs Across Models

Key Inputs	REGEN	PLEXOS LT	PLEXOS RA	PLEXOS PCM
Wind and Solar Profiles	EPRI Analysis	EPRI/CEC Analysis	EPRI/CEC Analysis	EPRI/CEC Analysis
Clean Energy Policy - CA	Joint Agency Direction	Joint Agency Direction	Joint Agency Direction	Joint Agency Direction
Clean Energy Policy - WECC	Public Sources	N/A	N/A	Public Sources
Electricity Demand	CA - Demand Scenario WECC - EPRI Analysis	CA - Demand Scenario	CA - Demand Scenario	CA - Demand Scenario WECC - EPRI Analysis
Planned Resources	CA- CPUC's PSP, POU IRPs WECC - Anchor Dataset	CA- CPUC's PSP, POU IRPs	CA- CPUC's PSP, POU IRPs	CA- CPUC's PSP, POU IRPs WECC - Anchor Dataset
Existing Resources	CA- Quarterly Fuel and Energy Report, CAISO, Utility filings WECC - Anchor Dataset	CA- Quarterly Fuel and Energy Report, CAISO, Utility filings	CA- Quarterly Fuel and Energy Report, CAISO, Utility filings	CA- Quarterly Fuel and Energy Report, CAISO, Utility filings WECC - Anchor Dataset
Candidate/Expansion Technologies	Specified Options	CA-REGEN output	PLEXOS LT	PLEXOS LT
Technology Costs	NREL ATB, with EPRI analysis	NREL ATB, with EPRI analysis	NREL ATB, with EPRI analysis	NREL ATB, with EPRI analysis
Fuel Prices	EIA Annual Energy Outlook	EIA Annual Energy Outlook	EIA Annual Energy Outlook	EIA Annual Energy Outlook
System Topology	CA - Balancing Authorities WECC - States	CA - Balancing Authorities	CA - Balancing Authorities	CA - Balancing Authorities WECC - States
Transmission	CA – Existing CA Dataset WECC – EPA Integrated Planning Model Platform v6	CA – Existing CA Dataset WECC – EPA Integrated Planning Model Platform v6	CA – Existing CA Dataset WECC – EPA Integrated Planning Model Platform v6	CA – Existing CA Dataset WECC – EPA Integrated Planning Model Platform v6
Additional Operating Details	Various public sources	Various public sources	Various public sources	Various public sources
Reserve Requirements	Simplification of Balancing Authority Requirements	Balancing Authority Requirements	Balancing Authority Requirements	Balancing Authority Requirements