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February 12, 2018

Paul Douglas
California Public Utilities Commission
Energy Division
505 Van Ness Ave.
San Francisco, CA 94102

RE: Energy Commission Staff Proof-of-Concept to Allocate Renewable Resource Portfolios Selected by RESOLVE to Specific Locations on the Electric Transmission Grid

Dear Mr. Douglas:

At the request of California Public Utilities Commission (CPUC) staff, Energy Commission staff in the Siting, Transmission and Environmental Protection Division developed an initial proposed substation allocation of the renewable energy portfolios associated with the Default Scenario and 42 MMT Scenario. It is our understanding that these allocations will be referenced by the CPUC when it transmits the portfolios to the California Independent System Operator (California ISO) for use in the 2018-2019 Transmission Planning Process (TPP). The purpose of this letter is to transmit Energy Commission staff's February 7, 2018, initial proposed substation allocation to the CPUC.

In developing this initial proposed substation allocation, staff assembled a statewide environmental information model to better understand the environmental implications, from a landscape perspective, of particular renewable resource areas. For the most part, staff did not use the environmental information model to identify or prioritize particular resource areas, as most resource areas are essentially pre-defined in the environmental screen used in RESOLVE. Staff relied on information from the CPUC, California ISO, RETI 2.0, California Department of Fish and Wildlife, and U.S. Bureau of Land Management (Nevada). Staff's allocation of megawatts to particular substations is not an endorsement of the suitability of those places for development on the basis of environmental value or viability; these areas are staff's attempt to align the renewable resource areas assumed in RESOLVE with substations to support transmission planning studies.

It is our understanding that any transmission system upgrades identified in the 2018-2019 TPP as necessary to integrate either of the resource portfolios provided by the CPUC, and allocated to substations by Energy Commission staff, will be for informational purposes only and will not trigger transmission system investment. Staff

interprets this to mean that the process of developing portfolios in this initial round of the CPUC's Integrated Resource Plan process for the 2018-2019 TPP is a "proof-of-concept" of how to align the process of transmitting CPUC portfolios to the California ISO that include sufficient information to perform necessary system studies. Energy Commission staff looks forward to continuing to work with stakeholders, CPUC staff, and the California ISO to improve upon the concept enclosed here and incorporate the best available environmental and geospatial information within energy planning processes.

Sincerely,

SHAWN PITTARD
Deputy Director
Siting, Transmission and Environmental Protection Division

Enclosure

February 7, 2018

Energy Commission Staff's Proof-of-Concept to Allocate Renewable Resource Portfolios Selected by RESOLVE to Specific Locations on the Electric Transmission Grid

Overview

This paper presents Energy Commission staff's proof-of-concept to improve the alignment of the California Public Utility Commission (CPUC) Integrated Resource Plan (IRP) process with California Independent System Operator (ISO) transmission planning. Currently, the CPUC selects new renewable portfolios needed to meet statewide 2030 energy and environmental policies as part of their IRP process, and transfers these renewable portfolios to the California ISO for transmission planning. The portfolios are at a geographic scale that is too broad for transmission planning, which requires specific interconnection locations. Working with CPUC staff and the California ISO, Energy Commission staff developed the concept described in this paper that assigns the capacity of renewable portfolios selected by CPUC to specific locations on the California ISO transmission grid to improve alignment between IRP and transmission planning.

Introduction

At the request of California Public Utility Commission (CPUC) staff working on Integrated Resource Planning (IRP), Energy Commission staff has undertaken an effort to allocate gross renewable resource capacity selected by RESOLVE, under particular "Selected Scenario Settings" to specific substations on the California Independent System Operator controlled transmission grid.[1] This effort focuses primarily on an allocation of megawatts to substations to support system planning studies. Energy Commission staff relied on information generated directly from the RESOLVE model and made available in the IRP process, including the range of different environmental screens that limit renewable energy potential based on various

[1] On December 28, 2017 the CPUC issued a proposed decision in Rulemaking 16-02-007 which states: "We recognize that both scenarios, to some degree, represent a less granular geographic data set than is required for CAISO to conduct transmission planning studies. We delegate to Commission staff to work with the CEC and the CAISO, as part of its stakeholder process, to develop the required granularity. This collaborative approach is consistent with our previous practices of providing data informing CAISO transmission planning. Staff should begin by utilizing the RETI 2.0 work to the extent possible, to identify the best-available project and geographic information for use in both scenarios, working with the CEC and CAISO staff."
The proposed decision is available at:
http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M201/K974/201974336.PDF

environmental information. Staff also relied on information from the Renewable Energy Transmission Initiative (RETI) 2.0 initiative.

Staff also reviewed statewide environmental information to better understand the environmental implications, from a landscape perspective, of particular renewable resource areas. For the most part, staff did not use the environmental information to identify or prioritize particular resource areas, as most resource areas are identified in RESOLVE. Staff does not endorse the selection of one resource area over another on the basis of environmental value or viability. Staff recommends that future iterations of RESOLVE model runs include additional environmental screening and evaluation in both the selection of gross renewable resources by resource area and in determining how such resources are allocated to substation locations within resource areas.

RESOLVE selects renewable energy capacity in portfolios at the scale of transmission zones, which are large geographic areas that typically span more than one county. As shown in Figure 1, the scale of transmission zones appears too coarse to study what (if any) transmission system investments may be needed to integrate those new resources. Performing necessary system studies, such as those in the California ISO Transmission Planning Process (TPP), requires allocating the selected resources of the transmission zone to more specific grid aligned (e.g. substations) renewable resource areas within each transmission zone. Energy Commission staff worked iteratively with staff from the CPUC and California ISO to allocate selected megawatts to substations.

CPUC staff requested the Energy Commission staff's assistance with allocating the selected renewable energy portfolios from two scenarios modeled by CPUC staff using RESOLVE:

- Default Scenario (the selected renewable portfolio is referred to as the "50% RPS portfolio")
- 42 MMT Scenario (the selected renewable portfolio is referred to as the "Reference System Portfolio")

It is Energy Commission staff's understanding that the portfolio associated with the Default Scenario will ultimately be forwarded to the California ISO for use in its 2018-2019 TPP as the reliability base case and the portfolio associated with the 42 MMT Scenario will be the basis for a policy-driven scenario recommended by the CPUC in the TPP.[2]

[2] During the iterative work process to allocate megawatts to substations, CPUC staff discovered an incorrect input in the RESOLVE user interface. CPUC corrected the input and ran RESOLVE, which revised some aspects of the two portfolios. CPUC describes this process as: "This spreadsheet summarizes the results of two RESOLVE runs that use assumptions identical to those used and reported in the IRP proceeding as the "42 MMT" and "Default" (50% RPS) cases with one exception: the capability of the Kramer Inyokern transmission area to absorb new EO generation was changed from 1,000 MW to 0 MW. This corrects an error pointed out by CAISO staff. The impact of changing this assumption on most results (e.g., revenue requirement, GHG emissions) was de minimis. Eliminating EO

It is also Energy Commission staff's understanding that any transmission system upgrades identified in the 2018-2019 TPP as necessary to integrate the resource portfolios provided by the CPUC will be for informational purposes only and will not trigger transmission system investment.[3] Energy Commission staff interprets this to mean that the process of developing portfolios in this initial round of IRP for the 2018-2019 TPP is a "proof-of-concept" of how to align the process of transmitting CPUC portfolios to the California ISO that include sufficient information to perform necessary system studies.

See Table 1 below for a summary of the renewable resources selected to partially meet California ISO load in 2030 in each RESOLVE transmission zone for both scenarios. Also, it is important to refer to Footnote 2, which describes why the portfolios described in Table 1 are somewhat different than the portfolios included in Commissioner Randolph's Proposed Decision on December 28, 2017 within the IRP proceeding. Within each zone, the capacity of selected renewable resources is broken out by technology (i.e. solar, wind, geothermal).

Table 1

Summary of resources selected in each RESOLVE transmission zone by scenario

Zone	Scenario	Generation Technology Type (In-State MWs)		
		Solar	Wind	Geothermal
Resources Selected within California				
Northern California	42 MMT	0	0	210
	Default	0	0	0
Solano	42 MMT	0	643	0
	Default	0	0	0
Central Valley / Los Banos	42 MMT	0	146	0
	Default	0	146	0
Greater Carrizo	42 MMT	0	160	0
	Default	0	0	0
Tehachapi	42 MMT	1,013	153	0

capability in Kramer Inyokern did shift the location of generic solar PV generation selected by the model out of that transmission area…."

[3] In other words, CAISO management will not seek CAISO Board of Governors approval for any transmission infrastructure identified as needed based on the CPUC resource portfolios.

	Default	1,013	153	0
Kramer / Inyokern	42 MMT	978	0	0
	Default	978	0	0
Mountain Pass / Eldorado	42 MMT	0	0	0
	Default	62	0	0
Riverside East / Palm Springs	42 MMT	3,875	42	0
	Default	0	0	0
Greater Imperial	42 MMT	0	0	0
	Default	0	0	0
SoCal Desert	42 MMT	0	0	0
	Default	0	0	0
Westlands	42 MMT	0	0	0
	Default	0	0	0
Resources Selected Outside of California				
Southern Nevada*	42 MMT	3,006		
	Default	1,135		
Total Capacity by Technology	42 MMT	8,872	1,144	210
	Default	3,188	299	0
Total Renewable Capacity	42 MMT	10,226 MW		
	Default	3,488 MW		

*Though the generation footprints for these resources are outside of California, for the purposes of modeling in RESOLVE, resources located in Southern Nevada are assumed to interconnect directly to the existing California ISO transmission system.

To develop its initial proposed allocations of megawatts to substations for each portfolio, Energy Commission staff used information from RESOLVE and existing statewide energy planning information, including RETI 2.0, in a geospatial analysis to identify renewable resource areas at a granularity that is sufficient for the California ISO to evaluate transmission need within the TPP. The Energy Commission used a geodatabase from the CPUC's website[4] that includes the geographic information used to develop inputs and assumptions for new renewable energy supply in the RESOLVE model, including a range of different environmental screens that limit renewable energy potential based on a variety of environmental constraints.[5] To develop both of the portfolios, the CPUC used the "DRECP/SJV" screen in the RESOLVE model. To maintain consistency with the RESOLVE inputs and assumptions the Energy Commission created a spatial representation of the renewable energy supply for solar, wind, and geothermal energy in each of the transmission zones consistent with the "DRECP/SJV" screen by:

- Assuming that 100 percent of the solar energy resource potential within a BLM designated Development Focus Area (DFA) within the Desert Renewable Energy Conservation Plan (DRECP) area is available.
- Assuming that none of the solar energy resource potential outside of a DFA but within the DRECP area (e.g. private lands and other BLM land designations) is available.
- Assuming that 100 percent of the solar energy resource potential within a "least-conflict" land within the San Joaquin Valley Solar PV Least Conflict planning area is available.
- Assuming that none of the solar energy resource potential outside of "least-conflict" land but within the San Joaquin Valley Solar PV Least Conflict planning area is available.
- Assuming that 5 percent of the solar energy resource potential outside of both the DRECP planning area and San Joaquin Valley Solar PV Least Conflict planning area is available after screening out solar energy resources that also conflict with Renewable Energy Transmission Initiative (RETI) Category 1 and 2 lands,

[4] See "Renewable Resources GIS Data": http://www.cpuc.ca.gov/General.aspx?id=6442453965

[5] The RESOLVE model is enabled to select from these environmental screens: 1) Baseline (excludes RETI Category 1 and discounts remaining solar by 95%); 2) Environmental Baseline (excludes RETI Category 1 and 2 lands and discounts remaining solar by 95%); 3) NGO 1 and 4) NGO 1&2 (refinements to RETI Category 1 and 2 exclusions by environmental stakeholders); 5) DRECP/SJV (limits solar development within DRECP and SJV to DFAs and least conflict land and all other resources are the same as the "Environmental Baseline" screen); 6) Conservative (this screen captures the most conservative screen by resource area). The Energy Commission used the following files from the geodatabase:"RETI_Cat1and2_4Solar", "RETI_Cat1and2_4Wind", "DRECP_DFA", "SJV_LeastConflict", "Projects_SolarPV_Area", "Qualifying Resource Area QRA", and "Projects_Wind".

including solar energy resource potential from in and around the Qualifying Resource Area (QRA) in Southwest Nevada.

- Assuming that wind energy resource potential is the resource potential after removing those areas from "Wind Projects" that intersect with RETI Category 1 and 2 lands. Within the DRECP, only those "Wind Projects" that intersect with DFAs.
- Assuming 682 MWs of wind re-power capacity from these transmission zones: Solano (270 MW in Altamont Pass and 7 MW is Solano); Tehachapi (383 MW in the Tehachapi Range); and, Riverside East/Palm Springs (22 MW from the San Gorgonio Pass).
- Assuming that geothermal resource potential is treated as a specific location within RESOLVE and the resources are not screened with environmental information.

After creating a spatial representation of the wind and solar resource supply areas, Energy Commission staff allocated the megawatt capacity for the renewable portfolio in each transmission zone to specific substations within the transmission zone. Energy Commission staff applied a data layer comprised of substations targeted by developers requesting interconnection to the California ISO grid to identify substations within a 5-mile radius of the wind and solar resource supply areas. In instances where there were no such substations within a 5 mile radius, Energy Commission staff relied on a data layer comprised of all operational substations in California between 33 kV and 500 kV to identify other substations in close proximity.[6]

For some RESOLVE transmission zones the implied resource areas (e.g., wind resource areas, DFAs) were highly fragmented and dispersed making it difficult not only to identify candidate substations but to do so in a manner that minimizes the number of substations identified for potential allocation. Energy Commission staff attempted to group dispersed resource areas to address this challenge. The land area of each resource area within a grouping is a percentage of the total land area of all resource areas within a grouping in a RESOLVE transmission zone and correspondingly a percentage of the resource capacity in a grouping. Generally, if the available megawatts represented by the groupings of resource areas within a RESOLVE transmission zone exceeded the amount selected by RESOLVE, then Energy Commission staff allocated an amount

[6] Energy Commission staff used the following as guidance in such instances: In using RESOLVE portfolios in its TPP the California ISO's likely focus will be on significant transmission needs rather than on the local upgrades typically identified through the generation interconnection process (e.g., Area Delivery Network Upgrades or "ADNUs" rather than Local Delivery Network Upgrades or "LDNUs"). Thus, Energy Commission staff initially sought to identify whether a major substation was close by at which the California ISO could model a low voltage bus and associated transformer and gen-tie as the California ISO deems appropriate. If no such substation was available, then Energy Commission staff identified one or more lower-voltage substations in close proximity.

from each grouping in proportion to its share of the total in the zone. An exception to this general approach is that megawatts available from wind repowers were allocated first and any remaining amount needed for allocation were taken from each grouping in proportion to its share of the remaining total in the zone. Additional description of the allocation process is included in each of the transmission zones below.

The resource area groupings developed by Energy Commission staff within each RESOLVE transmission zone, the available megawatts associated with each, and the corresponding amount allocated to substations is summarized in Table 2 (42 MMT Scenario) and Table 3 (Default Scenario). Substations are identified by the name found in the substation data layer used by Energy Commission staff (e.g., Round Mountain, Vaca-Dixon, Tesla, etc.) without designating a particular bus voltage. As stated earlier, Energy Commission staff assumes that the California ISO could determine the appropriate bus voltage and model as appropriate (e.g., model a low voltage bus, transformer, gen-tie, etc.).

It is important to note that in both of the scenarios RESOLVE selects a mixture of full capacity deliverability status (FCDS) and energy-only (EO) resources. The Energy Commission did not differentiate between FCDS and EO resources in the allocation to substations. Energy Commission staff is assuming that the California ISO will determine how best to apply the FCDS versus EO breakdown in the TPP. In the description of the allocations below, it is noted where RESOLVE selects a mixture of FCDS and EO resources.

In some of the summaries below, Energy Commission staff also describe how the portfolios relate to environmental information used for energy planning. In some transmission zones Energy Commission staff used environmental information to identify resources with lower implied environmental conflict to allocate to substations. In some transmission zones Energy Commission staff reviewed environmental information for the resource portfolio, but did not use the information to prioritize one resource area over another.

Summary of Process and Allocation by RESOLVE Transmission Zone

Northern California Transmission Zone

42 MMT Scenario (Reference System Portfolio)

In this scenario RESOLVE selects 210 MW of geothermal resources in Northern California that appear to come from three geothermal supply resources in RESOLVE (Medicine Lake is 384 MW, Honey Lake is 8 MW, and Surprise Valley is 32 MW). Though RESOLVE likely selects geothermal resources from Honey Lake and Surprise Valley, of the three resources Medicine Lake resource potential is of sufficient size to allocate the selected 210 MW. The substations in

close proximity to Medicine Lake are owned by Pacificorp. The nearest California ISO substation is owned by Pacific Gas and Electric (PG&E) on the Pit River system. The nearest major PG&E substation is Round Mountain.

Energy Commission staff is initially recommending that the 210 MW of geothermal be allocated to either Round Mountain or a substation on or near the Pit River system.

The 210 MW of geothermal capacity is FCDS.

The Energy Commission staff also recommends revisiting the supply assumptions of geothermal energy in the Medicine Lake Area. As presented in the description of the Lassen and Round Mountain Transmission Assessment Focus Area (TAFA) in RETI 2.0, the area is culturally significant and geothermal energy development has faced significant local opposition, especially from Native American tribes.[7]

Default Scenario (50% RPS portfolio)

No selections made by RESOLVE.

Solano Transmission Zone

42 MMT Scenario (Reference System Portfolio)

RESOLVE selects 643 MW of wind resource in the Solano transmission zone from several wind resource areas. The potential wind resources in RESOLVE in the Solano transmission zone under the "DRECP/SJV" screen is 643 MW, which is equivalent to the resources selected by RESOLVE, indicating that all of the potential wind resource under the "DRECP/SJV' screen in this portfolio should be allocated to substations in proximity to the wind resources. Identifying substations was challenging because there are 11 wind resource areas (including 2 repower areas). Energy Commission staff is initially recommending the following allocation:

- Tesla: 281 MW of wind
- Contra Costa: 42 MW of wind
- Christie or Unocal: 18 MW of wind (both subs are in the Crockett area)
- Vaca-Dixon: 247 MW of wind
- Eight Mile: 55 MW of wind

The 643 MW of wind capacity is EO.

[7] See Appendix A Transmission Assessment Focus Area Information of the final RETI 2.0 Plenary Report. http://www.energy.ca.gov/reti/reti2/documents/

As described in the overview of potential environmental conflicts with developing wind energy in the Northern California TAFAs in RETI 2.0 and based on the Energy Commission's review of statewide environmental information, some of the wind capacity selected by RESOLVE in this transmission zone may conflict with valuable biological resources. Also, Energy Commission staff found that some wind resource areas screened by the "DRECP/SJV" environmental screen (RETI Category 2 land) in RESOLVE have lower implied environmental conflict, indicating that there might be an opportunity to improve the resource supply assumptions in RESOLVE.

Default Scenario (50% RPS portfolio)

No selections made by RESOLVE.

Central Valley / Los Banos Transmission Zone

42 MMT Scenario (Reference System Portfolio)

RESOLVE selected 146 MW of wind from a single wind resource area that was partially reduced by the "DRECP/SJV" environmental screen from 170 MW to 146 MW. Energy Commission staff is initially recommending that this be allocated to the Los Banos substation.

The 146 MW of wind capacity is FCDS.

Default Scenario (50% RPS portfolio)

RESOLVE selected 146 MW of wind from a single wind resource area that was partially reduced with a RETI Category 2 environmental screen from 170 MW to 146 MW. Energy Commission staff is initially recommending that this be allocated to the Los Banos substation.

The 146 MW of wind capacity is FCDS.

Greater Carrizo Transmission Zone

42 MMT Scenario (Reference System Portfolio)

RESOLVE selected 160 MW of wind resources from the Greater Carrizo transmission zone. There are 9 wind resource areas in the Greater Carrizo transmission zone under the "DRECP/SJV" screen with a potential for 1,095 MW, which is much larger than the 165 MW selected by RESOLVE. Energy Commission staff reviewed environmental information to reduce the total wind resource potential by disregarding potential wind areas that appear to have greater environmental conflict. Energy Commission staff's review of environmental information shows that two wind resource areas—one along the coast and another inland from Santa Barbara are in places that are likely to have higher environmental conflict. The remaining wind resource areas were highly dispersed and none were in close proximity to major

substations. Nevertheless, Energy Commission staff identified a substation in proximity to each wind resource area. Energy Commission staff is initially recommending the following allocation:

- Carrizo Plains: 41 MW of wind
- Templeton: 56 MW of wind
- Zaca: 26 MW of wind
- Gaviota: 24 MW of wind
- Palmer: 13 MW of wind

The 160 MW of wind capacity is EO.

Default Scenario (50% RPS portfolio)

No selections made by RESOLVE.

Tehachapi Transmission Zone

42 MMT Scenario (Reference System Portfolio)

RESOLVE selected 1,013 MW of solar and 153 MW of wind resources from the Tehachapi Transmission Zone. The Tehachapi transmission zone has 1,073 MW of solar potential under the "DRECP/SJV" environmental screen, which confines the assumption of solar resource potential to within DRECP designated DFAs on U.S. Bureau of Land Management (BLM) managed lands. Energy Commission staff grouped smaller DFAs in proximity to one another into clusters and then calculated the proportion of the clustered DFAs based on the weighted size (in acres) of each DFA. Energy Commission staff used the proportional share of each clustered DFA to allocate the share of selected solar resources to the DFA cluster. The Tehachapi transmission zone has 3 wind resource areas under the "DRECP/SJV" with 407 MW of potential wind energy resources, which is greater than the 153 MW of selected wind energy resources. One of the potential wind resources is a 383 MW re-power resource, which is greater than the selected 153 MW of wind resource so Energy Commission staff identified the re-power to allocate megawatts. Energy Commission staff is initially recommending the following allocation:

- Highwind and Windhub: 153 MW of wind
- Windhub: 627 MW of solar
- Whirlwind and Windhub: 386 MW of solar

Where an amount is allocated across two substations, Energy Commission staff suggests that the California ISO determine an appropriate proportion at each substation (e.g., based on available capacity).

The 1,013 MW of solar capacity selected and 153 MW of wind capacity selected is FCDS.

Default Scenario (50% RPS portfolio)

RESOLVE selected the same portfolio of resources (1,013 MW of solar and 153 MW) in the Default Scenario as the 42 MMT Scenario in the Tehachapi transmission zone. Accordingly, Energy Commission staff is initially recommending the same allocation as the 42 MMT Scenario:

- Highwind and Windhub: 153 MW of wind
- Windhub: 627 MW of solar
- Whirlwind and Windhub: 386 MW of solar

Where an amount is allocated across two substations, Energy Commission staff suggests that the CAISO determine an appropriate proportion at each substation.

The 1,013 MW of solar capacity selected and 153 MW of wind capacity selected is FCDS.

Kramer / Inyokern Transmission Zone

42 MMT Scenario (Reference System Portfolio)

RESOLVE selected 978 MW of solar resources in the Kramer/Inyokern transmission zone. The Kramer/Inyokern transmission zone has 8,193 MW of solar potential under the "DRECP/SJV" environmental screen, which confines the assumption of solar resource potential to within DRECP designated DFAs on U.S. BLM managed lands. Energy Commission staff grouped smaller DFAs in proximity to one another into clusters and then calculated the proportion of the clustered DFAs based on the weighted size (in acres) of each DFA. Energy Commission staff used the proportional share of each clustered DFA to allocate the share of selected solar resources to the DFA cluster. Energy Commission staff refined how megawatts were assigned to DFAs north of the Kramer substation in and around Inyokern because the substations do not have available capacity.[8] The clustered DFAs in and around Victorville and Lucerne are highly dispersed and there are few high voltage substations. Energy Commission staff assigned 200 MW to substations from DFAs in and around Victorville and Lucerne and 778 MW from the DFAs near the Kramer substation. Energy Commission staff is initially recommending the following allocation:

- Inyokern: 0 MW. Although it appears that there was in excess of 5,000 MW of solar resource potential in the area to the north and northeast of the Inyokern substation, zero megawatts were allocated to Inyokern as further renewable generation north of

[8] See page 56 of the final RETI 2.0 Plenary Report that describes that there is likely no available capacity to interconnect new renewable generation north of Kramer.

Kramer would exacerbate the South of Kramer constraint (per RETI 2.0 Plenary Report, page 56).

- Kramer: 778 MW of solar. This represents 978 MW minus 100 MW at Cottonwood (see below) and minus 100 MW at Gale (see below).
- Cottonwood: 100 MW of solar. Although it appears that there was in excess of 3,000 MW of solar resource potential in the area, 100 MW of solar was arbitrarily allocated to the Cottonwood 115 kV substation as there were no other identified substations and uncertainty as to how much this substation can accept.
- Gale: 100 MW of solar. Approximately 1,400 MW of solar resource potential in the area, however only 100 MW was arbitrarily allocated to the Gale 115 kV substation as there were no other identified substations and uncertainty as to how much this substation can accept.

All 978 MW of the solar capacity selected is FCDS.

Default Scenario (50% RPS portfolio)

RESOLVE selected the same portfolio of resources (978 MW of solar) in the Default Scenario as the 42 MMT Scenario in the Kramer/Inyokern transmission zone. Accordingly, Energy Commission staff is initially recommending the same allocation as the 42 MMT Scenario:

- Kramer: 778 MW of solar
- Cottonwood: 100 MW of solar
- Gale: 100 MW of solar

All 978 MW of the solar capacity selected is FCDS.

Mountain Pass / Eldorado Transmission Zone

42 MMT Scenario (Reference System Portfolio)

No in-state selections were made by RESOLVE. However, 3,006 MW of solar from southern Nevada was selected by RESOLVE that would interconnect directly to the California ISO in the Mountain Pass/El Dorado transmission zone. RESOLVE assumes that the potential solar resources in Southern Nevada under the "DRECP/SJV" screen in the Mountain Pass/El Dorado transmission zone come from the "SW_NV" Qualifying Resource Area (QRA), which has 6,950 MW of solar potential under the "DRECP/SJV" environmental screen. Although the Energy Commission's existing environmental information for energy planning is limited to within California, Energy Commission staff did use existing information for public land in southern Nevada primarily using Bureau of Land Management (BLM) decisions for utility-scale solar energy development in the Western Solar Programmatic Environmental Impact Statement

(Solar PEIS)[9]. Energy Commission staff does not endorse the BLM's Solar PEIS and is only using information from the Solar PEIS to scale megawatt potential. Energy Commission staff considered using other sources of information, such as the Crucial Habitat Assessment Tool, to scale megawatts in the transmission zone and ultimately decided to use the BLM information because most of the land is public and a large share is managed by the BLM.

Energy Commission staff developed two allocation options for consideration by the California ISO. The major differences between the two are the assumed size and location of potential resource areas and the number of substations used for allocation. Option 1 limits the areas of resource potential to the specific Western Renewable Energy Zone (WREZ) QRA, which directs the allocation of megawatts to two 115kV substations and one 230kV substation. Option 2 relaxes this constraint and includes resources areas inside and outside of the QRA, but within Southern Nevada and also near higher voltage substations with commercial interconnection interest.

Option 1

Within the QRA, Energy Commission staff identified solar resource areas as those areas identified by the BLM in the Solar PEIS as either Solar Energy Zones (SEZ)[10] or Variance Areas[11]. After identifying the SEZ and Variance Areas within the QRA, Energy Commission staff removed fragmented areas of less than or equal to 100 acres. This results in 449,165 acres of land within the QRA (8,479 acres in the Amargosa Valley SEZ and 440,686 acres of Variance Area) used to identify three areas of solar resource potential near three substations. Energy Commission staff found that one of the solar resource areas is in close proximity to the Valley substation (approximately 52% of the total resource potential), one is in close proximity to Innovation (approximately 12% of the resource potential), and one is in close proximity to Vista (approximately 36% of the resource potential). Based on these proportions, 3,006 MW could be allocated approximately as follows:

- Valley 138 kV: 1,567 MW (52%)
- Innovation 230 kV: 354 MW (12%)

[9] The Solar PEIS is the Programmatic Environmental Impact Statement (PEIS) prepared by the Office of Energy Efficiency and Renewable Energy (EERE), Department of Energy (DOE); and the Bureau of Land Management (BLM), Department of the Interior (DOI). More information is available at: http://blmsolar.anl.gov/.

[10] The Bureau of Land Management (BLM) defines a solar energy zone (SEZ) as an area well suited for utility-scale production of solar energy, where the BLM will prioritize solar energy and associated transmission infrastructure development. http://blmsolar.anl.gov/sez/

[11] To provide flexibility, variance areas are potentially available for utility-scale solar energy development in accordance with the variance process. Variance areas are made up of BLM-administered lands that are outside of solar energy zones (SEZs) and not otherwise excluded by the Solar Energy Program. The BLM will consider right-of-way (ROW) applications for utility-scale solar energy development in variance areas on a case-by-case basis based on environmental considerations; coordination with appropriate Federal, State, and local agencies and tribes; and public outreach. http://blmsolar.anl.gov/variance/

- Vista 138 kV: 1,085 MW (36%)

Option 2

Recognizing that Option 1's allocation of the 3,006 MW to only three substations as well as the large proportion allocated to Valley 138 KV may not be feasible without driving significant transmission upgrades, Energy Commission staff attempted to develop a less constrained option by including the 230 kV Desert View substation and the 500 kV Eldorado substation. Using the three substations identified in Option 1 and Desert View and Eldorado, Energy Commission staff created a 25-mile buffer around each substation to determine the share of land identified by BLM as a SEZ or Variance Area. As in Option 1, Energy Commission staff removed fragmented areas of less than or equal to 100 acres and any overlap in acres due to buffering were eliminated by allocating to one substation but not both. The 25-mile buffering option results in 498,196 acres of SEZ and Variance Areas (8,479 acres in the Amargosa Valley SEZ and 5,717 acres in the Dry Lake SEZ and 484,000 acres of Variance Areas) and results in the following allocation:

- Valley 138 kV: 1,399 MW (47%)
- Innovation 230 kV: 458 MW (15%)
- Vista 138 kV: 377 MW (13%)
- Desert View 230 kV: 445 MW (15%)
- Eldorado: 327 MW (11%)

Under either optional approach, allocating to Valley, Innovation and Vista to the maximum extent possible before allocating to Desert View and Eldorado will tend to maximize the resource potential within the QRA.

Of the 3,006 MW of solar capacity selected in southern Nevada, 802 MW is FCDS and 2,204 MW is EO.

Default Scenario (50% RPS portfolio)

RESOLVE selected 62 MW of in-state solar resource and 1,135 MW of solar resource from southern Nevada. Energy Commission staff allocated the 62 MW of selected in-state solar resources to the El Dorado substation and this amount is additive to the allocation described in Option 2 below. Energy Commission staff used the same approach as described in the 42 MMT Scenario (see above) to allocate the resources in southern Nevada from the Default Scenario.

Option 1

- Valley 138 kV: 592 MW (52%)
- Innovation 230 kV: 134 MW (12%)
- Vista 138 kV: 410 MW (36%)

Option 2

- Valley 138 kV: 528 MW (47%)
- Innovation 230 kV: 173 MW (15%)
- Vista 138 kV: 142 MW (13%)
- Desert View 230 kV: 168 MW (15%)
- El Dorado: 123 MW (11%)

The 62 MW of in-state solar capacity and 802 MW of the southern Nevada solar capacity is FCDS. 334 MW of the solar in southern Nevada is EO.

Riverside East / Palm Springs Transmission Zone

42 MMT Scenario (Reference System Portfolio)

RESOLVE selected 3,875 MW of solar resources and 42 MW of wind resources in the Riverside East/Palm Springs Transmission Zone. The Riverside East/Palm Springs Transmission Zone has 14,341 MW of solar potential under the "DRECP/SJV" environmental screen, which confines the assumption of solar resource potential to within DRECP designated DFAs on U.S. BLM managed lands. Energy Commission staff grouped the DFAs in proximity to one another into clusters and then calculated the proportion of the clustered DFAs based on the weighted size (in acres) of each DFA. Energy Commission staff used the proportional share of each clustered DFA to allocate the share of selected solar resources to the DFA cluster. Identifying substations for solar was challenging as it appears that RESOLVE relied on several dispersed resource areas. Wind capacity was selected from one wind resource area with 20 MW of wind potential and 22 MW wind repower potential under the "DRECP/SJV" environmental screen, which is equal to the number of wind resource megawatts selected by RESOLVE. Using the approach of allocating megawatts based on the proportional acreage of each DFA grouping for solar resources, Energy Commission staff is initially recommending the following allocation:

- Red Bluff: 1,055 MW of solar
- Colorado River: 2,820 MW of solar
- Devers: 42 MW of wind (an alternative would be to allocate 22 MW across Seawind, Banwind, Venwind, Sandwind, Mountwind, Altwind, Terawind and Buckwind; and to allocate 20 MW across Tamarisk and Capewind)

2,791 MW of the solar capacity selected and the 42 MW of wind selected are FCDS and 1,084 MW of the solar capacity selected is EO.

Default Scenario (50% RPS portfolio)

No selections made by RESOLVE.

Westlands

No selections made by RESOLVE in either the 42 MMT Scenario or the Default Scenario.

SoCal Desert

No selections made by RESOLVE in either the 42 MMT Scenario or the Default Scenario.

Greater Imperial

No selections made by RESOLVE in either the 42 MMT Scenario or the Default Scenario.

Figure 1: Potential Renewable Energy Resource Areas

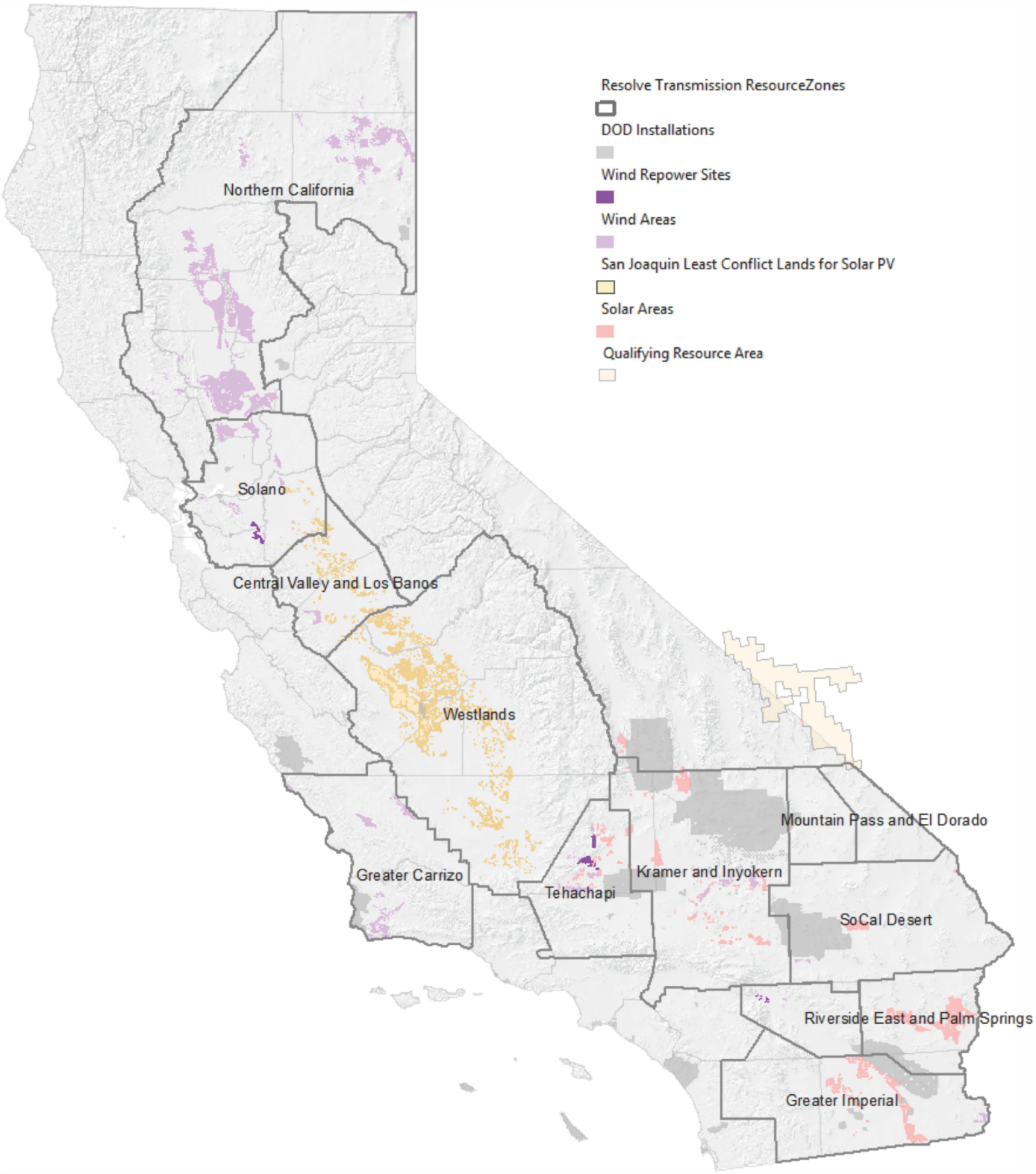

TABLE 2. IRP 42 MMT Scenario - REFERENCE SYSTEM PORTFOLIO - DETAIL FOR RESOLVE MODEL MW ASSIGNMENTS TO SUBSTATIONS

Resolve Transmission Zone	MWs by Zone	MWs in each Zone by Technology			Resource Area Groupings (Wind Repowers, Wind Resource Areas, DFA)[1]	MWs in each Subarea by Technology[2]							Substation Assignments		Notes
		Solar	Wind	Geothermal		Geothermal	Total MW Wind Area	Assigned MW Wind	Total MW Solar	Assigned MW Solar	Total Substation MW		Substation	Secondary Substations	
Northern California	210	0	0	210	Medicine Lake	210					210		Round Mt.		Alternative: Allocate MW to nearest PG&E substation(s) James B. Black, or on the Pit River System (Pit 1, Pit1 Ph, Pit3, Pit4, Pit 5, Pit 6, Pit 7)
Solano	643	0	643	0	REPOWER Altamont		270	270			281		Tesla		
					Wind 107		11	11							
					REPOWER Solano		7	7			42		Contra Costa		
					Wind 104		35	35							
					Wind 106		18	18			18		Christie	Unocal	Alternative: Allocate Wind 106 MW to either Christie or Unocal, based on avaialble capacity
					Wind 80		86	86			247		Vaca Dixon		
					Wind 82		51	51							
					Wind 83		78	78							
					Wind 84		32	32							
					Wind 89		39	39			55		Eight Mile		
					Wind 90		16	16							
					Wind 103		6	0			0		Not Assignd (small areas)		
					Wind 108		2	0							
Central Valley / Los Banos	146	0	146	0	Wind 112		146	146			146		Los Banos		
Greater Carrizo	160	0	160	0	Wind 123		151	29			41		Carrizo Plains		
					Wind 207		60	12							
					Wind 124		288	56			56		Templeton		
					Wind 152		133	26			26		Zaca		
					Wind 153		124	24			24		Gaviota		
					Wind 155		69	13			13		Palmer		
					Wind 154		80	0			0		Not Assigned (Environmental)		
					Wind 213		126	0							
					Wind 120		66	0							
Tehachapi	1166	1013	153	0	REPOWER Tehachapi		383	383			153		Highwind	Windhub	Tehachapi Tx Zone - Alternative: allocate both Wind and Solar MW proportionally between Windhub, Whirlwind and Highwind, based on avaialble capacity
					Wind 127		33	0			24		Not Assigned (All Wind MW Assigned to REPOWER)		
					Wind 129		53	0							
					Wind 156		86	10							
					Wind 157		138	0							
					Wind 171		23	14							
					DFA_5				2821	627	627		Windhub		
					DFA_6				1737	386	386		Whirlwind	Windhub	
					DFA_7				16	0	0		Not Assigned (small areas)		
					DFA_8				7	0					

TABLE 2. IRP 42 MMT Scenario - REFERENCE SYSTEM PORTFOLIO - DETAIL FOR RESOLVE MODEL MW ASSIGNMENTS TO SUBSTATIONS

Resolve Transmission Zone	MWs by Zone	MWs in each Zone by Technology			Resource Area Groupings (Wind Repowers, Wind Resource Areas, DFA)[1]	MWs in each Subarea by Technology[2]							Substation Assignments		Notes
		Solar	Wind	Geothermal		Geothermal	Total MW Wind Area	Assigned MW Wind	Total MW Solar	Assigned MW Solar	Total Substation MW		Substation	Secondary Substations	
Kramer / Inyokern	978	978	0	0	DFA_1				5399	0	0		Inyokern		
					DFA_2				3403	778	778		Kramer		
					DFA_3				3302	100	100		Cottonwood		
					DFA_4				1428	100	100		Gale		
Mountain Pass / El Dorado	3006	3006	0	0											
California In-State		0			DFA_9										
CAISO - Nevada SW		3006			NV_SW QRA				3006	3006	OPTION 1	OPTION 2			
											1567	1399	Valley		
											354	458	Innovation		
											1085	377	Vista		
												445	Desert View		
												327	El Dorado		
Riverside East / Palm Springs	3917	3875	42	0	DFA_10				5792	1055	1055		Red Bluff		Wind REPOWER MW - Alternative: allocate MW proportionally between Seawind, Banwind, Venwind, Sandwind, Mountwind, Altwind, Terawind or Buckwind, based on avaialble capacity; Allocate Wind 178 MW proportionally between Tamarisk, Capewind, Coffee, Desert Outpost, or
					DFA_11				15474	2820	2820		Colorado River		
					REPOWER San Gorgonio			22			42		Devers		
					Wind 178			20							
Westlands	0	0	0	0	n/a										
SoCal Desert	0	0	0	0	n/a										
Greater Imperial	0	0	0	0	n/a										

[1]The numerical DFA labels shown under Resource Area Groupings were assigned by Energy Commission staff for purposes of clustering non-contigous DFAs and the numerical reference does not come from RESOLVE or the DRECP

[2] The megawatt values for resource areas may not match the values in RESOLVE because some megawatt values for solar energy were derived by assuming 7 acres per megawatt instead of using the solar resource value used in RESOLVE.

TABLE 3. IRP Default Scenario - RENEWABLES PORTFOLIO STANDARD (RPS) 50% PORTFOLIO - DETAIL FOR RESOLVE MODEL MW ASSIGNMENTS TO SUBSTATIONS

Resolve Transmission Zone	MWs by Zone	MWs in each Zone by Technology			Resource Area Groupings (Wind Repowers, Wind Resource Areas, DFA)[1]	MWs in each Subarea by Technology[2]							Substation Assignments		Notes
		Solar	Wind	Geothermal		Geothermal	Total MW Wind Area	Assigned MW Wind	Total MW Solar	Assigned MW Solar	Total Substation MW		Substation	Secondary Substations	
Central Valley / Los Banos	146	0	146	0	Wind 112		146	146			146		Los Banos		
Tehachapi	1166	1013	153	0	REPOWER Tehachapi		383	383			153		Highwind	Windhub	Tehachapi Tx Zone - Alternative: allocate both Wind and Solar MW proportionally between Windhub, Whirlwind and High Wind, based on avaialble capacity
					Wind 156		10	0							
					Wind 171		14	0							
					DFA_5				2821	627	627		Windhub		
					DFA_6				1737	386	386		Whirlwind	Windhub	
					DFA_7				16	0	0		Not Assigned (small areas)		
					DFA_8				7	0					
Kramer / Inyokern	978	978	0	0	DFA_1				5399	0	0		Inyokern		
					DFA_2				3403	778	778		Kramer		
					DFA_3				2184	100	100		Cottonwood		
					DFA_4				1428	100	100		Gale		
Mountain Pass / El Dorado	1197	1135	0	0											
California In-State		62			DFA_9				623	62	62		El Dorado	Ivanpah	DFA_9 - Allocate MWs to El Dorado (Nevada), or to Ivanpah or Mt. Pass (California)
														Mt. Pass	
CAISO - Nevada SW		1135			NV_SW QRA				1135	1135	OPTION 1	OPTION 2			
											592	528	Valley		
											134	173	Innovation		
											410	142	Vista		
												168	Desert View		
												123	El Dorado		

[1]The numerical DFA labels shown under Resource Area Groupings were assigned by Energy Commission staff for purposes of clustering non-contigous DFAs and the numerical reference does not come from RESOLVE or the DRECP

[2] The megawatt values for resource areas may not match the values in RESOLVE because some megawatt values for solar energy were derived by assuming 7 acres per megawatt instead of using the solar resource value used in RESOLVE.