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Introduction

Following the release of the "2021 SB100 Joint Agency Report" (2021 SB 100 Report) in March 2021, the California Energy Commission (CEC), California Public Utilities Commission (CPUC), and California Independent System Operator (CAISO) initiated a collaborative process to focus on the resource build requirements to achieve The 100 Percent Clean Energy Act of 2018 (SB 100, De León, Chapter 312, Statutes of 2018).[1] This collaborative process is on-going and includes a public stakeholder process.

As described at a public workshop on August 12, 2021, one of the priorities for the SB 100 resource build process is using the analysis from the 2021 SB 100 Report to inform the CAISO's recently initiated 20-year transmission outlook ("20-year outlook") process.[2]

This document describes the Starting Point scenario, based on the SB 100 Report, for CAISO's use as the basis for the 20-year outlook process. The Starting Point scenario description in this document includes the allocation of resources in the scenario, and where applicable, how those resources are geographically mapped.

The objective of CAISO's 20-year outlook is to explore longer term grid requirements and options for meeting the state's greenhouse gas reduction goals. With this objective in mind, the Starting Point scenario is designed to provide information for a wide range of potential transmission needs driven by a combination of potential resource opportunities.

The 2021 SB 100 Report presents scenarios to reach 100 percent clean energy, including "core scenarios" and "study scenarios," intended to provide additional information to support broader state energy, climate planning, and public health efforts. The Starting Point scenario is largely based on the 2021 SB 100 Report Core scenario (SB 100 Core) but draws from other scenarios in the 2021 SB 100 Report as well. The potential resource opportunities include, for example, diverse resources known to require transmission development such as offshore wind energy and out-of-state resources, but also gas power plant retirements that may require transmission development to reduce local area constraints. Through this effort, the state aims to understand what transmission development would be required to make any one of these elements possible, thereby allowing the state to then refine resource planning.

The Starting Point scenario (including supporting documents) is intended to provide an immediately useful starting point for the CAISO in its 20-year outlook. The use of the Starting Point scenario for the 20-year outlook is not a commitment to the resource and storage mix included in the scenario. Instead, the energy agencies intend to continue to consider a range of scenarios in forthcoming reliability assessments and stakeholder work on resource build requirements. The Starting Point scenario is informational only and should not be used, in itself, to support approval of near-term infrastructure

[1] On May 21, 2021 the CEC opened a new docket, 21-SIT-01, for SB 100 Implementation Planning for SB 100 Resource Build: https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=21-SIT-01. Workshop materials and public and stakeholder comments are available in the docket.

[2] See the workshop webpage for the SB 100 Resource Build: Resource Mapping https://www.energy.ca.gov/event/workshop/2021-08/joint-agency-workshop-next-steps-plan-senate-bill-100-resource-build

investments. Underlying data and information that is incorporated into the Starting Point scenario, as well as input and additional information obtained in the public process, may be cited as appropriate.

The scenarios in the 2021 SB 100 Report were developed through a comprehensive interagency stakeholder process to meet a statewide 2045 policy, which includes Balancing Area Authorities (BAA) outside of the CAISO. The CEC, CPUC, and CAISO appreciate the interest expressed by non-CAISO BAAs in collaborative technical work to support this process.

Background

SB 100 establishes a policy that renewable and zero-carbon resources supply 100 percent of California's retail sales and electricity procured to serve all state agencies by 2045. Among other things, SB 100 requires the CEC, CPUC, and California Air Resources Board to develop and submit a joint-agency report to the legislature by January 1, 2021, and at least every four years thereafter.

The first joint-agency report published on March 15, 2021 recommends updates of land use information to reflect the increased resource requirements of SB 100, to further consider the potential impact of emerging resources and technologies, and to integrate into SB 100 planning the social costs and non-energy benefits of land-use impacts, public health, air quality, water supply and quality, economic impacts, and resilience.

The 2021 SB 100 Report indicates that achieving the 2045 goal is technically feasible but that it will require sustained record setting build rates of renewable resources, zero-carbon technologies and integration solutions.

Effectively integrating 100 percent renewable and zero-carbon technologies in California by 2045 will require rigorous analysis of implementation considerations and coordinated planning across the different levels of government and with grid operators throughout the state. Statewide planning will ensure that California has a safe and reliable electricity system as new renewable and zero-carbon resources and transmission infrastructure is developed, consistent with the state's clean energy and environmental priorities and goals.

To build-off of the 2021 SB 100 Report, the CEC, CPUC, and the CAISO collaborated on an approach to translate the analyses conducted for the first SB 100 joint-agency report into a Starting Point scenario for use by the CAISO in the 20-year outlook. The Starting Point scenario, and the criteria for using that scenario to study the transmission required for a particular portfolio of resources studied in the 2021 SB 100 Report, are described below. This initial portfolio is not an endorsement of any particular resource or potential transmission solution. The CEC and CPUC expect that the information from the 20-year outlook will help inform future electric sector planning, including the next SB 100 joint-agency report.

CAISO's 20-year transmission outlook

The objective of the 20-year outlook is to conduct a long-term assessment of transmission needs and grid development options for meeting SB 100.[3] The CAISO is conducting its 20-year outlook in parallel

[3] See the 20-year transmission outlook webpage: https://stakeholdercenter.caiso.com/RecurringStakeholderProcesses/20-Year-transmission-outlook

with its current 2021-2022 Transmission Planning Process (TPP). The TPP is the CAISO's annual tariff-based 10-year transmission planning process.[4]

The CAISO initiated the 20-year outlook to have a more flexible framework and stakeholder process outside of the formal tariff-based TPP, which focuses on transmission project needs and transmission project approvals over a 10-year planning horizon. The 20-year outlook may support state electric sector planning, including the next joint-agency SB 100 report, the CPUC's SB 350 Integrated Resource Planning (IRP) processes, and the CEC's Integrated Energy Policy Report.

SB 100 joint-agency report scenarios

The analyses for the 2021 SB 100 Report developed resource portfolios using the RESOLVE California model, a capacity expansion model developed by Energy and Environmental Economics, Inc. (E3). The RESOLVE model produces a least-cost resource portfolio, given policy and reliability constraints. The inputs and assumptions used in the RESOLVE model for the 2021 SB 100 Report built upon previous capacity expansion planning, including the CPUC's IRP proceedings, and were informed through public and stakeholder comments.[5]

The 2021 SB 100 Report included a range of scenarios and sensitivities to evaluate possible pathways to achieve the SB 100 policy and only resources that are commercialized or near commercialization and aligned with other state policies are included. Table 1 is from the 2021 SB 100 Report and represents a possible future mix of resources based on the best information at the time. The agencies recognize that there are emerging and potentially new technologies that may become part of the zero-carbon resource mix in the future. Table 1 below is a list of the scenarios explored in the 2021 SB 100 Report.

[4] See the 2021-2022 TPP webpage: http://www.caiso.com/planning/Pages/TransmissionPlanning/2021-2022TransmissionPlanningProcess.aspx.

[5] For more information on the scenarios modeled as part of the first joint-agency report, see: https://efiling.energy.ca.gov/EFiling/GetFile.aspx?tn=237167&DocumentContentId=70349

Table 1: SB 100 Core and Study Scenarios from the 2021 SB 100 Joint-Agency Report

Scenario Classification	Scenario Description
Core Study Scenarios	
60% RPS (Counterfactual)	60% RPS through 2045
SB 100 Core Scenario	Core Load Coverage[6]; High Electrification Demand; All candidate resources available
SB 100 Core, Demand Sensitivities	Change: Demand Scenarios or Load Shape
SB 100 Core, Resource Sensitivities	Change: Candidate Resource Availability
Study Scenarios	
Expanded Load Coverage	Core Load Coverage plus storage and T&D losses; High Electrification Demand; All candidate resources available
Expanded Load Coverage, Demand Sensitivities	Change: Demand Scenarios
Expanded Load Coverage, Resource Sensitivities	Change: Candidate Resource Availability
Zero Carbon Firm Resources	Add generic zero carbon firm resources to candidate resources as a proxy for emerging zero-carbon technologies
Accelerated Timelines	Accelerate 100% target to 2030, 2035, and 2040
No Combustion	No conventional combustion resources included (fossil and biomass based); retire all in-state combustion resources by 2045

Source: 2021 SB 100 Joint-Agency Report: https://www.energy.ca.gov/sb100

The Starting Point Scenario

The Starting Point scenario was developed by taking the 2040 SB 100 Core scenario and increasing assumed natural gas power plant retirements to 15,000 MW. This allows for an evaluation of the impact of more gas power plant retirements on the transmission system than was identified in the SB 100 Core scenario, in conjunction with bringing new energy storage and renewable energy resources online. Additionally, to generally offset the additional assumed natural gas power plant retirements, geothermal, offshore wind, out of state wind and battery energy storage systems capacity was added to levels that are generally reflective of other 2021 SB 100 Report scenarios.

While the Starting Point scenario will be used for the 20-year outlook, the agencies expect to use a range of scenarios to inform subsequent analytical and stakeholder work (e.g. reliability assessments and land use analysis).

To illustrate the Starting Point scenario, Table 2 below compares the SB 100 Core scenario for 2040 with the Starting Point scenario.

[6] The "SB 100 core" load coverage target is consistent with the joint agencies' interpretation of SB 100, and 100 percent of retail sales plus state agency loads in 2045 are met by zero-carbon generation. Interim years include a linear zero-carbon target from 2030 to 2045.

Table 2: Comparison of 2040 SB 100 Core and Starting Point Scenario

Resource Type	2040 SB 100 Core Scenario (MW)	2040 Starting Point Scenario (MW)
Natural gas fired power plants	(4,722)	(15,000)
Battery energy storage	32,093	37,000
Long duration energy storage	4,000	4,000
Utility-scale solar	53,212	53,212
In-state wind	2,237	2,237
Offshore wind	5,256	10,000
Out of state wind	10,315	12,000
Geothermal	135	2,332

Source: RESOLVE Model results viewer, SB 100 joint-agency model: https://www.energy.ca.gov/sb100

The next section discusses how the Starting Point scenario could be reflected in the 20-year outlook.

Resource allocations for the starting point scenario

The CAISO's 20-year outlook will require geographically mapping resources to specific locations, to the extent feasible. The RESOLVE model includes a coarse-level of geographic information by transmission zone for the new-build renewable energy resources. However, the Starting Point scenario makes some modifications to the allocations of certain resources to transmission zones as described below. In addition, RESOLVE does not include geographic information for potential natural gas power plant retirements or new energy storage facilities.

This section describes, for each resource in the portfolio, criteria for the CAISO to use in the 20-year outlook. The information builds off the current CPUC IRP portfolios being studied for the year 2031 within the 2021-22 TPP.

At the end of this section, a table with initial geographic allocations for the 20-year outlook for each resource is included, as applicable.

Natural gas power plant retirements

The Starting Point scenario includes an assumption that 15,000 MW of natural gas power plant capacity would be retired by 2040, which is approximately 50 percent of natural gas power plant capacity assumed in the 2021 SB 100 Report scenarios. To identify locations of these retirements in the 20-year outlook, the CAISO should use information provided by the agencies to assume that the oldest natural gas power plants retire first, with a priority on those that are in and adjacent to disadvantaged communities (DAC).[7] In addition, to understand the electric transmission implications of having no natural gas storage capacity at the Aliso Canyon natural gas storage facility, the CAISO should ensure that at least 3,000 MW of the 15,000 MW of retirements are assigned to gas power plants that rely on the Aliso Canyon storage facility as provided by the agencies, with a priority on the oldest power plants

[7] Disadvantaged communities are defined and identified by the California Office of Environmental Health Hazard Assessment and are available in the CalEnviroScreen 3.0 webtool at: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30. For purposes of this Starting Point scenario a DAC adjacent community is within a 2.5 mile radius of a natural gas power plant.

and those that are in and adjacent to DACs.[8] The CEC and CPUC staff will coordinate with the CAISO to identify the natural gas capacity assumed retired in the Starting Point scenario.

New-build energy storage

The RESOLVE model outputs do not include locational information for battery energy storage or long duration storage. Below is the criteria that informs the allocation for each energy storage type.

Battery energy storage

In the SB 100 Core scenario, RESOLVE selects 32,093 MW of battery energy storage in 2040. In the Starting Point scenario the CAISO will study 37,000 MW of battery energy storage in the 20-year outlook. The approach used for assigning battery energy storage to transmission zones for the 20-year outlook draws on the approach applied to battery energy storage in the CPUC's IRP process for the CAISO's TPP.[9] As shown in Table 3 at the end of this section, the 37,000 MW of selected battery energy storage is allocated as follows:

- 9,368 MW of battery storage already allocated in the IRP resource portfolio for the 2021-2022 TPP base case is carried over without any changes.
- The remaining battery energy storage will be allocated by expanding upon the approach from the 2021-2022 TPP base case:
    - Co-locate in transmission zones where renewable resources are concentrated.
    - Allow CAISO to allocate battery storage based on system needs identified in the study.

Long-duration energy storage

Long-duration energy storage (LDES) was modeled in the 2021 SB 100 Report as pumped hydroelectric energy storage.[10] However, any long-duration storage technology with eight hours or longer of energy generation at maximum output would represent similar attributes. The 4,000 MW of long-duration energy storage in the SB 100 Core scenario will be allocated by building off the current 2021-2022 TPP base case as well as current commercial interest.

The 4,000 MW of LDES will be allocated by:

- 627 MW of pumped hydroelectric already mapped in the IRP resource portfolio for the 2021-2022 TPP base case.

[8] If 3,000 MW of Aliso Canyon dependent gas power plants are not identified when assuming retirement for the oldest gas power plants in and adjacent to DACs statewide, then the CAISO should apply the aged based and DAC proximity criteria to a list of Aliso Canyon dependent gas power plants, until 3,000 MW is identified, and then the CAISO should apply the aged based and DAC proximity criteria to the remaining fleet of in-state natural gas power plants to derive the full 15,000 MW of assumed retirements.

[9] The methodology applied when mapping the IRP resource portfolios for the 2021-2022 TPP can be found here: Final Methodology for Resource-to-Busbar Mapping & Assumption for the 2021-2022 TPP

[10] An energy storage technology consisting of two water reservoirs separated vertically; during off-peak hours, water is pumped from the lower reservoir to the upper reservoir, allowing the off-peak electrical energy to be stored indefinitely as gravitational energy in the upper reservoir. During peak hours, water from the upper reservoir may be released and passed through hydraulic turbines to generate electricity as needed.

- 2,400 MW of pumped hydroelectric as described in the current CAISO interconnection queue.
- 1,600 MW of location unconstrained LDES that is unassigned should be assigned to transmission zones based on a combination of geologic and technological factors and system needs. The CAISO and agencies will work together with stakeholders and other California BAAs to continue assessing LDES opportunities, including locational factors for different technology types. [11]

New-build renewable energy

In contrast to the resources discussed above, new build renewable energy was assigned to transmission zones by the RESOLVE model. This section describes how the RESOLVE model assigned new build renewable resources to locations and summarizes the adjustments made to these allocations for the CAISO 20-year outlook.

RESOLVE renewable energy resource assumptions

The renewable resource potential used in the RESOLVE model formed the basis of geographic assumptions for the locations of renewable energy resources in the SB 100 scenarios. Renewable resource potential is based on raw technical potential and is calculated for each renewable resource type within RESOLVE transmission zones. The raw technical potential is then "filtered" through a set of environmental screens to produce the renewable resource potential that RESOLVE uses to select new-build renewable energy. The RESOLVE model includes six options for environmental screens:[12]

1. Base: includes RETI Category 1 exclusions only;
2. Environmental Baseline (EnvBase): includes RETI Category 1 and 2 exclusions;
3. NGO1: first screen developed by environmental NGOs;
4. NGO1&2: second screen developed by environmental NGOs;
5. DRECP/SJV: includes RETI Categories 1 and 2 plus preferred development areas only in the DRECP (Desert Renewable Energy Conservation Plan) and San Joaquin Valley (SJV); and,
6. Conservative: the potential when all the above screens are applied simultaneously

Additionally, a non-spatial calculation is applied to the renewable resource potential that discounts the resource potential by 80 percent to generically reflect development constraints and build in a preference for geographic diversity of renewable resources. Also, planned renewable energy resources with an online date after December 31, 2018 that are included in the baseline inputs of RESOLVE are subtracted from the available renewable resource potential in each transmission zone.

The RESOLVE model used for the 2021 SB 100 Report applied the DRECP/SJV resource screen. As a starting point, the map in Figure 1 below displays the renewable resource potential for the DRECP/SJV resource screen for each renewable resource type by transmission zone.

[11] While there are 4.5 GW of pumped hydro energy storage in California, new longer-duration energy storage systems (for example, 100 or more hours of energy storage) are in the development phase and may be deployed within the next decade with the right market signals. Longer-duration storage technologies, such as advanced batteries, thermal energy storage, liquid air energy storage, and compressed air energy storage, can support reliability and further promote achievement of SB 100 goals.

[12] See the SB 100 RESOLVE model Inputs and Assumptions: https://efiling.energy.ca.gov/GetDocument.aspx?tn=234532&DocumentContentId=67359

RESOLVE renewable resource assignments and starting point adjustments

For each renewable resource type, this section summarizes the process for making adjustments to the RESOLVE selections as a starting point for the 20-year outlook and further stakeholder discussion.

Utility-scale solar

In the Starting Point scenario, which is the same as the SB 100 Core scenario, 53,212 MW of solar capacity is assumed to be built in 2040. This would require 372,484 acres with current technology, assuming that 7 acres are required per MW.

For the CAISO 20-year outlook, the Starting Point scenario utilizes known commercial interest to allocate solar development to transmission zones rather than carrying forward the allocations made by the RESOLVE model. The CEC utilized a high-level environmental screen to assess whether the commercial interest allocation had resulted in a clearly disproportionate assignment of solar build out to any of the transmission zones relative to the availability of "lower implication" land in each zone. In one transmission zone, the CEC took the additional step of reallocating some solar capacity to a different transmission zone based on that review.

As shown in Table 3 below, the SB 100 RESOLVE model did not select solar resources from outside of California. However, to maintain consistency with the CPUC IRP and CAISO TPP the agencies allocate 4,624 MW of the total solar portfolio to transmission zones in Southern Nevada and Arizona.

Commercial interest

Commercial interest, as used in this Starting Point scenario, is determined by using the CAISO's publicly available interconnection queue information.[13] This includes projects in the queue through the Cluster 13 study window. The queue information was summarized by technology and assigned to the RESOLVE transmission zones. The agencies use the approximate proportional calculation of the solar projects in the queue, by transmission zone, to re-allocate the solar capacity selected by RESOLVE, and discounted by the out of state solar allocations, to transmission zones for this starting point. As shown in the table at the end of this section, applying the proportional calculation of commercial interest results in a different allocation of solar resources in RESOLVE transmission zones. The table also includes commercial interest by transmission zone for non-solar resource types, however these resources are not re-allocated based on commercial interest.

The map in Figure 2 below shows the in-state transmission zones as a starting point for where solar might be developed based on the re-allocation of solar based on commercial interest.

Environmental information

The re-allocation of resources based on proportions of commercial interest are compared to environmental information.[14] The CEC has mapped environmental and land use information to develop a high-level information screen for renewable energy resource areas. The screen is primarily based on

[13] http://www.caiso.com/planning/Pages/GeneratorInterconnection/Default.aspx

[14] See the workshop webpage for the SB 100 Resource Build: Resource Mapping https://www.energy.ca.gov/event/workshop/2021-08/joint-agency-workshop-next-steps-plan-senate-bill-100-resource-build

terrestrial biological information maintained by the California Department of Fish and Wildlife and several ecological models developed for the CEC landscape energy planning activities. This information helps identify landscapes that are important for species habitat, habitat connectivity, and provide intact landscapes. Taken together, these areas are best suited for long-term conservation of species and habitats and for climate resiliency. Renewable energy resources that are outside of these areas are considered to be areas better suited for renewable energy development.

For purposes of this review, it is assumed that these areas are where the potential future build-out of solar generation would occur. Additionally, the CEC assumed that up to 25 percent of the area might be buildable, due to other non-technical constraints. The acreage needed to achieve the buildout of solar capacity assigned by the RESOLVE model is based on the assumption of 7 acres per MW. The CEC next considered whether the re-allocation of resources based on proportions of commercial interest resulted in any obvious outliers in terms of our high-level estimates of the percentage build out of the more buildable land in each transmission zone.

Based on that comparison, the re-allocation of solar resources to the Tehachapi transmission zone is 58 percent of the more buildable area, while other re-allocations to transmission zones are between 1 and 29 percent. As described in the table, the CEC adjusted the re-allocation of solar capacity in the Tehachapi transmission zone to the current commercial interest amount, which is approximately 35 percent of the more buildable land.[15]

The agencies recognize that more work remains to be done to vet the environmental screening methodology developed by the CEC, including appropriate uses of these kinds of data and analytical tools as well as the assembly and interpretation of the underlying data and look forward to engaging further with stakeholders on this topic.

In-state wind

In the SB 100 Core scenario, the RESOLVE model selects all of the available in-state wind resource potential. As shown in Table 3 at the end of this section, RESOLVE selects 2,237 MW, which is similar to the 1,981 MW included in the CPUC IRP portfolios being studied in the 2021-2022 TPP base case. As shown in the renewable resource map (Figure 1), wind energy resources are selected by the model in regions of the state that have very limited, and in some cases no wind energy development. Stakeholders have questioned whether these selections may use out of date information to characterize resource potential. The agencies support the recommendation to conduct further engagement with stakeholders to improve the inputs and assumptions used for in-state wind resource potential.[16]

Offshore wind

In the SB 100 Core scenario, RESOLVE selects 5,256 MW of offshore wind in 2040. In the Starting Point scenario the CAISO will study 10,000 MW of offshore wind energy in the 20-year outlook which is

[15] The use of the environmental and land use information in this exercise was for the purpose of providing a comparison of these transmission zone areas. This information is used as a "starting point" and is intended to encourage discussion and input from stakeholders. This landscape level information does not address site specific issues or project level environmental assessments.

[16] See comment from the California Wind Energy Association in response to the August 12, 2021 resource build workshop: https://efiling.energy.ca.gov/GetDocument.aspx?tn=239406&DocumentContentId=72864

consistent with other SB 100 scenarios. In the 2021-2022 TPP the CAISO is studying offshore wind energy as a sensitivity and in an outlook study. There is more than 10,000 MW being assessed by the CAISO as part of the 2021-2022 TPP and the results of those studies will inform how offshore wind energy is included in the 20-year outlook. By looking beyond 10,000 MW of offshore wind energy for the 20-year outlook, the CAISO's analysis will provide important information to update the inputs and assumptions used to characterize offshore wind energy potential in future energy resource planning, including the next SB 100 joint-agency report.

Out-of-state wind

In the SB 100 Core scenario RESOLVE selects 10,315 MW of out of state wind resources in 2040 and in the Starting Point scenario the CAISO will study 12,000 MW in the 20-year outlook, which is consistent with other SB 100 scenarios. As shown in Table 3 at the end of this section, in the SB 100 Core scenario, RESOLVE selects 12,000 MW of out of state wind resources in 2040 and is allocated by:

- 2,087 MW already allocated in the IRP resource portfolio for the 2021-2022 TPP base case.
    - 530 MW from the Northwest
    - 495 MW from Baja California
    - 1,062 MW from Wyoming/Idaho or New Mexico
- An additional 1,938 MW of out of state wind on new transmission, for a total of 3,000 MW are also being studied as a sensitivity study in the 2021-2022 TPP and are allocated as:
    - 1,500 MW from Wyoming/Idaho
    - 1,500 MW from New Mexico
- For the capacity of out of state wind energy that was selected in the SB 100 Core scenario, but is not currently being studied in the 2021-2022 TPP, the transmission projects presented at the July 22, 2021 SB 100 resource build workshop will be a source of input for allocating these additional out of state wind energy resources.[17] The CAISO will consider the nature of transmission that would be required to integrate these resources, and where these resources should be interconnecting into the CAISO system.
- These allocations are just a starting point. Additional outreach to project developers, as well as collaboration with California BAAs and stakeholders to assess additional resource locations and transmission opportunities will be done to support the 20-year outlook.

Geothermal

In the Core scenario RESOLVE selects 135 MW of geothermal resources in 2040. In the Starting Point scenario the CAISO will study 2,332 MW of geothermal resources in 2040, which is consistent with other SB 100 scenarios and is nearly all of the resource potential assumed in the RESOLVE model. As shown in

[17] The SB 100 resource build workshop that focused on transmission included presentations from project developers with transmission projects under development. Of the projects that were presented, the majority were related to bringing out of state wind to California.

the map in Figure 1, some of the geothermal energy resources assumed in the model are located in regions of the state that have very limited, and in some cases no geothermal energy development.

As a starting point for the 20-year outlook, and to more fully understand the ability for geothermal to scale in and around the Salton Sea region the agencies allocated most, but not all, of the geothermal capacity to the Imperial transmission zone. Studying the transmission implications of this level of geothermal development in the Imperial transmission zone can improve the inputs and assumptions in future energy system planning, including the next SB 100 joint-agency report. The agencies will also conduct stakeholder engagement on other geothermal areas.

Table 3: SB 100 Build Scenario for CAISO 20 Year Transmission Outlook

Resource	Transmission Zone	Assumptions from RESOLVE CPUC IRP and CAISO TPP Base Case	Assumptions from RESOLVE CPUC IRP and CAISO TPP Base Case	Assumptions from 2021 SB 100 Core Scenario 2040	Commercial Interest (solar only)	Starting Point Scenario (with adjustments to SB 100 RESOLVE Outputs)	NOTES
Terrestrial Wind (In-State Footprint)		**FD**	**EO**		**MW**		
Humboldt_Wind	Sacramento_River-Humboldt		34	34			
Carrizo_Wind	SPGE_Z3_Carrizo	187		287		SB 100 RESOLVE selects 2,237	
Central_Valley_North_Los_Banos_Wind	SPGE_Z1_Westlands	173		173		MW, which is similar to the	
Kern_Greater_Carrizo_Wind	SPGE_Z2_KernAndGreaterCarrizo	20		60		1,981 MW included in the	
Northern_California_Ex_Wind	NorCalOutsideTxConstraintZones	767		866		CPUC IRP portfolios being	
Solano_Wind	Norcal_Z4_Solano	462		542		studied in the 2021-2022 TPP	
Tehachapi_Wind	Tehachapi	275		275		base case.	
Wind (Out-State Footprint on Existing Transmission)							
NW_Ext_Tx_Wind		530		1,500		As selected by SB 100 RESOLVE	
Southern_Nevada_Wind		-		none			
Baja_California_Wind		495		600		As selected by SB 100 RESOLVE	
Geothermal (In-State Footprint)							
Greater_Imperial_Geothermal	SCADSNV_Z3_GreaterImperial	600	600	none		2,012	The geothermal resources are allocated in the Starting Point scenario to the Imperial transmission zone.
Inyokern_North_Kramer_Geothermal	GK_Z2_InyokernAndNorthOfKramer			none		none	
Northern_California_Ex_Geothermal	NorCalOutsideTxConstraintZones			none		none	
Riverside_Palm_Springs_Geothermal				none		none	
Solano_Geothermal	Norcal_Z4_Solano	51		135		none	
Geothermal (Out-State Footprint)							
Southern_Nevada_Geothermal	Mountain_Pass_El_Dorado-SCADSNV			none		320	
Solar (In-State Footprint)							
Carrizo_Solar	SPGE_Z3_Carrizo		-	9,907	none	none	
Greater_Imperial_Solar	SCADSNV_Z3_GreaterImperial		548	1,300	3,800	6,407	
Inyokern_North_Kramer_Solar	GK_Z2_InyokernAndNorthOfKramer			97	1,282	2,162	
Kern_Greater_Carrizo_Solar	SPGE_Z2_KernAndGreaterCarrizo		700	8,329	3,650	6,154	
North_Victor_Solar	GK_Z3_NorthOfVictor	300		300	400	674	
Northern_California_Ex_Solar	NorCalOutsideTxConstraintZones			866	none	none	
Sacramento_River_Solar	Norcal_Z3_SacramentoRiver			23,484	592	998	
Solano_Solar	Norcal_Z4_Solano	57		622	100	169	
Tehachapi_Solar	Tehachapi	3,880	800	4,801	9,544	9,544	Projected MW Allocation exceeds 50% low implication land area. Allocation set to commercial interest. This area needs further evaluation and discussion in the SB 100 Implementation stakeholder process. 6,549 MW was reallocated to Westlands TX Zone.
Westlands_Ex_Solar	WestlandsOutsideTxConstraintZones	1,779		1,779	none	none	
Westlands_Solar	SPGE_Z1_Westlands	468		618	3,621	12,655	Projected MW Allocation augmented with reassigned MW from Tehachapi Solar (6,549 MW).
SCADSNV_Solar	SCADSNV	230	338	none	none	none	
Pisgah_Solar	GK_Z4_Pisgah	201		none	400	674	
Additional Solar Resources with Commercial Interest (In-State Footprint							
RiversideAndPalmSprings Solar	RiversideAndPalmSprings			none	2,919	4,922	
CentralValleyAndLos Banos Solar	CentralValleyAndLosBanosSolar			none	640	1,079	
Tehachapi Outside of Constraint Zones	Tehachapi Outside of Constraint Zones			none	1,225	2,066	
Greater ImpOutside Constraint Zones				none	590	995	
Subtotal					**28,763**	**48,500**	
Solar (Out-State Footprint)							
Mountain_Pass_El_Dorado_Solar	Mountain_Pass_El_Dorado	248		248		248	Mountain Pass_El Dorado Solar not selected in SB 100 RESOLVE Model. MW carried forward from CPUC IRP PSP 2031 46MMT Portfolio (248 MW). MW subtracted from In State Solar MW Total to adjust In State Build
Southern_Nevada_Solar	SCADSNV-GLW_VEA	624	1,400	none		2,024	Southern Nevada Solar not selected in SB 100 RESOLVE Model. MW carried forward from CPUC IRP PSP 2031 46MMT Portfolio (2,024 MW). MW subtracted from In State Solar MW Total to adjust In State Build
Arizona_Solar	SCADSNV-Riverside_Palm_Springs	772	1,580	none		2,352	Arizona Solar not selected in SB 100 RESOLVE Model. MW carried forward from CPUC IRP PSP 2031 46MMT Portfolio (2,352 MW). MW subtracted from In State Solar MW Total to adjust In State Build
Out of State Wind (Out-State Footprint)							
Wyoming_Wind_T1	SCADSNV_Z5_SCADSNV	1,062		3,000		As selected by SB 100 RESOLVE	
Wyoming_Wind_T2				none		1,685	
New_Mexico_Wind_T1	Riverside_Palm_Springs-SCADSNV			3,000		As selected by SB 100 RESOLVE	
New_Mexico_Wind_T2	Riverside_Palm_Springs-SCADSNV			2,215		As selected by SB 100 RESOLVE	

Figure 1

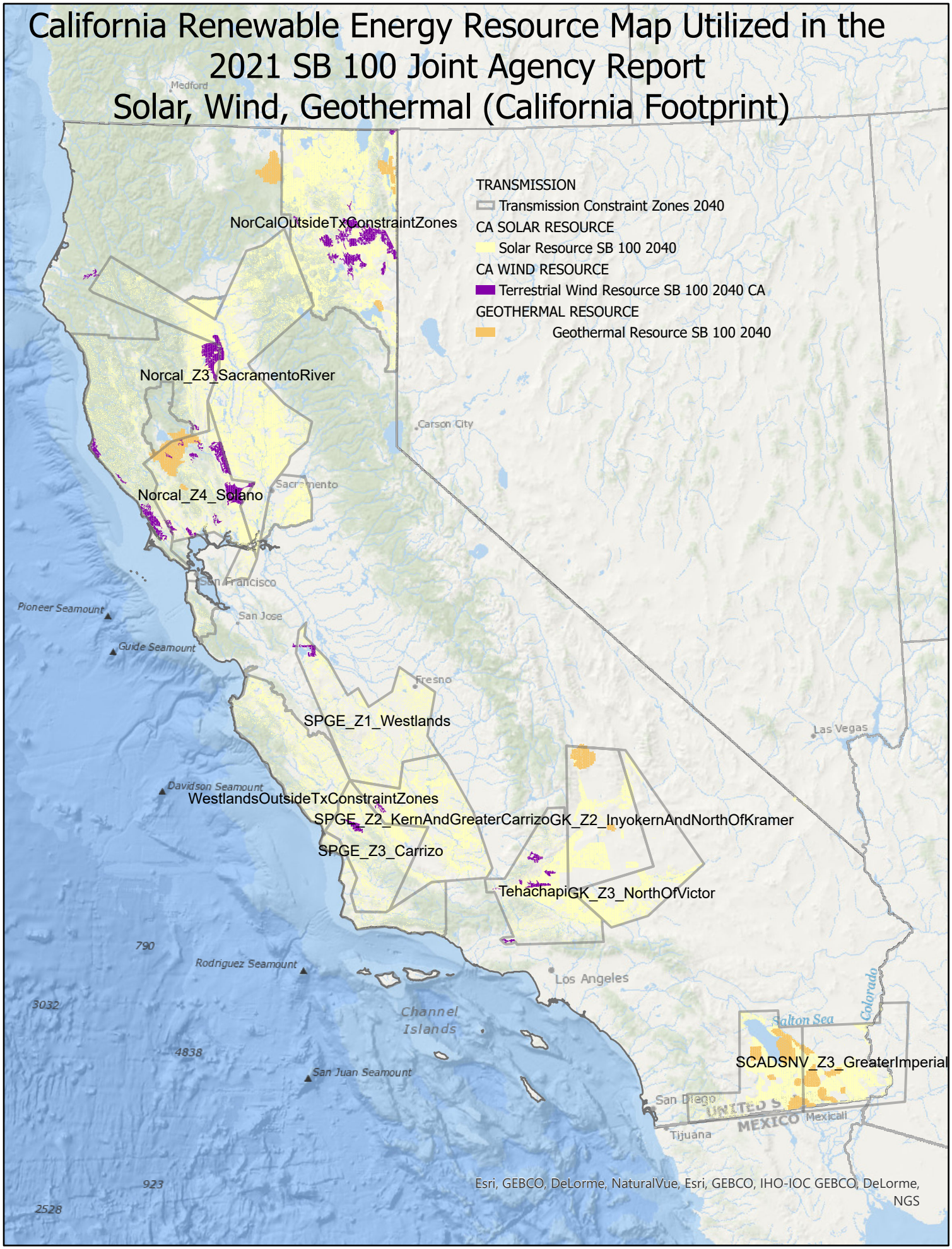
California Renewable Energy Resource Map Utilized in the 2021 SB 100 Joint Agency Report
Solar, Wind, Geothermal (California Footprint)
TRANSMISSION
Transmission Constraint Zones 2040
CA SOLAR RESOURCE
Solar Resource SB 100 2040
CA WIND RESOURCE
Terrestrial Wind Resource SB 100 2040 CA
GEOTHERMAL RESOURCE
Geothermal Resource SB 100 2040
NorCalOutsideTxConstraintZones
Norcal_Z3_SacramentoRiver
Norcal_Z4_Solano
SPGE_Z1_Westlands
WestlandsOutsideTxConstraintZones
SPGE_Z2_KernAndGreaterCarrizoGK_Z2_InyokernAndNorthOfKramer
SPGE_Z3_Carrizo
TehachapiGK_Z3_NorthOfVictor
SCADSNV_Z3_GreaterImperial
Medford
Carson City
Sacramento
San Francisco
San Jose
Fresno
Las Vegas
Los Angeles
San Diego
Tijuana
Mexicali
Salton Sea
Colorado
Channel Islands
Pioneer Seamount
Guide Seamount
Davidson Seamount
Rodriguez Seamount
San Juan Seamount
790
3032
4838
923
2528
Esri, GEBCO, DeLorme, NaturalVue, Esri, GEBCO, IHO-IOC GEBCO, DeLorme, NGS

Figure 2


California SB 100 Buildout Renewable Energy Resource Starting Point Map - Adjusted Solar (California Footprint)
Transmission Constraint Zones 2040 Adjusted
SolarResource_SB100 2040
Norcal_Z3_SacramentoRiver
Norcal_Z4_Solano
SPGE_Z4_CentralValleyAndLosBanos
SPGE_Z1_Westlands
SPGE_Z2_KernAndGreaterCarrizoGK_Z2_InyokernAndNorthOfKramer
TehachapiGK_Z3_NorthOfVictor
GK_Z4_Pisgah
TehachapiOutsideTxConstraintZones
SCADSNV_Z4_RiversideAndPalmSprings
GreaterImpOutsideTxConstraintZones
SCADSNV_Z3_GreaterImperial
Carson City
Sacramento
San Francisco
San Jose
Fresno
Las Vegas
Los Angeles
San Diego
Tijuana
Mexicali
Pioneer Seamount
Guide Seamount
Davidson Seamount
Rodriguez Seamount
San Juan Seamount
Channel Islands
Salton Sea
790
3032
4838
923
2528
Esri, GEBCO, DeLorme, NaturalVue, Esri, GEBCO, IHO-IOC GEBCO, DeLorme, NGS