RENEWABLE ENERGY TRANSMISSION INITIATIVE

PHASE 1B

FINAL REPORT

January 2009

Reflects changes from the December 17, 2008, Stakeholder Steering Committee meeting.

RETI Coordinating Committee

Prepared for

RETI Coordinating Committee
RETI Stakeholder Steering Committee

RETI-1000-2008-003-F

Report Organization:

I. Executive Summary
II. Economic Assessment of Competitive Renewable Energy Zones
III. Environmental Assessment of Competitive Renewable Energy Zone

I. Executive Summary

RETI Stakeholder Steering Committee

Renewable Energy Transmission Initiative

RETI Phase 1B – Executive Summary

FINAL REPORT

January 2009

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Preface

RETI is a collaborative stakeholder planning process initiated as a joint effort among the California Public Utilities Commission (CPUC), the California Energy Commission (Energy Commission), and the California Independent System Operator (CAISO), together with publicly owned and investor owned utilities. RETI's work is undertaken by a 29-member Stakeholder Steering Committee (SSC) that involves a broad range of participants[1], first to gather information and advice, and then to build active and consensus support for specific plans for renewable energy and related transmission development.

The ultimate goal of RETI's work is to identify major upgrades to California's electric transmission system needed to access competitive renewable energy zones (CREZs) sufficient to meet the state's energy targets. Phase 1 of this effort is to identify those CREZs that can be developed in the most cost effective and environmentally benign manner, as described in this report.

The Phase 1A report, accepted by the SSC on May 21, 2008, described the methodology, assumptions and resource information to be used in Phase 1B of RETI project.[2]

This Phase 1B Report is a high-level screening analysis that applies the resource valuation methodology developed in Phase 1A. Potential renewable energy projects have been grouped into CREZs based on geographical proximity, development timeframe, shared transmission constraints, and additive economic benefits. As described in this report, CREZs have been ranked according to cost effectiveness, environmental concerns, development and schedule certainty, and other factors to provide a renewable resource base case for California.

In Phase 2, the SSC will refine the analysis of CREZ generation potential, including project siting constraints, and will develop a statewide conceptual transmission plan. Phase 3 will advance this plan into proposals for specific transmission projects that can be approved, financed and built in order to provide renewable energy to customers across the state in the most cost-competitive and least environmentally harmful ways.

The requirement for new transmission facilities to meet California energy goals will be influenced by, among other things, future statewide electricity consumption and the deployment of generation technologies which do not require transmission, such as photovoltaic (PV) generation in urban areas. For purposes of transmission planning,

[1] For a list of SSC members, see http://www.energy.ca.gov/reti/steering/SSC_Member_List.pdf.
[2] The Phase 1A report is available at http://www.energy.ca.gov/2008publications/RETI-1000-2008-002/RETI-1000-2008-002-F.PDF. Note that this is a large file (9.9 megabytes.)

RETI uses projections of future electric energy consumption adopted by the California Energy Commission, and assumptions about deployment of new technologies as described in Sections 3.8 and 6.4 of this report. In future years these projections will be reassessed and transmission plans amended as appropriate.

California is moving assertively to deploy energy efficiency and clean distributed generating technologies, including PV in urban areas. But even optimistic assumptions about implementation of these technologies do not materially reduce the need for large-scale renewable generation.[3] Abandoning transmission planning for renewables in favor of much heavier reliance on energy efficiency and distributed generation greatly increases the risk of not being able to meet state policy goals by 2020. The RETI Stakeholder Steering Committee continues to believe that the projections used in this report provide a prudent basis for long-range transmission plans.

Introduction

California's Renewable Energy Transmission Initiative (RETI) has completed its preliminary assessment of Competitive Renewable Energy Zones (CREZs)[4] which can provide renewable energy for the state. The purpose of this assessment is to inform RETI decisions regarding major electric transmission projects needed to access this energy and deliver it to California consumers. This report to the Stakeholder Steering Committee describes the economic and environmental assessments of California CREZs and other renewable energy resources in the West which have been performed and the results.

The economic and environmental CREZ assessment methodologies have been previously reported.[5] This report provides a brief summary of those methodologies, describes recent modifications to them, and the results. This report also describes RETI planning for identifying needed transmission facilities.

The CREZ assessment process has been guided by a diverse group of stakeholders who have given generously of their time and expertise. This analysis is believed to be the most comprehensive ever undertaken, and the results will provide a robust basis for planning transmission connections to major renewable resource areas.

[3] Some comments received on the draft report claim projections used by RETI overstate the requirement for new transmission facilities.
[4] Previous RETI documents and other materials can be found on the RETI web site at http://www.energy.ca.gov/reti/index.html.
[5] Economic assumptions and assessment methodology are described in, "Renewable Energy Transmission Initiative Phase 1A Final Report," May 17, 2008; environmental assessment methodology is described in, "Interim Draft Phase 1B Report, August 15, 2008." Both reports are available at: www.energy.ca.gov/reti/documents/index.html.

Economic Assessment of CREZs

The economic assessment of renewable energy resources focused on California, with less detailed analysis of resources in Nevada, Arizona, the border region of Baja California, and the Pacific Northwest including British Columbia. It was performed by Black & Veatch with the assistance of the Phase 1B Working Group. Their work is described in detail in the chapter of this report entitled, "Economic Assessment of CREZs." Maps and other supporting materials are available on the RETI web site.

The economic assessment estimates the cost of developing renewable resources throughout these areas and transmitting the energy to California consumers. In addition, the assessment estimates the value of this energy by considering the time of day and capacity value of the resource (its contribution to system reliability). The difference between the estimated cost and value provides the basis for ranking the CREZs.

CREZ were identified based on density of resources in different areas, estimated cost of developing them, and shared transmission constraints. Using these considerations, Black & Veatch identified approximate geographic boundaries of each CREZ in California, as well as general areas within each CREZ deemed suitable for biomass, geothermal, solar and wind energy development.

CREZ identification respected areas specified by RETI's Environmental Working Group (EWG) as prohibiting or restricting energy development as a result of law and policies. Excluded areas are described in the chapter of this report entitled "Environmental Assessment of CREZs".

A CREZ may contain two types of projects: those known to be planned or proposed by renewable energy developers (referred to as "pre-identified" projects); and areas believed to be suitable for development but in which developers' interest is yet unknown (referred to as "proxy" projects).

An initial assessment identified resource areas sufficient to provide renewable energy far in excess of California's 2020 needs. At the direction of the Stakeholder Steering Committee, initial screening was performed to winnow the prospects to a more manageable number based on expected economic viability. As a result, 29 California CREZs capable of delivering total annual energy of approximately 200,000 gigawatt-hours per year (GWh/yr) were identified.[6] In addition, about 70,000 GWh/yr of smaller-scale non-CREZ resources were modeled in California. These included resources such as distribution-level solar photovoltaics and biomass projects which do not require large scale transmission upgrades. Finally, an additional 110,000 GWh/yr of resources were

[6] CREZ maps are available at: http://www.energy.ca.gov/reti/documents/index.html. One gigawatt-hour equals 1,000 megawatt-hours (MWh). Total California electric demand in 2007 was approximately 240,000 GWh in 2007.

identified in other states, British Columbia and Baja California Norte. While there are significantly more resources potentially available out-of-state, these resource were modeled as the most economically competitive for imports.

CREZ are ranked on the basis of the *weighted average* cost and value of all the projects in each CREZ. High cost projects raise the average cost assigned to a CREZ. Lower cost projects are thereby disadvantaged by their geographic association with higher cost projects. To counter this effect, six of the California CREZs were divided into two "sub-CREZs" and one was divided into three sub-CREZs for a total of 37 distinct areas in California. Out-of-state resources areas were also sub-divided to convey the range of costs in these regions.

The RETI renewable energy target is the amount of additional renewable energy needed to provide 33 percent of California's electric energy consumption in the year 2020. This value is referred to as the RETI "net short" and is estimated to be about 68,000 GWh/yr.[7] For purposes of identifying preferred California CREZs capable of supplying an adequate quantity of renewable energy for planning purposes, allowance has been made for uncertainties in the assessment, for the desirability of ensuring competition between developers of various technologies, and for the likelihood that some renewable energy will be imported from out of state. California CREZs with the best economic scores sufficient to supply about 100,000 GWh per year are shown in Table ES-1 below.

Table ES-1 provides the weighted average rank cost of each CREZ and sub-CREZ in California. The rank cost for a resource includes the cost of generation and transmission, less the capacity and energy value. At the request of the SSC, an alternative rank cost was also developed and is shown in the far right-hand side of the table. This rank cost excludes the capital cost of new transmission lines needed to access the CREZs. If this alternate rank cost were used to rank CREZs, the order of the CREZs in Table ES-1 would be slightly different.[8] Rank costs presented in the remainder of this Executive Summary include the transmission capital cost component unless otherwise indicated.

[7] It is important to note that the Net Short accounts for existing and under-construction resources, contributions from the California Solar Initiative, and the generation from smaller renewable resources not assessed in RETI Phase 1B, such as landfill gas, hydro, and marine energy. For more information, refer to the volume "Economic Assessment of Competitive Renewable Energy Zones."

[8] The alternate rank cost formulation was developed to demonstrate the effect that the capital cost of transmission has on CREZ rank costs. Transmission cost estimates at this early stage of analysis are known to have a large amount of uncertainty. The alternative rank cost shows that even if transmission capital costs were not considered in the assessment, there would be minimal impact on the CREZ rank order. For more information, including impacts on supply curves, refer to the volume "Economic Assessment of Competitive Renewable Energy Zones."

Table ES-1. Economic Ranking of California CREZs.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)*	
			Base Transmission Cost	No Transmission Capital Cost
Solano	2,721	2,721	-29	-29
Palm Springs	2,465	5,186	-20	-26
Victorville-A	2,112	7,298	-17	-21
Imperial North-A	10,095	17,393	-13	-13
Round Mountain-A	1,598	18,990	-11	-22
Fairmont	18,318	37,308	-9	-11
Tehachapi	25,091	62,400	-3	-9
Riverside East-A	2,339	64,739	3	3
Victorville-B	2,267	67,006	4	-2
Kramer	16,251	83,257	5	-3
Inyokern	7,136	90,393	8	-3
Owens Valley	3,433	93,826	10	-7
Twentynine Palms	1,944	95,769	15	3
San Bernardino - Lucerne	10,722	106,491	16	9

** The base transmission cost case (first column) includes all elements of the rank cost formulation as described in the economic assessment. The second column excludes the capital cost component of the transmission cost from the rank cost formula.

Economic assessment of CREZ depends on assumptions about generating technology costs and output characteristics, transmission costs, and the locational, seasonal and diurnal value of the electricity generated; and on assumptions about policy support and technology development. The SSC helped to develop, and agreed in general on the assumptions used, as described in the RETI Phase 1A Final Report. Despite this stakeholder agreement, many input assumptions remain inherently uncertain. Black & Veatch conducted an uncertainty analysis to illustrate the effects of different input cost assumptions. This analysis shows that different, but reasonable, assumptions about cost parameters may make some CREZ relatively more or less economically attractive. CREZ ranking as presented in Table ES-1 does not include the uncertainty bands discussed later in the report. CREZ economics will be evaluated in greater detail in RETI Phase 2.

As described in the Economic Assessment chapter of this report, Black & Veatch also conducted sensitivity analyses to illustrate the effect of different policies (e.g., extension or revocation of tax credits for renewable technologies), and of different technology costs (e.g., more rapid than expected cost reduction in solar photovoltaic thin-

film technologies). Tables summarizing CREZ rankings under different sensitivity scenarios are presented there.[9]

Transmission costs calculated by Black & Veatch and used in the Phase 1 economic ranking assume simultaneous delivery of the full nameplate generating capacity of every CREZ. This conservative approach, appropriate for a high-level screening analysis, likely overstates the amount and cost of the transmission facilities necessary to meet current state GHG and renewable energy goals. As agreed by the SSC in its Phase 1A Report, Black & Veatch treated major transmission projects in Southern California approved by the CAISO or publicly owned utilities as already built. Some generating projects in CREZs near these facilities thus were not assessed for a portion (or all) of their transmission route. Black & Veatch performed a sensitivity analysis in this Phase 1B Final Report to investigate the effect an assumption of such "free" transmission had on CREZ ranking, and found little effect (see Table 5-15, Economic Analysis Results – Full Transmission Cost Allocation). Since the transmission costs for the economic assessment of CREZs assumed electricity delivery only to the nearest load center, comments on the Draft Phase 1B Report questioned the economic assessment ratings of the Southern California CREZs since they do not include the transmission upgrade costs to deliver this electricity reliably to Northern California load centers. A more detailed analysis of transmission costs addressing all of these issues will be carried out in Phase 2, and the results used to re-rank CREZ as appropriate.

Results of the economic assessment and the environmental assessment described below are intended only to guide initial planning of the transmission facilities necessary to meet state renewable energy goals. The assessments are not intended to usurp local, state or federal project permitting authority, nor to impinge on the ability of renewable energy to be developed in other areas. Inclusion or omission of a resource area in a CREZ is not intended to prejudge the economic or environmental viability of any project. Any project, whether inside or outside a CREZ, may seek access to transmission capacity developed as a result of RETI or otherwise, consistent with market processes, transmission policy and permitting requirements.

[9] The sensitivity assessments include tax credits, energy value, capacity value, reduced solar costs, expanded geothermal potential, full allocation of transmission costs, and no transmission capital costs. Of these, the reduced solar cost sensitivity showed the most substantial variation from the base case. If substantial reductions in solar cost can be achieved, then both large scale solar resources and non-CREZ solar resources would benefit significantly. More information is provided in section 5 of the Economic Assessment.

Environmental Assessment of CREZs

At the direction of the SSC, the EWG assessed potential environmental concerns associated with CREZs identified by Black & Veatch and the renewable energy development areas within them. The EWG is chaired by the two environmental group representatives on the Stakeholder Steering Committee and involved active participation by a large number of stakeholders. Details of the EWG assessment and the results are described in the "Environmental Assessment of CREZs" chapter of this report.

The EWG identified areas in which energy development is prohibited or significantly restricted by law or policy.[10] CREZs identified by Black & Veatch were designed to be consistent with these restrictions.

Initial CREZ outlines were roughly drawn to surround identified development areas and associated connecting power lines, but these initial outlines were deemed to be unduly arbitrary and unnecessarily large for assessment purposes. In response, Black & Veatch shrank the outlines to the minimum area required to encompass the development areas and associated connecting transmission lines, a process referred to as "shrink-wrapping" the CREZ boundaries. These smaller and more focused outlines were the CREZ boundaries used by the EWG in its assessment. A two mile buffer zone was also identified for each CREZ, and the area of concern associated with transmission lines was extended one-half mile on both sides of the line.

Of the 37 California CREZs and sub-CREZs identified by Black & Veatch, only 30 of the most cost effective areas were assessed by the EWG due to technical reasons which could not be resolved in time for this report.

Environmental concerns are considerably more difficult to quantify than the factors used in the economic assessment. Nevertheless, some quantification of these concerns allows CREZs to be compared in a manner similar to economic ranking. The EWG assessment relies on publicly available data sources together with formulas which use the data to provide a numerical indication of the relative level of concern for each California CREZ for each of eight different criteria.

The numerical values are intended only to indicate relative levels of concern. Their relative magnitudes have been used for the limited purpose of comparing CREZs. Because these values are gross indicators of potential environmental concern rather than of actual environmental impacts, they should not be used for any other purpose.

Eight criteria were identified by the EWG for comparing the relative environmental sensitivity of the California CREZs, as described in Section 4 of the

[10] For a complete description of these laws and policies, see Section 2 of the Environmental Assessment chapter.

Environmental Assessment volume. In general, these criteria are designed to identify those CREZs which:

- disturb the least amount of land per unit of energy output, including land needed to collect and transmit that energy to the existing transmission grid;
- minimize potential conflicts with areas of special environmental concern;
- minimize potential impacts on wildlife and significant species; and
- maximize the use of previously disturbed lands.

In addition to the CREZ information provided by Black & Veatch, statewide datasets were identified to provide a quantitative basis for evaluating each of the eight criteria chosen by the EWG. The EWG devised formulas to translate the appropriate data for each CREZ into quantitative values, the magnitudes of which are indicators of the level of environmental concern associated with each CREZ and each criterion. Lower values given by the formulas are taken to represent relatively less concern. These values provide the basis for ranking CREZs according to relative levels of environmental concern.

Lack of data prevented inclusion of criteria to evaluate several environmental concerns, including visual impacts and effect of project development on cultural resources. The extent to which EWG formulas should express preference for development on disturbed land, and how such lands should be defined, remains problematic and controversial. For wind projects in particular, consensus could not be reached on how project footprint should be defined and applied in assessing their environmental effects.

The U.S. Department of Energy 20% Wind Vision report (May 2008) found that wind projects in the U.S. directly disturb on average 2.5%-5% of total project lease area for turbine tower foundations, access roads and substations.[11] The EWG used the midpoint of this range, 3.5% of total project area, in its criterion used to assess generating project footprint. At the same time, EWG formulas for two criteria intended to assess effect on sensitive species (in buffer areas around CREZ and on wildlife corridors) use the full lease area of wind projects. This is the first instance in which the environmental effect of wind projects has been characterized as proportional to the entire project lease area. The wind industry takes strong exception to such formulas, pointing to the lack of data and systematic study of such impacts. These formulas should not be considered to establish a precedent for evaluating wind project impacts.

Throughout the process of developing the criteria formulas and devising the ranking methodology, identities of the CREZs remained unknown to EWG participants.

[11] U.S. Department of Energy, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply,* May 12, 2008, p.110. Available at: http://www1.eere.energy.gov/windandhydro/

This anonymity was essential to preserve the objectivity of the results. Sensitivities have been performed with modified formulas and ranking methodologies to ensure that the results are robust against minor changes.

The eight ranking scores for each CREZ were then summed to provide a total ranking score of relative environmental concern for each CREZ. The best-scoring CREZs sufficient to provide nearly 100,000 GWh per year in the environmental assessment are identified in Table ES-2 below:

Table ES-2. Environmental Ranking of California CREZs.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Environmental Ranking Score
Imperial North-A	10,095	10,095	2.7
Twentynine Palms	1,944	12,038	2.8
Mountain Pass	6,942	18,980	3.9
Tehachapi	25,091	44,072	4.0
Fairmont	18,318	62,390	4.0
Pisgah-A	4,283	66,673	4.4
San Diego South	1,829	68,502	4.4
Imperial East	3,991	72,493	4.9
San Bernardino - Lucerne	10,722	83,215	4.9
Victorville-A	2,112	85,327	5.0
Iron Mountain	12,713	98,040	5.0

CREZs identified above are those in which EWG data and ranking methodology indicate that energy development may create fewer environmental concerns. Ranking scores are not intended to represent the level of concern in any individual project which may occur within a CREZ. The EWG CREZ ranking process is not intended in any way to prejudge or substitute for a thorough environmental review of proposed projects as required by the California Environmental Quality Act (CEQA) or the National Environmental Policy Act (NEPA).

Instead, incorporating environmental factors into CREZ ranking is intended to anticipate potential concerns associated with energy development and the transmission facilities needed to access these areas, thereby facilitating approval. CREZs able to be developed at the least economic cost and least environmental concern present the strongest case for approval of new transmission facilities.

Combined Assessment of CREZs

The economic and environmental CREZ ranking processes are based on two different concerns; the former attempts to minimize economic costs, while the latter attempts to minimize environmental concerns. Since the assessments are based on different metrics, it is impossible to develop a single formula for combining the two sets of results.

Nevertheless, the Stakeholder Steering Committee is faced with the task of recommending new major transmission facilities needed to access needed renewable energy. To assist them in this task, the combined results are displayed in Figure ES-1 below.

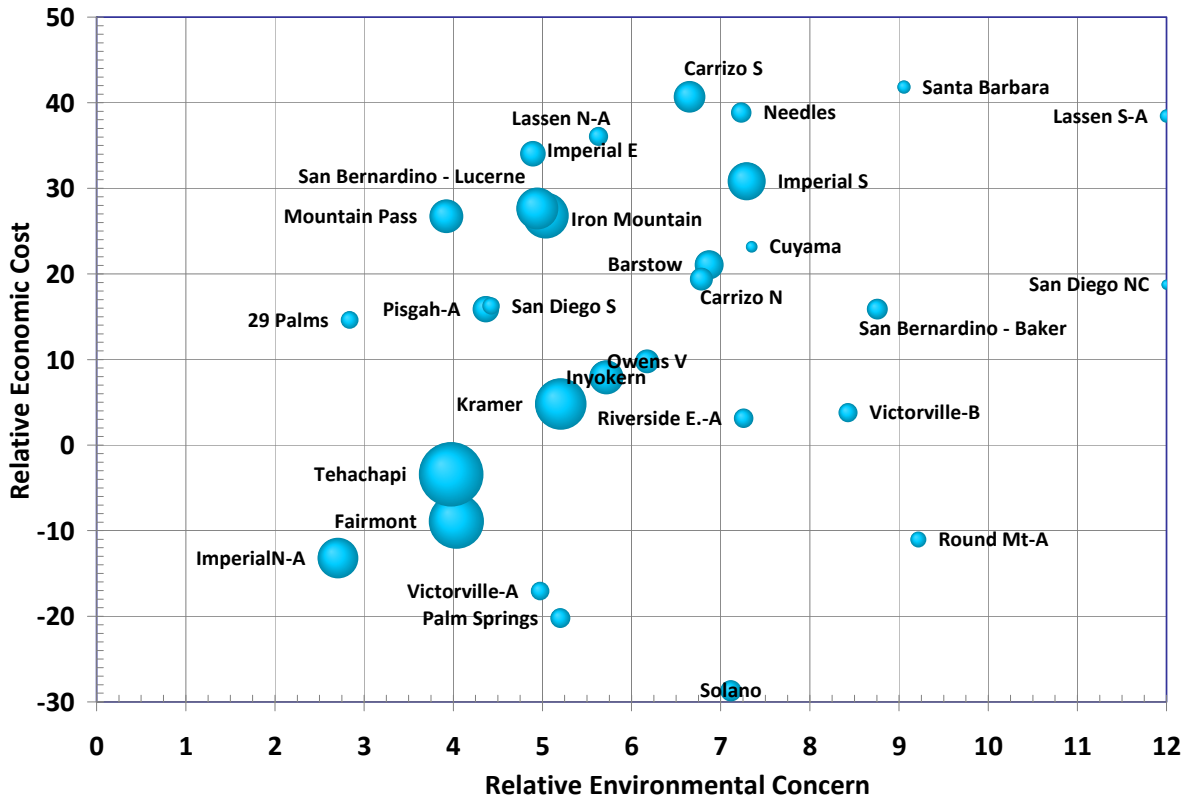

Figure ES-1. Economic and Environmental Assessment of California CREZs.
Circle size is proportional to CREZ energy potential (GWh/yr)

CREZs in the lower left section of the chart have the lowest (best) combination of economic and environmental ranking scores. These six CREZs have an estimated energy potential of 74,300 GWh/yr. It is noteworthy that three major transmission projects to access some of these areas are already being built or planned—the Tehachapi Renewable

Transmission Project, whose first phase is under construction by Southern California Edison, the Sunrise Powerlink proposed by SDG&E, and Green Path North proposed by Los Angeles Department of Water and Power.

The CREZs in the lower right have economic ranking scores as low (good) as those in the lower left but have higher (worse) environmental ranking scores. The six CREZs grouped in this section of the chart are all relatively small, having a total estimated energy potential of about 19,500 GWh/yr. The extent to which major new transmission facilities would be needed to access these areas is to be examined by the Stakeholder Steering Committee.

CREZs in the upper left have environmental ranking scores comparable to those in the lower left but have higher (worse) economic ranking scores. The four CREZs clustered in this section of the chart have an estimated energy potential of 23,900 GWh/yr.

CREZs in the upper right received relatively poor ranking scores in both assessments. These 14 CREZs have an estimated energy potential of 53,600 GWh/yr. Two of these had environmental ranking scores higher than 12 and are shown on the edge of the chart.

Some additional general features of the assessment results can be seen in Figure ES-1. CREZs receiving lower (better) environmental ranking scores—those on the left hand side of the chart—tend to have more energy potential than CREZs receiving higher scores. Evidently the criteria used by the EWG favor larger and more energetic resource areas.

A second observation is that only eight of the CREZs assessed would be interconnected to the northern section of the California transmission grid.[12] All of these CREZs have relatively high environmental scores and appear on the right side of the chart. Of these only two—Solano and Round Mountain—received relatively good economic scores and appear in the lower right quadrant. The total energy potential of all eight CREZs is less than 20,000 GWh/yr, only 11 percent of the total, reflecting the fact that a large majority of the remaining undeveloped California high-density renewable energy potential is found in Southern California.[13]

Renewable Resources Outside California

With the exception of Nevada geothermal resources (which are "points" by their nature), the CREZ identification and delineation process used by Black & Veatch for

[12] Carrizo North and South, Solano, Round Mountain, Santa Barbara, Cuyama, Lassen North and South.
[13] There are, however, significant biomass and solar photovoltaic resources in Northern California. These resources are generally distributed and do not require large transmission upgrades.

areas outside California was less detailed than that used for areas inside the state. In addition, the EWG was unable to obtain environmental data for out-of-state resources comparable to that available for California. As a result, the EWG was unable to assess out-of-state resources on a basis comparable to the assessment of California CREZs.

The absence of an environmental assessment for out-of-state renewable resources is not intended to indicate that these resources are unimportant. On the contrary, these resources are expected to play an important role in satisfying California's energy needs. The EWG will continue to search for sources of data and to develop a methodology which could be used to compare out-of-state resources to California CREZs for use by the SSC in transmission decisions.

Economically, there appear to be out-of-state resources that could justify the cost of new transmission construction and still be competitive with in-state California resources. An additional 110,000 GWh/yr of resources were identified in Arizona, Nevada, Oregon, Washington, British Columbia and Baja California Norte. Of these, about 15,000 GW/yr were considered competitive with California CREZs in the base case economic assessment, as summarized in Table ES-3.[14] These resources include wind and geothermal in British Columbia, geothermal in Oregon and Nevada, and wind resources in Baja California Norte. Wind resources in Mexico look particularly promising, and more study is recommended to refine the economic estimates and the environmental factors.

Table ES-3. Cost-Competitive Out-of-State Resources.

Region	Capacity (MW)	Annual Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Nevada	427	2,976	-21
Oregon	392	2,848	-19
Baja California Norte*	2,368	7,633	-11
British Columbia**	340	1,553	-9

Notes:

* Assessment of Baja wind resources in this project was preliminary. Evidence exists that additional resources may be cost effective, and this should be further explored in Phase 2.

** An additional 700 MW of resource (1040 MW total) is available at a relatively competitive cost of $5/MWh.

[14] Additional out-of-state resources are economic under certain sensitivity scenarios examined in the economic assessment.

Cost-competitive out-of-state resources are shown in relation to California CREZ resources on Figure ES-2 below. Because these resources have no environmental ranking, they are shown on the chart as lines rather than bubbles.

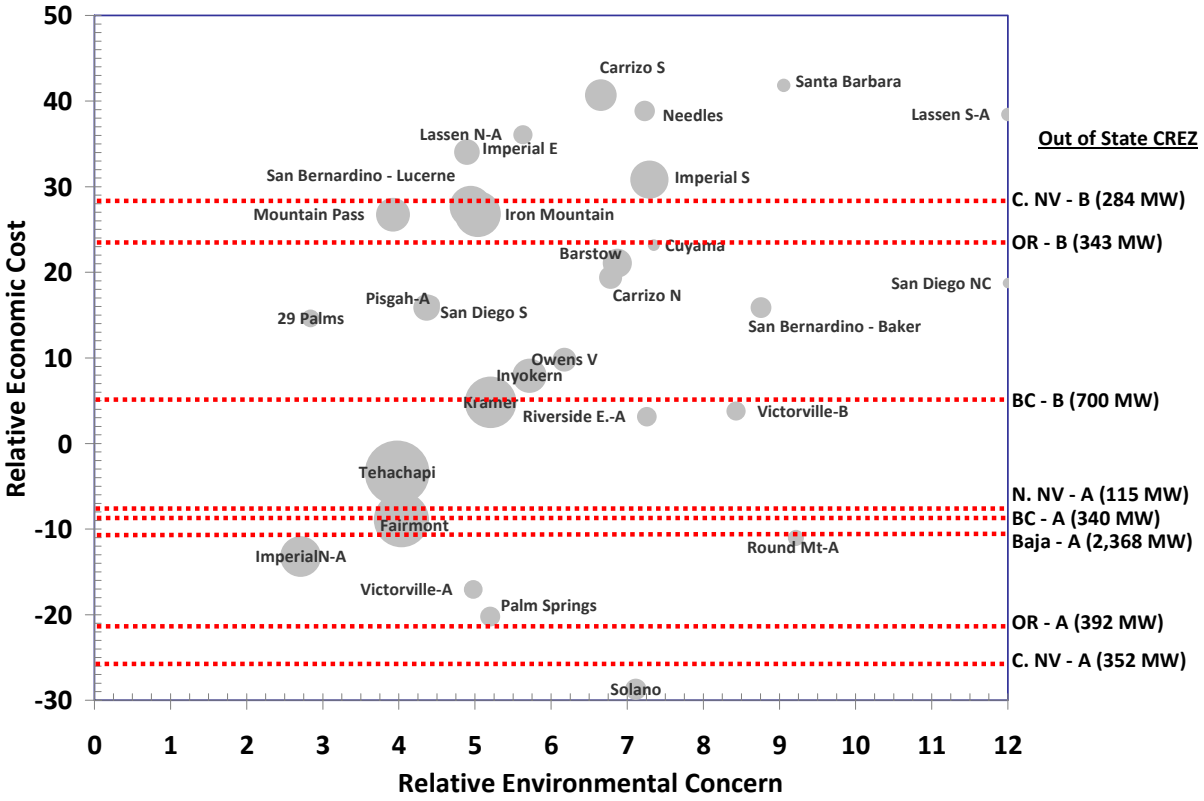

Figure ES-2. Economic Assessment of Out-of-State Resources.[15]

Comments Received on the Draft Phase 1B Report

The Draft Phase 1B Report was posted for comment on November 5, 2008 and presented to the public in a web meeting on November 12, 2008. Comments on the draft report were accepted through November 20, 2008. The RETI Stakeholder Steering Committee reviewed the draft in its November 14 and November 24 meetings.

The SSC reviewed all comments received in directing how the draft report should be revised into a Final Phase 1B Report as presented in this document.

Next Steps in the RETI Process

The CREZ identification and ranking contained in this report summarize the results of Phase 1 of the RETI initiative. The RETI SSC is expected to accept the Phase 1B Final Report at its meeting in December 2008.

[15] Additional out-of-state resources higher than $50/MWh in rank cost are not shown on this chart.

RETI Phase 2 work revolves around two main tasks: CREZ refinement; and conceptual transmission planning. The SSC has formed a CREZ Refinement Work Group to conduct detailed evaluation of identified CREZ, including on-the-ground assessments of permitting and project development feasibility. These assessments will confirm, or modify, the estimates of generation potential for each CREZ. CREZ boundaries may be adjusted as a result of this process, for example to avoid areas in which development appears infeasible, or make more extensive use of degraded lands. Since CREZ are intended to support major transmission upgrades, it is crucial that estimates of CREZ generation potential be as realistic as possible.

The SSC has also formed a Conceptual Transmission Planning Work Group to identify the most effective ways to connect CREZ to the statewide and WECC electric system, in ways that enhance the grid to make renewable power deliverable to consumers. The CAISO will coordinate this work, with active participation of both POU and IOU Load Serving Entities, renewable energy generators and environmental groups. Power flow modeling to evaluate the electrical effects of different conceptual connections will be performed by participating transmission owners. Phase 2 will not identify specific geographic transmission routes, but the RETI EWG will conduct a high-level environmental assessment of conceptual transmission routes.

CREZ refinement and conceptual transmission planning work in Phase 2, including more detailed evaluation of transmission costs, may change the initial economic and environmental assessments of CREZs presented in this report. As in Phase 1, the efforts of these two work groups will not usurp local, state or federal project permitting authority, nor impinge on the ability of renewable energy to be developed in areas outside CREZ. Inclusion or omission of a resource area in a CREZ is not intended to pre-judge the economic or environmental viability of any project.

Phase 2 is expected to conclude in the second quarter of 2009, with completion of a statewide conceptual transmission plan capable of accessing renewable resources in the most cost-competitive and least environmentally harmful way. Phase 2 results will be incorporated into the CAISO 2009 Transmission Planning Process for detailed engineering evaluation.

In Phase 3, RETI stakeholders will then work with publicly- and privately-owned utilities and the CAISO to translate conceptual transmission plans into detailed plans of service for commercial transmission projects that can be presented to the CPUC, POU governing boards and City Councils for approval.

II. Economic Assessment of Competitive Renewable Energy Zones

RETI Stakeholder Steering Committee

Renewable Energy Transmission Initiative

RETI Phase 1B – Economic Analysis of Competitive Renewable Energy Zones

FINAL REPORT
B&V Project Number 149148

Contract Manager

University of California, Office of the President
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1.0 Summary

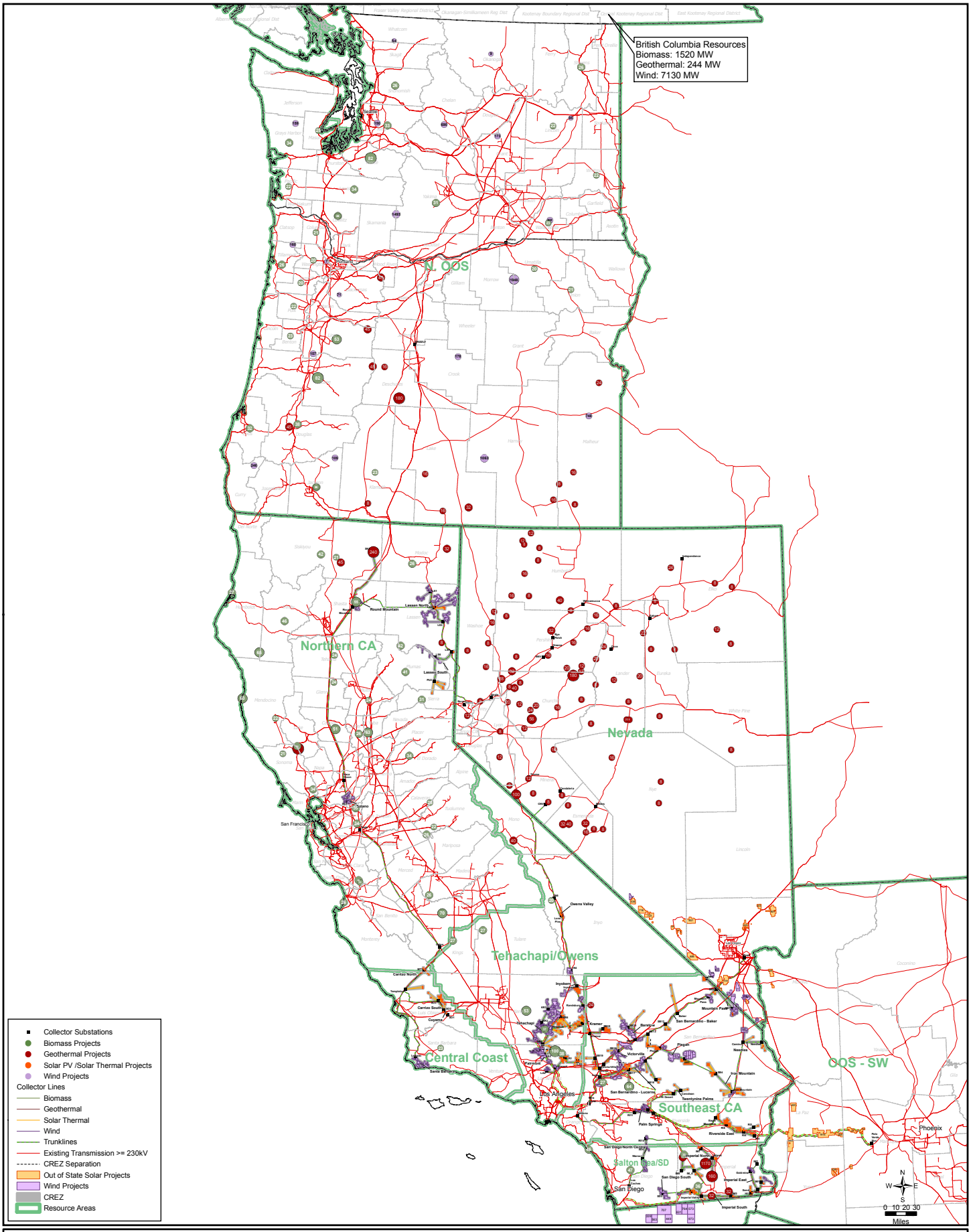
Black & Veatch is pleased to provide this Final Report on the Phase 1B activities of the California Renewable Energy Transmission Initiative (RETI) to the Stakeholder Steering Committee (SSC). This report includes the identification and economic analysis of renewable energy zones, resource areas and discrete renewable projects that may assist California in achieving its renewable energy goals. Additionally, this report identifies and characterizes the individual renewable resources evaluated in the RETI project.

This report is the final Black & Veatch deliverable for the Phase 1 portion of the RETI. In May 2008 the SSC accepted the RETI Phase 1A Report on study methodology, resources and economic assumptions, as well as the methodology to identify and value resources to be included in RETI analyses. In August, 2008 Black & Veatch provided the Draft Resource Report as in interim deliverable for the Phase 1B portion of RETI. That report identified potential resources to be used in the RETI analysis. This report, which replaces the Draft Resource Report, details the resources that were used in the RETI analysis and provides the economic valuation and ranking of Competitive Renewable Energy Zone (CREZ) areas in California and out-of-state resource areas with the potential to deliver renewable energy to meet California Renewable Portfolio Standard requirements.

This report is released in conjunction with an environmental ranking of the CREZs prepared by the RETI Environmental Working Group (EWG). The two reports are designed to provide the SSC the technical information necessary for the SSC to recommend transmission requirements to be considered in Phase 2 of RETI.

1.1 Identification and Ranking of Competitive Renewable Energy Zones and Resource Areas

RETI identified over 80,000 MW of potential renewable resources within 29 CREZs in California, and 40,000 MW located outside of California with the potential to deliver energy to California. Additionally, RETI identified over 25,000 MW of non-CREZ resources in California. The overwhelming majority of this non-CREZ capacity comes from distributed photovoltaic (PV) systems, as well as smaller stand-alone projects (such as biomass) that do not need large-scale transmission upgrades. For discussion purposes, CREZs, stand-alone projects and out-of-state resources have been aggregated into seven Resource Areas. Figure 1-1 depicts the resources and CREZs that are included within each resource area.



Disclaimer:
These maps are for transmission planning only and not for project siting.

Resource Map

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RETI - Phase 1B Resource Maps.mxd = Nov. 13, 2008 = C.Holmgren

1.2 California CREZ Economic Rank Cost and Supply Curve

Using the criteria developed and approved by the SSC, Black & Veatch has developed an economic ranking of the 29 identified CREZs. Within seven of these CREZs, Black & Veatch identified and characterized "sub-CREZs," or sets of projects that share common transmission, development timeframe and similar economics. Defining sub-CREZs allows for the development of a supply curve of resources within a CREZ, providing the SSC with finer granularity of the potential cost and development of resources within a CREZ. Table 1-1 provides the weighted average ranking cost of each CREZ and sub-CREZ in California. The rank cost for a resource includes the cost of generation and transmission, less the capacity and energy value.[1] At the request of the SSC, an alternative rank cost was also developed and is shown in the far right-hand side of the table. This rank cost excludes the capital cost of new transmission lines needed to access the CREZs. If this alternate rank cost were used to rank CREZs, the order of the CREZs in Table 1-1 would be slightly different.[2]

CREZ rankings as presented in Table 1-1 and the figures in this Summary do not include the uncertainty bands discussed later in this report.

The RETI analysis shows the need ("net short") for approximately 68,000 GWh/yr of renewable generation in 2020. To meet this need with only CREZ resources in California, the first ten CREZs in Table 1-1 would be required (using the base case transmission cost assumption). These CREZs are:

- Solano
- Palm Springs
- Victorville-A
- Imperial North-A
- Round Mountain-A
- Fairmont
- Tehachapi
- Riverside East-A
- Victorville-B
- Kramer

[1] All dollar amounts in this report are in 2009 dollars, unless otherwise stated. Further, unless otherwise stated, all economic figures in this report represent the midpoint of a range of costs, as discussed further in the uncertainty analysis in Section 5.

[2] The alternate rank cost formulation was developed to demonstrate the effect that the capital cost of transmission has on CREZ rank costs. Transmission cost estimates at this early stage of analysis are known to have a large amount of uncertainty. The alternative rank cost shows that even if transmission capital costs were not considered in the assessment, there would be minimal impact on the CREZ rank order.

Table 1-1. Weighted Average CREZ Rank Costs.

CREZ Name	Net Capacity (MW)	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh) *	
				Base Trans. Cost	No Trans. Cap. Cost
Solano	894	2,721	2,721	-29	-29
Palm Springs	770	2,465	5,186	-20	-26
Victorville-A	800	2,112	7,298	-17	-21
Imperial North-A	1,370	10,095	17,393	-13	-13
Round Mountain-A	240	1,598	18,990	-11	-22
Fairmont	6,918	18,318	37,308	-9	-11
Tehachapi	9,642	25,091	62,400	-3	-9
Riverside East-A	1,000	2,339	64,739	3	3
Victorville-B	895	2,267	67,006	4	-2
Kramer	6,627	16,251	83,257	5	-3
Inyokern	2,887	7,136	90,393	8	-3
Owens Valley	1,400	3,433	93,826	10	-7
Lassen South-A	1,000	3,010	96,836	14	3
Twentynine Palms	800	1,944	98,779	15	9
San Bernardino - Lucerne	4,290	10,722	109,501	16	7
Pisgah-A	1,800	4,283	113,785	16	-1
San Diego South	678	1,829	115,614	16	12
San Diego North Central	281	702	116,316	19	15
Carrizo North	1,600	3,225	119,541	19	11
Barstow	2,136	5,106	124,647	21	8
Lassen North-A	333	982	125,629	22	12
Riverside East-B	6,800	15,552	141,181	22	16
Cuyama	400	847	142,028	24	8
Pisgah-B	3,790	8,844	150,872	27	11
Mountain Pass	2,878	6,942	157,814	27	14
Iron Mountain	5,662	12,713	170,527	27	13
San Bernardino - Baker	1,200	2,705	173,232	28	23
Imperial North-B	1,830	4,282	177,514	29	14
Victorville-C	340	860	178,373	29	12
Imperial South	3,745	8,776	187,149	31	16
Imperial East	1,723	3,991	191,140	34	28
Round Mountain-B	187	705	191,845	38	14
Needles	1,061	2,517	194,361	39	17
Carrizo South	3,000	6,118	200,480	41	18
Santa Barbara	433	1,121	201,601	43	13
Lassen South-B	1,200	2,379	203,980	48	14
Lassen North-B	2,001	4,140	208,119	49	25

* The base transmission cost case (first column) includes all elements of the rank cost formulation as described in this report. The second column excludes the capital cost component of the transmission cost from the rank cost formula.

These CREZs represent the most cost-effective large scale resources in the state. The resources include geothermal, wind, and solar resources throughout the state, though the overwhelming majority of these resources are located in southern California, specifically in the Tehachapi Mountains, Salton Sea area of Imperial County, and the Mohave Desert. Southern California resources rank highly due to the quality of solar resource and the assumed transmission availability in these areas.[3]

There are relatively few cost-competitive resources located in northern California, as the solar and wind resource in northern California is poor relative to southern California. Additionally, northern California resources tend to be located in isolated areas way from the bulk transmission system, and the cost to interconnect these resources to the grid contributes to the poor economics.

Figure 1-2 depicts the California CREZs that are available to meet the net short requirement by cost and resource quantity. This figure depicts the rank cost with the base case transmission cost assumption. This figure shows that California has sufficient resource to meet its renewable energy goals, albeit at increasingly higher costs of development. This figure also includes out-of-state resources for comparison. Some of these resources may be cost competitive with California CREZs, as discussed further in the next section.

Figure 1-3 depicts the same information as Figure 1-2 except the transmission capital cost component has been removed from the rank cost formulation. While the apparent rank costs of nearly all CREZs/resource areas would fall if no transmission costs were assumed, the only resource area that would shift into the top ten CREZs/resource areas would be the British Columbia-B resource. British Columbia resources areas are the furthest away of all resources studied in this project. This scenario is discussed further in Section B of this report.

Rank costs presented in the remainder of this report include the transmission capital cost component unless otherwise indicated.

[3] Discussed in Section 3, RETI assumed CAISO-approved and publicly-owned utility (POU) approved transmission would be constructed, including Southern California Edison's Tehachapi and Devers-Palo Verde 2 lines, San Diego Gas & Electric's Sunrise Project, and Imperial Irrigation District's / Los Angeles Department of Water and Power's Green Path line. The capital costs for this transmission were assumed to be included in utility transmission rates, and were not considered as an incremental cost to the resources interconnecting to this transmission.

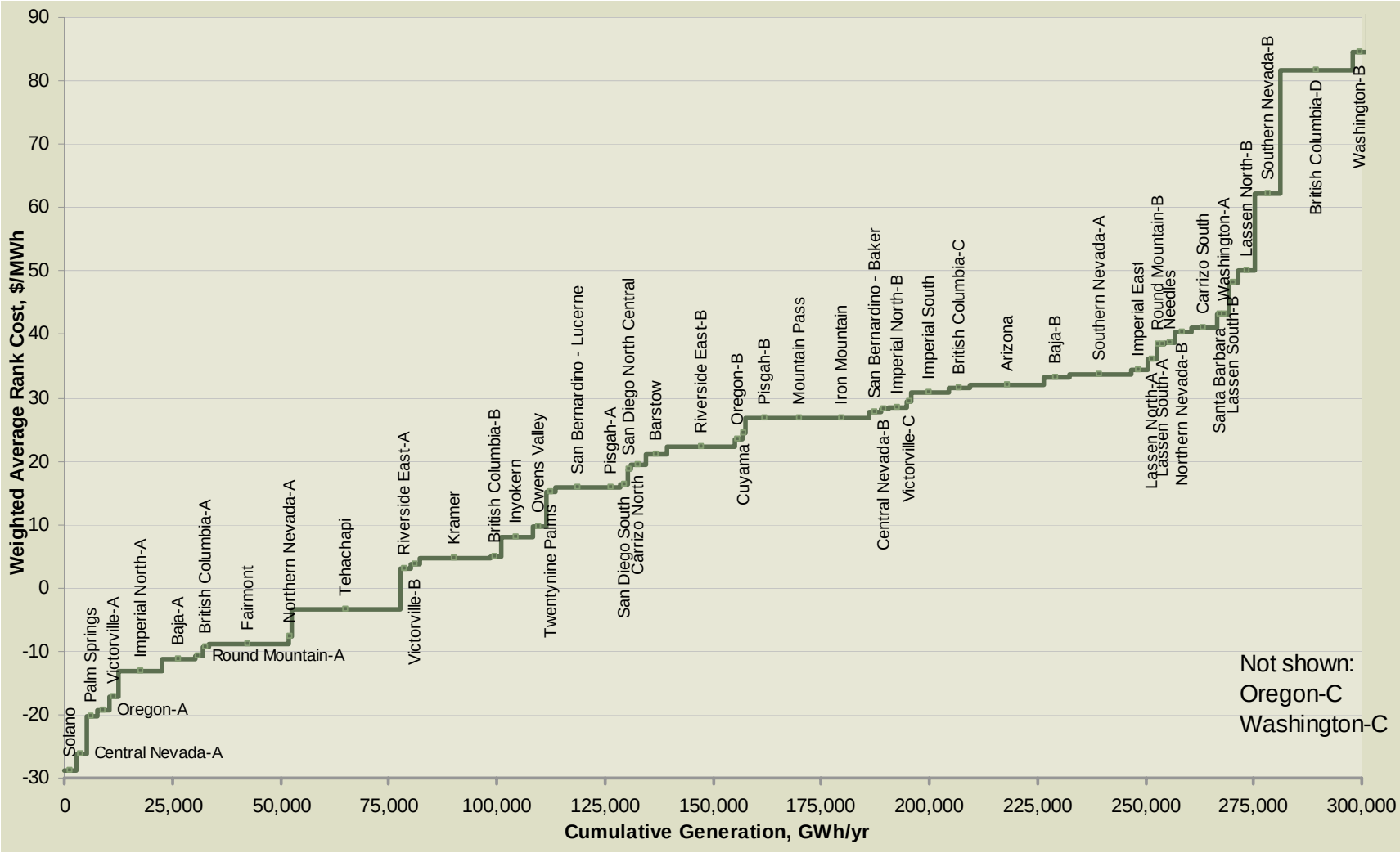


Figure 1-2. Weighted Average Rank Cost ($/MWh) for CREZ and Resource Areas.

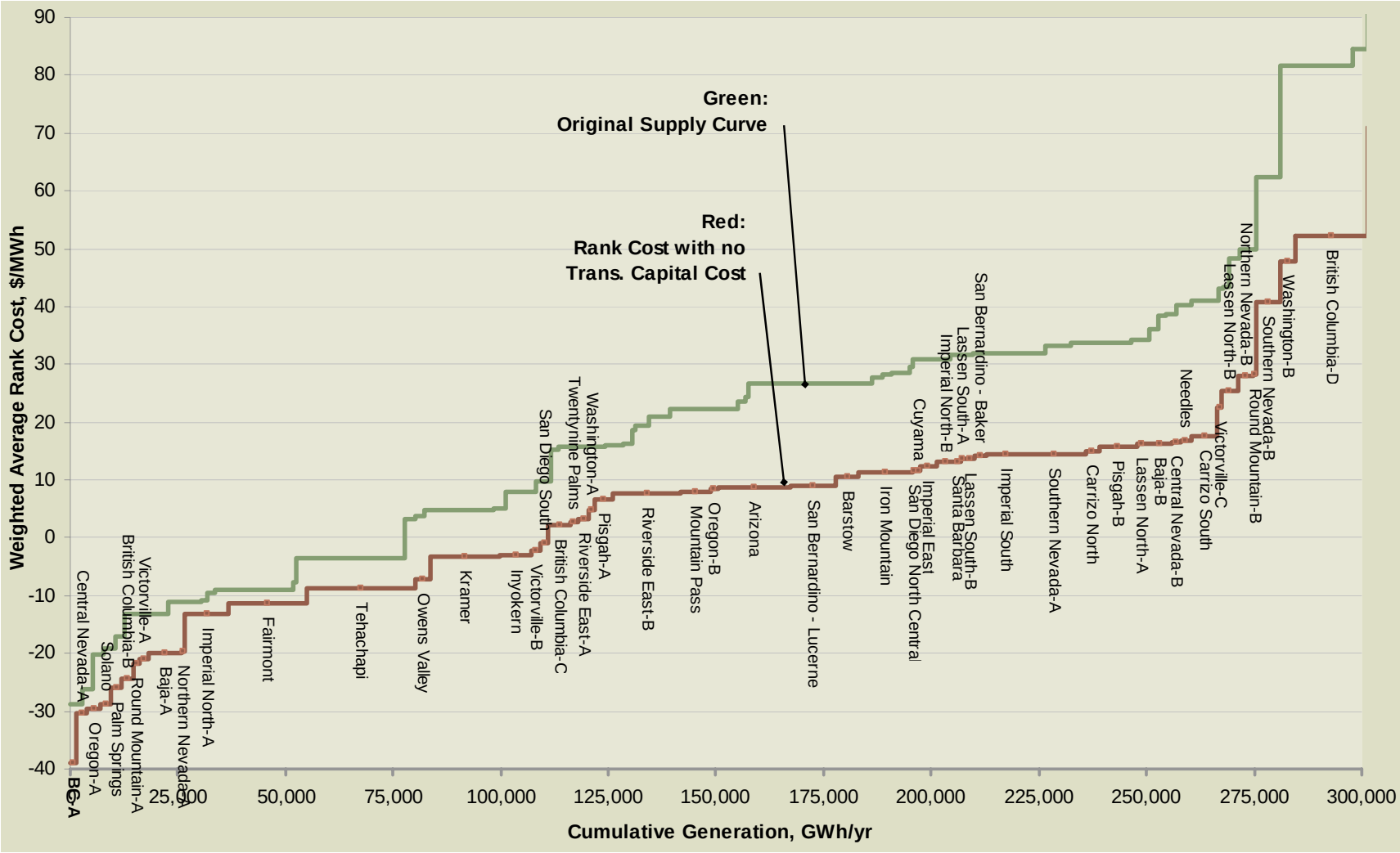


Figure 1-3. Impact of Removing Transmission Capital Cost from all Resources (in Ascending Order).

1.3 Economics of Out-of-State Resources

In addition to the California CREZs, there appear to be out-of-state resources that could justify the cost of new transmission construction and still be competitive with in-state California resources. RETI identified over 40,000 MW of potential resources out-of-state, with generation potential of approximately 110,000 GWh/yr. Resources were identified in Arizona, Nevada, Oregon, Washington, British Columbia, Canada (B.C.) and Baja California Norte, Mexico ("Baja"). Of these, about 15,000 GW/yr were modeled to be competitive with California CREZs, as summarized on Table 1-2. These resources include wind and geothermal in B.C, geothermal in Oregon and Nevada, and wind resources in Baja. Wind resources in Mexico look particularly promising, and more study is recommended to refine the economic estimates and the environmental factors.

In addition to the base case economic assessment, several sensitivity investigations were performed that included out-of-state resources. The result of these studies was that there could be scenarios where almost double the capacity shown in Table 1-2 could be cost competitive.

Table 1-2. Base Case Cost-Competitive Out-of-State Resources.

Region	Capacity (MW)	Annual Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Nevada	427	2,976	-21
Oregon	392	2,848	-19
Baja California Norte*	2,368	7,633	-11
British Columbia**	340	1,553	-9

Notes:

* Assessment of Baja wind resources in this project was preliminary. Evidence exists that additional resources may be cost effective, and this should be further explored in Phase 2.

** An additional 700 MW of resource (1040 MW total) is available at a relatively competitive cost of $5/MWh.

1.4 Economics of Non-CREZ Resources

As with out-of-state resources, there are several non-CREZ resources (areas less than 250 MW) that are cost competitive and may be used to serve California's energy requirements and satisfy the RPS goals. About 70,000 GWh/yr of smaller-scale non-CREZ resources were modeled in California, the majority of which were 20 MW solar

PV projects. Most biomass projects are also not within CREZs, as they are generally smaller and can be sited to take advantage of existing transmission infrastructure. Many of the non-CREZ resources are located in northern California.

Resources that are not reliant on large-scale transmission planning to be integrated into the system may be able to be brought on-line faster and at lower cost than CREZ resources that are reliant on such transmission.

Of the non-CREZ resources, a total of seven wind and geothermal projects were considered competitive with California CREZs in the base case. These projects total about 430 MW and 2,200 GWh/yr of annual generation. This is a relatively small fraction of the total supply needed to meet California's RPS. Because of the uncertainty of the costs and timing for the large scale transmission needed to reach CREZs, it is very likely that significantly more than 430 MW of non-CREZ resources will be developed in California.

1.5 Uncertainty and Sensitivity Analysis

It is very important to consider the uncertainty in the estimates used to quantify and value resources. By their very nature, these estimates include a margin of error due to the assumptions made by the RETI team. In addition to general uncertainty, there are wide variety of plausible future scenarios which may affect the modeling results and the ranking of the CREZs. An uncertainty and sensitivity assessment was carried out to identify which CREZs and resources areas might be economically viable under certain situations. As a result of this assessment it was found that the following CREZs and resource areas could be cost-competitive under certain scenarios[4]:

- Twentynine Palms
- San Bernardino - Lucerne
- Pisgah-A
- San Diego South
- San Diego North Central
- Carrizo North
- Lassen North-A
- Lassen South-A
- Santa Barbara
- Victorville-C

[4] This list includes CREZs identified by the sensitivity analysis to be potentially cost competitive. If the full range of the uncertainty bands is considered, nearly every CREZ and resource area is potentially cost competitive under certain scenarios. For example, if costs have been significantly overestimated only for high cost resources, they may be cost competitive with lower cost resources.

- Round Mountain-B

In addition, a sensitivity assessment of reduced solar costs was performed with significant implications. The sensitivity study used thin-film manufacturer cost targets as the basis for the solar capital cost. This assessment indicated that the costs for the large-scale solar CREZs would drop significantly. Figure 1-4 shows how the resource supply curve would be impacted by assuming lower costs for solar deployment. Another significant conclusion from the sensitivity study is that large amounts of distributed non-CREZ solar PV resources could be economic. The cost-competitive non-CREZ resources increase to about 45,000 GWh/yr, over two-thirds of the net short requirement. It is important to note that the non-CREZ resources were assumed to be connected to smaller substations on the 50-200 kV transmission system. Large scale deployment of hundreds of such systems would likely require system upgrades and reinforcements; however, this was beyond the scope of this study.

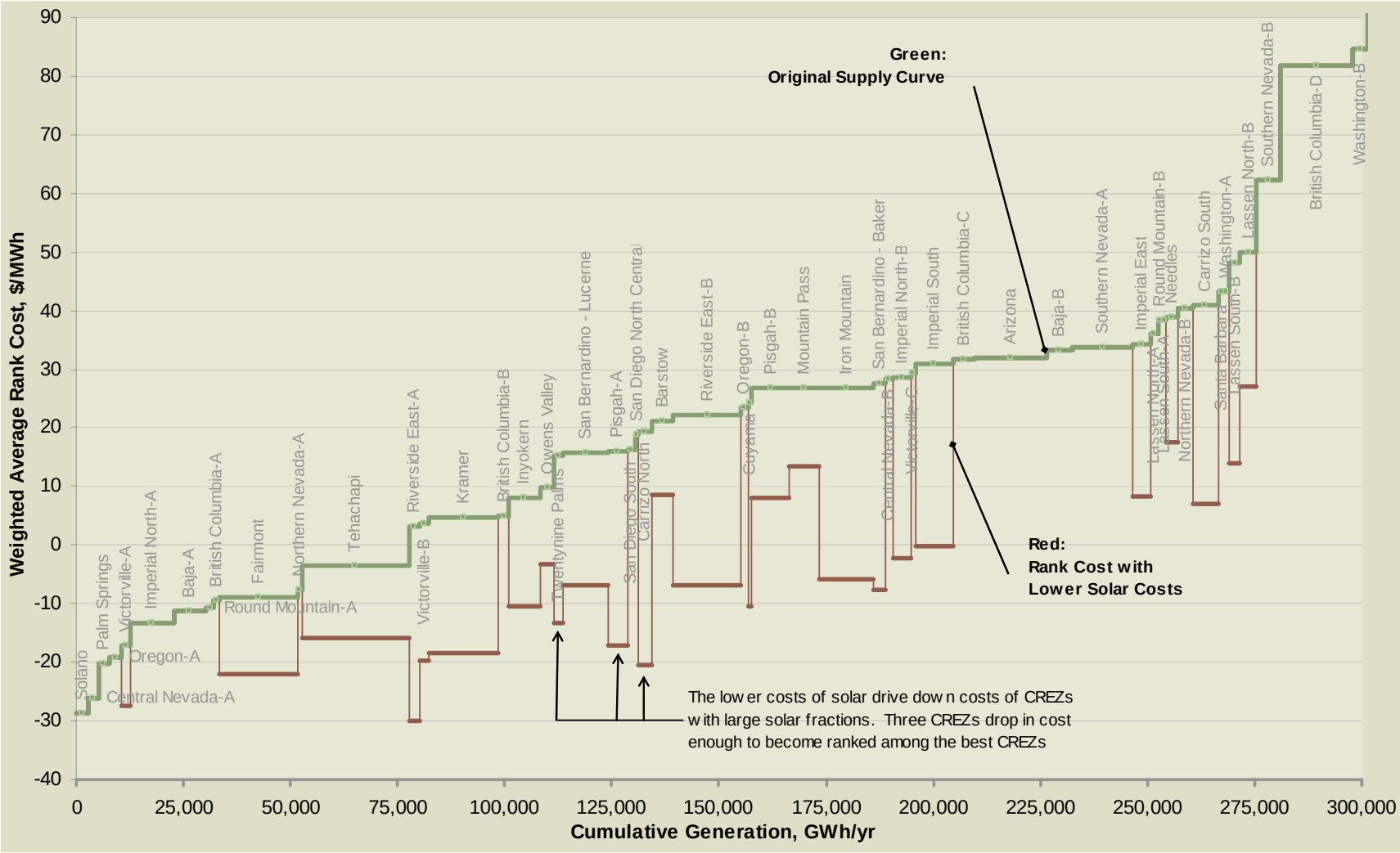


Figure 1-4. Effect of Reduced Solar Costs on CREZ Supply Curve.

Note that this figure does not show the reduced output (generation, GWh) of thin film solar PV. It is intended to just highlight the potential cost savings.

1.6 Summary of Renewable Energy Resources

This report identifies and characterizes over 2,100 individual projects. Black & Veatch initially identified over 3,600 projects, with a total capacity of over 500 GW, which were detailed in August 2008 Phase 1B Draft Resource Report. Based on recommendations by the SSC, Black & Veatch culled this list using economic screens to focus the analysis to the most economically developable resources. Table 1-3 presents a summary of resources by type and resource area. Individual resource identification and characteristics are included in Appendix D.

Table 1-3. RETI Resource Summary by Resource Area

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Central Coast	23		920	5,000	509	6,452
Northern CA	1,150	460	16,480	2,400	3,518	24,008
Salton Sea/SD	159	1,434	1,640	7,000	1,128	11,361
Southeast CA	91		4,020	29,000	5,579	38,690
Tehachapi/Owens	302	24	4,400	21,800	5,474	32,000
N. OOS[c]	2,423	764			15,080	18,267
Nevada		1,283		7,429	1,475	10,186
OOS – SW[d]			40	7,129	5,000	12,169
Total	**4,148**	**3,965**	**27,500**	**79,758**	**38,020**	**153,390**
Generation (GWh/yr)						
Central Coast	159		2,046	10,727	1,410	14,342
Northern CA	8,060	3,381	33,951	4,858	9,889	60
Salton Sea/SD	1,112	11,074	3,785	16,580	3,121	35,673
Southeast CA	638		9,215	70,621	15,571	96,046
Tehachapi/Owens	2,118	168	9,683	56,428	16,102	84,500
N. OOS	16,980	5,827			37,427	60,234
Nevada		9,165		17,761	3,203	30,130
OOS – SW			95	17,722	14,449	32,266
Total	**29,068**	**29,616**	**58,775**	**194,698**	**102,497**	**414,653**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] North out-of-state = Oregon, Washington, British Columbia.

[d] Southwest out-of-state = Arizona and Baja.

1.7 Use and Purpose of this Report

This report is intended to provide the SSC the economic ranking and valuation of California CREZs and the economic valuation for non-CREZ resources located within and outside of California. This information, coupled with the EWG analysis of the California CREZs, will assist the SSC in developing recommendations for transmission projects to access renewable resources in Phase 2 of RETI.

1.8 Recommended Phase 2 Issues

During the Phase 1 analysis Black & Veatch encountered numerous issues that it recommends be further explored in Phase 2. These are discussed further in this section.

RETI is intended to be a long-term and dynamic process designed to identify promising renewable resources for California and the transmission to access these resources. The information included in this Phase1B report is designed to provide RETI participants and stakeholders with the best available economic analysis of currently-known resources. The Phase 1B report includes a base case and several scenario analyses designed to reflect a plausible range of potential future scenarios. In subsequent phases, RETI is anticipated to be adapted to eliminate resources and areas with limited potential and to incorporate new information on resources, requirements, economics and other significant factors as it becomes available. The RETI analysis will be tailored in the future to meet the needs of the time.

There is a plethora of potential alternative assumptions, sensitivities, and analytical approaches that could be used in the RETI process, both in this phase and future phases. There is no single "correct" approach to conducting such a broad economic assessment. Comments on the report identified several areas where alternative methodologies may be considered in the future, and others identified critical assumptions that may need to be reviewed as they have substantial impact on the analysis results. Highlight below are several of the areas where alternative assumptions and approaches may ultimately result in different resource rankings.

1.8.1 Transmission Methodology

RETI employed an incremental transmission cost approach, adding transmission capacity to deliver all energy identified within in a CREZ to a designated major load area. This incremental cost approach includes the aggregate cost of transmission lines, substations and ancillary facilities, taking into account line losses and variable costs. RETI Phase 1 added transmission capacity to transmit renewable energy based on potential generator production. No load-flow analyses were conducted, nor were potential reliability benefits of new transmission considered in the transmission costs. In

addition, regional transmission benefits and potential cost sharing (such as with out-of-state utilities) were not captured in the analysis.

The advantage to using the incremental facility approach in RETI is that it identifies, quantifies and costs specific transmission facilities required to deliver a quantity of energy to the grid and to load areas. Alternative approaches, such as a simple percentage of resource cost or estimating a flat dollar-per-MW-mile, will provide for a transmission cost but do not adequately account for the cost of transmission based on distance from generation site to delivery point. A limitation to this approach is that it may not mirror the development of transmission, even among the same resources identified in RETI. Transmission lines will likely be added to the California grid to not only interconnect specific renewable resources to a specific load area, but to enhance reliability and reinforce the transmission system in total. This level of analysis can only be completed by conducting comprehensive load-flow modeling, which is the focus of the RETI Phase 2 effort.

The relative costs of CREZs may change when a more accurate transmission system cost assessment is complete. This assessment would include the potential to serve multiple zones and balancing areas as opposed to the incremental approach taken in Phase 1B.

1.8.2 Capacity Costs and Integration Costs

To value the capacity of renewable resources RETI used an assumption developed by the California Energy Commission in their cost of generation analysis that the installed cost of a fully dispatchable combustion turbine is $204/kW-year. This assumption was agreed to among the Phase 1A working group in Spring 2008 and used in the resource valuation and rank cost calculation used in RETI. To understand the sensitivity of the resources and CREZs to changes in the capacity value, Black & Veatch conducted a sensitivity analysis assuming the capital cost of a CT was half of the cost identified by the CEC.

The appropriate method to value capacity from resources is hotly debated. One could argue that to the extent that a renewable resource results in avoiding the development of conventional resources, the total cost of developing that generation is part of the capacity value. This “raw” capacity value is equal to the capital cost of the avoided resource. This value does not however, consider the market revenues of energy generation when dispatching that resource. Arguably, one would only build generation with the intention of using it at least partly to serve demand, and the revenues earned from selling energy from the facility when it is infra-marginal should be considered when valuing the capacity benefit of the resource. In this case the value of capacity is the

inferred value between the total cost of the resource less the market revenues earned by the resource. Appropriate capacity valuation methods should be explored further in the next phase of RETI.

In addition to capacity value, integration costs have not yet been included in the RETI analysis. As information is developed on appropriate assumptions to use for the cost to integrate intermittent wind and solar resources, these should be included in the RETI analysis.

1.8.3 Baja California Norte Wind Resources

Black & Veatch conducted resource assessments for all resources areas located in the United States. Due to limited available public information, Black & Veatch relied on a variety of primary and secondary sources of information to assess the developable potential of renewable resources in these regions. Based on CAISO queue applications, Black & Veatch identified approximately 5,000 MW of developable wind potential in Baja. Comments were received that this substantially understates the resource potential of the region.

Upon further review Black & Veatch identified a technical potential of approximately 25,000 MW of wind resources, though this estimate has no consideration for development constraints. Further analysis is required to determine the developable potential to result in an estimate consistent with those developed for American locations, factoring in environmental constraints, infrastructure requirements (for example, roads and transmission ROW) and development costs.

1.8.4 Project Identification Limitations

Black & Veatch conducted resource assessments and project identification for all resource areas to assess the developable potential of renewable resources in these regions. The assessment is based on the best available public information on resource potential; however, Phase 1 was not a detailed siting investigation. There are known issues with certain CREZs such as land ownership fragmentation that should be further investigated in Phase 2.

To insure that RETI includes the best available data in future phases, Black & Veatch recommends that project development and resource assessments be continuously monitored and the RETI dataset be refreshed to insure that it includes the broadest set of viable and developable projects.

2.0 Introduction

The objective of this report is to economically rank California CREZs and non-CREZ resources in and outside of California for the California Renewable Energy Transmission Initiative project. Additionally, this report identifies and details the individual renewable resources that were used in the RETI analysis. This section provides a brief background and overview of this report.

2.1 Background

This report is the final Black & Veatch deliverable for the Phase 1 portion of the RETI initiative. In May 2008, the SSC accepted the RETI Phase 1A Report on study methodology, resources and economic assumptions, as well as the methodology to identify and value resources to be included in RETI analyses. In August, 2008 Black & Veatch prepared a Draft Resource Report as an interim deliverable for the Phase 1B portion of RETI. This report details the economic valuation of Competitive Renewable Energy Zones (CREZ), resource areas and individual non-CREZ resources. This report also includes identification and characterization of all of the resources used in the final RETI analysis.

This report is released in conjunction with an environmental ranking of the CREZs prepared by the Environmental Working Group. Figure 2-1 shows the relationship of the material in this report to the overall RETI Phase 1 process.

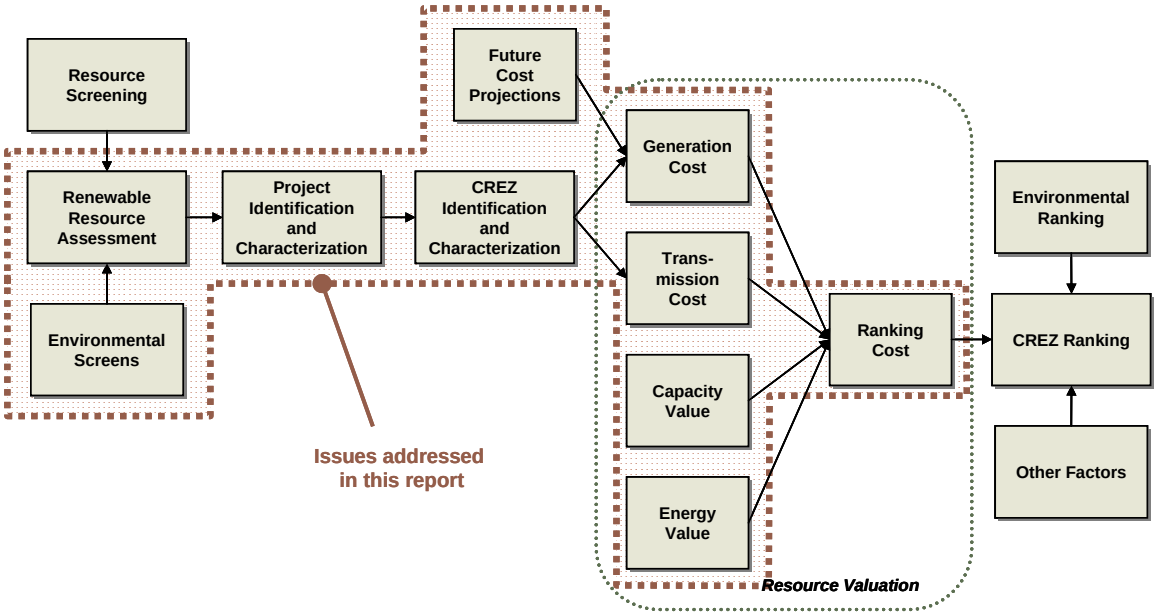


Figure 2-1. Overview of RETI Phase 1 Methodology.

2.2 Approach

The identification and characterization of CREZs requires consideration of a variety of factors affecting development, including the physical proximity of resources, the location of these resources relative to the transmission system, and the availability, or potential availability, of transmission to serve these projects. In developing this ranking of CREZs and sub-CREZs, resource areas and individual resources, Black & Veatch used the methodology proposed in Phase 1A and approved by the SSC. This is discussed in detail in Section 3.

2.3 Report Organization

Following this Introduction, this report is organized into the following sections:

- **Section 3 – Methodology and Assumptions**: This section describes the process, methodology and assumptions used to develop the CREZ, resource area and individual project economic rankings.
- **Section 4 – Competitive Renewable Energy Zones and Resource Areas:** Eight Resource Areas were defined in the RTEI analysis, including five located in California and three for out-of-state resources. This section provides a discussion of the resource area characteristics and presents summarized resource and ranking information.
- **Section 5 – Rank Costs and Supply Curves:** Supply curves were developed to rank resources by region. This section details the resource rank costs and presents the supply curves for the resources.
- **Section 6 – Generation Resources:** RETI identified and included over 2,100 discrete resources in this analysis, including biomass, geothermal, large-scale solar, disturbed solar photovoltaic, and wind resources. This section discusses the methodology used to characterize these resources.

2.4 Accompanying Maps

In conjunction with this report, Black & Veatch has developed a series of high-resolution maps showing the location of CREZs and projects. Additional maps identify and depict resource exclusion areas. The following maps are available for download at project website, www.energy.ca.gov/reti:

Resource Exclusion Maps

- General resource exclusions
- Solar PV resource exclusions

- Solar thermal resource exclusions
- Wind resource exclusions

Project Identification Maps

- Biomass
- Geothermal
- Solar PV
- Solar thermal
- Wind

CREZ/Resource Region Maps

- Competitive Renewable Energy Zones
- Resource Areas

3.0 Methodology and Assumptions

The foundation for the methodology and assumptions for RETI Phase 1 were established in the Phase 1A report. This section describes how some key components of the methodology were ultimately implemented to arrive at the results presented in this report.

3.1 Project Identification & CREZ Development Process

To identify individual projects for RETI, Black & Veatch implemented the methodology detailed in the Phase 1A report. The main steps of the process are shown in Figure 3-1. The specifics of the project identification and characterization process for each technology is outlined in Section 6 of this report.

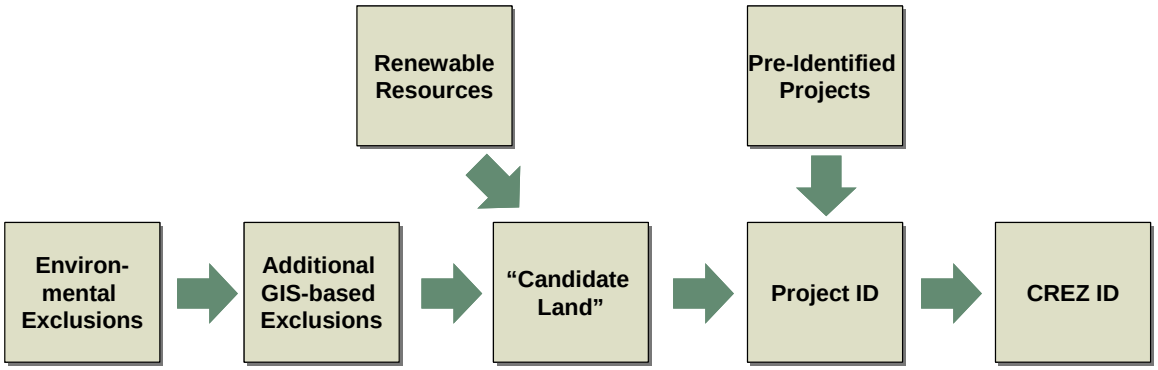


Figure 3-1. Project Identification & CREZ Development Process.

3.1.1 Project Identification and Characterization

The first step in this process was to develop a detailed set of environmental exclusion areas which indicated (1) areas completely off-limits for development and (2) areas where development is not preferred. These environmental exclusions where then combined with additional land use exclusions (such as airports, military bases, and urban areas) using geographic information systems (GIS) software. The GIS-based exclusions were removed from the parent renewable resource data set in order to identify "candidate land" for development.

A parallel process was undertaken to identify all proposed projects and potential projects where commercial interest has been expressed. These projects were assembled from a variety of public data sources including generator and market participant information submittals, BLM applications, commercial databases and power purchase agreements (PPAs) with utilities. These projects are known as "**pre-identified projects**".

It is important to note that the pre-identified projects have not been directly modeled in this report. Rather, Black & Veatch has identified resources in the same vicinity of the project. Sometimes the boundaries of Black & Veatch's projects match the pre-identified project boundaries, in other cases a portion of the boundaries overlap or the projects are nearby. In all cases, Black & Veatch made independent estimates of project capacity. The next step was to supplement the set of resources with **"proxy projects"** using the project identification criteria detailed in the resource chapters of this report and applying the exclusion criteria discussed above. This data was then validated with interconnection queue data to insure that sufficient projects had been identified in a given area.

Performance and cost estimates were created for each project. This process was necessarily different for each technology. The methodology for creating performance and cost estimates for each technology is outlined in Section 6.

3.1.2 CREZ Development

Once the projects were identified they were grouped into CREZs that shared common geography and transmission requirements. An effort was made to keep the CREZs to a manageable size, which practically worked out to be less than 10,000 MW and more than 250 MW. A conceptual transmission gathering system was designed within each CREZ including gen-ties and trunklines. The results of this effort are presented in Section 4.

When necessary, CREZs were split into "sub-CREZs" based on economics. This process is described in Section 5 of the report.

3.2 Exclusion Areas

In the identification of renewable resources and CREZs, Black & Veatch used a series of exclusion screens to filter out land and resources that would not be appropriate for development and should not be part of the RETI analysis. This includes land that is environmentally or culturally sensitive, restricted for military purposes, or inappropriate for certain types of development (such as wind development near airport runways). Most of the screens were applicable to all resources, though some screens were applicable only to certain technologies.

To develop the exclusion screens, Black & Veatch solicited and received input from a variety of sources. Environmental, cultural and land use screens were vetted by the Environmental Working Group and provided to Black & Veatch, while military restrictions on development were provided by the military. In developing screens that impacted specific types of resources, Black & Veatch consulted with developers and

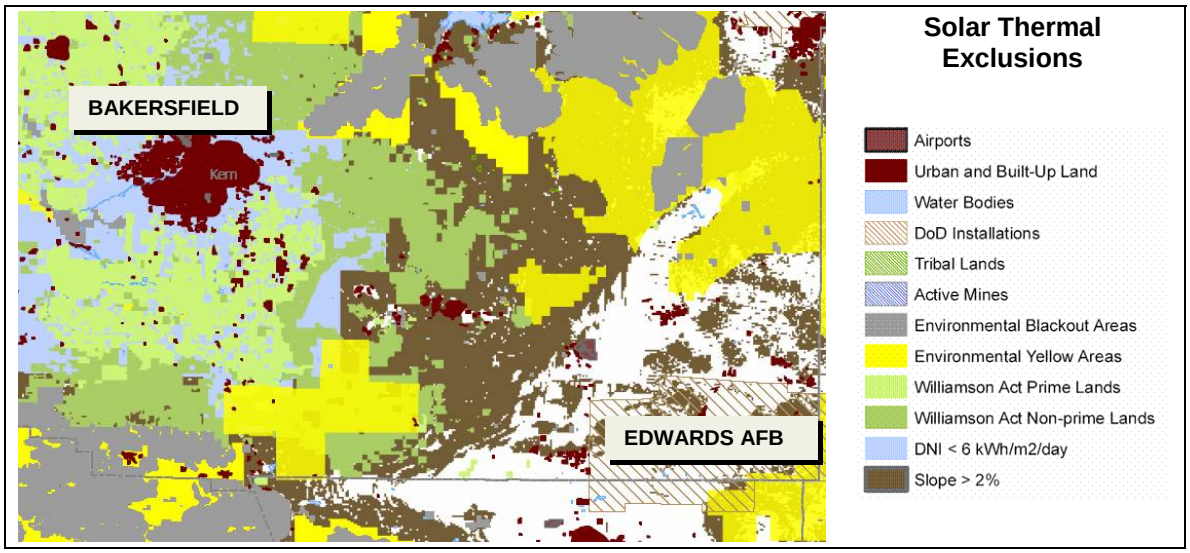
stakeholders in those represented industries. Table 3-1 is a discussion of the screens that were applied in the resources identification process.

Table 3-1. Excluded Lands for RETI.

	Geo-thermal	Solar PV	Solar Thermal	Wind	Notes
Environmental black areas	Yes	Yes	Yes	Yes	
Environmental yellow areas	Yes*	Yes*	Yes*	Yes*	*Pre-identified projects OK
Wetlands and water bodies	Yes	Yes	Yes	Yes	Dry lakes not excluded
Native American reservations	Yes*	Yes*	Yes*	Yes*	*Pre-identified projects OK
Military lands	Yes*	Yes*	Yes*	Yes*	*Pre-identified projects OK
Mines (surface)	Yes	Yes	Yes	Yes	
Urban areas	Yes	Yes, +buffer	Yes, +buffer	Yes, +buffer	buffer up to 3 miles depending on population
Airports	Yes	Yes	Yes	Yes, +buffer	Major airports only. Wind buffer is up to 5 miles.
Military flyways	No	No	No	Yes* (Red)	*Pre-identified projects OK in red zones. All other open.
Williamson Act Prime Agricultural Land	No	Yes*	Yes*	No	*Pre-identified projects OK
Williamson Act Non-Prime Agricultural Land	No	Yes**	Yes**	No	**Excluded until 2018, pre-identified projects OK
Renewable resource quality	No	No	< 6 kWh/ m^2/day	< 6.3 m/sec	
Min. contiguous square acreage	No	160	1280	none	640 acres = 1 section = 1 square mile
Land slope	No	> 5%	> 2%	> 20%	Geothermal evaluated on case by case basis
Note: Because biomass plants have very high siting flexibility, explicit land exclusions were not applied. Biomass plants can be easily moved to avoid sensitive areas.					

Figure 3-2 shows a comparative example of the exclusions applied near the Tehachapi area for wind and solar thermal resources. The land on these maps that is shown in white is known as "candidate land". This is land that has passed all environmental, land use, resource, and other restrictions. Full scale maps are available for download at the project website (www.energy.ca.gov/reti) for the following resources:

- General resource exclusions
- Solar PV resource exclusions
- Solar thermal resource exclusions
- Wind resource exclusions



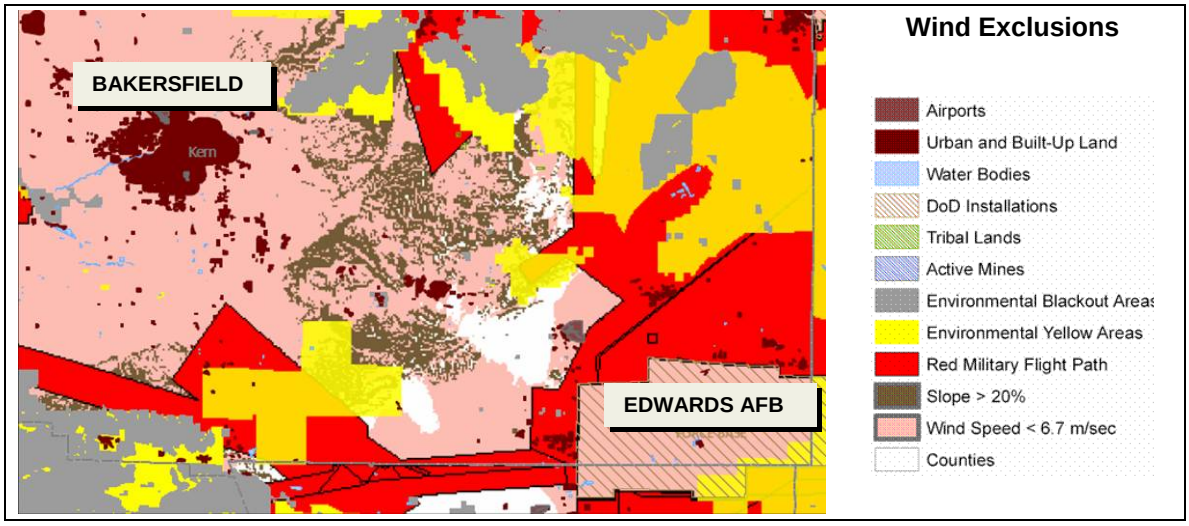


Figure 3-2. Example of Wind and Solar Thermal Exclusions Near Tehachapi.

The exclusions have simply been applied for the purposes of determining potential developable resources and performing high-level transmission planning. It is very important to emphasize that the purpose of these exclusions is for conceptual transmission planning and not to recommend specific project siting and land use decisions. Conversely, candidate lands shown as "open" for development should not necessarily be assumed to be appropriate for siting plants either. All projects will still need to proceed through all local, state, and federal permitting processes; RETI does not supercede these authorities. Finally, much of the land identified as part of this assessment is privately owned. RETI does not intend to interfere with the decisions of private land owners in any manner.

3.2.1 Environmental, Cultural and Land Use Exclusions

Black & Veatch conformed to the recommendations of the Environmental Working Group on the impact of environmental, cultural and land use concerns on project identification. The Environmental Working Group's report discusses these considerations in depth. It defines Category 1 areas (cited in this report as "blackout areas"), Category 2 areas (cited in this report as "yellow areas"), and the proper treatment of Forest Service land, Native American lands, agricultural lands, and other considerations.

3.2.2 Military Exclusions

The western U.S. and California host extensive military facilities. Two types of exclusions were applied to the project identification process: (1) active military bases and (2) flight zones.

- **Military Bases** – Only pre-identified projects are allowed on base properties. The Department of Defense provided a list of potential projects for consideration (see the next section). This restriction applies to all resources.
- **Flight Zones** – Tall structures can potentially impede military flight operational activities. The Department of Defense has developed a color coding system (Red-Yellow-Green) for air space to identify the review requirements for tall structures. For RETI, this only impacts identification of wind projects. Red land designations are the most restrictive, and projects may not be allowed in red areas. However, the exclusion is not categorical, and for this reason red lands are treated as Category 2 lands. The military's other designations (yellow and green air space) were not included as exclusions.

The proposed expansion of the military facility near Twentynine Palms may have an impact on the RETI analysis, but it has not yet been considered at the time of this report. Black & Veatch intends to consider the expansion before the final version of this report.

3.2.3 Other Exclusions

Other development restrictions were generally applied to all resources including wetlands and water bodies, urban areas, and active mines. Development of larger renewable energy projects in these areas is generally very difficult or impossible.

3.2.4 Resource Specific Exclusion Zones

In addition to these general exclusions impacting all development projects, RETI has developed exclusion areas that impact certain types of resources. For example, land with slope greater than 2 percent was not considered for proxy solar thermal projects. These exclusions are discussed in Section 6.

3.2.5 Limitations of the Project Identification Process

Black & Veatch conducted resource assessments and project identification for all resources areas to assess the developable potential of renewable resources in these regions. This methodology is discussed at length in this report. Given the vast amount of land and the discrete location of most renewables, the Black & Veatch project survey had several limitations, which could potentially result in significant variations in the estimates of generation potential and actual development in certain areas. These include the following.

- The assessment is based on the best available high-level resource data. However, these high-level assessments are known to be uncertain. Site-level resource data would improve the assessment, but there was no practical way to include these in this stage of analysis.
- Detailed siting reviews for each project were not conducted. There may be constraints that would preclude development of a site including high fragmentation of land ownership, constructability concerns, flood plains, presence of cultural resources, and other factors.
- It has been assumed that pre-identified projects could be sited in certain sensitive areas (for example, “yellow” areas and military flyways). This may not be possible after further project review.
- Local-zoning regulations and laws were not reviewed or applied to the assessment. Further, known historical opposition to project siting was not considered a fatal flaw in the assessment.
- In certain CREZs, a large fraction of the projects modeled are “proxy” projects. This indicates that there is limited *known* commercial interest in the CREZ, and the viability of development within these areas should be further reviewed. It may be that there is development activity is actually occurring, but the developer has chosen not to make this public as part of the RETI process. In contrast, however, there may not be any developer interest in this area for other unidentified reasons. A summary of the amount of proxy projects in each area is provided in Section 4.

- RETI collected information on projects by surveying public information and requesting project information from developers and project advocates. While known-pre-identified projects were included in RETI, there will inevitably be additional projects that were not included in the RETI analysis. An example of such a project is the Burney wind project, which was only identified in November after the developer had executed a PPA with a utility.

It is recommended that project identification be continuously monitored and the RETI data set be refreshed in subsequent RETI phases to ensure that RETI includes the broadest set of viable and developable projects.

3.3 Pre-Identified Projects

Planned projects and projects under construction were identified using publicly available information. That information came in a variety of forms. Table 3-2 summarizes the information received on pre-identified projects, and the specific data sources are discussed further below.

Table 3-2. Pre-Identified Resources by Source and Resource Type (All locations)

	Biomass		Geothermal		Large Solar[a]		Wind	
	No. Proj.	MW	No. Proj.	MW	No. Proj.	MW	No. Proj.	MW
PPAs	12	125	9	379	15	2,144	28	2,903
BLM Apps.	0	0	0	0	217	87,260	93	671[b]
RFIs	1	11	15	1,972	19	10,392	35	11,421
Military	0	0	1	100	6	586	1	74
TOTAL[c]	**13**	**136**	**25**	**2,451**	**267**	**100,382**	**178**	**14,398**
B. Columbia	43[d]	1,520	7	244	0	0	NA	6,630[e]

Notes:

[a] All pre-id solar projects were combined into a list of "large solar" projects, regardless of whether they employed solar thermal or solar PV technology. All large solar projects were then modeled as either solar thermal or solar PV.

[b] Most BLM wind applications do not report expected MW. Applications that did not report MW were usually applications to install MET towers, rather than to construct plants. These projects were not modeled in the RETI analysis.

[c] Totals do not include British Columbia resources identified by Pacific Gas and Electric in a separate study. Numbers are presented here for comparison.

[d] Only aggregate resource data was available for BC biomass. The capital cost per kW of a biomass project depends on the project's size. To estimate capital costs for BC biomass projects, an average project size of 35 MW was assumed. The number of biomass projects was determined by dividing the aggregate biomass resource potential in MW by the average project size in MW.

[e] Only aggregate resource data was available for BC wind. The number of individual wind projects was not assessed.

3.3.1 Generator Data Request

To ensure that RETI included commercial projects, CEERT circulated a data request for generators to provide information on existing and planned projects. The data request sought information on project ownership, development stage, location, acreage, site control, project type, technology, generation capacity, capacity factor, and interconnection information in its generator RFIs. Responses were received from 16 participants and provided identification of 70 individual projects.

It is important to note that most of these responses did not include specific geographical boundaries for project sites. For this reason, Black & Veatch has attempted to include projects representative of the generator-supplied information in its process. However, the boundaries of actual generator projects have generally not been identified.

Table 3-3. Pre-Identified Projects from Generator Data Request.

	No. of Projects	MW
Biomass	1	11
Geothermal	15	1,973
Large Solar	19	10,392
Wind	35	11,421
TOTAL*	**70**	**23,797**

Notes:
* Total does not include PG&E submitted British Columbia resources

3.3.2 Department of Defense Lands Proposed Development

The U.S. Department of Defense (DoD) has established a goal to have 25 percent of its energy requirements met by renewable energy resources by 2025. To effectuate this, the DoD is beginning to actively lease non-mission critical land on military installations for renewable energy development. The DoD has estimated the development of resources at several military installations, as detailed in Table 3-4.

Table 3-4. Pre-Identified Military Projects.

Installation	State	Technology	MW
El Centro Naval Air Facility	CA	Geothermal	100
Fort Irwin	CA	Solar Thermal	150
China Lake	CA	Solar Thermal	112
MAGTFTC Twentynine Palms	CA	Solar Thermal	100
Yuma Proving Ground	AZ	Solar Thermal	100
Sierra Army Depot	CA	Solar Thermal	50
Edwards Air Force Base	CA	Solar Thermal	200
Vandenberg Air Force Base	CA	Wind	74
Source: Tony Parisi, US Navy; Black & Veatch			

3.3.3 Bureau of Land Management Land Leases

Substantial portions of California, Nevada and Arizona lands are under the control of the U.S. Bureau of Land Management (BLM). BLM leases federal lands to private entities for commercial activities, including energy development. Generators seeking to develop projects on BLM land must apply to lease rights of way (ROW)s to use land through the regional BLM office and provide information regarding the type of project, the specific technology that will be used, the project's capacity, location and the acreage requested.

This information is filed and processed at local BLM offices. To meet demand for information and consistency in application treatment, BLM has developed a central database of renewable energy lease applications. RETI used renewable energy ROW data provided by the California, Nevada and Arizona BLMs. California data were used to determine whether or not modeled projects should be considered pre-identified or proxy. California data are considered up to date as of November 2008. Nevada and Arizona data were used to identify and characterize projects in these states. Data for these states are considered up to date as of July 2008. Appendix A includes the BLM applications considered for the RETI analysis provided by the BLM.

Table 3-5. BLM Application Pre-Identified Projects (all locations).

	No. of Projects	Capacity, MW	Acres
Large Solar	124	87,260	1,219,478
Wind	93	671*	761,694
TOTAL	**217**	**87,931**	**1,981,172**

Sources: California Bureau of Land Management, November, 2008; Arizona Bureau of Land Management, July 2008; Nevada Bureau of Land Management, July 2008.

Notes:

* Wind MW are small because most BLM Wind applications do not include capacity

3.3.4 Utility Power Purchase Agreements

Utilities enter into contracts for the purchase of energy from generators. A small amount of information from these contracts is publicly available and provides project type, technology, capacity, general location and projected on-line date. The information is summarized in Table 3-6 and Appendix B includes contract data as summarized by the California Energy Commission.

Table 3-6. Utility Power Purchase Agreement Pre-Identified Projects.

	No. of Projects	Capacity, MW	Generation, GWh/yr
Biomass	12	125	854
Geothermal	9	379	2,921
Solar PV	4	15	33
Solar Thermal	11	2,129	5,173
Wind	28	2,903	8,068
TOTAL	**64**	**5,552**	**17,051**

Source: California Energy Commission, "Database of Investor-Owned Utilities' Contracts for Renewable Generation, Contracts Signed Towards Meeting the California RPS Targets," available at: http://www.energy.ca.gov/portfolio/contracts_database.html, July 9, 2008

3.3.5 Transmission Operator Interconnection Queues

In order to access to the electric transmission system to deliver energy, generators must submit an interconnection request with the interconnecting transmission owner.

The interconnection requests include project type, technology, capacity, general location and planned substation interconnection information. Pursuant to FERC policy, basic data from the queue applications is publicly available. Pending requests are considered "in queue." Due to the recent surge in interconnection requests, transmission operators have extensive interconnection queues.

Black & Veatch reviewed transmission queue information for all major transmission owners in California, Arizona and Nevada. While indicative of commercial interest, the queue information does not provide sufficient facility information necessary for RETI to define "pre-identified" projects based on this data. However, Black & Veatch used this information to validate other information on project development. This information was specifically used to ensure the number of projects and generation capacity modeled by Black & Veatch in a given area equaled or exceeded the number of projects planned by developers in each county in the study area. Table 3-7 identifies the transmission queues that were reviewed by Black & Veatch. Appendix C provides all interconnection queue information.

Table 3-7. Generation Interconnection Queue Data Sources.

Arizona Public Service Company
California Independent System Operator
Imperial Irrigation District
Los Angeles Department of Water and Power
Nevada Power Company Generator
Salt River Project
Sierra Pacific Power Company
Tucson Electric Company
Western Area Power Administration

3.4 Out-of-state Resources

Out-of-state resources were handled differently than in-state resources for several reasons. In many cases, Black & Veatch did not have access to the same high-quality data that are available for renewable resource potential or land use for California. In addition, the EWG had not defined land constraints for out-of-state areas. Black & Veatch also had to make assumptions about how much of the out-of-state resources would be available for export to California due to (1) resource competition from regional utilities and (2) transmission limitations on bringing resources to California. These latter

two factors greatly limit the amount of out-of-state resources that California can practically rely on.

Black & Veatch had screened out many resources in different regions based on the preliminary resource assessment performed in Phase 1A. For example, Arizona wind resources were determined to be relatively small and high price, making them unlikely to be candidates for development of large transmission lines for export to California. Table 3-8 shows the out-of-state resource recommendations from the Phase 1A report.

Table 3-8. Resource Areas Studied in Phase 1B.

	CA	OR	WA	NV	AZ	Baja California	British Columbia
Solid Biomass	✓	✓	✓				✓
Solar Photovoltaic	✓						
Solar Thermal	✓			✓ (south)	✓ (west)		
Onshore Wind	✓	✓	✓	✓ (south)		✓ (north)	✓
Geothermal	✓	✓		✓			✓

Out-of-state resources were characterized based on resource types. Wind was assessed using a screening-level analysis as opposed to a more project specific analysis. This was not the case for geothermal and biomass, which generally used project level methodologies for both in state and out-of-state resources.[5] In southern Nevada and western Arizona, only pre-identified wind and solar projects were characterized, no proxy projects were created. In Baja, only border area wind resources were characterized.

For resources, such as wind, that were characterized by a screening-level process, a discount factor was applied to the identified resources. This factor takes into account the typical drop from technical potential to developable potential. The discount factor

[5] However, the focus of most of the time and effort was spent characterizing California resources – or larger resources that could be exported to California.

was based on the ratio of developable to technical potential identified in California from the results of the Phase 1A and detailed Phase 1B processes.

A more detailed discussion of out-of-state resources can be found in each resource section. British Columbia was handled separately, and is discussed below.

British Columbia Generating Resources

Pacific Gas and Electric Company (PG&E), PacifiCorp, Avista Corp., and British Columbia Transmission Corporation are proposing the development of a transmission line to access renewable generation located in British Columbia. A parallel effort being conducted by PG&E is the identification, quantification and characterization of the renewable resources in the province. RETI is including British Columbia in its modeling efforts to determine the relative feasibility of these resources.

Biomass and wind resource information for British Columbia included in the RETI analysis was provided by PG&E and is based on the assumptions developed by PG&E or its consultants. Black & Veatch has no comment on the quality of these assumptions. Geothermal resource assessments are based on data received from GeothermEx as part of the RETI review of resources. Although PG&E provided general data about geothermal potential in BC, GeothermEx's data were used because they characterize specific projects in greater detail.

An estimated 7,430 MW of installed capacity has been identified by PG&E as potentially available before 2016. Another estimated 2,500 MW could come on line after 2016.

Project-specific cost information was not provided by PG&E for wind or biomass resources, and these resources are characterized with generic project assumptions. For biomass, updated resource cost assumptions developed for Phase 1B and an individual project sizes of 35 MW are assumed for all 1,520 MW of biomass resource. For wind, updated resource cost assumptions developed for Phase 1B are used in combination with capacity factor assumptions for different wind classes. Using these assumptions, the levelized cost of energy (LCOE) for wind resources at each wind class was estimated. An average LCOE and capacity factor weighted by annual energy production is calculated for the entire BC wind resource from these results. A summary of resources in British Columbia in included on Table 3-9.

PG&E includes 1500 MW of long-term wind in its resource assessment that represents an off-shore wind farm. This resource was not included in the Black & Veatch analysis.

Table 3-9. British Columbia Resource Characteristics.

	Time Frame*	Project	MW	CF, %	Gen., GWh	Cap. Cost,, $/kW	FOM,$/ kW-yr	VOM, $/MWh	Fuel Cost, $/MBtu	LCOE, $/MWh
Wind	Mid	Generic	6,630	33	18,989	2,500	50	–	0	110.71
Wind	Long	Generic	1,500	40	5,311	2,500	50	–	0	86.69
Bio.	Mid	Generic	700	85	5212	4,863	91	12.45	2.46	140
Bio.	Long	Generic	820	85	6105	4,863	91	12.45	2.46	140
Geo.	Mid	Meager Creek Pebble Creek	90	80	710	3,835	–	22	0	61.78
Geo.	Long	Harrison Hot Springs	16	80	112	4,680	–	30	0	85.74
Geo.	Long	Kootenay	16	80	112	4,680	–	30	0	85.74
Geo.	Long	Mt. Cayley	45	80	355	3,900	–	25	0	66.44
Geo.	Long	Mt. Garibaldi	45	80	355	3,900	–	25	0	66.44
Geo.	Long	Okanagan	16	80	112	4,680	–	30	0	85.74
Geo.	Long	Upper Arrow	16	80	112	4,680	–	30	0	85.74

Source: Pacific Gas & Electric, GeothermEx (see Section 6).

* Mid term projects are expected to be on-line before 2016, long term projects are expected to be on-line after 2016

3.5 Transmission

The development of a transmission plan to access priority CREZs is the thrust of RETI Phase 2. RETI Phase 1 did not attempt to develop specific transmission plans for priority CREZs, rather it defined transmission requirements to access and interconnect all identified resources, and developed cost estimates for this transmission. This is required to provide a reliable estimate of the transmission cost used in the resource valuation. This section provides a discussion of the methodology and tools used by RETI to add transmission, and discusses transmission assumptions regarding California and interstate transmission.

3.5.1 Methodology

Black & Veatch designed a conceptual transmission system to interconnect all identified generating resources to the transmission system, and deliver energy produced by these resources to load centers in California, which are defined as major metropolitan areas including San Francisco / Sacramento, Los Angeles area, and San Diego. Transmission assumptions for California resources areas differed from those used for non-California resource, as RETI has substantially greater information on the transmission infrastructure within California. For out-of-state resources, RETI generally

assumed these resources would interconnect to their local utility and deliver energy over the bulk transmission system.

RETI used the existing transmission system as the basis for all of its transmission planning schemas. In determining the quantity and timing of transmission additions, RETI determined need based on the capacity of identified resources requiring interconnection. After considering all available transmission capability (ATC), new transmission was added to meet the requirements. Transmission options included the addition of 230 kV, 345 kV, and 500 kV lines, with single and double circuitry for each. RETI did not physically site transmission, but for purposes of cost estimation transmission additions were aligned to parallel existing transmission right-of-way (ROW) wherever possible in order to minimize new ROW. Where new transmission ROW was required, known physical barriers such as mountains and black-out areas were considered when estimating the transmission line distance. This analysis did not include the rigorous siting criteria required to site new ROW.

Transmission Additions

Transmission is added to meet a resource's (or resource area's) maximum potential generating capacity, assuming that all resources are simultaneously deliverable. This likely overstates the transmission requirements, but is appropriate for this analysis since the actual mix of generating resources on a line is unknown. Further, certain generators may elect "interruptible" transmission services where the generator may be curtailed at certain times in exchange for using under-utilized transmission capacity at a low cost. This will be situation specific and it would be difficult to assume that resources are constructed that are not available to meet peak demand.

Transmission Reliability Criteria

The Phase 1 RETI analysis did not include load flow modeling for system reliability analyses, nor did it attempt to quantify the ancillary service requirements necessary to interconnect a substantial quantity of renewables to the grid. It is anticipated the results of this analysis will form the basis of the initial load flow studies in Phase 2 of RETI.

Transmission Modeling Tools

The RETI transmission analysis was conducted using a variety of modeling tools including ArcGIS, AutoCAD and Excel. ArcGIS was utilized to identify resource locations, land characteristics and map the existing transmission system. Using the spatial information and land characteristics identified in ArcGIS, AutoCAD was used to

develop a transmission schema for each resource and CREZ. The schema was then analyzed in Excel to develop costs and allocate transmission costs for each project. Transmission costs were then adjusted in the cost of generation model and the CREZ's were again re-defined. This iterative process was conducted until the final CREZ's discussed in Section 4 were identified.

3.5.2 California Transmission

As part of the CREZ identification, valuation and ranking process RETI included the likely cost of the transmission necessary to deliver a resource's energy to a load center. Where existing or anticipated transmission could be used to deliver energy to the load center, there was limited transmission cost. Where incremental transmission was required to deliver this energy, RETI included this cost in the project economics. This section identifies the process used to identify the existing available transmission capability and assess new transmission capability requirements.

Existing System Available Transfer Capability

RETI first assessed the existing transmission system to determine the available capacity prior to adding additional capacity on the system. To identify the current available transfer capability (ATC) of the CAISO-controlled grid, RETI used Year 2007 Transmission Ranking Cost Report (TRCR) information prepared by California IOUs. In these reports the IOUs identify levels of ATC on their respective systems and estimate the upgrade costs to develop this transmission capacity. RETI included all "zero-cost" ATC identified by the IOUs in the base case. RETI did not use the TRCR cost estimates for upgrading existing lines, rather it used Black & Veatch cost estimates for developing incremental transmission. This was necessary to insure consistent cost assumptions were used in developing incremental transmission costs.

PG&E's TRCR provided transmission capacity at major substations on its system. The report identified ATC in several areas within the system, though these are not necessarily areas with substantial renewable development opportunities. PG&E identifies 1500 MW of ATC at the Gates substation, which could potentially be used by renewable resources in the Central Coast, particularly Carrizo Plains. SCE's TRCR identified ATC at an area level rather than at the substation level. Per the TRCR, SCE identified no "zero-cost" ATC. SDG&E provided ATC at a "cluster" (or area) level, and identified substantial ATC in the San Diego Coastal area but no ATC in the eastern portions of the service area.

Publicly Owned Utilities (POUs) are not required to publicize information regarding ATC on their systems. Anecdotal evidence indicates there is little ATC on

these transmission systems. RETI assumed no ATC for POU transmission in the base case.

Approved Transmission

There is a substantial amount of proposed transmission at various stages of development currently. RETI cannot ignore this, as at least a portion of this will be developed. In Phase 1A RETI stakeholders approved criteria for the inclusion of proposed lines in the analysis. These criteria identified the conditions under which proposed transmission would be assumed to be available. If proposed transmission has been approved for development by the CAISO, or by the appropriate decision-maker (i.e. City Council or Publicly Owned Utility Board of Directors) for a non-CAISO jurisdictional line, the transmission would be assumed to be available to transmit energy from renewable resources at its proposed availability date. Table 3-10 summarizes the approved transmission projects assumed to be available in the base case.

Table 3-10. Approved Transmission .

Project Name	Owner	Year Available
Tehachapi 1-3	SCE	2011
Tehachapi 4-11	SCE	2013
Devers-Palo Verde 2	SCE	2013
Sunrise	SDG&E	2012
Green Path	IID	2011

Allocation and Cost of Existing and Approved Transmission

While no transmission is “free”, the capital costs associates with existing and approved transmission is considered as a sunk cost by RETI. Accordingly, RETI assumed zero transmission cost for resources using these transmission resources.

The determination of which projects were granted free transmission was based on the value of the individual resource. Resources with the lowest ranking cost at the point of interconnection were considered most likely to be developed and were given priority to the free transmission. Once all free transmission was allocated, all other projects were assigned transmission costs based on the incremental cost of transmission to serve these resources. The amount of free transmission at each transmission line/interconnection point and the CREZs that could access this transmission are included in Table 3-11.

Table 3-11. Available Transfer Capability By CREZ

Transmission Line/ Interconnection Point	ATC (MW)	Eligible CREZs
Tehachapi 1-3 Tehachapi 4-11	4350	Fairmont Tehachapi Kramer (North) Inyokern Owens Valley Central Nevada
Palo Verde-Devers 2	1200	Riverside East Arizona
Gates Substation	1500	Carrizo North Carrizo South Cuyama Santa Barbara
Tesla Substation	2000	Solano
Sunrise & Green Path	2200	San Diego South San Diego North Central Imperial North Imperial East Imperial South Baja

The allocation of free transmission is an economic advantage for the resources in the affected CREZs. For this reason, a sensitivity scenario was run in Section 5 that explores the impact to CREZs if they are allocated full costs for transmission that is approved but not yet built.[6]

Incremental Transmission Additions

Transmission was added to connect the entire capacity of a resource or resource area. This includes the addition of new and/or upgraded facilities to meet expected requirements, including the following:

[6] The result of this sensitivity study was that only one of the top-ranking CREZs, Riverside East-A, is significantly impacted by this assumption.

- **Collector substations.** Many CREZs require upgrades of existing substations, or the addition of new substations, to allow resources in a CREZ to interconnect to the grid.
- **Trunk lines.** New transmission was added to enable collector points to interconnect to the existing high-voltage grid if the collector point is not on the current grid or if the line requires upgrading to deliver the energy and capacity to the grid.
- **Network costs.** The cost of delivering the energy to primary substations located in the identified load centers.

RETI did not include cost estimates for upgrades to the distribution system that may be required. Recognizing that the distribution system may require changes that will increase the total transmission cost, it is impossible to reliably estimate these costs without load flow modeling.

Generation Tie Lines, Trunk Lines and Environmental Exclusion Areas

Conceptual linkages representing generation tie-lines (gen-ties) were drawn from projects to hypothetical collector stations. Trunk lines were then drawn to load centers. These gen-ties and trunk lines are only conceptual representations of linkages between projects and CREZ substations. They were drawn to estimate distances, so that transmission costs could be estimated.

Because they do not represent actual routes, gen-ties and trunk lines were generally drawn point to point without respect for environmental exclusions. As a result, these lines may be shown crossing through environmental exclusion areas on RETI maps. This does not matter because these are conceptual, representative linkages, rather than actual or proposed routes.

3.5.3 Out-of-State Transmission

The transmission methodology use for non-California resources differed from the methodology used for California resources for several reasons. First, the ATC of lines outside California is not available to RETI. Next, the location of resources that may deliver energy to California is generally not precisely known, hence it would be impossible to develop meaningful transmission costs for those projects. Finally, anecdotal evidence suggests there is little bulk power transfer capability for exporting power in the West, and that most renewable energy will require incremental transmission capacity to deliver energy to California.

North Out-of-State Resource Areas (BC, WA and OR)

Discussed in detail in the resource sections of this report, there are substantial renewable resources in Oregon, Washington and British Columbia, Canada that have the potential to deliver energy to California. There is however, currently little or no available transmission to deliver energy from this resource area to California.

To increase this import capacity, Pacific Gas & Electric Company (PG&E), PacifiCorp, Avista Corp. and the British Columbia Transmission Corporation have proposed the Canada/Pacific Northwest – Northern California Transmission Line Project. As designed, the line has the capability to deliver an incremental 3,000 MW of resources from the North OOS resource area to California. In November, 2007 the WECC Technical Analysis Committee (TAC) conducted a Regional Planning Review for the proposed line, which evaluated 13 transmission alternatives for adding new transmission from British Columbia to California. It recommended a transmission strategy that would allow for the transmission of up to 3,000 MW of new generation from Canada to California or 1,500 MW of new generation from Canada and 1,500 MW of generation from Washington/Oregon. The TAC recommended route extends from Selkirk, British Columbia southward to the Tesla/Tracy substations in Northern California, with intermediate connections at McNary, WA and Grizzly, OR. The TAC study estimated the total cost of the preferred alternative to be $4.8 billion. These costs, by transmission segment, are provided on Table 3-12.[7]

Table 3-12. Transmission Capital Cost - WECC Technical Advisory Committee

Segment	$/kW
Selkirk, Canada – WA	1,734
WA (Mid-C/McNary) – Grizzly, OR	1,289
Grizzly, OR – Tesla/ Tracy, CA	656

RETI used the costs identified by the TAC for incremental transmission from the North OOS resource area. To develop a transmission cost for BC resources, RETI assumed that the entire line would be used to transmit BC resources, with the total cost of development allocated to these resources. To develop cost estimated for Washington and Oregon resources, RETI assumed a pro-rata portion of the BC cost based on segment mileage, including the cost of all required network upgrades.

[7] Sea Breeze Pacific Regional Transmission System filed comments for an alternate undersea cable proposal that they claim would significantly reduce costs and environmental impacts.

Nevada Resource Areas

The Nevada resource area included three distinct regions with different transmission interconnections and costs. The division of Nevada resources is required because the transmission solution necessary to transmit energy from each region is distinctly different. The Sierra Pacific Power Company, which operates in Northern Nevada, and Nevada Power Company, which operates in southern Nevada, are very weakly linked electrically and effectively operate as separate systems. Additionally, resources in Central Nevada are physically remote from either system. The sub-areas and their respective transmission requirements are discussed below.

Northern Nevada – This includes the area roughly from Reno north to the Idaho border. For RETI it was assumed that these resources would interconnect to the Sierra Pacific electric grid. Energy from these resources would travel north from Reno using an existing 230 kV line, with energy deliveries to California flowing though the South Lassen CREZ. Like the Northern California resource area, energy from Northern Nevada would be delivered to the San Francisco/Sacramento metropolitan area.

Central Nevada – This region includes the western portions of Mineral and Esmeralda counties. This area is remote from the existing Nevada transmission infrastructure, but near the Pacific Intertie, a direct current (DC) transmission line that extends from northern Oregon to Southern California. RETI assumed that a new 345 kV alternating current (AC) transmission line would be built to interconnect these facilities directly to the California grid. This line would extend from western Mineral County and interconnect to the California electric grid at the Control substation in Inyo County, California.

Southern Nevada - Southern Nevada resources interconnect to California grid in two ways. Several wind and solar facilities are currently proposed for development in Nevada near the California border, and at least some of these facilities propose to interconnect directly to the California grid. RETI modeled the interconnection cost for these facilities assuming a California grid interconnection, and these resources are not subject to the import caps for southern Nevada / Arizona resource imports.

In addition to the border resources, RETI identified a substantial quantity of solar and wind resources located in southern Nevada. These resources are presumed to interconnect to the Nevada Power Company transmission system, with energy transmitted to the CAISO grid at the Mead substation in Southwestern Nevada. These resources would be subject to a transfer limit of 2,500 MW.

3.5.4 South Out-of-State Resource Areas (AZ and Baja, Mexico)

Arizona

The CAISO identifies the Palo Verde substation located in northwestern Arizona as the CAISO transmission access point to California. For resources located in Arizona, RETI assumed the capital cost of transmission to include the cost of interconnecting identified resources directly to the Palo Verde substation. The estimated costs for delivering energy from the Palo Verde substation to Los Angeles was based on a route following the proposed Devers-Palo Verde 2 line.

Baja California Norte, Mexico

Several wind resources were identified along the U.S. / Mexico border in Baja, Mexico. Physically located in Mexico, these resource are anticipated to interconnect to the transmission grid at the Imperial Valley substation located in Imperial County, California. Transmission costs for these resources are consistent with other resources interconnecting to the grid at the Imperial Valley substation.

3.6 Resource Valuation

RETI evaluated a Rank Cost for each project. Rather than comparing projects on the levelized cost of generating energy alone, the Rank Cost includes the cost of generation and the cost of transmission and also considers the energy and capacity values of the generation profile of the project.

3.6.1 Generation Cost

The cost of generation is calculated as a levelized cost of generating power over the life of the resource. The cost of generation is calculated on a $/MWh basis, allowing the resource in question to be compared with disparate resources types with different costs and operating over different time periods. It is calculated using a simple financial model that considers the project from the point of view of a developer, including the developer's direct costs, charges and incentives, as well as an expected rate of return on the equity. Specifically, it considers:

- Operations and maintenance costs
- Fuel costs (as appropriate)
- Cost of equity investment in capital
- Cost of financing capital
- Taxes, including investment and production credits

Other costs, such as insurance, property taxes, development fees, interest during construction, and debt service reserve funds are included within these major categories. Black & Veatch has strived to make the model as simple as possible while still maintaining an appropriate level of accuracy for comparing the relative generation cost of different projects employing different renewable energy technologies. The simplifying assumptions allow the model to serve its analytical purpose and still be streamlined enough to evaluate hundreds of projects. Because of the simplifications, the model is not intended to simulate the exact financial performance of any one project. Use of the model in this way would be inappropriate.

Line items and calculations in the Cost of Generation Calculator are outlined below. The Excel model can be downloaded from the RETI website. A screenshot of the calculator is included as Figure 3-3.

- **NPV for Equity Return**: A cost of equity is assumed as part of the financial assumptions. This number is treated as a hurdle which the project must reach. The project must generate sufficient income from power sales to obtain this return on equity. The Net Present Value (NPV) for Equity Return discounts all cash flows associated with the project by this prescribed return to generate a present value. If this metric is zero, the project is returning exactly the prescribed amount to equity investors. Higher values mean that the project generates too much money, and lower values mean that it does not generate enough.
- **Levelized Cost of Generation**: The actual cost of generation used in the model escalates over time. The levelized cost of generation is the constant cost (no escalation) that produces the same net present value as the actual modeled costs of generation over the life of the project. This single metric is the main output of the model.
- **Annual Generation**: The annual generation for the project is calculated based on an 8,760 hour year, the project capacity and the assumed capacity factor.
- **Cost of Generation**: The Year one cost of generation is chosen such that the NPV for Equity Return is zero. Costs of generation in later years are escalated by the assumed value.
- **Fixed Operations and Maintenance**: Fixed O & M is calculated from the assumed dollars per kilowatt of capacity per year, the project capacity and the assumed escalation value.

- **Variable Operations and Maintenance**: Variable O & M is calculated from the assumed dollars per megawatt-hour, the annual generation and the assumed escalation value.
- **Fuel Cost**: Annual generation, net plant heat rate, fuel cost and annual escalation of fuel cost determine the annual fuel cost for the project.
- **Debt Service**: Mortgage-style principal and interest payments are calculated for the proportion of the project that is assumed to be financed, the debt rate and the term of the financing.
- **Tax Depreciation**: Depreciation of project assets are calculated for tax purposes. These numbers are based on the Modified Accelerated Cost Recovery System (MACRS) depreciation schedules detailed in the table at the bottom of the spreadsheet. The percent of capital cost to be depreciated is also an input. For simplification, only one depreciation schedule is assumed to apply to a project.
- **Production Tax Credit (PTC)**: The production tax credit is modeled using three parameters: the dollars per megawatt-hour credit, the annual escalation of the credit, and the duration of PTC availability in years.
- **Investment Tax Credit (ITC)**: ITC eligible projects are credited the prescribed percent of their capital costs in year one.
- **Taxes**: Projects pay an all-in combined tax rate on their taxable income (operating revenue less operating expenses and depreciation) and are credited for applicable tax credits (PTC and ITC).
- **Total**: These are the cash flows associated with the project, including the equity investment portion of the overall capital costs (accounted for as a single value in year zero).
- **Solving for Year One Cost of Generation**: Since NPV for equity return is linear with respect to year one cost of generation, the relationship can be defined by two points. In the "Calculation" box at the top of the spreadsheet, two cost scenarios ($0 and $5) are run using Excel's TABLE() function. The equation for the resulting line is solved for when NPV for equity return is zero and the value is set as the year one cost of generation.

Cost of Generation Calculator

All inputs are in blue.

Technology Assumptions	
Project Capacity (MW)	100
Capital Cost ($/kW)	$2,400
Fixed O&M ($/kW)	$50
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$0
Variable O&M Escalation	2.5%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Heat Rate (Btu/kWh)	0
Capacity Factor	35%

Financial/Economic Asumptions	
Debt Percentage	60%
Debt Rate	7.5%
Debt Term (years)	15
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	100%
Energy Price Escalation	2.5%
Tax Rate	40%
Cost of Equity	15%
Discount Rate	10.5%

Incentives	
PTC ($/MWh)	$21
PTC Escalation	2.5%
PTC Term (years)	10
ITC	0%

Outputs	
NPV Equity Return	$0
LCOE	$81.97

Calculation		
Cap Cost		##########
	0	
	0	-79935527.9
	5	-74177547.4
slope		1151596.1

5

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Annual Generation (MWh)	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600	306,600
Power Price	$69.41	$71.15	$72.93	$74.75	$76.62	$78.53	$80.50	$82.51	$84.57	$86.69	$88.85	$91.08	$93.35	$95.69	$98.08	$100.53	$103.04	$105.62	$108.26	$110.97
Total Operating Revenue	**$21,281,969**	**$21,814,019**	**$22,359,369**	**$22,918,353**	**$23,491,312**	**$24,078,595**	**$24,680,560**	**$25,297,574**	**$25,930,013**	**$26,578,263**	**$27,242,720**	**$27,923,788**	**$28,621,883**	**$29,337,430**	**$30,070,866**	**$30,822,637**	**$31,593,203**	**$32,383,033**	**$33,192,609**	**$34,022,424**
Fixed O&M	$5,000,000	$5,125,000	$5,253,125	$5,384,453	$5,519,064	$5,657,041	$5,798,467	$5,943,429	$6,092,014	$6,244,315	$6,400,423	$6,560,433	$6,724,444	$6,892,555	$7,064,869	$7,241,491	$7,422,528	$7,608,091	$7,798,294	$7,993,251
Variable O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operating Expenses	**$5,000,000**	**$5,125,000**	**$5,253,125**	**$5,384,453**	**$5,519,064**	**$5,657,041**	**$5,798,467**	**$5,943,429**	**$6,092,014**	**$6,244,315**	**$6,400,423**	**$6,560,433**	**$6,724,444**	**$6,892,555**	**$7,064,869**	**$7,241,491**	**$7,422,528**	**$7,608,091**	**$7,798,294**	**$7,993,251**
Interest Payment	$10,800,000	$10,386,498	$9,941,983	$9,464,130	$8,950,437	$8,398,218	$7,804,582	$7,166,424	$6,480,403	$5,742,931	$4,950,149	$4,097,908	$3,181,749	$2,196,878	$1,138,142	$0	$0	$0	$0	$0
Principal Payment	$5,513,362	$5,926,864	$6,371,379	$6,849,232	$7,362,925	$7,915,144	$8,508,780	$9,146,939	$9,832,959	$10,570,431	$11,363,213	$12,215,454	$13,131,613	$14,116,484	$15,175,220	$0	$0	$0	$0	$0
Debt Service	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$16,313,362**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation	$48,000,000	$76,800,000	$46,080,000	$27,648,000	$27,648,000	$13,824,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income	($42,518,031)	($70,497,479)	($38,915,739)	($19,578,229)	($18,626,190)	($3,800,664)	$11,077,511	$12,187,721	$13,357,595	$14,591,017	$15,892,148	$17,265,447	$18,715,690	$20,247,997	$21,867,855	$23,581,146	$24,170,675	$24,774,942	$25,394,315	$26,029,173
PTC	$6,438,600	$6,745,200	$6,745,200	$7,051,800	$7,051,800	$7,358,400	$7,358,400	$7,665,000	$7,971,600	$7,971,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ITC	$0																			
Taxes	**($23,445,812)**	**($34,944,192)**	**($22,311,496)**	**($14,883,092)**	**($14,502,276)**	**($8,878,666)**	**($2,927,396)**	**($2,789,911)**	**($2,628,562)**	**($2,135,193)**	**$6,356,859**	**$6,906,179**	**$7,486,276**	**$8,099,199**	**$8,747,142**	**$9,432,459**	**$9,668,270**	**$9,909,977**	**$10,157,726**	**$10,411,669**
Total ***(96,000,000)***	***23,414,420***	***35,319,848***	***23,104,378***	***16,103,630***	***16,161,161***	***10,986,857***	***5,496,126***	***5,830,694***	***6,153,198***	***6,155,780***	***(1,827,924)***	***(1,856,186)***	***(1,902,199)***	***(1,967,686)***	***(2,054,508)***	***14,148,688***	***14,502,405***	***14,864,965***	***15,236,589***	***15,617,504***

MACRS Depreciation Schedules																				
5	0.2	0.32	0.192	0.1152	0.1152	0.0576	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0.1429	0.2449	0.1749	0.1249	0.0893	0.0892	0.0893	0.0446	0	0	0	0	0	0	0	0	0	0	0	0
15	0.05	0.095	0.0855	0.077	0.0693	0.0623	0.059	0.059	0.0591	0.059	0.0591	0.059	0.0591	0.059	0.0591	0.0295	0	0	0	0
20	0.0375	0.07219	0.06677	0.06177	0.05713	0.05285	0.04888	0.04522	0.04462	0.04461	0.04462	0.04461	0.04462	0.04461	0.04462	0.04461	0.04462	0.04461	0.04462	0.04461

Figure 3-3. Example Generation Cost Calculation for a Wind Project.

3.6.2 Transmission Costs

The transmission cost for each project is unique and determined based on the project size, location and the specific transmission path required to deliver the energy to a California load area. Transmission costs in RETI includes a fixed cost component representing the expected cost to develop the transmission line, and a variable component. Generation resource interconnection costs (or "gen-tie" costs) are borne by the generating facility and are considered as part of the capital cost of the resource rather than part of the transmission cost.

Fixed Costs

Most facilities require some incremental transmission investment. The size of this transmission investment will depend on the location of the resource, and may include the following elements:

- **Collector substations.** Many CREZs require upgrades to existing substations or the addition of new substations to allow resources in a CREZ to interconnect to the grid.
- **Trunk lines.** This includes transmission necessary to interconnect collector points to the existing high-voltage grid if the collector point is not on the current grid or if the line requires upgrading to deliver the energy and capacity to the grid.
- **Network costs.** The cost of delivering the energy from the point of transfer to the transmission grid to the terminus substation located in the identified load centers.

RETI does not include cost estimates for upgrades to the distribution system that may be required. Recognizing that the distribution system may require changes that will increase the total transmission cost, without load flow modeling it is impossible to reliably estimate these costs.

Variable Costs

Projects are assigned costs per megawatt-hour delivered to the transmission system. For California projects, the CAISO's Transmission Access Charge (or TAC) was used as a proxy for all resources.

Out-of-state resources that do not directly interconnect to the California grid will likely face pancake transmission costs, having to pay a wheeling fee to the interconnecting utility as well as paying the CAISO's TAC charge. The wheeling cost may be highly variable depending on the location of the resource and the transmission interconnection agreement between the generator and the transmission host. As a simplifying assumption RETI used a wheeling cost of $2.00/MWh in addition to the

CAISO TAC charge. The variable transmission costs applied to projects in each resource area is detailed in Table 3-13.

Table 3-13. Variable Transmission Costs

Location	Cost ($/MWh)
California	3.75
OOS-North (WA/OR/B.C.)	5.75
Nevada – North	5.75
Nevada – Central	3.75
Nevada – South	3.75
Arizona	5.75
Baja	3.75

Line Loss Factors

The amount of energy loss due to transmission for each resource depends on several factors including line size, line loading, and distance from resource to delivery point. Line losses are dynamic and are calculated by the CAISO on an hourly basis. The CAISO does not forecast line losses for planning purposes, so RETI used CPUC guidance on line losses. CPUC Decision 07-09-040 directed Qualifying Facilities to the line loss assumptions provided in CPUC Decision 01-01-007. This decision provides "Renewable qualifying facilities (QFs) paid under the Section 390 (b) formula shall receive a transmission loss factor that is the greater of GMMQF/GMMSYS or 0.95." Accordingly, RETI assumed all California renewable resources will have a 5 percent loss.

For out-of-state resources, RETI applied formulaic loss factors. Losses are proportional to line length and the square of the current. For line loss calculation purposes RETI assumed that all lines would be 500 kV, and loaded at approximately 70 percent. Using this assumption, calculated losses were 0.20 MW per mile. These losses were applied to each project based on the point of interconnection to the CAISO delivery point. Similar to variable costs, RETI assumed that losses would pancake, so an additional 5 percent loss factor for California losses was applied to out-of-state resources.

3.6.3 Energy Value

An integral component of the resource valuation is the value of energy delivered by the generating resources. The Phase 1A report describes the calculation methodology for energy values; this section focuses on the energy price forecast used.

The energy value is intended to reflect the marginal cost of generation in the region where the resource is located. As RETI values the capacity of a resource

independent of the energy price, it is appropriate to consider only the marginal cost of generation in determining the energy value of a resource.

Three energy price forecasts were developed in order to allow a plausible range of future energy costs, including a reference, high, and low forecast. The forecasts were developed by Ventyx using the ProSym production cost model, incorporating assumptions developed by the CEC for the 2007 IEPR proceeding. Specifically, the energy price forecasts are based on the CEC's 2007 IEPR "Scenario 1B" forecast. This was selected by the RETI Phase 1B Working Group for several reasons:

- This scenario reflects RETI's assumptions regarding the achievement of RPS, implementation of the CSI, energy efficiency goals and demand response programs.
- Assumptions used in the CEC's 2007 IEPR forecast are well documented and have been publicly vetted.
- The forecast was prepared during summer 2007, and most assumptions underlying the forecast are substantively current.

Differences from the CEC IEPR Assumptions

The forecasts are based on the CEC IEPR, but differ in two major respects – the fuel price assumptions and the addition of a carbon adder.

Fuel Prices:

The CEC IEPR used fuel price forecasts prepared by Ventyx current as of summer 2007. Since then, fuel prices have been extremely volatile, making the selection of an appropriate gas forecast difficult. RETI used the Ventyx high fuel price forecast prepared for the CEC as the reference case assumption in RETI, and used the CEC IEPR base case forecast as the RETI low forecast. For the high fuel price case, RETI took a NYMEX annual stream of forward market prices as of June 27 (July foreword contract closing date) and escalated these at 1 percent annual inflation (real).

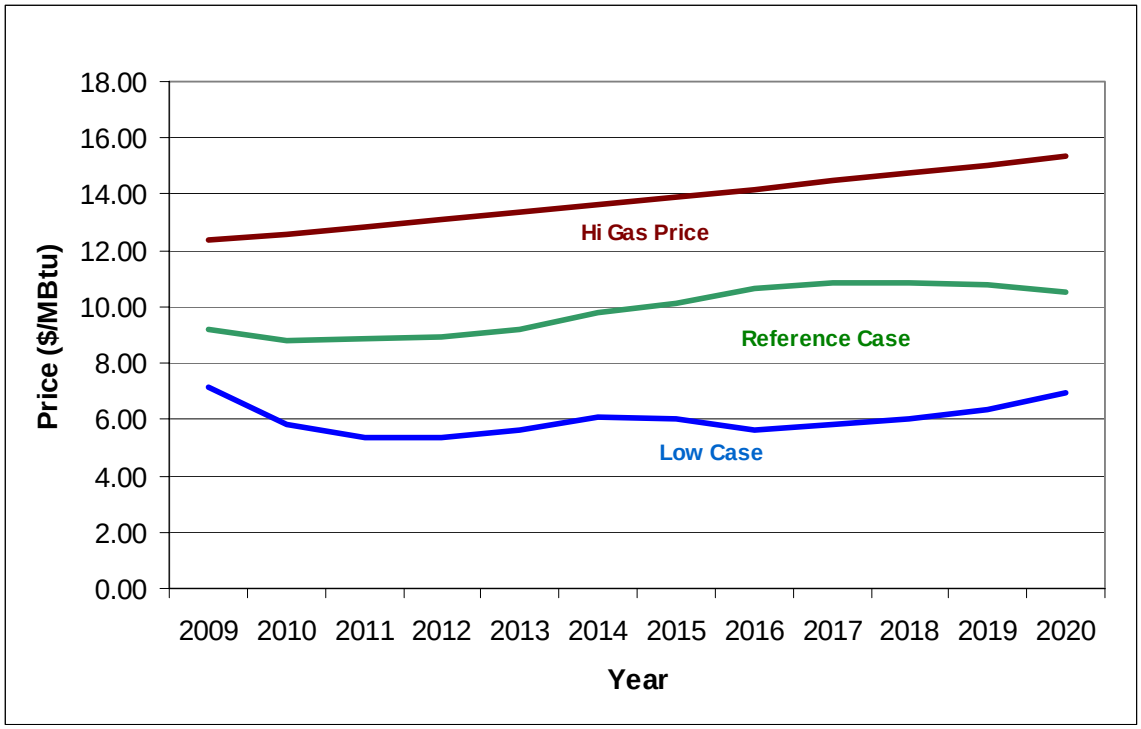


Figure 3-4. Energy Forecast Gas Prices ($/MBtu).

Table 3-14. Energy Forecast Gas Prices ($/MBtu)

Year	Reference Case Gas Prices	Low Case Gas Prices	High Case Gas Prices
2009	9.23	7.17	12.34
2010	8.78	5.82	12.59
2011	8.88	5.36	12.84
2012	8.94	5.34	13.10
2013	9.20	5.61	13.36
2014	9.78	6.09	13.63
2015	10.13	5.99	13.90
2016	10.66	5.60	14.18
2017	10.82	5.83	14.46
2018	10.84	6.02	14.75
2019	10.78	6.36	15.05
2020	10.55	6.96	15.35

Carbon Adder:

The CEC IEPR energy price scenarios did not include a Carbon adder in the dispatch price of fossil resources. RETI will include a carbon adder in all scenarios starting in 2012 thought the forecast period. The value is based on the CPUC's 2007 MPR proceeding adopted value.

The reference case and other forecast specifications are detailed on Table 3-15 below.

Table 3-15. Energy Forecast Assumptions

Assumption	CEC IEPR	RETI Reference Case	RETI Low Case	RETI High Case
Modeling	CEC sensitivity 1B	CEC sensitivity 1B	CEC sensitivity 1B	CEC sensitivity 1B
Gas Price	GED Base fuel price for CEC , 2007	GED High fuel price for CEC , 2007	GED Base fuel price for CEC , 2007	2008 CPUC MPR gas price forecast (w/CEC high fuel price forecast for other fuels)
Carbon Cost	N/A	CPUC MPR adder	CPUC MPR adder	CPUC MPR adder

Transmission Costs for Distributed Solar Photovoltaic Costs

Black & Veatch assumed that the 20 MW distributed solar PV projects characterized in this report would not require large transmission system upgrades. The only transmission cost included for these resources is the CAISO TAC and the project interconnection. These projects are assumed to be connected to smaller substations on the 50-200 kV transmission system. Large scale deployment of hundreds of such systems would likely require system upgrades and reinforcements; however, this was beyond the scope of this study.

3.6.4 Capacity Value

The capacity value of a generating resource is based on its ability to provide dependable and reliable capacity during peak periods when the system requires reliable resources for stable operation. Resources that can provide firm capacity will have a higher capacity value than resources that cannot. In California capacity value is assessed by the resource adequacy value. Current resource adequacy practice considers the average resource capacity factor during the 12:00 p.m. – 6:00 p.m. period year-round. However, based on guidance from the Phase 1A Working Group, RETI will limit this to determination of capacity factor during the summer months (June-September). For the purposes of RETI, this average summer peak capacity factor is known as the "capacity credit."

The baseline value of capacity is the cost of the next most likely addition of low-cost capacity, defined as the fixed carrying costs of a simple cycle gas turbine generator. This includes the capital costs, fixed operations and maintenance costs, and other fixed charges associated with the gas turbine generator capacity, expressed as a dollar per kilowatt per year ($/kW-year). The capacity value does not include variable costs, such as fuel purchases.

This baseline capacity value is adjusted for each project based on its capacity credit. Resources that are more "firm" receive a higher capacity credit. As discussed previously, the capacity credit is the average capacity factor for a project during the period from 12:00 p.m. – 6:00 p.m. during summer months. For all projects, this is derived from the projected 24 hour by 12 month generation profile for the resource, described in Section 6 for each resource.

There are other methods to calculate the capacity credit, such as the effective load carrying capability (ELCC), that might be more accurate. However, basing the capacity credit on the current resource adequacy approach is relatively straightforward from an analytical perspective and also consistent with current regulatory practice.

The example Table 3-16 shows the capacity value calculation for three hypothetical projects based on a hypothetical baseline capacity value of $100/kW-year and hypothetical capacity factors. This example is included for illustrative purposes only. The capacity value in dollars per kilowatt-year is calculated by multiplying the capacity credit by the baseline capacity value. The formula for calculating capacity value is:

Capacity Value =
(Capacity Credit) x (Baseline Capacity Value)

Table 3-16. Example Capacity Value Calculation.

	Wind	**Solar**	**Biomass / Geothermal**
Capacity Credit (CF in summer 12-6)	25%	90%	100%
Baseline Capacity Value ($/kW-yr)	$100	$100	$100
Capacity Value ($/kW-yr)	$25	$90	$100

Note: Hypothetical example, for conceptual illustration only.

The baseline capacity value is the levelized fixed costs of a simple cycle gas turbine generator, owned by a merchant generator. This value is sourced from the CEC Cost of Generation report. The determination is outlined below in Table 3-17.

Table 3-17. Baseline Capacity Value ($2007)	
Levelized Fixed Costs of a Simple Cycle Gas Turbine Generator ($/kW-yr)	
Capital & Financing - Construction	$137
Insurance	$8
Ad Valorem Costs	$7
Fixed O&M	$13
Corporate Taxes (w/Credits)	$39
Total Fixed Costs	$204

Source: CEC Comparative Cost of California Central Station Electricity Generation Technologies, CEC-200-2007-011-SF, December 2007.

3.6.5 Ranking Cost

The generation cost, transmission cost, capacity value, and energy value are combined in a single cost metric that represents the overall economic merit of a given project or CREZ. This is known as the ranking cost. The ranking cost is calculated using the following formula:

Ranking Costs =
Generation Cost + Transmission Cost
- Energy Value - Capacity Value

The ranking cost represents the costs of a renewable energy resource above (or below) its energy and capacity value. A lower ranking cost (including negative values), is indicative of a more cost-effective renewable energy project.

3.6.6 Consideration of Uncertainty and Sensitivities

It is very important to consider the uncertainty in the estimates used to value resources. By their very nature, these estimates include a margin of error. It would not be prudent to eliminate potential CREZs from consideration if the difference in their ranking cost is 5 percent, but the margin of error is 20 percent. For this reason, a methodology has been developed in to assess the impacts of uncertainty on the ranking process. This is described further in Section 5.

3.7 Development Timeframe

A consideration in the development of resource areas and CREZs is timing. To design, permit and construct new transmission facilities is a multi-year process, and RETI

recognizes that resources and CREZs requiring new transmission may only be available in the long term. To implement this RETI segregated the study period into three timeframes based on the availability of transmission, including near-, mid-, and long-term.

Table 3-18. Resource Development Timeframe

Resource Availability	Timeframe
Near-term	2009-2013
Mid-term	2014-2016
Long-term	2017-2020

RETI assumed that resources and CREZs using existing transmission, transmission under construction and CAISO-approved transmission would be available in the near-term. Resources using transmission lines that are currently proposed but not approved by the CAISO, such as PG&E's British Columbia line, are assumed to be available in the mid-term. New transmission, such as a new line from the Los Angeles area to Southern Nevada, was assumed to be only available in the long-term. Table 3-19 identifies the time frame in which resources located in each CREZ are expected to be available based on the expected availability of enabling near-term transmission.

Table 3-19. Development Timeframe by CREZ

	Timeframe	Enabling Near-Term Transmission
California CREZ		
Barstow	Mid-Long	
Carrizo North	Near	Available transmission
Carrizo South	Near	Available transmission
Cuyama	Near	Available transmission
Fairmont	Near	Tehachapi
Imperial East	Mid-Long	
Imperial North	Near	Sunrise and/or Green Path
Imperial South	Near	Sunrise and/or Green Path
Inyokern	Mid-Long	
Iron Mountain	Mid-Long	
Kramer	Mid-Long	
Lassen North	Mid-Long	
Lassen South	Mid-Long	
Mountain Pass	Mid-Long	
Needles	Mid-Long	
Owens Valley	Mid-Long	
Palm Springs	Near	Devers - Palo Verde 2
Pisgah	Mid-Long	
Riverside East	Near	Devers - Palo Verde 2
Round Mountain	Mid-Long	
San Bernardino - Baker	Mid-Long	
San Bernardino - Lucerne	Mid-Long	
San Diego North Central	Near	Sunrise
San Diego South	Near	Sunrise and/or Green Path
Santa Barbara	Mid-Long	
Solano	Near	Available transmission
Tehachapi	Near	Tehachapi
Twentynine Palms	Mid-Long	
Victorville	Mid-Long	
Non-CREZ Resources		
Non-CREZ Resources	Near	CA projects which don't require major transmission
Out-of-State Resources		
Arizona	Near	Devers - Palo Verde 2
Baja	Near	Sunrise and/or Green Path
British Columbia	Mid-Long	
Central Nevada	Mid-Long	
Northern Nevada	Mid-Long	
Oregon	Mid-Long	
Southern Nevada	Mid-Long	
Washington	Mid-Long	

3.8 Net Short Calculation

The RETI Phase 1B analysis forecasts the demand for renewable energy in California in order to determine the quantity of new generation that must be built. This is termed the "net short" and is described in this section.

The California energy demand has been forecasted through 2020 in order to determine the incremental percentage of renewable energy required to keep the state on target to reach the proposed Renewable Portfolio Standard (RPS) target of 33 percent by 2020.

California was among the first states to enact a renewable portfolio standard and currently has one of the most aggressive renewable energy portfolio requirements in the country. California's RPS requires that 20 percent of electric energy be generated from renewable resources by 2010 (2013 with flexible compliance).[8] The Governor and the state's Energy Action Plan have endorsed a further goal of 33 percent renewables by 2020, in part, as a possible strategy for meeting the greenhouse gas emission reduction requirements of AB 32.[9] The RETI analysis assumes to meet the 33 percent standard.

It has been noted that publicly owned utilities are not subject to the same RPS requirements as investor owned utilities. However, most have developed similar renewable goals, and it has been agreed that the state's requirements for investor owned utilities were an appropriate proxy for all load-serving entities.

3.8.1 California Load Growth

To project future renewable requirements, RETI is using the CEC statewide load forecast prepared as art of the 2007 Integrated Energy Policy Report (2007 IEPR), which extends through 2018. To forecast loads for the years 2019 and 2020, the 2018 statewide total electric load was inflated 1.3 percent per year, which is the average annual growth rate from 2007-2018 in the CEC forecast.[10] This forecast incorporates CEC staff's expectations for energy efficiency and behind-the-meter generation. If higher-levels of

[8] SB 1078 established an RPS of 20% by 2017. The Energy Action Plan, adopted by the Commission and the California Energy Commission (CEC) in May 2003, accelerated the completion date to 2010. SB 107, passed in 2006, codified that policy.

[9] Assembly Bill 32, Ch. 488, Stats. 2006. Executive Order S-3-05, signed by the Governor on June 1, 2005 establishes greenhouse gas emission reduction goals for California and identifies acceleration of the renewable energy goals to 33% of energy sales by 2020 as one strategy to meet those goals.

[10] California Energy Commission, "California Energy Demand 2008-2018: Staff Revised Forecast, FINAL Staff Forecast, 2nd Edition", Publication # CEC-200-2007-015-SF2, November 2007. Note that the 2007 final forecast is significantly higher than the draft forecast. The forecast includes energy efficiency and demand side measures that the CEC expects to occur.

energy efficiency and behind-the-meter generation are achieved, it will reduce the net short commensurately.

3.8.2 RPS Assumptions

RETI considers three RPS target points for generation in the analysis. The near term target is the 20 percent requirement, which RETI assumes, with flexible compliance, will be met in 2013. The ultimate target is 33 percent renewables by 2020. Additionally, an intermediate goal has been set for 2016, which lies on a straight-line interpolation. Table 3-20 shows the RPS requirement milestones. Figure 3-5 shows the annual RPS requirement, with the initial renewable contribution of 10.9 percent in 2006.

Table 3-20. RPS Requirements

Year	CA Load (GWh)	RPS Requirement (%)	RPS Requirement (GWh)
2013	309,148	20%	61,830
2016	320,178	26%	83,246
2020	335,644	33%	110,763

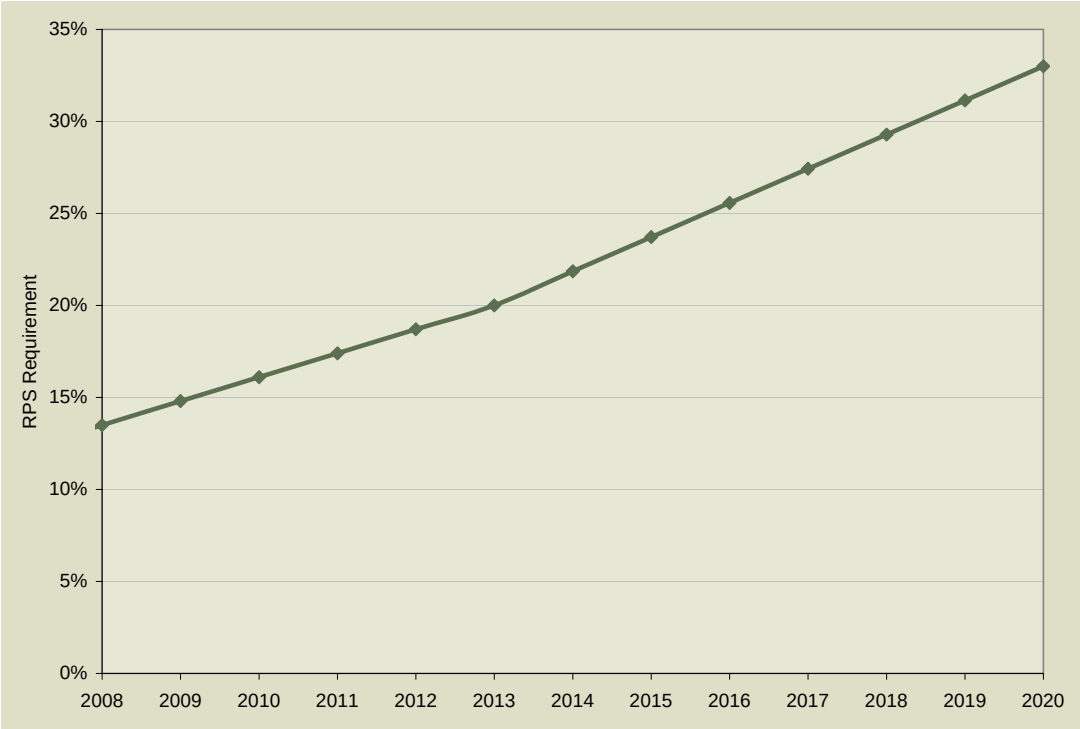


Figure 3-5. Annual RPS Requirement.

3.8.3 Existing Resources

Currently, approximately 12 percent of California's total electric energy requirements are satisfied with RPS-eligible generation as documented by Net System Power Report for 2007.[11] Investor owned utilities serve a somewhat higher percentage of the load with renewable energy, but this is tempered by lower quantities by publicly owned utilities. Table 3-21 provides a breakdown of the existing renewable capacity by resource type.

Generation from existing renewable resources is assumed to stay constant during the RETI study period.

Table 3-21. Existing RPS-Eligible Resources.

Resource	Energy Delivery (GWh)	Percent of California Energy
Biomass	6,236	2.1%
Geothermal	13,439	4.5%
Small Hydro	8,393	2.8%
Solar	675	0.2%
Wind	6,802	2.3%
Total	35,545	11.8%

Source: CEC 2007 Net system Power Report

3.8.4 Under Construction and Pre-Construction Resources

Under construction and pre-construction resources that have 2008 completion dates are considered by RETI to be part of the existing RPS-eligible renewable resources, but are not reported by the CEC 2007 Net System Power Report. A search for "under construction", "site preparation", and "permitted" projects was conducted using Ventyx's application Energy Velocity.

Renewable projects in the "permitted" stage have to meet the following criteria in order to be considered part of the existing RPS-eligible resources:

- A contract for energy sales
- All major siting and construction permits
- A transmission interconnection agreement

[11] California Energy Commission, "2007 Net System Power Report: Staff Report", Publication # CEC-200-2008-002, April 2008.

Table 3-22 shows the under construction and pre-construction projects that are considered RPS-eligible. Assumed capacity factors for each of the technologies are consistent with those reported in the Phase 1A report.

Table 3-22. RPS-Eligible Under Construction and Pre-Construction Resources

Stage	Resource	Project Capacity (MW)	Total Capacity (MW)	Total Energy Delivery (GWh)
Permitted	Solar	5	5	11
Site Preparation	Landfill Gas	4	4	27
Under Construction	Biomass Geothermal Landfill Gas Sludge Waste Solar Wind	2.2 66.0 19.4 1.4 0.3 300.5	390	1,224
Grand Total			399	1,262

Source: Black & Veatch query of Ventyx Energy Velocity database, July 28, 2008. Updated 13 October.

The net short calculation does not consider planned and contracted new renewable generation which does not require new transmission facilities (for example, the 50 MW Klickitat wind project in Washington). While relatively modest currently, the omission of these resource may result in the net short being overestimated.

3.8.5 California Solar Initiative

The California Solar Initiative (CSI) has reported that it is on target to contribute 100 MW of installed solar capacity to the grid by the end of 2008. The CSI program has a goal of installing 3,000 MW of solar generating capacity from the CPUC contribution of the general market program by 2016.[12] Table 3-23 provides a breakdown of the expected yearly contribution of CSI capacity to the California RPS requirement, with straight line interpolation between the 2008 contribution and the 2016 target. In estimating the total amount of CSI renewable energy credits (RECs) that will contribute toward the RPS, the following assumptions were made:

- The capacity factor for solar technologies is assumed to be 25 percent.

- 50 percent of the energy and capacity would be credited toward the RPS

Table 3-23. CSI Expected Contribution to RPS

Year	Installed Capacity (MW)	Energy Delivery (GWh)
2008	100	219
2009	275	602
2010	450	986
2011	625	1,369
2012	800	1,752
2013	975	2,135
2014	1,150	2,519
2015	1,325	2,902
2016	1,500	3,285

3.8.6 Contribution of Other Renewables

Several renewable energy technologies are not considered for in-depth analysis in this report based on several factors including the likely ability of the resource to contribute to California RPS requirements due to total resource potential, need for large-scale transmission, ability to cost-effectively deliver the resource to the California grid, and technology maturity. These technologies are expected to have some contribution to the RPS but are not sufficient resources to merit exploring potential new transmission access.

The RETI Phase 1A report estimated the resource potential for each of the following technologies: anaerobic digestion, landfill gas, small hydropower, wave and marine current. For the anaerobic digestion, landfill gas, and hydro projects, it was assumed that 50 percent of the California potential identified in the RETI Phase 1A report would be developed by 2020 and is included in the contribution assessment. For wave and marine current projects, Phase 1A identified a likely development path for each of these technologies through 2020. Due to the technical immaturity for capturing the potential of these resources, the amount of California potential expected to be utilized by 2020 is much lower: 8 percent for marine current and 5 percent for wave.

Table 3-24 shows a breakdown of the expected yearly energy delivery contributions of these renewable energy technologies. Only the contributions of projects within the state of California were considered in this section.

[12] California Public Utilities Commission, "California Solar Initiative, CPUC Staff Progress Report", July 2008.

Table 3-24. Production Timescale and Energy Delivery for Other Renewables

Year	Anaerobic Digestion	Landfill Gas	Small Hydro.	Marine Current	Wave	Total Energy Delivery
	(GWh)	(GWh)	(GWh)	(GWh)	(GWh)	(GWh)
2008	0	0	0	0	0	0
2009	86	41	29	0	0	155
2010	171	82	58	0	0	311
2011	257	123	87	0	0	466
2012	342	164	116	0	0	622
2013	428	205	145	0	0	777
2014	513	246	174	2	0	934
2015	599	287	203	3	93	1,184
2016	684	328	232	5	325	1,574
2017	770	369	261	9	556	1,965
2018	855	410	290	13	788	2,356
2019	941	451	319	17	1,020	2,748
2020	1,027	487	348	21	1,252	3,134

3.8.7 RETI Net Short

The RETI net short is the generation target to be met with resources identified in this project. The net short takes into account RPS demand as well as the base case resources and other renewables described above. The general equation for the RETI net short is:

RETI Net Short (GWh) =
{(California Energy Demand) x (Annual % RPS Requirement)}
- {(Operating Resources) + (Under Construction and Pre-Construction Resources)
+ (CSI Contribution) + (Other Renewables Contribution)}

The contributions of operating resources, under construction and pre-construction resources, CSI, and the other renewables to the calculation of net short are given in Table 3-25. The incremental RETI net short is the difference between the current and next year's net short amount; the amount of renewable capacity that the state needs to construct in order to stay on course to meet the 33 percent renewable goal by 2020, assuming that the contributions by the CSI and other renewables are realized.

The calculated RETI net short by 2020 is 67,536 GWh/yr. This is equivalent to about 19,300 MW at a 40 percent average capacity factor.

Figure 3-6 is a graphical representation of the data presented in Table 3-25.

Table 3-25. RETI Net Short Calculations

	RETI Net Short	Incr. RETI Net Short	CA Energy Demand	Annual RPS Req.	Operating Resources	Under & Pre-Cons. Resources	CSI	Other Renew-ables
Year	GWh	GWh	GWh	%	GWh	GWh	GWh	GWh
2010	9,724	3,538	297,062	16.1%	35,545	1,262	986	311
2011	13,772	4,048	301,230	17.4%	35,545	1,262	1,369	466
2012	17,911	4,139	305,303	18.7%	35,545	1,262	1,752	622
2013	22,110	4,199	309,148	20.0%	35,545	1,262	2,135	777
2014	28,126	6,016	312,878	21.9%	35,545	1,262	2,519	934
2015	34,181	6,054	316,575	23.7%	35,545	1,262	2,902	1,184
2016	40,208	6,028	320,178	25.6%	35,545	1,262	3,285	1,574
2017	46,710	6,502	323,630	27.4%	35,545	1,262	3,285	1,965
2018	53,341	6,631	327,085	29.3%	35,545	1,262	3,285	2,356
2019	60,348	7,007	331,337	31.1%	35,545	1,262	3,285	2,748
2020	67,536	7,188	335,644	33.0%	35,545	1,262	3,285	3,134

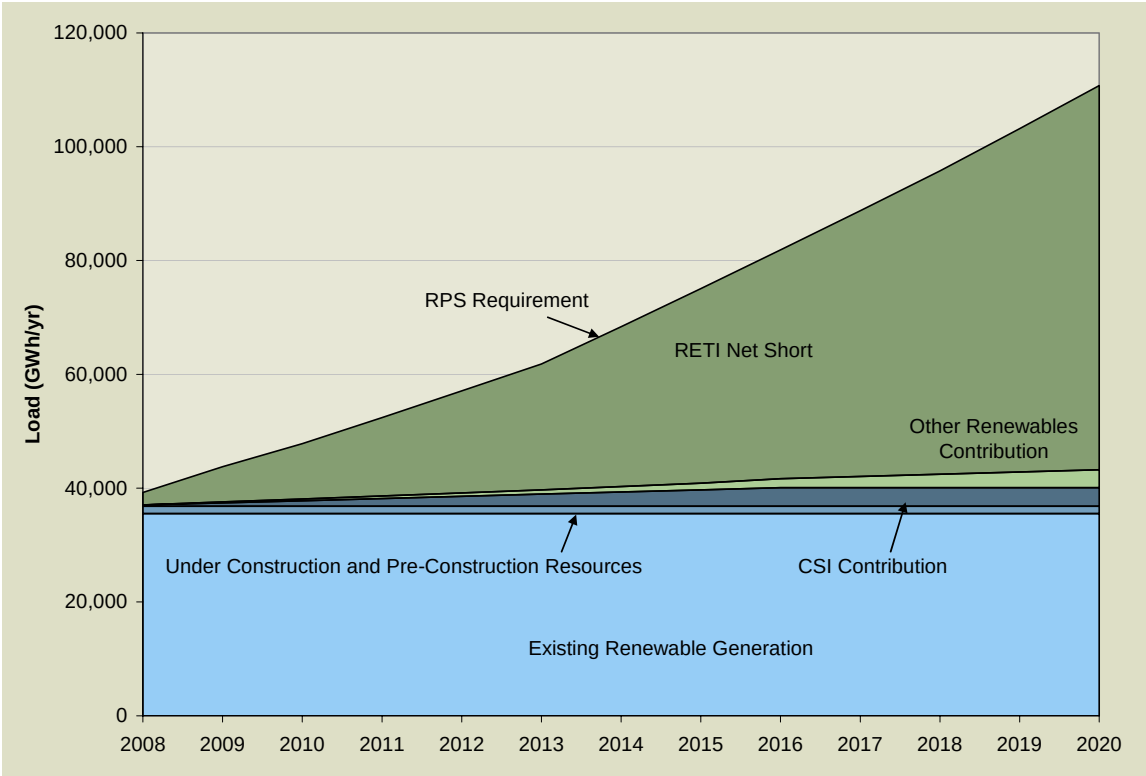


Figure 3-6. RETI Net Short Calculation

4.0 Competitive Renewable Energy Zones and Resource Areas

RETI identified over 2,100 renewable resource projects, with a combined generating capacity of over 153,000 MW, with the potential to deliver energy to California to meet California renewable generation goals. Within California RETI identified 29 Competitive Renewable Energy Zones (CREZs), or aggregations of renewable projects lined by common transmission requirements and within close physical proximity. In addition to the resources included in the CREZs in California, RETI identified stand-alone projects that do not share a transmission solution with enough renewable resources to define a CREZ. These are referred to as "non-CREZ resources." Outside of California, RETI identified renewable resources in four states (Washington, Oregon, Nevada, and Arizona) as well as British Columbia and Baja California Norte, Mexico that are capable of delivering renewable energy to California. For discussion purposes RETI aggregated the California CREZs and stand alone resources into five resource areas. Similarly, RETI aggregated out-of-state resources into three resource areas. This section describes these resource areas and the resources and CREZs that are included in them.

4.1 California Resource Areas

Five resource areas, containing 29 CREZs and additional individual resources, were identified in California. The resource areas are generally aligned with utility delivery areas within the state and include Central Coast, Northern California, Salton Sea / San Diego, Southeastern California and Tehachapi / Owens.

4.1.1 Central Coast

The Central Coast resource area includes four CREZs and several non-CREZ projects. This area is physically bounded by Morro Bay to the north and Santa Barbara to the south, with the eastern portion extending to near Kings City and the western portion to the Pacific Ocean. This resource area includes the Carrizo Plain, which has several proposed solar developments. Moderate quality wind resource potential was identified by RETI in the coastal section of the resource area.

The Central Coast currently has substantial transmission infrastructure, used primarily to transmit energy from the Morro Bay and Diablo Canyon power plants. The Central Coast CREZs have been modeled in RETI to interconnect to the existing Gates substation. As a result, they are capable of delivering energy to both Northern and Southern California load areas.

A map of the resource area, identifying the CREZs is included in Figure 4-1.

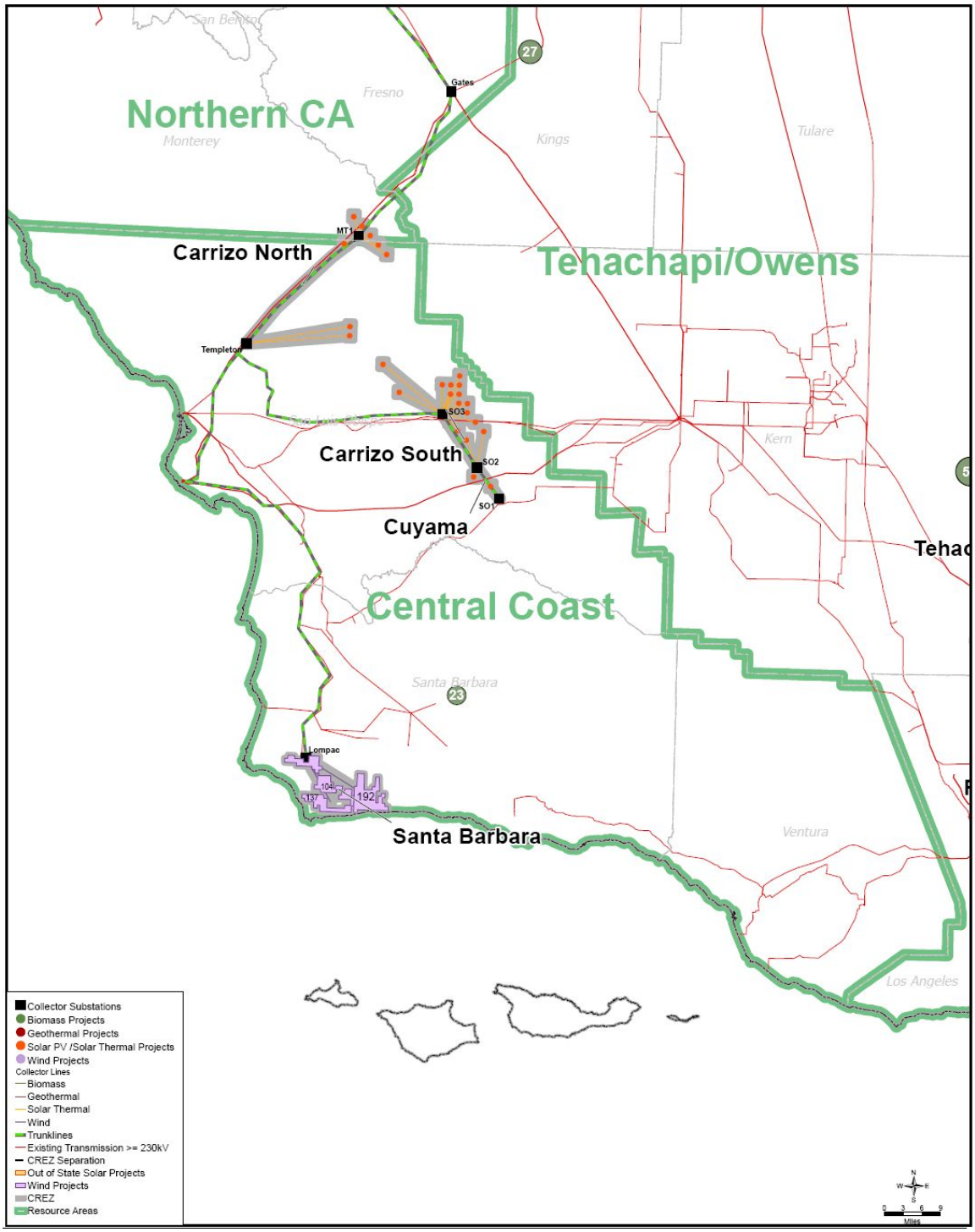


Figure 4-1. Central Coast Resource Area.

The Central Coast resource area includes 76 identified projects, with total generating capacity of 6,452 MW and potential energy delivery of approximately 14,342

GWh. The ranking for these CREZs are relatively poor, due primarily to the inferior quality of solar and wind resources relative to Southern California resources. A summary of Central Coast resources, by CREZ, is provided on Table 4-1, and a summary of the cost and ranking information for the resources in each CREZ is included on Table 4-2.

Table 4-1. Central Coast Resource Summary by CREZ.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Carrizo North				1,600		1,600
Carrizo South				3,000		3,000
Cuyama				400		400
Santa Barbara					433	433
CREZ Total				**5,000**	**433**	**5,433**
Non-CREZ Resources	23		920		77	1,019
Grand Total	**23**		**920**	**5,000**	**509**	**6,452**
Generation (GWh/yr)[c]						
Carrizo North				3,395		3,395
Carrizo South				6,440		6,440
Cuyama				892		892
Santa Barbara					1,180	1,180
CREZ Total				**10,727**	**1,180**	**11,907**
Non-CREZ Resources	159		2,046		230	2,435
Grand Total	**159**		**2,046**	**10,727**	**1,410**	**14,342**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-2. Central Coast Economic Characteristics by CREZ.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
Carrizo North	1,600	3,225	179	18**	98	170	19
Carrizo South	3,000	6,118	179	37	97	167	41
Cuyama	400	847	171	26**	97	168	24
Santa Barbara	433	1,121	112	42	88	63	43
Non-CREZ Resources	1,019	2,415	202	6	93	145	53

Notes:

* Includes transmission losses

** Transmission is assumed to be available on the existing transmission system. This impacts the transmission cost of these CREZs. Resources in the Carrizo North and Cuyama CREZs are allocated transmission capacity as they have slightly lower rank costs than resources in Carrizo South (prior to allocation of "free" transmission).

4.1.2 Salton Sea / San Diego

The Salton Sea / San Diego resource area includes five CREZs, as well as non-CREZ resources. Physically, this area includes San Diego and Imperial Counties and is bordered by the Pacific Ocean to the west, Mexico to the South, Arizona to the east and Riverside County to the north. The area is rich with renewable resources, including substantial amounts of geothermal potential near the Salton Sea, solar resources throughout the area, and wind resources in local mountain ranges.

Electrically, this area is currently very constrained. New transmission is expected to be available, with Imperial Irrigation District approving the Green Path project which allows for the transmission of approximately 1200 MW of Salton Sea-area resources to the Los Angeles area. Additionally, the CAISO has approved the Sunrise Powerlink, which will increase the flow of energy by approximately 1000 MW from Imperial County to the San Diego area. These transmission resources are assumed in the RETI modeling. A map of the resource area identifying the CREZs is included in Figure 4-2.

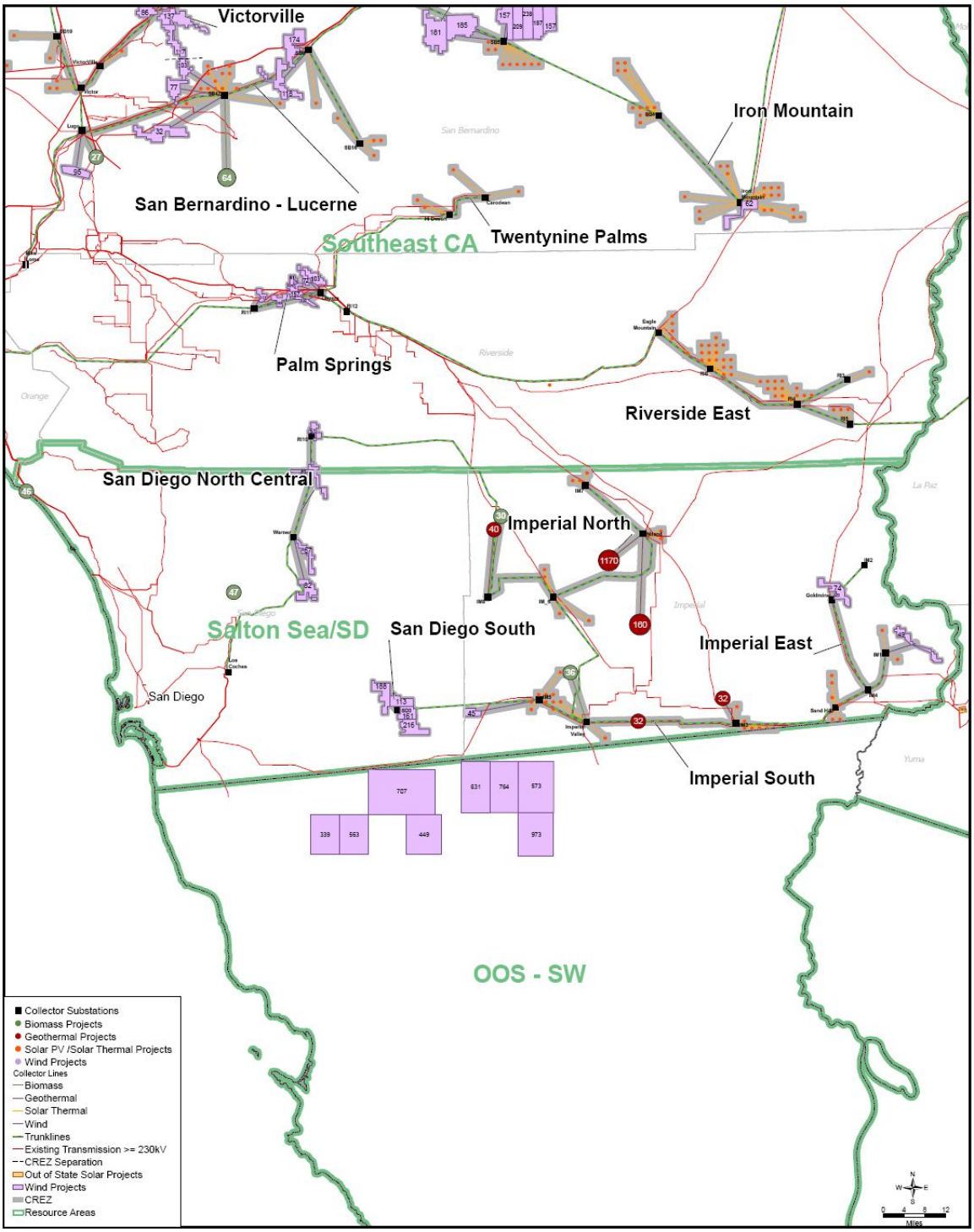


Figure 4-2. Salton Sea / San Diego Resource Area.

This Salton Sea / San Diego resource area has 137 identified projects, with total generating capacity of 11,361 MW and potential energy delivery of 35,673 GWh. The geothermal resources located near the Salton Sea are highly ranked due to their low generation cost and proximity to assumed transmission. Other resources in this area are

moderately or low ranked due to inferior solar and wind resource compared to other areas in Southern California, as well as the high cost to develop incremental transmission in this area. A summary of the resources by CREZ in this area is included in Table 4-3, and a summary of the cost and ranking information for the resources in each CREZ is included in Table 4-4.

Table 4-3. Salton Sea / San Diego Resource Summary by CREZ.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Imperial East				1,600	123	1,723
Imperial North – A		1,370				1,370
Imperial North – B	30			1,800		1,830
Imperial South	36	64		3,600	45	3,745
San Diego North Central					281	281
San Diego South					678	678
CREZ Total	**66**	**1,434**		**7,000**	**1,128**	**9,628**
Non-CREZ Resources	93		1,640			1,733
Grand Total	**159**	**1,434**	**1,640**	**7,000**	**1,128**	**11,361**
Generation (GWh/yr)[c]						
Imperial East				3,864	337	4,201
Imperial North – A		10,626				10,626
Imperial North – B	210			4,297		4,507
Imperial South	250	449		8,419	119	9,237
San Diego North Central					739	739
San Diego South					1,926	1,926
CREZ Total	**460**	**11,074**		**16,580**	**3,121**	**31,236**
Non-CREZ Resources	652		3,785			4,437
Grand Total	**1,112**	**11,074**	**3,785**	**16,580**	**3,121**	**35,673**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-4. Salton Sea / San Diego Economic Characteristics by CREZ.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
Imperial East	1,723	3,991	151	34	95	135	34
Imperial North – A	1,370	10,095	91	8**	86	204	-13
Imperial North – B	1,830	4,282	157	28	96	151	29
Imperial South	3,745	8,776	155	29**	96	146	31
San Diego N. Central	281	702	112	19	86	67	19
San Diego South	678	1,829	97	29	86	68	16
Non-CREZ Resources	1,733	4,404	196	5	94	160	46

Notes:
* Includes transmission losses
** Transmission is assumed to be available at the Sunrise and/or Green Path transmission lines, which are not yet built. This affects the transmission costs of these CREZs.

4.1.3 Northern California

The Northern California resource area is the largest geographic area in the RETI analysis, covering all of California north of the San Francisco and Sacramento metropolitan areas, and southward through the central valley. Pacific Gas and Electric (PG&E) and the Sacramento Municipal Utility District (SMUD) both operate electric systems in the region. The area also includes all or portions of several smaller electric suppliers' control areas, including Sierra Pacific (a subsidiary of PacifiCorp), Mountain Utilities, and several municipal utilities. The Western Area Power Administration (WAPA) also has resources and transmission in Northern California.

RETI identified four CREZs in Northern California, three of which include sub-CREZs. The Solano CREZ is located in the San Francisco bay area. The northeastern CREZs are expected to deliver energy to the San Francisco and Sacramento metropolitan areas via new transmission aligned with existing COI transmission. Non-CREZ resources are disbursed throughout the area and could be interconnected to existing and upgraded lines at voltages below 230 kV. A map of the Northern California resource area is found in Figure 4-3.

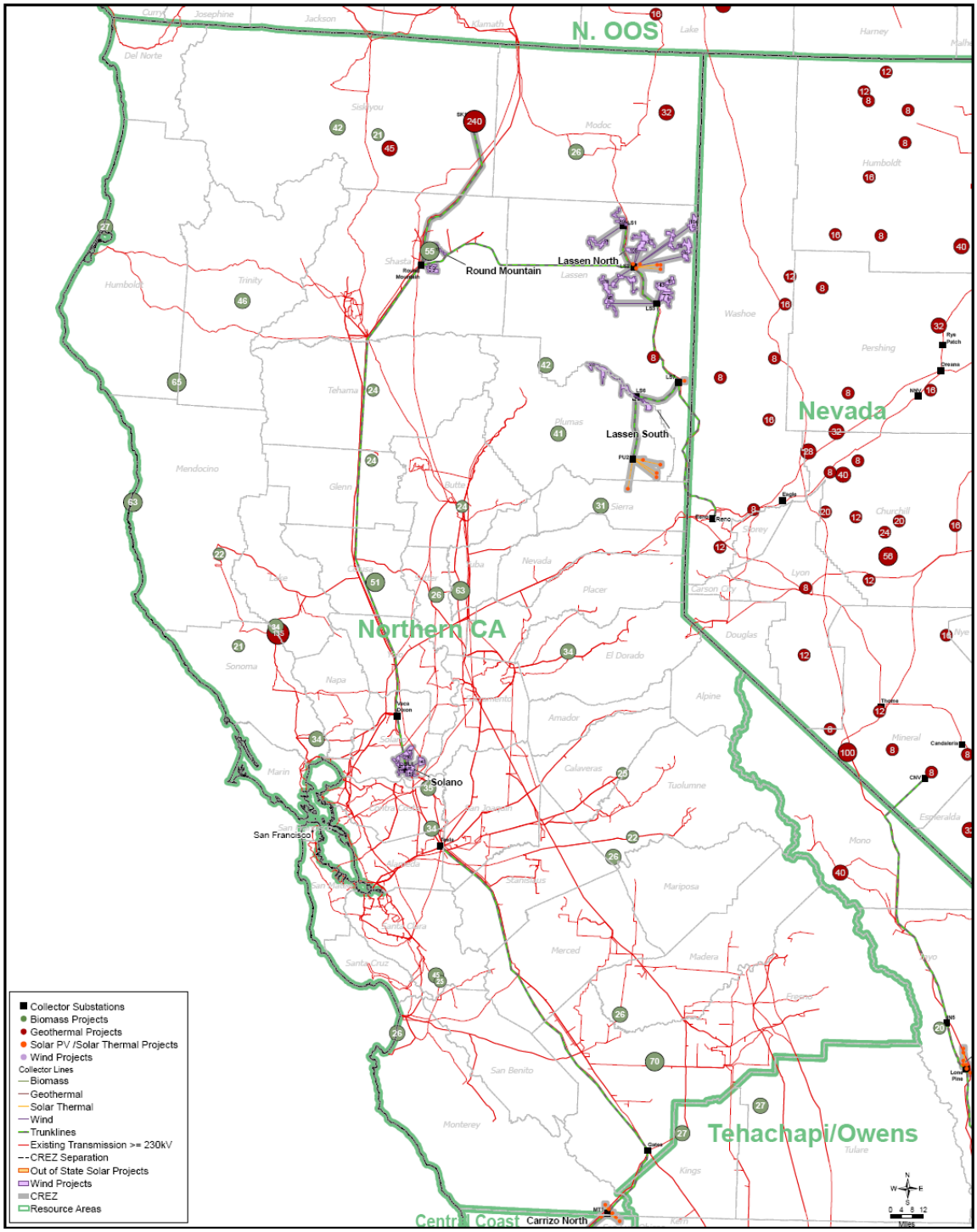


Figure 4-3. Northern California Resource Area.

This Northern California resource area contains 906 identified projects, with a total generating capacity of 24,625 MW and estimated annual energy generation of 61,464 GWh. With the exception of the Solano CREZ, the northern California CREZs

rank poorly. The Solano CREZ has a very good wind resource with low generation costs, along with ample existing transmission capacity. The other Northern California CREZs have marginal resources relative to the Southern California resources, and require substantial new transmission to deliver energy to the San Francisco / Sacramento metropolitan area. A summary of the Northern California resources are included in Table 4-5, and a summary of the cost and ranking information for the resources in each CREZ is included in Table 4-6.

Table 4-5. Northern California Resource Summary by CREZ.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Lassen North – A					821	821
Lassen North – B				1,200	646	1,846
Lassen South – A					410	410
Lassen South – B				1,200		1,200
Round Mountain – A		240				240
Round Mountain – B	55				132	187
Solano					894	894
CREZ Total	**55**	**240**		**2,400**	**2,903**	**5,598**
Non-CREZ Resources	1,095	220	16,480		615	18,410
Grand Total	**1,150**	**460**	**16,480**	**2,400**	**3,518**	**24,008**
Generation (GWh/yr)[c]						
Lassen North – A					2,195	2,195
Lassen North – B				2,355	1,589	3,943
Lassen South – A					1,106	1,106
Lassen South – B				2,504		2,504
Round Mountain – A		1,682				1,682
Round Mountain – B	385				357	742
Solano					2,865	2,865
CREZ Total	**385**	**1,682**		**4,858**	**8,112**	**15,037**
Non-CREZ Resources	7,675	1,699	33,951		1,787	45,112
Grand Total	**8,060**	**3,381**	**33,951**	**4,858**	**9,889**	**60,149**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-6. Northern California Economic Characteristics by CREZ.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
Lassen North – A	821	2,086	111	32	87	53	36
Lassen North – B	1,846	3,746	162	38	94	116	50
Lassen South – A	410	1,051	109	37	87	53	38
Lassen South – B	1,200	2,379	177	48	98	165	48
Round Mountain – A	240	1,598	86	20	87	204	-11
Round Mountain – B	187	705	129	21	87	131	38
Solano	894	2,721	77	10**	86	96	-29
Non-CREZ Resources	18,410	44,554	208	6	94	162	56

Notes:
* Includes transmission losses
** Transmission is assumed to be available on the existing transmission system. This affects the transmission cost of this CREZ.

4.1.4 Tehachapi / Owens

The Tehachapi / Owens resource area includes five CREZs. The resource area extends north and northeast from the Los Angeles basin through the Tehachapi Mountains and the Owens Valley to the Nevada border. The region contains both Southern California Edison (SCE)-owned and Los Angeles Department of Water and Power (LADWP)-owned transmission, and for the purposes of modeling, energy generated in this area would be delivered to the Los Angeles area. SCE is currently building transmission to the Tehachapi area that will allow for an incremental 1,200 MW of resources to be interconnected, and the CAISO has approved an additional 3,000 MW of transmission to the Tehachapi, which RETI assumes is available in 2013. A map of the resource area identifying the CREZs is included in Figure 4-4.

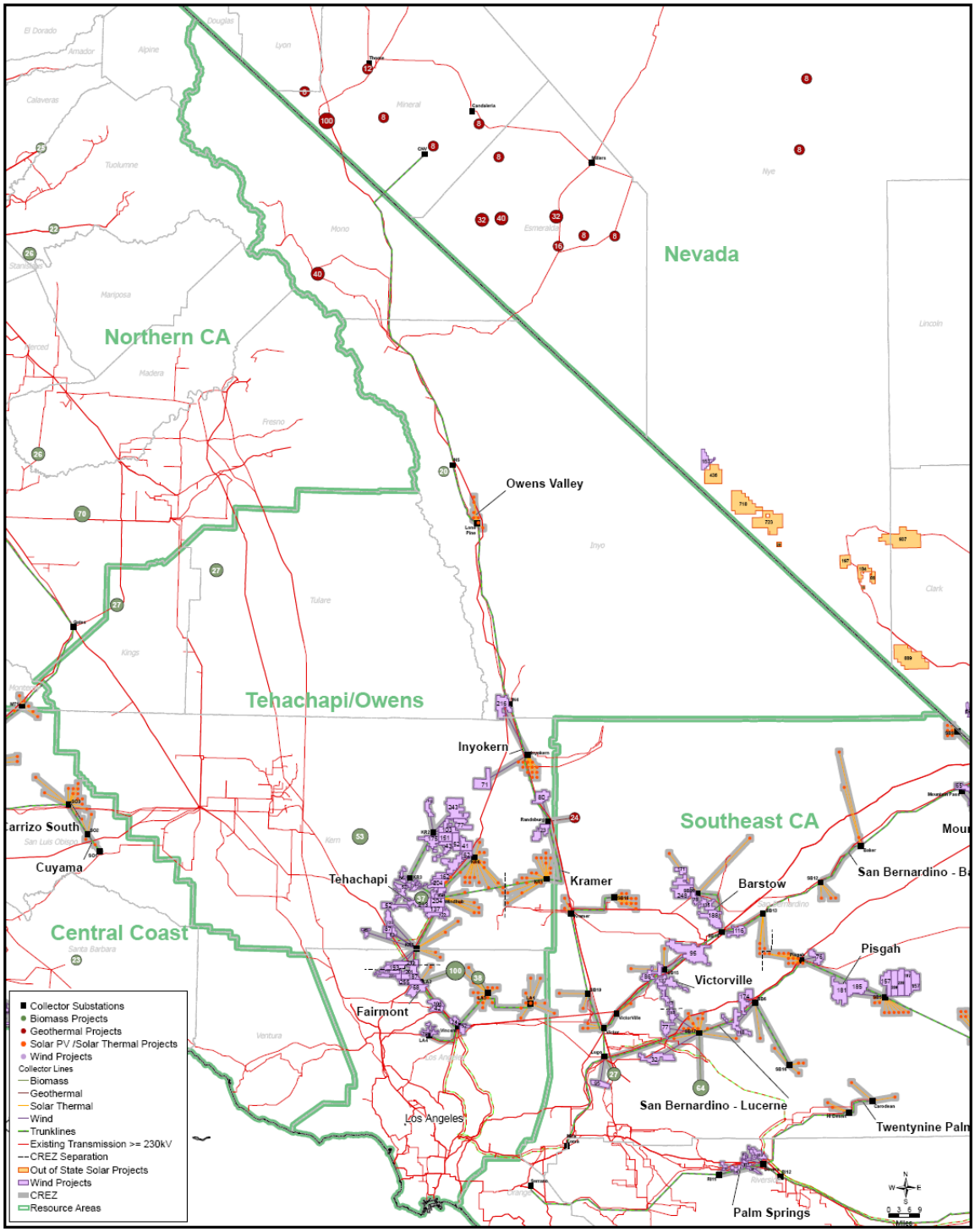


Figure 4-4. Tehachapi / Owens Resource Area.

This resource area includes 380 projects, with total generating capacity of 32,000 MW and expected annual energy generation of 84,500 GWh. Resources in this area

offer high value and are well-ranked in the analysis due to two factors -- excellent resource (solar and wind) and low transmission costs. The Mohave Desert has some of the highest solar insolation in the world, hence the lowest cost solar resources are to be found here. Further, the Tehachapi Mountains have excellent wind resources. Additionally, the RETI assumes the Tehachapi transmission line will be constructed, allowing the interconnection of many resources with low incremental transmission cost. A summary of the resources included in this area is included in Table 4-7, while a summary of the cost and ranking information for the resources in each CREZ are included in Table 4-8.

Table 4-7. Tehachapi / Owens Resource Summary by CREZ.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Fairmont	138			5,400	1,380	6,918
Inyokern				2,600	287	2,887
Kramer		24		6,400	203	6,627
Owens Valley				1,400		1,400
Tehachapi	37			6,000	3,605	9,642
CREZ Total	**175**	**24**		**21,800**	**5,474**	**27,473**
Non-CREZ Resources	127		4,400			4,527
Grand Total	**302**	**24**	**4,400**	**21,800**	**5,474**	**32,000**
Generation (GWh/yr)[c]						
Fairmont	967			14,179	4,136	19,282
Inyokern				6,798	713	7,511
Kramer		168		16,467	471	17,107
Owens Valley				3,613		3,613
Tehachapi	259			15,371	10,781	26,412
CREZ Total	**1,226**	**168**		**56,428**	**16,102**	**73,925**
Non-CREZ Resources	892		9,683			10,575
Grand Total	**2,118**	**168**	**9,683**	**56,428**	**16,102**	**84,500**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-8. Tehachapi / Owens Economic Characteristics by CREZ.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
Fairmont	6,918	18,318	130	14**	96	157	-9
Inyokern	2,887	7,136	145	23	98	163	8
Kramer	6,627	16,251	146	20**	99	164	5
Owens Valley	1,400	3,433	145	29	99	168	10
Tehachapi	9,642	25,091	125	17**	95	137	-3
Non-CREZ Resources	4,527	10,530	212	5	96	160	53

Notes:
* Includes transmission losses
** Transmission is assumed to be available on the Tehachapi transmission line, which is not yet built. This affects the transmission costs of these CREZs.

4.1.5 Southeast California

The Southeast California resource area contains the largest quantity of potential resources. This area extends east of the Los Angeles basin to the Nevada and Arizona borders, and includes most of San Bernardino and Riverside counties. There is an extensive transmission network in the region, which currently serves to connect Southern California to Nevada and Arizona. The CAISO has approved development of the Devers-Palo Verde 2 line, which will increase transfer capability from Arizona or the Southeast California resource area to the Los Angeles area by approximately 1,200 MW. Energy generated in this region would be delivered to the Los Angeles area. A map of this resource area is included in Figure 4-5.

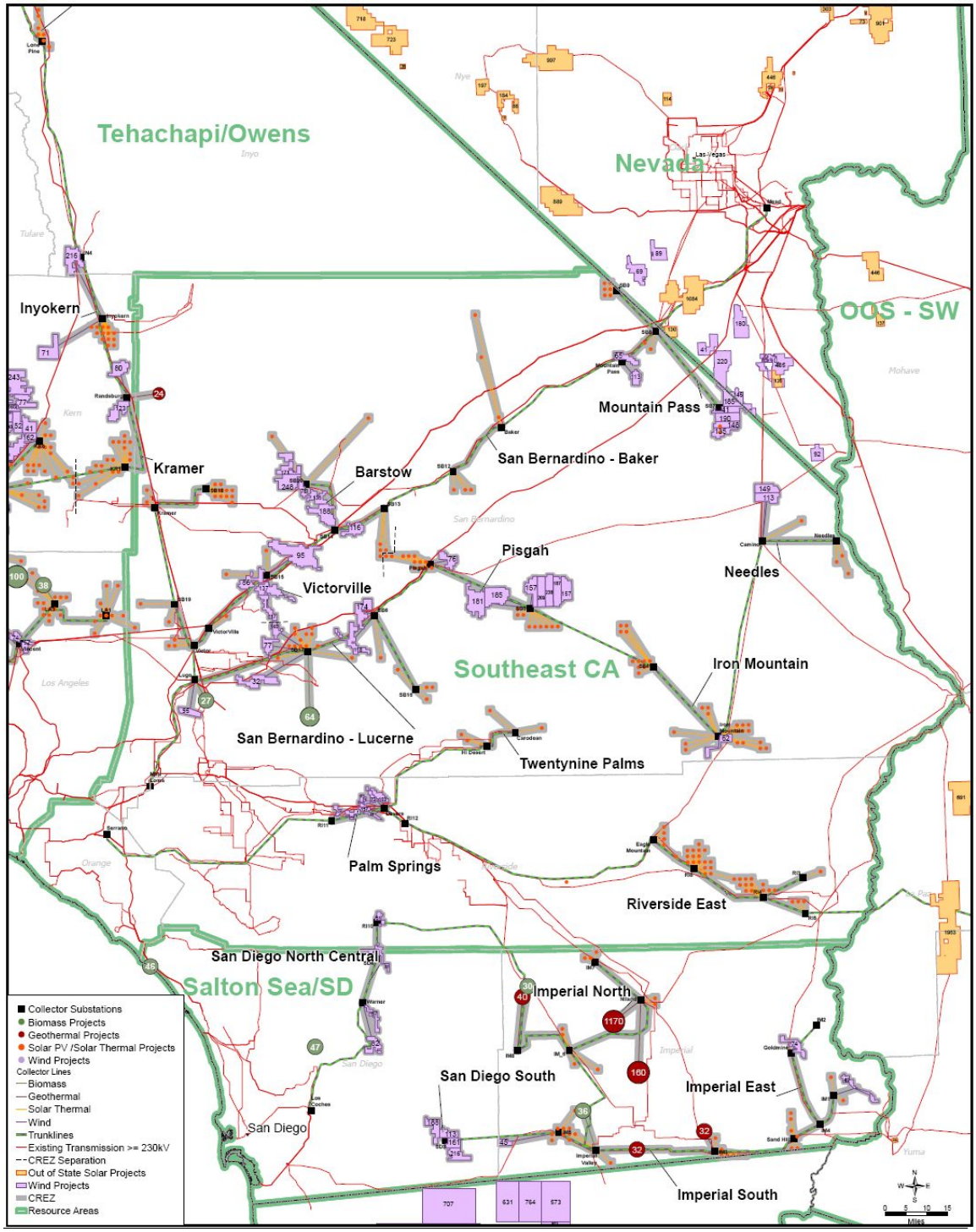


Figure 4-5. Southeast California Resource Area.

This resource area contains 391 projects located in eleven CREZs, with total generating capacity of 38,690 MW and potential energy delivery of 96,046 GWh. Three of the eleven CREZs include sub-CREZs. There is a mix of well-ranked and poorly-

ranked CREZs in the resource area, with the ranking varying due to both resource characteristics and location. While the resource area in general has excellent solar insolation, there are variances that distinguish one resource from a similar resource located 40 miles away. Additionally, the location of a resource relative to the transmission system will impact the cost of the resource. Resources located near existing substations require less transmission infrastructure to interconnect to the grid, and have a pronounced cost advantage over resources that require new collector stations, trunk lines and substations in order to interconnect to the grid. A summary of the resources located in this area is included in Table 4-9, and a summary of the CREZ cost and ranking information is included in Table 4-10.

Table 4-9. Southeast California Resource Summary by CREZ.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Barstow				1,200	936	2,136
Iron Mountain				5,600	62	5,662
Mountain Pass				2,000	878	2,878
Needles				800	261	1,061
Palm Springs					770	770
Pisgah – A				1,800		1,800
Pisgah – B				2,400	1,390	3,790
Riverside East – A				1,000		1,000
Riverside East – B				6,800		6,800
San Bernardino - Baker				1,200		1,200
San Bernardino - Lucerne	91			3,600	599	4,290
Twentynine Palms				800		800
Victorville – A				800		800
Victorville – B				800	95	895
Victorville – C					340	340
CREZ Total	**91**			**28,800**	**5,332**	**34,223**
Non-CREZ Resources			4,020	200	247	4,467
Grand Total	**91**		**4,020**	**29,000**	**5,579**	**38,690**
Generation (GWh/yr)[c]						
Barstow				2,888	2,487	5,375
Iron Mountain				13,232	151	13,383
Mountain Pass				4,872	2,436	7,307
Needles				1,950	699	2,649
Palm Springs					2,595	2,595
Pisgah – A				4,509		4,509
Pisgah – B				5,669	3,641	9,309
Riverside East – A				2,462		2,462
Riverside East – B				16,371		16,371
San Bernardino - Baker				2,847		2,847
San Bernardino - Lucerne	638			8,979	1,669	11,286
Twentynine Palms				2,046		2,046
Victorville – A				2,223		2,223
Victorville – B				2,069	317	2,387
Victorville – C					905	905
CREZ Total	**638**			**70,116**	**14,899**	**85,653**
Non-CREZ Resources			9,215	505	672	10,392
Grand Total	**638**		**9,215**	**70,621**	**15,571**	**96,046**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-10. Southeast California Economic Characteristics by CREZ.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
Barstow	2,136	5,106	134	23	92	108	21
Iron Mountain	5,662	12,713	158	28	98	144	27
Mountain Pass	2,878	6,942	135	31	94	112	27
Needles	1,061	2,517	146	34	94	117	39
Palm Springs	770	2,465	76	16	87	83	-20
Pisgah – A	1,800	4,283	153	22	98	151	16
Pisgah – B	3,790	8,844	140	23	93	105	27
Riverside East – A	1,000	2,339	149	12**	98	148	3
Riverside East – B	6,800	15,552	153	27	98	143	22
San Bernardino – Baker	1,200	2,705	162	26	99	148	28
San Bernardino – Lucerne	4,290	10,722	146	19	96	142	16
Twentynine Palms	800	1,944	151	25	99	159	15
Victorville – A	800	2,112	135	16	100	189	-17
Victorville – B	895	2,267	140	18	97	151	4
Victorville – C	340	860	117	19	85	57	29
Non-CREZ Resources	4,467	10,334	200	5	96	151	44

Notes:
* Includes transmission losses
** Transmission is assumed to be available at the Devers-Palo Verde 2 transmission line, which is not yet built. This affects the transmission costs of this CREZ.

Twentynine Palms marine base has submitted a land withdrawal application to the Bureau of Land Management (BLM) for approximately 422,000 acres contiguous to the base pro base expansion. This expansion would encompass the area identified in Figure 4-6, which includes approximately 15 projects modeled in the RETI process. Most of the affected projects are solar and some are wind.

The withdrawal of this land has not yet been approved by BLM. Given the fact that the decision to approve this base expansion is still pending, Black & Veatch has not removed the affected projects from the RETI model. However, a map of the proposed base expansion and the affected CREZs is provided below in Figure 4-6. If approved, the impact of the base expansion will need to be assessed in future RETI work.

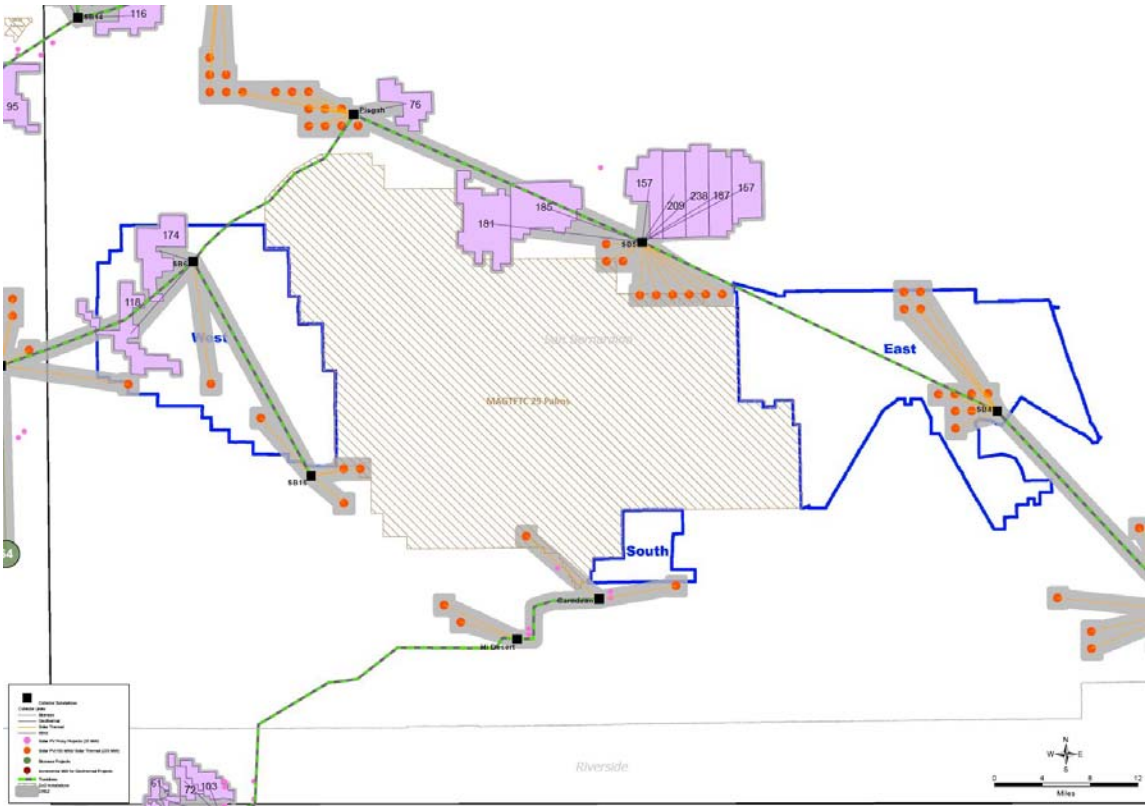


Figure 4-6. Twentynine Palms Planned Base Expansion (Blue Areas).

4.1.6 Percent of Proxy Projects Identified in CREZs

In certain CREZs, a large fraction of the projects modeled are "proxy" projects. This indicates that there is limited *known* commercial interest in the CREZ, and the viability of development within these areas should be further reviewed. A summary of the percent of the total generation potential in each CREZ from proxy projects is shown in Table 4-11.

It should be cautioned that the presence of a high number of proxy projects in a given area should not automatically preclude that area from further consideration. Proxy projects, by their definition, indicate areas that appear to be technically viable for development. It may be that private development is actually occurring in a proxy area, but the developer has chosen not to make this information public as part of the RETI process. For example, during the course of the RETI project, two very large solar PV projects were announced in the Carrizo South CREZ in "proxy" project locations.

In contrast, however, there may not be any developer interest in certain proxy project areas for other unidentified reasons. The Stakeholder Steering Committee has directed that Phase 2 of RETI place a higher priority on areas with demonstrated commercial interest.

Table 4-11. Generation Potential from Proxy Projects

CREZ Name	Percent Proxy Projects
Carrizo North	100%
Cuyama	100%
Fairmont	100%
Lassen South-B	100%
Owens Valley	100%
Round Mountain-B	100%
San Diego North Central	100%
Victorville-A	100%
Non-CREZ Resources	*97%*
Carrizo South	93%
Imperial East	92%
Santa Barbara	77%
Kramer	67%
Victorville-B	66%
Lassen North-B	60%
Grand Total	55%
Tehachapi	54%
Twentynine Palms	52%
San Diego South	45%
Imperial North-B	37%
Inyokern	35%
Imperial South	34%
Needles	34%
Victorville-C	26%
San Bernardino - Lucerne	23%
Palm Springs	21%
Pisgah-B	10%
Riverside East-B	6%
Barstow	4%
Imperial North-A	0%
Iron Mountain	0%
Lassen North-A	0%
Lassen South-A	0%
Mountain Pass	0%
Pisgah-A	0%
Riverside East-A	0%
Round Mountain-A	0%
San Bernardino - Baker	0%
Solano	0%
Total	55%

4.2 Out-of-State Resource Areas

Three out-of state resource areas were defined to aggregate resources located in four U.S. states, British Columbia, Canada and Baja California Norte, Mexico. The out-of-state resources identify resources but not CREZs, as RETI did not identify and optimize transmission solutions for these resources. These resources will likely interconnect to a local utility system and power would be transmitted over the bulk transmission system to California.

4.2.1 North Out-of-State

The North Out-of-State resource area includes the Province of British Columbia (BC), Canada and the states of Washington (WA) and Oregon (OR). There is substantial renewable energy potential in these areas from wind, geothermal and biomass. The resource assumptions and anticipated transmission interconnections for these resource areas are summarized below.

British Columbia, Canada – B.C. has substantial renewable resource potential, including wind, geothermal, biomass and potentially ocean current and wave resources[13]. The biomass and wind resources considered in RETI were identified by PG&E, and geothermal resources were characterized by GeothermEx. Noted above, the cost to transmit energy from these resources is based on the WECC assessment of the cost of the BC-California transmission line proposed by PG&E, PacifiCorp, Avista Corp. and the British Columbia Transmission Corporation.

Washington State - RETI assessed biomass and wind resources located in Washington State in the resource analysis. To transmit renewable resource energy to California, RETI assumed that these resources would use the transmission line proposed by PG&E, PacifiCorp, Avista Corp. and the British Columbia Transmission Corporation, gaining access to this line at the proposed McNary, WA substation.

Oregon - RETI included biomass, geothermal and wind resources located in Oregon in the resource analysis. Similar to the Washington resources discussed above, RETI assumed that Oregon resources would use the transmission line proposed by PG&E to transmit energy to California, gaining access to this line at the proposed Grizzly, OR substation.

California is currently linked electrically to these resource areas by several transmission lines which jointly allow for the import of approximately 4800 MW of capacity. These lines are generally at or near full capacity during on-peak periods, and

[13] Ocean tide and wave energy are not considered in RETI, as these resources are not likely to be commercially viable within the study period.

new transmission is required to allow for additional energy transfers. PG&E, PacifiCorp, Avista Corp. and the British Columbia Transmission Corporation have proposed a new transmission line extending from Selkirk, British Columbia in Canada to the San Francisco bay area that would increase the import capacity. In Phase 1A, RETI assumed that potential imports from the north are limited to 2,500 MW during the study period. The cost estimates to transmit this energy from Selkirk, BC to the San Francisco area that are used by RETI are based on the anticipated cost to develop the transmission line to BC, as estimated by the Western Energy Coordinating Council's (WECC) Technical Analysis Committee. A map of the North Out-of-State resource area is included in Figure 4-7.

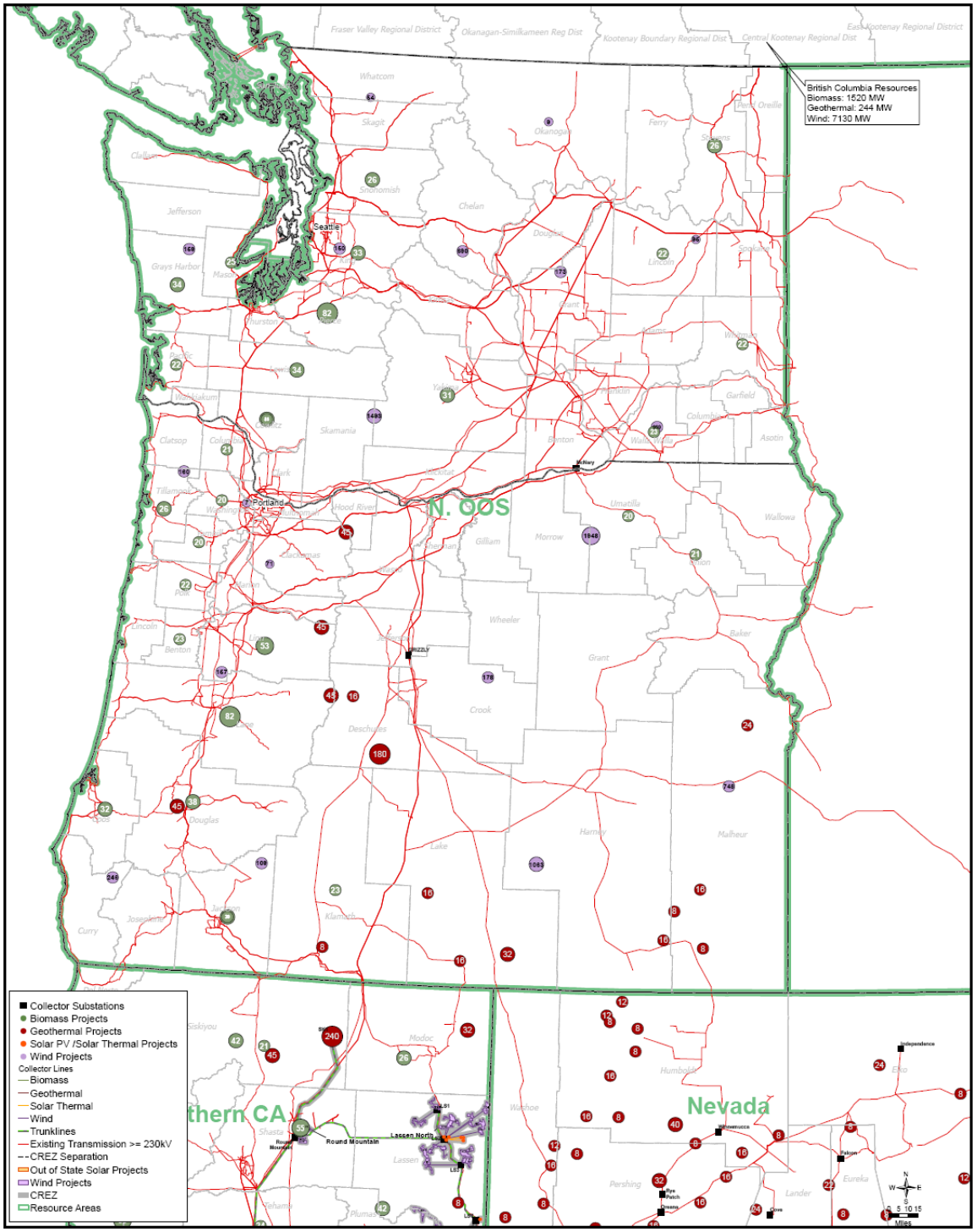


Figure 4-7. North Out-of-State Resource Areas.

The North Out-of-State resource area includes 129 projects, with a combined generating capacity of 18,267 MW and expected annual energy generation of 60,234 GWh. The resources included in each region are discussed below.

These resource areas rank poorly when compared with California resource areas. The cost of generation by these resources is competitive or lower than for California resources, but the cost of transmitting energy to California from these areas and the losses associated with long-distance transmission result in a high delivered energy cost. The WECC cost estimate for the transmission to interconnect these resources is $4.8 billion, resulting a capital cost of transmission alone for BC resources of over $30/MWh, not including losses.[14] A summary of the resources in this area is included in Table 4-12, while a summary of the cost and ranking information for the resources areas is included in Table 4-13.

[14] The RETI cost estimate is based on the hybrid double-circuit 500-kV and DC line as defined by the WECC, with a utilization factor of 76%.

Table 4-12. North Out-of-State Resource Summary by Resource Area.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
British Columbia – A		90			250	340
British Columbia – B		90			610	700
British Columbia – C					1,940	1,940
British Columbia – D	1,520	64			3,830	5,414
Oregon – A		392				392
Oregon – B	82	104			157	343
Oregon – C	372	24			4,531	4,927
Washington – A	82				316	398
Washington – B	367				522	889
Washington – C					2,924	2,924
Grand Total	**2,423**	**764**			**15,080**	**18,267**
Generation (GWh/yr)[c]						
British Columbia – A		710			1,139	1,848
British Columbia – B		710			2,298	3,007
British Columbia – C					5,948	5,948
British Columbia – D	10,652	449			8,986	20,087
Oregon – A		3,062				3,062
Oregon – B	575	729			557	1,860
Oregon – C	2,607	168			9,769	12,544
Washington – A	575				1,125	1,700
Washington – B	2,572				1,416	3,988
Washington – C					6,189	6,189
Grand Total	**16,980**	**5,827**			**37,427**	**60,234**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-13. North Out-of-State Economic Characteristics by Resource Area.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
British Columbia – A	340	1,553	55	51	85	204	-9
British Columbia – B	700	2,526	67	53	85	204	5
British Columbia – C	1,940	4,996	88	59	85	204	32
British Columbia – D	5,414	16,873	136	61	85	204	82
Oregon – A	392	2,848	69	22	85	204	-19
Oregon – B	343	1,730	103	29	84	156	24
Oregon – C	4,927	11,666	147	51	82	55	106
Washington – A	398	1,513	92	58	85	109	43
Washington – B	889	3,549	138	58	84	154	85
Washington – C	2,924	5,508	147	107	82	47	149

Notes:
* Includes transmission losses

4.2.2 Nevada

The Nevada resource area encompasses the entire state of Nevada, and includes three distinct regions within the state, including Northern Nevada, Central Nevada and Southern Nevada. This division of the state is required because each region has a unique transmission solution to deliver energy to California. The Sierra Pacific Power Company, which operates in Northern Nevada, and the Nevada Power Company, which operates in southern Nevada, are very weakly linked electrically and effectively operate as separate systems. Additionally, resources in Central Nevada are physically remote from either system. The three regions and their respective transmission requirements are discussed below.

Northern Nevada - Northern Nevada includes the area from just south of Reno north to the Idaho border. This high desert region has a large amount of geothermal resource and some wind resource. The solar resource in this area is poor. Renewable resources in this area, while abundant in the aggregate, are distributed and will not likely require nor support the development of new transmission. RETI assumes these resources would interconnect to the Sierra Pacific electric grid and deliver energy to California using existing transmission to the South Lassen area located in California. Like the South Lassen CREZ, energy from Northern Nevada would be delivered to the San Francisco and Sacramento metropolitan areas.

Central Nevada - The Central Nevada sub-area includes the western portions of Mineral and Esmeralda counties and is composed exclusively of geothermal resources. This area is remote from the existing Nevada transmission infrastructure. RETI assumes that a new transmission line would be developed to interconnect these facilities. This line would operate adjacent to the existing Pacific Intertie direct current (DC) transmission line that currently extends from northern Oregon to Southern California. This new line would begin in western Mineral County and interconnect with the California electric grid at Control substation in Inyo County, California.

Southern Nevada - Southern Nevada resources interconnect to the California grid in two ways. Several wind and solar projects are proposed for development in Nevada near the California border and anticipate interconnecting directly to the California grid. These are not considered "California resources" as there is insufficient environmental information regarding these facilities for the Environmental Working Group to conduct an environmental review. These facilities, while considered out-of-state resources, are modeled with transmission costs comparable to resources located over the border in California.

In addition to the border resources, RETI identified a substantial quantity of solar and wind resources in southern Nevada that could deliver renewable energy to California. These facilities are presumed to interconnect to the Nevada Power Company transmission system and transmit energy to California at the CAISO interconnection point at the Mead substation in southern Nevada. Available transmission capacity to this area is currently limited. Based on potential transmission additions over the next decade, these resources have been subjected to an incremental transfer limit of 2,500 MW.[15] A map of all Nevada resource sub-areas is included in Figure 4-8.

[15] The 2,500 MW import transfer limit is for all resources located in Arizona and the non-border resources located in Nevada.

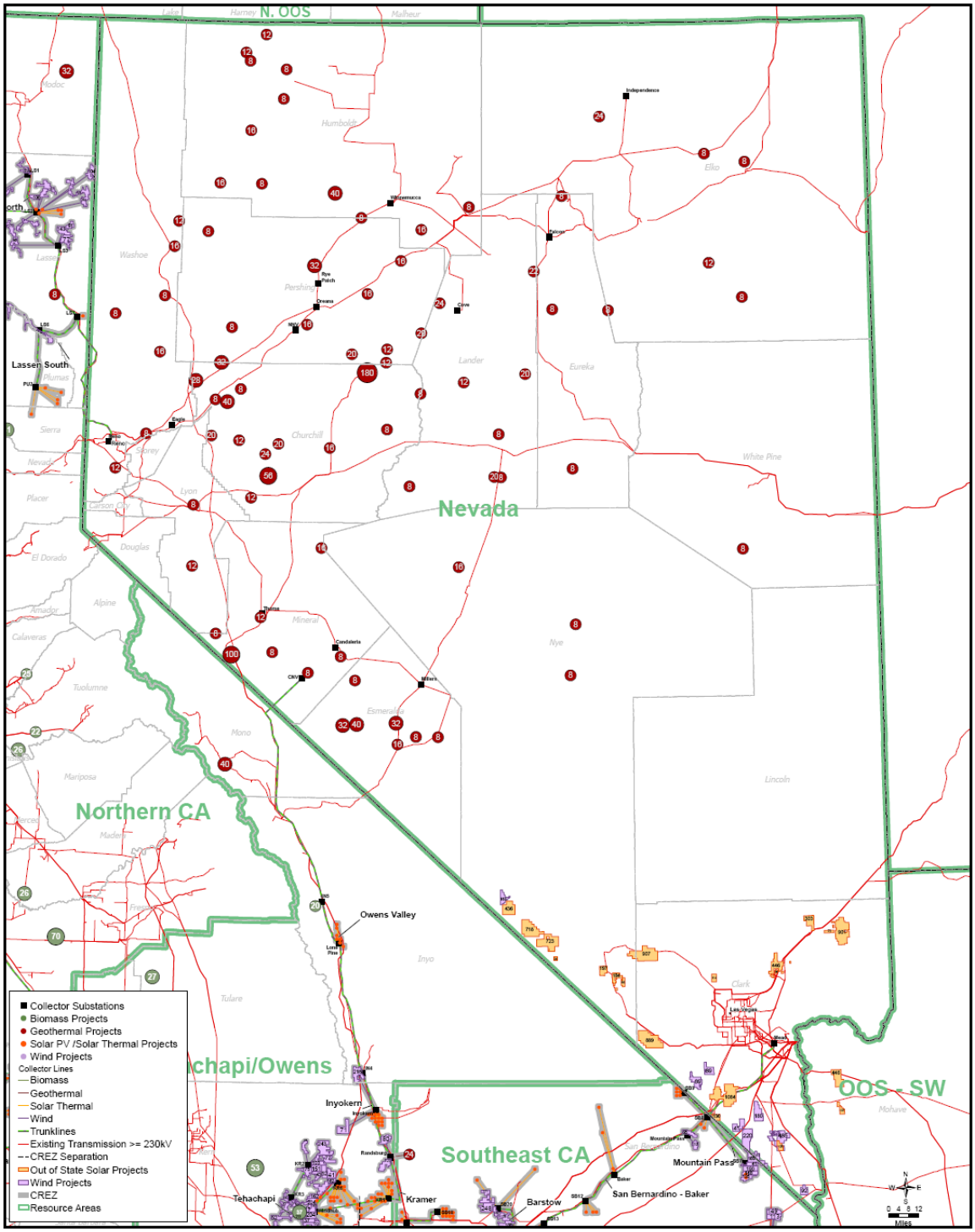


Figure 4-8. Nevada Resource Area.

The Nevada resource area includes 113 projects, with total generating capacity of 10,186 MW and estimated annual energy generation of 30,130 GWh. The central Nevada resources are highly ranked due to the low generation costs and moderate transmission

costs. Northern and southern Nevada resources both rank poorly. For northern Nevada geothermal resources, the cost to develop and interconnect small projects make resources in this area economically marginal, and the addition of transmission costs makes them uneconomic. Southern Nevada resources have comparable generation costs to California resources, and similar to remote California resources, have high transmission costs which make them relatively uncompetitive. A summary of the resources included in this area is included in Table 4-14, and a summary of the cost and ranking information for the resource areas is included in Table 4-15.

Table 4-14. Nevada Resource Summary by Resource Area.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Central Nevada – A		352				352
Central Nevada – B		284				284
Northern Nevada – A		115				115
Northern Nevada – B		532				532
Southern Nevada – A				6,012	89	6,101
Southern Nevada – B				1,417	1,386	2,802
Grand Total		**1,283**		**7,429**	**1,475**	**10,186**
Generation (GWh/yr)[c]						
Central Nevada – A		2,624				2,624
Central Nevada – B		1,990				1,990
Northern Nevada – A		822				822
Northern Nevada – B		3,728				3,728
Southern Nevada – A				14,638	223	14,861
Southern Nevada – B				3,123	2,981	6,104
Grand Total		**9,165**		**17,761**	**3,203**	**30,130**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-15. Nevada Economic Characteristics by Resource Area.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
Central Nevada – A	352	2,470	73	13**	85	204	-26
Central Nevada – B	284	1,871	119	23	85	204	28
Northern Nevada – A	211	773	82	23	85	204	-8
Northern Nevada – B	644	3,505	128	26	85	204	40
Southern Nevada –A	6,101	14,118	162	32	97	153	34
Southern Nevada – B	2,802	5,799	160	35	91	91	62

Notes:
* Includes transmission losses
** Transmission is assumed to be available at the Tehachapi transmission line, which is not yet built. This partially affects the transmission costs of this CREZ..

4.2.3 Southern Out-of-State

The Southern Out-of-State resource areas include Baja California Norte, Mexico and the State of Arizona. These areas are different in the resources that were characterized in RETI as well as the access to the California electric market.

Arizona – Arizona's renewable resources are very similar to Southeastern California's resources. RETI identified solar thermal resources in western Arizona that could potentially deliver energy to California. During the resource assessment process in Phase 1A of RETI, wind resources from Arizona were screened out as the wind resource in Arizona is not particularly good, and it was unlikely the resources would be competitive in the California market.

RETI did not develop transmission plans for individual resources to deliver energy to California, rather it assumed the facilities would interconnect to local transmission systems and the energy would be transmitted to California over the bulk transmission system. For Arizona, it was assumed that the bulk transmission access point would be the Palo Verde substation. RETI assumed there would be a combined import limit from Arizona and Southern Nevada of 2,500 MW.

Baja California Norte, Mexico – Baja California Norte, Mexico (Baja) has high quality renewable resources, primarily wind and solar. RETI included Baja wind resources that could potentially interconnect directly to the SDG&E transmission system. During the Phase 1A resource assessment RETI determined that solar resources located in Baja would not likely be competitive in the California market due to the lack of the 30 percent investment tax credit. There is currently limited bulk power transmission

capability between Baja and California, but the pre-identified wind resources are located near enough to the California border to interconnect to the California grid at the Imperial Valley substation. A total of 5,000 MW of border-region wind was modeled in Baja. This amount matches current interconnection queue applications.

A map of the resource areas is included in Figure 4-9.

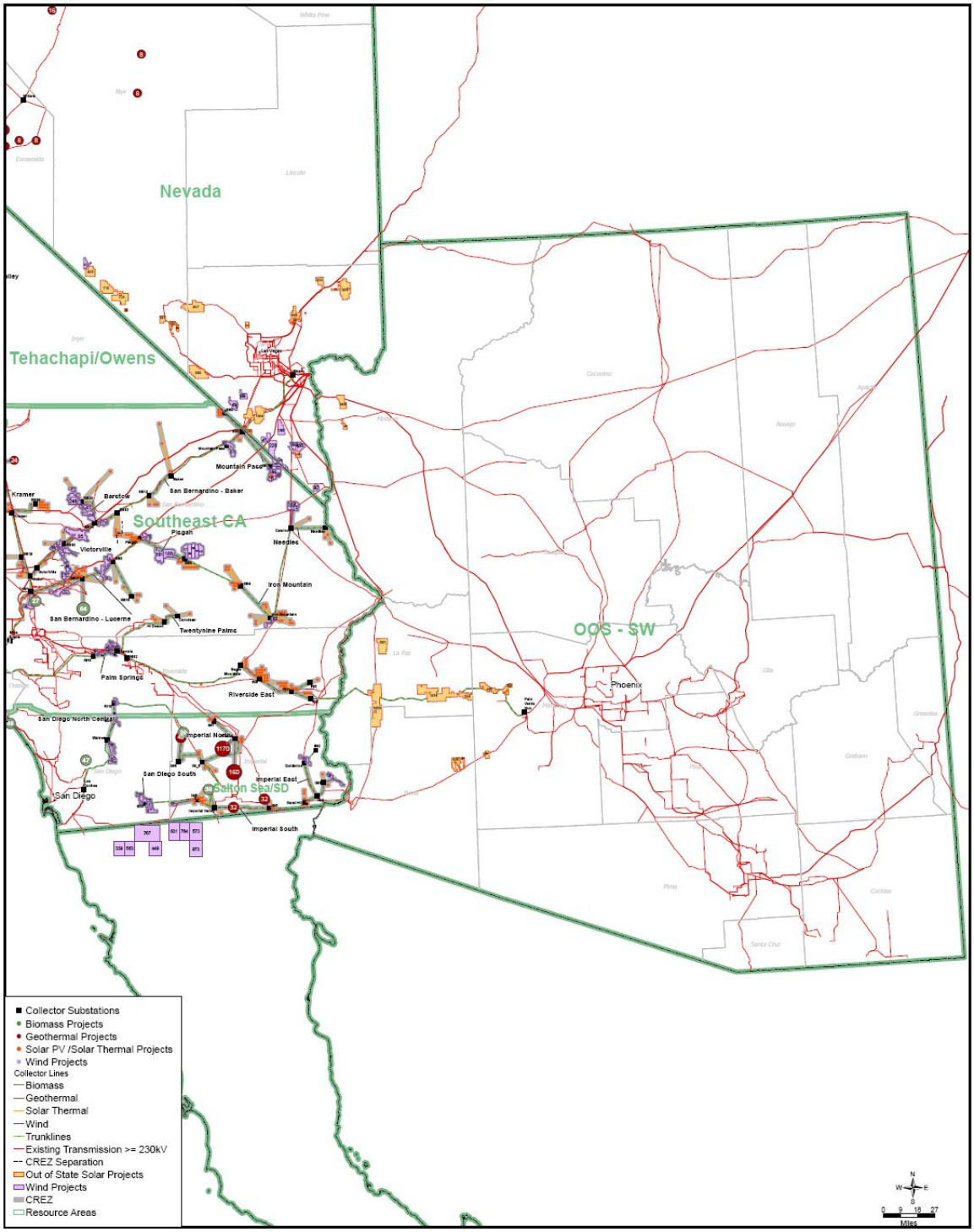


Figure 4-9. Southwest Out-of-State Resource Area.

The Southwest Out-of-State resource areas include 22 projects, with a total generating capacity of 12,169 MW and annual projected generation of 32,266 GWh. Baja resources are moderately competitive due to their good wind output, but are

hampered by the transmission required to deliver the energy to California load areas. Arizona resources compare poorly to California resources due to the incremental transmission costs to deliver this energy to California loads. A summary of the resources included in this area is included in Table 4-16, while a summary of the cost and ranking information for the resource area is included in Table 4-17.

Table 4-16. Southwest Out-of-State Resource Summary by Resource Area.

	Biomass	Geo-thermal	Dist. Solar PV[a]	Large Solar[b]	Wind	Total
Capacity (MW)						
Arizona				7,129		7,129
Baja – A					2,368	2,368
Baja – B					2,632	2,632
CREZ Total				7,129	5,000	12,129
Non-CREZ Resources			40			40
Grand Total			**40**	**7,129**	**5,000**	**12,169**
Generation (GWh/yr)[c]						
Arizona				17,722		17,722
Baja – A					8,035	8,035
Baja – B					6,414	6,414
CREZ Total				17,722	14,449	32,170
Non-CREZ Resources			95			95
Grand Total			**95**	**17,722**	**14,449**	**32,266**

Notes:

[a] This column quantifies the potential of small-scale, distributed solar PV projects 20 MW in size. Potential solar PV resources are much larger than shown in this table.

[b] This column quantifies the potential of large-scale solar plants. These project sites can utilize either solar thermal (200 MW per project) or solar PV (150 MW per project) technology. Solar thermal resource potential is quantified in this table. Solar PV technology is evaluated elsewhere in this report.

[c] Does not include transmission losses.

Table 4-17. Southwest Out-of-State Economic Characteristics by Resource Area.

	MW	GWh/yr*	Avg. Energy Cost ($/MWh)	Avg. T-Cost ($/MWh)	Avg. Energy Value ($/MWh)	Avg. Capacity Value ($/kW-yr)	Avg. Rank Cost ($/MWh)
Arizona	7,129	16,836	159	38	98	167	32
Baja – A	2,368	7,633	75	19**	85	68	-11
Baja – B	2,632	6,093	117	29	85	68	33
Non-CREZ resources	40	95	201	4	95	154	46

Notes:

* Includes transmission losses

** Transmission is assumed to be available at the Sunrise and/or Green Path transmission lines, which are not yet built. This affects the transmission costs of this CREZ.

5.0 CREZ Economic Analyses

Black & Veatch developed rank costs for each resource identified in RETI using the methodology discussed in Section 3. The rank costs are aggregated into weighted average rank costs for each CREZ and resource area, and are also used to develop supply curves for each CREZ and resource area. Supply curves are then analyzed to determine if a CREZ's resource economics justifies the development of sub-CREZs. Separately, the resource supply curves are subject to uncertainty and sensitivity analyses to determine if the curves fairly represented a robust range of resource costs. This section discusses the development of the ranking costs and supply curves as well as the identification of sub-CREZs using the supply curves. This section also presents the supply curves by CREZ. Finally, the results of the uncertainty and sensitivity analyses are detailed.

5.1 CREZ Rank Costs

Each identified resource in RETI was provided a ranking cost based on the methodology presented in Section 3. Weighted average rank costs were then calculated for each CREZ and resource area by aggregating the individual resource rank costs. Table 5-1 shows the weighted average rank cost for all CREZs and sub-CREZs in California. The rank cost for a resource includes the cost of generation and transmission, less the capacity and energy value. At the request of the SSC, an alternative rank cost was also developed and is shown in the far right-hand side of the table. This rank cost excludes the capital cost of new transmission lines needed to access the CREZs. If this alternate rank cost were used to rank CREZs, the order of the CREZs in Table 5-1 would be slightly different. The alternate transmission cost scenario is discussed further in Section 5.7. Rank costs presented in the remainder of this section include the transmission capital cost component unless otherwise indicated.

The net capacity of the CREZ, annual energy generation potential, and weighted average rank cost are shown in Table 5-1, along with the cumulative energy generation potential of all CREZs to that point. The cumulative potential is important when determining the amount of generation needed to cover the expected RPS net short (discussed in Section 3). The lowest weighted average CREZs that could cover the RPS net short are shaded in the table. To be included in this top tier of CREZs, the weighted average rank cost had to be $5/MWh or less. Table 5-2 adds out-of-state resource areas for comparison. The out-of-state resource areas are highlighted in yellow.

Table 5-1. Weighted Average California CREZ Rank Costs.

CREZ Name	Net Capacity (MW)	Annual Energy (GWh/yr)*	Cumulative Energy (GWh/yr)*	Weighted Average Rank Cost ($/MWh)**	
				Base Trans. Cost	No Trans. Cap. Cost
Solano	894	2,721	2,721	-29	-29
Palm Springs	770	2,465	5,186	-20	-26
Victorville-A	800	2,112	7,298	-17	-21
Imperial North-A	1,370	10,095	17,393	-13	-13
Round Mountain-A	240	1,598	18,990	-11	-22
Fairmont	6,918	18,318	37,308	-9	-11
Tehachapi	9,642	25,091	62,400	-3	-9
Riverside East-A	1,000	2,339	64,739	3	3
Victorville-B	895	2,267	67,006	4	-2
Kramer	6,627	16,251	83,257	5	-3
Inyokern	2,887	7,136	90,393	8	-3
Owens Valley	1,400	3,433	93,826	10	-7
Twentynine Palms	800	1,944	95,769	15	3
San Bernardino - Lucerne	4,290	10,722	106,491	16	9
Pisgah-A	1,800	4,283	110,775	16	7
San Diego South	678	1,829	112,604	16	-1
San Diego North Central	281	702	113,306	19	12
Carrizo North	1,600	3,225	116,531	19	15
Barstow	2,136	5,106	121,637	21	11
Riverside East-B	6,800	15,552	137,189	22	8
Cuyama	400	847	138,036	24	12
Pisgah-B	3,790	8,844	146,880	27	16
Mountain Pass	2,878	6,942	153,822	27	8
Iron Mountain	5,662	12,713	166,536	27	11
San Bernardino - Baker	1,200	2,705	169,240	28	14
Imperial North-B	1,830	4,282	173,522	29	13
Victorville-C	340	860	174,381	29	23
Imperial South	3,745	8,776	183,157	31	14
Imperial East	1,723	3,991	187,148	34	12
Lassen North-A	821	2,086	189,233	36	16
Round Mountain-B	187	705	189,938	38	28
Lassen South-A	410	1,051	190,989	38	14
Needles	1,061	2,517	193,506	39	17
Carrizo South	3,000	6,118	199,625	41	18
Santa Barbara	433	1,121	200,746	43	13
Lassen South-B	1,200	2,379	203,124	48	14
Lassen North-B	1,846	3,746	206,871	50	25

Note:
* Includes transmission losses
** The base transmission cost case (first column) includes all elements of the rank cost formulation as described in this report. The second column excludes the capital cost component of the transmission cost from the rank cost formula.

Table 5-2. Weighted Average Rank Costs – All CREZ and Resource Areas.

CREZ Name	Net Capacity (MW)	Annual Energy (GWh/yr)*	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)	
				Base Trans. Cost	No Trans. Cap. Cost
Solano	894	2,721	2,721	-29	-29
Central Nevada-A	352	2,470	5,191	-26	-30
Palm Springs	770	2,465	7,656	-20	-26
Oregon-A	392	2,848	10,504	-19	-30
Victorville-A	800	2,112	12,616	-17	-21
Imperial North-A	1,370	10,095	22,711	-13	-13
Baja-A	2,368	7,633	30,344	-11	-20
Round Mountain-A	240	1,598	31,941	-11	-22
British Columbia-A	340	1,553	33,494	-9	-39
Fairmont	6,918	18,318	51,812	-9	-11
Northern Nevada-A	115	773	52,585	-8	-20
Tehachapi	9,642	25,091	77,676	-3	-9
Riverside East-A	1,000	2,339	80,015	3	3
Victorville-B	895	2,267	82,282	4	-2
Kramer	6,627	16,251	98,534	5	-3
British Columbia-B	700	2,526	101,060	5	-24
Inyokern	2,887	7,136	108,196	8	-3
Owens Valley	1,400	3,433	111,628	10	-7
Twentynine Palms	800	1,944	113,572	15	3
San Bernardino - Lucerne	4,290	10,722	124,294	16	9
Pisgah-A	1,800	4,283	128,577	16	7
San Diego South	678	1,829	130,407	16	-1
San Diego North Central	281	702	131,109	19	12
Carrizo North	1,600	3,225	134,334	19	15
Barstow	2,136	5,106	139,439	21	11
Riverside East-B	6,800	15,552	154,992	22	8
Oregon-B	343	1,730	156,721	24	9
Cuyama	400	847	157,568	24	12
Pisgah-B	3,790	8,844	166,412	27	16
Mountain Pass	2,878	6,942	173,354	27	8
Iron Mountain	5,662	12,713	186,068	27	11
San Bernardino - Baker	1,200	2,705	188,772	28	14
Central Nevada-B	284	1,871	190,643	28	17
Imperial North-B	1,830	4,282	194,925	29	13
Victorville-C	340	860	195,785	29	23
Imperial South	3,745	8,776	204,560	31	14
British Columbia-C	1,940	4,996	209,556	32	2
Arizona	7,129	16,836	226,392	32	9
Baja-B	2,632	6,093	232,485	33	16
Southern Nevada-A	6,101	14,118	246,603	34	14
Imperial East	1,723	3,991	250,594	34	12
Lassen North-A	821	2,086	252,679	36	16
Round Mountain-B	187	705	253,385	38	28
Lassen South-A	410	1,051	254,436	38	14
Needles	1,061	2,517	256,952	39	17
Northern Nevada-B	532	3,505	260,457	40	28
Carrizo South	3,000	6,118	266,575	41	18
Santa Barbara	433	1,121	267,696	43	13
Washington-A	398	1,513	269,210	43	5
Lassen South-B	1,200	2,379	271,588	48	14
Lassen North-B	1,846	3,746	275,334	50	25
Southern Nevada-B	2,802	5,799	281,133	62	41
British Columbia-D	5,414	16,873	298,006	82	52
Washington-B	889	3,549	301,555	85	48
Oregon-C	4,927	11,666	313,222	106	74
Washington-C	2,924	5,508	318,729	149	71

5.2 Resource Supply Curves

A supply curve is a very useful way of depicting an array of resource options that offer different quantities and costs. A supply curve represents the quantity of a product that is available at a particular price (e.g., the amount of renewable energy that can be generated within a utility system for under $50/MWh). The supply curve is constructed by plotting the amount of generation or capacity added by each resource against its corresponding levelized cost. For RETI, the incremental generation from each CREZ is plotted against its rank cost in ascending order.

Figure 5-2 depicts the supply curve for all California CREZs and out-of-state resource areas using the weighted average rank costs from Table 5-2. The potential generation (GWh/yr) is on the x-axis and rank cost ($/MWh) is shown on the y-axis. To develop this curve, the CREZ rank costs were sorted from lowest to highest and plotted versus cumulative generation to develop one curve for comparing all the CREZs and resource areas. This supply curve also shows the calculated net short, or the anticipated quantity of renewable resources necessary to meet California's 33 percent RPS goal.

Section 5.7 shows the supply curve for CREZs and resource areas without the capital cost component of the transmission cost.

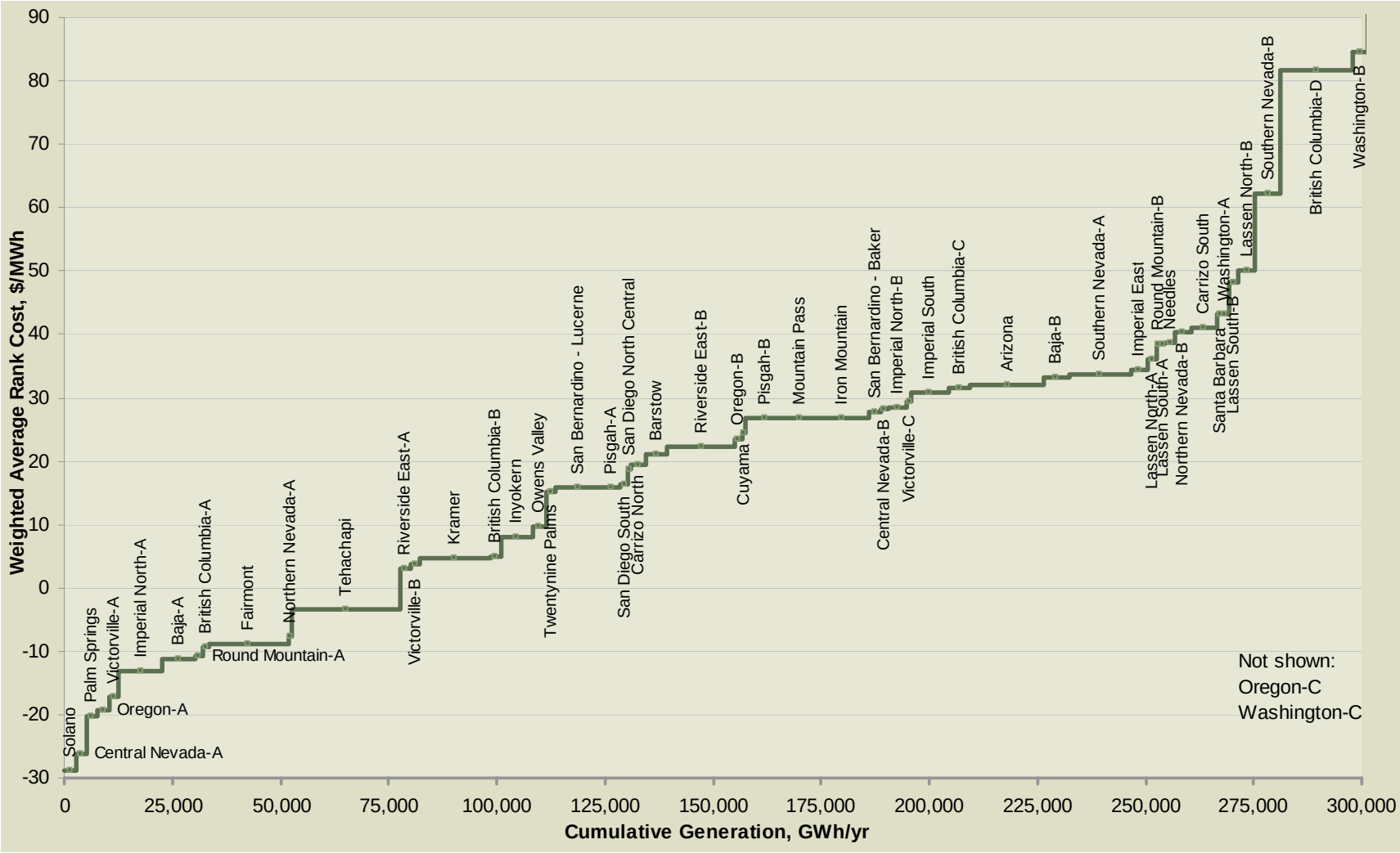


Figure 5-1. Weighted Average Rank Cost (2009 $/MWh) for CREZs and Resource Areas.

5.3 CREZ and Resource Area Supply Curves

All CREZs and resource areas contain individual projects with a range of rank costs. Supply curves were generated for each CREZ and resource region in the RETI study area. An example supply curve showing the rank cost of the resources identified by Black & Veatch for the Tehachapi supply curve can be seen in Figure 5-2. Supply curves for all CREZs and resource regions are provided in Appendix E.

The example supply curve for Tehachapi shows that there is a very large amount of renewable energy potentially available in this CREZ: about 25,000 GWh/yr. This is the largest CREZ in the study, and it alone is enough to meet over one-third of the RETI net short.[16] Projects within this region generally have uniformly good economics, although the cost of this energy rises as demand increases and there are some outlying projects at higher demand levels. There is about 4,400 GWh/yr potentially available below a rank cost of $-20/MWh, and about 10,000 GWh potentially available below a rank cost of $0/MWh. The weighted average rank cost for all projects in the CREZ is $-3/MWh, which is very good and competitive with the best CREZs in the state. The higher cost projects within this CREZ do raise the rank cost slightly, but not enough to make the entire CREZ uncompetitive. For this reason, it was decided not to split this CREZ into smaller sub-CREZs, as discussed in the next section.

The economics of the Tehachapi region are very good for a combination of reasons: (1) available high-speed wind resources, (2) excellent solar sites, (3) proximity to existing and planned transmission and other infrastructure, (4) relatively close proximity to load (Los Angeles load center), and (5) the allocation of available transfer capability due to the Tehachapi Renewable Transmission Project.

[16] This assumes that all projects within the CREZ are realistic and practically developable, which remains to be proven.

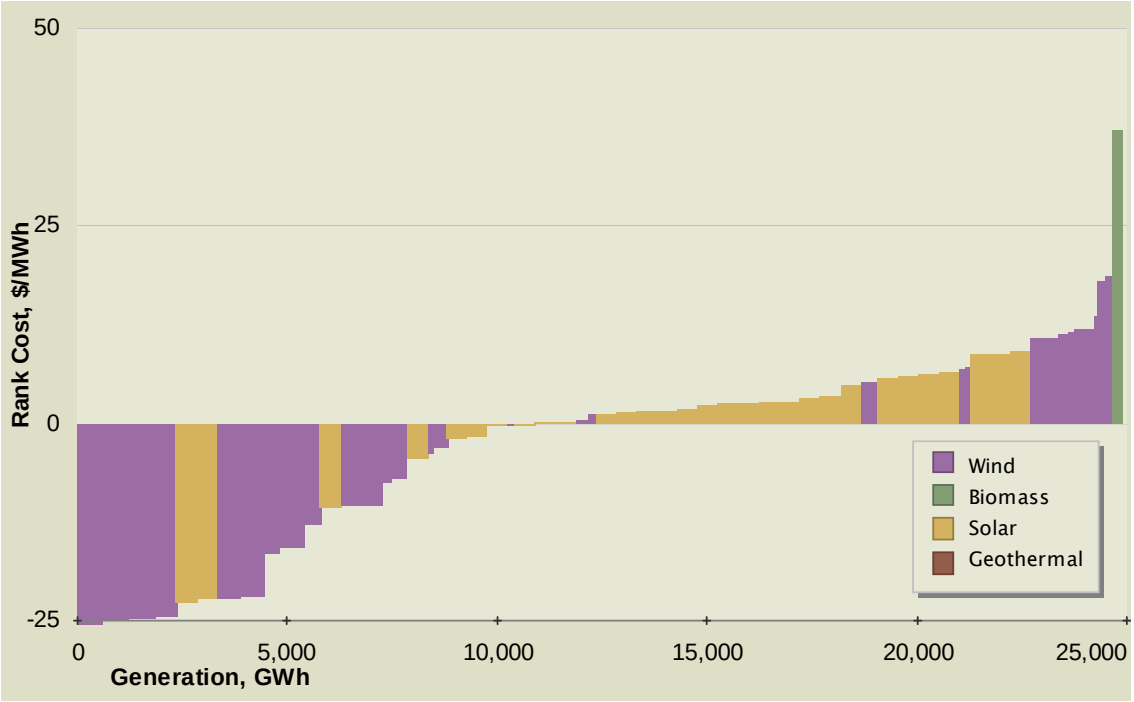


Figure 5-2. Tehachapi Supply Curve.

5.4 Sub-CREZ Identification

In some cases, the weighted average cost for all the projects within a CREZ or resource area is not an adequate representation of its relative economics compared to other CREZs. This may occur in one of several situations:

- There is a wide variation in rank costs within a CREZ. For example, Imperial North, whose rank costs range from $-30 to $+50/MWh.
- There is a group of projects (or single project) with distinctly lower costs than other projects in the CREZ. For example, Riverside East has about 3,000 GWh available below a rank cost of about $2-5/MWh; the rest of the projects are around $18-30/MWh.
- The CREZ has a relatively attractive environmental score, but the economics of the CREZ are marginal unless it is split. For example, the Pisgah CREZ appeared to have good environmental attributes, but the weighted average rank cost was only modest. By splitting this CREZ, the best projects in the CREZ could be evaluated separately.

In all cases, the intent was to recognize larger cost differences within the CREZ; generally these were greater than about $20/MWh. The purpose of splitting CREZ was primarily to highlight the better projects within a CREZ: those with substantially better

economics than the CREZ average. By separating these projects and calculating a new average rank cost for each sub-CREZ, it is possible to let the best part of the CREZ to be evaluated without higher cost projects raising its average cost.

It should be noted that CREZs that already had weighted average costs that are relatively low (below about $5/MWh), had been determined to be competitive CREZs without splitting. No effort was made to split these CREZs into smaller CREZs, even if they met some of the criteria mentioned above. A good example of such a CREZ is Tehachapi, which has a weighted average rank cost of $-3/MWh. The weighted rank cost of the Tehachapi CREZ make it one of the best CREZs. There is no need to subdivide this CREZ since the entire CREZ ranks high relative to other areas.

In contrast to the Tehachapi CREZ, Figure 5-3 depicts the supply curve for Lassen North. This is a much smaller CREZ than Tehachapi, consisting of roughly 6,000 GWh/yr of wind and solar resources. While the overall rank cost is $45/MWh, there is a clear break between the lowest and highest cost resources in this CREZ that justified the creation of two sub-CREZs in Lassen North. Lassen North sub-CREZ A consists of five wind projects (2,000 GWh/yr) with an weighted average rank cost of $36/MWh, while sub-CREZ B consists of wind and solar thermal projects (4,000 GWh/yr) with a higher weighted rank cost of $50/MWh. This separation was performed to make an economic and geographic distinction of low cost resources in CREZs that ranked poorly on the statewide supply curve.

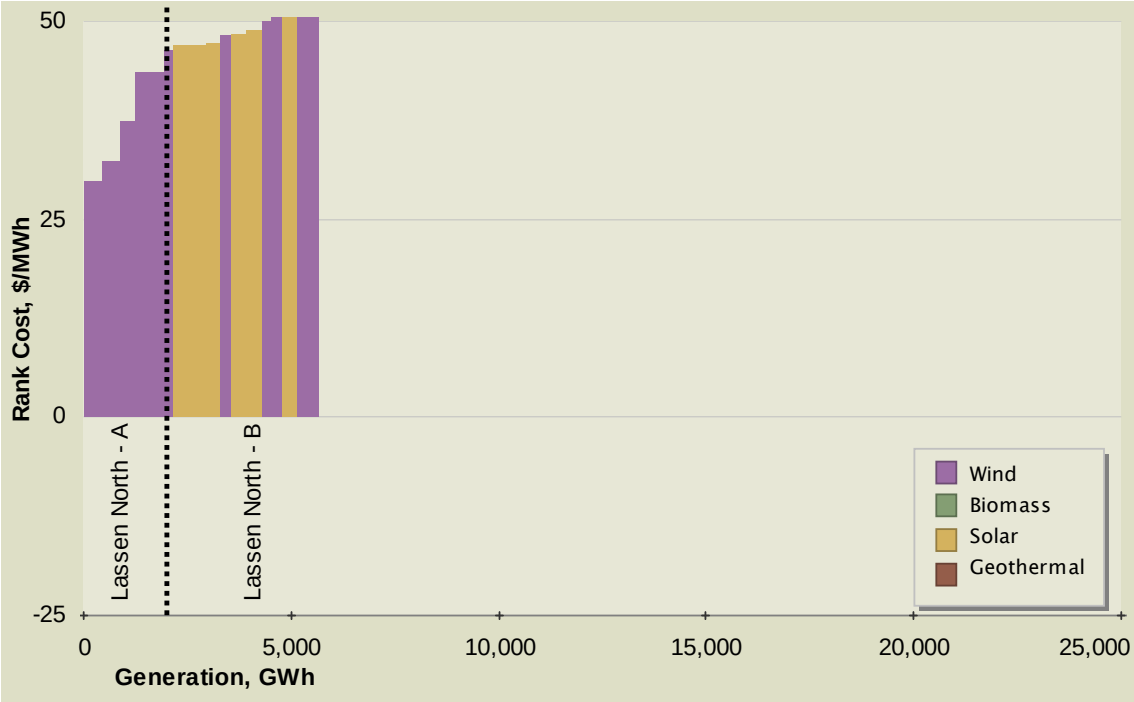


Figure 5-3. Lassen North Supply Curve.

Of the 29 California CREZs, seven were divided into sub-CREZs including:

- Victorville
- Imperial North
- Lassen North
- Lassen South
- Round Mountain
- Pisgah
- Riverside East

All were divided into two distinct sub-CREZs with the exception of Victorville which was subdivided into three. The segregation of the CREZ resources resulted in four of the sub-CREZs being ranked as the top tier CREZs.

It should be noted that while it is possible to distinguish the sub-CREZ's from each other geographically, the split between them was not based on geography, but economics. For this reason, it is often the case that projects representing a sub-CREZ are spread across the original CREZ boundaries and are interspersed with other sub-CREZ(s). Because the overall objective is to rank CREZs against each other and not identify relative project economics within a CREZ, sub-CREZ maps are not provided.

Out-of-state resources were also split into smaller components. Because out-of-state resources cover much larger geographic areas and have a large variation in costs, they were split into as many a four different sub-regions.

5.5 Out-of-State Resources

After identification of the in-state CREZs necessary to meet the net short requirements, out-of-state resources that could be competitive with these CREZs were identified. Such resources presumably could justify the cost of new transmission construction and still be competitive with in-state California resources. RETI identified a total of over 40,000 MW of projects capable of delivering power to California. These projects have a generation potential of approximately 110,000 GWh/yr. Resources were originally identified in Arizona, Nevada, Oregon, Washington, British Columbia and Baja as being possible to support California load. Based on the economic modeling, 15,000 GWh/yr of out-of-state resources were considered competitive with California CREZs, as summarized in Table 5-3. These resources include wind and geothermal in British Columbia, geothermal in Oregon and Nevada, and wind resources in Baja. Wind resources in Mexico look particularly promising, and more study is recommended to refine the economic estimates and the environmental factors.

Additional out-of-state resources that could be cost competitive under certain scenarios are identified in the sensitivity analysis.

Table 5-3. Cost-Competitive Out-of-State Resources.

Region	Capacity (MW)	Annual Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Nevada	427	2,976	-21
Oregon	392	2,848	-19
Baja California Norte*	2,368	7,633	-11
British Columbia**	340	1,553	-9

Notes:

* Assessment of Baja wind resources in this project was preliminary. Evidence exists that additional resources may be cost effective, and this should be further explored in Phase 2.

** An additional 700 MW of resource (1040 MW total) is available at a relatively competitive cost of $5/MWh.

No Arizona or Washington resources were identified as being competitive with the top tier CREZs identified in-state. Solar generation in Arizona was not cost

competitive with California solar once transmission costs were included. California possesses such strong solar resources that it would be difficult to justify building new transmission lines to out-of-state solar. Biomass and wind resources in Washington were found to not be cost competitive also due to the high cost of building new transmission.

5.6 Non-CREZ Resources

As with out-of-state resources, there are several non-CREZ resources that are cost competitive and may be used to serve California's energy requirements to satisfy the RPS goals. Resource areas containing less than 250 MW of potential were not considered as a CREZ, as it is likely these resources will interconnect to the grid at voltages below 230 kV. About 70,000 GWh/yr of smaller-scale non-CREZ resources were modeled in California, the majority of which were 20 MW solar PV projects. Most biomass projects are also not within CREZs, as they are generally smaller and can be sited to take advantage of existing transmission infrastructure. In addition, several smaller, isolated geothermal and wind projects were modeled as non-CREZ resources. Many of the non-CREZ resources are located in northern California.

Resources that are not reliant on large-scale transmission planning to be integrated into the system may be able to be brought on-line faster and at lower cost than CREZ resources that are reliant on such transmission.

Based on the base case economic assessment, a total of seven wind and geothermal projects were considered competitive with California CREZs. These projects, listed in Table 5-4, total about 430 MW and 2,200 GWh/yr of annual generation. This is a relatively small fraction of the total supply needed to meet California's RPS. It should be noted that this assessment does not exclude consideration of additional non-CREZ resources. Because of the uncertainty of the costs and timing for the large scale transmission needed to reach CREZs, it is very likely that significantly more than 430 MW of non-CREZ resources will be developed in California.

Table 5-4. Competitive Non-CREZ Wind and Geothermal Projects.

Project ID	Technology	Resource Area	Capacity (MW)	Annual Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
geo_3	Geothermal	Northern CA	135	1011	-45
geo_13	Geothermal	Northern CA	45	337	-34
geo_10	Geothermal	Northern CA	8	53	-21
geo_11	Geothermal	Northern CA	32	213	-12
03Aug2008_56	Wind	Southeast CA	72	211	-10
03Aug2008_134	Wind	Northern CA	91	248	-5
03Aug2008_158	Wind	Northern CA	45	132	-2

5.7 Results – Top Ranked CREZs

Results are presented for two cases: Including the capital cost component of the transmission cost and not including the capital cost component.

5.7.1 Results Including Transmission Capital Cost

Table 5-5 shows the results for the in-state CREZs resources, in-state non-CREZ resources, and out-of-state resources that could most economically be used to meet the California RPS net short. The cumulative is about 100,000 GWh/yr, which exceeds the estimated net short of nearly 68,000 GWh/yr. It is likely that additional resources may be necessary above this amount to account for uncertainty in the resource assessment approach, to ensure geographic diversity, and other factors.

Table 5-5. Economic Analysis Results – Base Case.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Solano	2,721	2,721	-29
Palm Springs	2,465	5,186	-20
Victorville-A	2,112	7,298	-17
Imperial North-A	10,095	17,393	-13
Round Mountain-A	1,598	18,990	-11
Fairmont	18,318	37,308	-9
Tehachapi	25,091	62,400	-3
Riverside East-A	2,339	64,739	3
Victorville-B	2,267	67,006	4
Kramer	16,251	83,257	5
In-state Non-CREZ Resources	2,206	85,464	-29
Out-of-state Resources	15,010	100,474	-14

The top-ranked CREZs are:

- Solano
- Palm Springs
- Victorville-A
- Imperial North-A
- Round Mountain-A
- Fairmont
- Tehachapi
- Riverside East-A
- Victorville-B
- Kramer

As mentioned earlier, the majority of the best resources are located in southern part of the study area. In fact, four CREZs that border each other just north of Los Angeles (Tehachapi, Victorville, Kramer, and Fairmont) make up 64 percent of the best resources in the state. Many of the remaining best resource areas are clustered further south, including Palm Springs, Imperial North, Riverside East, and Baja Mexico. This strong economic preference for development in this part of the state makes assuring that appropriate transmission is built between these areas and load centers important to

meeting renewable generation goals at the lowest costs.[17] Furthermore, planners may want to consider the value of geographic diversity in CREZ development. This is not included in this economics assessment.

5.7.2 Results without Transmission Capital Cost

The Stakeholder Steering Committee requested that the base case results be displayed with zero transmission capital costs for all CREZ. This was done because of the inherently high uncertainty involved in estimating transmission costs, especially for an early conceptual study of this type. This is not a sensitivity study, rather it is just a representation of the proportion of the rank cost that is comprised of the transmission capital cost component. This allows readers to determine how important the transmission cost assessment is in determining CREZ ranking.

The model was re-run with the capital cost component of transmission set to zero for all CREZs and resource areas. This is the equivalent of providing "free transmission" to all CREZs, as discussed in the sensitivity study later in this section. The results are shown in the following figures:

- Figure 5-4 shows the original supply curve from Figure 5-1 (green) with an alternate supply curve removing all transmission capital cost. The alternate supply curve is shown in red. The red supply curve is simply the original curve less the transmission capital cost component. The difference between the two is the average transmission capital cost for each resource. For example, the average transmission capital cost for the Tehachapi CREZ is $5/MWh, and the value for the British Columbia-B resource area is $29/MWh. From this chart it can be seen that there are several outliers with higher transmission costs. These are almost universally out-of-state resources areas, such as British Columbia and Nevada. While the rank costs of nearly all CREZs/resource areas would fall if no transmission costs were assumed, the only resource area that would shift into the top ten CREZs/resource areas would be the British Columbia-B resource. British Columbia resources areas are the furthest away of all resources studied in this project. It is also notable that the transmission capital cost is generally within the range of the uncertainty bands shown later in this section.

[17] It is important to note that the transmission cost methodology in Phase 1 of RETI assumed generation would be delivered to the nearest large load center. Because of the large amount of relatively economic generation in Southern California, this may result in an imbalance in generation and load. Phase 2 of RETI will need to further examine the feasibility and potential costs of large-scale transfers of power from southern to northern California.

- Figure 5-5 shows the same information as Figure 5-4, however, the supply curve has been resorted from lowest to highest rank cost.

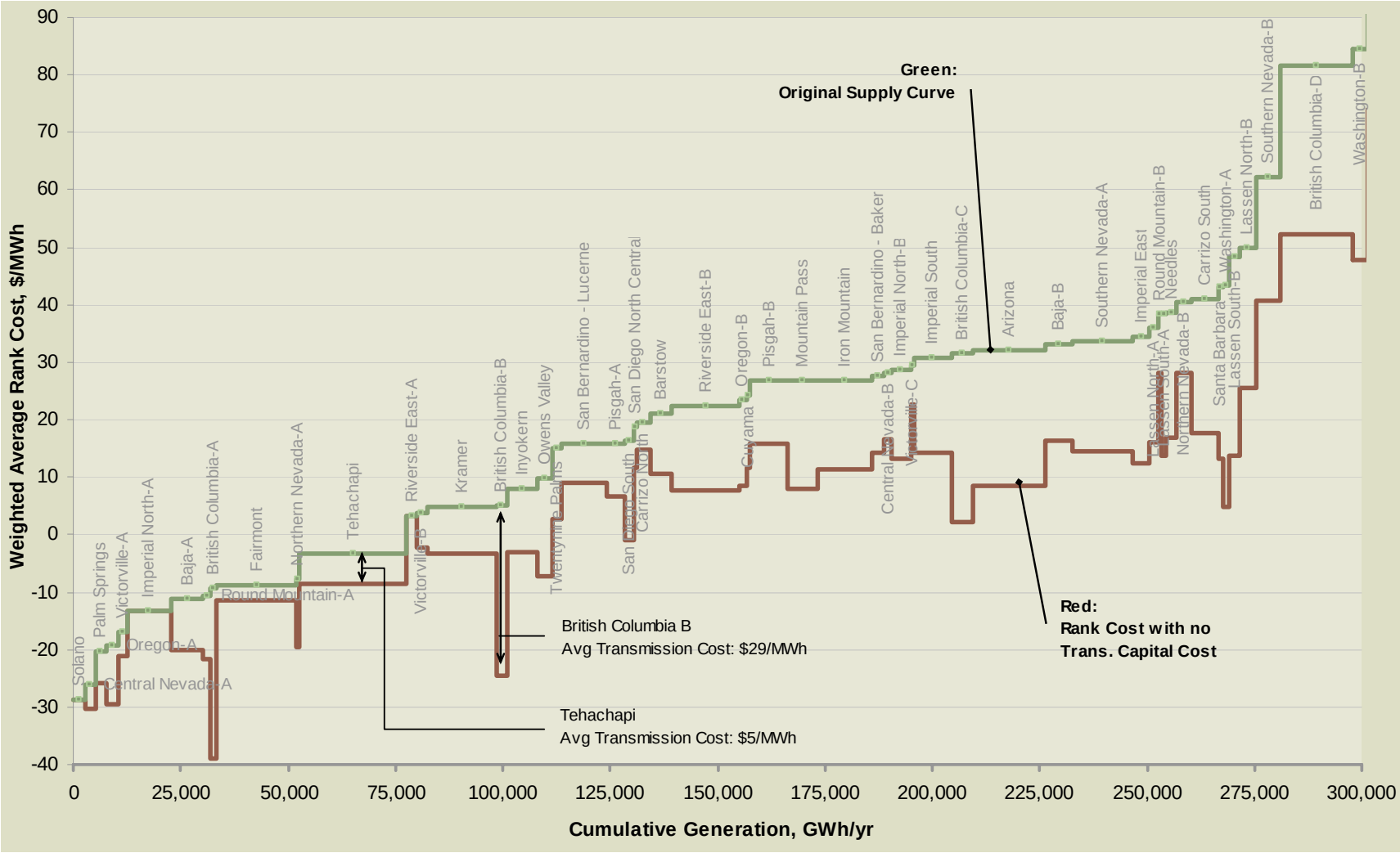


Figure 5-4. Impact of Removing Transmission Capital Cost from all Resources (in Original Order).

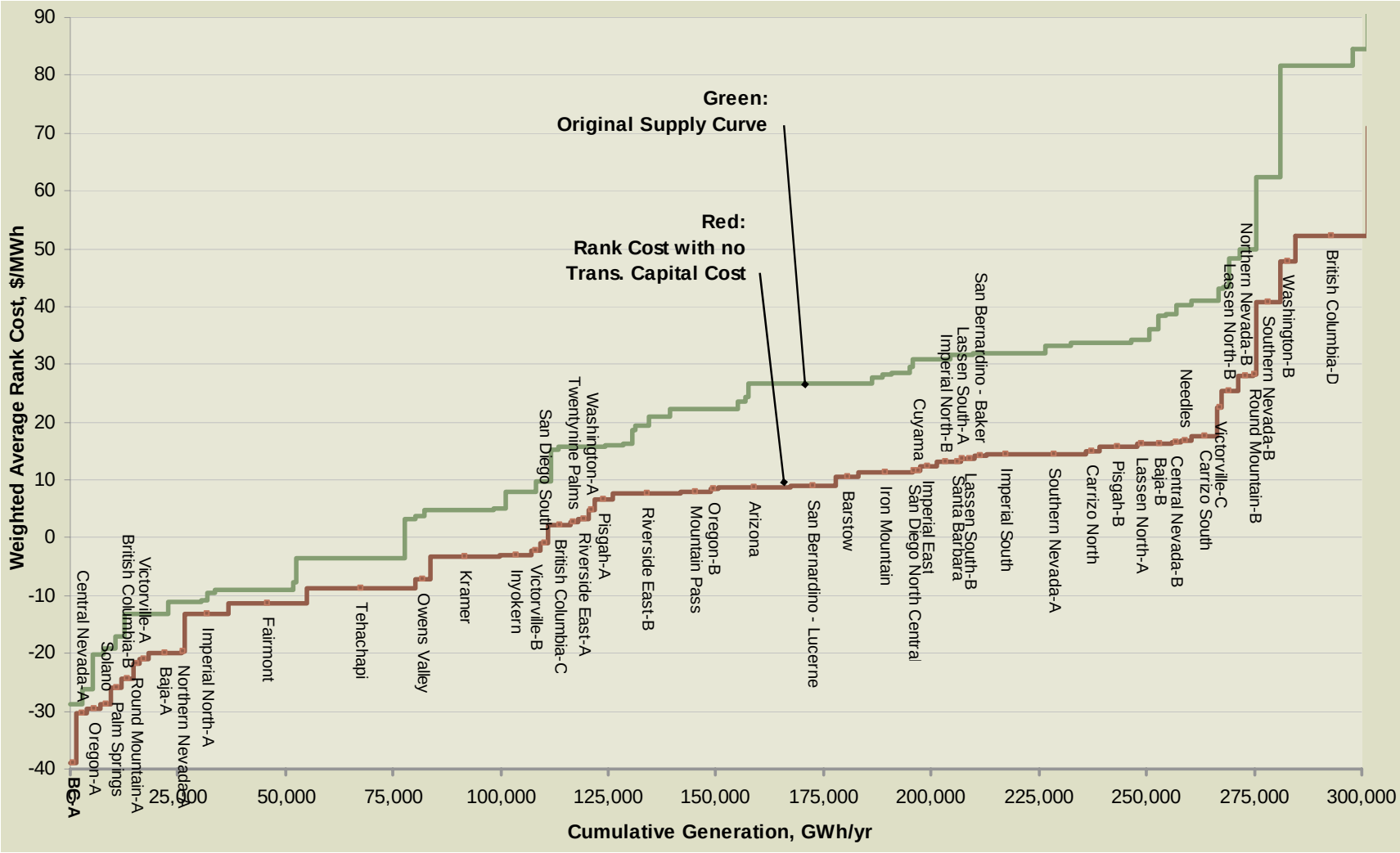


Figure 5-5. Impact of Removing Transmission Capital Cost from all Resources (in Ascending Order).

5.8 Uncertainty and Sensitivity Analyses

It is very important to consider the uncertainty in the estimates used to quantify and value resources. By their very nature, these estimates include a margin of error due to the assumptions made by the RETI team. Developing a methodology to assess uncertainty was a significant challenge. An informal group (the RETI Uncertainty Team) was convened to develop an approach for an appropriate method to treat uncertainty. This is described in this section.

There are numerous assumptions in RETI that could potentially change the results if significantly modified. The major categories of variables and examples are:

- Net short calculation (load growth, RPS assumptions, share for CSI and other small renewables)
- Financing assumptions (debt rate, interest rate, discount rate, economic life)
- Incentive assumptions (life and term of tax credits)
- Technology / project assumptions (capital cost, capacity factor, operating and maintenance costs)
- Environmental impacts (air emissions, land use per GWh, water consumption)
- Transmission assumptions (cost, availability)
- Energy value (reference energy price forecast, generation profile for each resource)
- Capacity value (baseline capacity value, capacity credit)
- Integration costs
- Development time-frame

Uncertainty analysis was limited to a set of key variables. The RETI Uncertainty Team prioritized evaluation on (1) major variables that can significantly change the CREZ rankings and (2) variables whose uncertainty may differentially impact CREZ ranking. For example, a change in load growth will probably not favor one CREZ over another.

Based on these principles, it was determined to ignore uncertainty in the net short calculation, financing assumptions, operating and maintenance costs and integration costs. It was further determined that certain assumptions lend themselves to evaluation using sensitivity scenarios instead of uncertainty bounds. These include the following:

- Tax credits
- Energy value
- Capacity value

- Lower solar photovoltaic costs
- Additional development potential (geothermal resource)
- Allocation of "sunk" transmission costs

The remaining assumptions identified that could impact CREZ rankings are associated with uncertainty in project capital and resource costs (capacity factor or fuel cost depending on the technology). The cost uncertainty assessment is detailed first, followed by discussion of the sensitivity analysis performed for the six variables bulleted above.

5.8.1 Uncertainty Assessment

Capital cost, capacity factor, and fuel cost were the major variables identified to quantify economic uncertainty. Black & Veatch calculated an uncertainty band for a representative project for each technology based on the assumptions shown in Table 5-6. The ranges of potential values were presented and explained to the RETI Uncertainty Team. They are not meant to be precise measures, but rather relative ranges that reflect potential differences in the assessment of the technologies and resources. For example, the capital cost range for geothermal is highest due to the limited site information available at this level, and the large amount of capital required for the relatively unknown resource development phase. In contrast, capital costs for solar photovoltaics are relatively predictable, as most costs are associated with module procurement.

Table 5-6. Potential Ranges of Uncertainty for Major Resource Variables.

	Capital Cost		Capacity Factor		Fuel Cost	
	Low	High	Low	High	Low	High
Geothermal	-15%	15%	-10%	10%		
Biomass	-10%	10%	-10%	10%	-30%	30%
Wind	-10%	10%	-20%	20%		
Solar Thermal	-10%	10%	-10%	10%		
Solar PV	-5%	5%	-10%	10%		

The uncertainty ranges shown are meant to capture the uncertainty when comparing one renewable project against another, rather than a general uncertainty range. For example, all wind projects are likely to be affected relatively equally by changes in wind turbine costs, so the uncertainty estimate does not include this variable. In contrast, estimates for balance of plant costs (roads, gen-ties, construction, etc.) for the wind

projects are relatively uncertain at this level of analysis and may *independently* vary between projects substantially. The uncertainty range reflects this variability.

The impact these cost, capacity, and fuel cost ranges have on calculated levelized generation cost was then determined. Mean values were calculated for the major variables for a typical project for each of the resource types. The uncertainty ranges shown in Table 5-6 were then applied to mean values. The low end of the cost range was determined by simultaneously combining "optimistic" assumptions. For example, for wind, it was assumed that uncertainty errors representing the lowest capital cost and highest capacity factor would be coincident. Similarly, the high end of the cost range was determined by simultaneously combining "pessimistic" assumptions.[18] The variation in cost of generation based on the combined simultaneous variation in inputs is summarized in Table 5-7 for each technology.

Table 5-7. Calculated Uncertainty Band for Typical Projects.

	Absolute Generation Cost Ranges ($/MWh)			**Relative Range ($/MWh)**		**Percentage Range**	
	Low	Base	Low	Low	High	Low	High
Geothermal	$90	$113	$140	-$22	$27	-20%	24%
Biomass	$120	$151	$186	-$31	$35	-21%	23%
Wind	$72	$103	$150	-$31	$47	-30%	45%
Solar Thermal	$130	$155	$186	-$25	$31	-16%	20%
Solar PV	$195	$224	$260	-$29	$36	-13%	16%

The uncertainty bands were then applied to each project, and new high and low weighted average CREZ rank costs were calculated. These have been added to the CREZ supply curve, as shown in Figure 5-6.

[18] More sophisticated approaches to quantifying uncertainty, such as using a probabilistic Monte Carlo approach, may be evaluated in future phases of RETI.

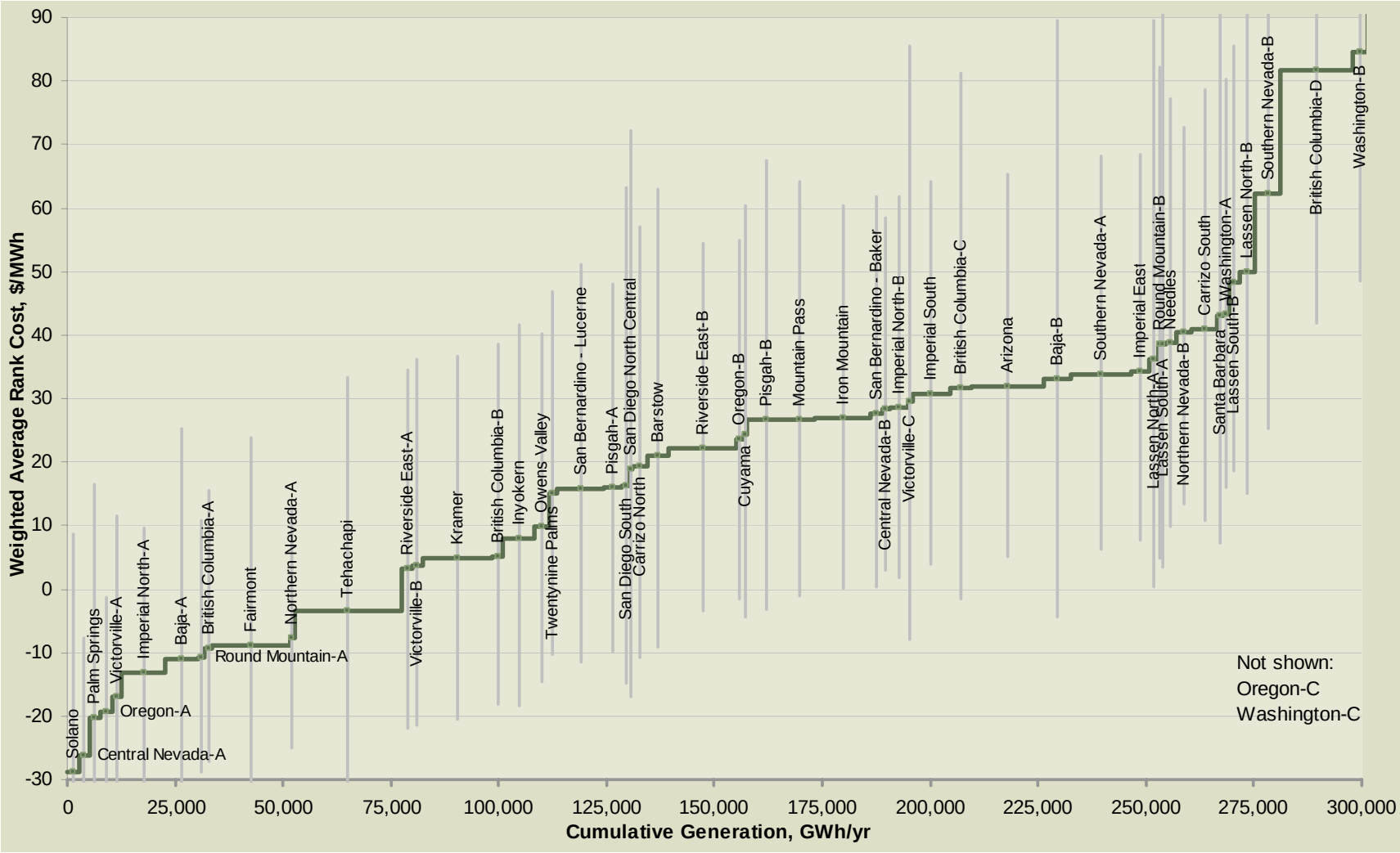


Figure 5-6. Supply Curve with Uncertainty Bands.

Figure 5-6 is useful in communicating the overall level of uncertainty that can be ascribed to the analysis. There is significant overlap in the uncertainty bands, which indicates considerable uncertainty in identifying a discrete set of clear CREZ priorities. The uncertainty results indicate that many CREZs may be competitive with the most economic CREZs once uncertainty is considered. Assuming all projects are successfully developed, the RETI Net Short could theoretically be satisfied at a rank cost of about $0/MWh. If costs are at the low end of the uncertainty range, there many other resources that could be competitive with this cost. These additional resources are those shown in Figure 5-6 whose lower uncertainty band drops below zero cost. Those resource areas that are below $0/MWh are tabulated in Table 5-8. Many of the CREZs and resources could be cost effective considering uncertainty.

Table 5-8. Resources Potentially Competitive Considering Uncertainty.

CREZ Name	Annual Energy (GWh/yr)*	Rank Cost ($/MWh)	
		Base	Low Range of Costs
Solano	2,721	-29	-54
Central Nevada-A	2,470	-26	-42
Palm Springs	2,465	-20	-45
Oregon-A	2,848	-19	-34
Victorville-A	2,112	-17	-40
Imperial North-A	10,095	-13	-32
Baja-A	7,633	-11	-35
Round Mountain-A	1,598	-11	-29
British Columbia-A	1,553	-9	-27
Fairmont	18,318	-9	-34
Northern Nevada-A	773	-8	-25
Tehachapi	25,091	-3	-30
Riverside East-A	2,339	3	-22
Victorville-B	2,267	4	-21
Kramer	16,251	5	-20
British Columbia-B	2,526	5	-18
Inyokern	7,136	8	-18
Owens Valley	3,433	10	-15
Twentynine Palms	1,944	15	-10
San Bernardino - Lucerne	10,722	16	-12
Pisgah-A	4,283	16	-10
San Diego South	1,829	16	-15
San Diego North Central	702	19	-17
Carrizo North	3,225	19	-11
Barstow	5,106	21	-9
Riverside East-B	15,552	22	-3
Oregon-B	1,730	24	-2
Cuyama	847	24	-4
Pisgah-B	8,844	27	-3
Mountain Pass	6,942	27	-1
Iron Mountain	12,713	27	>0*
San Bernardino - Baker	2,705	28	>0*
Central Nevada-B	1,871	28	>0*
Imperial North-B	4,282	29	>0*
Victorville-C	860	29	-8
Imperial South	8,776	31	>0*
British Columbia-C	4,996	32	-2
Arizona	16,836	32	>0*
Baja-B	6,093	33	-4

* The low-end range of rank costs for these CREZs/resource areas is greater than zero and is thus likely not competitive with better resources.

5.8.2 Sensitivity Analysis – Elimination of Tax Credits

A sensitivity run was made to evaluate the effect that tax credits have on the CREZ rank results. To perform this assessment, the following steps were taken:

- The production tax credit was removed for wind, biomass, and geothermal

- The 30 percent investment tax credit was eliminated for solar projects
- No changes were made for accelerated deprecation assumptions

The results are shown in Table 5-9. These can be compared to Table 5-5, which shows the base case results. Additional CREZs that enter the top ranks are highlighted in Table 5-9 in yellow.

The tables show that there are several new CREZs which may be viable under this scenario. Wind dominates these new CREZs, which largely displace solar CREZs. While the economics of all technologies are hurt by elimination of the tax credit, costs for solar are more severely impacted such that the resource is no longer competitive. Biomass is the technology with the lowest cost impact from elimination of the tax credits. Biomass accounts for most of the increase in cost-competitive in-state non-CREZ resources. There are also large increases in potentially cost-competitive out-of-state biomass, geothermal and wind resources. The combination of non-CREZ and out-of-state resources could supply about 45 percent of the net short, as compared to only about 15 percent in the base case analysis.

Table 5-9. Economic Analysis Results – No Tax Credit Sensitivity.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Solano	2,721	2,721	3
Palm Springs	2,465	5,186	11
Imperial North-A	10,095	15,281	18
Round Mountain-A	1,598	16,879	21
San Diego South	1,829	18,708	48
San Diego N. Cen.	702	19,410	50
Victorville-C	860	20,270	61
Round Mountain-B	705	20,975	61
Lassen North-A	2,086	23,061	68
Lassen South-A	1,051	24,112	70
Santa Barbara	1,121	25,233	75
Tehachapi	25,091	50,324	81
Fairmont	18,318	68,642	85
In-state Non-CREZ Resources	7,183	75,825	31
Out-of-state Resources	23,214	99,039	26

*CREZs highlighted in yellow are not in the base case results

5.8.3 Sensitivity Analysis – Energy Value

A sensitivity run was made to evaluate the effect that high and low energy price forecasts have on the CREZ rank results. Section 3 describes the marginal energy price forecasts used for the RETI study. A reference (or base), high, and low forecast were prepared by Ventyx. The reference forecast was used for the base case analysis. The results with the low and high energy values are shown in Table 5-10 and Table 5-11, respectively. Higher energy values tend to favor solar projects, which produce more of their power during peak periods, when prices tend to be higher.

Overall the results are relatively unchanged, similar to the cost uncertainty analysis results. The tables show that there is no impact on the top CREZs identified to meet the net short requirement.

Lower energy values do tend to slightly favor imports of non-solar resources from out-of-state. Conversely, higher energy values depress imports slightly.

Table 5-10. Economic Analysis Results – Low Energy Prices.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Solano	2,721	2,721	-3
Palm Springs	2,465	5,186	6
Imperial North-A	10,095	15,281	13
Victorville-A	2,112	17,393	16
Round Mountain-A	1,598	18,990	16
Fairmont	18,318	37,308	22
Tehachapi	25,091	62,400	27
Riverside East-A	2,339	64,739	35
Victorville-B	2,267	67,006	35
Kramer	16,251	83,257	37
In-state Non-CREZ Resources	2,206	85,464	-2
Out-of-state Resources	18,377	103,840	15

Table 5-11. Economic Analysis Results – High Energy Prices.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Solano	2,721	2,721	-61
Palm Springs	2,465	5,186	-53
Victorville-A	2,112	7,298	-52
Imperial North-A	10,095	17,393	-45
Fairmont	18,318	35,710	-44
Round Mountain-A	1,598	37,308	-44
Tehachapi	25,091	62,400	-38
Riverside East-A	2,339	64,739	-32
Victorville-B	2,267	67,006	-31
Kramer	16,251	83,257	-30
In-state Non-CREZ Resources	2,074	85,331	-64
Out-of-state Resources	13,942	99,273	-47

5.8.4 Reduced Capacity Value

The base case maximum capacity value of $204/kW-yr is established as described in Section 3 of this report. A sensitivity run was performed to see the impact of reducing this value by 50 percent ($102/kW-yr). The results are shown in Table 5-12. The results are somewhat similar to the tax credit sensitivity. The reduction in capacity value benefits wind more than other resources, since it typically provides minimal capacity benefits. As a result, two new wind CREZs appear to be competitive in meeting the net short. These same CREZs also were identified in the tax credit sensitivity.

Table 5-12. Economic Analysis Results – Reduced Capacity Value Sensitivity.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Solano	2,721	2,721	-14
Palm Springs	2,465	5,186	-8
Imperial North-A	10,095	15,281	0
Round Mountain-A	1,598	16,879	4
Victorville-A	2,112	18,990	17
Fairmont	18,318	37,308	19
Tehachapi	25,091	62,400	22
San Diego South	1,829	64,229	28
San Diego N. Cen.	702	64,931	31
Victorville-B	2,267	67,198	33
Riverside East-A	2,339	69,537	33
In-state Non-CREZ Resources	3372	72909	-2
Out-of-state Resources	20589	93498	4

*CREZs highlighted in yellow are not in the base case results

5.8.5 Reduced Solar Photovoltaic Costs (Thin Film)

In the Phase 1A report, Black & Veatch identified tracking crystalline as the proxy technology to represent solar PV resources. The costs for this technology are relatively high, and as a result the base case does not include development of any solar PV resources. Unlike most other renewable technologies, capital costs in the photovoltaic industry have significant potential to decrease, and there is considerable commercial interest in utility-scale “thin film” systems. This sensitivity tests an alternate thin film technology for solar with capital costs of about $3,700/kWe, roughly half that of

tracking crystalline. This figure represents goals and cost targets provided by manufacturers and developers. Notably, these capital costs are also lower than the large-scale solar thermal projects; therefore thin film solar is assumed to occur both at the distributed scale (20 MW) and also in large scale blocks (150 MW).[19] In addition to capital costs, assumptions for O&M cost, capacity factor, energy value, and capacity value were also updated. The results are shown in Table 5-13.

The results of this sensitivity run are dramatic. Every CREZ with solar potential benefits strongly. Three new CREZs, highlighted in yellow, make the list of top CREZs: Carrizo North, Pisgah-A, and Twentynine Palms. (Figure 5-7 shows this effect graphically.) More importantly, the cost-competitive in-state non-CREZ resources increase by more than 20 times to about 45,000 GWh/yr. This figure is over two-thirds of the net short requirement. The large majority of these non-CREZ resources are 20 MW solar PV projects assumed to connect to the distribution system.

[19] While this sensitivity is based on target costs for thin film technology, it could also be viewed as a proxy for potential cost reduction for any solar technology, including solar thermal. In the Phase 1A report, stakeholders agreed to not predict changes in technology cost over time. However, several other studies, including work by Black & Veatch, have forecast improvements in solar thermal technology that could lead to lower costs. The results of this sensitivity study could thus be viewed as showing potential for any solar technology.

Table 5-13. Economic Analysis Results – Reduced Solar Costs.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Riverside East-A	1,506	1,506	-30
Solano	2,721	4,227	-29
Victorville-A	1,231	5,458	-27
Fairmont	13,139	18,596	-22
Carrizo North	2,257	20,853	-20
Palm Springs	2,465	23,318	-20
Victorville-B	1,526	24,845	-20
Kramer	10,485	35,330	-18
Pisgah-A	2,738	38,067	-17
Tehachapi	19,647	57,714	-16
Twentynine Palms	1,246	58,960	-13
Imperial North-A	10,095	69,055	-13
In-state Non-CREZ Resources	46,142	115,197	-35
Out-of-state Resources	1,334	116,531	-37
*CREZs highlighted in yellow are not in the base case results			

This sensitivity run should be viewed as a test case, and not a realistic simulation of how large scale distributed solar development might occur. The distributed 20 MW projects near 69 kV non-urban substations played an important role in the sensitivity analysis. Although Black & Veatch did site these projects using GIS, it is equally valid to interpret the 20 MW as an aggregation of smaller projects on rooftops and open areas near the substation. The important message is that 20 MW is an estimate of the power that could be injected at the substation without network upgrades. In reality, some of the non-urban 69 kV substations would need upgrades to accept 20 MW of generating capacity. In fact, utilities have expressed concern that many of their substations would not be able to operate with such injections.

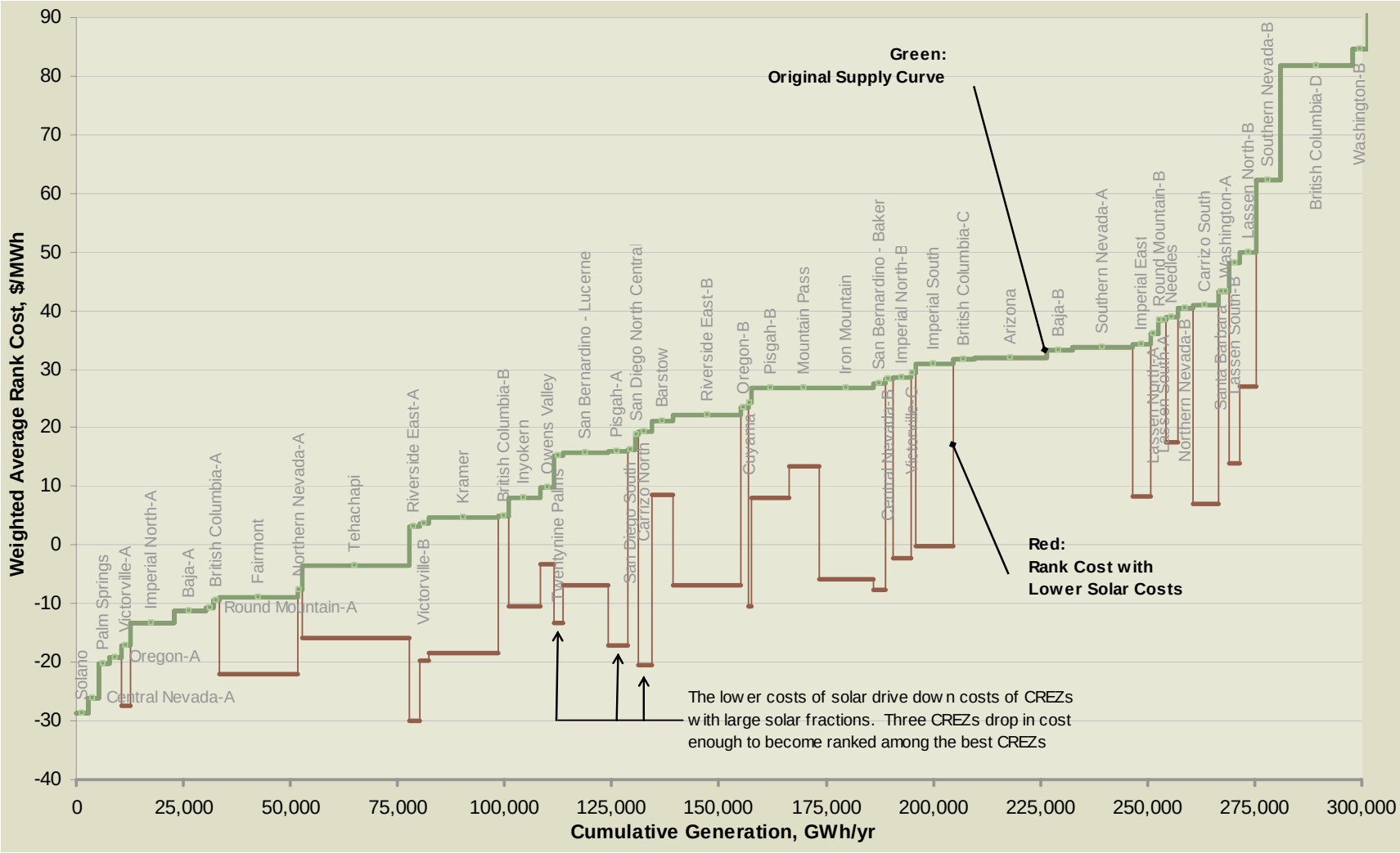


Figure 5-7. Effect of Reduced Solar Costs on CREZ Supply Curve.

Note that this figure does not show the reduced output (generation, GWh) of thin film solar PV. It is intended to just highlight the potential cost savings.

Though intriguing, the results of the thin film sensitivity need to be examined in the context of current market conditions. The results of the sensitivity suggest that nearly 30 GW of thin film capacity would be constructed to meet nearly 80 percent of California's RPS. This level of solar thin film development is far beyond most projections and raises numerous issues. This large amount of thin film modules is far beyond the supply available today or in the foreseeable future. While increasing significantly, the total global supply of thin film modules in 2008 was less than 0.5 GW, nearly 1/60th of the supply needed in the sensitivity analysis. As supply increases and prices approach the $3,700/kW target, global demand for thin film modules will also increase, which will challenge California in acquiring "its share". The results of this sensitivity should be used as merely a starting point for further investigation into the merits of distributed thin film PV to meet the RPS goals.[20]

5.8.6 Expanded Geothermal Potential

Geothermal resources are different from other renewable resources in several respects. First, while recent, detailed, and comprehensive resource maps exist for solar and wind, no analogous maps exist for geothermal with the same level of site-specific information. Second, exploration, confirmation, and development of geothermal resources is a capital-intensive and risky process that may discourage some potential investors. Finally, much of the information about promising geothermal reserves is proprietary and is not open for public review and dissemination.

The geothermal resource assessment described in Section 6 relied on publicly available data sources and did not utilize proprietary information. The estimates are generally conservative relative to estimates of wind and solar potential. Several generators responded to the RETI request for information with additional data on their sites and higher estimates of potential site capacity. These developer estimates were not included in the base case, but are evaluated in this sensitivity run. Updated capacity estimates for eight sites in northern California and northern Nevada were used. These sites total about 1,100 MW of additional capacity. Adjustments were also made to capital costs estimates to account for economies of scale.

Table 5-11 shows the results of the sensitivity run. The largest impact is in the out-of-state resources, particularly Nevada. The quantity of potentially cost-competitive geothermal from northern and central Nevada increases by about 2,900 GWh/yr (388 MW), approximately doubling the total from these regions. However, this increase

offsets some imports from British Columbia and Oregon, such that the total increase in out-of-state resource is 2,100 GWh/yr.

The list of top-ranked California CREZs does not vary from the base case run with one exception. The Kramer CREZ falls off the list because the Round Mountain CREZ has increased in size.

Table 5-14. Economic Analysis Results – Expanded Geothermal.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Solano	2,721	2,721	-29
Palm Springs	2,465	5,186	-20
Victorville-A	2,112	7,298	-17
Round Mountain-A	3,196	10,494	-16
Imperial North-A	10,095	20,588	-13
Fairmont	18,318	38,906	-9
Tehachapi	25,091	63,997	-3
Riverside East-A	2,339	66,337	3
Victorville-B	2,267	68,604	4
In-state Non-CREZ Resources	3,667	72,271	-28
Out-of-state Resources	17,130	89,401	-15

5.8.7 Full Allocation of Transmission Costs

In the base case several transmission lines that have been approved, but are not yet operational, were assumed to be built. The cost of these transmission lines is assumed to be "sunk", and the most economic projects that can access them are not assigned a transmission capital cost for that portion of their route to load. (See Section 3 for a full description of the approach). To evaluate the impact that this assumption has on the analysis, the assignment of "free" transmission from these projects was eliminated, and they were assigned transmission costs using the normal methodology described in Section 3.

[20] As noted before, this sensitivity study could also be viewed as a proxy for reduced solar costs for any solar technology. If other technologies besides thin film substantially reduce their costs, the manufacturing limitations discussed here may not apply.

The results are shown in Table 5-15. With the exception of the Riverside East-A CREZ dropping from the list of top CREZs, changes are relatively minor. Riverside East-A CREZ had been allocated 1,200 MW of "free" transmission due to the proposed Palo Verde-Devers 2 line. Once this CREZ had to pay for the transmission upgrade, its weighted average rank cost rose from $3/MWh to $17/MWh. Other impacts are limited. Small changes in costs for the Imperial North-A and Fairmont CREZs are indicated in the last column of Table 5-15. These changes are slight for a couple of reasons: (1) Free transmission was allocated to the lowest cost projects in the effected CREZs. While these projects will now have to cover similar transmission costs as other projects, they still remain the most economical projects. (2) CREZs (such as Tehachapi) are so large that the economic benefit of the free transmission is relatively modest.

In conclusion, this scenario indicates that with the exception of Riverside East, the allocation of free transmission to certain projects has minimal impacts on the overall CREZ ratings.

Table 5-15. Economic Analysis Results – Full Transmission Cost Allocation.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)
Solano	2,721	2,721	-29
Palm Springs	2,465	5,186	-20
Victorville-A	2,112	7,298	-17
Round Mountain-A	1,598	8,896	-11
Imperial North-A	10,095	18,990	-9 *(was -13)*
Fairmont	18,318	37,308	-8 *(was -9)*
Tehachapi	25,091	62,400	-3
Victorville-B	2,267	64,667	4
Kramer	16,251	80,918	5
In-state Non-CREZ Resources	2,206	83,124	-29
Out-of-state Resources	15,010	98,134	-13 *(was -14)*

5.8.8 Uncertainty and Sensitivity Analysis Conclusions

Based on the results of the uncertainty and sensitivity analysis, the following CREZs could be cost-competitive under certain scenarios:

- Twentynine Palms
- San Bernardino - Lucerne
- Pisgah-A
- San Diego South
- San Diego North Central
- Carrizo North
- Lassen North-A
- Lassen South-A
- Santa Barbara
- Victorville-C
- Round Mountain-B

This list includes CREZs identified by the sensitivity analysis to be potentially cost competitive. If the full range of the uncertainty bands is considered, nearly every CREZ and resource area is potentially cost competitive under certain scenarios. For example, if costs have been significantly overestimated only for high cost resources, they may be cost competitive with lower cost resources.

A key message from the results of this analysis is that certain CREZs considered to contain poor resources in the base case may become attractive depending on the assumptions made. For example, the Lassen CREZs generally rank poorly in the initial analysis. These CREZs contain a large amount of wind power. Policies and assumptions that favor wind, would improve the overall standing of these CREZs.

In addition to California CREZ, there are several sensitivity scenarios where additional out-of-state resources appear to be cost competitive. The maximum amount for each region under these different scenarios is shown below:

- British Columbia – 1,000 MW
- Baja California Norte – 3,500 MW
- Nevada – 900 MW
- Oregon – 500 MW

In addition, the sensitivity assessment of reduced solar photovoltaic costs indicated that large amounts of non-CREZ solar PV resources could be economic if manufacturer cost targets are met. The cost-competitive non-CREZ resources increase to about 45,000 GWh/yr. This figure is over two-thirds of the net short requirement.

Finally, the transmission cost allocation scenario indicates that with the exception of Riverside East-A, the allocation of free transmission to certain projects has minimal impacts on the overall CREZ ratings.

6.0 Project Identification and Characterization

This section describes the resource assessment, project identification, and project characterization process for biomass, geothermal, solar thermal, solar photovoltaic, and wind resources.

6.1 Biomass

This section details Black & Veatch's approach to the identification of biomass direct fired projects for the purposes of RETI analysis. Biomass resources were identified as promising throughout much of the RETI study region in the Phase 1A report. In Phase 1B, biomass resources have been characterized in California, Oregon, Washington, and British Columbia. This section discusses the methodology used to characterize the resources suitable for biomass direct firing technology. The general approach was to identify potential biomass direct fired projects based on site characteristics.

6.1.1 Project Identification Approach

Biomass resources are unique in Phase 1B of RETI: while the resource is generally distributed over a large area, the biomass fuel can be transported to the point of best use. This allows for a high degree of siting flexibility. For example, biomass projects can be sited near existing transmission lines with available transfer capacity. Projects can also be sited to avoid environmentally sensitive areas. At about 1 acre per MW, the physical footprint of biomass plants is relatively low. For these reasons, the project identification process for biomass resource utilization focused more on available biomass fuel and less on the actual locations of specific plants. While preliminary sites have been identified for projects, these exact locations are generally not critical to the viability of the facility.

For California projects, county-level information from the California Energy Commission and California Biomass Collaborative (CBC) was used as the basis for identifying the total amount of biomass that could be used for fuel for power generation.[21] This biomass fuel data is included in Section 6.1 of the Phase 1A Report. The feedstock types included agricultural residues (orchard/vineyard, field/seed crop, vegetable crop, and food/fiber), forest residues (thinnings, slash, shrub, and mill residues), and urban wood waste. After discussion with biomass stakeholders, Black & Veatch then assumed that one-third of this theoretical fuel capacity would be available

[21] California Energy Commission, *An Assessment of Biomass Resources in California*, PIER Collaborative Report 500-01-016, California Biomass Collaborative, 2006.

for power generation. The remainder would be unavailable or used in competing markets such as for mulch, biofuels, and other purposes. Using the amount of "technically available" biomass for each category by 2010, these estimates were converted to an equivalent amount of MW potential using the CBC heating value for each fuel, a heat rate of 13,650 BTU/kWh, and 80 an percent capacity factor. This method defined the state-wide capacity (by county) and set the basis for project identification. A similar approach was followed for out-of-state resources, as described later.

Pre-Identified Projects

A list of existing and planned biomass projects was developed from filed PPA data. This list was checked versus the preliminary capacity table, and it was determined that the capacity of the projects on the PPA list was properly represented in the capacity table. Siting of biomass plants is assumed to be flexible. Therefore, capturing the capacity of pre-identified projects is adequate to include their impact on the analysis. Black & Veatch concluded that proxy projects developed from the resource analysis would represent both existing and potential biomass development. As a result, no biomass projects in the project list found in Appendix D are labeled as pre-identified, although the pre-identified project list was used to verify the modeled data.

Proxy Projects

Once the total biomass fuel availability (feedstock, in MW) per county was identified, the process for siting specific single-county projects began. Black & Veatch assumed that in order for a specific CBC-defined biomass fuel feedstock to have a stand-alone project, a minimum of 20 MW worth of feedstock availability must exist. It was also assumed that no project would be larger than 100 MW; anything larger was broken into multiple units (this only occurred for one facility).

After identification of resources that could be used in the single-county projects, the remaining biomass fuel material was combined with bordering counties to form multi-county projects. The feedstock used for these projects were either combined agricultural or forest residues or urban wood waste to develop multi-fuel projects with a minimum size of 20 MW. Facilities that required transport distances beyond what was typically assumed for single county projects had additional transport costs added.

Any material from counties that could support a project 20 MW or larger was either included with an existing single county project, or was not used. This methodology was able to utilize 95 percent of the available biomass feedstock identified in the initial review.

To site each of the single and multi-county projects, Black & Veatch used information on existing transmission substations as a starting point. For single county projects, plants were sited near existing substations as close as possible to the biomass fuel resource, while respecting all exclusion zones. Multi-county projects followed the same methodology, and attempted to minimize the biomass fuel transport distance by taking into account resource location and projected transport methods. Generally speaking, it was possible to site biomass projects adjacent to existing substations while minimizing the biomass fuel transportation cost. Given the relatively small size of the biomass facilities and their siting flexibility, most biomass projects are assumed to be developable without triggering significant transmission upgrades.

The only other major factor taken into account when siting biomass projects was the areas of ozone and particulate matter (PM) non-attainment in the state. According to the California EPA (Cal EPA), all of the state is in non-attainment for at least one of these two factors with the exception of Del Norte, Humboldt, Trinity, Mendocino, Modoc, Lassen, Lake, Plumas, and Sierra Counties. Any biomass project sited in a non-attainment area would be required to purchase offsets for the nitrous oxides (NOx) and PM emissions generated. The costs of these offsets vary from county to county and district to district. Black & Veatch used Cal EPA emissions reduction credit (ERC) trading data and contacts with local air quality management districts (AQMDs) and air pollution control districts (APCDs) to classify each county into one of 13 districts, with a $/ton ERC for NOx and PM included for each district. A value for NOx and PM emission credits per plant, assuming an emissions rate of 0.07 lb/MBtu NOx and 0.01 lb/MBtu PM, was included in the capital cost for each plant. Facilities that could easily move resources to other locations to reduce their ERC costs were moved out of certain districts. This led to the relocation of 8 of the 46 identified projects, largely out of the South Coast and San Joaquin Valley air districts.

Out-of-state Resources

A similar process was used to site single- and multi-county projects in Oregon and Washington. NREL biomass resource data was used to identify the potential capacity for biomass generation from each of these states. However, there are two major differences with the methodology in these states. First, due to competing electric demand, it was assumed that only one-half of the total generation capacity of identified projects would be available for export to California, with the remainder used in the state of generation. Second, no environmental costs due to NOx or PM emissions were included due to resources in each of these states largely in attainment areas for ozone and PM.

In addition to these out-of-state resources, there are 1,520 MW of biomass resources available in British Columbia.

6.1.2 Project Characterization Assumptions

The following assumptions were made in the characterization of biomass direct-fired projects.

- Conversion Technology: Combustion of biomass fuel was assumed to take place in a stoker or fluidized bed steam generator with a standard steam power cycle. Assumed emissions control equipment included selective non-catalytic reduction (SNCR) for NOx control and a baghouse/electrostatic precipitator for particulate control. This combination represents conventional technology which has been proven over many years of operation.
- Biomass Feedstock Costs: Estimates for the cost of different biomass fuel feedstocks were developed from data supplied by the Green Power Institute, updated to 2008 costs, and adapted for the resources identified in the CBC report. Costs for each resource can be seen in Table 6-1. Additional transport cost was added as necessary for multi-county or long transport facilities.

Table 6-1. Delivered Biomass Resource Cost.

Resource	Energy Content (BTU/bdt)	Delivered Cost, $/bdt
Composite Agricultural Residues	7790	34.1
Multi-fuel	8264	40.7
Composite Wood Residues	8738	48.4
Forest Thinnings/Slash	9027	48.4
Urban Wood Waste	7179	24.2
Forest Slash	9027	48.4
Mill Residues	8597	40.7

- Capital Cost: Capital cost for the project sizes considered (20 to 100 MW) ranged from $4000 to $5500/kW, after a review of recent cost estimates performed by Black & Veatch. This is higher than the Phase 1A numbers ($3000 to $4500/kW) due to the range of smaller plant sizes and recent price escalation for new facilities. The capital cost is inclusive of transmission and interconnection cost as well as ERC costs.

- Fixed and Variable Operating Costs: As with capital cost, these varied from $56 to $116/kW-yr for fixed costs and $10.30 to $13.60/MWh for variable costs, based on the size of the facility. These are consistent with Phase 1A estimates.
- ERC Costs: The cost of ERCs was added to the capital cost for units located in ozone and PM non-attainment areas. The costs for each region ranged from $11,000 to $38,000 per ton of NOx and $1,000 to $38,000 per ton of PM for all areas except the South Coast AQMD. ERCs in the South Coast were $268,000 per ton of NOx and $422,000 per ton of PM. These very high ERC costs in the South Coast justified moving any resources in this area out of the district into less expensive compliance regions.
- Heat Rate: The heat rate varied based on the moisture content of the fuel, with a low of 14,000 BTU/kWh used for urban wood waste (12 percent moisture) to 15,780 BTU/kWh for forest residues (40 percent moisture).
- Capacity Factor and Performance: A capacity factor of 80 percent was applied to all projects. The generation profile was assumed to be flat.
- Tax Credits: A $10/MWh production tax credit, with a term of 10 years, indexed for inflation, was included in the financial analysis. No investment tax credit was assumed.

6.1.3 Data Sources

As described in the Phase 1A report, Black & Veatch relied on recent engineering analysis for capital and operating costs, as well as capacity factor and heat rate estimates. Additional data sources used in this analysis included:

- Milbrandt, A. "A Geographic Perspective on the Current Biomass Resource Availability in the United States," 2005. NREL Technical Report NREL/TP-560-39181.
- Williams, et al. “An Assessment of Biomass Resources in California, 2006,” 2006. California Biomass Collaborative Draft Report. Accessed online at: http://biomass.ucdavis.edu/reports.html on February 28, 2008.
- Cal EPA and contact with AQMDs and APCDs in California for ERC costs
- CBC and the Green Power Institute for feedstock costs

6.1.4 Projects Identified

In total, 46 projects were identified in California, totaling 1,725 MW capacity, with generation of just over 12,000 GWh/yr. Generation costs ranged from $107/MWh for a 100 MW urban wood waste project in northeast Los Angeles County, to almost

$167/MWh for small multi-fuel units operating in either in a remote area or one with high environmental costs. Costs averaged $149/MWh for all biomass generation in the state. As would be expected, costs were lowest from larger facilities that faced low feedstock, transport, and environmental costs. Urban wood waste is the lowest cost feedstock, but typically must be moved outside of the urban centers due to plant siting and environmental constraints. While this raises the LCOE, the low relative fuel cost of urban wood waste makes these plants some of the least expensive projects identified.

Facilities using agricultural residues had lower than average feedstock costs ($34/ton), but typically had LCOEs higher than average. This is due to the relatively small units being typically located in areas with poor air quality (San Joaquin Valley), requiring either transport of the biomass fuel out of the district or higher capital cost due to ERC purchases.

Oregon (15 projects, 454 MW) and Washington (14 projects, 450 MW) contributes up to 6,300 GWh/yr biomass generation capacity for consideration. Note that only half of this project generation will assumed to be available for exported to California (3,150 GWh/yr), since it was assumed that the other half would be used by competing demand. LCOE costs are estimated to be slightly higher than California due to fewer large scale plants and limited access to inexpensive urban wood waste. The extra transmission costs (not reflected below) to bring power to the state will further raise delivered costs.

In addition to the resources identified in this section, there are 1,520 MW of biomass resources available in British Columbia.

6.1.5 California Executive Order S-06-06

In April of 2006, Executive Order S-06-06 set targets for California to meet 20 percent of its future renewable generation goals in 2010 and 2020 through the use of biomass and biogas resources. To meet S-06-06 requirements by 2020, roughly 22,000 GWh/yr of the state's electricity will need to come from biomass/biogas under a 33 percent renewables scenario. This is based on the calculations for total renewables capacity required to meet the 33 percent target outlined in Section 3.8.

Currently, the state is producing roughly 6,200 GWh/yr of power from biomass/biogas. Section 3.8 projects that an additional 1,500 GWh/yr will come from anaerobic digestion and landfill gas, leaving a shortfall of 14,300 GWh/yr that would need to be made up via biomass utilization. The RETI process identified roughly 20,400 GWh of biomass generation potential in California (12,000 GWh/yr), Oregon, Washington (3,150 GWh/yr combined) and British Columbia (5,250 GWh/yr). If just

these resources were used, 70 percent of the identified capacity would need to be built by 2020 to meet S-06-06.

6.2 Geothermal

This section details Black & Veatch's approach to the identification of conventional hydrothermal geothermal projects for the purposes of RETI analysis. Geothermal resources were identified as promising throughout much of the RETI study region in the Phase 1A report. In Phase 1B, conventional hydrothermal geothermal resources have been characterized in California, Nevada, Oregon, and British Columbia. This section discusses the methodology used to characterize the resources suitable for these technologies. The general approach was to identify potential conventional geothermal projects based on site characteristics at sites where geothermal potential has been discovered.

6.2.1 Project Identification Approach

For the purposes of the RETI study, geothermal projects have been identified from a variety of public domain information, including government assessments of geothermal potential, research papers and maps by universities and national labs, industry publications and press releases, leasing records, and direct responses from geothermal developers to solicitations for information as part of the RETI process. The focus has been on specific tracts of land about which there is enough public information to make a quantitative estimate of MW potential over a development horizon of about 10 years.

Undiscovered conventional resources and enhanced geothermal systems (EGS) resources were not identified with this approach. For the purposes of near-term transmission planning, it is not possible to accurately and reliably quantify the locations of undiscovered conventional potential and EGS potential. Although the aggregate potential is estimated, the locations and magnitude of undiscovered conventional geothermal potential is not known. EGS technologies are not yet commercially proven, and it is too early to plan transmission for these resources.

That said, it is recognized that various research efforts have estimated the generating potential of undiscovered conventional resources and EGS resources in the US in the hundreds of thousands of MW. In California alone, the potential of undiscovered conventional resources is estimated to be as high as 25,439 MW. The potential of EGS resources in California is estimated to be as high as 67,600 MW.[22] These resources would greatly increase the geothermal potential. As additional information is learned

[22] Williams, Colin F., Reed, Marshall J., Mariner, Robert H., DeAngelo, Jacob, Galanis, S. Peter, Jr., 2008, Assessment of moderate- and high-temperature geothermal resources of the United States: U.S. Geological Survey Fact Sheet 2008-3082,

about the quantity, quality and location of these resources, it should be included in future transmission studies.

Pre-Identified Projects

Pre-identified projects have included existing geothermal plants with expansion potential, Known Geothermal Resource Areas (KGRAs) as published by the United States Geological Survey (USGS), geothermal leases as published by the BLM, and prospect areas with associated MW estimates published by the California Energy Commission (CEC) and the Western Governors Association (WGA). Isolated hot springs and warm wells have not been treated as projects unless there has been some expression of developer interest, such as the leasing of geothermal development rights on specific tracts.

Proxy Projects

Estimation of geothermal potential for RETI purposes has not involved designation of proxy projects. Because geothermal projects typically have relatively long lead-times and high up-front costs, only those areas in which assessment work or leasing has already occurred were considered relevant to transmission planning over a 10-year horizon.

Out-of-state Resources

Phase 1A of the RETI process entailed a high-level review of the geothermal potential of several areas outside California, including Nevada, Oregon, Washington, British Columbia, and northern Mexico. Based on this review, three out-of-state areas were deemed to have sufficient geothermal potential to warrant more detailed assessments for purposes of transmission planning: Nevada, Oregon, and southern British Columbia. In general, the assessment process for these areas was the same as the California resources.

6.2.2 Project Characterization Assumptions

Estimation of generation potential for specific areas has relied on volumetric estimation of heat in place wherever sufficient information was available to justify this approach. The methodology has been described in detail in a study of California and Nevada geothermal resources for the CEC PIER program (GeothermEx, 2004). In brief, the heat-in-place approach entails estimation of the area, thickness, and average temperature of the geothermal resource. Recovery factors that are based on industry experience are applied to estimate the proportion of heat that can be recovered as

electrical energy over an assumed project life of 30 years. Uncertainty in the input parameters is handled by a probabilistic approach that yields a range of possible generation values and associated probabilities. The modal value of the probability distribution is considered the "most likely value" of generation potential for the project concerned.

Where there is insufficient resource information to apply the heat-in-place method, estimates of generation potential have been made by analogy to better-known projects in similar geologic environments. If the only public information about a project is that it contains geothermal leases or has been the subject of a geological reconnaissance study, the project size has been estimated at a minimum size of 10 MW (gross). Larger estimates of capacity can be justified even in the absence of published resource data if there is evidence of active geothermal development efforts. For certain large volcanic centers in northern California, Oregon, and southern British Columbia, capacities of 50 MW (gross) have been estimated based on potentially favorable geologic conditions, even in the absence of current development efforts.

Characterization of capital and operating costs for geothermal projects has been based as much as possible on industry experience. The costs of drilling and plant equipment have risen markedly in recent years. A comparison of cost estimates from the CEC-PIER report (GeothermEx 2004) with actual development costs as of 2008 indicates that the CEC-PIER estimates have escalated by about 20 percent. Moreover, a correlation of the CEC-PIER cost estimates with estimated capacities has shown generally higher costs per kW installed for smaller projects. This correlation between cost and project size has been used to estimate the cost of projects not considered by the CEC-PIER study, and the 20 percent escalation factor has been used to express all project costs in 2008 dollars. For British Columbia, a 30 percent escalation factor has been applied to account for development challenges associated with colder climate and rugged topography. This analysis has yielded capital cost estimates ranging from $3,750 to $6,750/kW (net) installed. The most expensive 10 percent of estimated capacity was omitted from the analysis.

Operating costs have been estimated to range generally from $27 to $42/MWh (net), with higher costs characterizing the smaller project sizes. The hyper-saline brine resources of the Salton Sea field are estimated to have operating costs of $39/MWh. The operating cost estimates include site costs, general and administrative overhead, workovers, royalties, and insurance.

Incremental capacity estimates were first developed on a gross capacity basis and then converted to a net basis using an assumed average auxiliary load of 10 percent for flash resources and 20 percent for binary resources.

Initial capacity factor estimates for plants were assumed to be 90 percent for flash plants and 80 percent for binary plants. For the purposes of modeling energy and capacity value, the geothermal plants were assumed to produce the same amount of energy at all times of day.

6.2.3 Data Sources

The principal data sources for project identification and capacity estimates have included:

- Industry responses to requests for information under the RETI process
- Broad-based assessments of geothermal potential (such as the USGS assessment of 1979, currently being updated; the CEC-PIER report of 2004; the WGA study of 2006)
- Industry publications (such as reports and updates of the Geothermal Energy Association)
- Leasing records (such as the LR-2000 database of the BLM).
- Geothermal databases made available by state regulators (such as the California Division of Oil, Gas and Geothermal Resources, and the Nevada Division of Minerals.
- Research and maps published by universities and national labs (particularly the Great Basin Center for Geothermal Studies, the National Renewable Energy Lab, and Southern Methodist University.
- Technical literature published by the Geothermal Resources Council

The principal data sources for cost estimation have included:

- Industry press releases
- Reports prepared by or sponsored by government agencies, such as the US DOE and the CEC.

6.2.4 Projects Identified

Table 6-2 shows the geothermal project totals by state. In total, 115 projects were identified for the study region, with 13 of these projects within the state of California. The California projects totaled 1,958 MW (net) of incremental capacity, contributing almost 15,000 GWh of electricity generation. Total RETI study region estimated incremental capacity is 4,172 MW (net), with a potential generation of 29,600 GWh.

Table 6-2. Geothermal Project Totals by State (Net MW)	
California	1,958
Nevada	1,243
Oregon	520
British Columbia	244
Grand Total	**3,965**

6.3 Solar Thermal

This section details Black & Veatch's approach to the identification of large scale solar thermal projects for the purposes of RETI analysis. Solar thermal resources were identified as promising throughout much of the RETI study region in the Phase 1A report. In Phase 1B, solar thermal resources have been characterized in California, Nevada, and Arizona. This section discusses the methodology used to characterize the resources suitable for solar thermal technology. The general approach was to identify potential solar thermal projects based on site characteristics.

6.3.1 Project Identification Approach

Solar resource potential is more uniformly and widely distributed across the study area than resources for other technologies. For this reason, there are a large number of potential solar thermal projects, many more than can be assumed to be developable over the coming decades. The project identification approach, however, was to identify as many technically feasible, commercially attractive, and environmentally responsible projects as possible. Subsequent transmission, economic and environmental analysis will select which of the projects are suitable to include in the CREZ analysis.

Parcels that are appropriate for solar thermal development are also appropriate for development by other solar technologies. For this reason, parcels that fit criteria for solar thermal development are considered appropriate for any large scale solar technology and are characterized as both solar thermal and solar photovoltaic projects.

Project identification for large scale solar projects was based on a grid that covered the entire state of California. Each grid square was an area of two square miles, corresponding to a single project parcel with a capacity of 200 MW (or 150 MW for large scale solar PV). Grid squares which contained land in exclusion zones were eliminated from consideration, leaving a subset of parcels which were candidates for analysis. Potential projects were selected from these candidate parcels. Projects previously identified in publicly available sources were selected first, and remaining parcels that fit the criteria for proxy projects were also included.

Pre-Identified Projects

Grid squares were selected for pre-identified projects if Black & Veatch had evidence of interest in development of the land for large scale solar projects. Evidence of development interest could exist in the form of an application with the Bureau of Land Management, a contract for energy sales, or a response to Black & Veatch's request for

information. Black & Veatch also received guidance regarding the military's interest in developing large scale solar.

Pre-identified projects have not been explicitly modeled by this report. Rather, Black & Veatch has characterized a standard project on or near the location of the pre-identified project with the intention of capturing the relative performance of solar development in the area with development interest.

Grid squares were selected as pre-identified projects if they corresponded to project information obtained from one of the following sources:

- Bureau of Land Management (BLM) Applications - A grid square was selected on the basis of commercial interest if information indicated that an application to the BLM for solar development existed for land contained within the grid square. This source resulted in the identification of most of the pre-identified projects.
- Contracts for Energy Sales - The California Public Utilities Commission (CPUC) maintains a list of existing power purchase agreements. This list includes a number of contracts for solar thermal projects. Black & Veatch attempted to locate these projects based on publicly available information. Where this was possible, the grid square at the corresponding location was included as a pre-identified project.
- Request for Information - A number of generators provided data about their solar thermal generation projects. Where adequate geographic information was provided by the generators, the grid square at the corresponding location was included as a pre-identified project.
- Military - Black & Veatch received guidance regarding military bases with interest in developing large scale solar but not specific site information for the projects. Based on this information, grid squares on land near other identified projects inside military lands were selected as projects.

Proxy Projects

Black & Veatch defined proxy projects on candidate land parcels without demonstrated development interest. These projects were selected as the most attractive and technically feasible of the remaining candidate grid squares. The grid squares selected as proxy projects satisfied the following conditions:

- Did not contain land in an environmental "yellow area" as defined by the RETI Environmental Working Group

- Did not contain land in other restricted lands identified in Section 3 (for example urban areas)
- Had a median land slope of less than two percent
- Experienced an average annual direct normal insolation of more than 6 kWh/m^2/day

Some proxy projects were placed on land contracted under the Williamson Act as non-prime agricultural land. These projects, however, would not be available for development until 2018.

Out-of-state Resources

Projects were considered in southern Nevada and western Arizona if commercial interest was identified. Black & Veatch created projects corresponding to BLM applications in these areas and in response to information received from developers.

6.3.2 Project Characterization Assumptions

Each project was individually characterized to determine its rank cost. The following assumptions were made in the characterization of solar thermal projects:

Capacity Factor and Generation Profile

All solar thermal projects were modeled as a parabolic trough plant without thermal storage or gas assist. This assumption is from RETI Phase 1A. Performance of each project was simulated independently using a parabolic trough performance model developed at NREL. The insolation and weather data for each site is from the NREL database of satellite-based solar data.

Wet vs. Dry Cooling

All projects were assumed to be dry cooled with the exception of projects with adequate amounts of treated wastewater available. Wastewater was allocated to otherwise attractive projects closest to the source of the water. Water was sourced from population centers, and the amount of water was derived from population data. It was assumed that a population of 10,000 was adequate to support a 200MW plant.

Capital Cost

A unique capital cost was assigned to each project. More than 90 percent of projects have capital costs between $4500 and $5500/kW. The majority of the differences in capital costs arise from earthmoving costs associated with terracing sloped land. Costs also vary based on the need for a wet or dry condenser, and the miles of

access road needed. Examples of projects on the low end of the capital cost range include wet cooled projects on flat land close to existing roads.

6.3.3 Data Sources

Data sources used in this analysis included:

- Perez, et.al., "SUNY Satellite Solar Radiation model", available at: www.nrel.gov, accessed: June 2008.
- Blair, et.al., " Modeling Photovoltaic and Concentrating Solar Power Trough Performance, Cost, and Financing with the Solar Advisor Model", available at: www.nrel.gov, accessed: June 2008.

Project Screening

Initial project screening identified 1,785 projects in California, representing 357 GW of capacity. This large sum is testament to the incredible potential for solar generation in the state. The RETI stakeholders, however, determined that it was not productive or realistic to consider transmission for so much more capacity than is necessary to satisfy the net short. The projects with the best development potential were selected and kept for final characterization and inclusion in CREZs. The development potential was determined by economic and site screening, as defined below.

- Economic screen - The first screen for large scale solar thermal projects was the preliminary economic characterization. The most economically attractive projects were kept in each CREZ. Exact selection criteria varied by CREZ in order to ensure the retention of an appropriate number of projects in each. To show a preference for pre-identified projects over proxy projects, the selection criteria for pre-identified projects was less severe, typically by $10 in ranking cost. Despite this economic bias, numerous pre-identified projects were dropped at this stage. There were simply too many projects to carry forward for detailed analysis.
- Site Screen - After the economic screen, the reasonableness of site selection was considered. GIS tools were used to inspect satellite images of project sites. In a few cases, projects on unreasonable sites were relocated to a nearby site with a comparable ranking cost.

6.3.4 Projects Identified

A total of 326 solar thermal projects were identified in California, representing 65 GW of generating capacity and 159 TWh of annual electricity generation. Of those projects, 176 were pre-identified, 23 were designated as wet cooled, and 45 contain land

protected by the Williamson Act. These Williamson Act projects will only be assumed developed in the long term.

An additional 34 projects were identified in Nevada and Arizona, representing 14.5 GW of generating capacity and 35.5 TWh of annual electricity generation.

6.4 Solar Photovoltaic

This section details Black & Veatch's approach to the identification of solar photovoltaic projects for the purposes of RETI analysis. Solar photovoltaic resources were identified as promising throughout much of the state of California in the Phase 1A report. In Phase 1B, solar photovoltaic resources have been characterized for centralized large-scale projects (150 MW) and distributed utility-scale projects (20 MW) in California. This section discusses the methodology used to characterize the resources suitable for solar photovoltaic technology. The general approach was to identify potential solar photovoltaic projects based on site characteristics.

6.4.1 Project Identification Approach

Distributed solar photovoltaic projects were sized at 20 MW and sited close to existing substations. Centralized solar photovoltaic projects were sized at 150 MW, and sited using the same criteria as solar thermal projects. Smaller customer-sited photovoltaic projects are not directly considered for large-scale transmission upgrades as part of the RETI process, but they are assumed to be installed under the California Solar Initiative (CSI).

It is important to note that many more thousands of solar PV projects could have been included in the analysis. However, the range of costs for solar PV projects is relatively limited, and the selected projects are considered to be a representative sample for the purpose of the analysis.

Solar photovoltaic projects were identified by using available information on proposed projects as well as selecting areas which had good technical and commercial potential for development. Areas where existing commercial interest was expressed were considered "pre-identified" projects. Areas which were identified as having high solar resource potential in California were considered as "proxy" projects.

Pre-Identified Projects

Each pre-identified project needed to meet a set of criteria that would allow Black & Veatch to locate and characterize the project. At a minimum, these projects had specific geographic coordinates, land acreage and generation capacity. In some cases, the developers provided additional information about the geographic shape of the project area and the photovoltaic technology used in the project.

The information about the pre-identified solar photovoltaic projects came from a range of sources, and for the purpose of this study was combined into a joint set. Black

& Veatch assumed that an area that is a candidate for a solar thermal project is also appropriate for a solar photovoltaic project. All solar thermal projects shown in Appendix D could alternately be solar photovoltaic projects. Note that no distributed, utility-scale solar photovoltaic projects were pre-identified. As a result, no solar photovoltaic in the project list in Appendix D are labeled as pre-identified.

The most comprehensive source of data for pre-identified projects was the Bureau of Land Management (BLM), because many solar developers have filed applications for right of way on BLM lands. In terms of both land and total capacity, the BLM applications account for the majority of the pre-identified projects.

Another important source of project information was the generator data request. A letter requesting information on projects in development was distributed by the RETI Coordinating Committee to generators, utilities and other interested parties. Many solar project developers provided non-confidential information about their projects, which was used to verify and augment the project list.

Black & Veatch also received additional data from the utilities, the CEC, ISOs, and military. In most cases, this additional data did not include enough information to classify a project as pre-identified, and was only used to cross-check the existing data on pre-identified and proxy projects.

Proxy Projects

Solar photovoltaic proxy projects were created to account for areas with enough resource potential for development but no expressed commercial interest. Black & Veatch assumed that many utility-scale solar photovoltaic projects would be distributed across the state. These projects were assumed be 20 MWe[23], since this is the maximum size that can be connected to power transmission lines under the small generator interconnection process. The proxy projects would be located as close as possible to a substation for ease of interconnection, and minimization of transmission spur line costs.

These distributed projects (20 MW) would have short development timeframes because of their small, modular nature, and relative ease of permitting and interconnection (due to the small generator interconnection process). The assumptions for solar photovoltaic distributed utility-scale proxy projects are as follows:

- 20 MWe for each project.

[23] The nomenclature used by the solar industry can be confusing. Most solar output and costs are quoted in $ per watt "peak" or "dc" (shown as MWp). This is the peak rating of the solar module, and does not take into account degradation due to wiring loss, inverter efficiency, temperature and other factors. To accurately compare to other technologies, an "AC" rating should be used (MWe). This derate factor ranges from 77 to 85 percent, depending on the photovoltaic technology and location. All of the costs for other technologies in the RETI report are quoted on a net AC basis, and solar PV output and costs are presented in this report in a similar manner.

- Each project would occupy a 160 acre square (quarter section). This is 8 acres per MWe, or 6.4 acres per MWp.
- One project near each 50kV – 100kV substation. It was assumed that substations at this voltage range could accept 20 MW of generation.
- Two projects near each 100kV – 200kV substation. It was assumed that substations at this voltage range could accept 40 MW of generation.
- Median land slope of less than five percent. Land with higher slope was assumed to be too costly to construct.

The solar photovoltaic proxy projects also include a set of larger, centralized projects. These projects share the same criteria as the solar thermal proxy projects, and thus each of these areas is modeled as both solar thermal and solar photovoltaic for comparison. The solar thermal section has more detailed description of the methodology used to identify these projects. The assumptions for the solar photovoltaic large scale proxy projects are as follows:

- 150 MWe for each project.
- Two square mile area. This is 8.5 acres per MWe, 6.8 acres per MWp.
- Median land slope of less than two percent. The land slope requirements were for solar thermal, but were deemed appropriate for solar photovoltaic.
- Experienced an average annual direct normal insolation of more than six kilowatt-hours per square meter per day. This screen was for solar thermal, but areas with high quality direct normal insolation will also have high quality global insolation.

Environmental and policy screens were added to the technical screens to ensure that solar development did not take place on lands excluded by the GIS analysis performed in Section 3. The areas that were to be excluded from the solar development analysis included:

- Environmental "yellow" areas as defined by the RETI Environmental Working Group. See Section 3 for more information on these exclusion areas.
- Prime Agricultural Lands registered under the Williamson Act. The Williamson Act protects farmland for a period of 10 years, which is automatically renewed every year unless a request for non-renewal is submitted. Prime agricultural lands under the Williamson Act were not considered for solar proxy projects.
- Non-Prime Agricultural Lands registered under the Williamson Act. Non-prime farm land under the Williamson Act would be assessed for technical

potential for large-scale solar proxy projects. These lands, however, would be assumed to be undevelopable before 2018, to allow time for current contracts to expire. Because there are many other available small land parcels and it would take 9 years before land would become available for development, these lands were not considered for the smaller distributed proxy solar photovoltaic projects.

- Land with high slope. This was calculated as the median slope for each quarter section (160 acres). The slope maximum was lower for large-scale projects.
- Areas with annual average insolation of less than 6 kWh/m^2/day. This was the minimum insolation for the analysis for large-scale projects (150 MW) only.

Other land use screens were also applied. The complete list of exclusion areas is provided in Section 3.

Out-of-state Resources

No out-of-state resources were considered for solar photovoltaic projects. The RETI Phase 1A report concluded that sufficient solar photovoltaic resource potential exists in California.

6.4.2 Project Characterization Assumptions

Several assumptions were used when characterizing potential solar photovoltaic projects. Two different technologies were chosen to represent the trends in photovoltaics: single axis tracking crystalline silicon as the base case and fixed tilt thin film as a sensitivity case. The base case was characterized by the following assumptions:

- Multi-crystalline modules
- Single axis tracking, north-south axis
- Backtracking to avoid self-shading during sunrise and sunset
- Ground coverage ratio of 30 percent

A sensitivity case was outlined in the RETI Phase 1A report in order to evaluate a scenario with low cost thin film modules. The sensitivity case assumes a fixed tilt mounting structure instead of a single axis tracking system as in the base case. Due to a thin film's relatively lower cost and lower efficiency, the added cost of the tracking system is generally not justifiable. The thin film system was characterized by the assumptions below:

- Thin film modules
- Fixed tilt of 20 degrees

- South-facing
- Ground coverage ratio of 43 percent

These systems were evaluated based on their capacity factors and levelized cost of energy (LCOE). Assumptions affecting capacity factor and LCOE are discussed in the following sections.

Capacity Factor Assumptions

Capacity factors for the base and sensitivity cases were calculated for each potential project location. For a solar photovoltaic project, capacity factor is the ratio of its AC delivered energy over a year and its AC energy output if it had operated at full nameplate capacity the entire time.

Black & Veatch used data and models developed by the National Renewable Energy Laboratory (NREL) as a basis for the capacity factor analysis. NREL provided high resolution solar irradiance data in GIS format. This data included global horizontal, latitude tilt and direct normal monthly irradiance values for 10km x 10km grid squares. NREL derived the solar irradiance data from many years of satellite images covering the United States.

Black & Veatch used a proprietary tool to calculate energy production. The inputs for this tool included the NREL solar irradiance data, temperature data, geographical location, day and hour. The tool outputs average hourly energy production by month for both tracking crystalline silicon and fixed tilt thin film technologies. An annual degradation in performance of 1 percent was included in the cost of energy calculations.

Figure 6-1 and Figure 6-2 show examples of the daily energy generation profiles for single axis tracking and fixed tilt technologies. A single axis tracking system produces more energy in the mornings and afternoons than a fixed tilt system. For each solar photovoltaic project, generation profiles were used to calculate the energy and capacity values. These profiles consisted of an average daily energy production profile that was generated for each month of the year, every hour of the day (12x24 matrix).

The example daily energy generation profile in Figure 6-1 shows a July profile for crystalline and thin film. The thin film generation peak is above the crystalline peak for two major reasons. The first is that thin film has a lower temperature coefficient, which means that it suffers less from mid-day high temperatures than crystalline. The second is that the fixed tilt angle of thin film is more optimally pointed toward the sun than the flat horizontal tilt of crystalline at mid-day.

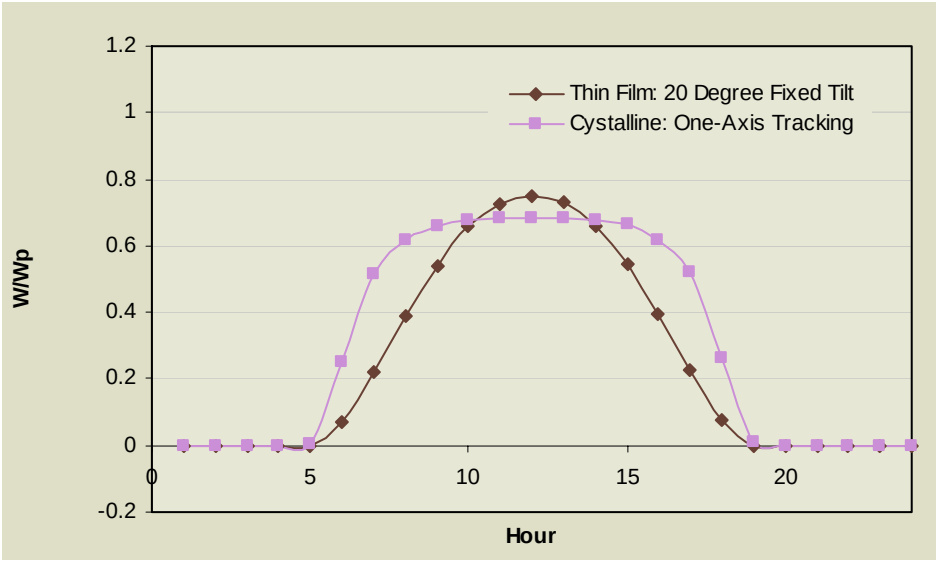


Figure 6-1. Example Energy Output from Tracking Crystalline and Fixed Tilt Thin Film (July).

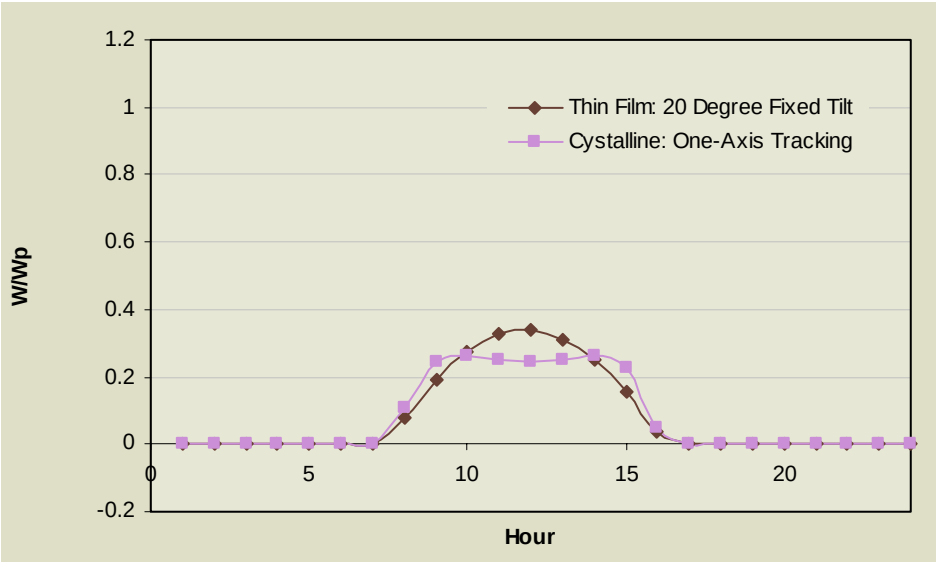


Figure 6-2. Example Energy Output from Tracking Crystalline and Fixed Tilt Thin Film (December).

Cost Assumptions

The key financial assumptions of solar photovoltaic technology consist mainly of capital cost and operations and maintenance (O&M) costs. These costs are shown in Table 6-3. As stated earlier, single axis tracking crystalline silicon photovoltaics were

chosen as the representative base case photovoltaic technology. However, thin film manufacturers have targeted aggressive capital cost reductions in the near term. In recognition of the significant impact that such cost reductions might have, the alternative thin film costs have been included here. Unlike all other estimates in RETI, these estimates are based on manufacturer projections and not actual project cost experience. For this reason, thin film is treated under a sensitivity scenario and not a base case assumption.

Table 6-3. Photovoltaics Cost Parameters.

	Base Case Crystalline	Sensitivity Thin Film
Base Project Capital Cost ($/kWe)	7,000	3,700
Variable O&M ($/MWh)	N/A	N/A
Fixed O&M ($/kWe)	44	25
Levelized Cost of Energy ($/MWh)	192 to 285	114 to 176

For the 20 MW utility-scale projects, the base capital cost was increased to account for interconnection costs. Black & Veatch assumed that upgrading the existing substations to accommodate the new generation would cost $800,000, and new transmission from the project to the substation would cost $200,000 per mile. No other transmission costs will be assigned to smaller PV projects, as they have been assumed to be integrated into the local grid without the need for major upgrades.

For the 150 MW large-scale projects, the base capital cost was increased to account for access roads to the site from the nearest major roadway. New roads were assumed to cost $50 per foot. Interconnection and other transmission costs will also be assigned to the larger projects in the final Phase 1B report.

6.4.3 Data Sources

Data sources used in this analysis included:

- R. Bird and C. Riordan, "Simple Spectral Model for Direct and Diffuse Irradiance on Horizontal and Tilted Planes at the Earth's Surface for Cloudless Atmospheres", available at: www.nrel.gov, accessed: June 2008.
- Perez, et.al., "SUNY Satellite Solar Radiation model", available at: www.nrel.gov, accessed: June 2008.
- NREL's GIS team, High Resolution National Solar Photovoltaics GIS data, available at: www.nrel.gov, accessed: June 2008.

6.4.4 Projects Identified

There were 1,375 distributed solar photovoltaic projects identified in 56 counties in the state of California, for a total of 27,500 MW. These projects are expected to generate 58,775 GWh annually. There were 326 large projects identified in California for a total of 48,900 MW.

6.5 Wind

This section details Black & Veatch's approach to the identification of wind projects for the purposes of RETI analysis. Wind resources were identified as promising throughout much of the RETI study region in the Phase 1A report. In Phase 1B, wind resources have been characterized in California, southern Nevada, Oregon, Washington, British Columbia, and the northern portion of Baja California Norte. This section discusses the methodology used to characterize the resources suitable for wind technology. The general approach was to identify potential wind projects based on site characteristics.

6.5.1 Project Identification Approach

Identification for wind projects in California was based on a high resolution AWS Truewind wind speed dataset, produced as part of the Energy Commission's Intermittency Analysis Project. The data included wind speed, wind direction, and Weibull shape and scale parameters for a 200 meter by 200 meter grid over the entire state of California in GIS format.

The GIS data was used to create a ½ mile by ½ mile grid (quarter sections) that included key cost and performance estimates of potential projects: capacity, capacity factor, and capital cost. Quarter sections that had a median slope greater than 20 percent were not considered. Capital cost data was based on Black & Veatch experience with of turbine supply costs and balance of plant costs. Balance of plant costs were determined for each site based on slope, miles of access road, and miles of project road required. Generation interconnection and other transmission costs are not included in the estimates in this report.

Nameplate project capacity was determined for each site by estimating how many turbines could be placed within the prospective wind class area within each site. While the final spacing of turbines is dependent on many site specific characteristics, research has shown that energy deficits due to wake effects tend to decrease with increasing wind speed. As such, Black & Veatch implemented a general wind class specific "rule of thumb" where each subsequently higher wind class area is assigned a tighter spatial distribution for turbine placement. Each area is also assigned a specific multiplier to compensate for terrain-based (flat, hilly, ridgeline) land availability issues at each site. These values for terrain and spacing are based upon industry standard practices and Black & Veatch's project experience.

Capacity factor estimates were derived from the AWS wind speed data (adjusted for altitude) and representative turbine power curves. A representative turbine power

curve was determined by averaging the power curves from three turbine manufacturers' models for IEC classes I, II and III. Only turbines from major manufacturers that produce Class I, II and III turbines were considered. Black & Veatch chose this method to ensure the analysis was not reliant on any specific turbine manufacturer. The three turbines that were chosen for each class are presented in Table 6-4. The calculated rating of each representative turbine is shown in Table 6-5 and the power curve is shown in Figure 6-3.

Table 6-4. Turbines Considered for Average Power Curve Calculation.

	Gamesa			Vestas			GE		
	G80	G87	G90	V80	V90	V90	1.5se	1.5sl	1.5xle
IEC Class	I	II	III	I	II	III	I	II	III
Rated Power (MW)	2	2	2	1.8	1.8	2.0	1.5	1.5	1.5

Table 6-5. Calculated 'Typical Turbine' Used in Analysis.

IEC Class	I	II	III
Rated Power (MW)	1.77	1.77	1.83

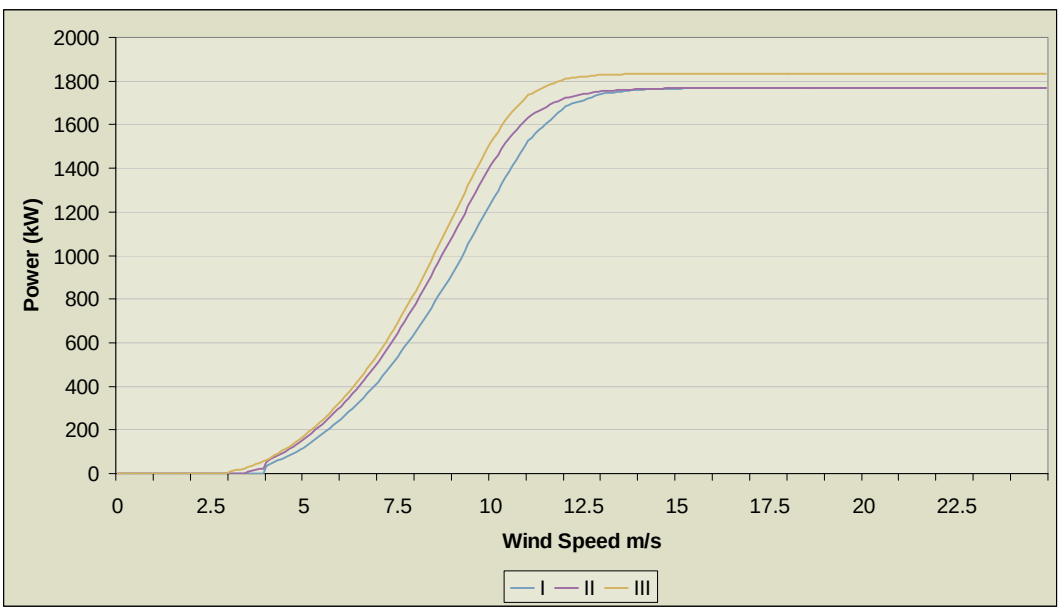


Figure 6-3 Averaged WTG Power Curves

Wind resource characteristics determine what class of turbine is to be used on site. These characteristics include values for maximum gusts, turbulence intensity, and

average wind speed. Some of these characteristics were not available to Black & Veatch in the analysis, so a simplified method of selection was used. IEC Class III turbines were used in NREL Class 3 winds, IEC Class II turbines were used in NREL Class 4 through 6 winds and IEC Class I turbines were used in NREL Class 7 winds.

A general loss factor of 12 percent was used to calculate net capacity factor from gross capacity factor. Losses come from many sources include icing, turbine availability, grid availability, and high wind hysteresis. An in-depth analysis of losses on a per project basis was not performed.

These capital costs and capacity factors were then used to create a levelized cost of energy for each quarter section. In order to define projects located on relatively flat areas, projects were identified by aggregating adjacent quarter sections with similar cost of energy characteristics. For potential projects located on ridgelines, strings of comparable quarter sections were identified on the ridgelines that allowed a project to be oriented perpendicular to the prevailing wind direction. Projects areas that had low wind power density and could not support a wind project of at least 30 MW were not considered.

Information on California's terrain, land use, and environmental designations was used to identify specific areas excluded from the development of utility scale wind energy projects. Land categories marked with an asterisk were not considered by Black & Veatch for placement of "proxy" projects, but pre-identified projects were considered for placement and characterization in these areas. The areas that were to be excluded from the wind development analysis included:

- Environmental "yellow" areas as defined by the RETI Environmental Working Group. See the Environmental Working Group's report for more information on these exclusion areas.*
- National Forest (designated roadless areas in National Forest are included in "black out" areas). See the Environmental Working Group's report for more information on these exclusion areas.*
- Land identified as "Red" by the Department of Defense in their maps of restricted airspace. These maps show restricted military airspace.*
- Existing wind projects. These projects may be available for repowering, but repowering was not contemplated in the RETI process.
- Areas adjacent to major airports. Major airports have significant FAA restrictions on wind development in the flight path.
- Land with greater than 20 percent slope. Slope was calculated as the median slope for each quarter section. Land with slope higher than 20 percent is considered too difficult to construct.

- Areas with annual average wind speeds of less than 6.3 meters per second.

Pre-Identified Projects

Projects were classified as "pre-identified" if Black & Veatch had evidence of commercial interest in development of the land for a wind project. Evidence of commercial interest could exist in the form of an application with the Bureau of Land Management, a contract for energy sales, or a response to Black & Veatch's request for information. These are discussed in more detail below.

Bureau of Land Management applications

There are three types of BLM applications for wind energy; type 1, 2 and 3. Type 1 applications are for wind speed monitoring only and cannot be renewed past the initial 3 year term. Type 2 applications grant exclusivity and can be renewed or extended to full development. Type 3 applications are for full development and have a term of 30 to 35 years. The data Black & Veatch received from the BLM did not always distinguish between the type of application, and Black & Veatch therefore included all three types of applications to indicate commercial interest.

In many cases, these BLM GIS data were incomplete. BLM GIS data was inconsistent with spreadsheet data provided by BLM. In addition, some BLM data was significantly out of date. Black & Veatch did not attempt to exactly match the GIS polygons provided by the BLM, but instead matched Black & Veatch identified projects that overlapped or were adjacent to identified BLM projects.

Power Purchase Agreements

The California Energy Commission maintains a list of existing power purchase agreements. Black & Veatch attempted to locate these projects based on publicly available information. Where this was possible, the project at the corresponding location was included as a pre-identified project.

Request for Information (RFI)

A number of generators provided Black & Veatch with data about their wind projects. Where adequate geographic information was provided by the generators, the project at or near the corresponding location was included as a pre-identified project.

Proxy Projects

Those projects identified by Black & Veatch that were not matched to a pre-identified project were considered "proxy" projects.

Out-of-state Resources

The methodology for out-of-state resources varied dependent on the location, and is described below.

- **Southern Nevada**: Only pre-identified projects were included, either using BLM application information or generator RFI data. Wind power density data at 50 meters from NREL GIS maps were used to calculate the capacity (MW) and annual generation (GWh) for these projects. Slope data were used to estimate capital costs.
- **Oregon and Washington:** NREL GIS data was used to estimate technical wind generation potential. This potential was estimated by wind class and region for both states (there are 19 regions in WA and OR) Developable capacity was derived from this technical potential using a 70 percent reduction, the same ratio of developable to technical potential found in California. Typical capacity factors for each wind class were applied for each wind class in each region. In addition, approximately 25 percent of the wind currently in Oregon and Washington is being sold to California. This value was used as a proxy to further reduce the projects to a realistic developable dataset that might be sold to California.
- **British Columbia:** Information provided by PG&E was used to describe wind energy potential in British Columbia.
- **Northern Baja:** Wind power GIS data from NREL was used to estimate technical potential in the border region. This technical potential (over 9,000 MW) was larger than the technical potential originally reported in the Phase 1A report due to a larger survey area. Wind power density data at 50 meters from NREL GIS maps were used to calculate the capacity (MW) and annual generation (GWh) for potential projects in the region. Slope data were used to estimate capital costs. There was no environmental or land use screening process applied to Baja wind resources (e.g. environmental, military, constructability, slope, airport, etc). For the purposes of initial modeling, a total of 5,000 MW of border-region wind was modeled in Baja. This amount matches current interconnection queue applications. Additional study is recommended to refine these estimates and collect additional siting data, as described below.

Additional Study of Baja Wind Resources Recommended

The RETI Phase 1B study focused on Baja wind resources near the California border. While large siting regions were identified for the 5,000 MW modeled in the

study, it is unknown if these correspond with the locations that developers are considering. Further, it appears that there may be significantly higher quantities of wind resources extending much further south in Baja than initially quantified. Limited environmental data and time prevented full consideration of these resources in Phase 1B of RETI; however, some preliminary results are presented here.

Black & Veatch received data on wind power density at 50 meters from NREL.[24] This data is for the northern 300 km of Baja California Norte. The class 4 and higher wind resources are shown in Figure 6-4. Areas of slope greater than 20 percent were excluded from the wind data, but no other exclusions were made. Assuming a wind farm density of 5 MW/km^2 (about 50 acres per MW), the total theoretical MW potential from Baja wind resources Class 4 and higher is 24,825 MW. A breakdown of this resource by wind class is shown in Table 6-6.

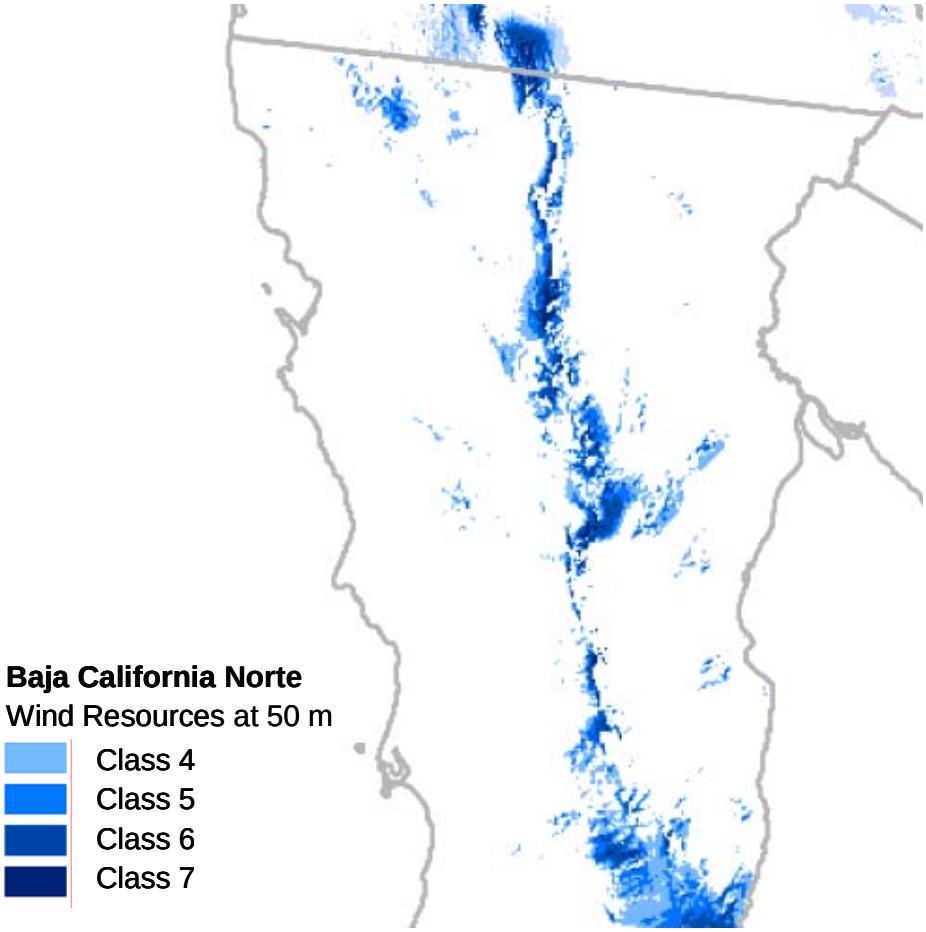


Figure 6-4. Baja Wind Resources.

[24] GIS data for wind speed at 70 meters was not available at the time of report publication. This data could be collected in assessed in Phase 2.

Table 6-6. Theoretical Baja Wind Resource (MW), Class 4 and higher.	
Class 4	12,592
Class 5	6,241
Class 6	4,534
Class 7	1,458
Total	24,825

This is a theoretical estimate without consideration for development constraints. At this high-level of analysis, it is not possible to determine what percentage of this capacity may be developable. While the results appear promising, further analysis is needed to determine environmental constraints and development costs. Much of the Baja region is rugged and lacks the basic infrastructure (for example, roads) that facilitate wind project construction in California. In addition, the transmission infrastructure to export power to California will need to be developed. Black & Veatch recommends that these issues be explored further in Phase 2 to get a more accurate assessment of this promising region.

6.5.2 Project Characterization Assumptions

In the course of analysis, many assumptions had to be made. A list of major assumptions is given below.

- Wind turbine procurement cost of $1,650 / kW; balance of plants costs estimated per site.
- Typical capacity factors were used in analyzing out-of-state wind resources for each NREL Class 3, 4, 5, 6 and 7 winds. These capacity factors are:
  - Class 3: 23 percent
  - Class 4: 29 percent
  - Class 5: 35 percent
  - Class 6: 43 percent
  - Class 7: 52 percent
- A twelve percent loss factor was incorporated to calculate net energy production from gross.
- Terrain modifiers were used for costs of construction only.
- A project will require an average of 1,200 feet of onsite roads per turbine.

- No inaccuracy factors were incorporated for estimating energy production from a Weibull curve.
- Operation and maintenance costs of $60/kW-yr.

6.5.3 Output Profile

The final task for wind project characterization was to estimate daily and seasonal output profiles. The project characterization method used the CEC Intermittency Analysis Project (IAP) data to create energy profiles. The IAP data had three years of hourly data from over 200 sites, some of which were existing sites (using existing data) and others that were planned, which used AWS modeled data. Black & Veatch used the data from planned sites, as they were modeled using modern wind turbines, with the exception of Palm Springs, which had no planned data. These sites were assigned to one of 14 regions around the state, as shown in Figure 6-5.

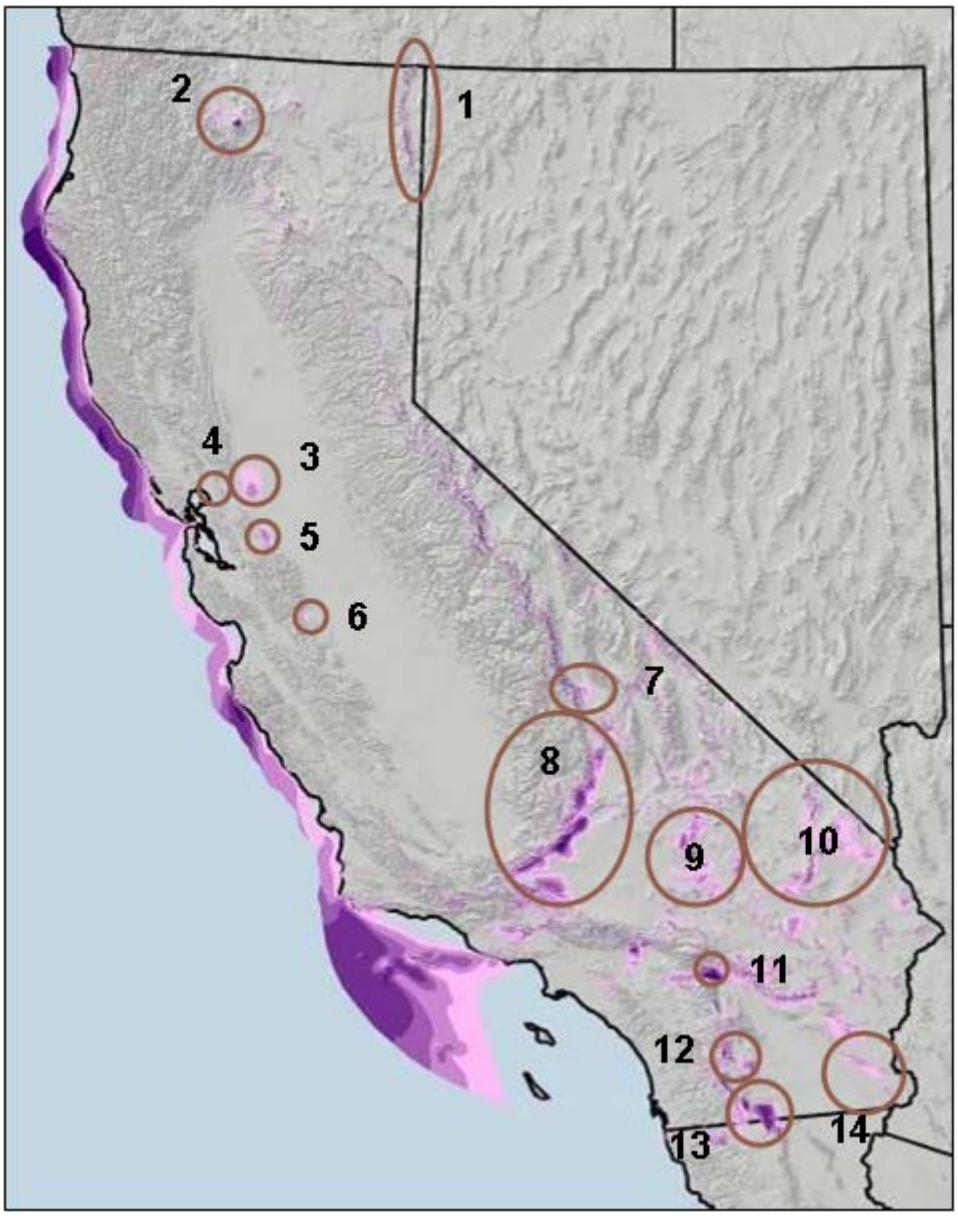


Figure 6-5 Wind Areas Studied by AWS Truewind.

Black & Veatch normalized this hourly data for each of the sites to a 100 MW project size (most sites were already very close to 100 MW). Black & Veatch then averaged all the sites in each region to produce a regional energy production profile, by month and hour of day (12x24 matrix). This regional production profile was then compared to data from existing modern wind farms as well as ISO and CPUC capacity valuation data to ensure its accuracy. Each RETI project was then assigned to one of the 14 regions, and the region's energy production profile was also assigned to the project.

Out-of-state resources very close to California's wind resource regions, such as northern Baja California Norte and southern Nevada, were assigned the same relative

energy production profiles as the adjacent areas. For out-of-state resources not close to one of the California wind resource regions, Black & Veatch generally used wind speed information from the AWS TrueWind wind maps to directly create energy production profiles for the identified projects.

6.5.4 Data Sources

- AWS Truewind, "New Wind Energy Resource Maps of California", available at: http://www.energy.ca.gov/pier/project_reports/500-02-055F.html, accessed: July 10, 2008.
- AWS Truewind and NREL, "GIS map for Baja California Norte", available at: http://www.nrel.gov/gis/wind.html, accessed June 28, 2008
- NREL, "GIS data for Oregon and Washington", available at: http://www.nrel.gov/gis/wind.html, accessed June 21, 2008
- Bureau of Land Management, "GIS Data Set", accessed February 2008
- Bureau of Land Management, "GIS Data from Geocommunicator", accessed June 2008
- BLM spreadsheet and GIS data (November, 2008) Provided to Black & Veatch by the BLM.
- Generator RFI responses
- IOU Contract database (CEC and CPUC)
- PG&E Supplied Wind Database for British Columbia

6.5.5 Projects Identified

Black & Veatch identified 134 wind projects in California with a total of 16,465 MW of capacity. The annual average energy production of these projects is expected to be 47,418 GWh. More than half (75) of these projects were pre-identified. The other 59 projects were "proxy" projects.

While project parcels are precisely defined, they are not intended to exactly represent pre-identified or optimal projects. The intent is to use the uniform projects to model the possible economic performance of a project in the area. Maps showing all of the identified projects are available on the project website.

Black & Veatch also identified 21,555 MW of capacity and 55,079 GWh of energy production outside the state. These resources are considered developable and include a discount for competition, as described previously. Table 6-7 shows the capacity and annual energy identified out of state.

Table 6-7. Out-of-state Wind Resources.

Region	Developable Capacity (MW)	Annual Energy (GWh/year)
Northern Baja California, Mexico	5,000	14,449
British Columbia, Canada	6,630	18,371
Nevada	1,475	3,203
Oregon	4,688	10,326
Washington	3,762	8,730

Appendix A. US Bureau of Land Management Lease Applications

California BLM lease applications are up to date as of November, 2008.

Nevada and Arizona BLM lease applications are up to date as of July, 2008

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
AZ	Boulevard Associates LLC	6/26/2007	7375	250	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit.	34184 AZA
AZ	Boulevard Associates LLC	6/26/2007	6232	250	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit.	34186 AZA
AZ	Boulevard Associates LLC	6/26/2007	13440	250	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit.	34187 AZA
AZ	Boulevard Associates LLC	6/22/2007	4787	250	Solar	Parabolic-Trough	Incomplete	34200 AZA
AZ	Boulevard Associates LLC	6/22/2007	15654	250	Solar	Parabolic-Trough	Incomplete	34201 AZA
AZ	Ausra AZ II LLC	10/1/2007	9950	180	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit. No POD	34321 AZA
AZ	Boulevard Associates LLC	6/8/2007	24221	250	Solar	Parabolic-Trough	Send cost reimbursement agreement	34335 AZA
AZ	Opti-Solar Inc.	11/6/2007	6100	300	Solar	Photovoltaic	Received $25K Cost Recovery deposit.	34357 AZA
AZ	Opti-Solar Inc.	11/6/2007	6400	300	Solar	Photovoltaic	Received $25K Cost Recovery deposit.	34358 AZA
AZ	Pacific Solar Investments	12/2/2004	19000	1500	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit.	34416 AZA
AZ	Pacific Solar	12/4/2007	13400	500	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit.	34424 AZA
AZ	Pacific Solar	12/7/2007	5800	500	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit.	34425 AZA
AZ	Pacific Solar Investments	12/2/2007	26000	2000	Solar	Parabolic-Trough	YFO is preparing cost recovery letter, have only had a pre-application meeting, start of NEPA is pending establishment of cost recovery account and receipt of completed POD	34426 AZA
AZ	Pacific Solar Investments	6/6/2007	32000	2000	Solar	Parabolic-Trough	Received $25K Cost Recovery deposit.	34427 AZA
AZ	NextLight Renewable Power, LLC	3/26/2008	20699	500	Solar	Parabolic-Trough	YFO is preparing cost recovery letter, have only had a pre-application meeting, start of NEPA is pending establishment of cost recovery account and receipt of completed POD	34554 AZA
AZ	NextLight Renewable Power, LLC	3/26/2008	15000	500	Solar	Parabolic-Trough	YFO is preparing cost recovery letter, have only had a pre-application meeting, start of NEPA is pending establishment of cost recovery account and receipt of completed POD	34560 AZA

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
AZ	NextLight Renewable Power, LLC	3/26/2008	15000	500	Solar	Parabolic-Trough	YFO is preparing cost recovery letter, have only had a pre-application meeting, start of NEPA is pending establishment of cost recovery account and receipt of completed POD	34561 AZA
AZ	NextLight Renewable Power, LLC	3/26/2008	14000	500	Solar	Parabolic-Trough	YFO is preparing cost recovery letter, have only had a pre-application meeting, start of NEPA is pending establishment of cost recovery account and receipt of completed POD	34566 AZA
AZ	NextLight Renewable Power, LLC	3/26/2008	23500	500	Solar	Parabolic-Trough	YFO is preparing cost recomvery lette,r have not had a pre-application meeting, start of NEPA is pending establishment of cost recovery account and receipt of completed POD	34568 AZA
AZ	Horizon Wind Energy LLC	3/4/2008	28760		Solar	Parabolic-Trough	Draft letter to applicant requesting more information.	3AZA
CA	Stirling Energy Systems, Inc. Solar 1	11/15/2006	6779	914	Solar	Solar: pending Stirling engine	AFC & EIS pending with CEC as CEQA lead. Received completed amended application June 2007. Three separate projects. NOI Expected 12/08. Revised POD Received Oct 6, 2008.	CACA 47702
CA	Stirling Energy Systems, Inc. Pilot site	11/15/2006	15	1	Solar	Solar: pending Stirling engine	Application complete EA in progress (5101)	CACA 48563
CA	Solar Investments VI LLC (G-S)	1/18/2007	6400	800	Solar	Solar: pending parabolic trough	Application complete POD outline sent/ revisions? 5101 setup.	CACA 48741
CA	Solar Investments, Inc. (G-S)	1/18/2007	9600	1000	Solar	Solar: pending parabolic trough	Application complete POD outline sent/revisions?. Cost recovery letter to be sent-5101	CACA 48742
CA	Solar Investments XI LLC (G-S)	1/18/2007	10000	1200	Solar	Solar: pending parabolic trough	Application complete POD outline sent, revisons? EIS required 5101 paperwork pending to sent	CACA 48743
CA	OptiSolar, Inc.	2/26/2007	14400	1205	Solar	Solar: pending photovoltaic	Received 5101 funds. Received POD.	CACA 48818
CA	OptiSolar, Inc.	2/26/2007	15280	1000	Solar	Solar: pending photovoltaic	5101 funds received. POD received.	CACA 48819
CA	DPT Broadwell Lake LLC (Brightsource)	1/24/2007	5130	500	Solar	Solar: pending power tower	Received 5101 funds. POD received.	CACA 48875
CA	OptiSolar, Inc.	5/4/2007	5120	585	Solar	Solar: pending photovoltaic	Sent 5101 letters CR Received (Proffer Established) Received POD	CACA 48941

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	FPL Energy, LLC (Blvd Assoc)	4/24/2007	7680	1200	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 49051
CA	Cannon Power, Inc.	2/26/2007	13440	1000	Solar	Solar: pending photovoltaic	NO 5101 funds received. Waiting POD	CACA 49350
CA	OptiSolar, Inc.	10/9/2007	9520	500	Solar	Solar: pending photovoltaic	Sent 5101 letters CR Received (Proffer Established) Received POD	CACA 49357
CA	OptiSolar, Inc.	10/9/2007	17920	500	Solar	Solar: pending photovoltaic	Sent 5101 letters CR Received (Proffer Established) Waiting for POD	CACA 49361
CA	Stirling Energy Systems, Inc. Solar 3	3/14/2007	4810	605	Solar	Solar: pending Stirling engine	AFC & EIS pending with CEC as CEQA lead. Received 03/2007 - subdivided project from original Solar One. Revised POD Received Oct 6, 2008. Area in Pisgah ACEC Relinquished.	CACA 49537
CA	Stirling Energy Systems, Inc. Solar 6	3/14/2007	12365	692	Solar	Solar: pending Stirling engine	Received 3/2007 - subdivided project from original Solar One. Revised POD Received Oct 6, 2008.	CACA 49539
CA	Stirling Energy Systems, Inc. Solar 8	3/14/2007	10044	1631	Solar	Solar: pending Stirling engine	Received 3/2007 - subdivided project from original Solar One. Revised POD Received Oct 6, 2008.	CACA 49540
CA	Chevron Energy Solutions Co.	12/7/2007	367	40	Solar	Solar: pending photovoltaic	Application received POD revision pending. Received Oct 6, 2008.	CACA 49561
CA	Caithness Soda Mtn, LLC (former Solenergis)	12/18/2007	1664	350	Solar	Solar: pending photovoltaic	Application received. Detailed POD received 9/16/08. review/approval of POD pending. EIS required. 5101 established	CACA 49584
CA	Power Partners Southwest (EnxCo)	12/27/2007	3840	1000	Solar	Solar: pending parabolic trough	Application received. Revised map. POD revision rec. inadequate from outline.	CACA 49585
CA	Bull Frog Green Energy LLC	12/20/2007	8999.4	300	Solar	Solar: pending photovoltaic	Appl. Received. Revise app rec. 9/10/08. POD needed. Outline sent.	CACA 49587
CA	Bull Frog Green Energy, LLC	12/20/2007	11522.7	300	Solar	Solar: pending parabolic trough	Application received. Revised App rec.9/10/08. POD needed. Outline sent.	CACA 49588
CA	LSR Pisgah, LLC	8/25/2008	10044	300	Solar	Solar: pending parabolic trough	App. Rec. POD needed-outline sent. 2nd in line behind solar 8 ** possible 1st pending w/dwn solar 8	CACA 50227

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	DBK Solar Utilities of California	5/3/2007	720	200	Solar	Solar: pending other/ unknown technology	Application not complete. Second deviciency letter mailed 2/12/08. Allowed 60 days to respond. Sent POD letter on 8/21/08. Due 10/21.	CACA 49443
CA	Stirling Energy Systems, Inc. (SES) Solar Two LLC	1/16/2006	7000	750	Solar	Solar: pending Stirling engine	5101 funds received. Joint EIS/IER with CEC as CEQA lead. AFC filed with CEC June 30, 2008. On July 30 CEC issued notice of data inadequacies in 9 areas of AFC.	CACA 47740
CA	BioRenewable Projects LLC	7/31/2006	609	20	Solar	Solar: pending photovoltaic	No monies or POD submitted yet. Cost recovery & POD ltr sent to applicant 08/14/08.	CACA 48273
CA	BCL & Associates	7/17/2007	5587	500	Solar	Solar: pending photovoltaic	Received 5101 funds. POD received.	CACA 49150
CA	SkyGen Solar LLC, c/o Invenergy	12/10/2007	1040	50	Solar	Solar: pending other/ unknown technology	5101 monies received. POD letter & template sent to applicant 7/15/2008	CACA 49513
CA	OptiSolar, Inc.	12/3/2007	2560	500	Solar	Solar: pending photovoltaic	Inadequate POD submitted with application. Acreage needs to be refined. Working w/ applicant to identify issues. Cost Recovery and POD ltr sent to applicant on 7/30/08.	CACA 49613
CA	Pacific Solar Investments, Inc. (Iberdrola)	9/5/2007	28000	1500	Solar	Solar: pending parabolic trough	Inadequate POD submitted with application. Acreage needs to be refined. Working w/applicant to identify issues. Cost Recovery & POD ltr sent to applicant 7/31/08. Submitted apln for testing 07/08.	CACA 49615
CA	SolarReserve, LLC	4/24/2008	4000	120	Solar	Solar: pending power tower	5101 monies rcvd. POD not submitted yet. Cost recovery & POD ltr sent to applicant 7/16/08.	CACA 49884
CA	Bull Frog Green Energy LLC	2/27/2008	2600	max 25	Solar	Solar: pending photovoltaic	Application denied/rejected 9/5/2008. Monies not submitted.	CACA 50012
CA	Power Partners Southwest LLC, c/o enXco	4/7/2008	540	300	Solar	Solar: pending parabolic trough	Partial rejection Sec 22 overlaps geothermal apln. 5101 monies rcvd. POD not submitted yet. Cost recovery & POD ltr sent to applicant 7/15/08.	CACA 50013
CA	Sempra Generation	7/21/2008	11000	500	Solar	Solar: pending photovoltaic	No monies or POD submitted yet. Cost recovery & POD ltr sent. 2 secs BOR Wdl lands. 2nd in line where overlaps 2 secs with 50012.	CACA 50113

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	LightSource Renewables LLC	8/11/2008	3020.43	400	Solar	Solar: pending parabolic trough	No monies or POD submitted yet. Cost recovery & POD ltr pending. Trans line on BOR wdl lands.	CACA 50174
CA	Solar Partners Ivanpah SEGS (DPT Ivanpah LLC)	11/17/2006	6720	400	Solar	Solar: pending power tower	CACA 49502, 49503, 49504 Modified application twice to increase acreage. 1/4 cost recovery received ($42,280). Draft EIS expected Fall 2008	CACA 48668
CA	OptiSolar, Inc.	12/14/2006	4160	350	Solar	Solar: pending photovoltaic	1/4 cost recovery received ($40,767); POD letter sent 7/31/08. POD Rcv'd 9-30-08.	CACA 48669
CA	Cogentrix/ Solar Investments VIII LLC	1/18/2007	8000	1000	Solar	Solar: pending parabolic trough	1/4 cost recovery rec'd ($199,047) 1 of 4 projects; Amended Decision w/ revised area due to partial conflict w CA 49004. POD Rcv'd 10-3-08	CACA 48758
CA	Cogentrix/ Solar Investments XIII LLC	1/18/2007	8960	1000	Solar	Solar: pending parabolic trough	1/4 cost recovery received ($199,047) 2 of 4 projects; POD letter sent 7/23/08. Draft POD Rcv'd 9/26/08.	CACA 48759
CA	Cogentrix/ Solar Investments I LLC	12/20/2006	10880	1000	Solar	Solar: pending parabolic trough	1/4 cost recovery received ($199,047) 3 of 4 projects; POD letter sent 7/23/08. Draft POD Rcv'd 9-26-08;	CACA 48760
CA	Cogentrix/ Solar Investments I LLC	3/23/2007	5440	1000	Solar	Solar: pending parabolic trough	Application accepted/rejected, in part 3/23/07. 1/4 cost recovery rec'd ($199,047) 4 of 4 projects; POD letter sent 7/23/08. Draft POD Rcv'd 9-26-08;	CACA 48778
CA	Leopold Companies, Inc.	4/2/2007	37120	4100	Solar	Solar: pending power tower	Sent 5101 letters CR Received (Proffer Established) Waiting for POD	CACA 49002
CA	Boulevard Associates, LLC	5/14/2007	7200	1000	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49004
CA	Boulevard Associates, LLC	5/14/2007	12160	1000	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49006
CA	Boulevard Associates, LLC	5/14/2007	35200	1000	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49008
CA	Solel, Inc.	7/23/2007	14080	600	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49424

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	PG&E	9/11/2007	18880		Solar	Solar: technology neutral	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49429
CA	Iberdrola Renewables	9/20/2007	14720		Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 49430
CA	Boulevard Associates, LLC	9/21/2007	9600	1000	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 49431
CA	PG&E	9/24/2007	5120	800	Solar	Solar: technology neutral	Received 5101 funds. Received POD.	CACA 49432
CA	NextLight Renewable Power, LLC	3/24/2008	7750	500	Solar	Solar: pending parabolic trough	Majority of project in Barstow area – 1st in time for Needles portion	CACA 49811
CA	NextLight Renewable Power, LLC	3/24/2008	12960	500	Solar	Solar: pending parabolic trough	1st in time for most of project area – Partial 2nd in line for some.	CACA 49812
CA	Iberdrola Renewables	4/1/2008	12720	1000	Solar	Solar: pending parabolic trough	1st in line; Iberdrola Renewables acquired Pacific Solar Investments (PSI)	CACA 49813
CA	Ewind Farm, Inc.	5/2/2008	12640	800	Solar	Solar: technology neutral	1st in time	CACA 49956
CA	Ewind Farm, Inc.	5/26/2008	13240	900	Solar	Solar: technology neutral	1st in time	CACA 50116
CA	Ewind Farm, Inc.	5/27/2008	21440	1700	Solar	Solar: technology neutral	1st in time	CACA 50117
CA	OptiSolar, Inc.	11/7/2006	7040	350	Solar	Solar: pending photovoltaic	Received 5101 funds. Received POD.	CACA 48649
CA	Florida Power & Light	1/31/2007	7773	250	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD. ROW in process for monitoring, water well drilling.	CACA 48728
CA	Chuckwalla Solar LLC	9/14/2006	4098	200	Solar	Solar: pending photovoltaic	Received 5101 funds. NOI being sent out (for publication) in Federal Register 11/9/07	CACA 48808

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	Chevron Energy Solutions Co. #2	2/15/2007	3119	100	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 48810
CA	Chevron Energy Solutions Co. #1	2/15/2007	3119	100	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 48811
CA	Florida Power & Light	1/31/2007	4491	250	Solar	Solar: pending parabolic trough	NO 5101 funds received. Waiting POD	CACA 48880
CA	Bullfrog Green Energy, LLC	6/13/2007	6629	2500	Solar	Solar: pending photovoltaic	5101 funds received. POD received.	CACA 49097
CA	OTB Power Holdings, Inc.	6/13/2007	8742	1000	Solar	Solar: pending photovoltaic	Sent 5101 letter. No 5101 funds Received. Wating for POD	CACA 49098
CA	OptiSolar, Inc.	9/28/2007	3840	600	Solar	Solar: pending photovoltaic	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49397
CA	Solar Millennium, LLC	10/22/2007	2753	500	Solar	Solar: pending parabolic trough	NO 5101 funds received. Waiting POD	CACA 49486
CA	EnXco Development, Inc.	11/13/2007	2070	300	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD	CACA 49488
CA	EnXco Development, Inc.	11/13/2007	11603	300	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Waiting for POD	CACA 49489
CA	EnXco Development, Inc.	11/13/2007	12879	300	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49490
CA	EnXco Development, Inc.	11/13/2007	1071	300	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49491
CA	EnXco Development, Inc.	11/13/2007	1216	300	Solar	Solar: pending parabolic trough	Sent 5101 letters CR Received (Proffer Established) Received POD.	CACA 49492
CA	Solel Inc.	11/7/2007	8775	500	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 49493

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	Solel Inc.	11/7/2004	7511	500	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 49494
CA	Bull Frog Green Energy, LLC	1/4/2008	22912	2500	Solar	Solar: pending photovoltaic	Received POD Sent 5101 letters	49702
CA	Lightsource Renewables, LLC	8/8/2008	7920	550	Solar	Solar: pending parabolic trough		CACA 50379
CA	Opti-solar, Inc.	2/13/2007	5760	745	Solar	Solar: pending photovoltaic	Sent 5101 letter. No 5101 funds Received. Wating for POD	CACA 48820
CA	Solar Millennium, LLC	3/23/2007	11000	745	Solar	Solar: pending parabolic trough	Received 5101 funds. Received POD.	CACA 49016
CA	Opti-solar, Inc.	4/3/2007	6600	745	Solar	Solar: pending photovoltaic	Received 5101 funds. Received POD.	CACA 49017
CA	Opti-solar, Inc.	11/28/2007	7182.5	600	Solar	Solar: pending photovoltaic	Received 5101 funds. Received POD.	CACA 49511
CA	Corum Solar Array LLC	5/5/2008	1200	100	Solar	Solar: pending photovoltaic	POD not filed yet; Interconnect Study near completion; near SCE powerlines and substation.	CACA 49960
CA	Invenergy LLC	4/28/2006 11/7/2006	2888		Wind	Wind: testing	AUTHORIZED	CACA 48119
CA	Greenraven Wind LLC	2/8/2008	17000		Wind	Wind: testing	originally Eagle Lake	CACA 49707
CA	EC&R West LLC (Airtricity, Inc.)	10/2/2007	27995		Wind	Wind: pending for testing	PENDING	
CA	Third Planet Windpower	7/25/2008	18825		Wind	Wind: pending for testing	PENDING	
CA	Wind Power Partners LLC	4/23/2007	3358		Wind	Wind: pending for testing	PENDING	
CA	AES Seawest Inc.	4/20/2007	200		Wind	Wind: pending for testing	Pending - Lands in both Ridgecrest and Bako FOs, RFO IS LEAD OFFICE	
CA	EC&R West LLC (Airtricity, Inc.)	10/22/2007	26000		Wind	Wind: pending for testing	PENDING RMP completion	
CA	EC&R West LLC (Airtricity, Inc.)	9/26/2007	2673		Wind	Wind: pending for testing	PENDING RMP completion	
CA	EC&R West LLC (Airtricity, Inc.)	11/20/2007	15286		Wind	Wind: pending for testing	PENDING RMP completion	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	AES Seawest, Inc.	6/20/2001 12/2004	4231		Wind	Wind: testing	ROW testing issued. Expired 12/07. Renewal filed w/POD. Within DWMA Ord/Rodman, Monkey Flower ACEC.	
CA	Granite Wind LLC	11/18/2002 10/8/2003	1968		Wind	Wind: testing	ROW Amendment - 3yr extension for met study while POD is analysed & avian studies are conducted	
CA	BP Alternative Energy	1/8/2003 9/29/2003	2442		Wind	Wind: testing	ROW testing renewed w/POD - expires 12/10 see CACA-48658 NOI Expected late 2008	
CA	Horizon Wind Energy	12/17/2004 2/9/2006	4479		Wind	Wind: testing	ROW testing issued. Expires 12/09	
CA	Horizon Wind Energy	12/17/2004 2/9/2006	27808		Wind	Wind: testing	ROW testing issued. Expires 03/09	
CA	Horizon Wind Energy	12/17/2004 2/9/2006	10073		Wind	Wind: testing	ROW testing issued. Expires 12/09	
CA	Horizon Wind Energy	12/22/2004 2/9/2006	720		Wind	Wind: testing	ROW testing issued. Expires 12/09	
CA	AES Wind Generation, Inc.	3/5/2005 8/26/2005 12/31/2011	2929		Wind	Wind: testing	Grant expires 8/08. Amendment filed to add METs.filed. DWMA- Ord/Rodman, raptors, high tortoise concentration. Within Monkey Flower ACEC.	
CA	FPL Energy	3/8/2005	2449		Wind	Wind: testing	ROW testing issued. Expires 12/08. Renewal filed with POD. Pending decision.	
CA	First Wind	3/25/2004 6/15/2006	15837		Wind	Wind: testing	ROW testing issued. Expires 12/09	
CA	First Wind	3/25/2004 6/15/2006	6820		Wind	Wind: testing	ROW testing issued. Expires 12/09	
CA	First Wind	3/25/2004 6/15/2006	10946		Wind	Wind: testing	ROW testing issued. Expires 12/09	
CA	First Wind	3/25/2004 6/15/2006	3458		Wind	Wind: testing	ROW testing issued. Expires 12/09	
CA	(Iberdrola) Pacific Wind Development LLC	8/17/2005 2/22/2006	5258		Wind	Wind: testing	ROW testing issued. Amendment approved 5/08 add met. Expires 12/09.	
CA	(Iberdrola) Pacific Wind Development LLC	8/17/2005 2/22/2006	2749		Wind	Wind: testing	ROW testing issued. Amendment approved- add 1 met. Expires 12/09	
CA	(Iberdrola) Pacific Wind Development LLC	8/17/2005 2/22/2006	6623		Wind	Wind: testing	ROW testing issued. Expires 12/09 Amendment approved- add 1 met.	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	Sierra Renewables	7/24/2006	1968	74	Wind	Wind: developing	POD for CA 44975 received w/transmission. Cost recovery started. Proposed 28 turbines. Pending	
CA	Power Parters SW (enXco)	10/10/2006	10240		Wind	Wind: pending for testing	Application revision: Met locations & access. Draft EA rec'd 01/2007-5101/CRA set up. Pending review/decision. Decision to deny Lone Mtn- within Milk Vetch ACEC. Advised appl. pending decision to proceed with Troy Lake study.	
CA	Power Parters SW (enXco)	10/10/2006	10240	2	Wind	Wind: pending for testing	Application revision: Met locations & access. Draft EA rec'd 01/2007-5101/CRA set up Pending review/decision. Decision to deny Lone Mtn- within Milk Vetch ACEC. Advised appl. pending decision to proceed with Troy Lake study.	
CA	AES Wind Generation, Inc.	8/26/2005	2930		Wind	Wind: pending for testing	Revised application pending. Met locations/access Draft EA rec'd. Review & decision pending 5101/CRA set up.	
CA	Oak Creek Energy	12/1/2006	17290		Wind	Wind: pending for testing	Revised application rec'd 09/2007. Met tower locations & access. 5101/CRA set up Draft EA rec'd 01/2007 pending review/decision.	
CA	Orion BP Alernative Energy	12/15/2006	2442	40-54	Wind	Wind: developing	Revised POD received. 5101 setup. Work w/San Bernardino Co.Inital pre-NEPA mtg & Consultant SOW pending. 36 turbines.	
CA	Oak Creek Energy Systems, Inc.	8/11/2005	28160		Wind	Wind: pending for testing	5101 setup, draft EA received-massive revisions required. Applicant advised of DWMA policy.	
CA	Renewergy, LLC	1/9/2007	3920		Wind	Wind: pending for testing	Application complete Surveys and EA in progress Revision of access pending.	
CA	West Fry Wind, LLC (FPL Energy)	3/29/2007	3248		Wind	Wind: developing	POD for CACA-47043. NOI posted 5/08.Consultant selected. Initial scope done. Draft EIS in process. 35 turbines.	
CA	GreenWing Energy (Alta Gas)	5/24/2007	9546		Wind	Wind: pending for testing	Initial application incomplete. EA required. 5101 set up Biological & cultural surveys pending.	
CA	GreenWing Energy (Alta Gas)	5/24/2007	8553		Wind	Wind: pending for testing	Initial application incomplete. EA required. 5101 set up Biological & cultural surveys pending.	
CA	Desert Power, LLC (Globalwinds)	07/1/92007	2500		Wind	Wind: pending for testing	Initial application incomplete. EA required. 5101 set up Biological & cultural surveys pending.	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	Verde Resources, Inc (Western Wind).	6/7/2007	3295		Wind	Wind: pending for testing	Initial application complete. EA required. 5101 set up Maps & met locations w/access rec'd 11/2007. Bilogical & cultural surveys underway. Awaiting draft EA	
CA	Horizon Wind Energy	7/19/2007	20811		Wind	Wind: pending for testing	Initial application complete. EA required. 5101 set up Maps & met locations w/access rec'd 11/2007. Biological & cultural surveys underway. Awaiting draft EA	
CA	EC&R West LLC (Airtricity, Inc.)	8/15/2007	14080		Wind	Wind: pending for testing	Appl. Complete. EA received. Under revisions- will post for public comment period. 5101 setup.	
CA	AES Wind Generation, Inc.	12/6/2007	2930	84mW	Wind	Wind: pending for testing	App. Received. Draft POD received. On HOLD w/DWMA	
CA	Debenham Energy	6/16/2008	1508		Wind	Wind: pending for testing	Scoped, Cat VI fee determination	
CA	Padoma Wind Power, NRG Inc.	8/19/2008	8950		Wind	Wind: pending for testing	Considering applying to Inyo NF too.	
CA	Plumas-Sierra Rural Electric	10/1/2004 2/1/2006	10061		Wind	Wind: testing	AUTHORIZED Lands in both Eagle Lake and Carson City Fos. ELFO IS LEAD OFFICE	
CA	Horizon Wind Energy	5/31/2005 5/19/2006	2222		Wind	Wind: testing	AUTHORIZED	
CA	Horizon Wind Energy	4/5/2005 11/17/2006	5497		Wind	Wind: testing	AUTHORIZED	
CA	Horizon Wind Energy	4/5/2006 6/7/2006	2560		Wind	Wind: testing	AUTHORIZED	
CA	Horizon Wind Energy	5/31/2005 5/30/2006	3837		Wind	Wind: testing	AUTHORIZED	
CA	Invenergy LLC (Lassen Wind Generation LLC)	4/6/2005 9/16/2005	19402		Wind	Wind: testing	AUTHORIZED Applicant submitted an amendment for additional testing acres on 12/26/06. Applicant submitted POD on 5/3/07.	
CA	Lassen Wind Generation	10/6/2005 3/1/2006	480		Wind	Wind: testing	ROW granted 3/1/06. Expires end of this year. 1,800 acres in NV.	
CA	Distribution Generation Systems	2/23/2006 11/01/2006	5542		Wind	Wind: testing	AUTHORIZED	
CA	Invenergy LLC	11/7/2006 4/30/2007	93919		Wind	Wind: testing	AUTHORIZED: some met towers in type II, type I has 6 additional met towers	
CA	William Butler	3/29/2007	640		Wind	Wind: pending for testing	PENDING; deficiency letter sent 11/07	
CA	Horizon Wind Energy	12/24/2006 10/18/2007	2.5		Wind	Wind: testing	AUTHORIZED Applicant submitted an amendment on 5/2/07 Applicant submitted POD on 3/6/07	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	BP Wind Energy North America	3/21/2008	5937		Wind	Wind: pending for testing	Original ROW 45025 (Orion) - expired; PENDING; more info requested 3/31/08	
CA	Pacific Wind (Iberdrola)	4/3/2003	16354.5		Wind	Wind: testing	ROW issued 9/15/04. Renewed 3 yrs 1/08 with submission of POD (CA 49698). 7/08 submitted apln to install add'l MET towers. Applicant advised that they must prepare EA. 08/08 relinquished 1262.62 acs.	
CA	Clipper Windpower, Inc.	10/1/2004	1318		Wind	Wind: pending for testing	Applicant was advised they need to prepare an EA due to staff workload. EA pending. Due diligence ltr will be issued.	
CA	GreenHunter Wind Energy	9/1/2005	6280		Wind	Wind: pending for testing	EA out for 30 day public review (ended April 3); FONSI and Decision Record delayed due to Native American consultation, as required by SHPO. Consultation complete. FONSI & DR expected to be posted by 10/31/08.	
CA	Renewergy, LLC	12/26/2005 1/23/2007	11187		Wind	Wind: testing	Testing & monitoring ROW issued 1/2007; 1 met tower installed. Due diligence ltr pending. ROW expires 12/31/2010.	
CA	Renewergy, LLC	4/26/2006	3219		Wind	Wind: pending for testing	EA nearing completion pending Native American consultation	
CA	Superior Renewable	6/6/2006	187		Wind	Wind: pending for testing	Applicant was advised they need to prepare an EA due to staff workload. EA pending. Due diligence ltr will be issued.	
CA	Imperial Wind	7/31/2006	1960		Wind	Wind: pending for testing	Pending NEPA (DNA) and Native American consultation, as required by SHPO. (ROW (expired) previously authorized to another party for which EA was completed.	
CA	Pacific Wind (Iberdrola)	POD 12/26/07	9000	200	Wind	Wind: developing	Cost recovery & POD ltr pending release of ROD for Eastern SD County RMP.	
CA	Horizon Wind Energy	11/24/2006 6/12/2007	1.1		Wind	Wind: testing	AUTHORIZED, Expires 5/31/10. Lands in both Bakersfield and Hollister Fos. HFO IS LEAD OFFICE	
CA	PPM Energy (Iberdrola)	10/15/2002 8/7/2003 8/4/2006	2330	75	Wind	Wind: testing	Cost recovery finalized for met towers 08/12/08. CX being done internally @ NFO. POD filed 8/06. ROW expires 12/31/09	
CA	First Wind	8/11/2005	10720		Wind	Wind: pending for testing	Pending - perfecting POD for outsource NEPA work. POD rec'd 9/20/04. CRA sent 7/2008	
CA	Renewergy, LLC	7/26/2006	7760		Wind	Wind: pending for testing	Pending - cost recovery recv'd	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	Renewergy, LLC	8/2/2006	2080		Wind	Wind: pending for testing	Pending. Rec'd $19k.	
CA	Renewergy, LLC	8/7/2006	17320		Wind	Wind: pending for testing	Pending. Rec'd $19k.	
CA	Oak Creek Energy	8/6/2006	7660		Wind	Wind: pending for testing	Pending - Joint project with Las Vegas FO Rec'd $15k.	
CA	Oak Creek Energy	8/11/2006	25600		Wind	Wind: pending for testing	Pending. Rec'd $15k	
CA	eWindFarm, Inc.	12/4/2006	6460		Wind	Wind: pending for testing	Pending. Proponent will contract for EA for met towers.	
CA	Little Mountain Wind Power LLC	5/12/2008	15000		Wind	Wind: pending for testing	Part is in Barstow FO boundary. Partial in 29 Palms Segregation Area. Pending.	
CA	Edom Hill	1/5/2007	360	20	Wind	Wind: functioning or repower	EA in review, awaiting biological & cultural	
CA	Mark Tech	12/27/2002	74	5	Wind	Wind: functioning or repower	Amendment complete. ROW expires 2022.	
CA	AES/ SeaWest	1/24/2005	265	75	Wind	Wind: functioning or repower	EIS in final review Sec. 7 conslutation w/ USFWS in process	
CA	Sierra Renewables LLC	7/6/2007	5300		Wind	Wind: pending for testing	ROW issued 9/15/04. Renewed 3 yrs 1/08 with submission of POD. 7/08 submitted apln to install add'l MET towers. Cost recovery & POD ltr for POD pending.	
CA	Oak Creek Energy	4/3/2002	160	20	Wind	Wind: functioning or repower	EA in staff review.	
CA	Oak Creek Energy	11/30/2005	4208	200	Wind	Wind: testing	Met towers in place POD filed EA underway. Awaiting transmission line intertie information.	
CA	Sierra Renewables LLC	2/11/2002	8835		Wind	Wind: pending for testing	EA started 06/03; terminated 09/06; CX initiated; Amendment to app filed separating north parcels from south parcels; South parcels are CACA--49581; under same Cost Reimbursement	
CA	Sean Roberts, Renewable Land LLC	7/1/2004	467		Wind	Wind: pending for testing	Initiating EA for monitoring sites	
CA	Boulevard Associates	8/22/2005	2678		Wind	Wind: pending for testing	EA in staff review. Split between Bakersfield and Ridgecrest offices. Native American req's on met towers	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
CA	Oak Creek Energy	1/11/2006	6826		Wind	Wind: pending for testing	29-day letter MOA for cost recovery Calegory VI	
CA	Oak Creek Energy	7/25/2006	1800		Wind	Wind: pending for testing	29-day letter MOA for cost recovery Category VI	
CA	Oak Creek Energy	6/25/2006	19565		Wind	Wind: pending for testing	29-day letter MOA for cost recovery Category VI	
CA	Renewergy, LLC	7/28/2006	14209		Wind	Wind: pending for testing	Initial application incomplete. EA required. 5101 set up Biological & cultural surveys pending.	
CA	Wind Power Partners	6/28/2007	2080		Wind	Wind: pending for testing	29-day letter MOA for cost recovery Category VI	
CA	Competitive Power Ventures LLC	8/10/2007	5000		Wind	Wind: pending for testing	29-day letter MOA for cost recovery Category VI	
CA	Power Parters SW (enXco)	8/10/2007	1816		Wind	Wind: pending for testing	2nd in line behind Oak Creek (CACA 48536)	
CA	Sierra Renewables LLC	11/1/2007	2554		Wind	Wind: pending for testing	29-day letter MOA for cost recovery Category VI. Southern portion of 45386.	
CA	Invenergy LLC	7/17/2006 1/18/2007	4160		Wind	Wind: testing	AUTHORIZED	
CA	GreenWing Energy	1/11/2008 5/15/2008	8157		Wind	Wind: testing	AUTHORIZED	
CA	EC&R West LLC (Airtricity, Inc.)	10/3/2007	3018		Wind	Wind: pending for testing	PENDING	
NV	Ausra NV I, LLC	3/12/2008	7040	180	Solar	Power tower	Meeting on 3/13/08 with Nye County and representatives for coordination with devleopers on renewable energy projects.	
NV	Bright Source Energy Solar	7/25/2007	24000	800	Solar	Parabolic-Trough	POD received with application. POD is being revised to reflect reduces project ares. Will ask applicatn to relinquish Northern portion of ROW due to grazing allotment.	
NV	Bright Source Energy Solar	4/17/2007	12000	800	Solar	Power tower	POD rcvd w/ application	
NV	Bright Source Energy Solar	12/7/2007	2000	1000	Solar	Power tower	Draft copy received with application.	
NV	Mud Lake Solar LLC	11/19/2007	3844	32	Solar	Unknown	Mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers. Anticipate withdrawal of application	
NV	Nevada Power Company	8/14/2007	1775	300	Solar	Parabolic-Trough	Draft POD received w/ application.	
NV	Opti-solar Inc.	10/22/2007	5500	400	Solar	Photovoltaic	Draft POD received w/ application.	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
NV	Pacific Solar Investments Inc.	12/7/2007	11000	1000	Solar	CSP	Draft POD received. Application to be rejected unless applicant will to move.	
NV	Pacific Solar Investments Inc.	12/7/2007	7500	500	Solar	parabolic-trough	Rec'd POD; requested rev. legals 1/22/08; mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers	
NV	Pacific Solar Investments Inc.	12/7/2007	7700	500	Solar	Parabolic-Trough	Rec'd POD; requested rev. legals 1/22/08; mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers	
NV	Power Partners Southwest LLC	12/7/2007	11520	250	Solar	CSP	Draft POD submitted with applications.	
NV	Solar Investments LLC	2/14/2007	4480	500	Solar	CSP	Draft POD received w/ application. No other POD requested at this time.	
NV	Solar Investments LLC	2/14/2007	13440	1400	Solar	CSP	Draft POD received w/ application. No other POD requested at this time. Working on fatal flaws associated with location.	
NV	Solar Investments LLC	2/14/2007	30720	3400	Solar	CSP	Draft POD received w/ application.	
NV	Solar Investments LLC	3/5/2006	12800	3400	Solar	CSP	Draft POD received w/ application.	
NV	Solar Investments LLC	3/5/2007	22400	3400	Solar	CSP	Draft POD received w/ application.	
NV	Solar Investments LLC	1/18/2007	5800	300	Solar	Parabolic-Trough	POD rcvd w/ application	
NV	Solar Investments LLC	1/18/2007	19840	1200	Solar	Parabolic-Trough	POD rcvd w/ application	
NV	Solar Millennium	11/1/2007	4800	500	Solar	Parabolic-Trough	Received revised legals, POD; Meeting on 3/13/08 w/ Nye Co. & reps for coord. w/ developers.	
NV	Solar Millennium	11/2/2007	2457	300	Solar	Parabolic-Trough	Rec'd revised legals, POD; mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers.	
NV	Solar Millennium	11/1/2004	1000	170	Solar	Parabolic-Trough	Rec'd revised legals, POD, Interconnect notification from Valley Electric, mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers.	
NV	Solar Millennium	11/20/2007	3597	500	Solar	Parabolic-Trough	Rec'd revised legals, POD, Interconnect notification from Valley Electric, mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers.	
NV	Solar Millennium	11/20/2007	3597	500	Solar	Parabolic-Trough	Rec'd revised legals, POD, Interconnect notification from Valley Electric, mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers.	
NV	Tonopah Solar Energy, LLC	3/6/2007	1720	100	Solar	Power tower	Mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers.	

State	Applicant	Date Application received	Acres	MW	Tech Cate-gory	Planned Technology	Status of Application	Serial Num.
NV	Tonopah Solar Energy, LLC c/o Solar Reserve	3/6/2007	1720	100	Solar	Power Tower	Mtg. on 3/13/08 w/ Nye Co. & reps for coord. w/ developers. Anticipate withdrawal of application	

Appendix B. Utility Power Purchase Agreements

Utility	Internal Tracking Number	CEC RPS ID#	Technology	Facility Name	Developer Name	Minimum Size (MW)	Maximum Size (MW)	Minimum Expected Deliveries (GWh/yr)	Maximum Expected Deliveries (GWh/yr)	Contract Term (yrs)	Operational Status
PG&E	PGE010	60543C	wind	FPL Montezuma Wind	FPL Energy	32.4	32.4	redacted	redacted	25	not online
PG&E	PGE012	Unknown	wind	Pacific Renewable Energy Generation	Pacific Renewable Energy Generation	82.5	82.5	redacted	redacted	20	not online
PG&E	PGE013	60488A	wind	Shiloh 1 Wind Project	PPM	75	75	225	225	15	online
PG&E	PGE016	60477D	geothermal	Military Pass-Newberry Volcano	Vulcan Power	120	120	840	840	20	not online
PG&E	PGE018	Unknown	biogas	Liberty	Liberty V Biofuels	5	10	33	35	15	not online
PG&E	PGE019	Unknown	biomass	HFI	HFI Bio Power Project LLC	20	40	140	280	10	not online
PG&E	PGE020	Unknown	geothermal	Northwest Geothermal	Davenport Power	30	120	210	840	20	not online
PG&E	PGE021	60490D	geothermal	IAE Truckhaven	IAE	49	49	370	370	20	not online
PG&E	PGE022	60567C	small hydro	Buckeye	Tunnel Hill Hydro	0.4	0.4	redacted	redacted	10	not online
PG&E	PGE023	60568C	small hydro	Tunnel Hill	Tunnel Hill Hydro	0.6	0.6	redacted	redacted	10	not online
PG&E	PGE024	60629C	biogas	Eden Vale	Eden Vale Dairy	0.15	0.15	redacted	redacted	10	not online
PG&E	PGE026	Unknown	biogas	BioEnergy LLC	BioEnergy LLC	2	44.38	15	389	10	not online
PG&E	PGE027	Unknown	biogas	Microgy	Microgy	2	44.38	15	389	10	not online
PG&E	PGE029	60088E	biomass	Lincoln Facility	Sierra Pacific Industries	6.7	6.7	redacted	redacted	5	online
PG&E	PGE031	60541D	solar PV	Green Volts	Green Volts Inc.	2	2	4.6	4.6	20	not online
PG&E	PGE032	60475D?	solar PV	CalRenew	CalRENEW-1 LLC	5	5	9	9	20	not online
PG&E	PGE033	60602C	wind	Klondike III	PPM	85	85	265	265	15	online
PG&E	PGE034	Unknown	solar thermal	SOLEL MSP-1	Solel	553.5	553.5	1388	1388	25	not online
PG&E	PGE035	60639C	wind	Shiloh II	EnXco	150	150	509	509	20	not online
PG&E	PGE036	60603D?	solar thermal	Carrizo Energy LLC	Ausra	177	177	388	388	20	not online
PG&E	PGE037	Unknown	ocean	Finavera	Finavera Renewables	2	2	4	4	15	not online
PG&E	PGE038	Unknown	wind	White Creek	PUD #1, Klickitat	50	50	147	147	3.25	online
PG&E	PGE040	Unknown	solar thermal	PPA1	BrightSource	100	100	246	246	25	not online
PG&E	PGE041	Unknown	solar thermal	PPA2	BrightSource	200	200	492	492	25	not online
PG&E	PGE042	Unknown	solar thermal	PPA3	BrightSource	200	200	492	492	25	not online
PG&E	PGE043	Unknown	solar thermal	PPA4	BrightSource	0	200	0	492	25	not online
PG&E	PGE044	Unknown	solar thermal	PPA5	BrightSource	0	200	0	492	25	not online
SCE	SCE002	60292E	biogas	El Sobrante	WM Energy Solutions	3.77	3.77	30	30	10	online
SCE	SCE003	60293E	biogas	Simi Valley	WM Energy Solutions	2.49	2.49	20	20	10	online

Utility	Internal Tracking Number	CEC RPS ID#	Technology	Facility Name	Developer Name	Minimum Size (MW)	Maximum Size (MW)	Minimum Expected Deliveries (GWh/yr)	Maximum Expected Deliveries (GWh/yr)	Contract Term (yrs)	Operational Status
SCE	SCE009	Unknown	biomass	Liberty 1 Biofuels	McCarthy Family Farms	5	15	37	110	15	not online
SCE	SCE010	Unknown	biomass	Sierra Biomass	Silvan Power	7.5	22.5	56	168	20	not online
SCE	SCE011	60500C	geothermal	Green Borders Geothermal	Vulcan Power	30	120	231	925	20	not online
SCE	SCE012	60487C	wind	Mountain View IV	AES SeaWest	37	50	118	159	20	not online
SCE	SCE013	60029A	wind	Brodie Wind Project	Coram Energy	12	100	47	394	20	not online
SCE	SCE014	Unknown	wind	Windstar 1, Aero Energy	Western Wind	50	120	154	370	20	not online
SCE	SCE015	60504C	solar thermal	Solar One	Stirling Energy Systems	500	850	1047	1780	20	not online
SCE	SCE016	60542C	wind	Dillon Wind, LLC	PPM	45	45	132	132	20	online
SCE	SCE018	60298E	biogas	MM Tajiguas Energy LLC	MM Tajiguas Energy LLC	0	1.5	0	9.9	20	online
SCE	SCE025	Unknown	wind	Alta Windpower	Allco and Oak Creek	1500	1550	4730	4888	20	not online
SCE	SCE026	60640C	geothermal	ORNI #18	Ormat	50	100	416	832	20	not online
SCE	SCE027	60518D	wind	Baja Wind	Sempra and Cannon Wind	200	250	578.2	722.7	20	not online
SCE	SCE028	Unknown	wind	Granite Wind	RES Americas and others	42	81	95.7	184.5	20	not online
SCE	SCE029	Unknown	solar PV	California Sunrise I	Alternative Energy Development LLC	0.99	0.99	2.3	2.3	20	not online
SCE	SCE031	Unknown	geothermal	ORNI #21	Ormat	30	100	250	832	20	not online
SCE	SCE032	Unknown	wind	Dagget Ridge	AES	79.5	85.5	197	212	20	not online
SCE	SCE033	Unknown	solar PV	FSE Blythe 1	First Solar	7.5	21	17.7	49.7	20	not online
SCE	SCE032	Unknown	biogas	Flex LA	FlexEnergy	2	2	12.26	12.26	20	not online
SCE	SCE033	Unknown	biogas	Flex Riverside	FlexEnergy	2	2	12.26	12.26	20	not online
SDG&E	SDGE1	60430A	wind	Mountain View III	PPM	22.8	22.8	redacted	redacted	15	online
SDG&E	SDGE4	60489A	wind	Oasis Power Systems	EnXco	60	60	redacted	redacted	15	online
SDG&E	SDGE6	60486A	biogas	Sycamore	Gas Recovery Systems	2.5	2.5	redacted	redacted	10	online
SDG&E	SDGE14	60470A	small hydro	Rancho Penasquitos	San Diego County Water Authority	4.5	4.5	20	20	10	online
SDG&E	SDGE15	60432A	wind	Kumeyaay Wind	Superior	50	50	redacted	redacted	20	online

Utility	Internal Tracking Number	CEC RPS ID#	Technology	Facility Name	Developer Name	Minimum Size (MW)	Maximum Size (MW)	Minimum Expected Deliveries (GWh/yr)	Maximum Expected Deliveries (GWh/yr)	Contract Term (yrs)	Operational Status
SDG&E	SDGE16	60566C	solar thermal	SES Solar Two	Stirling Energy Systems	300	900	648	1944	20	not online
SDG&E	SDGE17	60552A?	biogas	Algonquin, MM Prima Deshecha Energy	Cambrian Energy Development	10	10	redacted	redacted	15	online
SDG&E	SDGE18	60472D	biogas	Covanta Otay 3	Covanta Power Pacific	3.75	3.75	redacted	redacted	10	online
SDG&E	SDGE19	Unknown	wind	Pacific Wind LLC	EnXco	205.5	205.5	603	603	20	not online
SDG&E	SDGE21	60503C	biomass	Bull Moose	Bull Moose	25	25	168	168	20	not online
SDG&E	SDGE22	60494D	geothermal	Esmeralda San Felipe	Esmeralda Energy	20	20	166	166	15	not online
SDG&E	SDGE23	Unknown	solar thermal	Mount Signal Solar	Bethel/MMR Power Solutions	49.4	49.4	304	304	20	not online
SDG&E	SDGE24	Unknown	solar thermal	Bethel Solar 2	Bethel/MMR Power Solutions	49.4	49.4	168	168	20	not online
SDG&E	SDGE26	60630C	biomass	Vista	Envirepel Energy Inc.	1.5	1.5	11.826	11.826	2	not online
SDG&E	SDGE27	In Progress	biomass	Los Coyotes	Envirepel Energy Inc.	5	5	41.61	41.61	15	not online
SDG&E	SDGE28	In Progress	biomass	Ramona	Envirepel Energy Inc.	5	5	41.61	41.61	15	not online
SDG&E	SDGE29	Unknown	geothermal	Esmeralda Truckhaven	Esmeralda Energy	40	40	319.44	319.44	20	not online
PG&E	PGE005	60030C	wind	Diablo Winds	FPL Energy	18	18	65	65	11.5	online
PG&E	PGE011	60124A	wind	Buena Vista Energy	Buena Vista	38	38	95	95	10	online
SCE	SCE005	60404E	wind	CTV Power	CTV Power	14	14	41.185	41.185	30	online
SCE	SCE006	60411E	wind	Boxcar II	Windland Inc.	8	8	20	20	30	online
SCE	SCE007	60396E	wind	Karen Windfarm	Energy Development and Construction Corp.	11.66	11.66	35.6	35.6	30	online
SCE	SCE008	60390E	wind	Coram Energy	Coram Energy Group	3	3	11.162	11.162	30	online
SCE	SCE019	60608D	wind	Caithness 251 I	Caithness	15	18.265	redacted	44	20	not online
SCE	SCE020	60608D	wind	Caithness 251 II	Caithness	5.8	15.8	redacted	40	20	not online
SCE	SCE021	60609D	wind	Ridgetop Energy I	Caithness	6	17.66	redacted	40	20	online
SCE	SCE022	60609D	wind	Ridgetop Energy II	Caithness	5.03	17.03	redacted	42	20	not online
SCE	SCE030	60631C	biogas	Palos Verdes Gas to Energy Facility	County Sanitation Districts of LA County	1.6	1.6	12.6	12.6	10	not online
PG&E	PGE014	60471C	biomass	Global Common's Chowchilla	Global Ampersand	9	9	65	72	15	not online
PG&E	PGE015	60473C	biomass	Global Common's El Nido	Global Ampersand	9	9	65	72	15	not online

Utility	Internal Tracking Number	CEC RPS ID#	Technology	Facility Name	Developer Name	Minimum Size (MW)	Maximum Size (MW)	Minimum Expected Deliveries (GWh/yr)	Maximum Expected Deliveries (GWh/yr)	Contract Term (yrs)	Operational Status
PG&E	PGE017	60604A	geothermal	Bottle Rock	US Renewables Group	10	55	119	385	10 to 15	online
SCE	SCE017	60020A	biomass	Imperial Valley Resource Recovery	Imperial Valley Resource Recovery LLC	16.4	16.4	123.5	132	10	not online
SCE	SCE023	60574C	biomass	Mesquite Lake Resource Recovery Facility	Chateau Energy Inc.	15	15	105	105	15	not online

Appendix C. Transmission Owner Interconnection Queue

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
NV	Churchill	SPPC	6/6/2006	geothermal	geothermal	32		230kV
NV	Lander-Pershing	SPPC	6/6/2006	geothermal	geothermal	32		Cove Sub
NV	Churchill	SPPC	7/19/2006	geothermal	geothermal	62		230kV
NV	Nye	SPPC	5/9/2007	geothermal	geothermal	10		Big Smoky Vly
NV	Lander	SPPC	8/3/2007	geothermal	geothermal	26		Tonkin Spg
NV	Esmeralda	SPPC	8/20/2007	geothermal	geothermal	21		Silver Pk Sub
NV	Nye	SPPC	8/29/2007	geothermal	geothermal	10		Big Smoky Vly
NV	Lander	SPPC	9/6/2007	geothermal	geothermal	30		Antelope Sub
NV	Lander-Pershing	SPPC	9/12/2007	geothermal	geothermal	30		#152 Ln
NV	Nye	SPPC	9/12/2007	geothermal	geothermal	10		Big Smoky Vly
NV	Nye	SPPC	9/12/2007	geothermal	geothermal	32		Round Mtn Sub
NV	Lyon	SPPC	7/14/2008	geothermal	geothermal	240		345kV
NV	Washoe	SPPC	7/17/2008	geothermal	geothermal	45		Purgatory Sub
NV	Washoe	SPPC	4/15/2008	gas	natural gas	250		Fort Sage Sub
NV	Nye	SPPC	3/4/2008	steam turbine	solar	190		Tonopah Sub
NV	Mineral	SPPC	6/23/2008	steam turbine	solar	50		Table Mtn Sub
NV	Nye	SPPC	6/23/2008	steam turbine	solar	500		Millers Sub
NV	Washoe	SPPC	8/29/2005	wind turbine	wind	150		Eagle Sub
NV	White Pine	SPPC	3/13/2006	wind turbine	wind	149		230kV
CA	Lassen	SPPC	9/27/2006	wind turbine	wind	200		Alturas 345kV
NV	Washoe	SPPC	10/23/2006	wind turbine	wind	60		Eagle Sub
NV	Lyon	SPPC	1/5/2007	wind turbine	wind	150		Dove Sub
NV	Washoe	SPPC	3/23/2007	wind turbine	wind	100		Tracy
NV	Lyon	SPPC	3/29/2007	wind turbine	wind	150		Dove Sub
NV	Elko	SPPC	4/16/2007	wind turbine	wind	202		Mdpt-Vmy 345kV
NV	White Pine	SPPC	5/11/2007	wind turbine	wind	149		230kV
NV	White Pine	SPPC	6/5/2007	wind turbine	wind	100		Gonder Sub
NV	White Pine	SPPC	7/10/2007	wind turbine	wind	250		Gonder Sub
NV	White Pine	SPPC	8/21/2007	wind turbine	wind	200		Gonder Sub
NV	Elko	SPPC	9/5/2007	wind turbine	wind	200		Humb-Mdpt 345KV
NV	Washoe	SPPC	9/6/2007	wind turbine	wind	102		Tracy
AZ	Maricopa	APS	8/13/2007	biogas	biogas	4.5	4.5	Adobe 12kV
AZ	Maricopa	APS	9/18/2007	biogas	biogas	3	3	El Sol 12 kV
AZ	Maricopa	APS	7/31/2007	steam turbine	solar	102	102	Gila Bend 230kV Substation
AZ	Maricopa	APS	7/31/2007	steam turbine	solar	110	110	Proposed Harquahala Junction Switchyard

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
AZ	Yuma	APS	8/13/2007	steam turbine	solar	400	400	North Gila Substation
AZ	Maricopa	APS	11/27/2007	steam turbine	solar	400	400	Proposed Harquahala Junction Switchyard
AZ	Maricopa	APS	11/27/2007	steam turbine	solar	800	800	Proposed Harquahala Junction Switchyard
AZ	Maricopa	APS	2/19/2008	steam turbine	solar	280	280	Gila Bend 230kV Substation
AZ	Maricopa	APS	2/22/2008	steam turbine	solar	500	500	Proposed Harquahala Junction Switchyard
AZ	Yuma	APS	2/22/2008	steam turbine	solar	500	500	Proposed PV-NG2 500 kV Line
AZ	Yuma	APS	12/10/2008	steam turbine	solar	250	250	North Gila Substation
AZ	Conconino	APS	5/27/2004	wind turbine	wind	60	60	Cholla to Coconino 69Kv Line
AZ	Navajo	APS	4/29/2005	wind turbine	wind	128	128	Cholla/ Zeniff/Show Low Western 69kV line and Cholla / Show Low Eastern 69kV line
AZ	Yavapai	APS	6/15/2006	wind turbine	wind	270	270	Ashfork-Pollock 69 kV System and Seligman 230 kV to be studied
AZ	Navajo	APS	3/1/2007	wind turbine	wind	125	125	Cholla / Show Low Eastern 69kV line
AZ	Cochise	APS	7/6/2007	wind turbine	wind	100	100	Adams - Mural 115 kV Line
AZ	Coconino	APS	10/31/2007	wind turbine	wind	1000	1000	Moenkopi 500kV
AZ	Navajo	APS	11/19/2007	wind turbine	wind	300	300	Cholla-Pinnacle Peak 345 kV line
AZ	Coconino	APS	12/28/2007	wind turbine	wind	500	500	Moenkopi - Eldorado 500 kV Line
NM	San Juan	APS	2/16/2004	coal		700	700	Four Corners 500 Switchyard
NM	San Juan	APS	2/16/2004	coal		700	700	Four Corners 500 Switchyard
AZ	Phoenix	APS	12/14/2006	landfill gas		3.6	3.6	Existing Durango Substation
AZ	Mohave	TEP			wind	80		Dolan Springs Sub
CA	Fresno	PGE	1/3/2008	reciprocating engine	biomass	5.2		Helm-Kerman 70kV line
CA	Madera	PGE	4/28/2005	steam turbine	biomass	10.5		Le Grand-Chowcilla 115 kV
CA	Merced	PGE	4/28/2005	steam turbine	biomass	10.5		PG&E Merced #1 70 kV circuit
CA	San Diego	SDGE	5/2/2006	steam turbine	biomass	27		Border Substation 69 kV
CA	Kern	PGE	6/23/2006	steam turbine	biomass	20		Tap of Chevron 70kv tran line
CA	Madera	PGE	12/11/2007	steam turbine	biomass	29		Tap Dairyland-Mendota 115 kV line
NV	Mineral	SCE	1/25/2005	steam turbine	geothermal	62		Control 115kV Substation
CA	Sonoma	PGE	3/5/2007	steam turbine	geothermal	35		Geysers #3 – Cloverdale 115 kV Line
NV	Mineral	SCE	3/6/2007	steam turbine	geothermal	150		Bishop, CA Control Sub
CA	Sonoma	PGE	3/14/2007	steam turbine	geothermal	50		Geysers-Fulton 230kV transmission line
NV	Clark	SCE	11/8/2006	combined cycle	heat recovery	591		Eldorado 500 kV Substation
CA	San Mateo	PGE	5/9/2005	internal combustion	landfill gas	10.7		Hillsdale Junction-Half Moon Bay 60 kV line

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Contra Costa	PGE	8/10/1999	combined cycle	natural gas	590		Contra Costa Power Plant 230 kV bus
CA	San Diego	SDGE	11/1/1999	combined cycle	natural gas	550	550	Miguel Substation
CA	Riverside	SCE	4/21/2000	combined cycle	natural gas	850		Devers Substation 230 kV Bus
CA	Los Angeles	SCE	8/16/2000	combined cycle	natural gas	630		El Segundo 220 kV Bus
CA	San Joaquin	PGE	8/23/2000	combined cycle	natural gas	1156		Tesla Substation 230 kV Bus E
CA	San Diego	SDGE	11/28/2000	combined cycle	natural gas	750		Sycamore Canyon Substation
CA	San Luis Obispo	PGE	12/1/2000	combined cycle	natural gas	1200		Morro Bay Substation
CA	San Diego	SDGE	1/7/2003	combined cycle	natural gas	65		Miguel-Tijuana * (65 MWs -additional capacity, 615 total MW)
CA	Riverside	SCE	3/18/2003	combined cycle	natural gas	520		Devers-Palo Verde 500 kV line near Blythe
CA	Colusa	PGE	12/1/2004	combined cycle	natural gas	715		Between Cottonwood and Vaca-Dixon
CA	Riverside	SCE	12/21/2004	combined cycle	natural gas	810		SCE Valley Substation
CA	Alameda	PGE	3/28/2005	combined cycle	natural gas	245		Eastshore Substation
CA	Los Angeles	SCE	9/12/2005	combined cycle	natural gas	610		Laguna Bell Substation 230 kV
CA	San Bernardino	SCE	2/13/2006	combined cycle	natural gas	570		Caldwell-Victor line
CA	Los Angeles	SCE	2/24/2006	combined cycle	natural gas	570		Vincent 230 kV
CA	San Bernardino	SCE	10/24/2006	combined cycle	natural gas	698		SCE Rancho Vista 500kV Sub
CA	San Joaquin	PGE	2/8/2007	combined cycle	natural gas	508		Tesla-Bellota 230kV lines
CA	San Diego	SDGE	3/30/2007	combined cycle	natural gas	280		Encina 138kV Substation
CA	Riverside	SCE	5/23/2007	combined cycle	natural gas	640		500kV line to the new Midpoint switching station

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
NV	Clark	SCE	6/12/2007	combined cycle	natural gas	634		Eldorado 220kV switchyard
CA	Madera	PGE	7/30/2007	combined cycle	natural gas	67		Borden Substation 230kV Bus
CA	San Joaquin	PGE	7/30/2007	combined cycle	natural gas	67		Tesla-Bellota 230kV line
CA	Kings	PGE	8/21/2007	combined cycle	natural gas	600		Gates Substation 230kV bus
CA	Solano	PGE	9/10/2007	combined cycle	natural gas	575		New Fairfield Substation 230kV bus
CA	Contra Costa	PGE	9/12/2007	combined cycle	natural gas	520		Contra Costa Substation 230kV bus
CA	San Joaquin	PGE	9/12/2007	combined cycle	natural gas	260		Loop Gold Hill-Eight Mile Road 230kV line
CA	Sutter	PGE	9/12/2007	combined cycle	natural gas	345		Rio Oso Substation 115kV bus
CA	Los Angeles	SCE	9/28/2007	combined cycle	natural gas	104		Hinson Substation 220kV
CA	Sutter	PGE	10/19/2007	combined cycle	natural gas	325		Rio Oso Substation 230kV bus
CA	San Joaquin	PGE	10/23/2007	combined cycle	natural gas	280		Gold Hill-Eight Mile 230kV lines
CA	San Diego	SDGE	11/5/2007	combined cycle	natural gas	54		Palomar Substation 230kV
CA	Contra Costa	PGE	11/9/2007	combined cycle	natural gas	650		Contra Costa Switchyard 230kV bus
CA	Kern	PGE	1/29/2008	combined cycle	natural gas	400		Midway Substation 230kV bus
CA	Kings	PGE	1/29/2008	combined cycle	natural gas	27		Hanford Switchyard 115kV bus
CA	Contra Costa	PGE	3/10/2008	combined cycle	natural gas	611		Contra Costa Substation 230kV switchyard
CA	Contra Costa	PGE	3/17/2008	combined cycle	natural gas	611		Pittsburg 230kV switchyard
CA	Fresno	PGE	4/17/2008	combined cycle	natural gas	10		Kerman-Helms 70kV line
CA	Fresno	PGE	5/9/2008	combined cycle	natural gas	337.5		McCall Substation 115kV bus

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Fresno	PGE	5/9/2008	combined cycle	natural gas	337.5		McCall Substation 115kV bus
CA	Santa Clara	PGE	5/28/2008	combined cycle	natural gas	123		Los Esteros Substation 115kV bus
CA	Sutter	PGE	5/28/2008	combined cycle	natural gas	600		Table Mountain-Tesla 500kV line
CA	Los Angeles	SCE	5/29/2008	combined cycle	natural gas	85		Hinson Substation 230kV
CA	Kern	PGE	5/30/2008	combined cycle	natural gas	600		Midway Substation 230kV bus
CA	Solano	PGE	6/2/2008	combined cycle	natural gas	730		Loop Lakesville-Sobrante and Lakesville-Ignacio 230kV lines
CA	San Francisco	PGE	2/25/2004	combustion turbine	natural gas	145.1		Potrero 115 kV Sub
CA	San Francisco	PGE	4/26/2004	combustion turbine	natural gas	48.7		SF Airport Substation
CA	San Joaquin	PGE	11/8/2004	combustion turbine	natural gas	74.9		Tesla Substation
CA	Kern	SCE	11/9/2004	combustion turbine	natural gas	157		Pastoria Substation
CA	Fresno	PGE	11/11/2004	combustion turbine	natural gas	119.9		Panoche Substation
CA	Fresno	PGE	11/24/2004	combustion turbine	natural gas	300		McCall Substation
CA	Alameda	PGE	12/1/2004	combustion turbine	natural gas	361		Eastshore substation
CA	Fresno	PGE	12/1/2004	combustion turbine	natural gas	401		Panoche Sub Station
CA	Kern	PGE	3/28/2005	combustion turbine	natural gas	94		Kern Oil Substation 115 kV
CA	Los Angeles	SCE	5/6/2005	combustion turbine	natural gas	500.5		Walnut Substation
CA	San Diego	SDGE	2/16/2006	combustion turbine	natural gas	93		Existing radial 69kV gen-tie line to TL6929
CA	Los Angeles	SCE	4/14/2006	combustion turbine	natural gas	304		Laguna Bell 230 kV Substation
CA	San Diego	SDGE	8/16/2006	combustion turbine	natural gas	49		SDG&E Miramar GT Substation

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Fresno	PGE	9/1/2006	combustion turbine	natural gas	565	600	McCall Substation
CA	San Bernardino	SCE	10/16/2006	combustion turbine	natural gas	300		Etiwanda 230kV Substation
CA	San Diego	SDGE	10/17/2006	combustion turbine	natural gas	300		Encina Plant 230kV bus
CA	San Diego	SDGE	11/16/2006	combustion turbine	natural gas	43		Border Substation
CA	Alameda	PGE	12/1/2006	combustion turbine	natural gas	300		Oakland C 115kV substation
CA	Los Angeles	SCE	12/27/2006	combustion turbine	natural gas	202		Harbor Cogen
CA	San Diego	SDGE	2/16/2007	combustion turbine	natural gas	49.9		Pala 69kV Substation
CA	San Diego	SDGE	2/23/2007	combustion turbine	natural gas	49.9		Margarita 138kV Substation
CA	San Diego	SDGE	3/30/2007	combustion turbine	natural gas	330		Proposed Otay Mesa Energy Center 230kV Substation
CA	Madera	PGE	4/13/2007	combustion turbine	natural gas	508		Borden Substation 230kV Bus
CA	San Diego	SDGE	4/19/2007	combustion turbine	natural gas	99		Pala Substation
CA	Riverside	SCE	5/7/2007	combustion turbine	natural gas	50		Midpoint switching station
CA	Contra Costa	PGE	6/29/2007	combustion turbine	natural gas	630		Tesla-Tracy #1 230kV line
CA	San Joaquin	PGE	6/29/2007	combustion turbine	natural gas	630		Tesla Substation 230kV bus
CA	Solano	PGE	11/7/2007	combustion turbine	natural gas	630		Loop Vaca Dixon-Peabody & Vaca Dixon-Lambie 230 kV lines
CA	San Joaquin	PGE	3/11/2008	combustion turbine	natural gas	200		Tesla-Belota 230kV and Tesla-Webber 230kV lines
CA	Contra Costa	PGE	3/12/2008	combustion turbine	natural gas	476		Contra Costa Substation 230kV switchyard
CA	Alameda	PGE	4/4/2008	combustion turbine	natural gas	193.6		Kelso Substation 230kV bus
CA	San Francisco	PGE	4/18/2008	combustion turbine	natural gas	50		Mission Substation

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Merced	PGE	4/23/2008	combustion turbine	natural gas	525		Wilson Substation 230kV bus
CA	Fresno	PGE	4/25/2008	combustion turbine	natural gas	49		Panoche Substation 115kV bus
CA	Fresno	PGE	4/25/2008	combustion turbine	natural gas	49		Tap Helm-Valley Nitrogen 70kV line
CA	Stanislaus	PGE	4/25/2008	combustion turbine	natural gas	49		Salado Substation 115kV
CA	Yolo	PGE	4/25/2008	combustion turbine	natural gas	49		Tap Vaca-Rio Oso 115kV line
CA	Colusa	PGE	5/1/2008	combustion turbine	natural gas	200		Cortina Substation 230kV bus
CA	Solano	PGE	5/1/2008	combustion turbine	natural gas	390.4		Lambie-Contra costa Substation 230kV bus
CA	San Diego	SDGE	5/9/2008	combustion turbine	natural gas	150		Esco Substation 69 kV
CA	San Diego	SDGE	5/9/2008	combustion turbine	natural gas	150		Esco Substation 69 kV
CA	Solano	PGE	5/1/2008	combustion turbine	natural gas	390.4		Lambie-Contra Costa Substation 230kV bus
CA	San Joaquin	PGE	5/27/2008	combustion turbine	natural gas	315		Loop Tesla-Stagg and Tesla-Eight Mile 230kV lines
CA	Glenn	PGE	5/27/2008	combustion turbine	natural gas	49		Tap Cotonwood-Logan Creek-Vaca Dixon 230kV line
CA	Alameda	PGE	5/28/2008	combustion turbine	natural gas	600		Tracy Substation 230kV
CA	Kern	PGE	5/30/2008	combustion turbine	natural gas	450		Midway Substation 230kV bus
CA	San Joaquin	PGE	5/30/2008	combustion turbine	natural gas	400		Tesla Substation 230kV bus
CA	Fresno	PGE	5/30/2008	combustion turbine	natural gas	188		Panoche Substation 230kV
CA	San Diego	SDGE	5/30/2008	combustion turbine	natural gas	49		Talega-Escondido 230kV line
CA	San Diego	SDGE	5/30/2008	combustion turbine	natural gas	49		Lilac-Rincon 69kV
CA	San Diego	SDGE	5/30/2008	combustion turbine	natural gas	49		Pala-Lilac 69kV line

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Orange	SDGE	5/30/2008	combustion turbine	natural gas	49		Talega-San Mateo 69kV line
CA	San Diego	SDGE	5/30/2008	combustion turbine	natural gas	49		Ash-Valley Center 69kV line
CA	San Diego	SDGE	5/30/2008	combustion turbine	natural gas	49		Border Substation 69kV
CA	Alameda	PGE	10/19/2004	internal combustion	natural gas	118		Eastshore Substation
CA	Humboldt	PGE	10/19/2004	internal combustion	natural gas	146.4		Humboldt Power Plant Substation
CA	Solano	PGE	10/10/2007	reciprocating engine	natural gas	390.6		Birds Landing Substation 230 kV Bus
CA	San Joaquin	PGE	10/30/2007	reciprocating engine	natural gas	371.3		Tesla Substation 230kV bus
CA	Mendocino	PGE	12/13/2007	reciprocating engine	natural gas	115		Ukiah Substation 115kV bus
CA	Alameda	PGE	5/7/2008	reciprocating engine	natural gas	115.5		Kelso Substation
CA	Inyo	SCE	5/29/2008	steam turbine	natural gas	15		Kramer Substation 230kV
CA	Inyo	SCE	5/29/2008	steam turbine	natural gas	15		Kramer Substation 230kV
CA	Inyo	SCE	5/29/2008	steam turbine	natural gas	15		Inyokern Substation 115kV
NV	Churchill	SCE	5/29/2008	steam turbine	natural gas	52.5		Bishop Substation
NV	Churchill	SCE	5/29/2008	steam turbine	natural gas	52.5		Bishop Substation
NV	Churchill	SCE	5/29/2008	steam turbine	natural gas	52.5		Bishop Substation
NV	Churchill	SCE	5/29/2008	steam turbine	natural gas	52.5		Bishop Substation
NV	Churchill	SCE	5/29/2008	steam turbine	natural gas	52.5		Bishop Substation
NV	Churchill	SCE	5/29/2008	steam turbine	natural gas	52.5		Bishop Substation
CA	Lake	PGE	5/30/2008	steam turbine	natural gas	50		Geysers 17-Fulton #2 230kV line
CA	Los Angeles	SCE	7/10/2007	steam turbine	natural gas	12.72		Redondo Beach Generating Station 220kV switchyard
CA	San Joaquin	PGE	10/24/2007	steam turbine	natural gas	145		Tesla-Manteca 115kV line via Schulte Switchyard
CA	Kern	PGE	5/28/2008	steam turbine	natural gas	49.9		Famoso Substation
CA	Los Angeles	SCE	5/30/2008	steam turbine	natural gas	49.85		ChevGen Substation
CA	Kings	PGE	11/1/2007	combined cycle/photovoltaic	natural gas/solar	150		Henrietta Substation 70kV bus
CA	San Bernardino	SCE	3/30/2005	other	solar	850		Pisgah 230 kV Substation
CA	Imperial	SDGE	8/31/2005	other	solar	300		Imperial Valley Substation

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	San Bernardino	SCE	6/14/2006	other	solar	550		Pisgah Substation
CA	San Bernardino	SCE	6/14/2006	other	solar	1400		Pisgah Substation
CA	San Bernardino	SCE	8/9/2006	other	solar	1200		Mojave 500 kV Switchyard
CA	Imperial	SDGE	8/22/2006	other	solar	600		Imperial Valley Substation
CA	Kings	PGE	5/21/2008	photovoltaic	solar	20		Jacobs Corner Substation 70kV bus
CA	Kern	SCE	5/30/2008	photovoltaic	solar	700		Windhub Substation
CA	Kern	SCE	5/30/2008	photovoltaic	solar	250		Cottonwind-Whirlwind 230kV line
CA	Kern	SCE	5/30/2008	photovoltaic	solar	250		Cottonwind-Whirlwind 230kV line
CA	Los Angeles	SCE	5/30/2008	photovoltaic	solar	250		Antelope-Magunden 230kV line
CA	Riverside	SCE	6/2/2008	photovoltaic	solar	100		Victor Substation 115kV
CA	Riverside	SCE	6/2/2008	photovoltaic	solar	50		Antelope-Cal Cement 69kV line
CA	San Diego	SDGE	6/2/2008	photovoltaic	solar	50		Cameron Substation 69kV
CA	Kern	SCE	6/2/2008	photovoltaic	solar	50		Inyokern Substation 115kV
CA	San Bernardino	SCE	6/2/2008	photovoltaic	solar	58.8		Dunn Siding Substaion 115kV
CA	San Diego	SDGE	6/2/2008	photovoltaic	solar	58.8		Borrego Substation 69kV
CA	San Diego	SDGE	6/2/2008	photovoltaic	solar	58.8		Warner Substation 69kV
CA	Kern	SCE	6/2/2008	photovoltaic	solar	50		Redman Substation 69kV
CA	Kern	SCE	6/2/2008	photovoltaic	solar	50		Little Rock Substaiton 69kV
CA	Riverside	SCE	6/2/2008	photovoltaic	solar	100		Baker Substation 115kV
CA	Riverside	SCE	11/16/2006	photovoltaic	solar	150		Eagle Mountain Substation
CA	Riverside	SCE	11/16/2006	photovoltaic	solar	400		Eagle Mountain Substation
CA	San Bernardino	SCE	1/9/2007	photovoltaic	solar	300		Ivanpah Substation
CA	San Luis Obispo	PGE	1/23/2007	photovoltaic	solar	210		Midway-Morrow Bay 230kV line
CA	Kern	SCE	3/5/2007	photovoltaic	solar	500		Tehachapi Conceptual Substation
CA	Riverside	SCE	5/3/2007	photovoltaic	solar	600		Eagle Mountain Substation
CA	San Bernardino	SCE	5/23/2007	photovoltaic	solar	450		BLM West-Kramer 230kV line
CA	San Bernardino	SCE	5/23/2007	photovoltaic	solar	450		Cool Water-Kramer #1 230kV line
CA	San Bernardino	SCE	6/21/2007	photovoltaic	solar	1000		Devers Substation
CA	San Bernardino	SCE	6/21/2007	photovoltaic	solar	1000		Devers Substation
CA	San Luis Obispo	PGE	7/11/2007	photovoltaic	solar	45		Temblor-San Luis Obispo 115kV line
CA	San Luis Obispo	PGE	7/11/2007	photovoltaic	solar	250		Midway-Morro Bay 230kV line
CA	San Luis Obispo	PGE	7/13/2007	photovoltaic	solar	390		Morro Bay-Midway 230kV line
CA	Riverside	SCE	8/1/2007	photovoltaic	solar	200		Eagle Mountain-Blythe 161kV line
CA	Fresno	PGE	10/9/2007	photovoltaic	solar	5		Mendota-San Joaquin-Helm 70kV line
CA	Riverside	SCE	11/1/2007	photovoltaic	solar	700		Proposed Midpoint Substation 230kV

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	San Bernardino	SCE	11/1/2007	photovoltaic	solar	400		Lugo-Pisgah 230kV line
CA	San Bernardino	SCE	2/8/2008	photovoltaic	solar	500		Lugo-Pisgah 220kV line
CA	Tulare	PGE	2/28/2008	photovoltaic	solar	50		Smyrna-Alpaugh 115kV line
CA	Los Angeles	SCE	3/11/2008	photovoltaic	solar	100		Antelope Substation 66kV
CA	Los Angeles	SCE	3/11/2008	photovoltaic	solar	100		Antelope Substation 66kV
CA	Kern	SCE	3/27/2008	photovoltaic	solar	100		Kramer-Inyokern-Randsberg No. 1 115kV line
CA	Tulare	PGE	4/2/2008	photovoltaic	solar	20		Smyrna-Alpaugh 115kV line
CA	San Diego	SDGE	4/7/2008	photovoltaic	solar	75		Borrego Substation 69kV
CA	Kern	SCE	4/25/2008	photovoltaic	solar	40		Corum-Goldtown 66kV line
CA	Kern	SCE	4/25/2008	photovoltaic	solar	100		Goldtown Substation
CA	Los Angeles	SCE	4/25/2008	photovoltaic	solar	30		Lancaster-Redman 66kV line
CA	Los Angeles	SCE	4/25/2008	photovoltaic	solar	40		Piute-Redman 66kV line
CA	Los Angeles	SCE	4/25/2008	photovoltaic	solar	40		Lancaster-Little Rock-Piute 66kV line
CA	Los Angeles	SCE	4/25/2008	photovoltaic	solar	40		Lancaster-Little Rock-Piute 66kV line
CA	Los Angeles	SCE	4/25/2008	photovoltaic	solar	50		Del Sur Substation
CA	Los Angeles	SCE	4/25/2008	photovoltaic	solar	50		Helijet-Little Rock-Palmdale-Rockair 66kV line
CA	San Bernardino	SCE	4/25/2008	photovoltaic	solar	80		Eldorado-Baker-Cook Water-Dunn-Siding-Mountain Pass 115kV line
CA	Kern	PGE	4/28/2008	photovoltaic	solar	50		Midway-Sunset to Midway Substation 230kV
CA	San Luis Obispo	PGE	4/28/2008	photovoltaic	solar	100		San Luis Obispo-Tremblor 115kV line
CA	Santa Barbara	PGE	4/28/2008	photovoltaic	solar	50		Taft-Cuyama 70kV lines
CA	Kern	PGE	4/30/2008	photovoltaic	solar	100		Midway-Sunset to Midway Substation 230kV
CA	San Bernardino	SCE	5/1/2008	photovoltaic	solar	350		Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115kV line
CA	Kern	SCE	5/5/2008	photovoltaic	solar	700		Windhub Substation
CA	Kern	SCE	5/5/2008	photovoltaic	solar	700		Windhub Substation
CA	Santa Barbara	PGE	5/12/2008	photovoltaic	solar	50		69kV line proximate to Cuyama Substation
CA	San Bernardino	SCE	5/28/2008	steam turbine	solar	612		Pisgah-Lugo 230kV line
CA	San Bernardino	SCE	5/21/2008	steam turbine	solar	145		Lugo-Mohave 500kV line
NV	Clark	SCE	5/21/2008	steam turbine	solar	580		Eldorado Substation 230kV line
CA	San Bernardino	SCE	5/21/2008	steam turbine	solar	270		Lugo-Eldorado 500kV line
CA	San Bernardino	SCE	5/29/2008	steam turbine	solar	900		Mohave-Lugo 500kV line
CA	San Bernardino	SCE	5/29/2008	steam turbine	solar	600		Mohave-Lugo 500kV line
CA	Imperial	SDGE	5/29/2008	steam turbine	solar	900		North Gila-Imperial Valley 500kV line
AZ	La Posa	SDGE	5/29/2008	steam turbine	solar	900		Palo Verde-North Gila 500kV line

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
AZ	La Paz/Maricopa	SCE	5/29/2008	steam turbine	solar	600		Devers-Palo Verde 500 kV line
AZ	Maricopa	SCE	5/29/2008	steam turbine	solar	900		Devers-Palo Verde 500 kV line
AZ	Maricopa	SDGE	5/29/2008	steam turbine	solar	300		North Gila-Hassayampa 500kV line
CA	Kern	PGE	5/30/2008	steam turbine	solar	100		Midway Substation 230kV bus
CA	Imperial	SDGE	5/30/2008	steam turbine	solar	450		Imperial Valley Substation
CA	Riverside	SCE	5/30/2008	steam turbine	solar	49.5		Midpoint Substation 500kV
CA	Riverside	SCE	5/30/2008	steam turbine	solar	49.5		Midpoint Substation 500kV
CA	Riverside	SCE	5/30/2008	steam turbine	solar	280		Pisgah Substation 230kV
CA	Imperial	SDGE	5/30/2008	steam turbine	solar	280		Imperial Valley Substation 230kV bus
CA	Riverside	SCE	5/30/2008	steam turbine	solar	280		Devers-Palo Verde 500kV line
CA	Riverside	SCE	5/30/2008	steam turbine	solar	280		Midpoint Substation 230kV
CA	San Diego	SDGE	5/30/2008	steam turbine	solar	49.5		Borrego Substation 69kV
CA	Riverside	SCE	5/30/2008	steam turbine	solar	49.5		Eagle Mountain Substation
CA	Riverside	SCE	5/30/2008	steam turbine	solar	49.5		Camino-Iron Mouintain 230kV line
CA	Riverside	SCE	5/30/2008	steam turbine	solar	49.5		Camino-Iron Mouintain 230kV line
CA	San Bernardino	SCE	5/30/2008	steam turbine	solar	250		Mohave Switchyard
CA	Riverside	SCE	5/30/2008	steam turbine	solar	250		Colorado River Substation
NV	Clark	SCE	5/30/2008	steam turbine	solar	250		Mohave Switchyard
CA	Kern	SCE	5/30/2008	steam turbine	solar	250		Antelope Substation
CA	San Bernardino	SCE	5/30/2008	steam turbine	solar	250		Eagle Mountain Substation
CA	Imperial	SDGE	5/30/2008	steam turbine	solar	250		Imperial Valley Substation
CA	Kern	SCE	5/30/2008	steam turbine	solar	250		Kramer Substation
CA	San Bernardino	SCE	5/30/2008	steam turbine	solar	250		Mohave Switchyard
CA	San Bernardino	SCE	5/30/2008	steam turbine	solar	250		Iron Mountain Substation
CA	San Bernardino	SCE	5/30/2008	steam turbine	solar	250		Iron Mountain Substation
CA	San Bernardino	SCE	5/30/2008	steam turbine	solar	500		Mohave Switchyard
AZ	La Paz	SCE	5/30/2008	steam turbine	solar	250		Palo Verde-Devers #2 line
AZ	Maricopa	SCE	5/30/2008	steam turbine	solar	250		Palo Verde-Devers #2 line
CA	Riverside	SCE	5/30/2008	steam turbine	solar	500		Midpoint Substation
CA	Kern	SCE	5/30/2008	steam turbine	solar	500		Whirlwind Substation
CA	Imperial	SDGE	5/30/2008	steam turbine	solar	125		Imperial Valley 230kV
CA	Riverside	SCE	5/30/2008	steam turbine	solar	250		Midpoint Substation 500kV
CA	San Bernardino	SCE	5/30/2008	steam turbine	solar	1150		Pisgah Substation 230kV
AZ	La Paz	SCE	6/2/2008	steam turbine	solar	250		Mohave Switchyard
CA	Imperial	SDGE	6/2/2008	steam turbine	solar	84		Imperial Valley Substation 230kV

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Los Angeles	SCE	6/2/2008	steam turbine	solar	420		Whirlwind Substation 230kV
CA	Los Angeles	SCE	6/2/2008	steam turbine	solar	840		Vincent Substation
NV	Clark	SCE	5/30/2008	steam turbine	solar	230		Eldorado-Ivanpah 230kV line
AZ	Yuma	SDGE	5/30/2008	steam turbine	solar	280		Hassayampa-North Gila #1 500kV line
CA	San Bernardino	SCE	5/26/2006	steam turbine	solar	635		Mohave 500 kV Switchyard
CA	San Bernardino	SCE	8/22/2006	steam turbine	solar	250		Cool Water-Kramer 230kv line
CA	San Bernardino	SCE	9/25/2006	steam turbine	solar	100		Loop new sub connecting to Eldorado-Mtn Pass 115kV line
CA	San Bernardino	SCE	11/6/2006	steam turbine	solar	80		Kramer Substation
CA	San Bernardino	SCE	11/6/2006	steam turbine	solar	80		Kramer Substation
CA	San Bernardino	SCE	11/6/2006	steam turbine	solar	320		Kramer Substation
CA	San Bernardino	SCE	11/16/2006	steam turbine	solar	114		Loop new sub connecting Eldorado-Mtn Pass 115kV line
CA	Kern	SCE	11/28/2006	steam turbine	solar	500		Kramer 230 kV Substion
CA	San Bernardino	SCE	1/16/2007	steam turbine	solar	400		Pisgah 230kV Substation bus
CA	Imperial	SDGE	2/2/2007	steam turbine	solar	211.6		Imperial Valley 230kV bus
CA	Kern	SCE	2/2/2007	steam turbine	solar	500		Substation 5 (aka Whirlwind)
CA	San Bernardino	SCE	2/15/2007	steam turbine	solar	300		Julian Hinds 230kV Substation
CA	Riverside	SCE	3/19/2007	steam turbine	solar	500		Julian Hinds 230kV Substation
CA	San Luis Obispo	PGE	4/5/2007	steam turbine	solar	190		230kV lines near Carrizo Plain Substation
NV	Clark	SCE	4/20/2007	steam turbine	solar	600		El Dorado 220kV Switchyard
NV	Clark	SCE	6/27/2007	steam turbine	solar	400		Ivanpah Substation 230kV
CA	San Bernardino	SCE	6/27/2007	steam turbine	solar	200		Ivanpah Substation 230kV
CA	San Bernardino	SCE	7/12/2007	steam turbine	solar	400		Pisgah Sub 230kV
CA	San Bernardino	SCE	7/12/2007	steam turbine	solar	400		Pisgah Sub 230kV
CA	Kern	SCE	8/23/2007	steam turbine	solar	750		Inyokern Substaion
CA	San Bernardino	SCE	11/26/2007	steam turbine	solar	565		Pisgah Substation 230kV
CA	Fresno	PGE	12/12/2007	steam turbine	solar	106.8		Gates Substation 230kV bus
CA	Kern	SCE	12/21/2007	steam turbine	solar	231		Antelope-Magunden 230kV
CA	San Bernardino	SCE	12/27/2007	steam turbine	solar	250		Ivanpah Substation 230kV
CA	San Bernardino	SCE	12/27/2007	steam turbine	solar	750		Pisgah Substation 230kV
CA	Riverside	SCE	1/15/2008	steam turbine	solar	1000		Midpoint Substation 500kV
CA	San Bernardino	SCE	1/17/2008	steam turbine	solar	300		Pisgah Substation 220kV
CA	Los Angeles	SCE	1/18/2008	steam turbine	solar	66		Neenach-Bailey 66kV line
NV	Clark	SCE	1/23/2008	steam turbine	solar	140		El Dorado 220kV switchyard
CA	Kern	SCE	3/31/2008	steam turbine	solar	231		Windhub Substation

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Kern	SCE	3/31/2008	steam turbine	solar	264		Whirlwind Substation 230kV
CA	Kern	SCE	3/31/2008	steam turbine	solar	264		Windhub Substation
CA	Los Angeles	SCE	3/31/2008	steam turbine	solar	33		Antelope-Calcement 66kV line
CA	San Bernardino	SCE	3/31/2008	steam turbine	solar	33		Cool Water-Kramer 115kV line
CA	San Diego	SDGE	4/2/2008	steam turbine	solar	49.5		Borrego Substation 69kV
CA	Riverside	SCE	5/2/2008	steam turbine	solar	200		Blythe-Eagle Mountain 161kV line
CA	Riverside	SCE	5/2/2008	steam turbine	solar	300		Midpoint Substation
CA	Riverside	SCE	5/6/2008	steam turbine	solar	750		Midpoint Substation
CA	San Diego	SDGE	1/3/2003	hydro	water	40		Escondido
CA	Riverside	SCE/SDG	4/26/2005	hydro	water	500		Proposed Lee Lake Substation
CA	Mendocino	PGE	11/30/2007	hydro	water	40		Fort Bragg Substation 60kV bus
CA	Riverside	SCE	5/16/2008	hydro	water	1300		Midpoint Substation 500kV
CA	San Diego	SDGE	5/30/2008	wind turbine	wind	130		Boulevard Substation
CA	Kern	SCE	5/30/2008	wind turbine	wind	205		Highwind Substation 230kV
CA	Contra Costa	PGE	5/30/2008	wind turbine	wind	36		Pittsburg-Tesla 230kV line
CA	Shasta	PGE	5/30/2008	wind turbine	wind	350		Pit #3-Round Mountain 230kV line
CA	Kern	SCE	5/30/2008	wind turbine	wind	500		Windhub Substation
CA	Los Angeles & Kern	SCE	5/30/2008	wind turbine	wind	1150		Whirlwind Substation 230kV
CA	Riverside	SCE	9/30/1998	wind turbine	wind	16.5		Devers-Garnet 115 kV line (Tap)
CA	San Bernardino	SCE	10/14/2002	wind turbine	wind	63		Mountain Pass Substation
CA	Santa Barbara	PGE	3/11/2003	wind turbine	wind	120		Cabrillo
CA	Kern	SCE	8/19/2003	wind turbine	wind	300		Antelope
CA	Solano	PGE	11/18/2003	wind turbine	wind	38		New Birds Lndng Sw Sta near Contra Costa PP Sub
CA	Solano	PGE	1/30/2004	wind turbine	wind	150		High Winds/Contra Costa PP
CA	Lake & Sonoma	PGE	3/8/2004	wind turbine	wind	201		Collector Substation at Geysers #17 & Fulton 230 kV line
CA	San Diego	SDGE	5/12/2004	wind turbine	wind	201		Boulevard - Crestwood 69-kV transmission line
CA	Solano	PGE	11/11/2004	wind turbine	wind	200		New Birds Lndng Sw Sta near Contra Costa PP Sub
CA	Riverside	SCE	12/14/2004	wind turbine	wind	100.5		Devers Substation
CA	Kern	SCE	5/24/2005	wind turbine	wind	51		Proposed "New" Dutchwind Substation
CA	Kern	SCE	6/6/2005	wind turbine	wind	250		Antelope Sub
CA	Shasta	PGE	7/12/2005	wind turbine	wind	102		230kV line btn Pit#3 & Round Mtn
CA	San Bernardino	SCE	9/16/2005	wind turbine	wind	60		Lugo-Pisgah No. 2 230 kV tran line
CA	Kern	SCE	11/22/2005	wind turbine	wind	340		Cottonwind Substation
CA	Kern	SCE	1/20/2006	wind turbine	wind	33.1		Vincent Substation
CA	Kern	SCE	1/20/2006	wind turbine	wind	34		Canwind Substation

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Kern	SCE	2/22/2006	wind turbine	wind	51		Segment 3 of Antelope Transmission Project
CA	Kern	SCE	3/1/2006	wind turbine	wind	160		Tehachapi Conceptual Substation #5
CA	Kern	SCE	3/1/2006	wind turbine	wind	180		Tehachapi Conceptual Substation #2
CA	Kern	SCE	3/1/2006	wind turbine	wind	220		Tehachapi Conceptual Substation #1
CA	Kern	SCE	3/1/2006	wind turbine	wind	550		Tehachapi Conceptual Substation #1
CA	Kern	SCE	3/1/2006	wind turbine	wind	600		Tehachapi Conceptual Substation #1
CA	Kern	SCE	4/5/2006	wind turbine	wind	120		Vincent Substation through Sagebrush 230 kV line
CA	San Diego	SDGE	5/1/2006	wind turbine	wind	160		500 kV Imperial Valley-Miguel trans line
CA	Solano	PGE	6/9/2006	wind turbine	wind	128		Lambie-Contra Costa 230 kV
CA	San Diego	SDGE	6/28/2006	wind turbine	wind	300		500 kV Imperial Valley-Miguel trans line
CA	San Bernardino	SCE	6/29/2006	wind turbine	wind	50		Lugo-Pisgah 230kV line
CA	San Bernardino	SCE	6/29/2006	wind turbine	wind	150		Victor 230 kV
CA	San Bernardino	SCE	6/29/2006	wind turbine	wind	150		Lugo-Pisgah 230kV line
CA	Solano	PGE	6/29/2006	wind turbine	wind	30		Birds Landing
CA	Kern	SCE	8/8/2006	wind turbine	wind	500		Windhub Substation 230kV
NV	Clark	SCE	8/31/2006	wind turbine	wind	1500		Eldorado Substation
CA	Kern	SCE	9/27/2006	wind turbine	wind	297		SCE 230kV Conceptual Substation #2
CA	San Bernardino	SCE	10/10/2006	wind turbine	wind	60		Lugo-Pisgah 230kV line
CA	Riverside	SCE	10/23/2006	wind turbine	wind	150		Devers-Vista 230kV #1
CA	Kern	SCE	11/16/2006	wind turbine	wind	362		SCE Highwind Sub #2 (proposed) 230 kV
CA	Kern	SCE	11/22/2006	wind turbine	wind	100		66kV Antelope-Neenach-Bailey line
CA	Santa Barbara	PGE	11/22/2006	wind turbine	wind	105		No. 1 & No. 2 Mesa-Divide 115kV Lines
CA	San Bernardino	SCE	12/5/2006	wind turbine	wind	201		Lugo-Pisgah 230kV line
MX	La Rumorosa, Baja CA	SDGE	12/6/2006	wind turbine	wind	400		500kV Imperial Valley-Miguel transmission line
CA	Kern	SCE	12/15/2006	wind turbine	wind	100		66kV Rosamond-Antelope line
CA	Kern	SCE	12/15/2006	wind turbine	wind	100		66kV Rosamond-Delsur line
CA	Kern	SCE	12/15/2006	wind turbine	wind	100		66kV Antelope-Neenach-Bailey line
MX	La Rumorosa, Baja CA	SDGE	1/12/2007	wind turbine	wind	1000		Imperial Valley 230kV switchyard
MX	La Rumorosa, Baja CA	SDGE	2/2/2007	wind turbine	wind	1000		Imperial Valley 500kV bus
CA	Solano	PGE	2/9/2007	wind turbine	wind	500		Vaca-Tesla 500kV line
CA	Kern	SCE	2/21/2007	wind turbine	wind	500		SCE Proposed Whirlwind 230kV Substation
CA	Contra Costa	PGE	2/27/2007	wind turbine	wind	100		Bahia – Moraga 230 kV Line
MX	Mexicali/Ensenada/Tecate	SDGE	2/27/2007	wind turbine	wind	500		Miguel 230kV Bus
MX	Mexicali/Ensenada/Tecate	SDGE	2/27/2007	wind turbine	wind	500		Imperial Valley 230kV Substation
MX	La Rumorosa, Baja CA	SDGE	3/5/2007	wind turbine	wind	300		500kV Imperial Valley-Miguel transmission line

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Kern	SCE	3/23/2007	wind turbine	wind	200		Windhub Substation
CA	San Bernardino	SCE	4/19/2007	wind turbine	wind	149.4		Tortilla-Kramer 115 kV line
CA	San Bernardino	SCE	4/19/2007	wind turbine	wind	198.65		Cool Water-Kramer #1 230kV line
CA	San Bernardino	SCE	4/19/2007	wind turbine	wind	198.65		Cool Water-SEGS2-Tortilla 115kV line
CA	Lassen	PGE	4/23/2007	wind turbine	wind	201		Caribou 230kV Substation
MX	La Rumorosa, Baja CA	SDGE	5/2/2007	wind turbine	wind	400		New 230/500kV substation near the 500kV IV-ML line
CA	Humboldt	PGE	5/9/2007	wind turbine	wind	50		Bridgeville Substation
CA	San Bernardino	SCE	5/9/2007	wind turbine	wind	180		Coolwater 220kV bus
CA	San Bernardino	SCE	5/10/2007	wind turbine	wind	49.25		Coolwater-Kramer 115 kV line
MX	La Rumorosa, Baja CA	SDGE	5/21/2007	wind turbine	wind	420		Imperial Valley-Miguel 500kV
CA	Solano	PGE	5/23/2007	wind turbine	wind	60		Birds Landing Substation 230kV
CA	Riverside	SCE	6/13/2007	wind turbine	wind	50		Venwind portion of Devers-Garnett-Venwind line
CA	Kern and Inyo	SCE	7/16/2007	wind turbine	wind	120		Control-Haiwee-Inyokern 115kV line
CA	Riverside	SCE	7/16/2007	wind turbine	wind	228		Devers-Mirage-Julian Hinds 230kV line
CA	San Bernardino	SCE	7/16/2007	wind turbine	wind	429		Pisgah 230kV Substation
CA	Kern	SCE	7/17/2007	wind turbine	wind	120		Kramer-Inyokern-Randsburg #3 115kV line
CA	Lake and Colusa	PGE	7/30/2007	wind turbine	wind	140		Redbud-Cortina 115kV line
CA	Monterey	PGE	7/30/2007	wind turbine	wind	105		Moss-Linding-Salinas-Soledad 115kV #1 and #2 lines
CA	Santa Barbara	PGE	8/13/2007	wind turbine	wind	40		Cabrillo Substation 115kV
CA	San Bernardino	SCE	10/15/2007	wind turbine	wind	300		Lugo-Mohave 500kV line
CA	San Bernardino	SCE	12/13/2007	wind turbine	wind	150		Pisgah Substation 230kV
MX	Baja California	SDGE	2/27/2008	wind turbine	wind	500		Imperial Valley -Miguel 500kV line
CA	Plumas	PGE	3/18/2008	wind turbine	wind	598.2		Belden Substation 230kV
CA	Imperial	IID	5/17/2006	biomass	biomass	15.5		J 92 kV Line
CA	Imperial	IID	4/25/2008	biomass	biomass	49.3		EO 92 kV Line
CA	Imperial	IID	5/5/2005	geothermal	geothermal	25		L 161 kV Line
CA	Imperial	IID	2/10/2006	geothermal	geothermal	45		L 161 kV Line
CA	Imperial	IID	12/13/2006	geothermal	geothermal	50		CO 92 kV Line
CA	Imperial	IID	12/13/2006	geothermal	geothermal	50		CO 92 kV Line
CA	Imperial	IID	12/31/2006	geothermal	geothermal	49.9		Midway Substation
CA	Imperial	IID	12/31/2006	geothermal	geothermal	49.9		Midway Substation
CA	Imperial	IID	2/27/2007	geothermal	geothermal	15		HL-1 92 kV Line
CA	Imperial	IID	8/13/2007	geothermal	geothermal	20		L 161 kV Line
CA	Imperial	IID	8/14/2007	geothermal	geothermal	49.6		L 161 kV Line
CA	Imperial	IID	4/20/2007	steam turbine	solar	49.4		Imperial Valley Substation

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
CA	Imperial	IID	5/4/2007	steam turbine	solar	225		Midway Substation
CA	Imperial	IID	8/2/2007	steam turbine	solar	77		Midway Substation
CA	Imperial	IID	9/11/2007	steam turbine	solar	50		B 92 kV Line
CA	Imperial	IID	3/24/2008	steam turbine	solar	250		Highline Substation
CA	Imperial	IID	5/5/2008	steam turbine	solar	100		Dixieland Substation
CA	Riverside	IID	5/5/2008	steam turbine	solar	100		Mecca Substation
CA	Imperial	IID	12/3/2008	steam turbine	solar	500		L 161 kV Line
CA	Imperial	IID	5/5/2006	wind turbine	wind	115.5		Plaster City Substation
CA	Imperial	IID	7/21/2005	combined cycle		80		El Centro Switching Station
CA	Imperial	IID	9/26/2007	combined cycle		216		Midway Substation
CA	Imperial	IID	3/2/2007	gas turbine		46		J 92 kV Line
CA	Imperial	IID	9/26/2007	gas turbine		49.5		Midway Substation
CA	Los Angeles	LADWP	2/14/2007		natural gas	470	470	Wilmington 138kV Substation
NV	Clark	LADWP	10/10/2007		natural gas	634	634	(J) McCullough 230kV Substation
CA	San Bernardino	LADWP	4/9/2007		solar	250	250	(M) Marketplace-Adelanto 500kV Line
NV	Clark	LADWP	6/12/2007		solar	200	200	Mead-Victorville 287kV Line
CA	Kern	LADWP	9/10/2007		solar	250	250	Barren Ridge 230kV Substation
CA	Inyo	LADWP	11/2/2007		solar	165	170	Owerns Gorge - Rinaldi 230kV Line
NV	Clark	LADWP	2/20/2008		solar	110	110	Mead-Victorville 287kV Line
NV	Clark	LADWP	2/20/2008		solar	110	110	Mead-Victorville 287kV Line
CA	San Bernardino	LADWP	3/12/2008		solar	350	350	(M) Marketplace-Adelanto 500kV Line
NV	Clark	LADWP	5/19/2008		solar	640	640	McCullough-Victorville 500kV Line
CA	San Bernardino	LADWP	5/19/2008		solar	320	320	(M) Marketplace-Adelanto 500kV Line
CA	Inyo	LADWP	12/11/2007		solar	165	170	Owerns Gorge - Rinaldi 230kV Line
CA	Inyo	LADWP	12/11/2007		solar	245	250	Owerns Gorge - Rinaldi 230kV Line
NV	Clark	LADWP	1/14/2008		solar	320	320	(J) McCullough 230kV Substation
CA	Kern	LADWP	1/31/2006		wind	150	150	Pine Tree 230kV Substation
CA	Kern	LADWP	8/13/2007		wind	25.5	25.5	Pine Tree 230kV Substation
CA	San Bernardino	LADWP	9/19/2007		wind	50	50	Mead-Victorville 287kV Line
CA	San Bernardino	LADWP	9/19/2007		wind	150	150	Mead-Victorville 287kV Line
CA	Inyo	LADWP	10/10/2007		wind	201	201	Owerns Gorge - Rinaldi 230kV Line
CA	San Bernardino	LADWP	1/8/2008		wind	130	130	Mead-Victorville 287kV Line
Utah	Beaver Cty	LADWP	3/2/2007		wind	200	200	(I) IPP 345kV Switchyard

State	County	Utility	Interconn Request Rcv Dt	Type	Fuel	Summer (MW)	Winter (MW)	Station or Transmission Line
Utah	Beaver Cty	LADWP	3/2/2007		wind	200	200	(I) IPP 345kV Switchyard
Utah	Beaver Cty	LADWP	3/2/2007		wind	200	200	(I) IPP 345kV Switchyard
Utah	Beaver Cty	LADWP	12/9/2005		wind	200	200	(I) IPP 345kV Switchyard
Utah	Beaver Cty	LADWP	12/9/2005		wind	200	200	(I) IPP 345kV Switchyard
CA	Mohave	LADWP	2/11/2008	wind turbine	wind	150	150	Pine Tree 230kV Substation
CA	Mohave	LADWP	2/25/2008	wind turbine	wind	300	300	Barren Ridge - Castaic 230kV Line
NV	Clark	NPC	10/12/2006	gas	natural gas	150		Saguaro 138kV line
NV	Clark	NPC	6/13/2008	gas	natural gas	150		Saguaro 138kV line
NV	Clark	NPC	11/26/2007	steam turbine	solar	166		HA 230kV Sub
NV	Clark	NPC	11/26/2007	steam turbine	solar	312		Northwest Sub
NV	Clark	NPC	5/21/2008	steam turbine	solar	240		Bighorn Sub
NV	Nye	NPC	7/21/2008	steam turbine	solar	175		Mercury Switching Station
NV	Clark	NPC	7/23/2008	steam turbine	solar	140		Merchant 230kV Sub
NV	Lincoln	NPC	5/22/2006	coal		700		Red Butte-HA 345
AZ	Mohave		9/28/2006	gas turbine	natural gas	180	180	Griffith Switchyard 230 kV
AZ	Coconino		4/7/2006	wind turbine	wind	500	500	Tap on 345kV Glen Canyon-Pinnacle Peak transmission system
NV	Clark		11/6/2006	wind turbine	wind	300	300	Mead - Davis 230 kV Line
CA	Imperial		12/7/2006	wind turbine	wind	65.1	65.1	Goldmine Tap Substation
AZ	Mohave		3/12/2007	wind turbine	wind	500	500	Peacock Substation
AZ	Navajo	APS			biomass	22		Cholla zeniff
CA	Alameda	PGE	5/7/2008	reciprocating engine	natural gas	115.5		Kelso Substation
AZ	Maricopa	APS			solar	110		Panda Liberty line
AZ	Coconino	APS			wind	125		cholla - show
AZ	Coconino	APS			wind	128		Cholla Show
AZ	Coconino	WAPA			wind	500		Tap on 345kV Glen Canyon-Pinnacle Peak
AZ	Imperial	WAPA			wind	65.1		Goldmine Tap Substation
AZ	Mohave	TEP			wind	15		Dolan Springs Sub
AZ	Mohave	TEP			wind	15		Dolan Springs Sub
AZ	Mohave	WAPA			wind	300		Mead - Davis 230 kV Line
AZ	Mohave	WAPA			wind	500		Peacock Substation
AZ	Navajo	SRP			wind	150		CO-CH, CO-SK 500 kV
AZ	St Johns	TEP			wind	95		Co-Spr

Appendix D. Project Characteristics

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
CENTRAL COAST													
Central Coast	CA	Carrizo North	st32729	Solar Th.	Proxy	200	$5,012	24%	$178	$14	$176	$98	$12
Central Coast	CA	Carrizo North	st32742	Solar Th.	Proxy	200	$5,032	25%	$177	$33	$170	$98	$35
Central Coast	CA	Carrizo North	st32743	Solar Th.	Proxy	200	$4,773	25%	$172	$14	$174	$98	$7
Central Coast	CA	Carrizo North	st32755	Solar Th.	Proxy	200	$4,939	24%	$176	$14	$169	$98	$13
Central Coast	CA	Carrizo North	st32777	Solar Th.	Proxy	200	$4,950	24%	$180	$14	$167	$98	$17
Central Coast	CA	Carrizo North	st32799	Solar Th.	Proxy	200	$5,002	24%	$181	$14	$167	$98	$18
Central Coast	CA	Carrizo North	st32821	Solar Th.	Proxy	200	$5,068	24%	$184	$31	$168	$98	$37
Central Coast	CA	Carrizo North	st32843	Solar Th.	Proxy	200	$4,987	24%	$182	$14	$168	$98	$18
Central Coast	CA	Carrizo South	st25968	Solar Th.	Proxy	200	$5,136	25%	$182	$37	$174	$98	$40
Central Coast	CA	Carrizo South	st26013	Solar Th.	Proxy	200	$5,102	25%	$176	$36	$173	$98	$36
Central Coast	CA	Carrizo South	st26134	Solar Th.	Proxy	200	$5,069	25%	$178	$37	$170	$98	$39
Central Coast	CA	Carrizo South	st26157	Solar Th.	Proxy	200	$5,036	25%	$177	$37	$170	$98	$38
Central Coast	CA	Carrizo South	st26158	Solar Th.	Proxy	200	$5,110	25%	$180	$37	$170	$98	$40
Central Coast	CA	Carrizo South	st26177	Solar Th.	Proxy	200	$5,058	24%	$182	$37	$161	$97	$46
Central Coast	CA	Carrizo South	st26180	Solar Th.	Proxy	200	$4,969	25%	$176	$37	$168	$97	$37
Central Coast	CA	Carrizo South	st26181	Solar Th.	Proxy	200	$5,108	25%	$180	$37	$168	$97	$41
Central Coast	CA	Carrizo South	st26182	Solar Th.	Proxy	200	$5,108	25%	$180	$37	$168	$97	$41
Central Coast	CA	Carrizo South	st26183	Solar Th.	Proxy	200	$5,067	25%	$179	$37	$168	$97	$40
Central Coast	CA	Carrizo South	st26200	Solar Th.	Proxy	200	$4,893	24%	$177	$40	$161	$97	$44
Central Coast	CA	Carrizo South	st26203	Solar Th.	Pre-ID	200	$4,960	25%	$176	$37	$168	$97	$37
Central Coast	CA	Carrizo South	st26226	Solar Th.	Proxy	200	$4,984	24%	$180	$37	$161	$97	$44
Central Coast	CA	Carrizo South	st26249	Solar Th.	Proxy	200	$5,048	24%	$182	$41	$161	$97	$49
Central Coast	CA	Carrizo South	st26204	Solar Th.	Proxy	200	$5,186	25%	$182	$37	$168	$97	$44
Central Coast	CA	Cuyama	st26220	Solar Th.	Proxy	200	$5,208	25%	$177	$39	$169	$97	$43
Central Coast	CA	Cuyama	st26267	Solar Th.	Proxy	200	$4,799	26%	$164	$13	$167	$97	$6
Central Coast	CA	Non-CREZ	Santa Barbara	Biomass	Proxy	23	$5,456	80%	$165	$11	$204	$86	$61
Central Coast	CA	Non-CREZ	WI_169	Wind	Pre-ID	77	$2,673	34%	$101	$11	$39	$87	$13
Central Coast	CA	Non-CREZ	209641	Solar PV	Proxy	20	$7,042	27%	$199	$4	$159	$93	$44
Central Coast	CA	Non-CREZ	209642	Solar PV	Proxy	20	$7,044	27%	$199	$4	$159	$93	$44
Central Coast	CA	Non-CREZ	203668	Solar PV	Proxy	20	$7,088	24%	$224	$4	$151	$97	$61
Central Coast	CA	Non-CREZ	153795	Solar PV	Proxy	20	$7,052	25%	$216	$4	$151	$97	$56
Central Coast	CA	Non-CREZ	153996	Solar PV	Proxy	20	$7,066	25%	$217	$4	$151	$97	$56
Central Coast	CA	Non-CREZ	205642	Solar PV	Proxy	20	$7,054	28%	$198	$4	$163	$94	$42
Central Coast	CA	Non-CREZ	99944	Solar PV	Proxy	20	$7,086	25%	$223	$4	$148	$97	$61
Central Coast	CA	Non-CREZ	209574	Solar PV	Proxy	20	$7,043	27%	$198	$4	$160	$93	$43
Central Coast	CA	Non-CREZ	209575	Solar PV	Proxy	20	$7,043	27%	$198	$4	$160	$93	$43
Central Coast	CA	Non-CREZ	202886	Solar PV	Proxy	20	$7,075	25%	$221	$4	$153	$97	$58
Central Coast	CA	Non-CREZ	158394	Solar PV	Proxy	20	$7,045	26%	$211	$4	$159	$97	$48

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Central Coast	CA	Non-CREZ	151816	Solar PV	Proxy	20	$7,059	25%	$221	$4	$146	$94	$65
Central Coast	CA	Non-CREZ	151414	Solar PV	Proxy	20	$7,061	25%	$221	$4	$146	$94	$65
Central Coast	CA	Non-CREZ	151956	Solar PV	Proxy	20	$7,061	25%	$221	$4	$146	$94	$65
Central Coast	CA	Non-CREZ	151957	Solar PV	Proxy	20	$7,062	25%	$222	$4	$144	$94	$66
Central Coast	CA	Non-CREZ	204334	Solar PV	Proxy	20	$7,050	25%	$221	$4	$153	$94	$61
Central Coast	CA	Non-CREZ	204198	Solar PV	Proxy	20	$7,063	25%	$220	$4	$154	$94	$60
Central Coast	CA	Non-CREZ	154188	Solar PV	Proxy	20	$7,110	25%	$219	$4	$150	$94	$62
Central Coast	CA	Non-CREZ	204610	Solar PV	Proxy	20	$7,048	25%	$222	$4	$155	$94	$61
Central Coast	CA	Non-CREZ	100283	Solar PV	Proxy	20	$7,088	25%	$223	$4	$148	$94	$65
Central Coast	CA	Non-CREZ	151993	Solar PV	Proxy	20	$7,112	24%	$227	$4	$141	$94	$71
Central Coast	CA	Non-CREZ	151595	Solar PV	Proxy	20	$7,115	24%	$225	$4	$143	$94	$69
Central Coast	CA	Non-CREZ	152597	Solar PV	Proxy	20	$7,078	25%	$222	$4	$146	$94	$65
Central Coast	CA	Non-CREZ	153475	Solar PV	Proxy	20	$7,112	25%	$220	$4	$150	$97	$59
Central Coast	CA	Non-CREZ	204941	Solar PV	Proxy	20	$7,053	25%	$222	$4	$156	$94	$60
Central Coast	CA	Non-CREZ	257595	Solar PV	Proxy	20	$7,050	27%	$201	$4	$157	$94	$45
Central Coast	CA	Non-CREZ	205917	Solar PV	Proxy	20	$7,046	28%	$198	$4	$161	$93	$42
Central Coast	CA	Non-CREZ	205781	Solar PV	Proxy	20	$7,049	28%	$198	$4	$161	$93	$42
Central Coast	CA	Non-CREZ	152349	Solar PV	Proxy	20	$7,051	25%	$219	$4	$149	$94	$62
Central Coast	CA	Non-CREZ	152286	Solar PV	Proxy	20	$7,064	25%	$219	$4	$149	$94	$62
Central Coast	CA	Non-CREZ	259317	Solar PV	Proxy	20	$7,049	24%	$225	$4	$145	$93	$68
Central Coast	CA	Non-CREZ	256292	Solar PV	Proxy	20	$7,057	28%	$198	$4	$162	$97	$38
Central Coast	CA	Non-CREZ	151662	Solar PV	Proxy	20	$7,044	24%	$223	$4	$143	$94	$67
Central Coast	CA	Non-CREZ	151663	Solar PV	Proxy	20	$7,046	24%	$223	$4	$143	$94	$67
Central Coast	CA	Non-CREZ	204994	Solar PV	Proxy	20	$7,085	25%	$223	$4	$156	$94	$61
Central Coast	CA	Non-CREZ	259271	Solar PV	Proxy	20	$7,047	27%	$202	$4	$154	$93	$48
Central Coast	CA	Non-CREZ	205243	Solar PV	Proxy	20	$7,051	25%	$221	$4	$157	$94	$59
Central Coast	CA	Non-CREZ	154466	Solar PV	Proxy	20	$7,041	25%	$214	$4	$153	$97	$53
Central Coast	CA	Non-CREZ	154467	Solar PV	Proxy	20	$7,045	25%	$214	$4	$153	$97	$53
Central Coast	CA	Non-CREZ	152085	Solar PV	Proxy	20	$7,051	25%	$219	$4	$149	$94	$62
Central Coast	CA	Non-CREZ	151327	Solar PV	Proxy	20	$7,118	24%	$225	$4	$143	$94	$69
Central Coast	CA	Non-CREZ	151464	Solar PV	Proxy	20	$7,124	24%	$225	$4	$143	$94	$69
Central Coast	CA	Non-CREZ	259440	Solar PV	Proxy	20	$7,063	25%	$216	$4	$155	$94	$57
Central Coast	CA	Non-CREZ	151398	Solar PV	Proxy	20	$7,077	24%	$224	$4	$143	$94	$68
Central Coast	CA	Non-CREZ	154476	Solar PV	Proxy	20	$7,065	26%	$212	$4	$158	$97	$49
Central Coast	CA	Non-CREZ	154474	Solar PV	Proxy	20	$7,073	25%	$215	$4	$153	$97	$54
Central Coast	CA	Santa Barbara	WI_53	Wind	Pre-ID	104	$2,645	30%	$117	$43	$70	$88	$45
Central Coast	CA	Santa Barbara	WI_54	Wind	Proxy	137	$2,641	31%	$114	$43	$73	$89	$41
Central Coast	CA	Santa Barbara	WI_55	Wind	Proxy	192	$2,612	32%	$108	$41	$53	$87	$44
NORTH OUT-OF-STATE													

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
N. OOS	BC	British Columbia	Harrison Hot Springs	Geothermal	Pre-ID	16	$5,850	80%	$117	$56	$204	$85	$57
N. OOS	BC	British Columbia	Kootenay	Geothermal	Pre-ID	16	$5,850	80%	$117	$56	$204	$85	$57
N. OOS	BC	British Columbia	Meager Creek / Pebble Creek	Geothermal	Pre-ID	90	$4,261	90%	$66	$49	$204	$85	-$1
N. OOS	BC	British Columbia	Mt. Cayley	Geothermal	Pre-ID	45	$4,333	90%	$71	$49	$204	$85	$5
N. OOS	BC	British Columbia	Mt. Garibaldi	Geothermal	Pre-ID	45	$4,333	90%	$71	$49	$204	$85	$5
N. OOS	BC	British Columbia	Okanagan	Geothermal	Pre-ID	16	$5,850	80%	$117	$56	$204	$85	$57
N. OOS	BC	British Columbia	Upper Arrow	Geothermal	Pre-ID	16	$5,850	80%	$117	$56	$204	$85	$57
N. OOS	BC	British Columbia	BC Near	Biomass	Proxy	700	$4,863	80%	$146	$56	$204	$85	$87
N. OOS	BC	British Columbia	BC Long	Biomass	Proxy	820	$4,863	80%	$146	$56	$204	$85	$87
N. OOS	BC	British Columbia	WI_BC_3	Wind	Proxy	1415	$2,440	23%	$150	$71	$204	$85	$106
N. OOS	BC	British Columbia	WI_BC_4_distant	Wind	Proxy	1000	$2,440	29%	$117	$65	$204	$85	$67
N. OOS	BC	British Columbia	WI_BC_4	Wind	Proxy	1415	$2,440	29%	$112	$64	$204	$85	$61
N. OOS	BC	British Columbia	WI_BC_5	Wind	Proxy	1940	$2,440	35%	$88	$59	$204	$85	$32
N. OOS	BC	British Columbia	WI_BC_6	Wind	Proxy	610	$2,440	43%	$66	$55	$204	$85	$5
N. OOS	BC	British Columbia	WI_BC_7	Wind	Proxy	250	$2,440	52%	$49	$52	$204	$85	-$15
N. OOS	OR	Oregon	Alvord Hot Springs	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$48
N. OOS	OR	Oregon	Borax Lake	Geothermal	Pre-ID	16	$5,400	80%	$111	$26	$204	$85	$23
N. OOS	OR	Oregon	Crump's Hot Springs	Geothermal	Pre-ID	32	$4,550	80%	$89	$25	$204	$85	$0
N. OOS	OR	Oregon	Klamath Falls	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$48
N. OOS	OR	Oregon	Lakeview (includes Hot Lake area)	Geothermal	Pre-ID	16	$5,400	80%	$111	$26	$204	$85	$23
N. OOS	OR	Oregon	Mickey Hot Springs	Geothermal	Pre-ID	16	$5,400	80%	$111	$26	$204	$85	$23
N. OOS	OR	Oregon	Mt Hood (outside wilderness area)	Geothermal	Pre-ID	45	$4,222	90%	$71	$22	$204	$85	-$18
N. OOS	OR	Oregon	Mt Rose (near Roseburg, along I-5)	Geothermal	Pre-ID	45	$4,000	90%	$67	$22	$204	$85	-$21
N. OOS	OR	Oregon	Neal Hot Springs (incl. Vale)	Geothermal	Pre-ID	24	$4,838	80%	$94	$25	$204	$85	$5
N. OOS	OR	Oregon	Newberry Caldera	Geothermal	Pre-ID	180	$4,000	90%	$67	$22	$204	$85	-$22
N. OOS	OR	Oregon	Summer Lake	Geothermal	Pre-ID	16	$5,400	80%	$111	$26	$204	$85	$23
N. OOS	OR	Oregon	Three Creeks Butte (15 mi NW of Bend)	Geothermal	Pre-ID	16	$5,400	80%	$111	$26	$204	$85	$23
N. OOS	OR	Oregon	Three Sisters	Geothermal	Pre-ID	45	$4,222	90%	$71	$22	$204	$85	-$18
N. OOS	OR	Oregon	Trout Creek	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$48
N. OOS	OR	Oregon	Warm Springs (OR)	Geothermal	Pre-ID	45	$4,000	90%	$67	$22	$204	$85	-$21
N. OOS	OR	Oregon	Columbia	Biomass	Proxy	21	$5,376	80%	$158	$27	$204	$85	$72
N. OOS	OR	Oregon	Umatilla	Biomass	Proxy	20	$5,428	80%	$162	$27	$204	$85	$76

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
N. OOS	OR	Oregon	Benton	Biomass	Proxy	23	$5,281	80%	$155	$27	$204	$85	$69
N. OOS	OR	Oregon	Lane	Biomass	Proxy	82	$4,115	80%	$123	$25	$204	$85	$34
N. OOS	OR	Oregon	Douglas	Biomass	Proxy	38	$4,785	80%	$141	$26	$204	$85	$54
N. OOS	OR	Oregon	Jackson 1	Biomass	Proxy	33	$4,920	80%	$145	$26	$204	$85	$58
N. OOS	OR	Oregon	Washington	Biomass	Proxy	20	$5,428	80%	$171	$27	$204	$85	$85
N. OOS	OR	Oregon	Klamath	Biomass	Proxy	23	$5,281	80%	$167	$27	$204	$85	$80
N. OOS	OR	Oregon	Union	Biomass	Proxy	21	$5,376	80%	$161	$27	$204	$85	$75
N. OOS	OR	Oregon	Yamhill	Biomass	Proxy	20	$5,428	80%	$162	$27	$204	$85	$76
N. OOS	OR	Oregon	Tillamook	Biomass	Proxy	26	$5,155	80%	$159	$27	$204	$85	$72
N. OOS	OR	Oregon	Polk	Biomass	Proxy	22	$5,327	80%	$164	$27	$204	$85	$78
N. OOS	OR	Oregon	Linn	Biomass	Proxy	53	$4,483	80%	$145	$26	$204	$85	$57
N. OOS	OR	Oregon	Jackson 2	Biomass	Proxy	20	$5,428	80%	$169	$27	$204	$85	$82
N. OOS	OR	Oregon	Coos	Biomass	Proxy	32	$4,949	80%	$153	$26	$204	$85	$66
N. OOS	OR	Oregon	WI_OR_10_3	Wind	Proxy	79	$2,412	23%	$159	$62	$6	$82	$135
N. OOS	OR	Oregon	WI_OR_10_4	Wind	Proxy	49	$2,440	29%	$121	$50	$6	$82	$87
N. OOS	OR	Oregon	WI_OR_10_5	Wind	Proxy	20	$2,441	35%	$95	$43	$6	$82	$53
N. OOS	OR	Oregon	WI_OR_10_6	Wind	Proxy	13	$2,440	43%	$71	$36	$6	$82	$24
N. OOS	OR	Oregon	WI_OR_11_3	Wind	Proxy	6	$2,412	23%	$157	$61	$8	$86	$128
N. OOS	OR	Oregon	WI_OR_11_4	Wind	Proxy	1	$2,442	29%	$119	$50	$8	$86	$80
N. OOS	OR	Oregon	WI_OR_12_3	Wind	Proxy	44	$2,412	23%	$154	$61	$20	$80	$126
N. OOS	OR	Oregon	WI_OR_12_4	Wind	Proxy	17	$2,440	29%	$117	$50	$20	$80	$79
N. OOS	OR	Oregon	WI_OR_12_5	Wind	Proxy	5	$2,441	35%	$92	$43	$20	$80	$48
N. OOS	OR	Oregon	WI_OR_12_6	Wind	Proxy	4	$2,440	43%	$69	$36	$20	$80	$19
N. OOS	OR	Oregon	WI_OR_13_3	Wind	Proxy	92	$2,412	23%	$155	$61	$4	$81	$134
N. OOS	OR	Oregon	WI_OR_13_4	Wind	Proxy	38	$2,441	29%	$118	$50	$4	$81	$86
N. OOS	OR	Oregon	WI_OR_13_5	Wind	Proxy	17	$2,440	35%	$92	$43	$4	$81	$53
N. OOS	OR	Oregon	WI_OR_13_6	Wind	Proxy	10	$2,440	43%	$69	$36	$4	$81	$24
N. OOS	OR	Oregon	WI_OR_14_3	Wind	Proxy	97	$2,412	23%	$162	$62	$88	$86	$95
N. OOS	OR	Oregon	WI_OR_14_4	Wind	Proxy	81	$2,441	29%	$124	$51	$88	$86	$54
N. OOS	OR	Oregon	WI_OR_14_5	Wind	Proxy	39	$2,441	35%	$97	$43	$88	$86	$25
N. OOS	OR	Oregon	WI_OR_14_6	Wind	Proxy	30	$2,440	43%	$73	$36	$88	$86	$0
N. OOS	OR	Oregon	WI_OR_15_3	Wind	Proxy	60	$2,412	23%	$158	$62	$27	$89	$116
N. OOS	OR	Oregon	WI_OR_15_4	Wind	Proxy	32	$2,440	29%	$120	$50	$27	$89	$70
N. OOS	OR	Oregon	WI_OR_15_5	Wind	Proxy	11	$2,441	35%	$94	$43	$27	$89	$39
N. OOS	OR	Oregon	WI_OR_15_6	Wind	Proxy	7	$2,441	43%	$71	$36	$27	$89	$10
N. OOS	OR	Oregon	WI_OR_16_3	Wind	Proxy	1441	$2,412	23%	$156	$61	$7	$81	$133
N. OOS	OR	Oregon	WI_OR_16_4	Wind	Proxy	421	$2,440	29%	$119	$50	$7	$81	$85
N. OOS	OR	Oregon	WI_OR_16_5	Wind	Proxy	63	$2,440	35%	$93	$43	$7	$81	$52
N. OOS	OR	Oregon	WI_OR_16_6	Wind	Proxy	24	$2,441	43%	$70	$36	$7	$81	$23

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
N. OOS	OR	Oregon	WI_OR_17_3	Wind	Proxy	134	$2,412	23%	$151	$61	$3	$84	$127
N. OOS	OR	Oregon	WI_OR_17_4	Wind	Proxy	33	$2,440	29%	$115	$50	$3	$84	$79
N. OOS	OR	Oregon	WI_OR_17_5	Wind	Proxy	6	$2,440	35%	$90	$43	$3	$84	$47
N. OOS	OR	Oregon	WI_OR_17_6	Wind	Proxy	4	$2,440	43%	$67	$36	$3	$84	$18
N. OOS	OR	Oregon	WI_OR_18_3	Wind	Proxy	872	$2,412	23%	$157	$61	$14	$78	$133
N. OOS	OR	Oregon	WI_OR_18_4	Wind	Proxy	148	$2,440	29%	$120	$50	$14	$78	$86
N. OOS	OR	Oregon	WI_OR_18_5	Wind	Proxy	27	$2,441	35%	$94	$43	$14	$78	$54
N. OOS	OR	Oregon	WI_OR_18_6	Wind	Proxy	16	$2,441	43%	$70	$36	$14	$78	$24
N. OOS	OR	Oregon	WI_OR_19_3	Wind	Proxy	639	$2,412	23%	$161	$62	$6	$81	$140
N. OOS	OR	Oregon	WI_OR_19_4	Wind	Proxy	98	$2,440	29%	$123	$51	$6	$81	$90
N. OOS	OR	Oregon	WI_OR_19_5	Wind	Proxy	11	$2,440	35%	$96	$43	$6	$81	$57
N. OOS	WA	Washington	Whitman	Biomass	Proxy	22	$5,327	80%	$154	$45	$204	$85	$85
N. OOS	WA	Washington	Snohomish	Biomass	Proxy	26	$5,155	80%	$152	$44	$204	$85	$82
N. OOS	WA	Washington	Mason	Biomass	Proxy	25	$5,195	80%	$153	$44	$204	$85	$83
N. OOS	WA	Washington	Pierce	Biomass	Proxy	82	$4,115	80%	$123	$41	$204	$85	$50
N. OOS	WA	Washington	Yakima	Biomass	Proxy	31	$4,980	80%	$147	$44	$204	$85	$77
N. OOS	WA	Washington	Lewis	Biomass	Proxy	34	$4,891	80%	$144	$43	$204	$85	$74
N. OOS	WA	Washington	Cowlitz 1	Biomass	Proxy	44	$4,649	80%	$137	$43	$204	$85	$66
N. OOS	WA	Washington	Stevens	Biomass	Proxy	26	$5,155	80%	$163	$44	$204	$85	$94
N. OOS	WA	Washington	Grays Harbor/Jefferson	Biomass	Proxy	34	$4,891	80%	$156	$43	$204	$85	$85
N. OOS	WA	Washington	Lincoln	Biomass	Proxy	22	$5,327	80%	$166	$45	$204	$85	$97
N. OOS	WA	Washington	King	Biomass	Proxy	33	$4,920	80%	$154	$43	$204	$85	$84
N. OOS	WA	Washington	Pacific	Biomass	Proxy	22	$5,327	80%	$166	$45	$204	$85	$97
N. OOS	WA	Washington	Walla Walla	Biomass	Proxy	23	$5,281	80%	$166	$45	$204	$85	$97
N. OOS	WA	Washington	Cowlitz 2	Biomass	Proxy	25	$5,195	80%	$160	$44	$204	$85	$91
N. OOS	WA	Washington	WI_WA_1_3	Wind	Proxy	90	$2,412	23%	$165	$113	$12	$83	$189
N. OOS	WA	Washington	WI_WA_1_4	Wind	Proxy	38	$2,441	29%	$126	$91	$12	$83	$129
N. OOS	WA	Washington	WI_WA_1_5	Wind	Proxy	14	$2,440	35%	$99	$77	$12	$83	$89
N. OOS	WA	Washington	WI_WA_1_6	Wind	Proxy	18	$2,440	43%	$75	$64	$12	$83	$52
N. OOS	WA	Washington	WI_WA_2_3	Wind	Proxy	21	$2,412	23%	$164	$113	$13	$82	$189
N. OOS	WA	Washington	WI_WA_2_4	Wind	Proxy	9	$2,441	29%	$125	$91	$13	$82	$129
N. OOS	WA	Washington	WI_WA_2_5	Wind	Proxy	7	$2,441	35%	$98	$77	$13	$82	$89
N. OOS	WA	Washington	WI_WA_2_6	Wind	Proxy	17	$2,440	43%	$74	$64	$13	$82	$52
N. OOS	WA	Washington	WI_WA_3_3	Wind	Proxy	44	$2,412	23%	$160	$112	$40	$89	$164
N. OOS	WA	Washington	WI_WA_3_4	Wind	Proxy	31	$2,440	29%	$122	$91	$40	$89	$108
N. OOS	WA	Washington	WI_WA_3_5	Wind	Proxy	21	$2,440	35%	$96	$76	$40	$89	$70
N. OOS	WA	Washington	WI_WA_3_6	Wind	Proxy	54	$2,440	43%	$72	$63	$40	$89	$36
N. OOS	WA	Washington	WI_WA_4_3	Wind	Proxy	311	$2,412	23%	$157	$112	$16	$80	$181

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
N. OOS	WA	Washington	WI_WA_4_4	Wind	Proxy	270	$2,440	29%	$120	$90	$16	$80	$123
N. OOS	WA	Washington	WI_WA_4_5	Wind	Proxy	82	$2,440	35%	$94	$76	$16	$80	$84
N. OOS	WA	Washington	WI_WA_4_6	Wind	Proxy	27	$2,440	43%	$70	$63	$16	$80	$49
N. OOS	WA	Washington	WI_WA_5_3	Wind	Proxy	982	$2,412	23%	$156	$112	$88	$86	$138
N. OOS	WA	Washington	WI_WA_5_4	Wind	Proxy	326	$2,440	29%	$119	$90	$88	$86	$88
N. OOS	WA	Washington	WI_WA_5_5	Wind	Proxy	90	$2,441	35%	$93	$76	$88	$86	$54
N. OOS	WA	Washington	WI_WA_5_6	Wind	Proxy	95	$2,440	43%	$70	$63	$88	$86	$23
N. OOS	WA	Washington	WI_WA_6_3	Wind	Proxy	6	$2,413	23%	$162	$112	$14	$77	$190
N. OOS	WA	Washington	WI_WA_6_4	Wind	Proxy	2	$2,440	29%	$123	$91	$14	$77	$131
N. OOS	WA	Washington	WI_WA_7_3	Wind	Proxy	144	$2,412	23%	$156	$112	$72	$81	$151
N. OOS	WA	Washington	WI_WA_7_4	Wind	Proxy	24	$2,441	29%	$118	$90	$72	$81	$99
N. OOS	WA	Washington	WI_WA_7_5	Wind	Proxy	5	$2,441	35%	$93	$76	$72	$81	$64
N. OOS	WA	Washington	WI_WA_8_3	Wind	Proxy	59	$2,412	23%	$158	$112	$22	$80	$179
N. OOS	WA	Washington	WI_WA_8_4	Wind	Proxy	18	$2,441	29%	$120	$90	$22	$80	$122
N. OOS	WA	Washington	WI_WA_8_5	Wind	Proxy	10	$2,440	35%	$94	$76	$22	$80	$83
N. OOS	WA	Washington	WI_WA_8_6	Wind	Proxy	8	$2,440	43%	$71	$63	$22	$80	$48
N. OOS	WA	Washington	WI_WA_9_3	Wind	Proxy	701	$2,412	23%	$151	$111	$32	$78	$169
N. OOS	WA	Washington	WI_WA_9_4	Wind	Proxy	197	$2,441	29%	$115	$90	$32	$78	$114
N. OOS	WA	Washington	WI_WA_9_5	Wind	Proxy	34	$2,441	35%	$90	$76	$32	$78	$77
N. OOS	WA	Washington	WI_WA_9_6	Wind	Proxy	7	$2,441	43%	$67	$63	$32	$78	$44
NEVADA													
Nevada	CA	Central Nevada	Long Valley - M-P Leases	Geothermal	Pre-ID	40	$3,750	80%	$74	$8	$204	$88	-$35
Nevada	NV	Central Nevada	Alkali Hot Springs	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Alum	Geothermal	Pre-ID	32	$4,482	80%	$88	$24	$204	$85	-$2
Nevada	NV	Central Nevada	Aurora	Geothermal	Pre-ID	100	$4,625	80%	$84	$24	$204	$85	-$6
Nevada	NV	Central Nevada	Candelaria Hills	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Darrough Hot Springs	Geothermal	Pre-ID	16	$5,400	80%	$111	$25	$204	$85	$22
Nevada	NV	Central Nevada	Dixie Valley	Geothermal	Pre-ID	180	$4,176	90%	$65	$11	$204	$85	-$35
Nevada	NV	Central Nevada	Emigrant	Geothermal	Pre-ID	40	$5,712	80%	$108	$25	$204	$85	$19
Nevada	NV	Central Nevada	Excelsior	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Fish Lake	Geothermal	Pre-ID	32	$5,825	80%	$110	$25	$204	$85	$22
Nevada	NV	Central Nevada	Hawthorne	Geothermal	Pre-ID	12	$6,585	80%	$132	$26	$204	$85	$44
Nevada	NV	Central Nevada	Hot Creek Ranch	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Hyder Hot Springs	Geothermal	Pre-ID	12	$10,416	80%	$197	$30	$204	$85	$114
Nevada	NV	Central Nevada	Jersey Hot Springs (aka Jersey Valley)	Geothermal	Pre-ID	20	$5,025	80%	$97	$24	$204	$85	$8
Nevada	NV	Central Nevada	McGinness Hills	Geothermal	Pre-ID	20	$5,025	80%	$97	$24	$204	$85	$8

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Nevada	NV	Central Nevada	Pearl Hot Springs	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Pirouette Mountain	Geothermal	Pre-ID	16	$4,565	80%	$97	$24	$204	$85	$7
Nevada	NV	Central Nevada	Rhodes Marsh	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Silver Peak	Geothermal	Pre-ID	16	$5,400	80%	$111	$25	$204	$85	$22
Nevada	NV	Central Nevada	Sou Hot Springs (aka Seven Devils Springs)	Geothermal	Pre-ID	12	$6,309	80%	$127	$26	$204	$85	$39
Nevada	NV	Central Nevada	Teels Marsh	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Walker Warm Springs (NV)	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Warm Springs (NV)	Geothermal	Pre-ID	8	$6,750	80%	$134	$26	$204	$85	$47
Nevada	NV	Central Nevada	Wedell Springs (aka Gabbs Valley)	Geothermal	Pre-ID	16	$5,400	80%	$111	$25	$204	$85	$22
Nevada	NV	Northern Nevada	Adobe Valley	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Antelope (aka Bartholomae Hot Springs)	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Baltazor	Geothermal	Pre-ID	12	$7,800	80%	$152	$28	$204	$85	$67
Nevada	NV	Northern Nevada	Beowawe	Geothermal	Pre-ID	23	$4,836	90%	$81	$23	$204	$85	-$7
Nevada	NV	Northern Nevada	Boulder Valley	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Brady's	Geothermal	Pre-ID	8	$5,081	80%	$106	$25	$204	$85	$17
Nevada	NV	Northern Nevada	Colado	Geothermal	Pre-ID	16	$6,978	80%	$138	$27	$204	$85	$52
Nevada	NV	Northern Nevada	Crescent Valley	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Delcer Buttes	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Desert Peak	Geothermal	Pre-ID	40	$3,849	80%	$76	$23	$204	$85	-$14
Nevada	NV	Northern Nevada	Desert Queen	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Devil's Punch Bowl (north of Deeth)	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Double (Black Rock) Hot Springs (aka Sulfur Hot Springs)	Geothermal	Pre-ID	16	$7,496	80%	$147	$28	$204	$85	$61
Nevada	NV	Northern Nevada	Dyke Hot Springs	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Empire (aka San Emidio)	Geothermal	Pre-ID	8	$6,558	80%	$131	$26	$204	$85	$44
Nevada	NV	Northern Nevada	Fly Ranch (Hualapi Flat & Granite Ranch)	Geothermal	Pre-ID	12	$12,148	80%	$227	$33	$204	$85	$146
Nevada	NV	Northern Nevada	Gerlach (aka Great Boiling Springs)	Geothermal	Pre-ID	16	$6,030	80%	$122	$26	$204	$85	$34

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Nevada	NV	Northern Nevada	Gridley Lake	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Hazen (aka Patua Hot Springs)	Geothermal	Pre-ID	20	$6,078	80%	$116	$26	$204	$85	$28
Nevada	NV	Northern Nevada	Hot Creek Springs (aka Carlotti Ranch Springs)	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Hot Pot	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Howard Hot Springs	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Jackrabbit	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Kyle Hot Springs (aka Granite Montain)	Geothermal	Pre-ID	16	$5,562	80%	$114	$25	$204	$85	$26
Nevada	NV	Northern Nevada	Leach Hot Springs	Geothermal	Pre-ID	16	$10,091	80%	$192	$30	$204	$85	$109
Nevada	NV	Northern Nevada	Lee Hot Springs	Geothermal	Pre-ID	12	$6,395	80%	$128	$26	$204	$85	$41
Nevada	NV	Northern Nevada	Macfarlanes Bath House Spring	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	McCoy	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	McGee Mountain	Geothermal	Pre-ID	12	$5,091	80%	$106	$25	$204	$85	$17
Nevada	NV	Northern Nevada	New York Canyon	Geothermal	Pre-ID	20	$5,273	80%	$102	$25	$204	$85	$13
Nevada	NV	Northern Nevada	North Valley (incl. Black Warrior, Fireball Ridge)	Geothermal	Pre-ID	28	$4,418	80%	$88	$24	$204	$85	-$2
Nevada	NV	Northern Nevada	Pinto Hot Springs	Geothermal	Pre-ID	16	$4,637	80%	$98	$24	$204	$85	$9
Nevada	NV	Northern Nevada	Preston Springs	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Pumpernickel Valley	Geothermal	Pre-ID	16	$6,389	80%	$128	$26	$204	$85	$41
Nevada	NV	Northern Nevada	Pyramid Lake Indian Reservation (aka The Needles)	Geothermal	Pre-ID	16	$5,825	80%	$119	$26	$204	$85	$31
Nevada	NV	Northern Nevada	Reese River (aka Shoshone)	Geothermal	Pre-ID	12	$4,793	80%	$101	$25	$204	$85	$12
Nevada	NV	Northern Nevada	Rose Creek	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Rye Patch (incl. Humboldt House)	Geothermal	Pre-ID	32	$5,655	80%	$107	$25	$204	$85	$19
Nevada	NV	Northern Nevada	Smith Creek Valley	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Soda Lake	Geothermal	Pre-ID	12	$3,782	80%	$83	$23	$204	$85	-$7
Nevada	NV	Northern Nevada	Spencer (aka MacLeod's Hot Springs)	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Nevada	NV	Northern Nevada	Steamboat Hot Springs	Geothermal	Pre-ID	12	$4,000	80%	$87	$24	$204	$85	-$3
Nevada	NV	Northern Nevada	Sulphur Hot Springs (aka Ruby Valley)	Geothermal	Pre-ID	12	$6,000	80%	$122	$26	$204	$85	$34
Nevada	NV	Northern Nevada	Tracy	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Trego	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Trinity Mountains	Geothermal	Pre-ID	32	$4,763	80%	$92	$24	$204	$85	$3
Nevada	NV	Northern Nevada	Tungsten Mountain	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Vigus Canyon	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Wabuska	Geothermal	Pre-ID	8	$8,703	80%	$168	$29	$204	$85	$83
Nevada	NV	Northern Nevada	Wells (aka Humboldt Wells)	Geothermal	Pre-ID	8	$6,750	80%	$134	$27	$204	$85	$47
Nevada	NV	Northern Nevada	Wilson Hot Springs (aka Barren Hills)	Geothermal	Pre-ID	12	$4,641	80%	$98	$24	$204	$85	$9
Nevada	NV	Southern Nevada	WI_NV_12	Wind	Pre-ID	485	$2,374	25%	$137	$35	$41	$85	$69
Nevada	NV	Southern Nevada	WI_NV_13	Wind	Pre-ID	220	$2,373	24%	$140	$36	$41	$85	$72
Nevada	NV	Southern Nevada	WI_NV_17	Wind	Pre-ID	180	$2,374	25%	$132	$34	$41	$85	$63
Nevada	NV	Southern Nevada	WI_NV_33	Wind	Pre-ID	153	$2,373	24%	$148	$36	$41	$83	$81
Nevada	NV	Southern Nevada	WI_NV_7	Wind	Pre-ID	145	$2,373	25%	$137	$35	$41	$85	$69
Nevada	NV	Southern Nevada	WI_NV_6	Wind	Pre-ID	92	$2,377	26%	$128	$33	$41	$85	$59
Nevada	NV	Southern Nevada	WI_NV_27	Wind	Pre-ID	89	$2,380	29%	$113	$31	$41	$85	$43
Nevada	NV	Southern Nevada	WI_NV_25	Wind	Pre-ID	69	$2,375	24%	$138	$35	$41	$85	$69
Nevada	NV	Southern Nevada	WI_NV_14	Wind	Pre-ID	41	$2,374	23%	$145	$37	$41	$85	$77
Nevada	NV	Southern Nevada	solnvaz_14	Solar Th.	Pre-ID	126	$5,183	28%	$163	$33	$147	$98	$37
Nevada	NV	Southern Nevada	solnvaz_15	Solar Th.	Pre-ID	130	$5,183	25%	$178	$35	$136	$99	$53
Nevada	NV	Southern Nevada	solnvaz_17	Solar Th.	Pre-ID	1084	$5,183	27%	$167	$33	$142	$98	$41
Nevada	NV	Southern Nevada	solnvaz_19	Solar Th.	Pre-ID	889	$5,183	27%	$167	$33	$153	$97	$38
Nevada	NV	Southern Nevada	solnvaz_20	Solar Th.	Pre-ID	19	$5,183	27%	$165	$33	$152	$97	$37
Nevada	NV	Southern Nevada	solnvaz_21	Solar Th.	Pre-ID	86	$5,183	29%	$153	$31	$164	$97	$23
Nevada	NV	Southern Nevada	solnvaz_22	Solar Th.	Pre-ID	114	$5,183	27%	$169	$33	$153	$97	$40
Nevada	NV	Southern Nevada	solnvaz_23	Solar Th.	Pre-ID	184	$5,183	27%	$165	$33	$152	$97	$37
Nevada	NV	Southern Nevada	solnvaz_24	Solar Th.	Pre-ID	18	$5,183	28%	$164	$33	$147	$97	$39
Nevada	NV	Southern Nevada	solnvaz_25	Solar Th.	Pre-ID	29	$5,183	28%	$163	$33	$147	$97	$38
Nevada	NV	Southern Nevada	solnvaz_26	Solar Th.	Pre-ID	197	$5,183	29%	$157	$32	$158	$97	$28
Nevada	NV	Southern Nevada	solnvaz_27	Solar Th.	Pre-ID	7	$5,183	28%	$163	$33	$150	$97	$36
Nevada	NV	Southern Nevada	solnvaz_28	Solar Th.	Pre-ID	28	$5,183	29%	$156	$31	$163	$98	$25
Nevada	NV	Southern Nevada	solnvaz_29	Solar Th.	Pre-ID	446	$5,183	28%	$163	$32	$147	$97	$38
Nevada	NV	Southern Nevada	solnvaz_30	Solar Th.	Pre-ID	907	$5,183	29%	$158	$32	$159	$97	$29
Nevada	NV	Southern Nevada	solnvaz_31	Solar Th.	Pre-ID	723	$5,183	28%	$160	$32	$162	$98	$28

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Nevada	NV	Southern Nevada	solnvaz_32	Solar Th.	Pre-ID	73	$5,183	25%	$181	$36	$137	$97	$57
Nevada	NV	Southern Nevada	solnvaz_33	Solar Th.	Pre-ID	9	$5,183	25%	$181	$36	$137	$97	$57
Nevada	NV	Southern Nevada	solnvaz_34	Solar Th.	Pre-ID	718	$5,183	28%	$163	$32	$161	$98	$32
Nevada	NV	Southern Nevada	solnvaz_35	Solar Th.	Pre-ID	901	$5,183	25%	$183	$36	$137	$97	$58
Nevada	NV	Southern Nevada	solnvaz_36	Solar Th.	Pre-ID	303	$5,183	26%	$175	$34	$146	$97	$48
Nevada	NV	Southern Nevada	solnvaz_37	Solar Th.	Pre-ID	436	$5,183	29%	$158	$31	$171	$98	$24
NORTHERN CA													
Northern CA	CA	Lassen North-A	WI_123	Wind	Pre-ID	77	$2,657	33%	$107	$32	$53	$87	$33
Northern CA	CA	Lassen North-A	WI_125	Wind	Proxy	81	$2,674	33%	$107	$32	$53	$87	$33
Northern CA	CA	Lassen North-A	WI_157	Wind	Pre-ID	122	$2,542	40%	$81	$30	$53	$87	$8
Northern CA	CA	Lassen North-A	WI_203	Wind	Pre-ID	52	$2,574	33%	$103	$29	$53	$87	$26
Northern CA	CA	Lassen North-B	WI_116	Wind	Proxy	68	$2,469	27%	$133	$35	$53	$87	$58
Northern CA	CA	Lassen North-B	WI_117	Wind	Proxy	61	$2,411	29%	$120	$33	$53	$87	$44
Northern CA	CA	Lassen North-B	WI_118	Wind	Pre-ID	104	$2,423	28%	$126	$34	$53	$87	$50
Northern CA	CA	Lassen North-B	WI_121	Wind	Pre-ID	45	$2,653	28%	$139	$48	$53	$87	$77
Northern CA	CA	Lassen North-B	WI_124	Wind	Pre-ID	143	$2,654	31%	$111	$33	$53	$87	$38
Northern CA	CA	Lassen North-B	WI_126	Wind	Proxy	108	$2,635	29%	$124	$33	$53	$87	$48
Northern CA	CA	Lassen North-B	WI_127	Wind	Proxy	107	$2,487	28%	$122	$33	$53	$87	$46
Northern CA	CA	Lassen North-B	WI_128	Wind	Proxy	75	$2,605	28%	$131	$41	$53	$87	$63
Northern CA	CA	Lassen North-B	WI_129	Wind	Proxy	89	$2,522	28%	$123	$40	$53	$87	$54
Northern CA	CA	Lassen North-B	st83892	Solar Th.	Proxy	200	$4,730	22%	$186	$40	$157	$98	$48
Northern CA	CA	Lassen North-B	st83913	Solar Th.	Proxy	200	$4,868	22%	$191	$40	$157	$98	$53
Northern CA	CA	Lassen North-B	st83936	Solar Th.	Proxy	200	$4,732	22%	$187	$40	$157	$98	$49
Northern CA	CA	Lassen North-B	st84046	Solar Th.	Proxy	200	$4,730	23%	$185	$40	$159	$98	$47
Northern CA	CA	Lassen North-B	st84067	Solar Th.	Proxy	200	$4,731	23%	$186	$40	$159	$98	$47
Northern CA	CA	Lassen North-B	st84068	Solar Th.	Proxy	200	$4,730	23%	$186	$40	$159	$98	$47
Northern CA	CA	Lassen South-A	WI_159	Wind	Pre-ID	1000	$2,540	36%	$88	$30	$53	$87	$14
Northern CA	CA	Lassen South-B	st75765	Solar Th.	Proxy	200	$4,756	24%	$177	$48	$168	$98	$47
Northern CA	CA	Lassen South-B	st75860	Solar Th.	Proxy	200	$4,844	24%	$177	$48	$168	$98	$47
Northern CA	CA	Lassen South-B	st75944	Solar Th.	Proxy	200	$4,849	24%	$175	$47	$168	$98	$46
Northern CA	CA	Lassen South-B	st75945	Solar Th.	Proxy	200	$4,731	24%	$172	$47	$168	$98	$42
Northern CA	CA	Lassen South-B	st75969	Solar Th.	Proxy	200	$4,730	24%	$177	$49	$163	$98	$49
Northern CA	CA	Lassen South-B	st80169	Solar Th.	Proxy	200	$4,761	23%	$183	$47	$154	$97	$55
Northern CA	CA	Non-CREZ	Geysers (incl Calistoga & Clear Lake [Sulphur Bank])	Geothermal	Pre-ID	135	$3,920	90%	$61	$8	$204	$87	-$45
Northern CA	CA	Non-CREZ	Honey Lake	Geothermal	Pre-ID	8	$4,026	80%	$87	$8	$204	$87	-$21

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	Lake City / Surprise Valley	Geothermal	Pre-ID	32	$4,991	80%	$95	$9	$204	$87	-$12
Northern CA	CA	Non-CREZ	Mt Shasta (incl. areas around Lassen: Growler & Morgan)	Geothermal	Pre-ID	45	$4,222	90%	$71	$8	$204	$87	-$34
Northern CA	CA	Non-CREZ	Butte	Biomass	Proxy	24	$5,337	80%	$154	$11	$204	$87	$48
Northern CA	CA	Non-CREZ	Colusa	Biomass	Proxy	51	$4,618	80%	$138	$10	$204	$87	$32
Northern CA	CA	Non-CREZ	El Dorado	Biomass	Proxy	34	$4,982	80%	$157	$10	$204	$87	$51
Northern CA	CA	Non-CREZ	Fresno	Biomass	Proxy	70	$4,383	80%	$132	$9	$204	$87	$25
Northern CA	CA	Non-CREZ	Glenn	Biomass	Proxy	24	$5,337	80%	$154	$11	$204	$87	$48
Northern CA	CA	Non-CREZ	Humboldt 1	Biomass	Proxy	65	$4,307	80%	$138	$9	$204	$87	$31
Northern CA	CA	Non-CREZ	Lassen	Biomass	Proxy	42	$4,692	80%	$150	$10	$204	$87	$44
Northern CA	CA	Non-CREZ	Madera	Biomass	Proxy	26	$5,294	80%	$157	$10	$204	$87	$51
Northern CA	CA	Non-CREZ	Mendocino 1	Biomass	Proxy	63	$4,333	80%	$139	$9	$204	$87	$32
Northern CA	CA	Non-CREZ	Santa Clara 1	Biomass	Proxy	25	$5,251	80%	$160	$10	$204	$87	$54
Northern CA	CA	Non-CREZ	Modoc	Biomass	Proxy	26	$5,155	80%	$163	$10	$204	$87	$58
Northern CA	CA	Non-CREZ	Plumas	Biomass	Proxy	41	$4,714	80%	$151	$10	$204	$87	$44
Northern CA	CA	Non-CREZ	Contra Costa 1	Biomass	Proxy	34	$4,947	80%	$148	$10	$204	$87	$42
Northern CA	CA	Non-CREZ	Siskiyou 1	Biomass	Proxy	21	$5,459	80%	$160	$11	$204	$87	$54
Northern CA	CA	Non-CREZ	Siskiyou 2	Biomass	Proxy	42	$4,783	80%	$152	$10	$204	$87	$45
Northern CA	CA	Non-CREZ	Sonoma 1	Biomass	Proxy	21	$5,432	80%	$162	$11	$204	$87	$56
Northern CA	CA	Non-CREZ	Sutter	Biomass	Proxy	26	$5,256	80%	$151	$10	$204	$87	$45
Northern CA	CA	Non-CREZ	Tehama	Biomass	Proxy	24	$5,338	80%	$159	$11	$204	$87	$53
Northern CA	CA	Non-CREZ	Trinity	Biomass	Proxy	46	$4,609	80%	$148	$10	$204	$87	$41
Northern CA	CA	Non-CREZ	Tuolumne 1	Biomass	Proxy	22	$5,418	80%	$170	$11	$204	$87	$65
Northern CA	CA	Non-CREZ	Sonoma 2	Biomass	Proxy	34	$4,932	80%	$137	$10	$204	$87	$31
Northern CA	CA	Non-CREZ	Contra Costa 2	Biomass	Proxy	35	$4,918	80%	$137	$10	$204	$87	$31
Northern CA	CA	Non-CREZ	Santa Clara 2	Biomass	Proxy	45	$4,682	80%	$130	$10	$204	$87	$23
Northern CA	CA	Non-CREZ	Calaveras	Biomass	Proxy	25	$5,292	80%	$162	$10	$204	$87	$57
Northern CA	CA	Non-CREZ	Yuba	Biomass	Proxy	63	$4,434	80%	$137	$9	$204	$87	$30
Northern CA	CA	Non-CREZ	Humboldt 2	Biomass	Proxy	27	$5,136	80%	$158	$10	$204	$87	$52
Northern CA	CA	Non-CREZ	Lake	Biomass	Proxy	34	$4,891	80%	$152	$10	$204	$87	$45
Northern CA	CA	Non-CREZ	Mendocino 2	Biomass	Proxy	22	$5,309	80%	$167	$11	$204	$87	$61
Northern CA	CA	Non-CREZ	Tuolumne 2	Biomass	Proxy	26	$5,232	80%	$161	$10	$204	$87	$55
Northern CA	CA	Non-CREZ	Sierra	Biomass	Proxy	31	$4,979	80%	$154	$10	$204	$87	$48
Northern CA	CA	Non-CREZ	Monterey	Biomass	Proxy	26	$5,218	80%	$162	$10	$204	$87	$56
Northern CA	CA	Non-CREZ	WI_114	Wind	Proxy	43	$2,463	29%	$113	$12	$39	$79	$31
Northern CA	CA	Non-CREZ	WI_115	Wind	Proxy	59	$2,676	29%	$125	$13	$84	$82	$23

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	WI_132	Wind	Proxy	148	$2,641	37%	$112	$12	$45	$85	$24
Northern CA	CA	Non-CREZ	WI_133	Wind	Proxy	58	$2,648	37%	$95	$11	$32	$84	$12
Northern CA	CA	Non-CREZ	WI_134	Wind	Proxy	91	$2,304	33%	$91	$11	$60	$86	-$5
Northern CA	CA	Non-CREZ	WI_135	Wind	Proxy	43	$2,518	27%	$125	$13	$24	$79	$48
Northern CA	CA	Non-CREZ	WI_136	Wind	Proxy	128	$2,451	32%	$106	$12	$36	$86	$19
Northern CA	CA	Non-CREZ	WI_158	Wind	Pre-ID	45	$2,542	35%	$92	$11	$53	$87	-$2
Northern CA	CA	Non-CREZ	529365	Solar PV	Proxy	20	$7,080	23%	$234	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	532778	Solar PV	Proxy	20	$7,063	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	700282	Solar PV	Proxy	20	$7,049	23%	$238	$4	$156	$96	$68
Northern CA	CA	Non-CREZ	444967	Solar PV	Proxy	20	$7,052	26%	$208	$4	$164	$96	$45
Northern CA	CA	Non-CREZ	445032	Solar PV	Proxy	20	$7,057	26%	$208	$4	$165	$96	$45
Northern CA	CA	Non-CREZ	445159	Solar PV	Proxy	20	$7,049	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	721713	Solar PV	Proxy	20	$7,042	19%	$287	$4	$128	$96	$119
Northern CA	CA	Non-CREZ	721653	Solar PV	Proxy	20	$7,046	19%	$287	$4	$128	$96	$119
Northern CA	CA	Non-CREZ	364072	Solar PV	Proxy	20	$7,083	24%	$226	$4	$152	$94	$65
Northern CA	CA	Non-CREZ	520973	Solar PV	Proxy	20	$7,086	22%	$244	$4	$151	$96	$75
Northern CA	CA	Non-CREZ	491917	Solar PV	Proxy	20	$7,046	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	658050	Solar PV	Proxy	20	$7,047	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	657925	Solar PV	Proxy	20	$7,055	20%	$270	$4	$141	$97	$98
Northern CA	CA	Non-CREZ	534073	Solar PV	Proxy	20	$7,049	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	572824	Solar PV	Proxy	20	$7,144	23%	$236	$4	$161	$96	$66
Northern CA	CA	Non-CREZ	448522	Solar PV	Proxy	20	$7,101	24%	$232	$4	$158	$96	$64
Northern CA	CA	Non-CREZ	574081	Solar PV	Proxy	20	$7,062	23%	$236	$4	$160	$96	$65
Northern CA	CA	Non-CREZ	443486	Solar PV	Proxy	20	$7,078	26%	$210	$4	$163	$99	$44
Northern CA	CA	Non-CREZ	703549	Solar PV	Proxy	20	$7,044	23%	$237	$4	$161	$96	$65
Northern CA	CA	Non-CREZ	703550	Solar PV	Proxy	20	$7,044	23%	$237	$4	$161	$96	$65
Northern CA	CA	Non-CREZ	639670	Solar PV	Proxy	20	$7,055	23%	$235	$4	$158	$96	$65
Northern CA	CA	Non-CREZ	484803	Solar PV	Proxy	20	$7,056	23%	$237	$4	$154	$96	$69
Northern CA	CA	Non-CREZ	533876	Solar PV	Proxy	20	$7,045	23%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	495262	Solar PV	Proxy	20	$7,066	24%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	625424	Solar PV	Proxy	20	$7,048	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	497649	Solar PV	Proxy	20	$7,043	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	497713	Solar PV	Proxy	20	$7,044	24%	$227	$4	$161	$96	$59
Northern CA	CA	Non-CREZ	595423	Solar PV	Proxy	20	$7,043	24%	$226	$4	$165	$96	$56
Northern CA	CA	Non-CREZ	518022	Solar PV	Proxy	20	$7,064	25%	$219	$4	$163	$96	$53
Northern CA	CA	Non-CREZ	658138	Solar PV	Proxy	20	$7,163	23%	$243	$4	$157	$96	$72
Northern CA	CA	Non-CREZ	537611	Solar PV	Proxy	20	$7,060	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	537475	Solar PV	Proxy	20	$7,074	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	564971	Solar PV	Proxy	20	$7,043	23%	$234	$4	$163	$97	$62

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	622136	Solar PV	Proxy	20	$7,106	23%	$239	$4	$160	$96	$67
Northern CA	CA	Non-CREZ	358364	Solar PV	Proxy	20	$7,049	23%	$239	$4	$137	$96	$78
Northern CA	CA	Non-CREZ	414859	Solar PV	Proxy	20	$7,049	24%	$226	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	534622	Solar PV	Proxy	20	$7,059	23%	$235	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	448377	Solar PV	Proxy	20	$7,085	24%	$231	$4	$158	$96	$63
Northern CA	CA	Non-CREZ	448638	Solar PV	Proxy	20	$7,085	24%	$231	$4	$158	$96	$63
Northern CA	CA	Non-CREZ	370686	Solar PV	Proxy	20	$7,215	24%	$231	$4	$152	$94	$69
Northern CA	CA	Non-CREZ	370621	Solar PV	Proxy	20	$7,217	24%	$228	$4	$154	$94	$66
Northern CA	CA	Non-CREZ	443953	Solar PV	Proxy	20	$7,079	27%	$205	$4	$166	$96	$42
Northern CA	CA	Non-CREZ	569754	Solar PV	Proxy	20	$7,046	24%	$230	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	447125	Solar PV	Proxy	20	$7,093	24%	$232	$4	$159	$97	$63
Northern CA	CA	Non-CREZ	446981	Solar PV	Proxy	20	$7,080	24%	$232	$4	$158	$96	$64
Northern CA	CA	Non-CREZ	567543	Solar PV	Proxy	20	$7,050	23%	$233	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	484619	Solar PV	Proxy	20	$7,053	23%	$239	$4	$151	$96	$72
Northern CA	CA	Non-CREZ	310619	Solar PV	Proxy	20	$7,046	25%	$218	$4	$153	$94	$59
Northern CA	CA	Non-CREZ	488478	Solar PV	Proxy	20	$7,056	23%	$232	$4	$158	$96	$64
Northern CA	CA	Non-CREZ	570109	Solar PV	Proxy	20	$7,042	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	570110	Solar PV	Proxy	20	$7,045	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	660697	Solar PV	Proxy	20	$7,051	23%	$239	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	455680	Solar PV	Proxy	20	$7,047	24%	$228	$4	$162	$97	$59
Northern CA	CA	Non-CREZ	500206	Solar PV	Proxy	20	$7,172	24%	$230	$4	$163	$97	$61
Northern CA	CA	Non-CREZ	499950	Solar PV	Proxy	20	$7,183	24%	$231	$4	$162	$97	$62
Northern CA	CA	Non-CREZ	606701	Solar PV	Proxy	20	$7,045	24%	$224	$4	$162	$96	$56
Northern CA	CA	Non-CREZ	534693	Solar PV	Proxy	20	$7,053	24%	$232	$4	$164	$97	$60
Northern CA	CA	Non-CREZ	534757	Solar PV	Proxy	20	$7,054	23%	$235	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	481370	Solar PV	Proxy	20	$7,050	25%	$215	$4	$164	$96	$50
Northern CA	CA	Non-CREZ	709503	Solar PV	Proxy	20	$7,043	24%	$229	$4	$161	$96	$60
Northern CA	CA	Non-CREZ	657626	Solar PV	Proxy	20	$7,051	19%	$282	$4	$129	$96	$114
Northern CA	CA	Non-CREZ	657436	Solar PV	Proxy	20	$7,052	20%	$271	$4	$140	$97	$100
Northern CA	CA	Non-CREZ	657423	Solar PV	Proxy	20	$7,060	19%	$292	$4	$121	$96	$127
Northern CA	CA	Non-CREZ	657298	Solar PV	Proxy	20	$7,062	19%	$292	$4	$121	$96	$127
Northern CA	CA	Non-CREZ	664836	Solar PV	Proxy	20	$7,085	23%	$241	$4	$159	$96	$69
Northern CA	CA	Non-CREZ	652784	Solar PV	Proxy	20	$7,134	24%	$226	$4	$162	$96	$59
Northern CA	CA	Non-CREZ	394599	Solar PV	Proxy	20	$7,104	24%	$226	$4	$162	$100	$55
Northern CA	CA	Non-CREZ	598305	Solar PV	Proxy	20	$7,061	23%	$234	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	598372	Solar PV	Proxy	20	$7,071	23%	$234	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	648410	Solar PV	Proxy	20	$7,173	24%	$230	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	415697	Solar PV	Proxy	20	$7,166	24%	$230	$4	$153	$94	$68
Northern CA	CA	Non-CREZ	677826	Solar PV	Proxy	20	$7,064	23%	$237	$4	$160	$96	$66

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	634444	Solar PV	Proxy	20	$7,054	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	551954	Solar PV	Proxy	20	$7,052	23%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	722106	Solar PV	Proxy	20	$7,050	19%	$287	$4	$128	$96	$119
Northern CA	CA	Non-CREZ	699235	Solar PV	Proxy	20	$7,054	23%	$239	$4	$156	$96	$69
Northern CA	CA	Non-CREZ	597217	Solar PV	Proxy	20	$7,042	23%	$239	$4	$160	$97	$67
Northern CA	CA	Non-CREZ	364734	Solar PV	Proxy	20	$7,107	25%	$221	$4	$154	$94	$61
Northern CA	CA	Non-CREZ	592085	Solar PV	Proxy	20	$7,066	24%	$231	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	532360	Solar PV	Proxy	20	$7,055	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	645751	Solar PV	Proxy	20	$7,041	24%	$225	$4	$164	$96	$56
Northern CA	CA	Non-CREZ	645937	Solar PV	Proxy	20	$7,040	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	668576	Solar PV	Proxy	20	$7,134	23%	$244	$4	$159	$97	$71
Northern CA	CA	Non-CREZ	568309	Solar PV	Proxy	20	$7,055	23%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	532758	Solar PV	Proxy	20	$7,041	24%	$231	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	481524	Solar PV	Proxy	20	$7,140	25%	$221	$4	$161	$96	$55
Northern CA	CA	Non-CREZ	453228	Solar PV	Proxy	20	$7,043	24%	$227	$4	$161	$97	$58
Northern CA	CA	Non-CREZ	363847	Solar PV	Proxy	20	$7,048	24%	$223	$4	$154	$94	$62
Northern CA	CA	Non-CREZ	365491	Solar PV	Proxy	20	$7,051	24%	$225	$4	$152	$94	$64
Northern CA	CA	Non-CREZ	366969	Solar PV	Proxy	20	$7,056	25%	$222	$4	$153	$94	$61
Northern CA	CA	Non-CREZ	574795	Solar PV	Proxy	20	$7,104	23%	$237	$4	$158	$96	$67
Northern CA	CA	Non-CREZ	615016	Solar PV	Proxy	20	$7,060	22%	$251	$4	$153	$97	$78
Northern CA	CA	Non-CREZ	614268	Solar PV	Proxy	20	$7,080	21%	$258	$4	$149	$97	$86
Northern CA	CA	Non-CREZ	443112	Solar PV	Proxy	20	$7,058	25%	$220	$4	$158	$96	$55
Northern CA	CA	Non-CREZ	579480	Solar PV	Proxy	20	$7,129	23%	$236	$4	$162	$96	$65
Northern CA	CA	Non-CREZ	569546	Solar PV	Proxy	20	$7,042	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	572170	Solar PV	Proxy	20	$7,065	23%	$234	$4	$161	$96	$64
Northern CA	CA	Non-CREZ	572105	Solar PV	Proxy	20	$7,065	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	352714	Solar PV	Proxy	20	$7,064	24%	$230	$4	$153	$94	$67
Northern CA	CA	Non-CREZ	351231	Solar PV	Proxy	20	$7,050	24%	$225	$4	$153	$94	$63
Northern CA	CA	Non-CREZ	443949	Solar PV	Proxy	20	$7,067	27%	$205	$4	$166	$99	$40
Northern CA	CA	Non-CREZ	663392	Solar PV	Proxy	20	$7,043	23%	$238	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	579160	Solar PV	Proxy	20	$7,096	23%	$235	$4	$162	$96	$64
Northern CA	CA	Non-CREZ	663139	Solar PV	Proxy	20	$7,042	23%	$238	$4	$158	$96	$67
Northern CA	CA	Non-CREZ	395092	Solar PV	Proxy	20	$7,097	24%	$225	$4	$154	$97	$61
Northern CA	CA	Non-CREZ	633270	Solar PV	Proxy	20	$7,068	23%	$239	$4	$156	$96	$69
Northern CA	CA	Non-CREZ	633144	Solar PV	Proxy	20	$7,068	23%	$235	$4	$159	$96	$66
Northern CA	CA	Non-CREZ	596102	Solar PV	Proxy	20	$7,053	25%	$222	$4	$165	$96	$53
Northern CA	CA	Non-CREZ	596227	Solar PV	Proxy	20	$7,055	25%	$219	$4	$164	$96	$52
Northern CA	CA	Non-CREZ	496768	Solar PV	Proxy	20	$7,046	23%	$234	$4	$158	$96	$65
Northern CA	CA	Non-CREZ	318276	Solar PV	Proxy	20	$7,072	25%	$220	$4	$154	$94	$60

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	443618	Solar PV	Proxy	20	$7,088	26%	$211	$4	$163	$99	$44
Northern CA	CA	Non-CREZ	493954	Solar PV	Proxy	20	$7,063	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	494347	Solar PV	Proxy	20	$7,073	24%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	395821	Solar PV	Proxy	20	$7,076	24%	$224	$4	$162	$96	$56
Northern CA	CA	Non-CREZ	570160	Solar PV	Proxy	20	$7,049	24%	$230	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	308211	Solar PV	Proxy	20	$7,046	27%	$203	$4	$153	$94	$49
Northern CA	CA	Non-CREZ	404911	Solar PV	Proxy	20	$7,045	21%	$255	$4	$127	$94	$98
Northern CA	CA	Non-CREZ	701103	Solar PV	Proxy	20	$7,042	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	701164	Solar PV	Proxy	20	$7,044	23%	$237	$4	$161	$96	$65
Northern CA	CA	Non-CREZ	316058	Solar PV	Proxy	20	$7,068	25%	$220	$4	$150	$94	$61
Northern CA	CA	Non-CREZ	317246	Solar PV	Proxy	20	$7,099	25%	$217	$4	$156	$94	$57
Northern CA	CA	Non-CREZ	594030	Solar PV	Proxy	20	$7,043	24%	$230	$4	$163	$96	$59
Northern CA	CA	Non-CREZ	409597	Solar PV	Proxy	20	$7,060	24%	$225	$4	$161	$96	$57
Northern CA	CA	Non-CREZ	409270	Solar PV	Proxy	20	$7,065	24%	$225	$4	$161	$96	$57
Northern CA	CA	Non-CREZ	409271	Solar PV	Proxy	20	$7,047	24%	$225	$4	$161	$96	$57
Northern CA	CA	Non-CREZ	407534	Solar PV	Proxy	20	$7,044	24%	$226	$4	$159	$96	$59
Northern CA	CA	Non-CREZ	362378	Solar PV	Proxy	20	$7,048	24%	$231	$4	$144	$94	$72
Northern CA	CA	Non-CREZ	362377	Solar PV	Proxy	20	$7,049	24%	$231	$4	$146	$94	$71
Northern CA	CA	Non-CREZ	362170	Solar PV	Proxy	20	$7,067	23%	$234	$4	$142	$94	$75
Northern CA	CA	Non-CREZ	362169	Solar PV	Proxy	20	$7,072	23%	$239	$4	$136	$94	$81
Northern CA	CA	Non-CREZ	573177	Solar PV	Proxy	20	$7,054	23%	$232	$4	$162	$96	$62
Northern CA	CA	Non-CREZ	445814	Solar PV	Proxy	20	$7,050	24%	$230	$4	$159	$97	$62
Northern CA	CA	Non-CREZ	531260	Solar PV	Proxy	20	$7,079	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	633073	Solar PV	Proxy	20	$7,097	23%	$236	$4	$159	$96	$66
Northern CA	CA	Non-CREZ	633074	Solar PV	Proxy	20	$7,100	23%	$236	$4	$159	$96	$66
Northern CA	CA	Non-CREZ	645140	Solar PV	Proxy	20	$7,042	24%	$226	$4	$164	$96	$57
Northern CA	CA	Non-CREZ	658004	Solar PV	Proxy	20	$7,043	21%	$263	$4	$146	$97	$91
Northern CA	CA	Non-CREZ	657941	Solar PV	Proxy	20	$7,046	21%	$264	$4	$146	$97	$91
Northern CA	CA	Non-CREZ	366678	Solar PV	Proxy	20	$7,042	24%	$225	$4	$153	$94	$63
Northern CA	CA	Non-CREZ	691683	Solar PV	Proxy	20	$7,134	24%	$232	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	406966	Solar PV	Proxy	20	$7,048	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	407032	Solar PV	Proxy	20	$7,050	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	351939	Solar PV	Proxy	20	$7,044	24%	$229	$4	$153	$94	$66
Northern CA	CA	Non-CREZ	351808	Solar PV	Proxy	20	$7,049	24%	$230	$4	$154	$94	$66
Northern CA	CA	Non-CREZ	498165	Solar PV	Proxy	20	$7,048	24%	$229	$4	$161	$96	$60
Northern CA	CA	Non-CREZ	498294	Solar PV	Proxy	20	$7,051	24%	$228	$4	$161	$96	$59
Northern CA	CA	Non-CREZ	531471	Solar PV	Proxy	20	$7,051	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	660785	Solar PV	Proxy	20	$7,050	23%	$239	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	737899	Solar PV	Proxy	20	$7,068	23%	$235	$4	$157	$96	$66

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	597889	Solar PV	Proxy	20	$7,053	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	409914	Solar PV	Proxy	20	$7,057	24%	$227	$4	$154	$94	$64
Northern CA	CA	Non-CREZ	410110	Solar PV	Proxy	20	$7,065	24%	$228	$4	$153	$94	$65
Northern CA	CA	Non-CREZ	570920	Solar PV	Proxy	20	$7,060	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	362083	Solar PV	Proxy	20	$7,111	24%	$228	$4	$148	$94	$68
Northern CA	CA	Non-CREZ	632853	Solar PV	Proxy	20	$7,046	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	573312	Solar PV	Proxy	20	$7,052	23%	$232	$4	$162	$96	$62
Northern CA	CA	Non-CREZ	573314	Solar PV	Proxy	20	$7,056	23%	$232	$4	$162	$96	$62
Northern CA	CA	Non-CREZ	595477	Solar PV	Proxy	20	$7,058	24%	$225	$4	$166	$96	$55
Northern CA	CA	Non-CREZ	608589	Solar PV	Proxy	20	$7,048	25%	$220	$4	$164	$96	$53
Northern CA	CA	Non-CREZ	536842	Solar PV	Proxy	20	$7,053	23%	$233	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	536592	Solar PV	Proxy	20	$7,064	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	453248	Solar PV	Proxy	20	$7,050	24%	$229	$4	$162	$97	$60
Northern CA	CA	Non-CREZ	453313	Solar PV	Proxy	20	$7,052	24%	$229	$4	$161	$97	$59
Northern CA	CA	Non-CREZ	261957	Solar PV	Proxy	20	$7,117	25%	$218	$4	$155	$97	$55
Northern CA	CA	Non-CREZ	409208	Solar PV	Proxy	20	$7,054	24%	$225	$4	$161	$96	$57
Northern CA	CA	Non-CREZ	409407	Solar PV	Proxy	20	$7,055	24%	$226	$4	$161	$96	$58
Northern CA	CA	Non-CREZ	353366	Solar PV	Proxy	20	$7,057	24%	$232	$4	$153	$94	$68
Northern CA	CA	Non-CREZ	567643	Solar PV	Proxy	20	$7,043	24%	$231	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	597612	Solar PV	Proxy	20	$7,047	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	535035	Solar PV	Proxy	20	$7,056	24%	$232	$4	$164	$97	$60
Northern CA	CA	Non-CREZ	535098	Solar PV	Proxy	20	$7,063	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	494746	Solar PV	Proxy	20	$7,047	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	492948	Solar PV	Proxy	20	$7,045	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	523612	Solar PV	Proxy	20	$7,067	23%	$242	$4	$151	$96	$74
Northern CA	CA	Non-CREZ	558315	Solar PV	Proxy	20	$7,050	24%	$226	$4	$165	$97	$56
Northern CA	CA	Non-CREZ	729363	Solar PV	Proxy	20	$7,133	23%	$239	$4	$159	$96	$68
Northern CA	CA	Non-CREZ	660273	Solar PV	Proxy	20	$7,046	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	367789	Solar PV	Proxy	20	$7,052	24%	$225	$4	$152	$94	$64
Northern CA	CA	Non-CREZ	367923	Solar PV	Proxy	20	$7,066	24%	$224	$4	$153	$94	$63
Northern CA	CA	Non-CREZ	597669	Solar PV	Proxy	20	$7,051	23%	$236	$4	$158	$96	$66
Northern CA	CA	Non-CREZ	316229	Solar PV	Proxy	20	$7,043	25%	$216	$4	$155	$94	$57
Northern CA	CA	Non-CREZ	316024	Solar PV	Proxy	20	$7,041	25%	$217	$4	$155	$94	$57
Northern CA	CA	Non-CREZ	316559	Solar PV	Proxy	20	$7,045	25%	$216	$4	$155	$94	$57
Northern CA	CA	Non-CREZ	316881	Solar PV	Proxy	20	$7,060	25%	$220	$4	$154	$94	$59
Northern CA	CA	Non-CREZ	414361	Solar PV	Proxy	20	$7,045	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	414165	Solar PV	Proxy	20	$7,060	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	626724	Solar PV	Proxy	20	$7,055	23%	$240	$4	$156	$96	$70
Northern CA	CA	Non-CREZ	404836	Solar PV	Proxy	20	$7,078	24%	$227	$4	$162	$96	$58

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	658125	Solar PV	Proxy	20	$7,048	23%	$240	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	658065	Solar PV	Proxy	20	$7,050	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	498621	Solar PV	Proxy	20	$7,061	24%	$228	$4	$161	$96	$60
Northern CA	CA	Non-CREZ	633095	Solar PV	Proxy	20	$7,044	23%	$234	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	492930	Solar PV	Proxy	20	$7,043	24%	$230	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	492630	Solar PV	Proxy	20	$7,052	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	572117	Solar PV	Proxy	20	$7,042	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	500205	Solar PV	Proxy	20	$7,050	24%	$226	$4	$163	$97	$57
Northern CA	CA	Non-CREZ	564867	Solar PV	Proxy	20	$7,049	23%	$234	$4	$162	$96	$63
Northern CA	CA	Non-CREZ	535273	Solar PV	Proxy	20	$7,043	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	722332	Solar PV	Proxy	20	$7,076	19%	$289	$4	$127	$96	$121
Northern CA	CA	Non-CREZ	367730	Solar PV	Proxy	20	$7,048	25%	$222	$4	$153	$94	$61
Northern CA	CA	Non-CREZ	486086	Solar PV	Proxy	20	$7,071	23%	$237	$4	$157	$96	$68
Northern CA	CA	Non-CREZ	447139	Solar PV	Proxy	20	$7,065	24%	$231	$4	$159	$96	$62
Northern CA	CA	Non-CREZ	593483	Solar PV	Proxy	20	$7,049	24%	$230	$4	$163	$96	$60
Northern CA	CA	Non-CREZ	494838	Solar PV	Proxy	20	$7,042	24%	$231	$4	$160	$96	$61
Northern CA	CA	Non-CREZ	405487	Solar PV	Proxy	20	$7,046	23%	$235	$4	$151	$96	$69
Northern CA	CA	Non-CREZ	405486	Solar PV	Proxy	20	$7,047	23%	$233	$4	$153	$96	$67
Northern CA	CA	Non-CREZ	481107	Solar PV	Proxy	20	$7,061	25%	$219	$4	$165	$96	$52
Northern CA	CA	Non-CREZ	585656	Solar PV	Proxy	20	$7,063	24%	$226	$4	$163	$96	$57
Northern CA	CA	Non-CREZ	660324	Solar PV	Proxy	20	$7,047	23%	$238	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	398810	Solar PV	Proxy	20	$7,070	24%	$225	$4	$163	$96	$56
Northern CA	CA	Non-CREZ	398692	Solar PV	Proxy	20	$7,074	24%	$225	$4	$163	$96	$57
Northern CA	CA	Non-CREZ	414686	Solar PV	Proxy	20	$7,076	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	406714	Solar PV	Proxy	20	$7,056	24%	$226	$4	$160	$96	$59
Northern CA	CA	Non-CREZ	406715	Solar PV	Proxy	20	$7,058	24%	$225	$4	$161	$96	$58
Northern CA	CA	Non-CREZ	598704	Solar PV	Proxy	20	$7,080	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	402682	Solar PV	Proxy	20	$7,050	24%	$225	$4	$162	$96	$56
Northern CA	CA	Non-CREZ	442422	Solar PV	Proxy	20	$7,120	25%	$222	$4	$167	$97	$53
Northern CA	CA	Non-CREZ	442689	Solar PV	Proxy	20	$7,137	25%	$225	$4	$164	$97	$56
Northern CA	CA	Non-CREZ	454302	Solar PV	Proxy	20	$7,044	24%	$225	$4	$164	$97	$56
Northern CA	CA	Non-CREZ	454172	Solar PV	Proxy	20	$7,046	24%	$225	$4	$164	$97	$56
Northern CA	CA	Non-CREZ	409012	Solar PV	Proxy	20	$7,074	24%	$228	$4	$160	$96	$60
Northern CA	CA	Non-CREZ	409077	Solar PV	Proxy	20	$7,077	24%	$226	$4	$161	$96	$58
Northern CA	CA	Non-CREZ	627121	Solar PV	Proxy	20	$7,052	23%	$238	$4	$158	$96	$67
Northern CA	CA	Non-CREZ	529972	Solar PV	Proxy	20	$7,044	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	530036	Solar PV	Proxy	20	$7,048	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	735848	Solar PV	Proxy	20	$7,050	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	735909	Solar PV	Proxy	20	$7,052	23%	$237	$4	$157	$96	$68

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	597829	Solar PV	Proxy	20	$7,061	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	574029	Solar PV	Proxy	20	$7,058	23%	$235	$4	$158	$96	$66
Northern CA	CA	Non-CREZ	709818	Solar PV	Proxy	20	$7,042	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	709757	Solar PV	Proxy	20	$7,043	24%	$230	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	657822	Solar PV	Proxy	20	$7,191	19%	$287	$4	$129	$96	$119
Northern CA	CA	Non-CREZ	316154	Solar PV	Proxy	20	$7,060	25%	$220	$4	$150	$94	$61
Northern CA	CA	Non-CREZ	658623	Solar PV	Proxy	20	$7,048	23%	$240	$4	$157	$96	$69
Northern CA	CA	Non-CREZ	536836	Solar PV	Proxy	20	$7,056	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	536639	Solar PV	Proxy	20	$7,057	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	492898	Solar PV	Proxy	20	$7,041	24%	$230	$4	$160	$96	$61
Northern CA	CA	Non-CREZ	492382	Solar PV	Proxy	20	$7,047	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	403021	Solar PV	Proxy	20	$7,116	24%	$226	$4	$154	$94	$64
Northern CA	CA	Non-CREZ	356186	Solar PV	Proxy	20	$7,117	22%	$245	$4	$130	$94	$89
Northern CA	CA	Non-CREZ	368956	Solar PV	Proxy	20	$7,119	24%	$228	$4	$153	$94	$66
Northern CA	CA	Non-CREZ	531343	Solar PV	Proxy	20	$7,072	24%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	530506	Solar PV	Proxy	20	$7,061	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	531259	Solar PV	Proxy	20	$7,065	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	571034	Solar PV	Proxy	20	$7,059	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	691862	Solar PV	Proxy	20	$7,230	24%	$232	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	351612	Solar PV	Proxy	20	$7,049	24%	$230	$4	$154	$94	$66
Northern CA	CA	Non-CREZ	351678	Solar PV	Proxy	20	$7,049	24%	$230	$4	$154	$94	$66
Northern CA	CA	Non-CREZ	532681	Solar PV	Proxy	20	$7,077	23%	$233	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	453614	Solar PV	Proxy	20	$7,055	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	725753	Solar PV	Proxy	20	$7,050	23%	$239	$4	$157	$96	$69
Northern CA	CA	Non-CREZ	360084	Solar PV	Proxy	20	$7,048	23%	$238	$4	$136	$94	$81
Northern CA	CA	Non-CREZ	653650	Solar PV	Proxy	20	$7,071	24%	$227	$4	$160	$96	$60
Northern CA	CA	Non-CREZ	605178	Solar PV	Proxy	20	$7,198	23%	$239	$4	$159	$96	$69
Northern CA	CA	Non-CREZ	527588	Solar PV	Proxy	20	$7,042	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	574665	Solar PV	Proxy	20	$7,059	23%	$235	$4	$161	$96	$64
Northern CA	CA	Non-CREZ	528033	Solar PV	Proxy	20	$7,058	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	443313	Solar PV	Proxy	20	$7,086	27%	$206	$4	$166	$96	$43
Northern CA	CA	Non-CREZ	706336	Solar PV	Proxy	20	$7,064	23%	$239	$4	$160	$96	$67
Northern CA	CA	Non-CREZ	534981	Solar PV	Proxy	20	$7,085	23%	$234	$4	$164	$97	$62
Northern CA	CA	Non-CREZ	602937	Solar PV	Proxy	20	$7,059	23%	$236	$4	$160	$96	$65
Northern CA	CA	Non-CREZ	658372	Solar PV	Proxy	20	$7,056	23%	$240	$4	$157	$96	$69
Northern CA	CA	Non-CREZ	658373	Solar PV	Proxy	20	$7,056	23%	$240	$4	$157	$96	$69
Northern CA	CA	Non-CREZ	644141	Solar PV	Proxy	20	$7,042	23%	$235	$4	$160	$96	$65
Northern CA	CA	Non-CREZ	407420	Solar PV	Proxy	20	$7,050	24%	$227	$4	$159	$96	$59
Northern CA	CA	Non-CREZ	407225	Solar PV	Proxy	20	$7,050	24%	$227	$4	$162	$97	$58

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	537616	Solar PV	Proxy	20	$7,083	23%	$234	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	537551	Solar PV	Proxy	20	$7,088	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	407329	Solar PV	Proxy	20	$7,070	24%	$225	$4	$161	$96	$58
Northern CA	CA	Non-CREZ	408037	Solar PV	Proxy	20	$7,075	24%	$227	$4	$161	$96	$59
Northern CA	CA	Non-CREZ	364631	Solar PV	Proxy	20	$7,084	25%	$221	$4	$154	$94	$60
Northern CA	CA	Non-CREZ	552509	Solar PV	Proxy	20	$7,055	24%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	532103	Solar PV	Proxy	20	$7,055	24%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	531140	Solar PV	Proxy	20	$7,045	23%	$233	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	567883	Solar PV	Proxy	20	$7,046	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	351567	Solar PV	Proxy	20	$7,053	24%	$229	$4	$154	$94	$66
Northern CA	CA	Non-CREZ	491224	Solar PV	Proxy	20	$7,050	24%	$230	$4	$159	$96	$62
Northern CA	CA	Non-CREZ	596660	Solar PV	Proxy	20	$7,041	25%	$219	$4	$164	$96	$52
Northern CA	CA	Non-CREZ	657305	Solar PV	Proxy	20	$7,052	19%	$289	$4	$121	$96	$125
Northern CA	CA	Non-CREZ	657306	Solar PV	Proxy	20	$7,057	19%	$292	$4	$121	$96	$127
Northern CA	CA	Non-CREZ	454898	Solar PV	Proxy	20	$7,070	24%	$226	$4	$162	$97	$57
Northern CA	CA	Non-CREZ	454897	Solar PV	Proxy	20	$7,073	24%	$226	$4	$162	$97	$57
Northern CA	CA	Non-CREZ	644930	Solar PV	Proxy	20	$7,050	24%	$227	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	644349	Solar PV	Proxy	20	$7,062	24%	$226	$4	$163	$96	$57
Northern CA	CA	Non-CREZ	721107	Solar PV	Proxy	20	$7,050	19%	$287	$4	$128	$96	$119
Northern CA	CA	Non-CREZ	579609	Solar PV	Proxy	20	$7,080	23%	$234	$4	$162	$96	$63
Northern CA	CA	Non-CREZ	568370	Solar PV	Proxy	20	$7,045	23%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	454630	Solar PV	Proxy	20	$7,041	25%	$222	$4	$166	$97	$53
Northern CA	CA	Non-CREZ	454694	Solar PV	Proxy	20	$7,046	25%	$222	$4	$165	$97	$54
Northern CA	CA	Non-CREZ	448485	Solar PV	Proxy	20	$7,073	24%	$231	$4	$158	$96	$63
Northern CA	CA	Non-CREZ	362050	Solar PV	Proxy	20	$7,081	23%	$239	$4	$136	$94	$82
Northern CA	CA	Non-CREZ	352840	Solar PV	Proxy	20	$7,064	24%	$230	$4	$153	$94	$67
Northern CA	CA	Non-CREZ	570969	Solar PV	Proxy	20	$7,042	23%	$233	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	534614	Solar PV	Proxy	20	$7,049	24%	$230	$4	$164	$97	$59
Northern CA	CA	Non-CREZ	600363	Solar PV	Proxy	20	$7,069	24%	$226	$4	$163	$96	$57
Northern CA	CA	Non-CREZ	600110	Solar PV	Proxy	20	$7,069	24%	$228	$4	$163	$96	$59
Northern CA	CA	Non-CREZ	651691	Solar PV	Proxy	20	$7,178	24%	$229	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	651816	Solar PV	Proxy	20	$7,179	24%	$228	$4	$163	$96	$60
Northern CA	CA	Non-CREZ	573935	Solar PV	Proxy	20	$7,047	24%	$231	$4	$165	$97	$59
Northern CA	CA	Non-CREZ	737086	Solar PV	Proxy	20	$7,077	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	551841	Solar PV	Proxy	20	$7,050	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	719421	Solar PV	Proxy	20	$7,061	24%	$231	$4	$158	$96	$63
Northern CA	CA	Non-CREZ	518898	Solar PV	Proxy	20	$7,063	25%	$219	$4	$163	$96	$53
Northern CA	CA	Non-CREZ	617022	Solar PV	Proxy	20	$7,121	23%	$243	$4	$159	$96	$71
Northern CA	CA	Non-CREZ	450187	Solar PV	Proxy	20	$7,066	24%	$227	$4	$161	$96	$58

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	446879	Solar PV	Proxy	20	$7,044	24%	$231	$4	$158	$96	$63
Northern CA	CA	Non-CREZ	654855	Solar PV	Proxy	20	$7,115	19%	$292	$4	$121	$96	$128
Northern CA	CA	Non-CREZ	497712	Solar PV	Proxy	20	$7,042	24%	$231	$4	$160	$96	$61
Northern CA	CA	Non-CREZ	613705	Solar PV	Proxy	20	$7,148	21%	$263	$4	$146	$97	$92
Northern CA	CA	Non-CREZ	352726	Solar PV	Proxy	20	$7,043	24%	$229	$4	$154	$94	$65
Northern CA	CA	Non-CREZ	405474	Solar PV	Proxy	20	$7,051	23%	$237	$4	$149	$96	$71
Northern CA	CA	Non-CREZ	492235	Solar PV	Proxy	20	$7,057	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	613669	Solar PV	Proxy	20	$7,103	22%	$247	$4	$157	$97	$74
Northern CA	CA	Non-CREZ	516118	Solar PV	Proxy	20	$7,092	25%	$223	$4	$165	$96	$55
Northern CA	CA	Non-CREZ	710975	Solar PV	Proxy	20	$7,043	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	710853	Solar PV	Proxy	20	$7,052	23%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	451393	Solar PV	Proxy	20	$7,126	24%	$228	$4	$161	$96	$60
Northern CA	CA	Non-CREZ	442485	Solar PV	Proxy	20	$7,110	24%	$226	$4	$163	$97	$57
Northern CA	CA	Non-CREZ	626370	Solar PV	Proxy	20	$7,048	23%	$239	$4	$156	$96	$69
Northern CA	CA	Non-CREZ	522261	Solar PV	Proxy	20	$7,078	23%	$238	$4	$156	$96	$69
Northern CA	CA	Non-CREZ	522071	Solar PV	Proxy	20	$7,080	23%	$242	$4	$150	$96	$75
Northern CA	CA	Non-CREZ	521026	Solar PV	Proxy	20	$7,069	22%	$250	$4	$142	$96	$85
Northern CA	CA	Non-CREZ	362739	Solar PV	Proxy	20	$7,054	24%	$230	$4	$146	$94	$70
Northern CA	CA	Non-CREZ	353282	Solar PV	Proxy	20	$7,082	23%	$234	$4	$153	$94	$70
Northern CA	CA	Non-CREZ	353150	Solar PV	Proxy	20	$7,085	23%	$234	$4	$153	$94	$70
Northern CA	CA	Non-CREZ	657546	Solar PV	Proxy	20	$7,052	20%	$271	$4	$140	$97	$100
Northern CA	CA	Non-CREZ	364566	Solar PV	Proxy	20	$7,054	24%	$224	$4	$152	$94	$64
Northern CA	CA	Non-CREZ	532907	Solar PV	Proxy	20	$7,071	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	307684	Solar PV	Proxy	20	$7,063	27%	$206	$4	$156	$94	$49
Northern CA	CA	Non-CREZ	487942	Solar PV	Proxy	20	$7,042	23%	$233	$4	$158	$96	$64
Northern CA	CA	Non-CREZ	702694	Solar PV	Proxy	20	$7,041	23%	$237	$4	$161	$96	$65
Northern CA	CA	Non-CREZ	702755	Solar PV	Proxy	20	$7,043	23%	$238	$4	$160	$96	$66
Northern CA	CA	Non-CREZ	662637	Solar PV	Proxy	20	$7,044	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	488959	Solar PV	Proxy	20	$7,118	23%	$235	$4	$156	$96	$67
Northern CA	CA	Non-CREZ	488834	Solar PV	Proxy	20	$7,119	23%	$235	$4	$156	$96	$67
Northern CA	CA	Non-CREZ	352419	Solar PV	Proxy	20	$7,062	25%	$221	$4	$154	$94	$60
Northern CA	CA	Non-CREZ	492129	Solar PV	Proxy	20	$7,044	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	720592	Solar PV	Proxy	20	$7,048	23%	$237	$4	$155	$96	$68
Northern CA	CA	Non-CREZ	351570	Solar PV	Proxy	20	$7,057	24%	$229	$4	$154	$94	$66
Northern CA	CA	Non-CREZ	567671	Solar PV	Proxy	20	$7,067	24%	$230	$4	$163	$96	$60
Northern CA	CA	Non-CREZ	599278	Solar PV	Proxy	20	$7,071	23%	$234	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	516686	Solar PV	Proxy	20	$7,051	25%	$222	$4	$165	$96	$53
Northern CA	CA	Non-CREZ	403571	Solar PV	Proxy	20	$7,046	24%	$223	$4	$163	$97	$55
Northern CA	CA	Non-CREZ	443118	Solar PV	Proxy	20	$7,087	25%	$216	$4	$160	$96	$53

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	487670	Solar PV	Proxy	20	$7,109	23%	$237	$4	$156	$96	$68
Northern CA	CA	Non-CREZ	732710	Solar PV	Proxy	20	$7,085	23%	$238	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	486094	Solar PV	Proxy	20	$7,075	23%	$238	$4	$153	$96	$70
Northern CA	CA	Non-CREZ	393248	Solar PV	Proxy	20	$7,143	24%	$227	$4	$162	$100	$56
Northern CA	CA	Non-CREZ	668642	Solar PV	Proxy	20	$7,160	23%	$241	$4	$159	$96	$70
Northern CA	CA	Non-CREZ	535014	Solar PV	Proxy	20	$7,047	24%	$232	$4	$164	$97	$60
Northern CA	CA	Non-CREZ	718215	Solar PV	Proxy	20	$7,102	23%	$235	$4	$158	$96	$66
Northern CA	CA	Non-CREZ	594657	Solar PV	Proxy	20	$7,044	24%	$226	$4	$165	$96	$56
Northern CA	CA	Non-CREZ	634210	Solar PV	Proxy	20	$7,049	23%	$238	$4	$156	$96	$69
Northern CA	CA	Non-CREZ	362168	Solar PV	Proxy	20	$7,140	23%	$238	$4	$138	$94	$80
Northern CA	CA	Non-CREZ	492367	Solar PV	Proxy	20	$7,046	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	527396	Solar PV	Proxy	20	$7,046	23%	$236	$4	$157	$96	$66
Northern CA	CA	Non-CREZ	557938	Solar PV	Proxy	20	$7,044	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	663900	Solar PV	Proxy	20	$7,044	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	661497	Solar PV	Proxy	20	$7,042	23%	$241	$4	$158	$96	$70
Northern CA	CA	Non-CREZ	530542	Solar PV	Proxy	20	$7,105	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	451522	Solar PV	Proxy	20	$7,055	24%	$227	$4	$161	$97	$59
Northern CA	CA	Non-CREZ	651817	Solar PV	Proxy	20	$7,042	24%	$225	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	605428	Solar PV	Proxy	20	$7,145	24%	$228	$4	$163	$96	$59
Northern CA	CA	Non-CREZ	606303	Solar PV	Proxy	20	$7,138	25%	$224	$4	$164	$96	$56
Northern CA	CA	Non-CREZ	594286	Solar PV	Proxy	20	$7,054	24%	$229	$4	$164	$96	$59
Northern CA	CA	Non-CREZ	521405	Solar PV	Proxy	20	$7,075	23%	$238	$4	$154	$96	$70
Northern CA	CA	Non-CREZ	444016	Solar PV	Proxy	20	$7,091	26%	$208	$4	$164	$96	$45
Northern CA	CA	Non-CREZ	571887	Solar PV	Proxy	20	$7,046	24%	$230	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	571888	Solar PV	Proxy	20	$7,048	23%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	487999	Solar PV	Proxy	20	$7,055	24%	$231	$4	$159	$96	$62
Northern CA	CA	Non-CREZ	404830	Solar PV	Proxy	20	$7,047	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	640418	Solar PV	Proxy	20	$7,043	23%	$237	$4	$158	$96	$66
Northern CA	CA	Non-CREZ	354330	Solar PV	Proxy	20	$7,054	22%	$243	$4	$130	$94	$87
Northern CA	CA	Non-CREZ	354264	Solar PV	Proxy	20	$7,055	22%	$245	$4	$129	$94	$89
Northern CA	CA	Non-CREZ	525327	Solar PV	Proxy	20	$7,054	24%	$231	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	525263	Solar PV	Proxy	20	$7,059	24%	$231	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	491032	Solar PV	Proxy	20	$7,086	24%	$231	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	680087	Solar PV	Proxy	20	$7,147	24%	$232	$4	$162	$96	$62
Northern CA	CA	Non-CREZ	556335	Solar PV	Proxy	20	$7,103	24%	$229	$4	$164	$97	$59
Northern CA	CA	Non-CREZ	721168	Solar PV	Proxy	20	$7,055	23%	$238	$4	$156	$96	$69
Northern CA	CA	Non-CREZ	534092	Solar PV	Proxy	20	$7,059	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	534093	Solar PV	Proxy	20	$7,064	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	318138	Solar PV	Proxy	20	$7,060	25%	$215	$4	$156	$94	$56

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	398628	Solar PV	Proxy	20	$7,128	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	456924	Solar PV	Proxy	20	$7,105	24%	$229	$4	$162	$97	$60
Northern CA	CA	Non-CREZ	560753	Solar PV	Proxy	20	$7,073	24%	$228	$4	$162	$96	$59
Northern CA	CA	Non-CREZ	446772	Solar PV	Proxy	20	$7,066	24%	$232	$4	$157	$96	$64
Northern CA	CA	Non-CREZ	447481	Solar PV	Proxy	20	$7,075	24%	$231	$4	$159	$96	$62
Northern CA	CA	Non-CREZ	628027	Solar PV	Proxy	20	$7,057	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	689935	Solar PV	Proxy	20	$7,043	24%	$227	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	494539	Solar PV	Proxy	20	$7,045	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	722026	Solar PV	Proxy	20	$7,048	19%	$287	$4	$128	$96	$119
Northern CA	CA	Non-CREZ	442824	Solar PV	Proxy	20	$7,050	25%	$223	$4	$164	$97	$54
Northern CA	CA	Non-CREZ	594636	Solar PV	Proxy	20	$7,043	24%	$226	$4	$165	$96	$56
Northern CA	CA	Non-CREZ	533547	Solar PV	Proxy	20	$7,045	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	645312	Solar PV	Proxy	20	$7,050	24%	$226	$4	$164	$96	$57
Northern CA	CA	Non-CREZ	638180	Solar PV	Proxy	20	$7,043	23%	$238	$4	$158	$96	$67
Northern CA	CA	Non-CREZ	625302	Solar PV	Proxy	20	$7,047	23%	$238	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	309999	Solar PV	Proxy	20	$7,048	25%	$220	$4	$153	$94	$60
Northern CA	CA	Non-CREZ	538941	Solar PV	Proxy	20	$7,195	24%	$236	$4	$162	$96	$65
Northern CA	CA	Non-CREZ	538940	Solar PV	Proxy	20	$7,200	23%	$237	$4	$161	$96	$67
Northern CA	CA	Non-CREZ	406614	Solar PV	Proxy	20	$7,082	24%	$227	$4	$161	$96	$59
Northern CA	CA	Non-CREZ	361027	Solar PV	Proxy	20	$7,073	23%	$239	$4	$137	$94	$81
Northern CA	CA	Non-CREZ	361477	Solar PV	Proxy	20	$7,082	23%	$239	$4	$137	$94	$82
Northern CA	CA	Non-CREZ	599492	Solar PV	Proxy	20	$7,079	24%	$228	$4	$163	$96	$59
Northern CA	CA	Non-CREZ	599429	Solar PV	Proxy	20	$7,083	24%	$228	$4	$163	$96	$59
Northern CA	CA	Non-CREZ	366254	Solar PV	Proxy	20	$7,048	24%	$223	$4	$152	$94	$62
Northern CA	CA	Non-CREZ	602558	Solar PV	Proxy	20	$7,088	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	493225	Solar PV	Proxy	20	$7,047	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	617195	Solar PV	Proxy	20	$7,104	23%	$241	$4	$159	$96	$70
Northern CA	CA	Non-CREZ	598479	Solar PV	Proxy	20	$7,064	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	414794	Solar PV	Proxy	20	$7,064	24%	$225	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	491687	Solar PV	Proxy	20	$7,062	23%	$232	$4	$157	$96	$65
Northern CA	CA	Non-CREZ	533421	Solar PV	Proxy	20	$7,044	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	661157	Solar PV	Proxy	20	$7,058	23%	$239	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	322135	Solar PV	Proxy	20	$7,047	25%	$222	$4	$153	$94	$61
Northern CA	CA	Non-CREZ	368081	Solar PV	Proxy	20	$7,067	25%	$222	$4	$153	$94	$61
Northern CA	CA	Non-CREZ	529364	Solar PV	Proxy	20	$7,076	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	529237	Solar PV	Proxy	20	$7,087	24%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	522275	Solar PV	Proxy	20	$7,046	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	644991	Solar PV	Proxy	20	$7,082	24%	$228	$4	$162	$96	$59
Northern CA	CA	Non-CREZ	453162	Solar PV	Proxy	20	$7,065	24%	$230	$4	$162	$97	$60

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	449197	Solar PV	Proxy	20	$7,065	24%	$228	$4	$160	$96	$60
Northern CA	CA	Non-CREZ	352596	Solar PV	Proxy	20	$7,050	24%	$232	$4	$149	$94	$70
Northern CA	CA	Non-CREZ	709628	Solar PV	Proxy	20	$7,044	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	556292	Solar PV	Proxy	20	$7,048	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	491091	Solar PV	Proxy	20	$7,050	24%	$230	$4	$159	$96	$62
Northern CA	CA	Non-CREZ	482925	Solar PV	Proxy	20	$7,054	23%	$242	$4	$149	$96	$74
Northern CA	CA	Non-CREZ	482994	Solar PV	Proxy	20	$7,077	23%	$242	$4	$149	$96	$76
Northern CA	CA	Non-CREZ	305626	Solar PV	Proxy	20	$7,071	27%	$206	$4	$156	$94	$50
Northern CA	CA	Non-CREZ	583692	Solar PV	Proxy	20	$7,064	24%	$226	$4	$163	$96	$57
Northern CA	CA	Non-CREZ	638009	Solar PV	Proxy	20	$7,051	23%	$238	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	447903	Solar PV	Proxy	20	$7,044	24%	$230	$4	$158	$96	$62
Northern CA	CA	Non-CREZ	409090	Solar PV	Proxy	20	$7,046	24%	$225	$4	$161	$96	$57
Northern CA	CA	Non-CREZ	409025	Solar PV	Proxy	20	$7,046	24%	$225	$4	$161	$100	$54
Northern CA	CA	Non-CREZ	362149	Solar PV	Proxy	20	$7,042	23%	$235	$4	$138	$94	$77
Northern CA	CA	Non-CREZ	654294	Solar PV	Proxy	20	$7,058	19%	$283	$4	$126	$96	$117
Northern CA	CA	Non-CREZ	703336	Solar PV	Proxy	20	$7,041	23%	$237	$4	$161	$96	$65
Northern CA	CA	Non-CREZ	598246	Solar PV	Proxy	20	$7,057	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	535483	Solar PV	Proxy	20	$7,042	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	532952	Solar PV	Proxy	20	$7,043	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	533214	Solar PV	Proxy	20	$7,053	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	493045	Solar PV	Proxy	20	$7,104	24%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	722358	Solar PV	Proxy	20	$7,042	19%	$280	$4	$133	$96	$110
Northern CA	CA	Non-CREZ	567885	Solar PV	Proxy	20	$7,043	24%	$229	$4	$161	$96	$60
Northern CA	CA	Non-CREZ	405409	Solar PV	Proxy	20	$7,049	23%	$233	$4	$156	$97	$65
Northern CA	CA	Non-CREZ	405537	Solar PV	Proxy	20	$7,050	24%	$227	$4	$160	$96	$59
Northern CA	CA	Non-CREZ	492473	Solar PV	Proxy	20	$7,077	24%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	493416	Solar PV	Proxy	20	$7,050	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	698818	Solar PV	Proxy	20	$7,040	19%	$288	$4	$123	$96	$122
Northern CA	CA	Non-CREZ	542751	Solar PV	Proxy	20	$7,216	24%	$236	$4	$162	$96	$66
Northern CA	CA	Non-CREZ	542815	Solar PV	Proxy	20	$7,220	24%	$236	$4	$162	$97	$65
Northern CA	CA	Non-CREZ	403416	Solar PV	Proxy	20	$7,046	25%	$222	$4	$155	$94	$61
Northern CA	CA	Non-CREZ	309122	Solar PV	Proxy	20	$7,046	24%	$223	$4	$149	$94	$64
Northern CA	CA	Non-CREZ	487734	Solar PV	Proxy	20	$7,089	23%	$239	$4	$152	$96	$72
Northern CA	CA	Non-CREZ	626929	Solar PV	Proxy	20	$7,079	23%	$240	$4	$156	$96	$70
Northern CA	CA	Non-CREZ	309374	Solar PV	Proxy	20	$7,071	25%	$221	$4	$152	$94	$61
Northern CA	CA	Non-CREZ	692289	Solar PV	Proxy	20	$7,060	21%	$261	$4	$149	$97	$87
Northern CA	CA	Non-CREZ	447134	Solar PV	Proxy	20	$7,067	24%	$232	$4	$158	$96	$64
Northern CA	CA	Non-CREZ	616007	Solar PV	Proxy	20	$7,123	22%	$247	$4	$158	$97	$74
Northern CA	CA	Non-CREZ	615506	Solar PV	Proxy	20	$7,151	22%	$248	$4	$158	$97	$75

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	523230	Solar PV	Proxy	20	$7,056	24%	$230	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	523420	Solar PV	Proxy	20	$7,056	23%	$241	$4	$151	$96	$73
Northern CA	CA	Non-CREZ	607943	Solar PV	Proxy	20	$7,042	25%	$221	$4	$163	$96	$54
Northern CA	CA	Non-CREZ	608069	Solar PV	Proxy	20	$7,047	25%	$221	$4	$163	$96	$54
Northern CA	CA	Non-CREZ	558523	Solar PV	Proxy	20	$7,071	24%	$227	$4	$164	$96	$57
Northern CA	CA	Non-CREZ	558524	Solar PV	Proxy	20	$7,074	24%	$227	$4	$164	$96	$57
Northern CA	CA	Non-CREZ	721190	Solar PV	Proxy	20	$7,056	19%	$281	$4	$133	$96	$111
Northern CA	CA	Non-CREZ	724821	Solar PV	Proxy	20	$7,045	23%	$240	$4	$156	$96	$70
Northern CA	CA	Non-CREZ	703557	Solar PV	Proxy	20	$7,051	23%	$238	$4	$160	$96	$66
Northern CA	CA	Non-CREZ	364963	Solar PV	Proxy	20	$7,050	24%	$225	$4	$152	$94	$64
Northern CA	CA	Non-CREZ	528257	Solar PV	Proxy	20	$7,054	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	528321	Solar PV	Proxy	20	$7,058	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	367440	Solar PV	Proxy	20	$7,048	24%	$225	$4	$152	$94	$63
Northern CA	CA	Non-CREZ	367506	Solar PV	Proxy	20	$7,052	24%	$224	$4	$152	$94	$63
Northern CA	CA	Non-CREZ	447263	Solar PV	Proxy	20	$7,062	24%	$231	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	447652	Solar PV	Proxy	20	$7,065	24%	$230	$4	$159	$96	$62
Northern CA	CA	Non-CREZ	492236	Solar PV	Proxy	20	$7,046	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	351537	Solar PV	Proxy	20	$7,047	24%	$229	$4	$154	$94	$65
Northern CA	CA	Non-CREZ	457039	Solar PV	Proxy	20	$7,046	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	497633	Solar PV	Proxy	20	$7,059	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	495956	Solar PV	Proxy	20	$7,067	24%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	568575	Solar PV	Proxy	20	$7,049	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	556161	Solar PV	Proxy	20	$7,049	24%	$228	$4	$163	$96	$58
Northern CA	CA	Non-CREZ	555969	Solar PV	Proxy	20	$7,050	24%	$231	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	533553	Solar PV	Proxy	20	$7,074	23%	$234	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	563916	Solar PV	Proxy	20	$7,051	21%	$261	$4	$136	$96	$96
Northern CA	CA	Non-CREZ	692172	Solar PV	Proxy	20	$7,042	21%	$259	$4	$150	$97	$86
Northern CA	CA	Non-CREZ	696967	Solar PV	Proxy	20	$7,041	23%	$238	$4	$156	$96	$69
Northern CA	CA	Non-CREZ	492015	Solar PV	Proxy	20	$7,144	24%	$234	$4	$161	$97	$64
Northern CA	CA	Non-CREZ	453982	Solar PV	Proxy	20	$7,061	24%	$228	$4	$162	$97	$59
Northern CA	CA	Non-CREZ	663092	Solar PV	Proxy	20	$7,188	23%	$244	$4	$158	$96	$73
Northern CA	CA	Non-CREZ	452477	Solar PV	Proxy	20	$7,050	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	452476	Solar PV	Proxy	20	$7,053	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	556040	Solar PV	Proxy	20	$7,058	24%	$229	$4	$163	$96	$59
Northern CA	CA	Non-CREZ	556166	Solar PV	Proxy	20	$7,059	24%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	361902	Solar PV	Proxy	20	$7,065	23%	$236	$4	$138	$94	$78
Northern CA	CA	Non-CREZ	362424	Solar PV	Proxy	20	$7,075	24%	$227	$4	$149	$94	$67
Northern CA	CA	Non-CREZ	362761	Solar PV	Proxy	20	$7,055	24%	$223	$4	$154	$94	$62
Northern CA	CA	Non-CREZ	362433	Solar PV	Proxy	20	$7,059	24%	$231	$4	$146	$94	$71

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	407345	Solar PV	Proxy	20	$7,049	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	407409	Solar PV	Proxy	20	$7,049	24%	$227	$4	$162	$97	$58
Northern CA	CA	Non-CREZ	359288	Solar PV	Proxy	20	$7,048	24%	$226	$4	$148	$94	$67
Northern CA	CA	Non-CREZ	565752	Solar PV	Proxy	20	$7,051	23%	$233	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	496558	Solar PV	Proxy	20	$7,054	24%	$232	$4	$161	$97	$62
Northern CA	CA	Non-CREZ	496818	Solar PV	Proxy	20	$7,055	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	492149	Solar PV	Proxy	20	$7,051	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	542743	Solar PV	Proxy	20	$7,061	23%	$233	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	543006	Solar PV	Proxy	20	$7,064	24%	$231	$4	$162	$97	$61
Northern CA	CA	Non-CREZ	523981	Solar PV	Proxy	20	$7,043	24%	$230	$4	$163	$97	$59
Northern CA	CA	Non-CREZ	640765	Solar PV	Proxy	20	$7,042	23%	$237	$4	$158	$96	$66
Northern CA	CA	Non-CREZ	402988	Solar PV	Proxy	20	$7,063	24%	$225	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	402721	Solar PV	Proxy	20	$7,077	24%	$225	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	710281	Solar PV	Proxy	20	$7,095	23%	$234	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	521322	Solar PV	Proxy	20	$7,055	23%	$238	$4	$155	$96	$69
Northern CA	CA	Non-CREZ	454737	Solar PV	Proxy	20	$7,066	24%	$225	$4	$164	$97	$56
Northern CA	CA	Non-CREZ	446388	Solar PV	Proxy	20	$7,079	24%	$232	$4	$158	$96	$64
Northern CA	CA	Non-CREZ	480676	Solar PV	Proxy	20	$7,063	25%	$220	$4	$165	$96	$52
Northern CA	CA	Non-CREZ	721267	Solar PV	Proxy	20	$7,047	19%	$287	$4	$128	$96	$119
Northern CA	CA	Non-CREZ	479646	Solar PV	Proxy	20	$7,090	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	660401	Solar PV	Proxy	20	$7,042	23%	$239	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	526317	Solar PV	Proxy	20	$7,054	24%	$231	$4	$163	$97	$60
Northern CA	CA	Non-CREZ	526318	Solar PV	Proxy	20	$7,059	24%	$230	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	527598	Solar PV	Proxy	20	$7,080	23%	$237	$4	$157	$96	$67
Northern CA	CA	Non-CREZ	526574	Solar PV	Proxy	20	$7,081	24%	$231	$4	$163	$97	$60
Northern CA	CA	Non-CREZ	657547	Solar PV	Proxy	20	$7,054	19%	$282	$4	$129	$96	$114
Northern CA	CA	Non-CREZ	657862	Solar PV	Proxy	20	$7,057	19%	$283	$4	$128	$96	$115
Northern CA	CA	Non-CREZ	491682	Solar PV	Proxy	20	$7,062	23%	$232	$4	$157	$96	$65
Northern CA	CA	Non-CREZ	447349	Solar PV	Proxy	20	$7,069	24%	$230	$4	$159	$96	$62
Northern CA	CA	Non-CREZ	492143	Solar PV	Proxy	20	$7,057	24%	$232	$4	$161	$97	$61
Northern CA	CA	Non-CREZ	634770	Solar PV	Proxy	20	$7,042	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	535451	Solar PV	Proxy	20	$7,065	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	690422	Solar PV	Proxy	20	$7,107	24%	$231	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	698855	Solar PV	Proxy	20	$7,048	19%	$288	$4	$124	$96	$122
Northern CA	CA	Non-CREZ	498297	Solar PV	Proxy	20	$7,042	24%	$228	$4	$163	$96	$58
Northern CA	CA	Non-CREZ	498233	Solar PV	Proxy	20	$7,043	24%	$229	$4	$161	$96	$60
Northern CA	CA	Non-CREZ	604869	Solar PV	Proxy	20	$7,054	23%	$236	$4	$160	$96	$65
Northern CA	CA	Non-CREZ	453853	Solar PV	Proxy	20	$7,067	24%	$230	$4	$161	$97	$61
Northern CA	CA	Non-CREZ	570694	Solar PV	Proxy	20	$7,063	24%	$232	$4	$160	$96	$63

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	571735	Solar PV	Proxy	20	$7,067	24%	$231	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	350856	Solar PV	Proxy	20	$7,059	23%	$242	$4	$135	$94	$84
Northern CA	CA	Non-CREZ	693610	Solar PV	Proxy	20	$7,063	23%	$237	$4	$157	$96	$68
Northern CA	CA	Non-CREZ	352252	Solar PV	Proxy	20	$7,054	24%	$226	$4	$154	$94	$63
Northern CA	CA	Non-CREZ	495613	Solar PV	Proxy	20	$7,044	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	491024	Solar PV	Proxy	20	$7,097	24%	$231	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	571148	Solar PV	Proxy	20	$7,067	24%	$231	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	534548	Solar PV	Proxy	20	$7,048	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	534549	Solar PV	Proxy	20	$7,049	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	729522	Solar PV	Proxy	20	$7,042	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	362641	Solar PV	Proxy	20	$7,059	24%	$230	$4	$146	$94	$70
Northern CA	CA	Non-CREZ	362507	Solar PV	Proxy	20	$7,073	24%	$227	$4	$149	$94	$66
Northern CA	CA	Non-CREZ	403515	Solar PV	Proxy	20	$7,047	24%	$223	$4	$163	$97	$55
Northern CA	CA	Non-CREZ	531172	Solar PV	Proxy	20	$7,076	23%	$234	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	531108	Solar PV	Proxy	20	$7,077	23%	$233	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	533749	Solar PV	Proxy	20	$7,050	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	533813	Solar PV	Proxy	20	$7,051	23%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	595606	Solar PV	Proxy	20	$7,045	25%	$221	$4	$165	$96	$53
Northern CA	CA	Non-CREZ	595480	Solar PV	Proxy	20	$7,045	24%	$224	$4	$166	$96	$55
Northern CA	CA	Non-CREZ	496387	Solar PV	Proxy	20	$7,042	23%	$234	$4	$158	$96	$65
Northern CA	CA	Non-CREZ	483967	Solar PV	Proxy	20	$7,071	23%	$238	$4	$155	$96	$70
Northern CA	CA	Non-CREZ	483903	Solar PV	Proxy	20	$7,074	23%	$242	$4	$150	$96	$74
Northern CA	CA	Non-CREZ	485310	Solar PV	Proxy	20	$7,107	23%	$239	$4	$153	$96	$71
Northern CA	CA	Non-CREZ	484931	Solar PV	Proxy	20	$7,138	23%	$239	$4	$154	$96	$71
Northern CA	CA	Non-CREZ	709561	Solar PV	Proxy	20	$7,041	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	482990	Solar PV	Proxy	20	$7,122	23%	$244	$4	$149	$96	$76
Northern CA	CA	Non-CREZ	413718	Solar PV	Proxy	20	$7,074	24%	$228	$4	$162	$97	$59
Northern CA	CA	Non-CREZ	258296	Solar PV	Proxy	20	$7,059	27%	$201	$4	$156	$94	$46
Northern CA	CA	Non-CREZ	481270	Solar PV	Proxy	20	$7,088	24%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	495336	Solar PV	Proxy	20	$7,057	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	660392	Solar PV	Proxy	20	$7,043	23%	$236	$4	$161	$96	$64
Northern CA	CA	Non-CREZ	494555	Solar PV	Proxy	20	$7,042	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	658124	Solar PV	Proxy	20	$7,046	22%	$247	$4	$155	$97	$75
Northern CA	CA	Non-CREZ	593521	Solar PV	Proxy	20	$7,047	24%	$230	$4	$163	$96	$60
Northern CA	CA	Non-CREZ	598021	Solar PV	Proxy	20	$7,045	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	360340	Solar PV	Proxy	20	$7,056	23%	$238	$4	$136	$94	$81
Northern CA	CA	Non-CREZ	360406	Solar PV	Proxy	20	$7,058	23%	$236	$4	$141	$94	$76
Northern CA	CA	Non-CREZ	371464	Solar PV	Proxy	20	$7,128	24%	$225	$4	$154	$94	$64
Northern CA	CA	Non-CREZ	598097	Solar PV	Proxy	20	$7,045	23%	$233	$4	$159	$96	$64

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	597848	Solar PV	Proxy	20	$7,066	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	358964	Solar PV	Proxy	20	$7,047	22%	$244	$4	$129	$94	$89
Northern CA	CA	Non-CREZ	445428	Solar PV	Proxy	20	$7,050	24%	$230	$4	$162	$97	$60
Northern CA	CA	Non-CREZ	445234	Solar PV	Proxy	20	$7,052	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	359250	Solar PV	Proxy	20	$7,111	22%	$246	$4	$129	$94	$91
Northern CA	CA	Non-CREZ	359184	Solar PV	Proxy	20	$7,116	22%	$246	$4	$129	$94	$91
Northern CA	CA	Non-CREZ	403035	Solar PV	Proxy	20	$7,101	24%	$225	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	568420	Solar PV	Proxy	20	$7,056	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	568613	Solar PV	Proxy	20	$7,056	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	495307	Solar PV	Proxy	20	$7,051	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	408842	Solar PV	Proxy	20	$7,061	24%	$227	$4	$161	$96	$59
Northern CA	CA	Non-CREZ	711094	Solar PV	Proxy	20	$7,108	23%	$234	$4	$160	$96	$65
Northern CA	CA	Non-CREZ	711033	Solar PV	Proxy	20	$7,112	23%	$234	$4	$160	$96	$65
Northern CA	CA	Non-CREZ	403020	Solar PV	Proxy	20	$7,058	24%	$225	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	567646	Solar PV	Proxy	20	$7,043	24%	$229	$4	$163	$96	$59
Northern CA	CA	Non-CREZ	568129	Solar PV	Proxy	20	$7,071	24%	$230	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	568067	Solar PV	Proxy	20	$7,073	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	315889	Solar PV	Proxy	20	$7,044	25%	$215	$4	$155	$94	$55
Northern CA	CA	Non-CREZ	481745	Solar PV	Proxy	20	$7,044	26%	$207	$4	$163	$96	$45
Northern CA	CA	Non-CREZ	534165	Solar PV	Proxy	20	$7,044	23%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	452603	Solar PV	Proxy	20	$7,053	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	554417	Solar PV	Proxy	20	$7,048	24%	$232	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	499242	Solar PV	Proxy	20	$7,050	24%	$228	$4	$162	$97	$59
Northern CA	CA	Non-CREZ	369764	Solar PV	Proxy	20	$7,057	24%	$224	$4	$154	$94	$62
Northern CA	CA	Non-CREZ	369698	Solar PV	Proxy	20	$7,062	24%	$225	$4	$154	$94	$63
Northern CA	CA	Non-CREZ	572441	Solar PV	Proxy	20	$7,093	24%	$233	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	497064	Solar PV	Proxy	20	$7,068	24%	$230	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	405475	Solar PV	Proxy	20	$7,056	24%	$231	$4	$157	$96	$63
Northern CA	CA	Non-CREZ	664537	Solar PV	Proxy	20	$7,049	23%	$239	$4	$159	$96	$68
Northern CA	CA	Non-CREZ	536841	Solar PV	Proxy	20	$7,052	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	536963	Solar PV	Proxy	20	$7,064	23%	$233	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	529724	Solar PV	Proxy	20	$7,083	24%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	532947	Solar PV	Proxy	20	$7,050	24%	$231	$4	$162	$97	$61
Northern CA	CA	Non-CREZ	316962	Solar PV	Proxy	20	$7,080	25%	$216	$4	$156	$94	$56
Northern CA	CA	Non-CREZ	602873	Solar PV	Proxy	20	$7,041	24%	$230	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	568304	Solar PV	Proxy	20	$7,042	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	662650	Solar PV	Proxy	20	$7,043	23%	$241	$4	$158	$96	$70
Northern CA	CA	Non-CREZ	606134	Solar PV	Proxy	20	$7,043	24%	$224	$4	$162	$96	$56
Northern CA	CA	Non-CREZ	606132	Solar PV	Proxy	20	$7,058	24%	$225	$4	$162	$96	$57

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	556111	Solar PV	Proxy	20	$7,107	23%	$234	$4	$158	$96	$65
Northern CA	CA	Non-CREZ	531138	Solar PV	Proxy	20	$7,047	23%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	533944	Solar PV	Proxy	20	$7,054	23%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	724635	Solar PV	Proxy	20	$7,046	20%	$268	$4	$145	$97	$94
Northern CA	CA	Non-CREZ	352675	Solar PV	Proxy	20	$7,063	24%	$230	$4	$153	$94	$67
Northern CA	CA	Non-CREZ	515678	Solar PV	Proxy	20	$7,055	24%	$227	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	485018	Solar PV	Proxy	20	$7,058	23%	$237	$4	$154	$96	$69
Northern CA	CA	Non-CREZ	484629	Solar PV	Proxy	20	$7,064	23%	$239	$4	$155	$96	$69
Northern CA	CA	Non-CREZ	527725	Solar PV	Proxy	20	$7,054	24%	$230	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	527662	Solar PV	Proxy	20	$7,060	24%	$230	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	453589	Solar PV	Proxy	20	$7,044	24%	$230	$4	$162	$97	$60
Northern CA	CA	Non-CREZ	369227	Solar PV	Proxy	20	$7,053	24%	$226	$4	$153	$94	$64
Northern CA	CA	Non-CREZ	369226	Solar PV	Proxy	20	$7,054	24%	$224	$4	$153	$94	$63
Northern CA	CA	Non-CREZ	574320	Solar PV	Proxy	20	$7,085	23%	$236	$4	$158	$96	$66
Northern CA	CA	Non-CREZ	626079	Solar PV	Proxy	20	$7,084	23%	$240	$4	$157	$96	$70
Northern CA	CA	Non-CREZ	529301	Solar PV	Proxy	20	$7,041	23%	$233	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	530301	Solar PV	Proxy	20	$7,053	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	530302	Solar PV	Proxy	20	$7,055	23%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	626754	Solar PV	Proxy	20	$7,083	23%	$243	$4	$158	$96	$71
Northern CA	CA	Non-CREZ	560303	Solar PV	Proxy	20	$7,054	24%	$228	$4	$163	$96	$58
Northern CA	CA	Non-CREZ	523304	Solar PV	Proxy	20	$7,068	24%	$231	$4	$163	$97	$60
Northern CA	CA	Non-CREZ	709748	Solar PV	Proxy	20	$7,056	24%	$229	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	371004	Solar PV	Proxy	20	$7,118	24%	$228	$4	$152	$94	$66
Northern CA	CA	Non-CREZ	371005	Solar PV	Proxy	20	$7,121	24%	$225	$4	$154	$94	$63
Northern CA	CA	Non-CREZ	451395	Solar PV	Proxy	20	$7,091	24%	$228	$4	$161	$96	$59
Northern CA	CA	Non-CREZ	352242	Solar PV	Proxy	20	$7,060	24%	$231	$4	$152	$94	$68
Northern CA	CA	Non-CREZ	406119	Solar PV	Proxy	20	$7,065	24%	$228	$4	$160	$96	$60
Northern CA	CA	Non-CREZ	564890	Solar PV	Proxy	20	$7,045	23%	$233	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	647312	Solar PV	Proxy	20	$7,086	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	482590	Solar PV	Proxy	20	$7,063	23%	$242	$4	$149	$96	$75
Northern CA	CA	Non-CREZ	523755	Solar PV	Proxy	20	$7,092	24%	$232	$4	$163	$97	$61
Northern CA	CA	Non-CREZ	532948	Solar PV	Proxy	20	$7,046	24%	$230	$4	$163	$97	$60
Northern CA	CA	Non-CREZ	612350	Solar PV	Proxy	20	$7,045	20%	$277	$4	$134	$96	$108
Northern CA	CA	Non-CREZ	366809	Solar PV	Proxy	20	$7,057	25%	$222	$4	$154	$94	$61
Northern CA	CA	Non-CREZ	449398	Solar PV	Proxy	20	$7,069	24%	$227	$4	$161	$96	$58
Northern CA	CA	Non-CREZ	450118	Solar PV	Proxy	20	$7,070	24%	$228	$4	$160	$96	$60
Northern CA	CA	Non-CREZ	661122	Solar PV	Proxy	20	$7,059	23%	$239	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	350975	Solar PV	Proxy	20	$7,053	23%	$241	$4	$135	$94	$84
Northern CA	CA	Non-CREZ	351041	Solar PV	Proxy	20	$7,054	24%	$224	$4	$154	$94	$62

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	536783	Solar PV	Proxy	20	$7,059	24%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	533779	Solar PV	Proxy	20	$7,050	23%	$232	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	448406	Solar PV	Proxy	20	$7,125	24%	$233	$4	$158	$96	$64
Northern CA	CA	Non-CREZ	572859	Solar PV	Proxy	20	$7,051	23%	$234	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	532430	Solar PV	Proxy	20	$7,046	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	647126	Solar PV	Proxy	20	$7,046	24%	$224	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	652007	Solar PV	Proxy	20	$7,067	24%	$225	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	402358	Solar PV	Proxy	20	$7,053	24%	$226	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	402487	Solar PV	Proxy	20	$7,056	24%	$225	$4	$162	$96	$57
Northern CA	CA	Non-CREZ	352798	Solar PV	Proxy	20	$7,060	24%	$229	$4	$154	$94	$66
Northern CA	CA	Non-CREZ	257281	Solar PV	Proxy	20	$7,061	27%	$199	$4	$161	$94	$43
Northern CA	CA	Non-CREZ	479579	Solar PV	Proxy	20	$7,091	24%	$227	$4	$162	$96	$59
Northern CA	CA	Non-CREZ	498401	Solar PV	Proxy	20	$7,173	24%	$231	$4	$163	$96	$61
Northern CA	CA	Non-CREZ	498395	Solar PV	Proxy	20	$7,187	24%	$232	$4	$163	$96	$62
Northern CA	CA	Non-CREZ	311583	Solar PV	Proxy	20	$7,075	25%	$221	$4	$152	$94	$61
Northern CA	CA	Non-CREZ	353666	Solar PV	Proxy	20	$7,047	23%	$241	$4	$135	$94	$84
Northern CA	CA	Non-CREZ	359144	Solar PV	Proxy	20	$7,049	22%	$244	$4	$129	$94	$89
Northern CA	CA	Non-CREZ	359279	Solar PV	Proxy	20	$7,061	24%	$232	$4	$142	$94	$73
Northern CA	CA	Non-CREZ	359345	Solar PV	Proxy	20	$7,081	23%	$236	$4	$138	$94	$78
Northern CA	CA	Non-CREZ	367903	Solar PV	Proxy	20	$7,064	24%	$224	$4	$152	$94	$63
Northern CA	CA	Non-CREZ	368566	Solar PV	Proxy	20	$7,068	25%	$222	$4	$153	$94	$61
Northern CA	CA	Non-CREZ	368759	Solar PV	Proxy	20	$7,047	25%	$222	$4	$154	$94	$61
Northern CA	CA	Non-CREZ	403486	Solar PV	Proxy	20	$7,043	24%	$223	$4	$164	$97	$54
Northern CA	CA	Non-CREZ	406211	Solar PV	Proxy	20	$7,044	24%	$226	$4	$153	$94	$64
Northern CA	CA	Non-CREZ	442631	Solar PV	Proxy	20	$7,067	24%	$224	$4	$163	$97	$56
Northern CA	CA	Non-CREZ	481769	Solar PV	Proxy	20	$7,072	22%	$252	$4	$139	$96	$87
Northern CA	CA	Non-CREZ	353611	Solar PV	Proxy	20	$7,057	24%	$232	$4	$153	$94	$68
Northern CA	CA	Non-CREZ	353742	Solar PV	Proxy	20	$7,060	22%	$245	$4	$129	$94	$90
Northern CA	CA	Non-CREZ	258282	Solar PV	Proxy	20	$7,075	27%	$206	$4	$155	$94	$50
Northern CA	CA	Non-CREZ	317776	Solar PV	Proxy	20	$7,083	25%	$216	$4	$156	$94	$56
Northern CA	CA	Non-CREZ	317710	Solar PV	Proxy	20	$7,086	25%	$215	$4	$156	$94	$56
Northern CA	CA	Non-CREZ	572494	Solar PV	Proxy	20	$7,063	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	491229	Solar PV	Proxy	20	$7,052	23%	$233	$4	$156	$96	$65
Northern CA	CA	Non-CREZ	572661	Solar PV	Proxy	20	$7,047	23%	$234	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	410178	Solar PV	Proxy	20	$7,064	24%	$228	$4	$162	$97	$59
Northern CA	CA	Non-CREZ	410243	Solar PV	Proxy	20	$7,064	24%	$228	$4	$162	$97	$59
Northern CA	CA	Non-CREZ	625547	Solar PV	Proxy	20	$7,048	23%	$236	$4	$160	$96	$65
Northern CA	CA	Non-CREZ	722527	Solar PV	Proxy	20	$7,048	20%	$279	$4	$134	$96	$109
Northern CA	CA	Non-CREZ	488504	Solar PV	Proxy	20	$7,058	23%	$233	$4	$156	$96	$65

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	535872	Solar PV	Proxy	20	$7,055	24%	$232	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	535548	Solar PV	Proxy	20	$7,057	24%	$231	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	662820	Solar PV	Proxy	20	$7,042	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	606429	Solar PV	Proxy	20	$7,110	25%	$223	$4	$164	$96	$56
Northern CA	CA	Non-CREZ	483492	Solar PV	Proxy	20	$7,042	23%	$241	$4	$149	$96	$74
Northern CA	CA	Non-CREZ	484261	Solar PV	Proxy	20	$7,095	23%	$241	$4	$150	$96	$74
Northern CA	CA	Non-CREZ	709461	Solar PV	Proxy	20	$7,067	24%	$230	$4	$161	$96	$61
Northern CA	CA	Non-CREZ	658892	Solar PV	Proxy	20	$7,069	23%	$239	$4	$158	$96	$68
Northern CA	CA	Non-CREZ	601059	Solar PV	Proxy	20	$7,073	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	601058	Solar PV	Proxy	20	$7,077	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	637639	Solar PV	Proxy	20	$7,044	23%	$238	$4	$158	$96	$67
Northern CA	CA	Non-CREZ	570310	Solar PV	Proxy	20	$7,055	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	710009	Solar PV	Proxy	20	$7,053	23%	$233	$4	$159	$96	$63
Northern CA	CA	Non-CREZ	691749	Solar PV	Proxy	20	$7,049	24%	$228	$4	$160	$96	$60
Northern CA	CA	Non-CREZ	487736	Solar PV	Proxy	20	$7,064	23%	$239	$4	$152	$96	$71
Northern CA	CA	Non-CREZ	487798	Solar PV	Proxy	20	$7,056	23%	$238	$4	$152	$96	$71
Northern CA	CA	Non-CREZ	308669	Solar PV	Proxy	20	$7,046	24%	$223	$4	$152	$94	$62
Northern CA	CA	Non-CREZ	308604	Solar PV	Proxy	20	$7,049	24%	$224	$4	$150	$94	$64
Northern CA	CA	Non-CREZ	309057	Solar PV	Proxy	20	$7,055	24%	$223	$4	$151	$94	$63
Northern CA	CA	Non-CREZ	483214	Solar PV	Proxy	20	$7,053	22%	$246	$4	$144	$96	$80
Northern CA	CA	Non-CREZ	483596	Solar PV	Proxy	20	$7,058	22%	$251	$4	$139	$96	$86
Northern CA	CA	Non-CREZ	483528	Solar PV	Proxy	20	$7,049	23%	$241	$4	$149	$96	$75
Northern CA	CA	Non-CREZ	453780	Solar PV	Proxy	20	$7,051	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	453717	Solar PV	Proxy	20	$7,052	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	628460	Solar PV	Proxy	20	$7,052	23%	$239	$4	$159	$96	$68
Northern CA	CA	Non-CREZ	444847	Solar PV	Proxy	20	$7,085	26%	$209	$4	$164	$96	$46
Northern CA	CA	Non-CREZ	635488	Solar PV	Proxy	20	$7,096	23%	$239	$4	$160	$96	$67
Northern CA	CA	Non-CREZ	352842	Solar PV	Proxy	20	$7,051	23%	$232	$4	$152	$94	$69
Northern CA	CA	Non-CREZ	498396	Solar PV	Proxy	20	$7,286	24%	$234	$4	$163	$96	$64
Northern CA	CA	Non-CREZ	483686	Solar PV	Proxy	20	$7,067	23%	$241	$4	$150	$96	$74
Northern CA	CA	Non-CREZ	524142	Solar PV	Proxy	20	$7,073	23%	$239	$4	$155	$96	$70
Northern CA	CA	Non-CREZ	481785	Solar PV	Proxy	20	$7,071	22%	$252	$4	$139	$96	$87
Northern CA	CA	Non-CREZ	579170	Solar PV	Proxy	20	$7,066	23%	$234	$4	$162	$96	$63
Northern CA	CA	Non-CREZ	638936	Solar PV	Proxy	20	$7,043	23%	$237	$4	$159	$96	$66
Northern CA	CA	Non-CREZ	402419	Solar PV	Proxy	20	$7,049	24%	$224	$4	$162	$96	$56
Northern CA	CA	Non-CREZ	657942	Solar PV	Proxy	20	$7,053	21%	$264	$4	$146	$97	$91
Northern CA	CA	Non-CREZ	491617	Solar PV	Proxy	20	$7,065	23%	$233	$4	$157	$96	$65
Northern CA	CA	Non-CREZ	590607	Solar PV	Proxy	20	$7,063	24%	$226	$4	$163	$96	$57
Northern CA	CA	Non-CREZ	481050	Solar PV	Proxy	20	$7,058	25%	$219	$4	$165	$96	$52

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	363720	Solar PV	Proxy	20	$7,101	24%	$225	$4	$154	$94	$63
Northern CA	CA	Non-CREZ	578137	Solar PV	Proxy	20	$7,110	24%	$234	$4	$162	$96	$63
Northern CA	CA	Non-CREZ	624739	Solar PV	Proxy	20	$7,047	23%	$242	$4	$159	$97	$70
Northern CA	CA	Non-CREZ	366000	Solar PV	Proxy	20	$7,066	24%	$224	$4	$153	$94	$63
Northern CA	CA	Non-CREZ	482125	Solar PV	Proxy	20	$7,062	23%	$242	$4	$149	$96	$75
Northern CA	CA	Non-CREZ	487384	Solar PV	Proxy	20	$7,054	23%	$237	$4	$153	$96	$69
Northern CA	CA	Non-CREZ	398799	Solar PV	Proxy	20	$7,073	24%	$224	$4	$154	$94	$62
Northern CA	CA	Non-CREZ	447204	Solar PV	Proxy	20	$7,060	24%	$229	$4	$159	$96	$61
Northern CA	CA	Non-CREZ	352331	Solar PV	Proxy	20	$7,041	25%	$220	$4	$154	$94	$60
Northern CA	CA	Non-CREZ	442421	Solar PV	Proxy	20	$7,043	25%	$220	$4	$167	$97	$51
Northern CA	CA	Non-CREZ	596178	Solar PV	Proxy	20	$7,063	25%	$222	$4	$165	$96	$54
Northern CA	CA	Non-CREZ	596241	Solar PV	Proxy	20	$7,064	25%	$220	$4	$164	$96	$53
Northern CA	CA	Non-CREZ	533714	Solar PV	Proxy	20	$7,048	24%	$230	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	533620	Solar PV	Proxy	20	$7,058	23%	$233	$4	$161	$96	$63
Northern CA	CA	Non-CREZ	257157	Solar PV	Proxy	20	$7,060	28%	$198	$4	$162	$93	$42
Northern CA	CA	Non-CREZ	567913	Solar PV	Proxy	20	$7,051	24%	$228	$4	$162	$96	$59
Northern CA	CA	Non-CREZ	617514	Solar PV	Proxy	20	$7,134	23%	$243	$4	$159	$96	$71
Northern CA	CA	Non-CREZ	598090	Solar PV	Proxy	20	$7,060	23%	$234	$4	$160	$96	$64
Northern CA	CA	Non-CREZ	487247	Solar PV	Proxy	20	$7,057	23%	$239	$4	$151	$96	$72
Northern CA	CA	Non-CREZ	597218	Solar PV	Proxy	20	$7,047	23%	$239	$4	$160	$97	$67
Northern CA	CA	Non-CREZ	677879	Solar PV	Proxy	20	$7,049	23%	$237	$4	$159	$96	$66
Northern CA	CA	Non-CREZ	653474	Solar PV	Proxy	20	$7,059	24%	$227	$4	$160	$96	$59
Northern CA	CA	Non-CREZ	654166	Solar PV	Proxy	20	$7,078	20%	$276	$4	$133	$96	$107
Northern CA	CA	Non-CREZ	568174	Solar PV	Proxy	20	$7,070	24%	$230	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	729042	Solar PV	Proxy	20	$7,041	23%	$237	$4	$157	$96	$67
Northern CA	CA	Non-CREZ	452015	Solar PV	Proxy	20	$7,048	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	451950	Solar PV	Proxy	20	$7,052	24%	$229	$4	$161	$97	$60
Northern CA	CA	Non-CREZ	727942	Solar PV	Proxy	20	$7,053	23%	$239	$4	$157	$96	$69
Northern CA	CA	Non-CREZ	451394	Solar PV	Proxy	20	$7,126	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	729352	Solar PV	Proxy	20	$7,043	23%	$236	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	451523	Solar PV	Proxy	20	$7,084	24%	$228	$4	$161	$97	$59
Northern CA	CA	Non-CREZ	491920	Solar PV	Proxy	20	$7,048	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	626246	Solar PV	Proxy	20	$7,082	23%	$237	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	395872	Solar PV	Proxy	20	$7,070	24%	$226	$4	$153	$94	$64
Northern CA	CA	Non-CREZ	663015	Solar PV	Proxy	20	$7,048	23%	$241	$4	$158	$96	$70
Northern CA	CA	Non-CREZ	367439	Solar PV	Proxy	20	$7,045	24%	$225	$4	$152	$94	$63
Northern CA	CA	Non-CREZ	645809	Solar PV	Proxy	20	$7,053	24%	$226	$4	$162	$96	$58
Northern CA	CA	Non-CREZ	700922	Solar PV	Proxy	20	$7,045	23%	$236	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	736642	Solar PV	Proxy	20	$7,041	23%	$234	$4	$159	$96	$64

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	736581	Solar PV	Proxy	20	$7,043	23%	$237	$4	$157	$96	$67
Northern CA	CA	Non-CREZ	366671	Solar PV	Proxy	20	$7,057	24%	$225	$4	$153	$94	$63
Northern CA	CA	Non-CREZ	366605	Solar PV	Proxy	20	$7,059	25%	$222	$4	$153	$94	$62
Northern CA	CA	Non-CREZ	443282	Solar PV	Proxy	20	$7,094	26%	$213	$4	$162	$96	$49
Northern CA	CA	Non-CREZ	443143	Solar PV	Proxy	20	$7,096	25%	$217	$4	$160	$96	$53
Northern CA	CA	Non-CREZ	453097	Solar PV	Proxy	20	$7,079	24%	$230	$4	$162	$97	$60
Northern CA	CA	Non-CREZ	558334	Solar PV	Proxy	20	$7,058	24%	$226	$4	$164	$96	$57
Northern CA	CA	Non-CREZ	640843	Solar PV	Proxy	20	$7,052	23%	$235	$4	$158	$96	$65
Northern CA	CA	Non-CREZ	449737	Solar PV	Proxy	20	$7,057	24%	$228	$4	$160	$96	$60
Northern CA	CA	Non-CREZ	449802	Solar PV	Proxy	20	$7,062	24%	$226	$4	$161	$96	$58
Northern CA	CA	Non-CREZ	363657	Solar PV	Proxy	20	$7,094	24%	$227	$4	$153	$94	$65
Northern CA	CA	Non-CREZ	484244	Solar PV	Proxy	20	$7,083	23%	$241	$4	$150	$96	$74
Northern CA	CA	Non-CREZ	493051	Solar PV	Proxy	20	$7,050	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	594746	Solar PV	Proxy	20	$7,058	24%	$226	$4	$165	$96	$56
Northern CA	CA	Non-CREZ	628712	Solar PV	Proxy	20	$7,049	23%	$236	$4	$158	$96	$66
Northern CA	CA	Non-CREZ	564278	Solar PV	Proxy	20	$7,046	23%	$237	$4	$159	$96	$66
Northern CA	CA	Non-CREZ	686958	Solar PV	Proxy	20	$7,061	24%	$229	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	520646	Solar PV	Proxy	20	$7,063	21%	$254	$4	$140	$96	$88
Northern CA	CA	Non-CREZ	491480	Solar PV	Proxy	20	$7,060	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	690364	Solar PV	Proxy	20	$7,052	24%	$229	$4	$162	$96	$60
Northern CA	CA	Non-CREZ	572977	Solar PV	Proxy	20	$7,042	23%	$232	$4	$162	$96	$61
Northern CA	CA	Non-CREZ	362418	Solar PV	Proxy	20	$7,061	24%	$231	$4	$146	$94	$71
Northern CA	CA	Non-CREZ	443351	Solar PV	Proxy	20	$7,076	26%	$210	$4	$163	$96	$47
Northern CA	CA	Non-CREZ	497630	Solar PV	Proxy	20	$7,047	24%	$231	$4	$160	$96	$61
Northern CA	CA	Non-CREZ	532693	Solar PV	Proxy	20	$7,046	23%	$233	$4	$160	$96	$63
Northern CA	CA	Non-CREZ	360535	Solar PV	Proxy	20	$7,110	23%	$240	$4	$136	$94	$83
Northern CA	CA	Non-CREZ	360601	Solar PV	Proxy	20	$7,111	23%	$240	$4	$136	$94	$83
Northern CA	CA	Non-CREZ	362482	Solar PV	Proxy	20	$7,048	23%	$234	$4	$141	$94	$75
Northern CA	CA	Non-CREZ	317240	Solar PV	Proxy	20	$7,070	25%	$216	$4	$156	$94	$56
Northern CA	CA	Non-CREZ	317241	Solar PV	Proxy	20	$7,072	25%	$216	$4	$156	$94	$56
Northern CA	CA	Non-CREZ	634893	Solar PV	Proxy	20	$7,041	23%	$237	$4	$160	$96	$66
Northern CA	CA	Non-CREZ	569456	Solar PV	Proxy	20	$7,041	23%	$232	$4	$158	$96	$63
Northern CA	CA	Non-CREZ	656928	Solar PV	Proxy	20	$7,071	19%	$290	$4	$121	$96	$126
Northern CA	CA	Non-CREZ	661089	Solar PV	Proxy	20	$7,042	23%	$238	$4	$159	$96	$67
Northern CA	CA	Non-CREZ	621570	Solar PV	Proxy	20	$7,150	23%	$241	$4	$158	$96	$70
Northern CA	CA	Non-CREZ	621630	Solar PV	Proxy	20	$7,157	23%	$241	$4	$158	$96	$70
Northern CA	CA	Non-CREZ	564096	Solar PV	Proxy	20	$7,042	21%	$263	$4	$131	$96	$100
Northern CA	CA	Non-CREZ	555100	Solar PV	Proxy	20	$7,061	24%	$231	$4	$161	$96	$62
Northern CA	CA	Non-CREZ	646946	Solar PV	Proxy	20	$7,154	24%	$228	$4	$161	$96	$60

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Northern CA	CA	Non-CREZ	370051	Solar PV	Proxy	20	$7,264	24%	$231	$4	$154	$94	$69
Northern CA	CA	Non-CREZ	529988	Solar PV	Proxy	20	$7,056	24%	$231	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	600807	Solar PV	Proxy	20	$7,049	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	600933	Solar PV	Proxy	20	$7,055	23%	$235	$4	$159	$96	$65
Northern CA	CA	Non-CREZ	367400	Solar PV	Proxy	20	$7,056	25%	$222	$4	$153	$94	$61
Northern CA	CA	Non-CREZ	404063	Solar PV	Proxy	20	$7,047	27%	$202	$4	$158	$94	$46
Northern CA	CA	Non-CREZ	365617	Solar PV	Proxy	20	$7,048	24%	$226	$4	$152	$94	$64
Northern CA	CA	Non-CREZ	687122	Solar PV	Proxy	20	$7,058	23%	$237	$4	$159	$96	$66
Northern CA	CA	Non-CREZ	569542	Solar PV	Proxy	20	$7,045	23%	$233	$4	$159	$96	$64
Northern CA	CA	Non-CREZ	528459	Solar PV	Proxy	20	$7,077	24%	$232	$4	$160	$96	$62
Northern CA	CA	Non-CREZ	528395	Solar PV	Proxy	20	$7,082	23%	$234	$4	$159	$96	$65
Northern CA	CA	Round Mountain-A	Medicine Lake	Geothermal	Pre-ID	240	$4,500	80%	$86	$20	$204	$87	-$11
Northern CA	CA	Round Mountain-B	Shasta	Biomass	Proxy	55	$4,559	80%	$146	$15	$204	$87	$46
Northern CA	CA	Round Mountain-B	WI_130	Wind	Proxy	73	$2,505	32%	$104	$26	$53	$87	$24
Northern CA	CA	Round Mountain-B	WI_131	Wind	Proxy	59	$2,616	29%	$120	$28	$53	$87	$40
Northern CA	CA	Solano	WI_141	Wind	Pre-ID	159	$2,281	37%	$77	$10	$96	$86	-$29
Northern CA	CA	Solano	WI_142	Wind	Pre-ID	119	$2,279	39%	$70	$10	$96	$86	-$34
Northern CA	CA	Solano	WI_143	Wind	Pre-ID	37	$2,270	32%	$91	$11	$96	$86	-$18
Northern CA	CA	Solano	WI_144	Wind	Pre-ID	97	$2,277	34%	$84	$11	$96	$86	-$23
Northern CA	CA	Solano	WI_145	Wind	Pre-ID	92	$2,279	38%	$73	$10	$96	$86	-$32
Northern CA	CA	Solano	WI_173	Wind	Pre-ID	40	$2,263	29%	$108	$12	$96	$86	-$4
Northern CA	CA	Solano	WI_174	Wind	Pre-ID	104	$2,280	36%	$80	$10	$96	$86	-$26
Northern CA	CA	Solano	WI_175	Wind	Pre-ID	105	$2,283	38%	$72	$10	$96	$86	-$32
Northern CA	CA	Solano	WI_180	Wind	Pre-ID	142	$2,284	38%	$74	$10	$96	$86	-$31
SOUTHWEST OUT-OF-STATE													
OOS - SW	AZ	Arizona	solnvaz_3	Solar Th.	Pre-ID	436	$5,183	28%	$159	$37	$164	$101	$29
OOS - SW	AZ	Arizona	solnvaz_4	Solar Th.	Pre-ID	105	$5,183	28%	$158	$37	$163	$100	$29
OOS - SW	AZ	Arizona	solnvaz_5	Solar Th.	Pre-ID	166	$5,183	28%	$159	$37	$160	$100	$30
OOS - SW	AZ	Arizona	solnvaz_6	Solar Th.	Pre-ID	384	$5,183	27%	$163	$38	$163	$98	$36
OOS - SW	AZ	Arizona	solnvaz_7	Solar Th.	Pre-ID	1914	$5,183	29%	$157	$36	$170	$98	$28
OOS - SW	AZ	Arizona	solnvaz_8	Solar Th.	Pre-ID	1953	$5,183	29%	$158	$36	$167	$98	$31
OOS - SW	AZ	Arizona	solnvaz_9	Solar Th.	Pre-ID	268	$5,183	28%	$159	$37	$167	$98	$31
OOS - SW	AZ	Arizona	solnvaz_10	Solar Th.	Pre-ID	449	$5,183	29%	$156	$36	$168	$97	$28
OOS - SW	AZ	Arizona	solnvaz_13	Solar Th.	Pre-ID	691	$5,183	28%	$162	$37	$163	$101	$32
OOS - SW	AZ	Arizona	solnvaz_16	Solar Th.	Pre-ID	137	$5,183	28%	$163	$32	$165	$100	$27
OOS - SW	AZ	Arizona	solnvaz_18	Solar Th.	Pre-ID	446	$5,183	27%	$164	$33	$166	$100	$28
OOS - SW	AZ	Arizona	st0001	Solar Th.	Pre-ID	180	$5,183	28%	$162	$37	$166	$99	$32
OOS - SW	MX	Baja	WI_BAJA_342	Wind	Proxy	764	$2,396	38%	$78	$23	$68	$85	-$6
OOS - SW	MX	Baja	WI_BAJA_343	Wind	Proxy	973	$2,400	38%	$77	$22	$68	$85	-$7

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
OOS - SW	MX	Baja	WI_BAJA_344	Wind	Proxy	707	$2,373	23%	$145	$34	$68	$85	$60
OOS - SW	MX	Baja	WI_BAJA_345	Wind	Proxy	449	$2,373	25%	$136	$32	$68	$85	$52
OOS - SW	MX	Baja	WI_BAJA_346	Wind	Proxy	563	$2,387	33%	$95	$25	$68	$85	$11
OOS - SW	MX	Baja	WI_BAJA_347	Wind	Proxy	573	$2,382	31%	$100	$26	$68	$85	$16
OOS - SW	MX	Baja	WI_BAJA_348	Wind	Proxy	631	$2,392	40%	$71	$10	$68	$85	-$24
OOS - SW	MX	Baja	WI_BAJA_349	Wind	Proxy	339	$2,376	27%	$124	$30	$68	$85	$40
OOS - SW	CA	Non-CREZ	19543	Solar PV	Proxy	20	$7,045	27%	$202	$4	$152	$95	$48
OOS - SW	CA	Non-CREZ	19475	Solar PV	Proxy	20	$7,048	27%	$199	$4	$156	$95	$44
SALTON SEA / SAN DIEGO													
Salton Sea/SD	CA	Imperial East	WI_1	Wind	Pre-ID	74	$2,501	32%	$100	$42	$37	$83	$46
Salton Sea/SD	CA	Imperial East	WI_2	Wind	Pre-ID	49	$2,517	29%	$116	$41	$37	$83	$60
Salton Sea/SD	CA	Imperial East	st2578	Solar Th.	Proxy	200	$4,968	28%	$154	$32	$147	$96	$30
Salton Sea/SD	CA	Imperial East	st2581	Solar Th.	Proxy	200	$4,916	28%	$153	$32	$147	$96	$29
Salton Sea/SD	CA	Imperial East	st2583	Solar Th.	Proxy	200	$4,870	28%	$155	$32	$146	$96	$30
Salton Sea/SD	CA	Imperial East	st2584	Solar Th.	Proxy	200	$4,854	28%	$154	$32	$146	$96	$30
Salton Sea/SD	CA	Imperial East	st2602	Solar Th.	Proxy	200	$4,808	27%	$157	$33	$140	$96	$34
Salton Sea/SD	CA	Imperial East	st2604	Solar Th.	Proxy	200	$4,814	27%	$157	$33	$140	$96	$34
Salton Sea/SD	CA	Imperial East	st2758	Solar Th.	Proxy	200	$4,828	28%	$151	$37	$141	$96	$35
Salton Sea/SD	CA	Imperial East	st2802	Solar Th.	Proxy	200	$5,007	28%	$157	$38	$140	$96	$42
Salton Sea/SD	CA	Imperial North-A	Brawley (sum of Brawley, East Brawley, and South Brawley)	Geothermal	Pre-ID	160	$4,190	80%	$77	$8	$204	$86	-$29
Salton Sea/SD	CA	Imperial North-A	Salton Sea (incl. Niland & Westmoreland)	Geothermal	Pre-ID	1170	$4,889	90%	$92	$8	$204	$86	-$11
Salton Sea/SD	CA	Imperial North-A	Truckhaven (incl. San Felipe prospect)	Geothermal	Pre-ID	40	$4,500	80%	$88	$9	$204	$86	-$18
Salton Sea/SD	CA	Imperial North-B	Imperial 1	Biomass	Proxy	30	$5,069	80%	$151	$17	$204	$86	$53
Salton Sea/SD	CA	Imperial North-B	st1800	Solar Th.	Pre-ID	200	$4,765	29%	$143	$24	$168	$97	$4
Salton Sea/SD	CA	Imperial North-B	st5598	Solar Th.	Pre-ID	200	$4,812	27%	$158	$26	$144	$97	$26
Salton Sea/SD	CA	Imperial North-B	st5599	Solar Th.	Pre-ID	200	$4,850	27%	$159	$26	$144	$97	$27
Salton Sea/SD	CA	Imperial North-B	st5641	Solar Th.	Pre-ID	200	$4,852	26%	$161	$26	$140	$96	$30
Salton Sea/SD	CA	Imperial North-B	st5707	Solar Th.	Proxy	200	$4,872	28%	$152	$32	$152	$97	$25
Salton Sea/SD	CA	Imperial North-B	st5731	Solar Th.	Proxy	200	$4,909	28%	$153	$32	$152	$97	$26
Salton Sea/SD	CA	Imperial North-B	st5756	Solar Th.	Proxy	200	$5,092	28%	$157	$32	$152	$97	$31
Salton Sea/SD	CA	Imperial North-B	st5987	Solar Th.	Pre-ID	200	$5,025	26%	$168	$31	$140	$97	$40
Salton Sea/SD	CA	Imperial North-B	st5988	Solar Th.	Pre-ID	200	$5,040	26%	$168	$31	$140	$97	$41

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Salton Sea/SD	CA	Imperial South	East Mesa (incl. Dunes & Glamis)	Geothermal	Pre-ID	32	$7,609	80%	$140	$23	$204	$86	$48
Salton Sea/SD	CA	Imperial South	Heber (incl. Border, Mount Signal, & Superstition Mountain)	Geothermal	Pre-ID	32	$4,231	80%	$84	$8	$204	$86	-$23
Salton Sea/SD	CA	Imperial South	Imperial 2	Biomass	Proxy	36	$4,904	80%	$154	$18	$204	$86	$56
Salton Sea/SD	CA	Imperial South	WI_3	Wind	Pre-ID	45	$2,274	30%	$106	$37	$68	$83	$34
Salton Sea/SD	CA	Imperial South	st1596	Solar Th.	Pre-ID	200	$4,988	26%	$164	$30	$137	$97	$38
Salton Sea/SD	CA	Imperial South	st1597	Solar Th.	Pre-ID	200	$5,025	26%	$165	$30	$137	$97	$39
Salton Sea/SD	CA	Imperial South	st1622	Solar Th.	Pre-ID	200	$4,877	26%	$164	$31	$139	$97	$36
Salton Sea/SD	CA	Imperial South	st1645	Solar Th.	Pre-ID	200	$4,916	26%	$162	$30	$137	$97	$36
Salton Sea/SD	CA	Imperial South	st1646	Solar Th.	Pre-ID	200	$4,868	26%	$163	$30	$139	$97	$36
Salton Sea/SD	CA	Imperial South	st1668	Solar Th.	Pre-ID	200	$4,942	26%	$163	$29	$137	$97	$36
Salton Sea/SD	CA	Imperial South	st1669	Solar Th.	Pre-ID	200	$4,916	26%	$163	$29	$137	$97	$36
Salton Sea/SD	CA	Imperial South	st1670	Solar Th.	Pre-ID	200	$4,863	26%	$163	$30	$139	$97	$36
Salton Sea/SD	CA	Imperial South	st1693	Solar Th.	Pre-ID	200	$4,683	27%	$153	$28	$154	$98	$18
Salton Sea/SD	CA	Imperial South	st1697	Solar Th.	Proxy	200	$4,695	26%	$161	$31	$155	$98	$25
Salton Sea/SD	CA	Imperial South	st1832	Solar Th.	Pre-ID	200	$4,630	26%	$160	$29	$151	$98	$24
Salton Sea/SD	CA	Imperial South	st2289	Solar Th.	Proxy	200	$4,758	28%	$151	$30	$143	$96	$26
Salton Sea/SD	CA	Imperial South	st2290	Solar Th.	Proxy	200	$4,785	28%	$152	$30	$143	$96	$27
Salton Sea/SD	CA	Imperial South	st2313	Solar Th.	Proxy	200	$4,804	28%	$153	$30	$143	$96	$28
Salton Sea/SD	CA	Imperial South	st2337	Solar Th.	Proxy	200	$4,806	28%	$153	$30	$143	$96	$28
Salton Sea/SD	CA	Imperial South	st2361	Solar Th.	Proxy	200	$4,769	28%	$152	$30	$143	$96	$27
Salton Sea/SD	CA	Imperial South	st2385	Solar Th.	Proxy	200	$4,779	28%	$149	$30	$144	$96	$24
Salton Sea/SD	CA	Imperial South	st2268	Solar Th.	Pre-ID	200	$4,790	26%	$161	$32	$133	$96	$38
Salton Sea/SD	CA	Non-CREZ	San Diego 2	Biomass	Proxy	46	$4,666	80%	$130	$10	$204	$89	$22
Salton Sea/SD	CA	Non-CREZ	San Diego 1	Biomass	Proxy	47	$4,647	80%	$125	$10	$204	$89	$17
Salton Sea/SD	CA	Non-CREZ	47295	Solar PV	Proxy	20	$7,066	27%	$201	$4	$156	$95	$45
Salton Sea/SD	CA	Non-CREZ	16796	Solar PV	Proxy	20	$7,064	27%	$201	$4	$155	$95	$46
Salton Sea/SD	CA	Non-CREZ	5882	Solar PV	Proxy	20	$7,097	26%	$213	$4	$154	$95	$54
Salton Sea/SD	CA	Non-CREZ	43766	Solar PV	Proxy	20	$7,042	27%	$202	$4	$155	$95	$46
Salton Sea/SD	CA	Non-CREZ	23360	Solar PV	Proxy	20	$7,066	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	23918	Solar PV	Proxy	20	$7,056	27%	$202	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	6142	Solar PV	Proxy	20	$7,065	26%	$212	$4	$154	$95	$53
Salton Sea/SD	CA	Non-CREZ	34714	Solar PV	Proxy	20	$7,063	24%	$224	$4	$143	$95	$67
Salton Sea/SD	CA	Non-CREZ	46426	Solar PV	Proxy	20	$7,041	27%	$204	$4	$154	$95	$48
Salton Sea/SD	CA	Non-CREZ	41029	Solar PV	Proxy	20	$7,044	27%	$203	$4	$155	$98	$44
Salton Sea/SD	CA	Non-CREZ	38935	Solar PV	Proxy	20	$7,106	26%	$208	$4	$157	$98	$46

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Salton Sea/SD	CA	Non-CREZ	9677	Solar PV	Proxy	20	$7,045	27%	$200	$4	$158	$95	$44
Salton Sea/SD	CA	Non-CREZ	16208	Solar PV	Proxy	20	$7,051	27%	$201	$4	$154	$95	$46
Salton Sea/SD	CA	Non-CREZ	16140	Solar PV	Proxy	20	$7,063	27%	$202	$4	$154	$95	$47
Salton Sea/SD	CA	Non-CREZ	47635	Solar PV	Proxy	20	$7,056	27%	$200	$4	$156	$95	$45
Salton Sea/SD	CA	Non-CREZ	7976	Solar PV	Proxy	20	$7,045	27%	$204	$4	$158	$95	$46
Salton Sea/SD	CA	Non-CREZ	2924	Solar PV	Proxy	20	$7,070	24%	$225	$4	$143	$95	$67
Salton Sea/SD	CA	Non-CREZ	34645	Solar PV	Proxy	20	$7,081	24%	$225	$4	$143	$95	$67
Salton Sea/SD	CA	Non-CREZ	15268	Solar PV	Proxy	20	$7,045	27%	$205	$4	$152	$95	$50
Salton Sea/SD	CA	Non-CREZ	36853	Solar PV	Proxy	20	$7,050	25%	$217	$4	$151	$95	$57
Salton Sea/SD	CA	Non-CREZ	9273	Solar PV	Proxy	20	$7,059	27%	$203	$4	$158	$98	$42
Salton Sea/SD	CA	Non-CREZ	34092	Solar PV	Proxy	20	$7,071	24%	$226	$4	$142	$95	$68
Salton Sea/SD	CA	Non-CREZ	13641	Solar PV	Proxy	20	$7,045	27%	$205	$4	$152	$95	$50
Salton Sea/SD	CA	Non-CREZ	13714	Solar PV	Proxy	20	$7,042	27%	$205	$4	$152	$95	$49
Salton Sea/SD	CA	Non-CREZ	18117	Solar PV	Proxy	20	$7,046	27%	$201	$4	$154	$95	$46
Salton Sea/SD	CA	Non-CREZ	17791	Solar PV	Proxy	20	$7,041	27%	$201	$4	$154	$95	$46
Salton Sea/SD	CA	Non-CREZ	17787	Solar PV	Proxy	20	$7,045	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	17785	Solar PV	Proxy	20	$7,045	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	17789	Solar PV	Proxy	20	$7,046	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	17786	Solar PV	Proxy	20	$7,045	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	7911	Solar PV	Proxy	20	$7,128	26%	$210	$4	$157	$95	$51
Salton Sea/SD	CA	Non-CREZ	52039	Solar PV	Proxy	20	$7,041	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	52244	Solar PV	Proxy	20	$7,082	27%	$204	$4	$153	$95	$49
Salton Sea/SD	CA	Non-CREZ	52248	Solar PV	Proxy	20	$7,085	27%	$204	$4	$152	$95	$49
Salton Sea/SD	CA	Non-CREZ	4163	Solar PV	Proxy	20	$7,118	25%	$222	$4	$146	$95	$64
Salton Sea/SD	CA	Non-CREZ	15535	Solar PV	Proxy	20	$7,052	27%	$202	$4	$154	$95	$47
Salton Sea/SD	CA	Non-CREZ	15425	Solar PV	Proxy	20	$7,043	27%	$202	$4	$154	$95	$47
Salton Sea/SD	CA	Non-CREZ	17042	Solar PV	Proxy	20	$7,062	27%	$201	$4	$154	$95	$46
Salton Sea/SD	CA	Non-CREZ	16714	Solar PV	Proxy	20	$7,058	27%	$201	$4	$154	$95	$46
Salton Sea/SD	CA	Non-CREZ	21795	Solar PV	Proxy	20	$7,043	27%	$205	$4	$157	$95	$47
Salton Sea/SD	CA	Non-CREZ	21796	Solar PV	Proxy	20	$7,043	27%	$199	$4	$156	$95	$44
Salton Sea/SD	CA	Non-CREZ	9417	Solar PV	Proxy	20	$7,059	27%	$202	$4	$158	$98	$42
Salton Sea/SD	CA	Non-CREZ	33854	Solar PV	Proxy	20	$7,134	24%	$227	$4	$142	$95	$70
Salton Sea/SD	CA	Non-CREZ	15689	Solar PV	Proxy	20	$7,045	27%	$202	$4	$153	$95	$47
Salton Sea/SD	CA	Non-CREZ	15762	Solar PV	Proxy	20	$7,048	27%	$202	$4	$154	$95	$47
Salton Sea/SD	CA	Non-CREZ	2512	Solar PV	Proxy	20	$7,098	24%	$226	$4	$142	$95	$69
Salton Sea/SD	CA	Non-CREZ	33786	Solar PV	Proxy	20	$7,070	24%	$226	$4	$142	$95	$68
Salton Sea/SD	CA	Non-CREZ	33576	Solar PV	Proxy	20	$7,055	24%	$226	$4	$145	$95	$67
Salton Sea/SD	CA	Non-CREZ	41499	Solar PV	Proxy	20	$7,070	27%	$204	$4	$154	$95	$48
Salton Sea/SD	CA	Non-CREZ	14187	Solar PV	Proxy	20	$7,058	27%	$206	$4	$152	$95	$50

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Salton Sea/SD	CA	Non-CREZ	47857	Solar PV	Proxy	20	$7,047	27%	$203	$4	$155	$95	$47
Salton Sea/SD	CA	Non-CREZ	47788	Solar PV	Proxy	20	$7,050	27%	$203	$4	$155	$95	$47
Salton Sea/SD	CA	Non-CREZ	23292	Solar PV	Proxy	20	$7,052	27%	$203	$4	$152	$95	$49
Salton Sea/SD	CA	Non-CREZ	2444	Solar PV	Proxy	20	$7,057	24%	$225	$4	$142	$95	$68
Salton Sea/SD	CA	Non-CREZ	47688	Solar PV	Proxy	20	$7,042	27%	$200	$4	$156	$95	$45
Salton Sea/SD	CA	Non-CREZ	4232	Solar PV	Proxy	20	$7,065	25%	$221	$4	$146	$95	$63
Salton Sea/SD	CA	Non-CREZ	16007	Solar PV	Proxy	20	$7,051	27%	$202	$4	$154	$95	$47
Salton Sea/SD	CA	Non-CREZ	13029	Solar PV	Proxy	20	$7,046	27%	$203	$4	$154	$95	$47
Salton Sea/SD	CA	Non-CREZ	4210	Solar PV	Proxy	20	$7,077	25%	$219	$4	$150	$95	$60
Salton Sea/SD	CA	Non-CREZ	15735	Solar PV	Proxy	20	$7,049	27%	$202	$4	$154	$95	$47
Salton Sea/SD	CA	Non-CREZ	34370	Solar PV	Proxy	20	$7,062	25%	$219	$4	$150	$95	$59
Salton Sea/SD	CA	Non-CREZ	34093	Solar PV	Proxy	20	$7,047	25%	$221	$4	$149	$95	$61
Salton Sea/SD	CA	Non-CREZ	37858	Solar PV	Proxy	20	$7,162	25%	$217	$4	$153	$95	$58
Salton Sea/SD	CA	Non-CREZ	47548	Solar PV	Proxy	20	$7,051	27%	$201	$4	$156	$95	$45
Salton Sea/SD	CA	Non-CREZ	43995	Solar PV	Proxy	20	$7,049	27%	$201	$4	$157	$95	$44
Salton Sea/SD	CA	Non-CREZ	46527	Solar PV	Proxy	20	$7,075	27%	$204	$4	$154	$95	$48
Salton Sea/SD	CA	Non-CREZ	42937	Solar PV	Proxy	20	$7,042	26%	$206	$4	$152	$95	$50
Salton Sea/SD	CA	Non-CREZ	34648	Solar PV	Proxy	20	$7,113	24%	$226	$4	$143	$95	$68
Salton Sea/SD	CA	Non-CREZ	20774	Solar PV	Proxy	20	$7,042	27%	$204	$4	$150	$95	$50
Salton Sea/SD	CA	Non-CREZ	14251	Solar PV	Proxy	20	$7,046	27%	$201	$4	$154	$95	$46
Salton Sea/SD	CA	Non-CREZ	14793	Solar PV	Proxy	20	$7,053	27%	$206	$4	$151	$95	$51
Salton Sea/SD	CA	Non-CREZ	14263	Solar PV	Proxy	20	$7,052	27%	$202	$4	$154	$95	$46
Salton Sea/SD	CA	Non-CREZ	18628	Solar PV	Proxy	20	$7,042	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	19303	Solar PV	Proxy	20	$7,045	27%	$200	$4	$155	$95	$45
Salton Sea/SD	CA	Non-CREZ	53345	Solar PV	Proxy	20	$7,063	27%	$203	$4	$152	$95	$48
Salton Sea/SD	CA	Non-CREZ	15608	Solar PV	Proxy	20	$7,045	27%	$201	$4	$155	$95	$45
Salton Sea/SD	CA	Non-CREZ	35691	Solar PV	Proxy	20	$7,134	25%	$217	$4	$152	$95	$58
Salton Sea/SD	CA	Non-CREZ	17029	Solar PV	Proxy	20	$7,050	27%	$201	$4	$155	$95	$45
Salton Sea/SD	CA	Non-CREZ	38403	Solar PV	Proxy	20	$7,040	26%	$209	$4	$157	$98	$47
Salton Sea/SD	CA	Non-CREZ	4079	Solar PV	Proxy	20	$7,064	25%	$218	$4	$150	$95	$59
Salton Sea/SD	CA	Non-CREZ	46723	Solar PV	Proxy	20	$7,054	27%	$202	$4	$155	$95	$46
Salton Sea/SD	CA	Non-CREZ	23154	Solar PV	Proxy	20	$7,059	27%	$202	$4	$153	$95	$47
Salton Sea/SD	CA	San Diego North Central	WI_10	Wind	Proxy	80	$2,594	30%	$115	$23	$83	$88	$18
Salton Sea/SD	CA	San Diego North Central	WI_11	Wind	Proxy	51	$2,455	31%	$104	$26	$83	$88	$12
Salton Sea/SD	CA	San Diego North Central	WI_8	Wind	Proxy	82	$2,397	29%	$114	$15	$53	$85	$23
Salton Sea/SD	CA	San Diego North Central	WI_9	Wind	Proxy	67	$2,572	31%	$110	$14	$53	$85	$20
Salton Sea/SD	CA	San Diego South	WI_4	Wind	Proxy	216	$2,390	32%	$96	$28	$68	$86	$14
Salton Sea/SD	CA	San Diego South	WI_5	Wind	Pre-ID	161	$2,330	32%	$96	$29	$68	$86	$15
Salton Sea/SD	CA	San Diego South	WI_6	Wind	Proxy	113	$2,361	29%	$108	$31	$68	$86	$27

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Salton Sea/SD	CA	San Diego South	WI_7	Wind	Proxy	188	$2,627	35%	$95	$27	$68	$86	$14
SOUTHEAST CA													
Southeast CA	CA	Barstow	WI_39	Wind	Pre-ID	171	$2,369	30%	$103	$22	$57	$85	$18
Southeast CA	CA	Barstow	WI_40	Wind	Pre-ID	248	$2,475	32%	$99	$22	$57	$85	$16
Southeast CA	CA	Barstow	WI_41	Wind	Proxy	78	$2,664	29%	$121	$23	$57	$85	$37
Southeast CA	CA	Barstow	WI_42	Wind	Pre-ID	135	$2,657	29%	$124	$23	$57	$85	$40
Southeast CA	CA	Barstow	WI_43	Wind	Pre-ID	188	$2,633	30%	$116	$22	$57	$85	$31
Southeast CA	CA	Barstow	WI_44	Wind	Pre-ID	116	$2,258	29%	$106	$21	$57	$85	$20
Southeast CA	CA	Barstow	st22695	Solar Th.	Pre-ID	200	$4,765	27%	$155	$23	$149	$99	$17
Southeast CA	CA	Barstow	st22696	Solar Th.	Pre-ID	200	$4,778	27%	$156	$23	$149	$99	$17
Southeast CA	CA	Barstow	st22697	Solar Th.	Pre-ID	200	$4,804	27%	$156	$23	$149	$99	$18
Southeast CA	CA	Barstow	st22720	Solar Th.	Pre-ID	200	$4,961	27%	$160	$24	$149	$99	$22
Southeast CA	CA	Barstow	stm29171	Solar Th.	Pre-ID	200	$4,883	28%	$151	$23	$156	$99	$13
Southeast CA	CA	Barstow	stm29582	Solar Th.	Pre-ID	200	$5,008	28%	$156	$24	$155	$99	$19
Southeast CA	CA	Iron Mountain	WI_18	Wind	Pre-ID	62	$2,660	28%	$131	$29	$41	$85	$58
Southeast CA	CA	Iron Mountain	st16821	Solar Th.	Pre-ID	200	$4,808	28%	$153	$26	$148	$98	$20
Southeast CA	CA	Iron Mountain	st16843	Solar Th.	Pre-ID	200	$4,893	28%	$155	$27	$148	$98	$22
Southeast CA	CA	Iron Mountain	st16844	Solar Th.	Pre-ID	200	$4,891	28%	$155	$27	$148	$98	$22
Southeast CA	CA	Iron Mountain	st16845	Solar Th.	Pre-ID	200	$4,850	28%	$154	$27	$148	$98	$21
Southeast CA	CA	Iron Mountain	st16868	Solar Th.	Pre-ID	200	$4,887	27%	$156	$27	$146	$98	$24
Southeast CA	CA	Iron Mountain	st16869	Solar Th.	Pre-ID	200	$4,886	27%	$156	$27	$146	$98	$24
Southeast CA	CA	Iron Mountain	st16893	Solar Th.	Pre-ID	200	$4,870	27%	$156	$27	$146	$98	$23
Southeast CA	CA	Iron Mountain	st16977	Solar Th.	Pre-ID	200	$4,978	26%	$166	$30	$140	$99	$36
Southeast CA	CA	Iron Mountain	st17022	Solar Th.	Pre-ID	200	$5,004	26%	$166	$30	$140	$99	$37
Southeast CA	CA	Iron Mountain	st17023	Solar Th.	Pre-ID	200	$4,880	26%	$163	$30	$140	$99	$33
Southeast CA	CA	Iron Mountain	st17101	Solar Th.	Pre-ID	200	$4,839	27%	$157	$29	$147	$99	$26
Southeast CA	CA	Iron Mountain	st17124	Solar Th.	Pre-ID	200	$4,913	27%	$159	$29	$147	$99	$27
Southeast CA	CA	Iron Mountain	st17125	Solar Th.	Pre-ID	200	$4,839	27%	$157	$29	$147	$99	$25
Southeast CA	CA	Iron Mountain	st17239	Solar Th.	Pre-ID	200	$4,884	27%	$158	$29	$142	$98	$29
Southeast CA	CA	Iron Mountain	st17241	Solar Th.	Pre-ID	200	$4,883	27%	$158	$29	$142	$98	$29
Southeast CA	CA	Iron Mountain	st17242	Solar Th.	Pre-ID	200	$4,763	27%	$155	$29	$147	$98	$23
Southeast CA	CA	Iron Mountain	st17263	Solar Th.	Pre-ID	200	$4,844	27%	$157	$29	$142	$98	$28
Southeast CA	CA	Iron Mountain	st17265	Solar Th.	Pre-ID	200	$4,758	27%	$155	$29	$142	$98	$26
Southeast CA	CA	Iron Mountain	st17266	Solar Th.	Pre-ID	200	$4,740	27%	$154	$29	$147	$98	$23
Southeast CA	CA	Iron Mountain	st17289	Solar Th.	Pre-ID	200	$4,789	27%	$156	$29	$142	$98	$27
Southeast CA	CA	Iron Mountain	st23690	Solar Th.	Pre-ID	200	$4,862	26%	$162	$28	$145	$99	$28
Southeast CA	CA	Iron Mountain	st23691	Solar Th.	Pre-ID	200	$4,906	26%	$163	$28	$145	$99	$30
Southeast CA	CA	Iron Mountain	st23714	Solar Th.	Pre-ID	200	$4,891	26%	$163	$28	$145	$99	$29
Southeast CA	CA	Iron Mountain	st23715	Solar Th.	Pre-ID	200	$4,832	26%	$161	$28	$145	$99	$27

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Iron Mountain	st17290	Solar Th.	Pre-ID	200	$4,756	27%	$155	$29	$147	$98	$23
Southeast CA	CA	Iron Mountain	st17358	Solar Th.	Pre-ID	200	$4,918	27%	$159	$29	$147	$99	$28
Southeast CA	CA	Iron Mountain	st17334	Solar Th.	Pre-ID	200	$4,865	27%	$158	$29	$147	$99	$26
Southeast CA	CA	Iron Mountain	st17335	Solar Th.	Pre-ID	200	$4,932	27%	$159	$29	$147	$99	$28
Southeast CA	CA	Mountain Pass	WI_22	Wind	Pre-ID	135	$2,265	30%	$100	$30	$41	$85	$30
Southeast CA	CA	Mountain Pass	WI_23	Wind	Pre-ID	148	$2,301	31%	$98	$29	$41	$85	$28
Southeast CA	CA	Mountain Pass	WI_24	Wind	Pre-ID	190	$2,396	32%	$99	$29	$41	$85	$28
Southeast CA	CA	Mountain Pass	WI_25	Wind	Pre-ID	41	$2,526	36%	$87	$35	$41	$85	$25
Southeast CA	CA	Mountain Pass	WI_26	Wind	Pre-ID	185	$2,507	34%	$94	$27	$41	$85	$23
Southeast CA	CA	Mountain Pass	WI_27	Wind	Pre-ID	113	$2,586	32%	$107	$28	$41	$85	$36
Southeast CA	CA	Mountain Pass	WI_28	Wind	Pre-ID	65	$2,618	27%	$132	$32	$41	$85	$62
Southeast CA	CA	Mountain Pass	st31067	Solar Th.	Pre-ID	200	$5,067	30%	$147	$31	$152	$98	$22
Southeast CA	CA	Mountain Pass	st31068	Solar Th.	Pre-ID	200	$5,211	30%	$150	$31	$152	$98	$26
Southeast CA	CA	Mountain Pass	st37280	Solar Th.	Pre-ID	200	$4,732	27%	$153	$32	$146	$98	$26
Southeast CA	CA	Mountain Pass	st37281	Solar Th.	Pre-ID	200	$4,730	27%	$153	$32	$146	$98	$26
Southeast CA	CA	Mountain Pass	st37282	Solar Th.	Pre-ID	200	$4,731	27%	$153	$32	$146	$98	$26
Southeast CA	CA	Mountain Pass	st37303	Solar Th.	Pre-ID	200	$4,731	27%	$153	$32	$146	$98	$26
Southeast CA	CA	Mountain Pass	st37304	Solar Th.	Pre-ID	200	$4,731	27%	$153	$32	$146	$98	$26
Southeast CA	CA	Mountain Pass	st37305	Solar Th.	Pre-ID	200	$4,730	27%	$153	$32	$146	$98	$26
Southeast CA	CA	Mountain Pass	st37433	Solar Th.	Pre-ID	200	$4,834	28%	$153	$31	$148	$98	$25
Southeast CA	CA	Mountain Pass	st37455	Solar Th.	Pre-ID	200	$4,730	28%	$151	$31	$148	$98	$22
Southeast CA	CA	Needles	WI_20	Wind	Pre-ID	113	$2,308	30%	$103	$31	$41	$85	$34
Southeast CA	CA	Needles	WI_21	Wind	Proxy	149	$2,471	31%	$107	$31	$41	$85	$38
Southeast CA	CA	Needles	st24476	Solar Th.	Pre-ID	200	$5,130	28%	$161	$34	$143	$98	$38
Southeast CA	CA	Needles	st24613	Solar Th.	Pre-ID	200	$5,240	28%	$162	$36	$145	$98	$41
Southeast CA	CA	Needles	st24659	Solar Th.	Pre-ID	200	$5,238	28%	$162	$36	$145	$98	$41
Southeast CA	CA	Needles	st24638	Solar Th.	Proxy	200	$5,112	28%	$159	$36	$145	$98	$38
Southeast CA	CA	Non-CREZ	WI_56	Wind	Proxy	72	$2,651	35%	$96	$11	$88	$89	-$10
Southeast CA	CA	Non-CREZ	WI_75	Wind	Proxy	175	$2,662	29%	$121	$13	$88	$89	$11
Southeast CA	CA	Non-CREZ	st10088	Solar Th.	Pre-ID	200	$5,119	29%	$153	$13	$159	$99	$5
Southeast CA	CA	Non-CREZ	79105	Solar PV	Proxy	20	$7,077	27%	$202	$4	$157	$97	$44
Southeast CA	CA	Non-CREZ	165479	Solar PV	Proxy	20	$7,046	26%	$209	$4	$161	$97	$46
Southeast CA	CA	Non-CREZ	67583	Solar PV	Proxy	20	$7,163	25%	$224	$4	$150	$97	$62
Southeast CA	CA	Non-CREZ	70430	Solar PV	Proxy	20	$7,068	26%	$214	$4	$155	$97	$52
Southeast CA	CA	Non-CREZ	70147	Solar PV	Proxy	20	$7,075	25%	$216	$4	$154	$97	$54
Southeast CA	CA	Non-CREZ	169666	Solar PV	Proxy	20	$7,049	27%	$200	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	110751	Solar PV	Proxy	20	$7,102	26%	$215	$4	$154	$97	$54
Southeast CA	CA	Non-CREZ	121771	Solar PV	Proxy	20	$7,047	28%	$198	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	121706	Solar PV	Proxy	20	$7,050	28%	$198	$4	$162	$97	$38

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Non-CREZ	67175	Solar PV	Proxy	20	$7,042	25%	$221	$4	$150	$97	$59
Southeast CA	CA	Non-CREZ	117991	Solar PV	Proxy	20	$7,103	25%	$222	$4	$151	$97	$60
Southeast CA	CA	Non-CREZ	121145	Solar PV	Proxy	20	$7,094	27%	$202	$4	$162	$97	$42
Southeast CA	CA	Non-CREZ	121146	Solar PV	Proxy	20	$7,099	27%	$202	$4	$162	$97	$42
Southeast CA	CA	Non-CREZ	77884	Solar PV	Proxy	20	$7,048	28%	$197	$4	$160	$97	$39
Southeast CA	CA	Non-CREZ	77885	Solar PV	Proxy	20	$7,049	28%	$197	$4	$160	$97	$39
Southeast CA	CA	Non-CREZ	77942	Solar PV	Proxy	20	$7,063	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	78624	Solar PV	Proxy	20	$7,050	27%	$203	$4	$157	$97	$44
Southeast CA	CA	Non-CREZ	77799	Solar PV	Proxy	20	$7,052	27%	$204	$4	$155	$97	$46
Southeast CA	CA	Non-CREZ	77732	Solar PV	Proxy	20	$7,052	27%	$201	$4	$157	$97	$43
Southeast CA	CA	Non-CREZ	66552	Solar PV	Proxy	20	$7,224	24%	$228	$4	$148	$97	$66
Southeast CA	CA	Non-CREZ	70839	Solar PV	Proxy	20	$7,053	26%	$213	$4	$155	$97	$51
Southeast CA	CA	Non-CREZ	240446	Solar PV	Proxy	20	$7,061	28%	$198	$4	$162	$97	$39
Southeast CA	CA	Non-CREZ	240448	Solar PV	Proxy	20	$7,064	28%	$198	$4	$162	$97	$39
Southeast CA	CA	Non-CREZ	124347	Solar PV	Proxy	20	$7,133	27%	$206	$4	$154	$96	$48
Southeast CA	CA	Non-CREZ	35332	Solar PV	Proxy	20	$7,041	24%	$224	$4	$143	$97	$64
Southeast CA	CA	Non-CREZ	35401	Solar PV	Proxy	20	$7,044	25%	$218	$4	$150	$97	$57
Southeast CA	CA	Non-CREZ	144241	Solar PV	Proxy	20	$7,047	27%	$203	$4	$153	$96	$46
Southeast CA	CA	Non-CREZ	186303	Solar PV	Proxy	20	$7,104	25%	$218	$4	$156	$97	$55
Southeast CA	CA	Non-CREZ	177646	Solar PV	Proxy	20	$7,052	24%	$227	$4	$142	$97	$67
Southeast CA	CA	Non-CREZ	177579	Solar PV	Proxy	20	$7,056	24%	$227	$4	$142	$97	$67
Southeast CA	CA	Non-CREZ	70212	Solar PV	Proxy	20	$7,041	25%	$215	$4	$154	$97	$53
Southeast CA	CA	Non-CREZ	70279	Solar PV	Proxy	20	$7,048	25%	$215	$4	$154	$97	$53
Southeast CA	CA	Non-CREZ	109845	Solar PV	Proxy	20	$7,054	25%	$219	$4	$150	$97	$58
Southeast CA	CA	Non-CREZ	69262	Solar PV	Proxy	20	$7,051	25%	$216	$4	$153	$97	$55
Southeast CA	CA	Non-CREZ	69402	Solar PV	Proxy	20	$7,052	25%	$216	$4	$153	$97	$55
Southeast CA	CA	Non-CREZ	107533	Solar PV	Proxy	20	$7,059	24%	$231	$4	$136	$97	$73
Southeast CA	CA	Non-CREZ	106572	Solar PV	Proxy	20	$7,089	24%	$226	$4	$140	$97	$68
Southeast CA	CA	Non-CREZ	67585	Solar PV	Proxy	20	$7,115	24%	$227	$4	$145	$97	$66
Southeast CA	CA	Non-CREZ	67586	Solar PV	Proxy	20	$7,115	24%	$227	$4	$145	$97	$66
Southeast CA	CA	Non-CREZ	131394	Solar PV	Proxy	20	$7,043	27%	$198	$4	$159	$96	$40
Southeast CA	CA	Non-CREZ	131393	Solar PV	Proxy	20	$7,043	27%	$200	$4	$157	$96	$42
Southeast CA	CA	Non-CREZ	104836	Solar PV	Proxy	20	$7,130	24%	$227	$4	$142	$94	$71
Southeast CA	CA	Non-CREZ	105828	Solar PV	Proxy	20	$7,061	25%	$218	$4	$150	$97	$57
Southeast CA	CA	Non-CREZ	66834	Solar PV	Proxy	20	$7,068	24%	$223	$4	$148	$97	$61
Southeast CA	CA	Non-CREZ	106573	Solar PV	Proxy	20	$7,062	24%	$231	$4	$136	$97	$73
Southeast CA	CA	Non-CREZ	68794	Solar PV	Proxy	20	$7,151	25%	$217	$4	$153	$97	$56
Southeast CA	CA	Non-CREZ	105764	Solar PV	Proxy	20	$7,099	24%	$226	$4	$142	$97	$67
Southeast CA	CA	Non-CREZ	124552	Solar PV	Proxy	20	$7,052	27%	$204	$4	$154	$96	$46

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Non-CREZ	124621	Solar PV	Proxy	20	$7,056	27%	$204	$4	$154	$96	$46
Southeast CA	CA	Non-CREZ	118585	Solar PV	Proxy	20	$7,091	25%	$220	$4	$153	$97	$57
Southeast CA	CA	Non-CREZ	79038	Solar PV	Proxy	20	$7,070	27%	$203	$4	$157	$97	$45
Southeast CA	CA	Non-CREZ	168481	Solar PV	Proxy	20	$7,043	27%	$201	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	43054	Solar PV	Proxy	20	$7,066	27%	$205	$4	$155	$97	$46
Southeast CA	CA	Non-CREZ	43055	Solar PV	Proxy	20	$7,070	27%	$205	$4	$155	$97	$46
Southeast CA	CA	Non-CREZ	65609	Solar PV	Proxy	20	$7,049	24%	$227	$4	$147	$97	$64
Southeast CA	CA	Non-CREZ	71211	Solar PV	Proxy	20	$7,048	25%	$214	$4	$153	$97	$53
Southeast CA	CA	Non-CREZ	75051	Solar PV	Proxy	20	$7,043	27%	$199	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	75117	Solar PV	Proxy	20	$7,043	27%	$199	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	237669	Solar PV	Proxy	20	$7,055	28%	$198	$4	$164	$97	$38
Southeast CA	CA	Non-CREZ	237534	Solar PV	Proxy	20	$7,056	27%	$200	$4	$163	$97	$39
Southeast CA	CA	Non-CREZ	76871	Solar PV	Proxy	20	$7,057	28%	$196	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	106497	Solar PV	Proxy	20	$7,067	24%	$230	$4	$137	$97	$72
Southeast CA	CA	Non-CREZ	75668	Solar PV	Proxy	20	$7,052	28%	$196	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	75861	Solar PV	Proxy	20	$7,054	28%	$196	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	75725	Solar PV	Proxy	20	$7,055	28%	$196	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	108709	Solar PV	Proxy	20	$7,058	25%	$219	$4	$150	$97	$58
Southeast CA	CA	Non-CREZ	72128	Solar PV	Proxy	20	$7,046	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	72264	Solar PV	Proxy	20	$7,049	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	120263	Solar PV	Proxy	20	$7,176	27%	$205	$4	$162	$97	$45
Southeast CA	CA	Non-CREZ	113610	Solar PV	Proxy	20	$7,101	26%	$214	$4	$155	$97	$52
Southeast CA	CA	Non-CREZ	110762	Solar PV	Proxy	20	$7,058	25%	$216	$4	$153	$97	$54
Southeast CA	CA	Non-CREZ	75525	Solar PV	Proxy	20	$7,044	28%	$196	$4	$162	$97	$37
Southeast CA	CA	Non-CREZ	75594	Solar PV	Proxy	20	$7,046	28%	$196	$4	$162	$97	$37
Southeast CA	CA	Non-CREZ	106179	Solar PV	Proxy	20	$7,090	25%	$219	$4	$150	$97	$58
Southeast CA	CA	Non-CREZ	164535	Solar PV	Proxy	20	$7,064	26%	$207	$4	$160	$97	$45
Southeast CA	CA	Non-CREZ	74711	Solar PV	Proxy	20	$7,101	26%	$212	$4	$158	$97	$50
Southeast CA	CA	Non-CREZ	111846	Solar PV	Proxy	20	$7,075	25%	$215	$4	$153	$97	$54
Southeast CA	CA	Non-CREZ	145621	Solar PV	Proxy	20	$7,084	27%	$205	$4	$153	$96	$48
Southeast CA	CA	Non-CREZ	130435	Solar PV	Proxy	20	$7,043	27%	$198	$4	$159	$96	$40
Southeast CA	CA	Non-CREZ	130436	Solar PV	Proxy	20	$7,043	27%	$198	$4	$157	$96	$41
Southeast CA	CA	Non-CREZ	175835	Solar PV	Proxy	20	$7,050	25%	$216	$4	$155	$97	$54
Southeast CA	CA	Non-CREZ	70778	Solar PV	Proxy	20	$7,125	26%	$215	$4	$155	$97	$53
Southeast CA	CA	Non-CREZ	121630	Solar PV	Proxy	20	$7,071	27%	$201	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	121629	Solar PV	Proxy	20	$7,073	27%	$201	$4	$162	$97	$41
Southeast CA	CA	Non-CREZ	31676	Solar PV	Proxy	20	$7,131	27%	$204	$4	$152	$96	$48
Southeast CA	CA	Non-CREZ	67700	Solar PV	Proxy	20	$7,075	25%	$223	$4	$148	$97	$61
Southeast CA	CA	Non-CREZ	77873	Solar PV	Proxy	20	$7,055	27%	$204	$4	$155	$97	$46

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Non-CREZ	75327	Solar PV	Proxy	20	$7,042	26%	$207	$4	$153	$97	$48
Southeast CA	CA	Non-CREZ	83951	Solar PV	Proxy	20	$7,044	27%	$202	$4	$156	$97	$44
Southeast CA	CA	Non-CREZ	31538	Solar PV	Proxy	20	$7,136	27%	$204	$4	$152	$96	$48
Southeast CA	CA	Non-CREZ	68041	Solar PV	Proxy	20	$7,059	25%	$218	$4	$151	$97	$57
Southeast CA	CA	Non-CREZ	144011	Solar PV	Proxy	20	$7,052	27%	$204	$4	$153	$96	$47
Southeast CA	CA	Non-CREZ	168950	Solar PV	Proxy	20	$7,047	27%	$201	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	170947	Solar PV	Proxy	20	$7,043	28%	$198	$4	$162	$97	$39
Southeast CA	CA	Non-CREZ	110892	Solar PV	Proxy	20	$7,049	26%	$214	$4	$154	$97	$52
Southeast CA	CA	Non-CREZ	72918	Solar PV	Proxy	20	$7,066	27%	$204	$4	$156	$97	$45
Southeast CA	CA	Non-CREZ	72233	Solar PV	Proxy	20	$7,075	27%	$204	$4	$155	$97	$46
Southeast CA	CA	Non-CREZ	285001	Solar PV	Proxy	20	$7,043	27%	$200	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	285000	Solar PV	Proxy	20	$7,045	27%	$200	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	79018	Solar PV	Proxy	20	$7,046	27%	$203	$4	$157	$97	$44
Southeast CA	CA	Non-CREZ	79832	Solar PV	Proxy	20	$7,041	27%	$204	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	71051	Solar PV	Proxy	20	$7,085	26%	$214	$4	$157	$97	$51
Southeast CA	CA	Non-CREZ	71187	Solar PV	Proxy	20	$7,088	26%	$211	$4	$158	$97	$49
Southeast CA	CA	Non-CREZ	75054	Solar PV	Proxy	20	$7,053	27%	$199	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	120942	Solar PV	Proxy	20	$7,068	27%	$201	$4	$162	$97	$41
Southeast CA	CA	Non-CREZ	34916	Solar PV	Proxy	20	$7,063	24%	$224	$4	$143	$97	$65
Southeast CA	CA	Non-CREZ	34298	Solar PV	Proxy	20	$7,071	24%	$232	$4	$136	$97	$74
Southeast CA	CA	Non-CREZ	70566	Solar PV	Proxy	20	$7,051	26%	$213	$4	$155	$97	$51
Southeast CA	CA	Non-CREZ	70703	Solar PV	Proxy	20	$7,054	26%	$213	$4	$155	$97	$51
Southeast CA	CA	Non-CREZ	67588	Solar PV	Proxy	20	$7,180	24%	$229	$4	$145	$97	$68
Southeast CA	CA	Non-CREZ	244695	Solar PV	Proxy	20	$7,043	28%	$197	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	244761	Solar PV	Proxy	20	$7,044	27%	$200	$4	$157	$96	$43
Southeast CA	CA	Non-CREZ	75390	Solar PV	Proxy	20	$7,045	26%	$207	$4	$153	$97	$48
Southeast CA	CA	Non-CREZ	75253	Solar PV	Proxy	20	$7,044	28%	$196	$4	$162	$97	$37
Southeast CA	CA	Non-CREZ	75185	Solar PV	Proxy	20	$7,041	27%	$204	$4	$158	$97	$44
Southeast CA	CA	Non-CREZ	197174	Solar PV	Proxy	20	$7,043	25%	$217	$4	$156	$97	$53
Southeast CA	CA	Non-CREZ	166948	Solar PV	Proxy	20	$7,042	26%	$207	$4	$159	$97	$46
Southeast CA	CA	Non-CREZ	108689	Solar PV	Proxy	20	$7,092	24%	$224	$4	$143	$97	$65
Southeast CA	CA	Non-CREZ	70606	Solar PV	Proxy	20	$7,047	25%	$215	$4	$154	$97	$53
Southeast CA	CA	Non-CREZ	70674	Solar PV	Proxy	20	$7,048	25%	$215	$4	$154	$97	$53
Southeast CA	CA	Non-CREZ	77135	Solar PV	Proxy	20	$7,072	26%	$207	$4	$153	$97	$49
Southeast CA	CA	Non-CREZ	112320	Solar PV	Proxy	20	$7,076	26%	$213	$4	$155	$97	$52
Southeast CA	CA	Non-CREZ	80574	Solar PV	Proxy	20	$7,048	27%	$204	$4	$155	$97	$46
Southeast CA	CA	Non-CREZ	77616	Solar PV	Proxy	20	$7,046	27%	$200	$4	$158	$97	$41
Southeast CA	CA	Non-CREZ	170013	Solar PV	Proxy	20	$7,041	27%	$199	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	43056	Solar PV	Proxy	20	$7,058	27%	$204	$4	$155	$97	$46

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Non-CREZ	165343	Solar PV	Proxy	20	$7,041	26%	$208	$4	$160	$97	$46
Southeast CA	CA	Non-CREZ	74847	Solar PV	Proxy	20	$7,043	26%	$212	$4	$155	$97	$51
Southeast CA	CA	Non-CREZ	170406	Solar PV	Proxy	20	$7,054	27%	$200	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	71533	Solar PV	Proxy	20	$7,043	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	71466	Solar PV	Proxy	20	$7,045	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	70551	Solar PV	Proxy	20	$7,053	25%	$218	$4	$152	$97	$56
Southeast CA	CA	Non-CREZ	66149	Solar PV	Proxy	20	$7,070	24%	$227	$4	$147	$97	$65
Southeast CA	CA	Non-CREZ	170957	Solar PV	Proxy	20	$7,042	28%	$198	$4	$162	$97	$39
Southeast CA	CA	Non-CREZ	75330	Solar PV	Proxy	20	$7,041	28%	$196	$4	$162	$97	$37
Southeast CA	CA	Non-CREZ	75331	Solar PV	Proxy	20	$7,045	28%	$196	$4	$162	$97	$37
Southeast CA	CA	Non-CREZ	168944	Solar PV	Proxy	20	$7,047	27%	$204	$4	$159	$97	$44
Southeast CA	CA	Non-CREZ	34088	Solar PV	Proxy	20	$7,100	24%	$226	$4	$142	$97	$67
Southeast CA	CA	Non-CREZ	170967	Solar PV	Proxy	20	$7,043	27%	$198	$4	$162	$97	$39
Southeast CA	CA	Non-CREZ	70589	Solar PV	Proxy	20	$7,053	25%	$215	$4	$154	$97	$53
Southeast CA	CA	Non-CREZ	70521	Solar PV	Proxy	20	$7,058	25%	$215	$4	$154	$97	$53
Southeast CA	CA	Non-CREZ	169809	Solar PV	Proxy	20	$7,050	27%	$201	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	117853	Solar PV	Proxy	20	$7,081	26%	$213	$4	$155	$97	$52
Southeast CA	CA	Non-CREZ	110612	Solar PV	Proxy	20	$7,150	26%	$216	$4	$154	$97	$55
Southeast CA	CA	Non-CREZ	167870	Solar PV	Proxy	20	$7,107	26%	$207	$4	$160	$97	$46
Southeast CA	CA	Non-CREZ	111034	Solar PV	Proxy	20	$7,080	25%	$215	$4	$153	$97	$54
Southeast CA	CA	Non-CREZ	75049	Solar PV	Proxy	20	$7,043	27%	$199	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	75457	Solar PV	Proxy	20	$7,042	26%	$207	$4	$153	$97	$48
Southeast CA	CA	Non-CREZ	74780	Solar PV	Proxy	20	$7,050	26%	$211	$4	$158	$97	$49
Southeast CA	CA	Non-CREZ	75120	Solar PV	Proxy	20	$7,041	27%	$199	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	74915	Solar PV	Proxy	20	$7,042	26%	$208	$4	$159	$97	$46
Southeast CA	CA	Non-CREZ	122800	Solar PV	Proxy	20	$7,137	28%	$200	$4	$164	$97	$40
Southeast CA	CA	Non-CREZ	109807	Solar PV	Proxy	20	$7,055	25%	$217	$4	$149	$97	$57
Southeast CA	CA	Non-CREZ	76665	Solar PV	Proxy	20	$7,061	28%	$196	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	121707	Solar PV	Proxy	20	$7,078	28%	$199	$4	$162	$97	$39
Southeast CA	CA	Non-CREZ	285059	Solar PV	Proxy	20	$7,054	28%	$197	$4	$162	$96	$38
Southeast CA	CA	Non-CREZ	285058	Solar PV	Proxy	20	$7,055	28%	$197	$4	$162	$96	$38
Southeast CA	CA	Non-CREZ	180026	Solar PV	Proxy	20	$7,046	25%	$218	$4	$155	$97	$55
Southeast CA	CA	Non-CREZ	179890	Solar PV	Proxy	20	$7,046	26%	$213	$4	$157	$97	$51
Southeast CA	CA	Non-CREZ	169274	Solar PV	Proxy	20	$7,055	27%	$201	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	106801	Solar PV	Proxy	20	$7,116	24%	$232	$4	$136	$97	$75
Southeast CA	CA	Non-CREZ	77088	Solar PV	Proxy	20	$7,046	28%	$196	$4	$162	$97	$37
Southeast CA	CA	Non-CREZ	69506	Solar PV	Proxy	20	$7,046	25%	$217	$4	$152	$97	$55
Southeast CA	CA	Non-CREZ	69437	Solar PV	Proxy	20	$7,047	25%	$217	$4	$152	$97	$55
Southeast CA	CA	Non-CREZ	65475	Solar PV	Proxy	20	$7,084	24%	$227	$4	$147	$97	$65

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Non-CREZ	65338	Solar PV	Proxy	20	$7,062	24%	$229	$4	$145	$97	$66
Southeast CA	CA	Non-CREZ	70240	Solar PV	Proxy	20	$7,055	25%	$217	$4	$152	$97	$56
Southeast CA	CA	Non-CREZ	69970	Solar PV	Proxy	20	$7,060	25%	$217	$4	$152	$97	$56
Southeast CA	CA	Non-CREZ	72032	Solar PV	Proxy	20	$7,055	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	71625	Solar PV	Proxy	20	$7,055	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	70172	Solar PV	Proxy	20	$7,057	25%	$217	$4	$152	$97	$56
Southeast CA	CA	Non-CREZ	169472	Solar PV	Proxy	20	$7,057	27%	$201	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	76535	Solar PV	Proxy	20	$7,069	26%	$207	$4	$153	$97	$49
Southeast CA	CA	Non-CREZ	76803	Solar PV	Proxy	20	$7,081	28%	$197	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	69741	Solar PV	Proxy	20	$7,066	25%	$216	$4	$154	$97	$54
Southeast CA	CA	Non-CREZ	69403	Solar PV	Proxy	20	$7,073	25%	$217	$4	$153	$97	$55
Southeast CA	CA	Non-CREZ	78888	Solar PV	Proxy	20	$7,045	27%	$202	$4	$156	$97	$44
Southeast CA	CA	Non-CREZ	179507	Solar PV	Proxy	20	$7,218	26%	$218	$4	$157	$97	$55
Southeast CA	CA	Non-CREZ	179640	Solar PV	Proxy	20	$7,218	26%	$218	$4	$157	$97	$55
Southeast CA	CA	Non-CREZ	178281	Solar PV	Proxy	20	$7,051	26%	$212	$4	$159	$97	$49
Southeast CA	CA	Non-CREZ	178214	Solar PV	Proxy	20	$7,054	24%	$227	$4	$142	$97	$67
Southeast CA	CA	Non-CREZ	170281	Solar PV	Proxy	20	$7,046	27%	$200	$4	$161	$97	$40
Southeast CA	CA	Non-CREZ	130786	Solar PV	Proxy	20	$7,057	27%	$199	$4	$159	$96	$41
Southeast CA	CA	Non-CREZ	79291	Solar PV	Proxy	20	$7,052	27%	$203	$4	$156	$97	$44
Southeast CA	CA	Non-CREZ	179622	Solar PV	Proxy	20	$7,043	26%	$213	$4	$157	$97	$50
Southeast CA	CA	Non-CREZ	179623	Solar PV	Proxy	20	$7,043	26%	$213	$4	$157	$97	$50
Southeast CA	CA	Non-CREZ	120541	Solar PV	Proxy	20	$7,057	28%	$198	$4	$163	$97	$39
Southeast CA	CA	Non-CREZ	120474	Solar PV	Proxy	20	$7,057	27%	$202	$4	$162	$97	$42
Southeast CA	CA	Non-CREZ	76267	Solar PV	Proxy	20	$7,080	26%	$208	$4	$153	$97	$49
Southeast CA	CA	Non-CREZ	75929	Solar PV	Proxy	20	$7,080	28%	$197	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	68642	Solar PV	Proxy	20	$7,084	25%	$220	$4	$152	$97	$57
Southeast CA	CA	Non-CREZ	68442	Solar PV	Proxy	20	$7,085	25%	$219	$4	$151	$97	$58
Southeast CA	CA	Non-CREZ	78358	Solar PV	Proxy	20	$7,051	27%	$203	$4	$155	$97	$45
Southeast CA	CA	Non-CREZ	165068	Solar PV	Proxy	20	$7,093	26%	$209	$4	$160	$97	$47
Southeast CA	CA	Non-CREZ	284928	Solar PV	Proxy	20	$7,051	27%	$201	$4	$161	$97	$41
Southeast CA	CA	Non-CREZ	165010	Solar PV	Proxy	20	$7,047	26%	$212	$4	$159	$97	$49
Southeast CA	CA	Non-CREZ	75671	Solar PV	Proxy	20	$7,053	28%	$196	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	79509	Solar PV	Proxy	20	$7,099	27%	$206	$4	$154	$97	$48
Southeast CA	CA	Non-CREZ	172952	Solar PV	Proxy	20	$7,042	28%	$197	$4	$162	$97	$38
Southeast CA	CA	Non-CREZ	67379	Solar PV	Proxy	20	$7,072	25%	$221	$4	$150	$97	$59
Southeast CA	CA	Non-CREZ	65538	Solar PV	Proxy	20	$7,075	24%	$229	$4	$145	$97	$67
Southeast CA	CA	Palm Springs	WI_14	Wind	Pre-ID	121	$2,333	44%	$59	$14	$83	$87	-$35
Southeast CA	CA	Palm Springs	WI_15	Wind	Pre-ID	61	$2,681	30%	$120	$20	$83	$87	$21
Southeast CA	CA	Palm Springs	WI_16a	Wind	Pre-ID	105	$2,287	41%	$66	$15	$83	$87	-$29

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Palm Springs	WI_16c	Wind	Pre-ID	157	$2,381	42%	$66	$15	$83	$87	-$29
Southeast CA	CA	Palm Springs	WI_17a	Wind	Proxy	72	$2,542	42%	$72	$15	$83	$87	-$23
Southeast CA	CA	Palm Springs	WI_17b	Wind	Proxy	103	$2,350	30%	$102	$19	$83	$87	$2
Southeast CA	CA	Palm Springs	WI_208	Wind	Pre-ID	150	$2,379	36%	$84	$16	$83	$87	-$14
Southeast CA	CA	Pisgah-A	st22719	Solar Th.	Pre-ID	200	$4,769	27%	$155	$22	$149	$99	$16
Southeast CA	CA	Pisgah-A	st22815	Solar Th.	Pre-ID	200	$5,089	29%	$153	$22	$152	$98	$17
Southeast CA	CA	Pisgah-A	st22837	Solar Th.	Pre-ID	200	$5,042	29%	$152	$22	$152	$98	$15
Southeast CA	CA	Pisgah-A	st22838	Solar Th.	Pre-ID	200	$5,009	29%	$151	$22	$152	$98	$14
Southeast CA	CA	Pisgah-A	st22839	Solar Th.	Pre-ID	200	$5,098	29%	$153	$22	$152	$98	$17
Southeast CA	CA	Pisgah-A	st22861	Solar Th.	Pre-ID	200	$5,111	29%	$154	$22	$152	$98	$17
Southeast CA	CA	Pisgah-A	st22862	Solar Th.	Pre-ID	200	$5,067	29%	$152	$22	$152	$98	$16
Southeast CA	CA	Pisgah-A	st22885	Solar Th.	Pre-ID	200	$5,014	29%	$151	$22	$152	$98	$14
Southeast CA	CA	Pisgah-A	st22886	Solar Th.	Pre-ID	200	$5,146	29%	$154	$22	$152	$98	$18
Southeast CA	CA	Pisgah-B	WI_29	Wind	Proxy	157	$2,486	30%	$113	$23	$41	$85	$35
Southeast CA	CA	Pisgah-B	WI_30	Wind	Proxy	187	$2,412	30%	$108	$22	$41	$85	$30
Southeast CA	CA	Pisgah-B	WI_31	Wind	Pre-ID	238	$2,399	30%	$104	$22	$41	$85	$27
Southeast CA	CA	Pisgah-B	WI_32	Wind	Pre-ID	209	$2,336	30%	$101	$22	$41	$85	$23
Southeast CA	CA	Pisgah-B	WI_33	Wind	Pre-ID	157	$2,357	29%	$107	$23	$41	$85	$29
Southeast CA	CA	Pisgah-B	WI_34	Wind	Pre-ID	181	$2,478	30%	$112	$23	$41	$85	$35
Southeast CA	CA	Pisgah-B	WI_35	Wind	Pre-ID	185	$2,349	29%	$107	$22	$41	$85	$29
Southeast CA	CA	Pisgah-B	WI_36	Wind	Pre-ID	76	$2,643	30%	$120	$21	$41	$85	$41
Southeast CA	CA	Pisgah-B	st22743	Solar Th.	Pre-ID	200	$5,027	27%	$162	$23	$149	$99	$23
Southeast CA	CA	Pisgah-B	st22791	Solar Th.	Pre-ID	200	$5,043	27%	$162	$23	$149	$99	$23
Southeast CA	CA	Pisgah-B	st22909	Solar Th.	Pre-ID	200	$4,912	25%	$172	$24	$135	$98	$35
Southeast CA	CA	Pisgah-B	st23261	Solar Th.	Pre-ID	200	$5,193	28%	$160	$24	$147	$98	$26
Southeast CA	CA	Pisgah-B	st23262	Solar Th.	Pre-ID	200	$5,273	28%	$162	$24	$147	$98	$28
Southeast CA	CA	Pisgah-B	st23285	Solar Th.	Pre-ID	200	$5,269	28%	$161	$24	$150	$98	$26
Southeast CA	CA	Pisgah-B	st23307	Solar Th.	Pre-ID	200	$4,947	27%	$160	$25	$147	$99	$24
Southeast CA	CA	Pisgah-B	st23331	Solar Th.	Pre-ID	200	$4,911	27%	$159	$25	$147	$99	$23
Southeast CA	CA	Pisgah-B	st23355	Solar Th.	Pre-ID	200	$4,785	27%	$156	$24	$147	$99	$19
Southeast CA	CA	Pisgah-B	st23379	Solar Th.	Pre-ID	200	$4,740	26%	$158	$25	$144	$99	$22
Southeast CA	CA	Pisgah-B	st23403	Solar Th.	Pre-ID	200	$4,743	26%	$158	$25	$144	$99	$22
Southeast CA	CA	Pisgah-B	st23427	Solar Th.	Pre-ID	200	$4,825	26%	$160	$25	$144	$99	$24
Southeast CA	CA	Riverside East-A	st10505	Solar Th.	Pre-ID	200	$4,867	28%	$151	$12	$149	$98	$5
Southeast CA	CA	Riverside East-A	st10596	Solar Th.	Pre-ID	200	$4,732	28%	$148	$12	$146	$98	$3
Southeast CA	CA	Riverside East-A	st10597	Solar Th.	Pre-ID	200	$4,731	28%	$148	$12	$146	$98	$3
Southeast CA	CA	Riverside East-A	st10689	Solar Th.	Pre-ID	200	$4,831	28%	$149	$12	$149	$98	$3
Southeast CA	CA	Riverside East-A	st10926	Solar Th.	Pre-ID	200	$4,730	28%	$150	$12	$150	$99	$2
Southeast CA	CA	Riverside East-B	st10502	Solar Th.	Pre-ID	200	$5,039	28%	$155	$25	$148	$98	$22

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Riverside East-B	st10503	Solar Th.	Pre-ID	200	$4,943	28%	$153	$25	$149	$98	$20
Southeast CA	CA	Riverside East-B	st10504	Solar Th.	Pre-ID	200	$4,881	28%	$151	$12	$149	$98	$5
Southeast CA	CA	Riverside East-B	st10548	Solar Th.	Pre-ID	200	$4,875	28%	$152	$25	$146	$98	$20
Southeast CA	CA	Riverside East-B	st10595	Solar Th.	Pre-ID	200	$4,960	28%	$154	$26	$146	$98	$23
Southeast CA	CA	Riverside East-B	st10619	Solar Th.	Pre-ID	200	$4,797	27%	$156	$27	$142	$98	$25
Southeast CA	CA	Riverside East-B	st10620	Solar Th.	Pre-ID	200	$4,733	27%	$154	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10621	Solar Th.	Pre-ID	200	$4,733	27%	$155	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10643	Solar Th.	Pre-ID	200	$4,731	27%	$154	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10644	Solar Th.	Pre-ID	200	$4,733	27%	$154	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10645	Solar Th.	Proxy	200	$4,734	27%	$155	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10646	Solar Th.	Proxy	200	$4,733	27%	$155	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10665	Solar Th.	Pre-ID	200	$5,047	28%	$154	$26	$149	$98	$22
Southeast CA	CA	Riverside East-B	st10666	Solar Th.	Pre-ID	200	$4,739	27%	$154	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10667	Solar Th.	Pre-ID	200	$4,730	27%	$154	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10669	Solar Th.	Proxy	200	$4,734	27%	$155	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10690	Solar Th.	Pre-ID	200	$4,737	27%	$155	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10691	Solar Th.	Pre-ID	200	$4,732	27%	$154	$27	$142	$98	$23
Southeast CA	CA	Riverside East-B	st10784	Solar Th.	Pre-ID	200	$4,732	27%	$153	$27	$143	$98	$22
Southeast CA	CA	Riverside East-B	st10807	Solar Th.	Pre-ID	200	$4,736	28%	$151	$28	$141	$98	$23
Southeast CA	CA	Riverside East-B	st10808	Solar Th.	Pre-ID	200	$4,732	28%	$151	$28	$141	$98	$23
Southeast CA	CA	Riverside East-B	st10830	Solar Th.	Pre-ID	200	$4,778	28%	$152	$28	$141	$98	$24
Southeast CA	CA	Riverside East-B	st10831	Solar Th.	Pre-ID	200	$4,731	28%	$151	$28	$141	$98	$23
Southeast CA	CA	Riverside East-B	st10832	Solar Th.	Pre-ID	200	$4,731	28%	$151	$28	$141	$98	$23
Southeast CA	CA	Riverside East-B	st10854	Solar Th.	Pre-ID	200	$4,763	28%	$151	$28	$141	$98	$23
Southeast CA	CA	Riverside East-B	st10855	Solar Th.	Pre-ID	200	$4,766	28%	$152	$28	$141	$98	$24
Southeast CA	CA	Riverside East-B	st10856	Solar Th.	Pre-ID	200	$4,759	28%	$151	$28	$141	$98	$23
Southeast CA	CA	Riverside East-B	st10902	Solar Th.	Pre-ID	200	$4,754	28%	$150	$28	$150	$99	$18
Southeast CA	CA	Riverside East-B	st10903	Solar Th.	Pre-ID	200	$4,744	28%	$150	$28	$150	$99	$18
Southeast CA	CA	Riverside East-B	st10950	Solar Th.	Pre-ID	200	$4,734	28%	$150	$28	$150	$99	$18
Southeast CA	CA	Riverside East-B	st11020	Solar Th.	Pre-ID	200	$4,782	28%	$152	$30	$141	$98	$26
Southeast CA	CA	Riverside East-B	st11044	Solar Th.	Pre-ID	200	$4,772	28%	$152	$30	$141	$98	$26
Southeast CA	CA	Riverside East-B	st11068	Solar Th.	Pre-ID	200	$4,793	28%	$152	$30	$141	$98	$26
Southeast CA	CA	Riverside East-B	st11145	Solar Th.	Pre-ID	200	$4,826	27%	$155	$33	$142	$98	$30
Southeast CA	CA	San Bernardino - Baker	st29930	Solar Th.	Pre-ID	200	$5,026	27%	$164	$26	$143	$98	$30
Southeast CA	CA	San Bernardino - Baker	st29978	Solar Th.	Pre-ID	200	$4,897	27%	$161	$26	$143	$98	$27
Southeast CA	CA	San Bernardino - Baker	st30002	Solar Th.	Pre-ID	200	$4,865	27%	$160	$26	$143	$98	$26
Southeast CA	CA	San Bernardino - Baker	st30072	Solar Th.	Pre-ID	200	$5,143	28%	$163	$27	$153	$99	$27
Southeast CA	CA	San Bernardino - Baker	st30134	Solar Th.	Pre-ID	200	$5,089	27%	$162	$27	$150	$99	$27
Southeast CA	CA	San Bernardino - Baker	st36748	Solar Th.	Pre-ID	200	$5,210	28%	$164	$27	$154	$99	$29

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	San Bernardino - Lucerne	San Bernardino 1	Biomass	Proxy	64	$4,374	80%	$137	$12	$204	$88	$32
Southeast CA	CA	San Bernardino - Lucerne	San Bernardino 2	Biomass	Proxy	27	$5,169	80%	$142	$18	$204	$88	$43
Southeast CA	CA	San Bernardino - Lucerne	WI_160	Wind	Pre-ID	95	$2,542	32%	$106	$19	$57	$85	$19
Southeast CA	CA	San Bernardino - Lucerne	WI_37	Wind	Pre-ID	118	$2,559	28%	$123	$21	$57	$85	$36
Southeast CA	CA	San Bernardino - Lucerne	WI_38	Wind	Pre-ID	174	$2,573	32%	$103	$19	$57	$85	$17
Southeast CA	CA	San Bernardino - Lucerne	WI_50	Wind	Pre-ID	103	$2,679	33%	$107	$17	$57	$85	$19
Southeast CA	CA	San Bernardino - Lucerne	WI_51	Wind	Pre-ID	77	$2,674	34%	$102	$17	$57	$85	$15
Southeast CA	CA	San Bernardino - Lucerne	WI_52	Wind	Pre-ID	32	$2,648	31%	$120	$32	$57	$85	$46
Southeast CA	CA	San Bernardino - Lucerne	st15384	Solar Th.	Pre-ID	200	$4,742	28%	$150	$18	$151	$99	$7
Southeast CA	CA	San Bernardino - Lucerne	st15408	Solar Th.	Pre-ID	200	$4,730	28%	$149	$18	$151	$99	$7
Southeast CA	CA	San Bernardino - Lucerne	st15432	Solar Th.	Pre-ID	200	$4,730	28%	$149	$18	$151	$99	$7
Southeast CA	CA	San Bernardino - Lucerne	st15456	Solar Th.	Proxy	200	$4,730	28%	$149	$18	$151	$99	$7
Southeast CA	CA	San Bernardino - Lucerne	st15646	Solar Th.	Pre-ID	200	$5,019	29%	$152	$18	$153	$98	$11
Southeast CA	CA	San Bernardino - Lucerne	st15766	Solar Th.	Proxy	200	$4,768	29%	$144	$20	$156	$98	$5
Southeast CA	CA	San Bernardino - Lucerne	st15836	Solar Th.	Pre-ID	200	$5,260	29%	$155	$23	$156	$98	$19
Southeast CA	CA	San Bernardino - Lucerne	st15951	Solar Th.	Pre-ID	200	$5,247	29%	$155	$23	$153	$98	$20
Southeast CA	CA	San Bernardino - Lucerne	st15977	Solar Th.	Pre-ID	200	$5,352	28%	$163	$23	$151	$99	$27
Southeast CA	CA	San Bernardino - Lucerne	st22322	Solar Th.	Pre-ID	200	$5,142	28%	$160	$19	$151	$99	$18
Southeast CA	CA	San Bernardino - Lucerne	st22345	Solar Th.	Pre-ID	200	$4,730	28%	$149	$18	$151	$99	$7
Southeast CA	CA	San Bernardino - Lucerne	st22370	Solar Th.	Pre-ID	200	$4,896	28%	$153	$19	$151	$99	$11
Southeast CA	CA	San Bernardino - Lucerne	st22394	Solar Th.	Pre-ID	200	$5,066	29%	$149	$18	$156	$98	$9
Southeast CA	CA	San Bernardino - Lucerne	st22395	Solar Th.	Pre-ID	200	$5,267	29%	$154	$18	$156	$98	$14
Southeast CA	CA	San Bernardino - Lucerne	st22323	Solar Th.	Proxy	200	$4,931	28%	$155	$19	$151	$99	$13
Southeast CA	CA	San Bernardino - Lucerne	st15953	Solar Th.	Pre-ID	200	$5,626	29%	$164	$23	$153	$98	$29
Southeast CA	CA	San Bernardino - Lucerne	st15504	Solar Th.	Proxy	200	$5,196	29%	$152	$18	$156	$98	$12
Southeast CA	CA	San Bernardino - Lucerne	st15334	Solar Th.	Proxy	200	$5,127	28%	$159	$19	$151	$99	$18
Southeast CA	CA	Twentynine Palms	st16089	Solar Th.	Proxy	200	$4,914	30%	$142	$23	$166	$99	$3
Southeast CA	CA	Twentynine Palms	st16112	Solar Th.	Proxy	200	$5,277	30%	$150	$23	$166	$99	$12
Southeast CA	CA	Twentynine Palms	stm16213	Solar Th.	Pre-ID	200	$5,061	29%	$152	$26	$158	$98	$18
Southeast CA	CA	Twentynine Palms	st16426	Solar Th.	Pre-ID	200	$5,049	27%	$162	$28	$146	$99	$30
Southeast CA	CA	Victorville-A	st14880	Solar Th.	Proxy	200	$5,043	32%	$138	$15	$189	$100	-$15
Southeast CA	CA	Victorville-A	st14904	Solar Th.	Proxy	200	$4,984	32%	$137	$15	$189	$100	-$16
Southeast CA	CA	Victorville-A	st21796	Solar Th.	Proxy	200	$4,798	32%	$133	$18	$189	$100	-$17
Southeast CA	CA	Victorville-A	st21817	Solar Th.	Proxy	200	$4,799	32%	$133	$15	$189	$100	-$20
Southeast CA	CA	Victorville-B	WI_206	Wind	Pre-ID	95	$2,450	38%	$80	$16	$57	$85	-$6
Southeast CA	CA	Victorville-B	st21679	Solar Th.	Proxy	200	$4,854	29%	$144	$19	$162	$99	$1
Southeast CA	CA	Victorville-B	st22037	Solar Th.	Pre-ID	200	$5,238	28%	$159	$17	$158	$99	$14
Southeast CA	CA	Victorville-B	st22216	Solar Th.	Proxy	200	$5,104	31%	$142	$19	$179	$99	-$4
Southeast CA	CA	Victorville-B	st22044	Solar Th.	Proxy	200	$5,143	29%	$153	$20	$161	$99	$11

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Southeast CA	CA	Victorville-C	WI_47	Wind	Proxy	86	$2,650	31%	$115	$19	$57	$85	$28
Southeast CA	CA	Victorville-C	WI_48	Wind	Pre-ID	137	$2,666	30%	$116	$19	$57	$85	$29
Southeast CA	CA	Victorville-C	WI_49	Wind	Pre-ID	117	$2,662	30%	$119	$19	$57	$85	$31
TEHACHAPI/OWENS													
Tehachapi/Owens	CA	Fairmont	Los Angeles NE 1	Biomass	Proxy	100	$4,009	80%	$109	$10	$204	$88	$2
Tehachapi/Owens	CA	Fairmont	Los Angeles NE 2	Biomass	Proxy	38	$4,837	80%	$143	$16	$204	$88	$42
Tehachapi/Owens	CA	Fairmont	WI_57	Wind	Proxy	79	$2,634	31%	$111	$21	$88	$89	$12
Tehachapi/Owens	CA	Fairmont	WI_58	Wind	Proxy	52	$2,534	31%	$107	$13	$88	$89	-$1
Tehachapi/Owens	CA	Fairmont	WI_59	Wind	Proxy	74	$2,601	33%	$103	$13	$88	$89	-$4
Tehachapi/Owens	CA	Fairmont	WI_60	Wind	Proxy	42	$2,576	30%	$118	$14	$88	$89	$10
Tehachapi/Owens	CA	Fairmont	WI_61	Wind	Proxy	106	$2,528	31%	$109	$15	$88	$89	$3
Tehachapi/Owens	CA	Fairmont	WI_65	Wind	Proxy	255	$2,448	36%	$86	$11	$88	$89	-$20
Tehachapi/Owens	CA	Fairmont	WI_66	Wind	Proxy	187	$2,286	35%	$81	$10	$88	$89	-$26
Tehachapi/Owens	CA	Fairmont	WI_67	Wind	Proxy	201	$2,283	35%	$82	$10	$88	$89	-$25
Tehachapi/Owens	CA	Fairmont	WI_68	Wind	Proxy	201	$2,497	36%	$88	$13	$88	$89	-$16
Tehachapi/Owens	CA	Fairmont	WI_69	Wind	Proxy	115	$2,428	34%	$92	$14	$88	$89	-$12
Tehachapi/Owens	CA	Fairmont	WI_205	Wind	Proxy	68	$2,480	34%	$93	$14	$88	$89	-$12
Tehachapi/Owens	CA	Fairmont	st21036	Solar Th.	Proxy	200	$4,560	30%	$137	$12	$184	$100	-$23
Tehachapi/Owens	CA	Fairmont	st21203	Solar Th.	Proxy	200	$4,667	29%	$141	$12	$185	$100	-$20
Tehachapi/Owens	CA	Fairmont	st21228	Solar Th.	Proxy	200	$4,606	30%	$136	$12	$183	$100	-$22
Tehachapi/Owens	CA	Fairmont	st21247	Solar Th.	Proxy	200	$4,666	30%	$137	$12	$183	$100	-$21
Tehachapi/Owens	CA	Fairmont	st21249	Solar Th.	Proxy	200	$4,639	30%	$136	$12	$183	$100	-$21
Tehachapi/Owens	CA	Fairmont	st21269	Solar Th.	Proxy	200	$4,742	30%	$138	$12	$183	$100	-$19
Tehachapi/Owens	CA	Fairmont	st21270	Solar Th.	Proxy	200	$4,703	30%	$137	$12	$183	$100	-$20
Tehachapi/Owens	CA	Fairmont	st21271	Solar Th.	Proxy	200	$4,750	30%	$138	$12	$183	$100	-$19
Tehachapi/Owens	CA	Fairmont	st21292	Solar Th.	Proxy	200	$4,807	30%	$140	$15	$183	$100	-$15
Tehachapi/Owens	CA	Fairmont	st21293	Solar Th.	Proxy	200	$4,830	30%	$140	$15	$183	$100	-$14
Tehachapi/Owens	CA	Fairmont	st21294	Solar Th.	Proxy	200	$4,737	30%	$138	$12	$183	$100	-$19
Tehachapi/Owens	CA	Fairmont	st21318	Solar Th.	Proxy	200	$4,868	29%	$146	$15	$166	$99	-$3
Tehachapi/Owens	CA	Fairmont	st21320	Solar Th.	Proxy	200	$4,887	29%	$146	$15	$166	$99	-$3
Tehachapi/Owens	CA	Fairmont	st21344	Solar Th.	Proxy	200	$4,904	29%	$146	$15	$166	$99	-$3
Tehachapi/Owens	CA	Fairmont	st21368	Solar Th.	Proxy	200	$4,886	29%	$146	$15	$166	$99	-$3
Tehachapi/Owens	CA	Fairmont	st21509	Solar Th.	Proxy	200	$4,987	31%	$142	$17	$168	$99	-$3
Tehachapi/Owens	CA	Fairmont	st21511	Solar Th.	Proxy	200	$4,986	31%	$142	$17	$168	$99	-$3
Tehachapi/Owens	CA	Fairmont	st21534	Solar Th.	Proxy	200	$5,002	31%	$142	$17	$168	$99	-$3
Tehachapi/Owens	CA	Fairmont	st21538	Solar Th.	Proxy	200	$5,003	31%	$143	$17	$168	$99	-$2
Tehachapi/Owens	CA	Fairmont	st21557	Solar Th.	Proxy	200	$5,059	31%	$143	$17	$168	$99	-$1
Tehachapi/Owens	CA	Fairmont	st21605	Solar Th.	Proxy	200	$4,934	29%	$146	$17	$162	$99	$1
Tehachapi/Owens	CA	Fairmont	st21651	Solar Th.	Proxy	200	$4,966	30%	$144	$17	$166	$99	-$1

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Tehachapi/Owens	CA	Fairmont	st21586	Solar Th.	Proxy	200	$5,158	31%	$146	$17	$168	$99	$1
Tehachapi/Owens	CA	Fairmont	st21533	Solar Th.	Proxy	200	$5,093	31%	$144	$17	$168	$99	-$1
Tehachapi/Owens	CA	Fairmont	st21484	Solar Th.	Proxy	200	$5,046	30%	$146	$17	$172	$99	-$2
Tehachapi/Owens	CA	Fairmont	st21482	Solar Th.	Proxy	200	$5,169	30%	$149	$17	$172	$99	$2
Tehachapi/Owens	CA	Fairmont	st21341	Solar Th.	Proxy	200	$4,940	29%	$147	$15	$166	$99	-$2
Tehachapi/Owens	CA	Inyokern	WI_108	Wind	Pre-ID	71	$2,374	30%	$111	$23	$88	$89	$11
Tehachapi/Owens	CA	Inyokern	WI_110	Wind	Pre-ID	216	$2,584	28%	$127	$26	$88	$89	$28
Tehachapi/Owens	CA	Inyokern	st35182	Solar Th.	Proxy	200	$5,006	30%	$147	$23	$170	$99	$5
Tehachapi/Owens	CA	Inyokern	st35204	Solar Th.	Proxy	200	$5,046	30%	$147	$23	$170	$99	$6
Tehachapi/Owens	CA	Inyokern	st35205	Solar Th.	Proxy	200	$4,918	30%	$144	$23	$170	$99	$3
Tehachapi/Owens	CA	Inyokern	st35226	Solar Th.	Pre-ID	200	$5,143	30%	$149	$23	$169	$99	$8
Tehachapi/Owens	CA	Inyokern	st35227	Solar Th.	Proxy	200	$5,006	30%	$145	$23	$172	$99	$3
Tehachapi/Owens	CA	Inyokern	st35228	Solar Th.	Proxy	200	$4,942	30%	$144	$23	$172	$99	$1
Tehachapi/Owens	CA	Inyokern	st35248	Solar Th.	Pre-ID	200	$5,171	30%	$150	$23	$169	$99	$9
Tehachapi/Owens	CA	Inyokern	st35249	Solar Th.	Pre-ID	200	$5,029	30%	$146	$23	$169	$99	$6
Tehachapi/Owens	CA	Inyokern	st35250	Solar Th.	Pre-ID	200	$4,981	30%	$145	$23	$172	$99	$3
Tehachapi/Owens	CA	Inyokern	st35251	Solar Th.	Pre-ID	200	$5,043	30%	$146	$23	$172	$99	$4
Tehachapi/Owens	CA	Inyokern	st35271	Solar Th.	Pre-ID	200	$5,334	30%	$153	$23	$169	$99	$13
Tehachapi/Owens	CA	Inyokern	st35272	Solar Th.	Pre-ID	200	$5,330	30%	$153	$23	$169	$99	$13
Tehachapi/Owens	CA	Inyokern	st35273	Solar Th.	Pre-ID	200	$5,138	30%	$149	$23	$172	$99	$6
Tehachapi/Owens	CA	Kramer	Randsburg	Geothermal	Pre-ID	24	$4,091	80%	$81	$8	$204	$88	-$28
Tehachapi/Owens	CA	Kramer	WI_106	Wind	Proxy	123	$2,552	27%	$132	$26	$88	$89	$31
Tehachapi/Owens	CA	Kramer	WI_107	Wind	Pre-ID	80	$2,635	26%	$139	$26	$88	$89	$38
Tehachapi/Owens	CA	Kramer	st21720	Solar Th.	Proxy	200	$5,009	30%	$145	$20	$166	$99	$3
Tehachapi/Owens	CA	Kramer	st22080	Solar Th.	Pre-ID	200	$4,958	27%	$162	$23	$155	$100	$19
Tehachapi/Owens	CA	Kramer	st28345	Solar Th.	Proxy	200	$4,972	30%	$145	$19	$172	$99	$0
Tehachapi/Owens	CA	Kramer	st28347	Solar Th.	Proxy	200	$4,951	30%	$145	$19	$172	$99	-$1
Tehachapi/Owens	CA	Kramer	st28397	Solar Th.	Proxy	200	$4,938	30%	$145	$19	$168	$99	$1
Tehachapi/Owens	CA	Kramer	st28419	Solar Th.	Proxy	200	$4,961	30%	$145	$19	$172	$99	-$1
Tehachapi/Owens	CA	Kramer	st28422	Solar Th.	Proxy	200	$5,002	30%	$146	$19	$168	$99	$2
Tehachapi/Owens	CA	Kramer	st28445	Solar Th.	Proxy	200	$4,994	31%	$142	$19	$168	$99	$0
Tehachapi/Owens	CA	Kramer	st28446	Solar Th.	Proxy	200	$5,000	31%	$142	$19	$168	$99	$0
Tehachapi/Owens	CA	Kramer	st28471	Solar Th.	Proxy	200	$4,979	31%	$142	$19	$168	$99	-$1
Tehachapi/Owens	CA	Kramer	st28493	Solar Th.	Proxy	200	$4,998	31%	$142	$19	$168	$99	$0
Tehachapi/Owens	CA	Kramer	st28495	Solar Th.	Proxy	200	$4,983	31%	$142	$19	$168	$99	-$1
Tehachapi/Owens	CA	Kramer	st28498	Solar Th.	Proxy	200	$5,042	31%	$143	$19	$172	$99	-$1
Tehachapi/Owens	CA	Kramer	st28517	Solar Th.	Proxy	200	$5,098	31%	$144	$19	$168	$99	$2
Tehachapi/Owens	CA	Kramer	st28522	Solar Th.	Proxy	200	$4,955	31%	$141	$19	$172	$99	-$3
Tehachapi/Owens	CA	Kramer	st28545	Solar Th.	Proxy	200	$5,068	30%	$145	$19	$169	$99	$2

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Tehachapi/Owens	CA	Kramer	st28546	Solar Th.	Proxy	200	$4,973	31%	$142	$19	$168	$99	-$1
Tehachapi/Owens	CA	Kramer	st28547	Solar Th.	Proxy	200	$5,055	31%	$144	$19	$168	$99	$1
Tehachapi/Owens	CA	Kramer	st28567	Solar Th.	Proxy	200	$5,121	30%	$146	$19	$169	$99	$3
Tehachapi/Owens	CA	Kramer	st28568	Solar Th.	Proxy	200	$5,009	30%	$143	$19	$169	$99	$0
Tehachapi/Owens	CA	Kramer	st28570	Solar Th.	Proxy	200	$4,934	31%	$141	$19	$168	$99	-$2
Tehachapi/Owens	CA	Kramer	st28634	Solar Th.	Proxy	200	$5,019	30%	$145	$20	$166	$99	$4
Tehachapi/Owens	CA	Kramer	st28921	Solar Th.	Pre-ID	200	$4,855	30%	$141	$21	$166	$99	$0
Tehachapi/Owens	CA	Kramer	st28922	Solar Th.	Pre-ID	200	$4,851	30%	$141	$21	$166	$99	$0
Tehachapi/Owens	CA	Kramer	st28923	Solar Th.	Pre-ID	200	$4,932	30%	$143	$21	$166	$99	$2
Tehachapi/Owens	CA	Kramer	st28945	Solar Th.	Pre-ID	200	$4,925	27%	$161	$23	$155	$100	$18
Tehachapi/Owens	CA	Kramer	st28946	Solar Th.	Pre-ID	200	$4,839	27%	$159	$23	$155	$100	$16
Tehachapi/Owens	CA	Kramer	st28947	Solar Th.	Pre-ID	200	$4,960	27%	$162	$23	$155	$100	$19
Tehachapi/Owens	CA	Kramer	st28969	Solar Th.	Pre-ID	200	$4,858	27%	$159	$23	$155	$100	$17
Tehachapi/Owens	CA	Kramer	st28970	Solar Th.	Pre-ID	200	$4,837	27%	$159	$23	$155	$100	$16
Tehachapi/Owens	CA	Kramer	st28993	Solar Th.	Pre-ID	200	$4,887	27%	$160	$23	$155	$100	$18
Tehachapi/Owens	CA	Kramer	st28994	Solar Th.	Pre-ID	200	$4,951	27%	$162	$23	$155	$100	$19
Tehachapi/Owens	CA	Non-CREZ	Kern East 1	Biomass	Proxy	53	$4,537	80%	$141	$9	$204	$88	$34
Tehachapi/Owens	CA	Non-CREZ	Kings	Biomass	Proxy	27	$5,256	80%	$156	$10	$204	$88	$50
Tehachapi/Owens	CA	Non-CREZ	Tulare	Biomass	Proxy	27	$5,255	80%	$151	$10	$204	$88	$44
Tehachapi/Owens	CA	Non-CREZ	Inyo	Biomass	Proxy	20	$5,467	80%	$167	$11	$204	$88	$61
Tehachapi/Owens	CA	Non-CREZ	223267	Solar PV	Proxy	20	$7,044	25%	$219	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	268542	Solar PV	Proxy	20	$7,060	25%	$218	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	268810	Solar PV	Proxy	20	$7,064	25%	$218	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	322408	Solar PV	Proxy	20	$7,071	25%	$222	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	264422	Solar PV	Proxy	20	$7,059	25%	$217	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	321637	Solar PV	Proxy	20	$7,067	25%	$222	$4	$153	$97	$59
Tehachapi/Owens	CA	Non-CREZ	218726	Solar PV	Proxy	20	$7,063	25%	$219	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	218278	Solar PV	Proxy	20	$7,045	25%	$220	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	218144	Solar PV	Proxy	20	$7,046	27%	$205	$4	$159	$97	$44
Tehachapi/Owens	CA	Non-CREZ	263055	Solar PV	Proxy	20	$7,071	25%	$217	$4	$155	$94	$57
Tehachapi/Owens	CA	Non-CREZ	214161	Solar PV	Proxy	20	$7,051	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	422178	Solar PV	Proxy	20	$7,096	24%	$228	$4	$161	$100	$56
Tehachapi/Owens	CA	Non-CREZ	422565	Solar PV	Proxy	20	$7,070	24%	$227	$4	$161	$100	$55
Tehachapi/Owens	CA	Non-CREZ	422243	Solar PV	Proxy	20	$7,071	24%	$228	$4	$162	$100	$56
Tehachapi/Owens	CA	Non-CREZ	422760	Solar PV	Proxy	20	$7,041	25%	$215	$4	$160	$99	$48
Tehachapi/Owens	CA	Non-CREZ	422694	Solar PV	Proxy	20	$7,042	24%	$226	$4	$161	$100	$54
Tehachapi/Owens	CA	Non-CREZ	266084	Solar PV	Proxy	20	$7,050	25%	$214	$4	$157	$97	$52
Tehachapi/Owens	CA	Non-CREZ	324539	Solar PV	Proxy	20	$7,069	24%	$224	$4	$153	$97	$60
Tehachapi/Owens	CA	Non-CREZ	276470	Solar PV	Proxy	20	$7,071	25%	$219	$4	$156	$97	$55

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Tehachapi/Owens	CA	Non-CREZ	322474	Solar PV	Proxy	20	$7,054	25%	$221	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	327691	Solar PV	Proxy	20	$7,110	25%	$224	$4	$154	$97	$60
Tehachapi/Owens	CA	Non-CREZ	271197	Solar PV	Proxy	20	$7,083	25%	$223	$4	$154	$97	$59
Tehachapi/Owens	CA	Non-CREZ	214493	Solar PV	Proxy	20	$7,043	25%	$218	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	222994	Solar PV	Proxy	20	$7,042	25%	$219	$4	$157	$97	$54
Tehachapi/Owens	CA	Non-CREZ	321328	Solar PV	Proxy	20	$7,111	25%	$224	$4	$153	$97	$60
Tehachapi/Owens	CA	Non-CREZ	266143	Solar PV	Proxy	20	$7,047	25%	$214	$4	$157	$97	$51
Tehachapi/Owens	CA	Non-CREZ	269794	Solar PV	Proxy	20	$7,050	25%	$222	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	217062	Solar PV	Proxy	20	$7,045	25%	$219	$4	$154	$97	$56
Tehachapi/Owens	CA	Non-CREZ	465504	Solar PV	Proxy	20	$7,087	24%	$227	$4	$163	$100	$55
Tehachapi/Owens	CA	Non-CREZ	465569	Solar PV	Proxy	20	$7,092	24%	$229	$4	$162	$100	$56
Tehachapi/Owens	CA	Non-CREZ	164076	Solar PV	Proxy	20	$7,077	26%	$211	$4	$159	$97	$48
Tehachapi/Owens	CA	Non-CREZ	217025	Solar PV	Proxy	20	$7,048	25%	$220	$4	$154	$97	$56
Tehachapi/Owens	CA	Non-CREZ	271640	Solar PV	Proxy	20	$7,058	25%	$220	$4	$156	$97	$56
Tehachapi/Owens	CA	Non-CREZ	271639	Solar PV	Proxy	20	$7,061	25%	$221	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	211867	Solar PV	Proxy	20	$7,051	27%	$200	$4	$158	$93	$45
Tehachapi/Owens	CA	Non-CREZ	282766	Solar PV	Proxy	20	$7,054	27%	$204	$4	$160	$97	$44
Tehachapi/Owens	CA	Non-CREZ	214357	Solar PV	Proxy	20	$7,044	25%	$217	$4	$155	$97	$54
Tehachapi/Owens	CA	Non-CREZ	324300	Solar PV	Proxy	20	$7,069	24%	$224	$4	$153	$97	$60
Tehachapi/Owens	CA	Non-CREZ	468759	Solar PV	Proxy	20	$7,058	24%	$225	$4	$164	$100	$53
Tehachapi/Owens	CA	Non-CREZ	214760	Solar PV	Proxy	20	$7,041	25%	$218	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	319645	Solar PV	Proxy	20	$7,062	25%	$219	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	215027	Solar PV	Proxy	20	$7,071	25%	$217	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	170794	Solar PV	Proxy	20	$7,081	27%	$200	$4	$163	$97	$40
Tehachapi/Owens	CA	Non-CREZ	281191	Solar PV	Proxy	20	$7,175	27%	$208	$4	$161	$97	$47
Tehachapi/Owens	CA	Non-CREZ	222797	Solar PV	Proxy	20	$7,045	25%	$220	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	221733	Solar PV	Proxy	20	$7,050	26%	$208	$4	$159	$97	$47
Tehachapi/Owens	CA	Non-CREZ	212459	Solar PV	Proxy	20	$7,073	27%	$206	$4	$152	$96	$49
Tehachapi/Owens	CA	Non-CREZ	212452	Solar PV	Proxy	20	$7,042	27%	$205	$4	$153	$96	$47
Tehachapi/Owens	CA	Non-CREZ	323745	Solar PV	Proxy	20	$7,055	25%	$222	$4	$154	$97	$58
Tehachapi/Owens	CA	Non-CREZ	426469	Solar PV	Proxy	20	$7,051	24%	$226	$4	$162	$100	$54
Tehachapi/Owens	CA	Non-CREZ	264498	Solar PV	Proxy	20	$7,051	26%	$214	$4	$156	$97	$52
Tehachapi/Owens	CA	Non-CREZ	222135	Solar PV	Proxy	20	$7,044	26%	$208	$4	$159	$97	$46
Tehachapi/Owens	CA	Non-CREZ	324234	Solar PV	Proxy	20	$7,145	24%	$228	$4	$153	$97	$63
Tehachapi/Owens	CA	Non-CREZ	217890	Solar PV	Proxy	20	$7,043	26%	$208	$4	$159	$97	$46
Tehachapi/Owens	CA	Non-CREZ	217891	Solar PV	Proxy	20	$7,046	26%	$208	$4	$159	$97	$47
Tehachapi/Owens	CA	Non-CREZ	378941	Solar PV	Proxy	20	$7,042	24%	$225	$4	$153	$94	$63
Tehachapi/Owens	CA	Non-CREZ	213106	Solar PV	Proxy	20	$7,043	25%	$220	$4	$153	$97	$57
Tehachapi/Owens	CA	Non-CREZ	373237	Solar PV	Proxy	20	$7,120	24%	$227	$4	$153	$94	$65

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Tehachapi/Owens	CA	Non-CREZ	226476	Solar PV	Proxy	20	$7,062	27%	$202	$4	$162	$97	$41
Tehachapi/Owens	CA	Non-CREZ	226343	Solar PV	Proxy	20	$7,064	27%	$202	$4	$162	$97	$41
Tehachapi/Owens	CA	Non-CREZ	323968	Solar PV	Proxy	20	$7,060	25%	$222	$4	$154	$97	$58
Tehachapi/Owens	CA	Non-CREZ	214777	Solar PV	Proxy	20	$7,051	25%	$216	$4	$156	$97	$53
Tehachapi/Owens	CA	Non-CREZ	213984	Solar PV	Proxy	20	$7,044	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	217238	Solar PV	Proxy	20	$7,048	25%	$219	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	221534	Solar PV	Proxy	20	$7,052	26%	$208	$4	$159	$97	$47
Tehachapi/Owens	CA	Non-CREZ	213034	Solar PV	Proxy	20	$7,046	25%	$216	$4	$154	$94	$57
Tehachapi/Owens	CA	Non-CREZ	213101	Solar PV	Proxy	20	$7,048	25%	$216	$4	$154	$94	$57
Tehachapi/Owens	CA	Non-CREZ	427005	Solar PV	Proxy	20	$7,043	24%	$226	$4	$161	$100	$54
Tehachapi/Owens	CA	Non-CREZ	164075	Solar PV	Proxy	20	$7,123	26%	$212	$4	$159	$97	$50
Tehachapi/Owens	CA	Non-CREZ	215678	Solar PV	Proxy	20	$7,047	25%	$218	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	215138	Solar PV	Proxy	20	$7,045	25%	$220	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	214207	Solar PV	Proxy	20	$7,074	25%	$217	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	214743	Solar PV	Proxy	20	$7,092	25%	$219	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	214828	Solar PV	Proxy	20	$7,058	25%	$216	$4	$156	$97	$53
Tehachapi/Owens	CA	Non-CREZ	212979	Solar PV	Proxy	20	$7,045	25%	$216	$4	$154	$94	$57
Tehachapi/Owens	CA	Non-CREZ	212914	Solar PV	Proxy	20	$7,049	25%	$222	$4	$145	$93	$66
Tehachapi/Owens	CA	Non-CREZ	275876	Solar PV	Proxy	20	$7,149	25%	$222	$4	$156	$97	$57
Tehachapi/Owens	CA	Non-CREZ	223736	Solar PV	Proxy	20	$7,041	25%	$218	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	268161	Solar PV	Proxy	20	$7,066	25%	$215	$4	$157	$97	$52
Tehachapi/Owens	CA	Non-CREZ	267966	Solar PV	Proxy	20	$7,068	25%	$215	$4	$157	$97	$52
Tehachapi/Owens	CA	Non-CREZ	163154	Solar PV	Proxy	20	$7,082	25%	$220	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	169433	Solar PV	Proxy	20	$7,043	27%	$200	$4	$161	$97	$40
Tehachapi/Owens	CA	Non-CREZ	334636	Solar PV	Proxy	20	$7,069	27%	$202	$4	$158	$96	$43
Tehachapi/Owens	CA	Non-CREZ	334637	Solar PV	Proxy	20	$7,074	27%	$202	$4	$158	$96	$43
Tehachapi/Owens	CA	Non-CREZ	221307	Solar PV	Proxy	20	$7,057	27%	$205	$4	$159	$97	$44
Tehachapi/Owens	CA	Non-CREZ	222399	Solar PV	Proxy	20	$7,045	27%	$205	$4	$159	$97	$44
Tehachapi/Owens	CA	Non-CREZ	319402	Solar PV	Proxy	20	$7,075	25%	$218	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	227750	Solar PV	Proxy	20	$7,044	27%	$201	$4	$162	$97	$41
Tehachapi/Owens	CA	Non-CREZ	227817	Solar PV	Proxy	20	$7,044	27%	$198	$4	$163	$94	$41
Tehachapi/Owens	CA	Non-CREZ	422826	Solar PV	Proxy	20	$7,043	24%	$227	$4	$162	$100	$54
Tehachapi/Owens	CA	Non-CREZ	320515	Solar PV	Proxy	20	$7,059	25%	$220	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	327544	Solar PV	Proxy	20	$7,145	25%	$224	$4	$154	$97	$60
Tehachapi/Owens	CA	Non-CREZ	326682	Solar PV	Proxy	20	$7,044	24%	$223	$4	$153	$97	$59
Tehachapi/Owens	CA	Non-CREZ	162757	Solar PV	Proxy	20	$7,061	25%	$220	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	219230	Solar PV	Proxy	20	$7,061	25%	$219	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	272037	Solar PV	Proxy	20	$7,043	25%	$221	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	271970	Solar PV	Proxy	20	$7,044	25%	$219	$4	$156	$97	$55

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Tehachapi/Owens	CA	Non-CREZ	276953	Solar PV	Proxy	20	$7,089	25%	$220	$4	$156	$97	$56
Tehachapi/Owens	CA	Non-CREZ	217824	Solar PV	Proxy	20	$7,055	26%	$207	$4	$160	$97	$45
Tehachapi/Owens	CA	Non-CREZ	212059	Solar PV	Proxy	20	$7,041	27%	$205	$4	$153	$96	$47
Tehachapi/Owens	CA	Non-CREZ	318252	Solar PV	Proxy	20	$7,053	25%	$215	$4	$156	$97	$53
Tehachapi/Owens	CA	Non-CREZ	216287	Solar PV	Proxy	20	$7,102	25%	$220	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	216902	Solar PV	Proxy	20	$7,061	25%	$221	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	218474	Solar PV	Proxy	20	$7,061	25%	$221	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	218881	Solar PV	Proxy	20	$7,066	25%	$221	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	323564	Solar PV	Proxy	20	$7,107	24%	$225	$4	$154	$97	$61
Tehachapi/Owens	CA	Non-CREZ	216555	Solar PV	Proxy	20	$7,058	25%	$217	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	463528	Solar PV	Proxy	20	$7,052	24%	$226	$4	$163	$97	$57
Tehachapi/Owens	CA	Non-CREZ	326549	Solar PV	Proxy	20	$7,055	25%	$222	$4	$154	$97	$58
Tehachapi/Owens	CA	Non-CREZ	320457	Solar PV	Proxy	20	$7,061	25%	$220	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	324282	Solar PV	Proxy	20	$7,073	24%	$223	$4	$154	$97	$59
Tehachapi/Owens	CA	Non-CREZ	380234	Solar PV	Proxy	20	$7,041	24%	$226	$4	$153	$94	$64
Tehachapi/Owens	CA	Non-CREZ	380233	Solar PV	Proxy	20	$7,044	24%	$226	$4	$153	$94	$64
Tehachapi/Owens	CA	Non-CREZ	222633	Solar PV	Proxy	20	$7,081	25%	$220	$4	$156	$97	$56
Tehachapi/Owens	CA	Non-CREZ	266624	Solar PV	Proxy	20	$7,043	26%	$214	$4	$157	$97	$51
Tehachapi/Owens	CA	Non-CREZ	324267	Solar PV	Proxy	20	$7,067	24%	$225	$4	$153	$97	$61
Tehachapi/Owens	CA	Non-CREZ	507951	Solar PV	Proxy	20	$7,072	24%	$227	$4	$163	$100	$54
Tehachapi/Owens	CA	Non-CREZ	270537	Solar PV	Proxy	20	$7,067	25%	$222	$4	$155	$97	$58
Tehachapi/Owens	CA	Non-CREZ	270125	Solar PV	Proxy	20	$7,084	25%	$223	$4	$155	$97	$59
Tehachapi/Owens	CA	Non-CREZ	211978	Solar PV	Proxy	20	$7,062	27%	$200	$4	$158	$96	$42
Tehachapi/Owens	CA	Non-CREZ	212515	Solar PV	Proxy	20	$7,044	25%	$217	$4	$155	$97	$54
Tehachapi/Owens	CA	Non-CREZ	212915	Solar PV	Proxy	20	$7,043	25%	$217	$4	$153	$97	$55
Tehachapi/Owens	CA	Non-CREZ	213234	Solar PV	Proxy	20	$7,043	25%	$220	$4	$153	$97	$57
Tehachapi/Owens	CA	Non-CREZ	212581	Solar PV	Proxy	20	$7,044	25%	$216	$4	$156	$97	$53
Tehachapi/Owens	CA	Non-CREZ	213171	Solar PV	Proxy	20	$7,042	25%	$220	$4	$153	$97	$57
Tehachapi/Owens	CA	Non-CREZ	214621	Solar PV	Proxy	20	$7,042	25%	$218	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	227818	Solar PV	Proxy	20	$7,046	27%	$199	$4	$163	$97	$39
Tehachapi/Owens	CA	Non-CREZ	508076	Solar PV	Proxy	20	$7,052	24%	$226	$4	$164	$100	$53
Tehachapi/Owens	CA	Non-CREZ	222472	Solar PV	Proxy	20	$7,043	25%	$220	$4	$156	$97	$56
Tehachapi/Owens	CA	Non-CREZ	421792	Solar PV	Proxy	20	$7,100	24%	$229	$4	$162	$97	$60
Tehachapi/Owens	CA	Non-CREZ	271913	Solar PV	Proxy	20	$7,056	25%	$220	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	422892	Solar PV	Proxy	20	$7,040	24%	$226	$4	$162	$100	$54
Tehachapi/Owens	CA	Non-CREZ	319403	Solar PV	Proxy	20	$7,063	25%	$216	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	214987	Solar PV	Proxy	20	$7,061	25%	$216	$4	$156	$97	$53
Tehachapi/Owens	CA	Non-CREZ	215052	Solar PV	Proxy	20	$7,063	25%	$217	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	168850	Solar PV	Proxy	20	$7,042	27%	$201	$4	$162	$97	$40

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Tehachapi/Owens	CA	Non-CREZ	216990	Solar PV	Proxy	20	$7,051	25%	$220	$4	$154	$97	$56
Tehachapi/Owens	CA	Non-CREZ	212713	Solar PV	Proxy	20	$7,045	25%	$220	$4	$148	$97	$60
Tehachapi/Owens	CA	Non-CREZ	212782	Solar PV	Proxy	20	$7,053	25%	$220	$4	$148	$97	$60
Tehachapi/Owens	CA	Non-CREZ	215222	Solar PV	Proxy	20	$7,053	25%	$217	$4	$157	$97	$53
Tehachapi/Owens	CA	Non-CREZ	217467	Solar PV	Proxy	20	$7,050	25%	$220	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	265359	Solar PV	Proxy	20	$7,060	25%	$215	$4	$155	$97	$53
Tehachapi/Owens	CA	Non-CREZ	164364	Solar PV	Proxy	20	$7,066	25%	$219	$4	$157	$97	$55
Tehachapi/Owens	CA	Non-CREZ	211931	Solar PV	Proxy	20	$7,042	27%	$199	$4	$158	$93	$45
Tehachapi/Owens	CA	Non-CREZ	217758	Solar PV	Proxy	20	$7,042	26%	$211	$4	$159	$97	$48
Tehachapi/Owens	CA	Non-CREZ	217825	Solar PV	Proxy	20	$7,043	26%	$207	$4	$160	$97	$45
Tehachapi/Owens	CA	Non-CREZ	269683	Solar PV	Proxy	20	$7,052	25%	$221	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	422249	Solar PV	Proxy	20	$7,048	24%	$227	$4	$162	$100	$55
Tehachapi/Owens	CA	Non-CREZ	463464	Solar PV	Proxy	20	$7,101	24%	$227	$4	$163	$97	$58
Tehachapi/Owens	CA	Non-CREZ	463392	Solar PV	Proxy	20	$7,104	24%	$228	$4	$163	$97	$59
Tehachapi/Owens	CA	Non-CREZ	325511	Solar PV	Proxy	20	$7,089	25%	$223	$4	$154	$97	$59
Tehachapi/Owens	CA	Non-CREZ	326630	Solar PV	Proxy	20	$7,082	24%	$224	$4	$155	$97	$59
Tehachapi/Owens	CA	Non-CREZ	272581	Solar PV	Proxy	20	$7,055	25%	$220	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	272582	Solar PV	Proxy	20	$7,060	25%	$222	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	272518	Solar PV	Proxy	20	$7,056	25%	$222	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	272585	Solar PV	Proxy	20	$7,058	25%	$222	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	215679	Solar PV	Proxy	20	$7,044	25%	$216	$4	$156	$97	$53
Tehachapi/Owens	CA	Non-CREZ	215614	Solar PV	Proxy	20	$7,048	25%	$218	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	425811	Solar PV	Proxy	20	$7,112	24%	$228	$4	$162	$100	$56
Tehachapi/Owens	CA	Non-CREZ	173208	Solar PV	Proxy	20	$7,081	28%	$197	$4	$163	$97	$38
Tehachapi/Owens	CA	Non-CREZ	173275	Solar PV	Proxy	20	$7,082	28%	$197	$4	$163	$97	$38
Tehachapi/Owens	CA	Non-CREZ	168904	Solar PV	Proxy	20	$7,044	27%	$202	$4	$161	$97	$41
Tehachapi/Owens	CA	Non-CREZ	163493	Solar PV	Proxy	20	$7,046	25%	$219	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	217010	Solar PV	Proxy	20	$7,048	25%	$220	$4	$154	$97	$56
Tehachapi/Owens	CA	Non-CREZ	463776	Solar PV	Proxy	20	$7,109	24%	$229	$4	$161	$100	$57
Tehachapi/Owens	CA	Non-CREZ	463841	Solar PV	Proxy	20	$7,111	24%	$229	$4	$161	$100	$57
Tehachapi/Owens	CA	Non-CREZ	218778	Solar PV	Proxy	20	$7,063	25%	$221	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	213166	Solar PV	Proxy	20	$7,043	25%	$220	$4	$153	$97	$57
Tehachapi/Owens	CA	Non-CREZ	268967	Solar PV	Proxy	20	$7,047	25%	$217	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	269034	Solar PV	Proxy	20	$7,050	25%	$221	$4	$153	$97	$57
Tehachapi/Owens	CA	Non-CREZ	215547	Solar PV	Proxy	20	$7,088	25%	$218	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	466015	Solar PV	Proxy	20	$7,077	24%	$227	$4	$162	$100	$55
Tehachapi/Owens	CA	Non-CREZ	466016	Solar PV	Proxy	20	$7,080	24%	$227	$4	$163	$100	$54
Tehachapi/Owens	CA	Non-CREZ	217630	Solar PV	Proxy	20	$7,041	26%	$210	$4	$159	$97	$48
Tehachapi/Owens	CA	Non-CREZ	217563	Solar PV	Proxy	20	$7,046	25%	$219	$4	$155	$97	$56

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Tehachapi/Owens	CA	Non-CREZ	272026	Solar PV	Proxy	20	$7,050	25%	$219	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	268713	Solar PV	Proxy	20	$7,046	25%	$218	$4	$155	$97	$54
Tehachapi/Owens	CA	Non-CREZ	268714	Solar PV	Proxy	20	$7,046	25%	$217	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	211997	Solar PV	Proxy	20	$7,043	27%	$199	$4	$158	$96	$42
Tehachapi/Owens	CA	Non-CREZ	219648	Solar PV	Proxy	20	$7,069	25%	$220	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	325751	Solar PV	Proxy	20	$7,114	25%	$224	$4	$154	$97	$60
Tehachapi/Owens	CA	Non-CREZ	326638	Solar PV	Proxy	20	$7,090	24%	$225	$4	$153	$97	$61
Tehachapi/Owens	CA	Non-CREZ	213102	Solar PV	Proxy	20	$7,043	24%	$223	$4	$151	$97	$60
Tehachapi/Owens	CA	Non-CREZ	213956	Solar PV	Proxy	20	$7,044	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	217759	Solar PV	Proxy	20	$7,043	26%	$211	$4	$159	$97	$48
Tehachapi/Owens	CA	Non-CREZ	213829	Solar PV	Proxy	20	$7,046	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	213762	Solar PV	Proxy	20	$7,050	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	213437	Solar PV	Proxy	20	$7,048	25%	$216	$4	$155	$97	$54
Tehachapi/Owens	CA	Non-CREZ	214289	Solar PV	Proxy	20	$7,048	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	222263	Solar PV	Proxy	20	$7,057	26%	$207	$4	$162	$97	$44
Tehachapi/Owens	CA	Non-CREZ	163293	Solar PV	Proxy	20	$7,050	25%	$218	$4	$157	$97	$54
Tehachapi/Owens	CA	Non-CREZ	272163	Solar PV	Proxy	20	$7,056	25%	$220	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	213367	Solar PV	Proxy	20	$7,052	25%	$220	$4	$153	$97	$57
Tehachapi/Owens	CA	Non-CREZ	264862	Solar PV	Proxy	20	$7,060	26%	$214	$4	$156	$97	$52
Tehachapi/Owens	CA	Non-CREZ	327422	Solar PV	Proxy	20	$7,062	24%	$224	$4	$155	$97	$59
Tehachapi/Owens	CA	Non-CREZ	328054	Solar PV	Proxy	20	$7,141	24%	$225	$4	$155	$97	$61
Tehachapi/Owens	CA	Non-CREZ	215533	Solar PV	Proxy	20	$7,046	25%	$218	$4	$155	$97	$55
Tehachapi/Owens	CA	Non-CREZ	215802	Solar PV	Proxy	20	$7,056	25%	$217	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	213499	Solar PV	Proxy	20	$7,041	25%	$216	$4	$155	$97	$53
Tehachapi/Owens	CA	Non-CREZ	213566	Solar PV	Proxy	20	$7,044	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	222667	Solar PV	Proxy	20	$7,047	25%	$220	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	271705	Solar PV	Proxy	20	$7,042	25%	$220	$4	$155	$97	$56
Tehachapi/Owens	CA	Non-CREZ	271638	Solar PV	Proxy	20	$7,044	25%	$221	$4	$154	$97	$57
Tehachapi/Owens	CA	Non-CREZ	213915	Solar PV	Proxy	20	$7,045	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	214051	Solar PV	Proxy	20	$7,049	25%	$218	$4	$154	$97	$55
Tehachapi/Owens	CA	Non-CREZ	217640	Solar PV	Proxy	20	$7,052	26%	$211	$4	$159	$97	$48
Tehachapi/Owens	CA	Non-CREZ	272650	Solar PV	Proxy	20	$7,041	25%	$219	$4	$156	$97	$54
Tehachapi/Owens	CA	Non-CREZ	272583	Solar PV	Proxy	20	$7,045	25%	$219	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	326140	Solar PV	Proxy	20	$7,068	24%	$224	$4	$154	$97	$59
Tehachapi/Owens	CA	Non-CREZ	223331	Solar PV	Proxy	20	$7,042	25%	$219	$4	$158	$97	$54
Tehachapi/Owens	CA	Non-CREZ	221705	Solar PV	Proxy	20	$7,043	26%	$208	$4	$159	$97	$46
Tehachapi/Owens	CA	Non-CREZ	218260	Solar PV	Proxy	20	$7,071	27%	$205	$4	$159	$97	$45
Tehachapi/Owens	CA	Non-CREZ	213104	Solar PV	Proxy	20	$7,045	25%	$220	$4	$153	$97	$57
Tehachapi/Owens	CA	Non-CREZ	277951	Solar PV	Proxy	20	$7,058	26%	$211	$4	$162	$97	$47

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Tehachapi/Owens	CA	Non-CREZ	219344	Solar PV	Proxy	20	$7,084	25%	$220	$4	$155	$97	$57
Tehachapi/Owens	CA	Non-CREZ	212582	Solar PV	Proxy	20	$7,042	24%	$226	$4	$143	$97	$67
Tehachapi/Owens	CA	Non-CREZ	271015	Solar PV	Proxy	20	$7,048	24%	$224	$4	$152	$97	$60
Tehachapi/Owens	CA	Non-CREZ	423748	Solar PV	Proxy	20	$7,116	24%	$228	$4	$162	$100	$56
Tehachapi/Owens	CA	Non-CREZ	222739	Solar PV	Proxy	20	$7,046	25%	$219	$4	$156	$97	$55
Tehachapi/Owens	CA	Non-CREZ	423494	Solar PV	Proxy	20	$7,059	24%	$227	$4	$162	$100	$55
Tehachapi/Owens	CA	Owens Valley	st47505	Solar Th.	Proxy	200	$4,977	29%	$147	$29	$166	$99	$13
Tehachapi/Owens	CA	Owens Valley	st47506	Solar Th.	Proxy	200	$4,911	29%	$146	$29	$166	$99	$11
Tehachapi/Owens	CA	Owens Valley	st47508	Solar Th.	Proxy	200	$4,830	30%	$143	$29	$172	$99	$7
Tehachapi/Owens	CA	Owens Valley	st47509	Solar Th.	Proxy	200	$4,838	30%	$143	$29	$172	$99	$7
Tehachapi/Owens	CA	Owens Valley	st47527	Solar Th.	Proxy	200	$4,826	29%	$143	$29	$166	$99	$9
Tehachapi/Owens	CA	Owens Valley	st47528	Solar Th.	Proxy	200	$4,867	29%	$144	$29	$166	$99	$10
Tehachapi/Owens	CA	Owens Valley	st47549	Solar Th.	Proxy	200	$4,909	29%	$145	$29	$166	$99	$11
Tehachapi/Owens	CA	Tehachapi	Kern East 2	Biomass	Proxy	37	$4,862	80%	$142	$12	$204	$88	$37
Tehachapi/Owens	CA	Tehachapi	WI_100	Wind	Proxy	151	$2,647	33%	$104	$21	$88	$89	$5
Tehachapi/Owens	CA	Tehachapi	WI_101	Wind	Pre-ID	175	$2,661	31%	$111	$22	$88	$89	$12
Tehachapi/Owens	CA	Tehachapi	WI_103	Wind	Proxy	77	$2,644	30%	$118	$22	$88	$89	$19
Tehachapi/Owens	CA	Tehachapi	WI_104	Wind	Proxy	110	$2,640	32%	$110	$22	$88	$89	$11
Tehachapi/Owens	CA	Tehachapi	WI_70	Wind	Proxy	193	$2,315	35%	$85	$11	$88	$89	-$22
Tehachapi/Owens	CA	Tehachapi	WI_71	Wind	Proxy	219	$2,290	34%	$87	$15	$88	$89	-$16
Tehachapi/Owens	CA	Tehachapi	WI_72	Wind	Proxy	103	$2,658	41%	$79	$18	$88	$89	-$16
Tehachapi/Owens	CA	Tehachapi	WI_76	Wind	Pre-ID	49	$2,338	30%	$110	$26	$88	$89	$13
Tehachapi/Owens	CA	Tehachapi	WI_77	Wind	Proxy	63	$2,307	29%	$107	$16	$88	$89	$0
Tehachapi/Owens	CA	Tehachapi	WI_78	Wind	Proxy	87	$2,293	31%	$98	$15	$88	$89	-$8
Tehachapi/Owens	CA	Tehachapi	WI_79	Wind	Proxy	123	$2,398	31%	$102	$15	$88	$89	-$3
Tehachapi/Owens	CA	Tehachapi	WI_80	Wind	Pre-ID	122	$2,457	31%	$106	$16	$88	$89	$0
Tehachapi/Owens	CA	Tehachapi	WI_81	Wind	Pre-ID	137	$2,266	32%	$92	$15	$88	$89	-$13
Tehachapi/Owens	CA	Tehachapi	WI_82	Wind	Pre-ID	52	$2,679	31%	$119	$21	$88	$89	$18
Tehachapi/Owens	CA	Tehachapi	WI_83	Wind	Pre-ID	56	$2,334	29%	$110	$21	$88	$89	$7
Tehachapi/Owens	CA	Tehachapi	WI_86	Wind	Pre-ID	125	$2,615	36%	$92	$18	$88	$89	-$7
Tehachapi/Owens	CA	Tehachapi	WI_90	Wind	Pre-ID	204	$2,273	34%	$86	$11	$88	$89	-$22
Tehachapi/Owens	CA	Tehachapi	WI_91a	Wind	Pre-ID	216	$2,359	41%	$67	$10	$88	$89	-$37
Tehachapi/Owens	CA	Tehachapi	WI_91b	Wind	Pre-ID	169	$2,287	35%	$83	$10	$88	$89	-$24
Tehachapi/Owens	CA	Tehachapi	WI_93	Wind	Pre-ID	162	$2,504	35%	$92	$15	$88	$89	-$11
Tehachapi/Owens	CA	Tehachapi	WI_97	Wind	Proxy	41	$2,675	34%	$102	$28	$88	$89	$11
Tehachapi/Owens	CA	Tehachapi	WI_98	Wind	Proxy	52	$2,614	35%	$97	$17	$88	$89	-$4
Tehachapi/Owens	CA	Tehachapi	WI_99	Wind	Pre-ID	43	$2,618	35%	$95	$29	$88	$89	$7
Tehachapi/Owens	CA	Tehachapi	WI_200	Wind	Pre-ID	52	$2,607	34%	$101	$19	$88	$89	$1
Tehachapi/Owens	CA	Tehachapi	WI_201	Wind	Proxy	243	$2,620	32%	$109	$22	$88	$89	$11

Resource Area	State	CREZ	Name	Tech-nology	Type	MW	Capital Cost ($/kW)	Cap Factor (%)	Gen Cost ($/MWh)	Trans Cost ($/MWh)	Capacity Value ($/kW-yr)	Energy Value ($/MWh)	Rank Cost ($/MWh)
Tehachapi/Owens	CA	Tehachapi	WI_202	Wind	Proxy	162	$2,660	37%	$89	$16	$88	$89	-$10
Tehachapi/Owens	CA	Tehachapi	WI_204	Wind	Pre-ID	204	$2,490	38%	$80	$10	$88	$89	-$25
Tehachapi/Owens	CA	Tehachapi	WI_207	Wind	Pre-ID	213	$2,313	36%	$82	$10	$88	$89	-$25
Tehachapi/Owens	CA	Tehachapi	st21063	Solar Th.	Proxy	200	$4,730	28%	$149	$17	$166	$100	-$2
Tehachapi/Owens	CA	Tehachapi	st21086	Solar Th.	Proxy	200	$4,563	30%	$137	$12	$184	$100	-$23
Tehachapi/Owens	CA	Tehachapi	st21115	Solar Th.	Proxy	200	$5,068	31%	$145	$16	$190	$100	-$11
Tehachapi/Owens	CA	Tehachapi	stm21182	Solar Th.	Pre-ID	200	$4,562	29%	$138	$12	$185	$101	-$22
Tehachapi/Owens	CA	Tehachapi	st21263	Solar Th.	Pre-ID	200	$5,340	29%	$158	$17	$170	$100	$9
Tehachapi/Owens	CA	Tehachapi	st21287	Solar Th.	Pre-ID	200	$5,220	29%	$155	$17	$170	$100	$6
Tehachapi/Owens	CA	Tehachapi	st21288	Solar Th.	Pre-ID	200	$5,104	29%	$150	$17	$172	$99	$1
Tehachapi/Owens	CA	Tehachapi	st28037	Solar Th.	Pre-ID	200	$5,265	29%	$157	$17	$167	$99	$9
Tehachapi/Owens	CA	Tehachapi	st28062	Solar Th.	Pre-ID	200	$5,240	29%	$157	$17	$167	$99	$9
Tehachapi/Owens	CA	Tehachapi	st28105	Solar Th.	Proxy	200	$4,837	29%	$147	$17	$167	$99	-$2
Tehachapi/Owens	CA	Tehachapi	st28111	Solar Th.	Pre-ID	200	$5,049	29%	$152	$20	$167	$99	$6
Tehachapi/Owens	CA	Tehachapi	st28133	Solar Th.	Pre-ID	200	$4,980	29%	$151	$20	$167	$99	$5
Tehachapi/Owens	CA	Tehachapi	st28134	Solar Th.	Pre-ID	200	$5,026	29%	$152	$20	$167	$99	$6
Tehachapi/Owens	CA	Tehachapi	st28157	Solar Th.	Pre-ID	200	$4,951	29%	$147	$19	$167	$99	$2
Tehachapi/Owens	CA	Tehachapi	st28158	Solar Th.	Pre-ID	200	$4,968	29%	$148	$19	$167	$99	$3
Tehachapi/Owens	CA	Tehachapi	st28177	Solar Th.	Proxy	200	$4,883	29%	$145	$17	$172	$99	-$4
Tehachapi/Owens	CA	Tehachapi	st28182	Solar Th.	Proxy	200	$4,959	29%	$147	$19	$167	$99	$2
Tehachapi/Owens	CA	Tehachapi	st28185	Solar Th.	Proxy	200	$4,937	29%	$146	$19	$167	$99	$2
Tehachapi/Owens	CA	Tehachapi	st28205	Solar Th.	Proxy	200	$4,985	29%	$148	$19	$167	$99	$3
Tehachapi/Owens	CA	Tehachapi	st28209	Solar Th.	Proxy	200	$4,947	29%	$147	$19	$167	$99	$2
Tehachapi/Owens	CA	Tehachapi	st28211	Solar Th.	Proxy	200	$4,962	29%	$148	$19	$168	$99	$2
Tehachapi/Owens	CA	Tehachapi	st28232	Solar Th.	Proxy	200	$4,924	29%	$146	$19	$167	$99	$1
Tehachapi/Owens	CA	Tehachapi	st28233	Solar Th.	Proxy	200	$5,006	29%	$148	$19	$167	$99	$3
Tehachapi/Owens	CA	Tehachapi	st28235	Solar Th.	Proxy	200	$4,985	29%	$149	$19	$168	$99	$3
Tehachapi/Owens	CA	Tehachapi	st28252	Solar Th.	Proxy	200	$4,960	30%	$145	$19	$170	$99	$0
Tehachapi/Owens	CA	Tehachapi	st28301	Solar Th.	Proxy	200	$4,910	30%	$145	$19	$169	$99	$0
Tehachapi/Owens	CA	Tehachapi	st28323	Solar Th.	Proxy	200	$4,932	30%	$145	$19	$170	$99	$0
Tehachapi/Owens	CA	Tehachapi	st28324	Solar Th.	Proxy	200	$4,957	30%	$146	$19	$170	$99	$0
Tehachapi/Owens	CA	Tehachapi	st28213	Solar Th.	Pre-ID	200	$5,111	29%	$152	$20	$168	$99	$6
Tehachapi/Owens	CA	Tehachapi	st28131	Solar Th.	Proxy	200	$4,957	29%	$150	$17	$167	$99	$2

Appendix E. Supply Curves

Note: Solar projects indicated in the supply curves are large scale solar thermal projects.

California CREZs

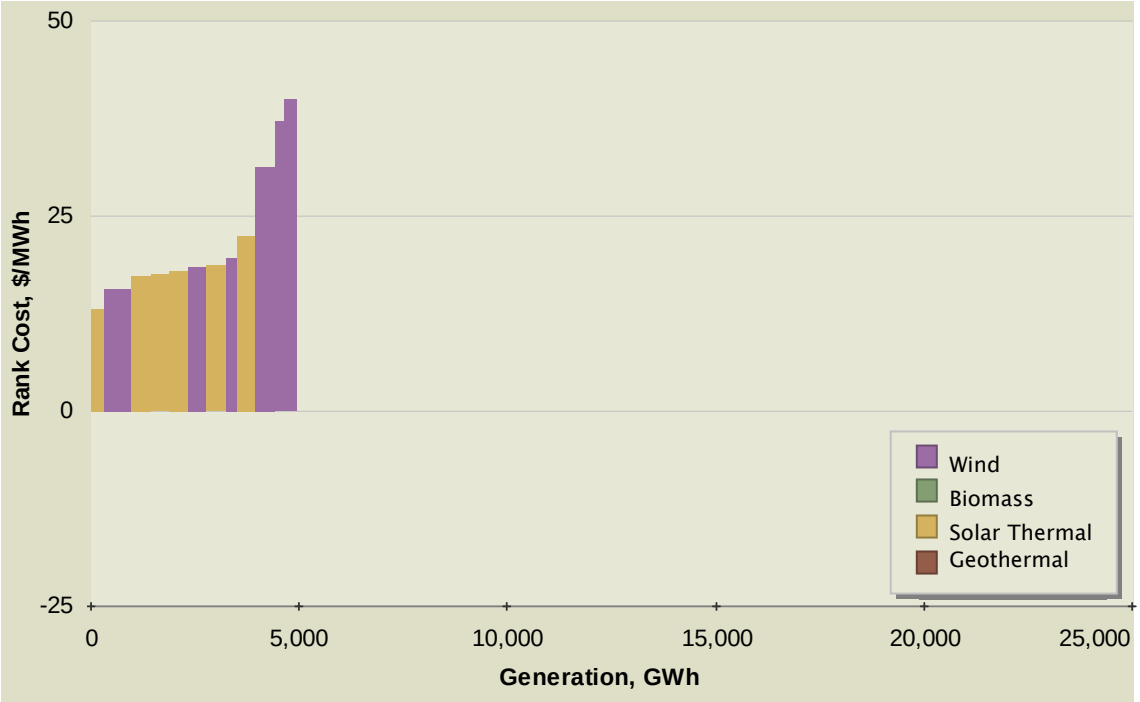


Figure E-1. Barstow CREZ Supply Curve CREZ Supply Curve

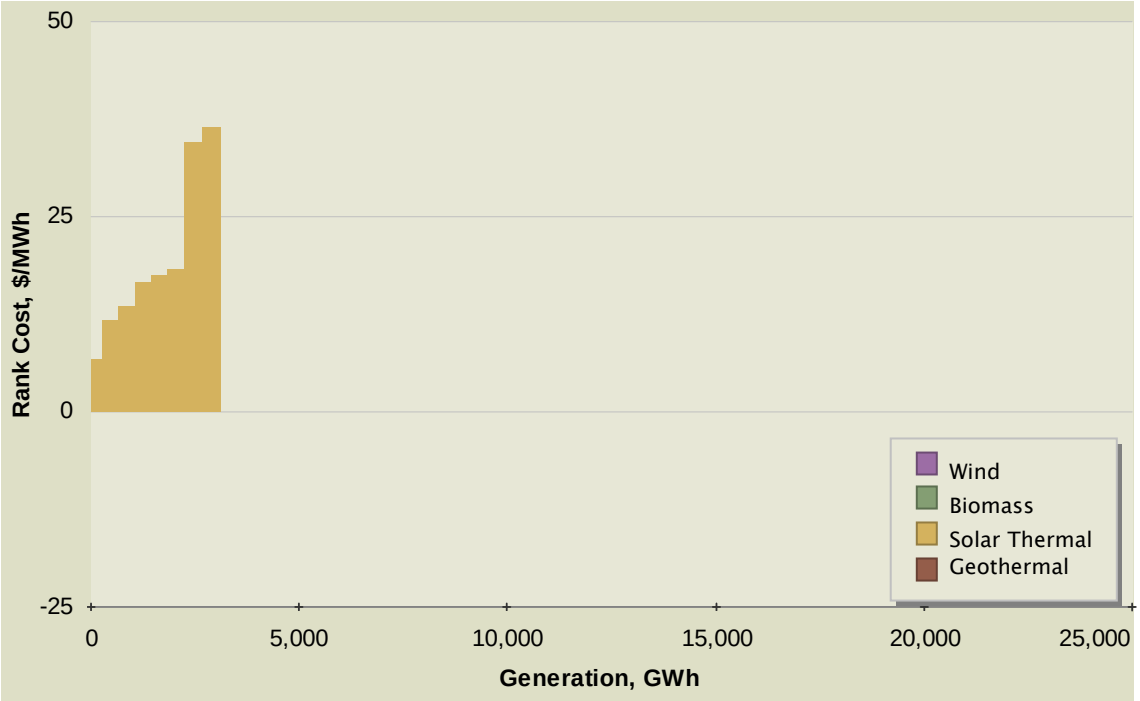


Figure E-2. Carrizo North CREZ Supply Curve

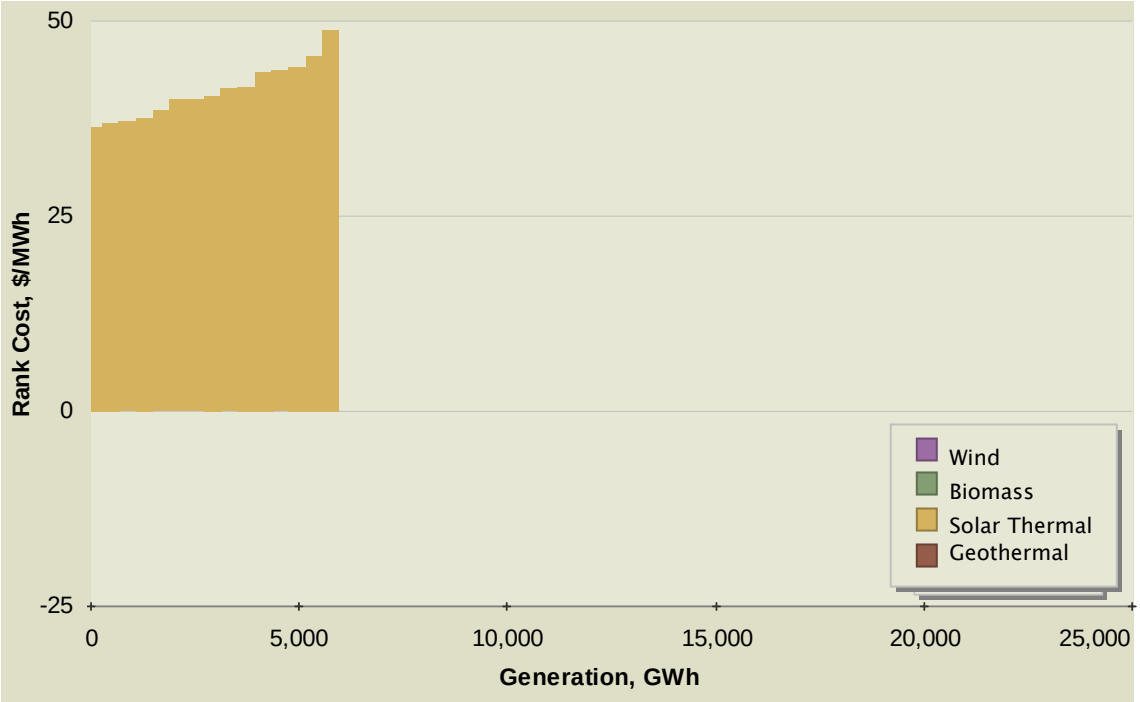


Figure E-3. Carrizo South CREZ Supply Curve

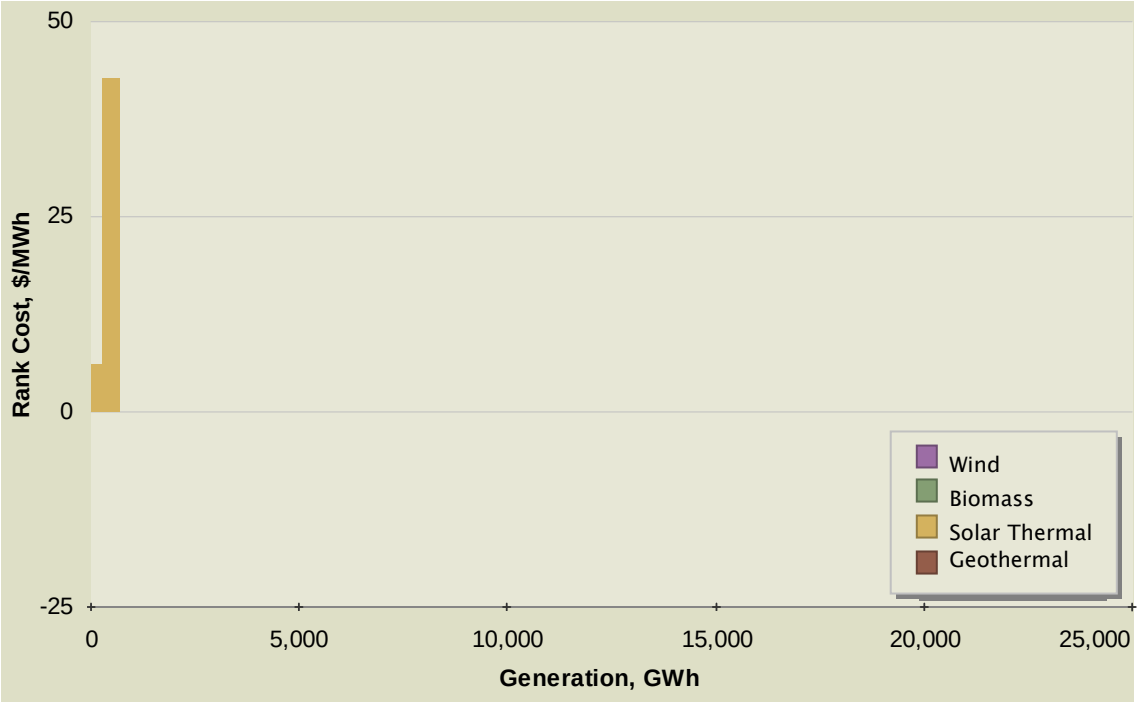


Figure E-4. Cuyama CREZ Supply Curve

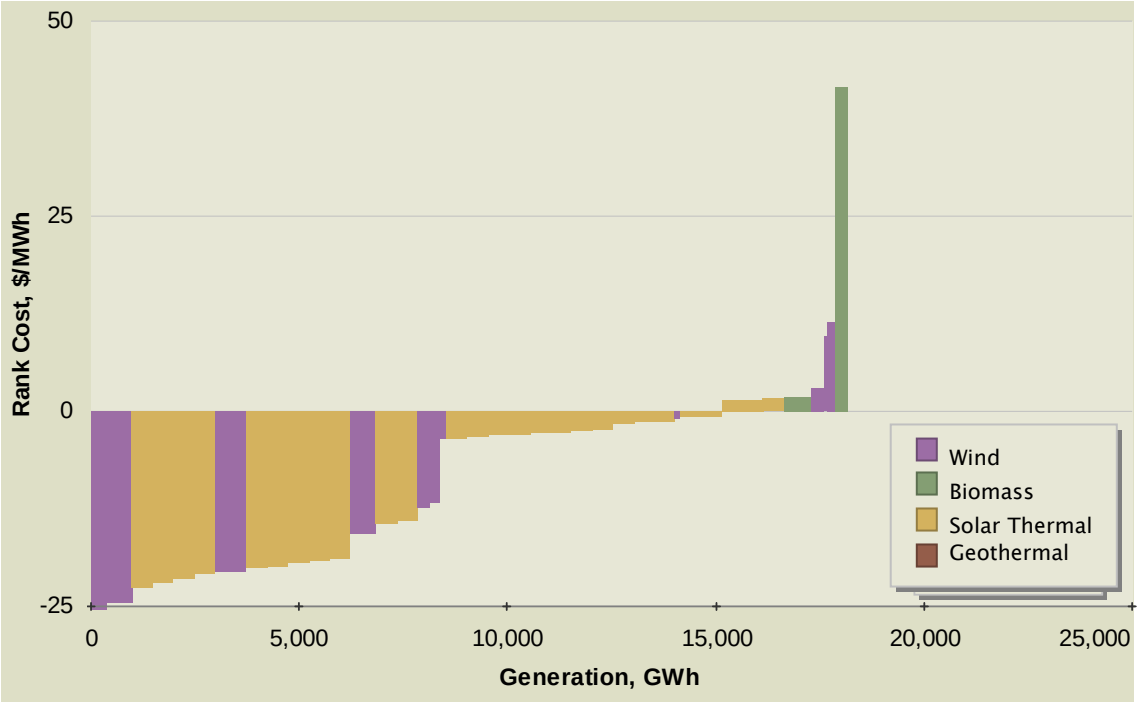


Figure E-5. Fairmont CREZ Supply Curve

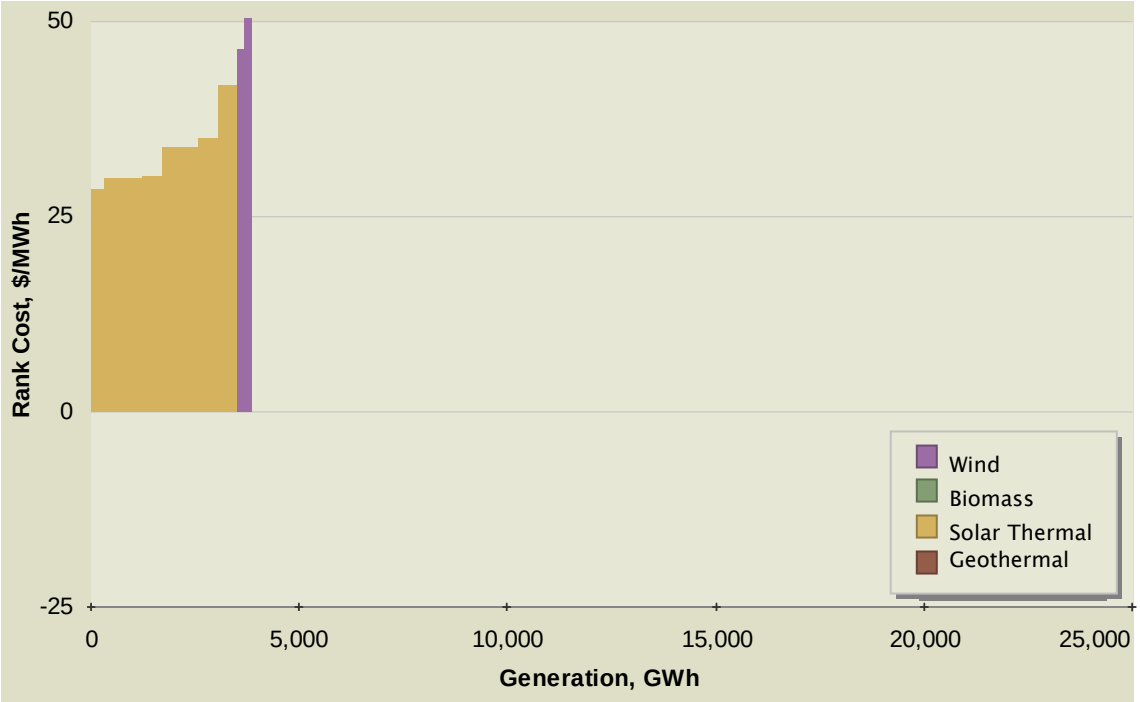


Figure E-6. Imperial East CREZ Supply Curve
Rank costs over $50/MWh not shown on chart.

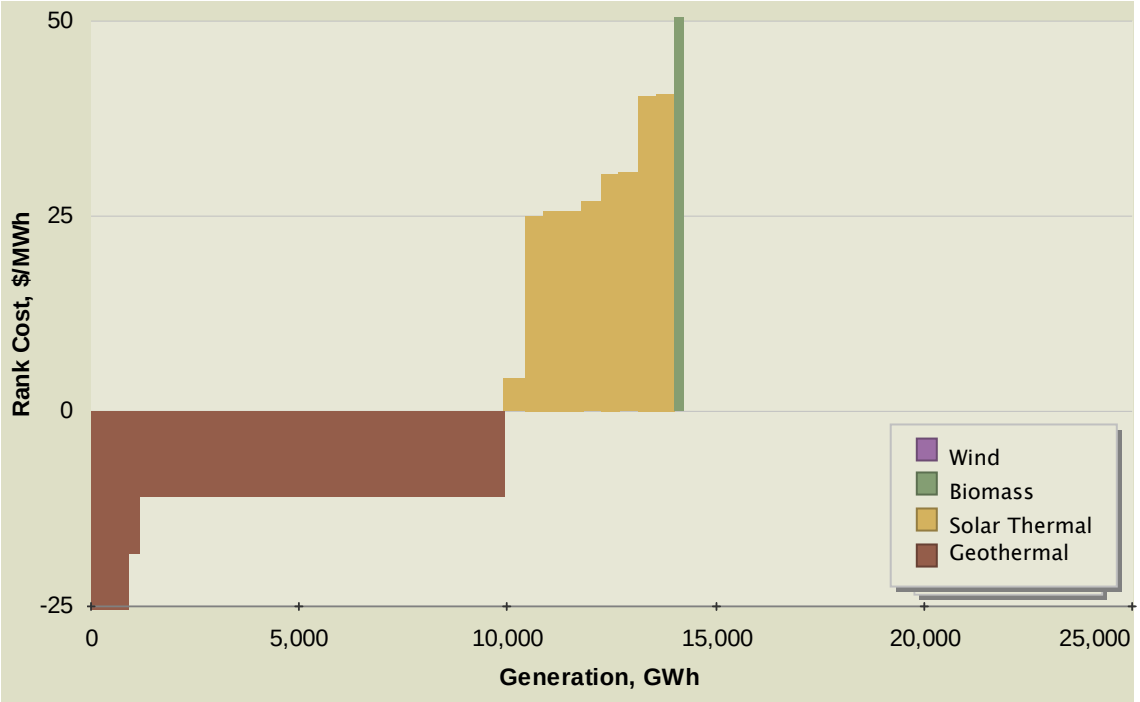


Figure E-7. Imperial North CREZ Supply Curve
Rank costs over $50/MWh not shown on chart.

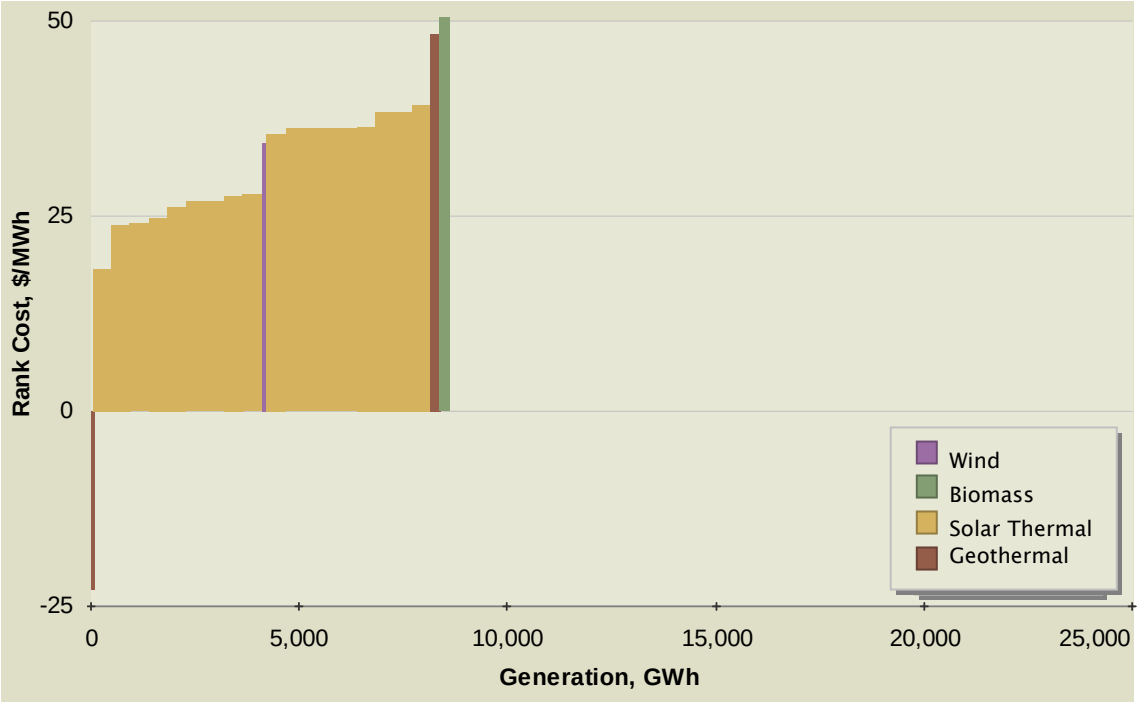


Figure E-8. Imperial South CREZ Supply Curve
Rank costs over $50/MWh not shown on chart.

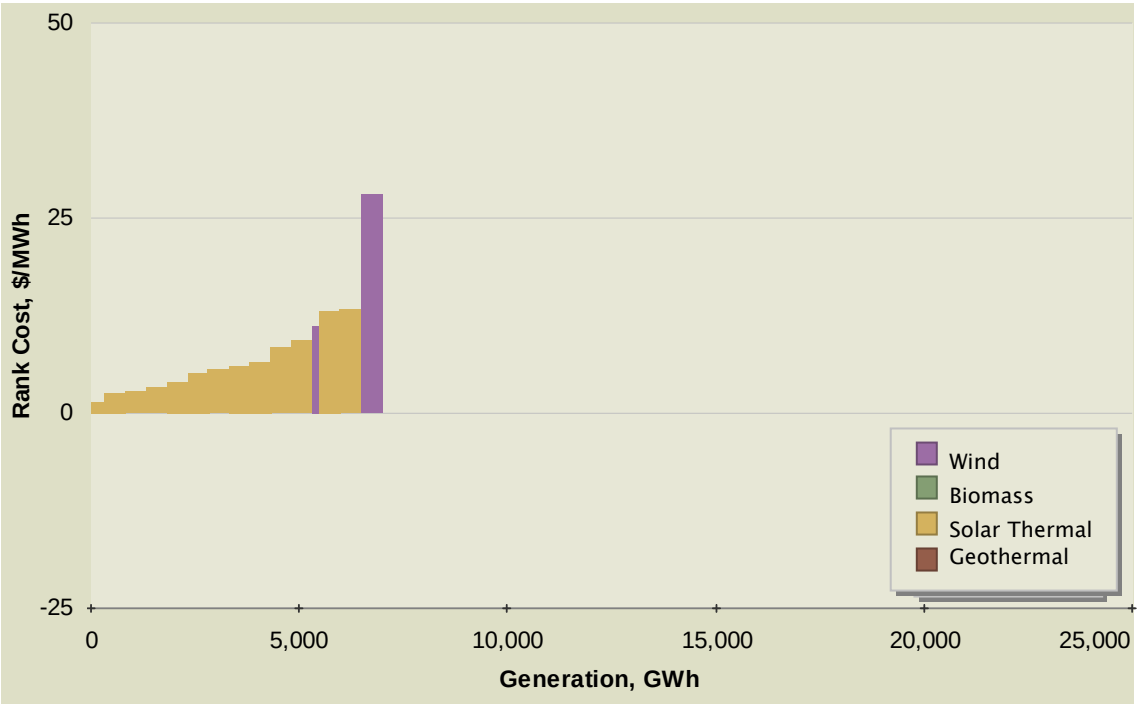


Figure E-9. Inyokern CREZ Supply Curve

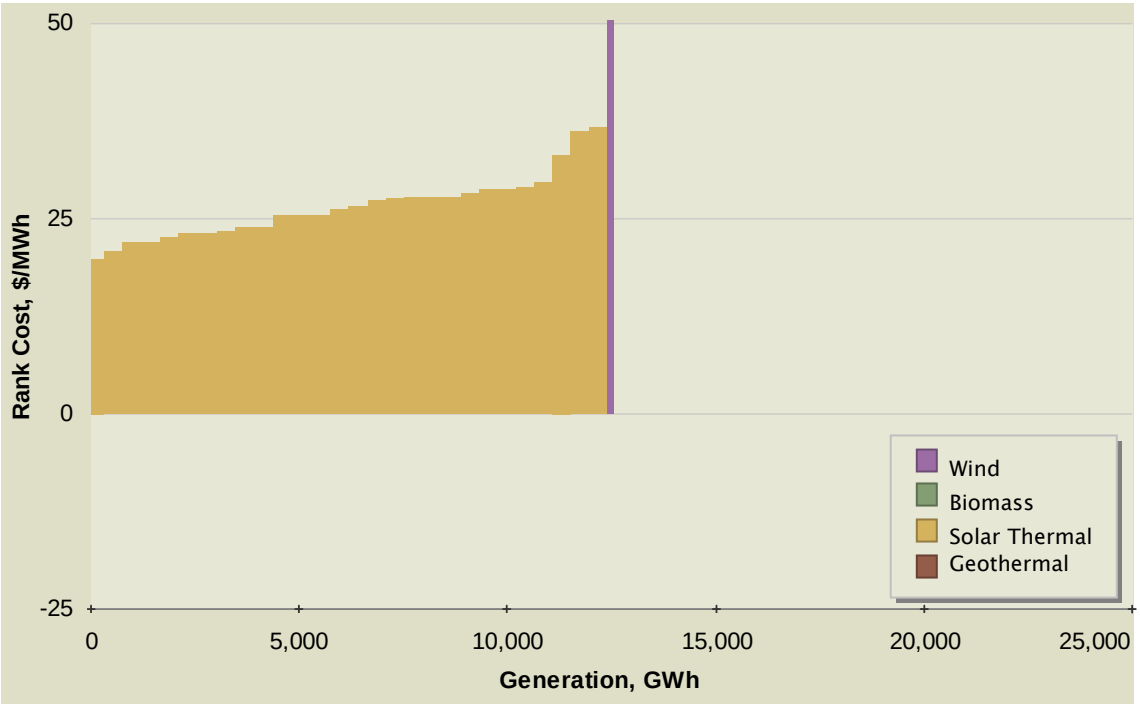


Figure E-10. Iron Mountain CREZ Supply Curve
Rank costs over $50/MWh not shown on chart.

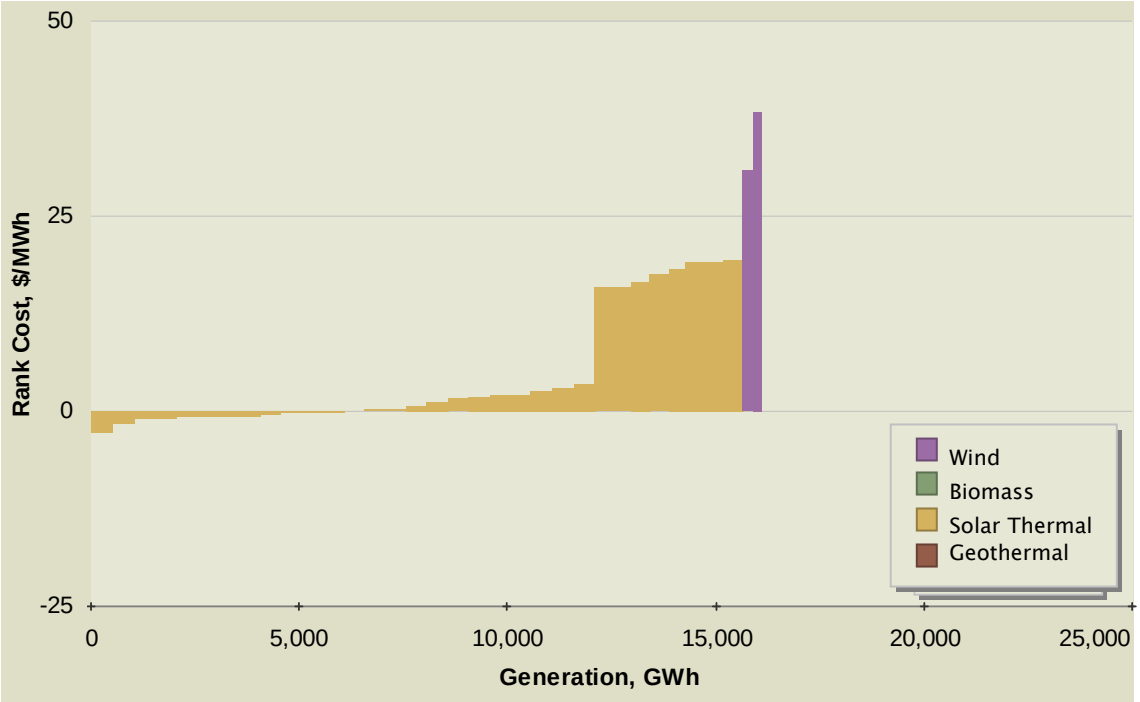


Figure E-11. Kramer CREZ Supply Curve

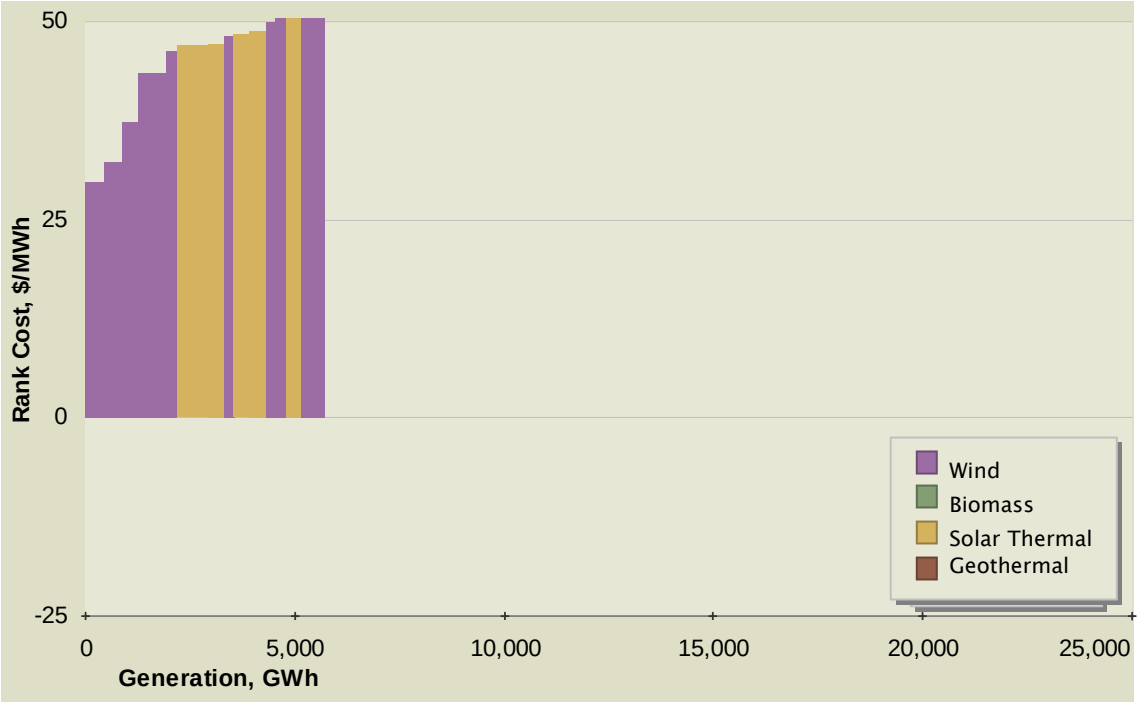


Figure E-12. Lassen North CREZ Supply Curve
Rank costs over $50/MWh not shown on chart.

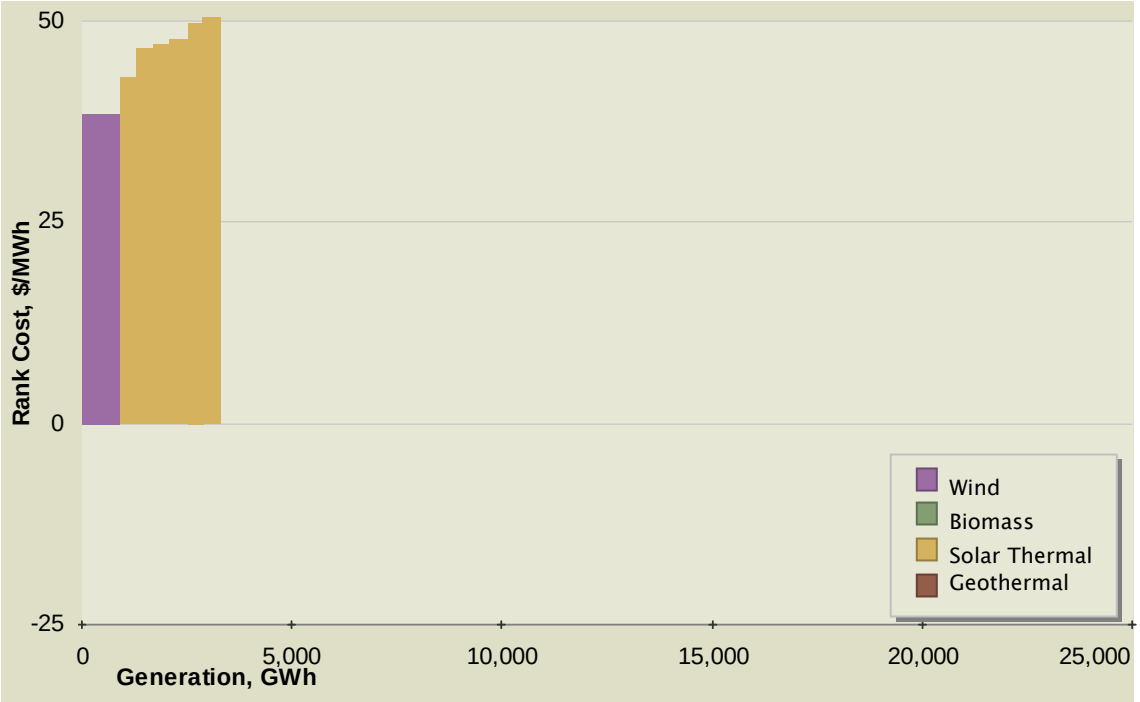


Figure E-13. Lassen South CREZ Supply Curve
Rank costs over $50/MWh not shown on chart.

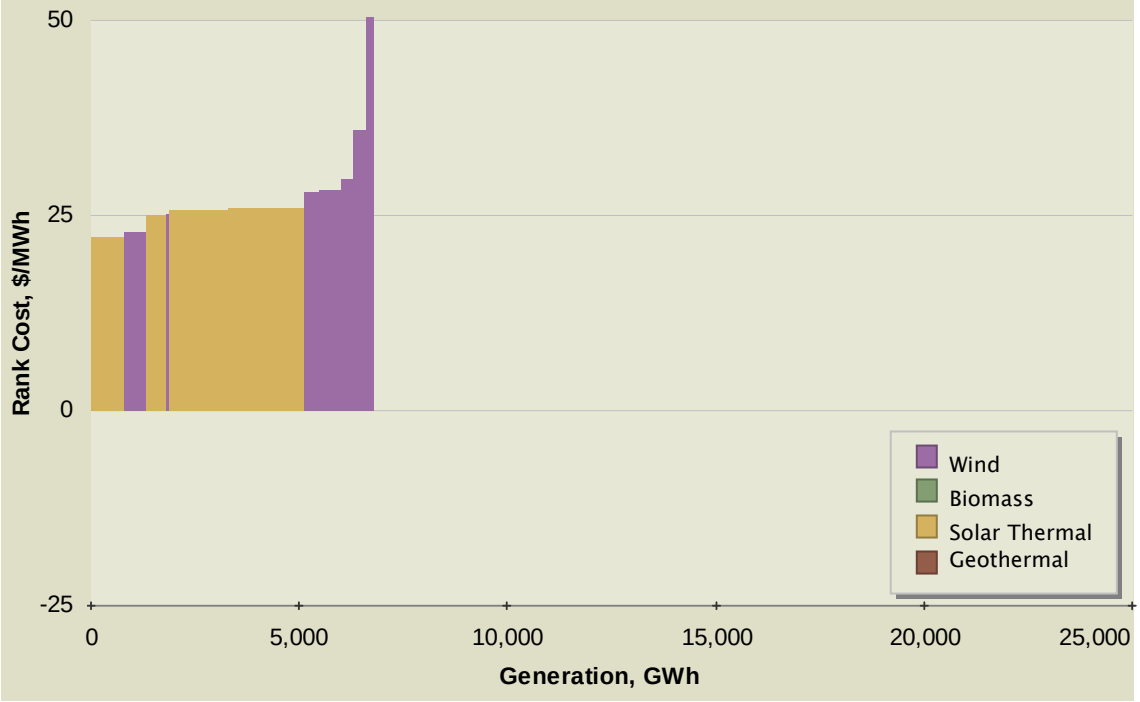


Figure E-14. Mountain Pass CREZ Supply Curve
Rank costs over $50/MWh not shown on chart.

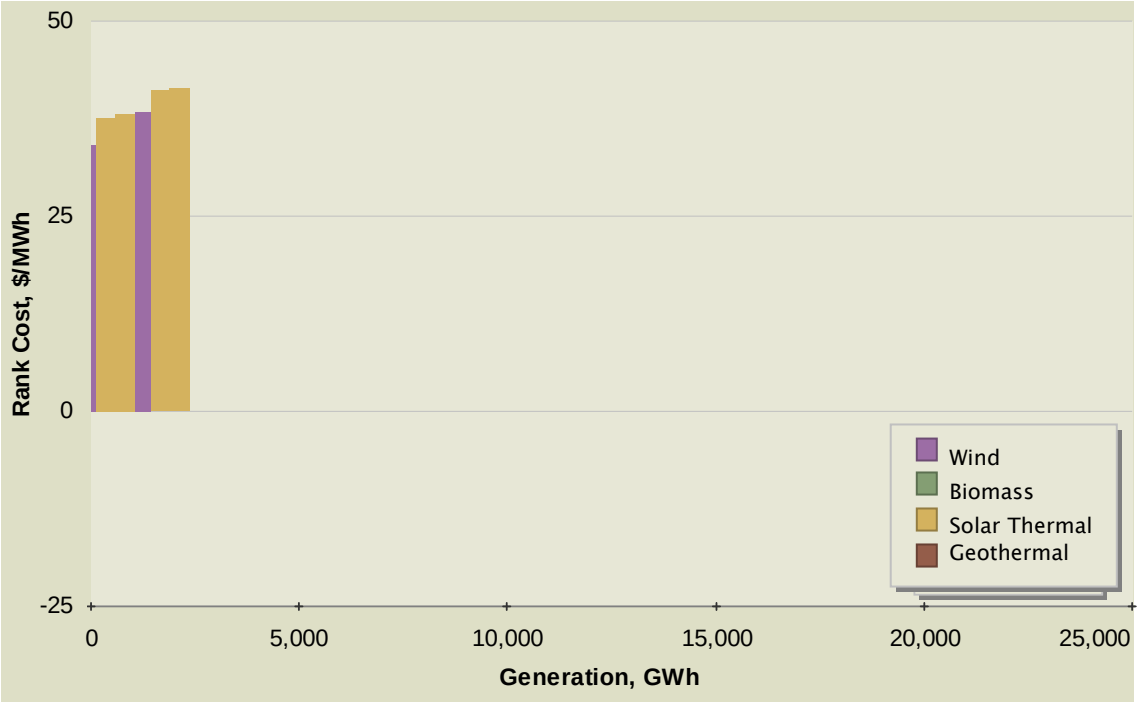


Figure E-15. Needles CREZ Supply Curve

Figure E-16. Owens Valley CREZ Supply Curve

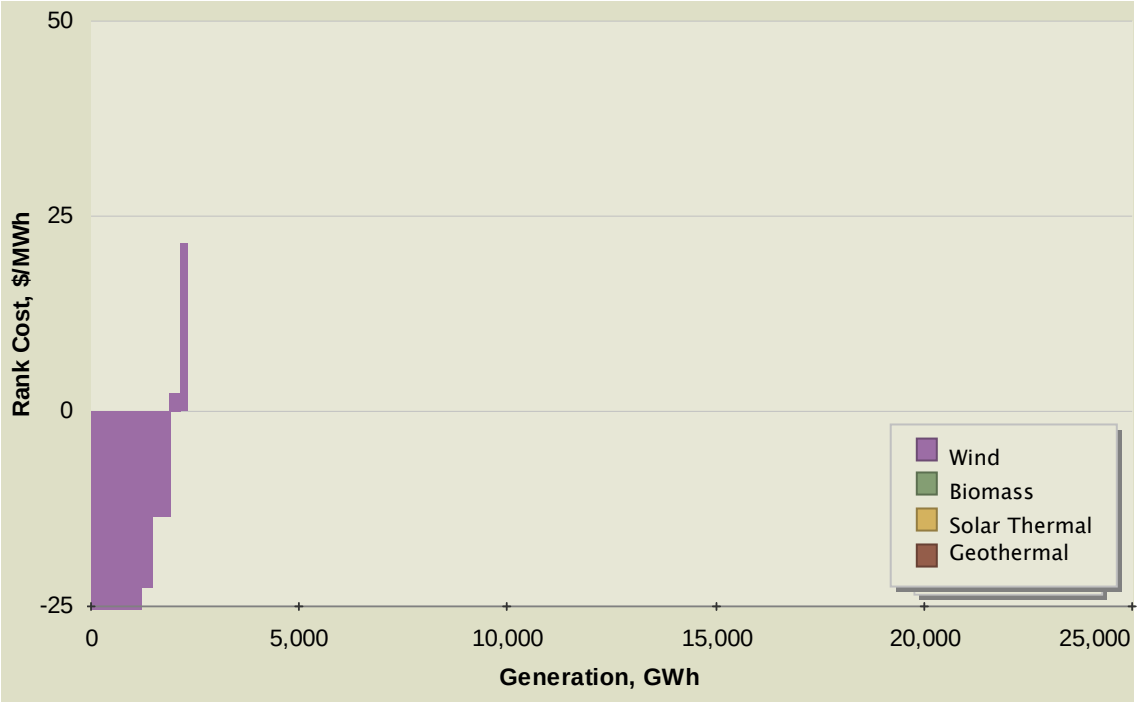


Figure E-17. Palm Springs CREZ Supply Curve

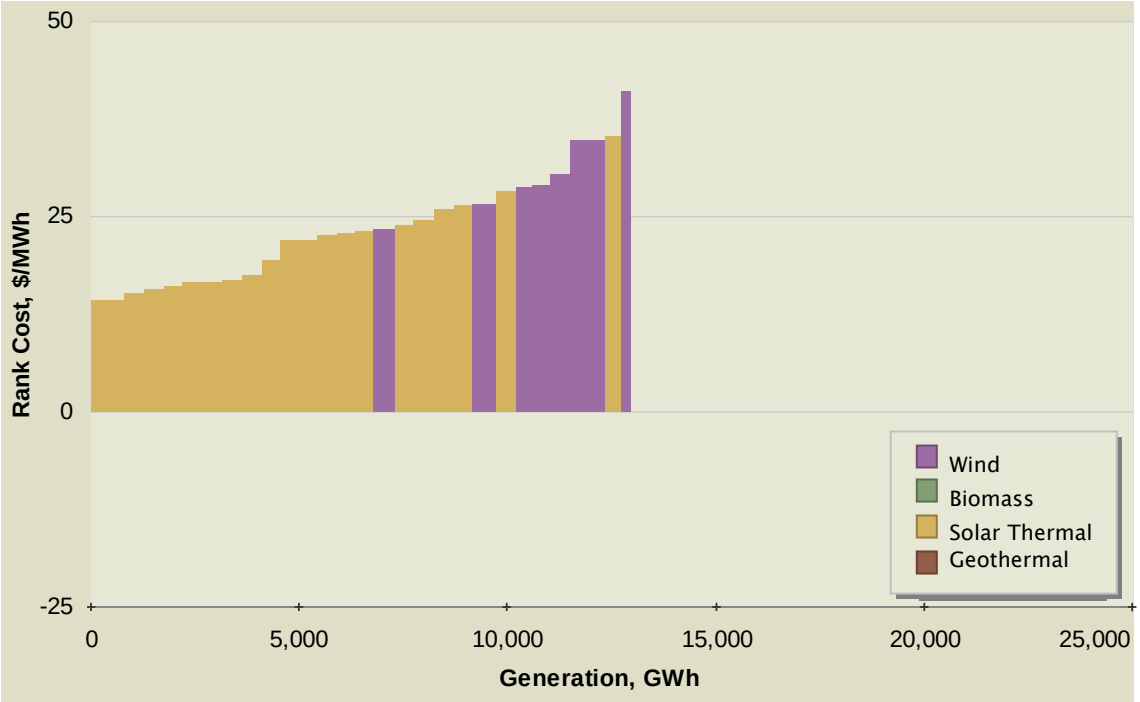


Figure E-18. Pisgah CREZ Supply Curve

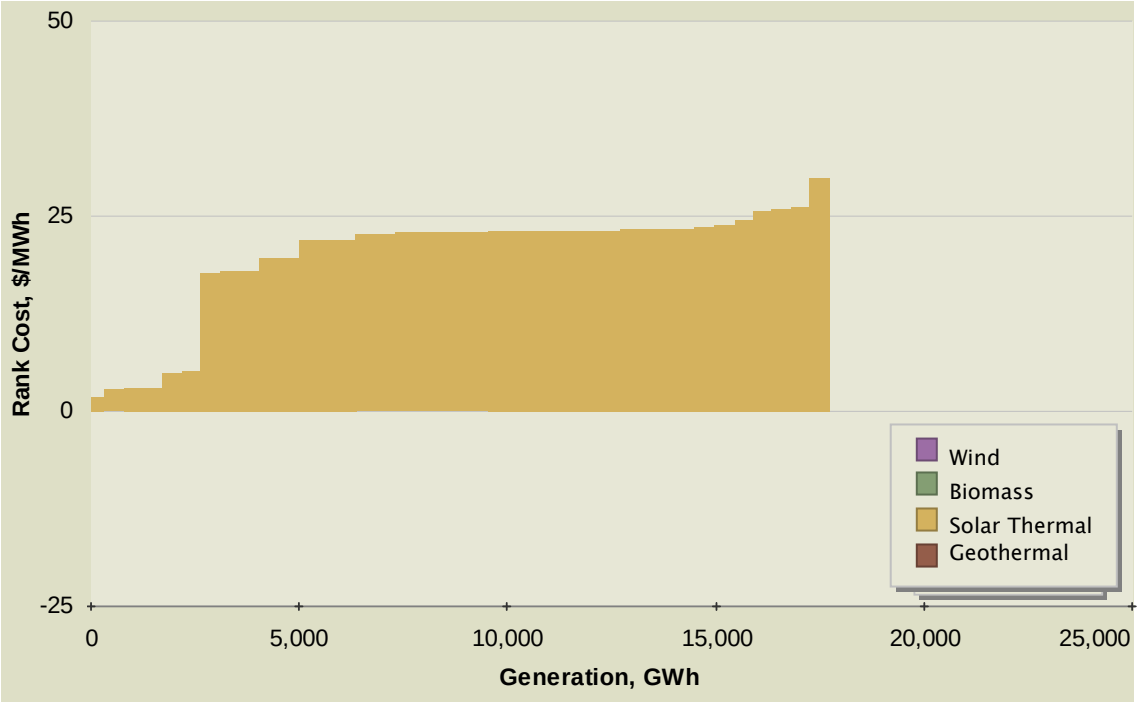


Figure E-19. Riverside East CREZ Supply Curve

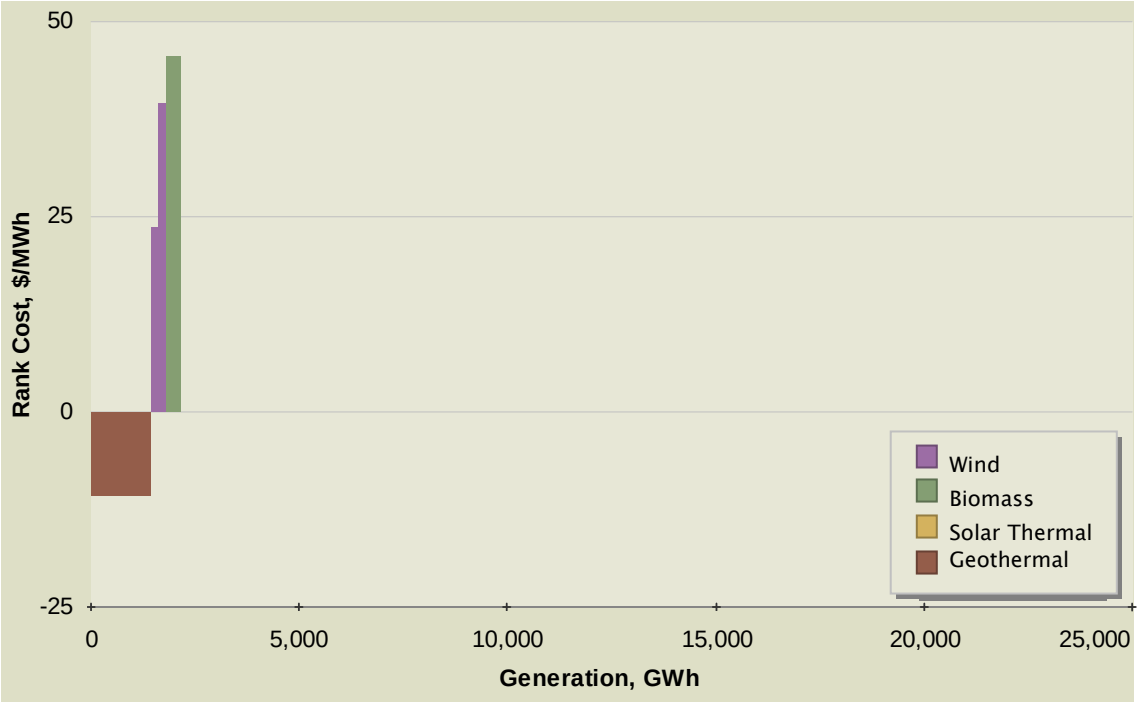


Figure E-20. Round Mountain CREZ Supply Curve

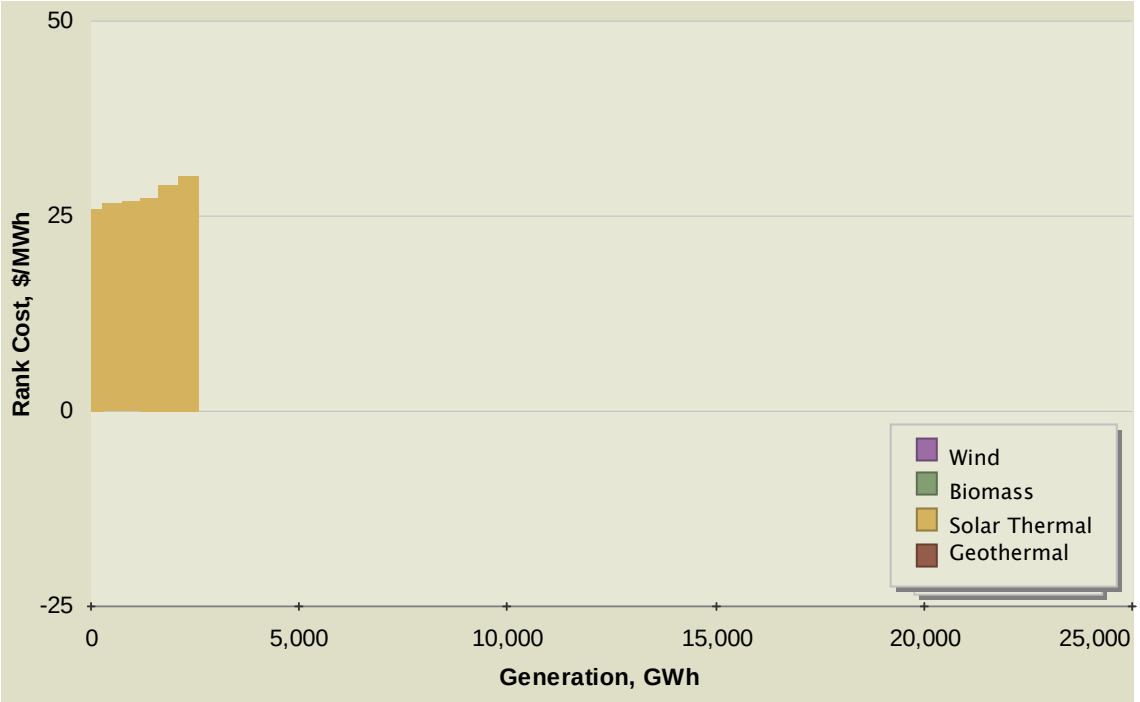


Figure E-21. San Bernardino - Baker CREZ Supply Curve

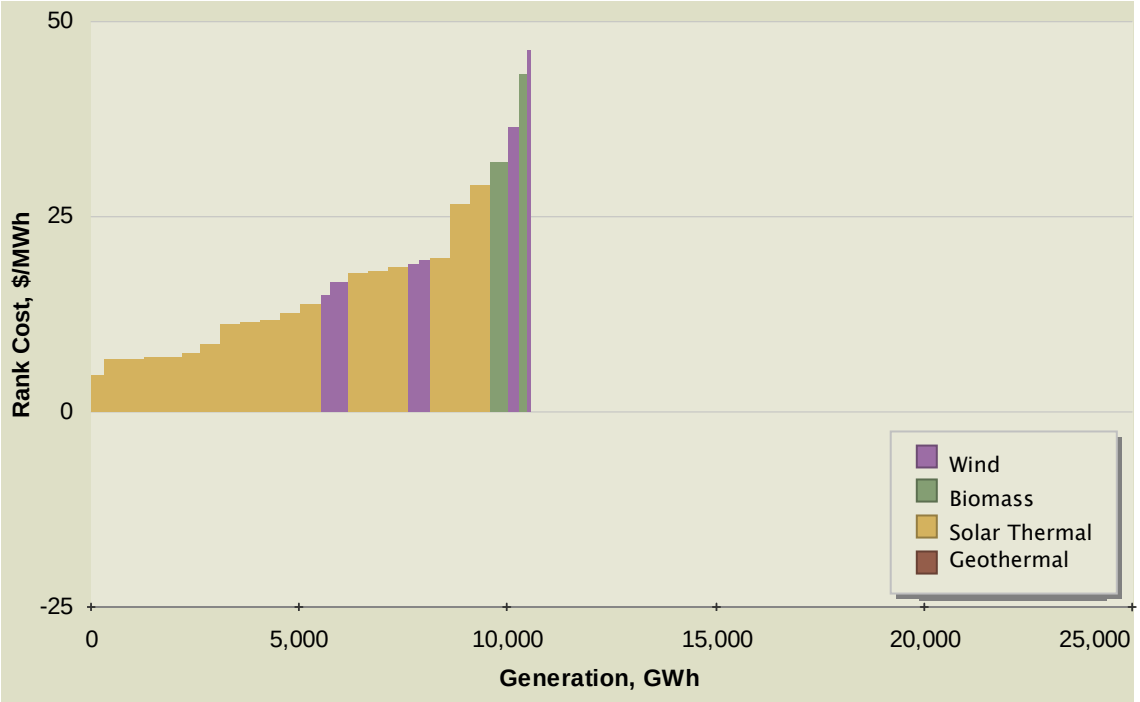


Figure E-22. San Bernardino - Lucerne CREZ Supply Curve

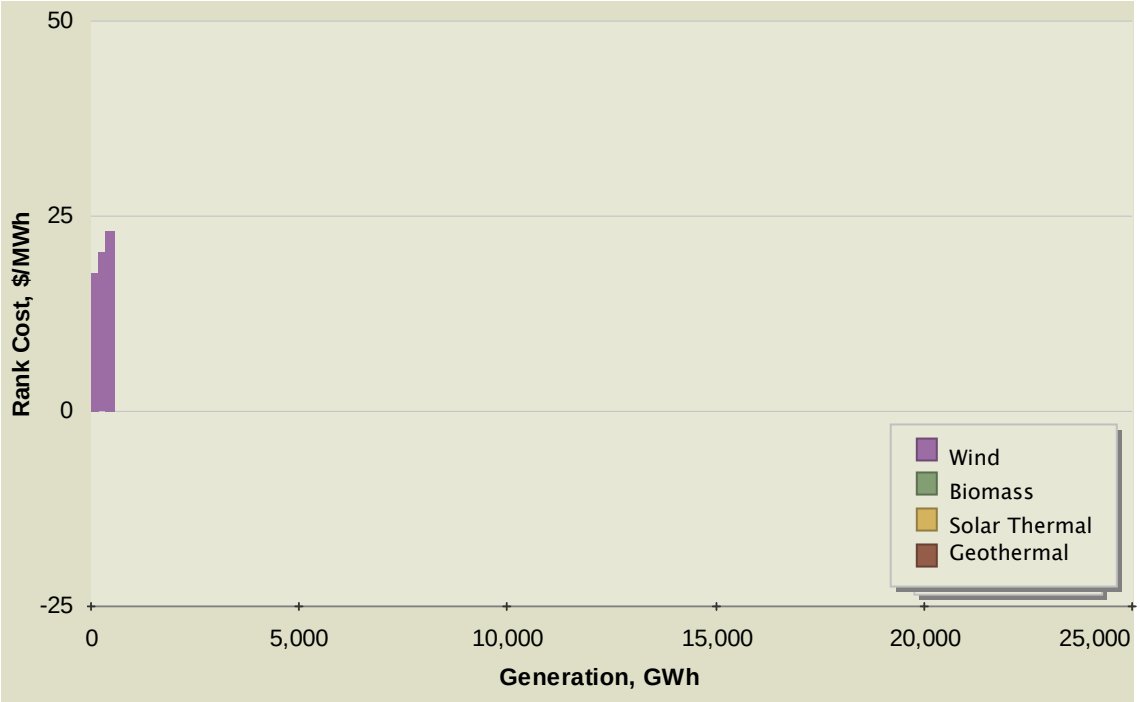


Figure E-23. San Diego North Central CREZ Supply Curve

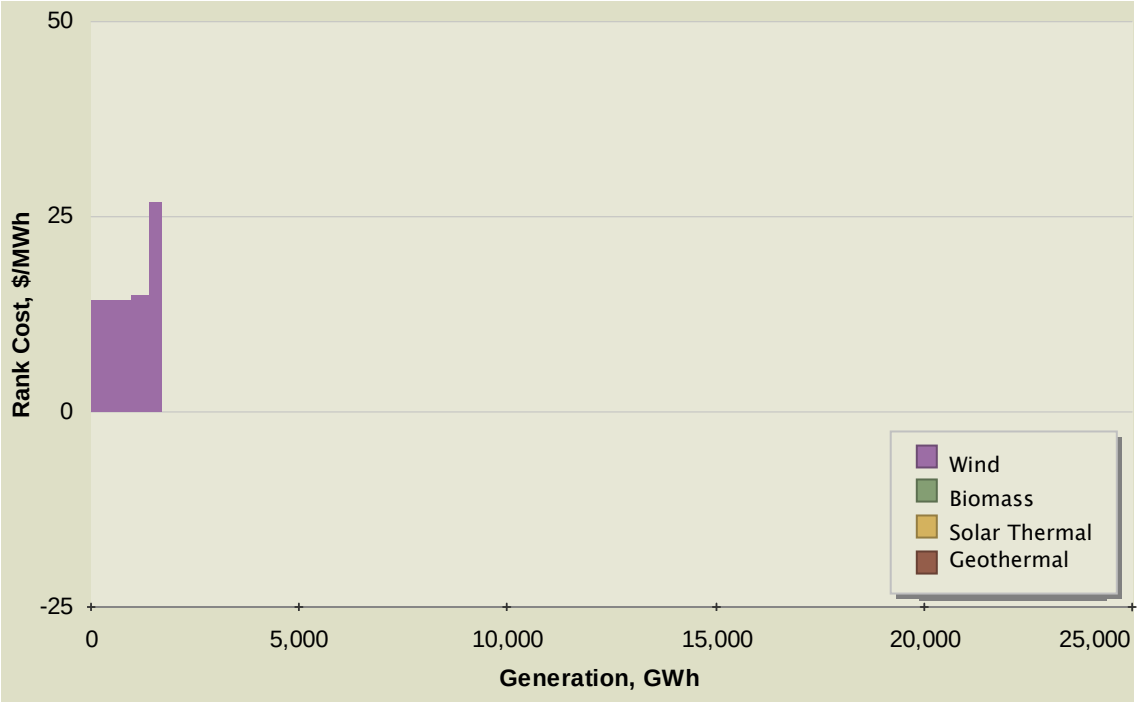
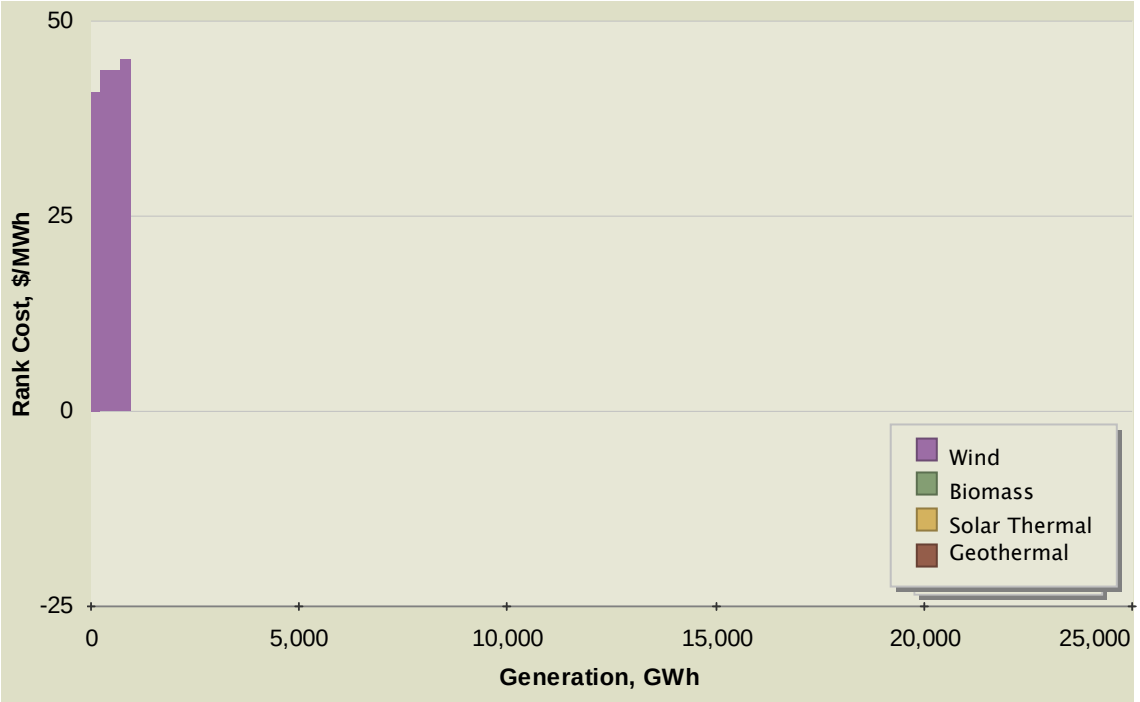


Figure E-24. San Diego South CREZ Supply Curve



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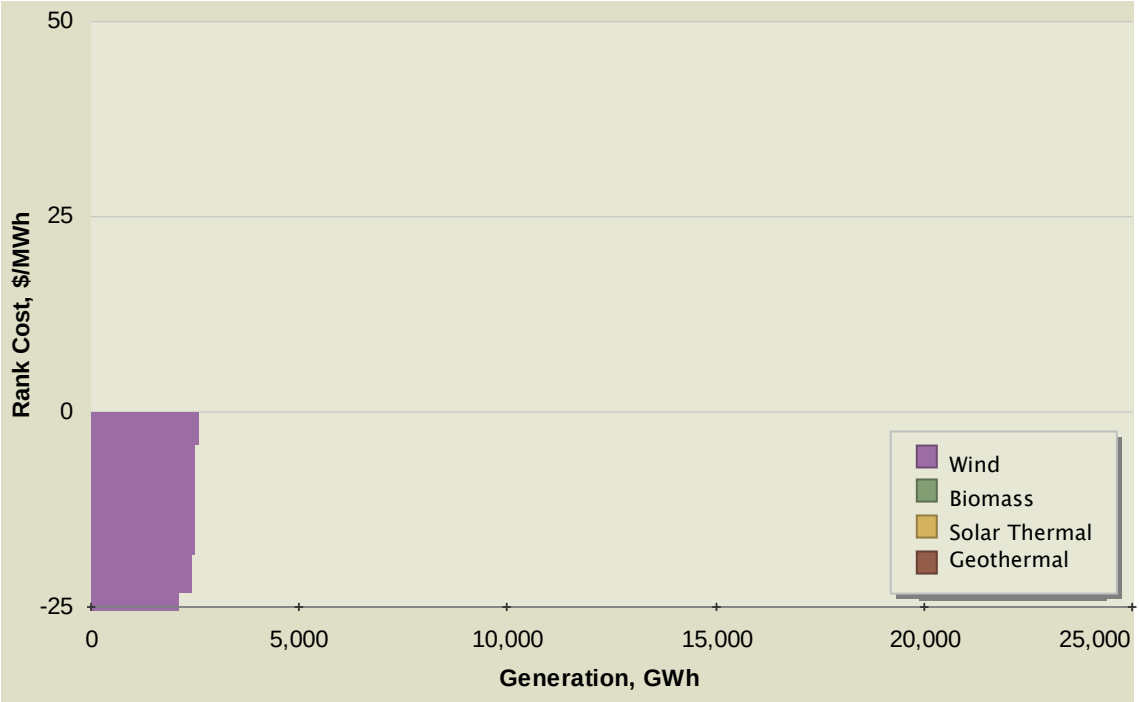

Figure E-26. Solano CREZ Supply Curve

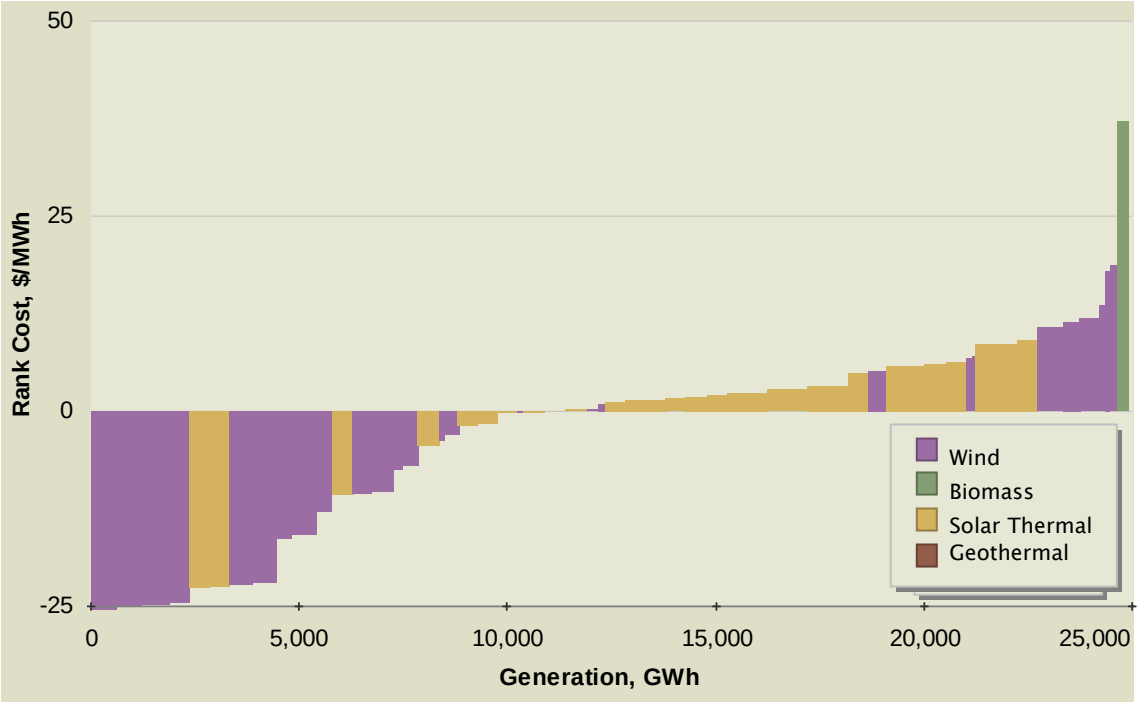

Figure E-27. Tehachapi CREZ Supply Curve

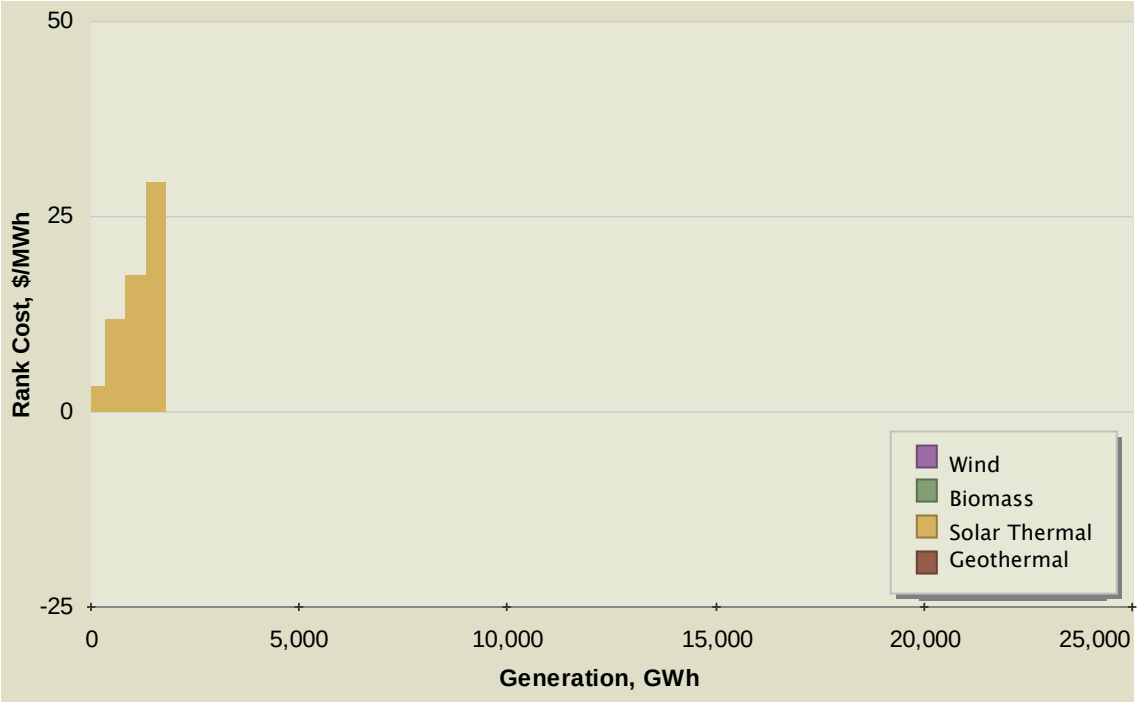

Figure E-28. Twentynine Palms CREZ Supply Curve

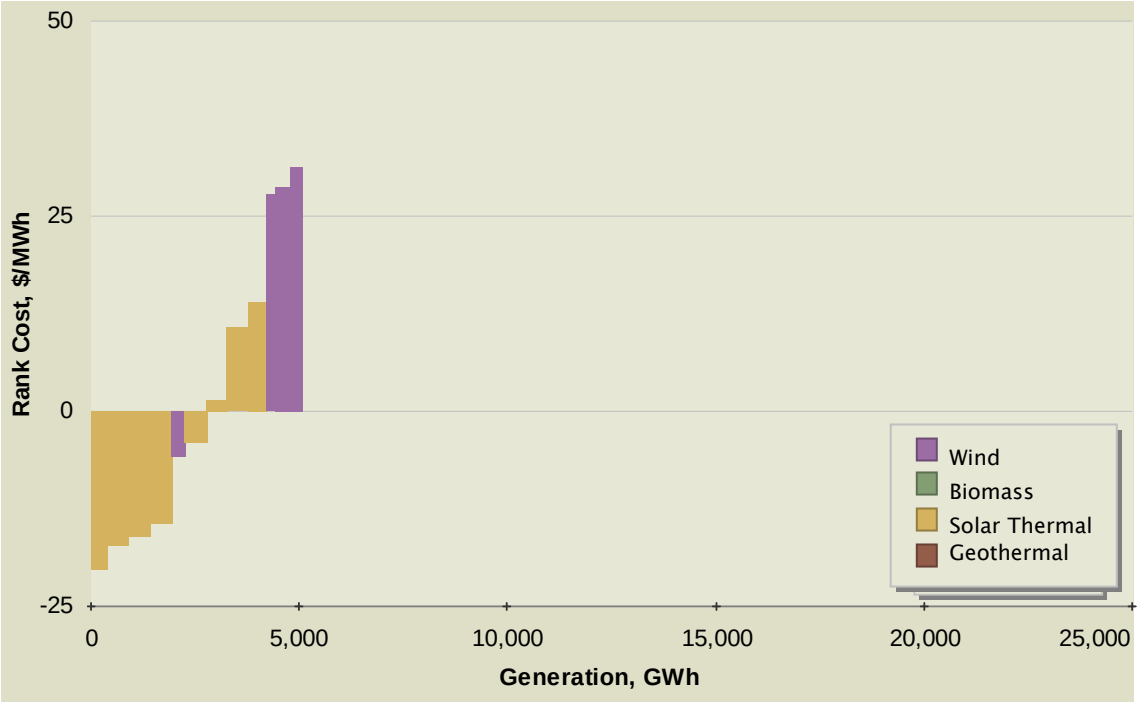

Figure E-29. Victorville CREZ Supply Curve

Out of State Resources

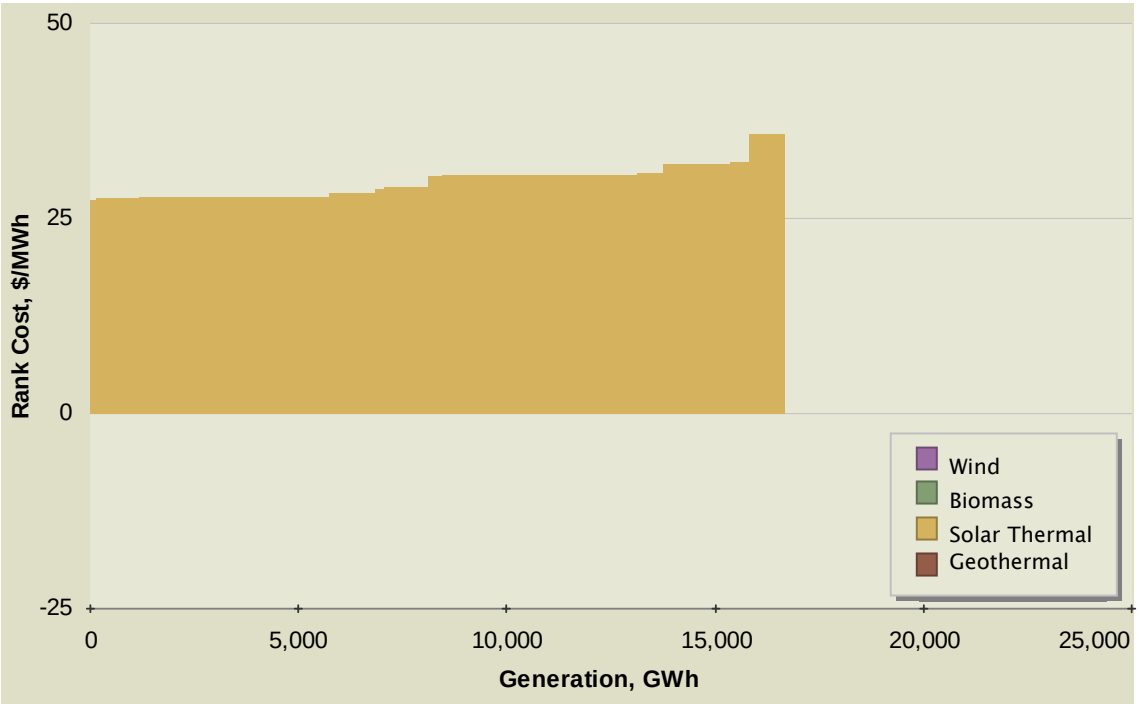

Figure E-30. Arizona Resource Supply Curve

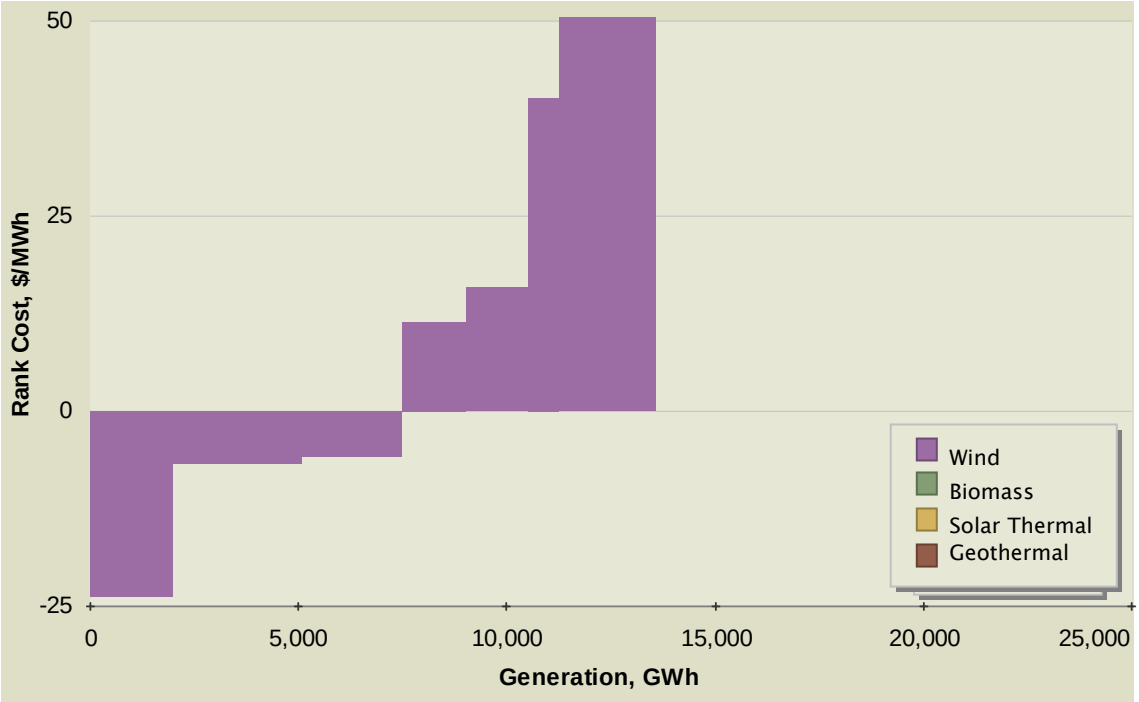

Figure E-31. Baja California Norte, Mexico Resource Supply Curve
Rank costs over $50/MWh not shown on chart.

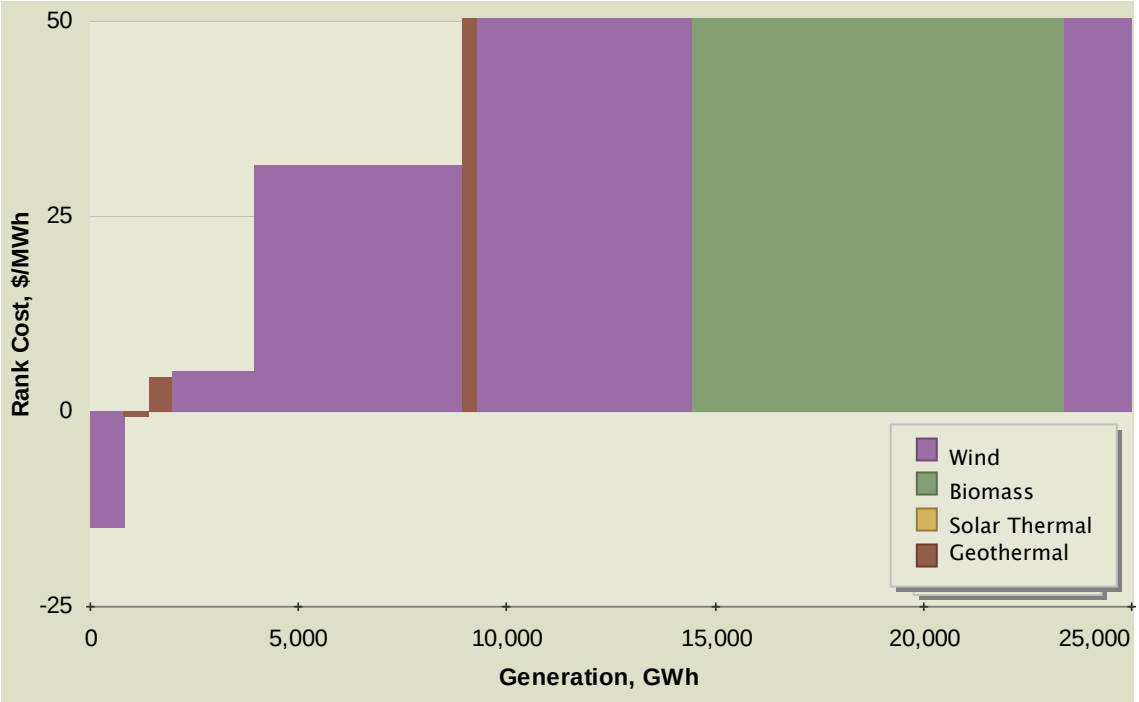

Figure E-32. British Columbia Resource Supply Curve
Rank costs over $50/MWh not shown on chart.

Generation over 25,000 GWh/yr not shown on chart.

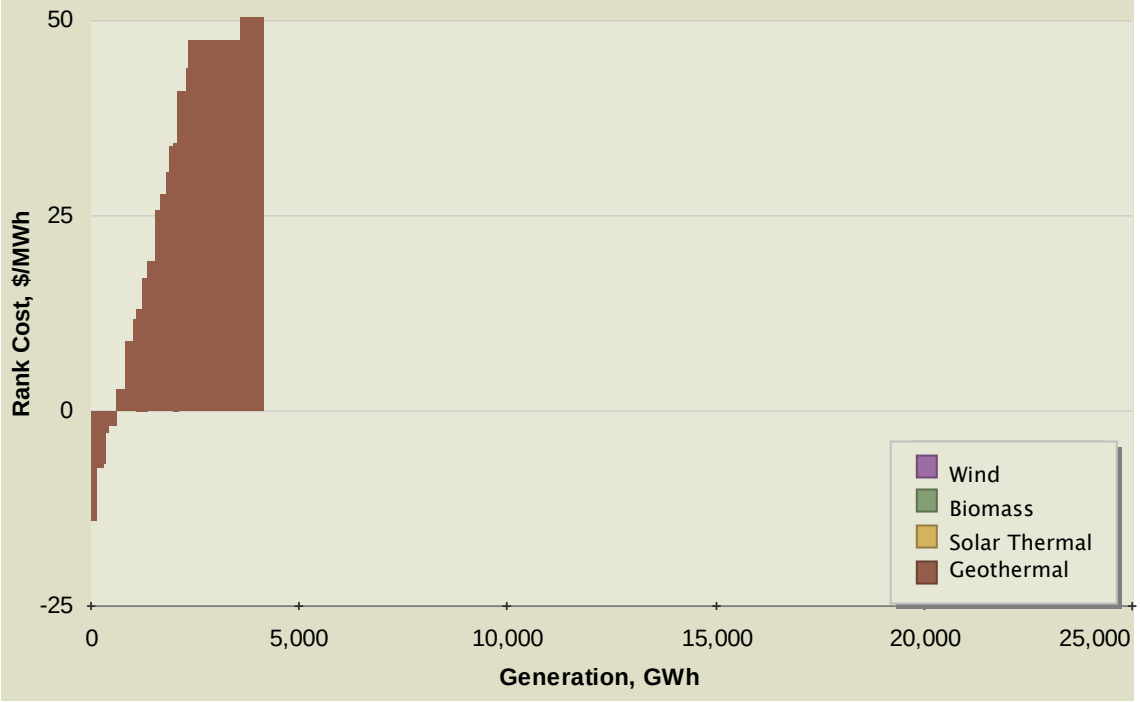

Figure E-33. Nevada—Northern Resource Supply Curve
Rank costs over $50/MWh not shown on chart.

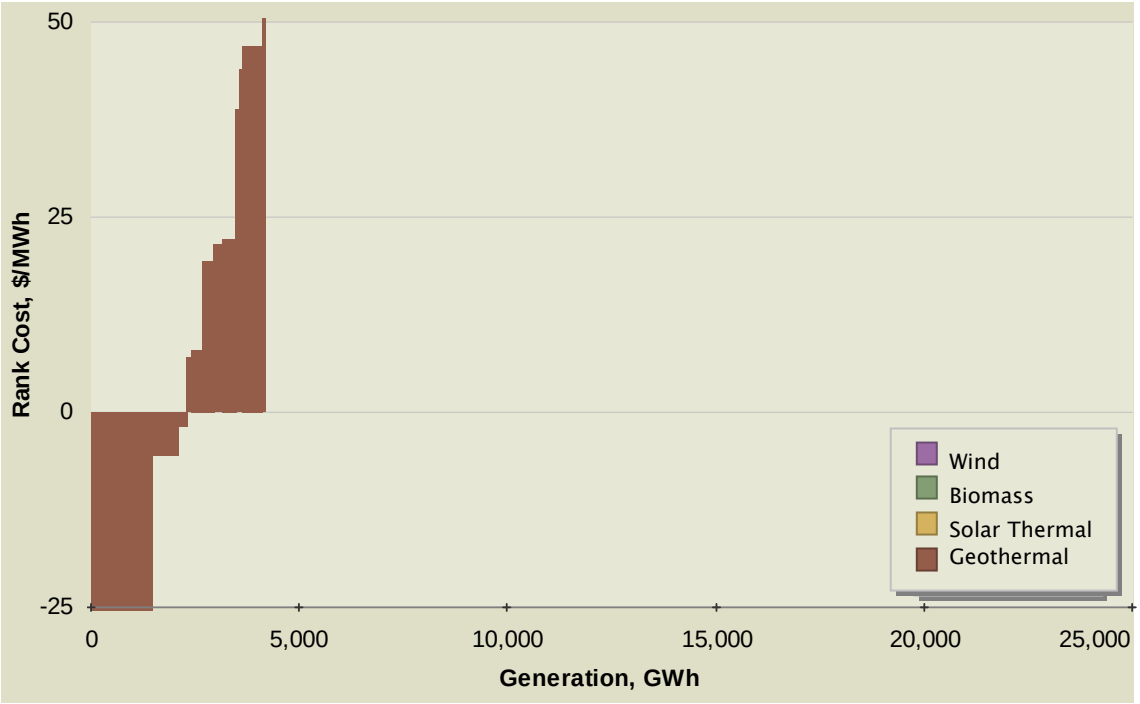

Figure E-34. Nevada—Central Resource Supply Curve
Rank costs over $50/MWh not shown on chart.

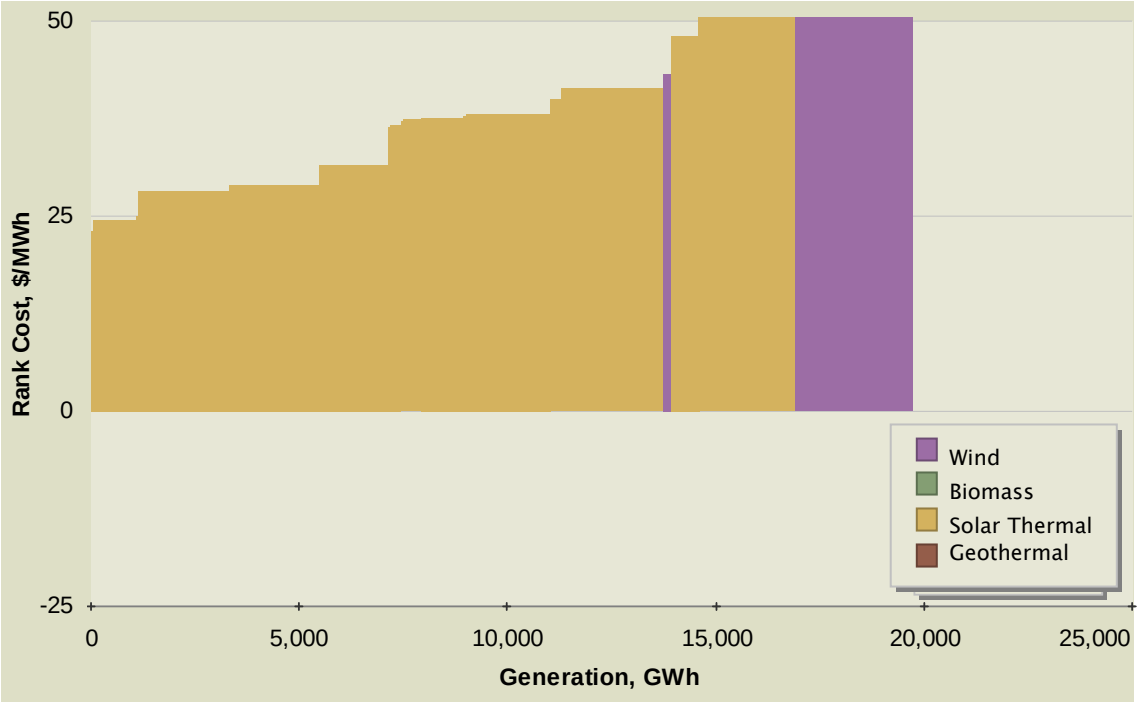

Figure E-35. Nevada—Southern Resource Supply Curve
Rank costs over $50/MWh not shown on chart.

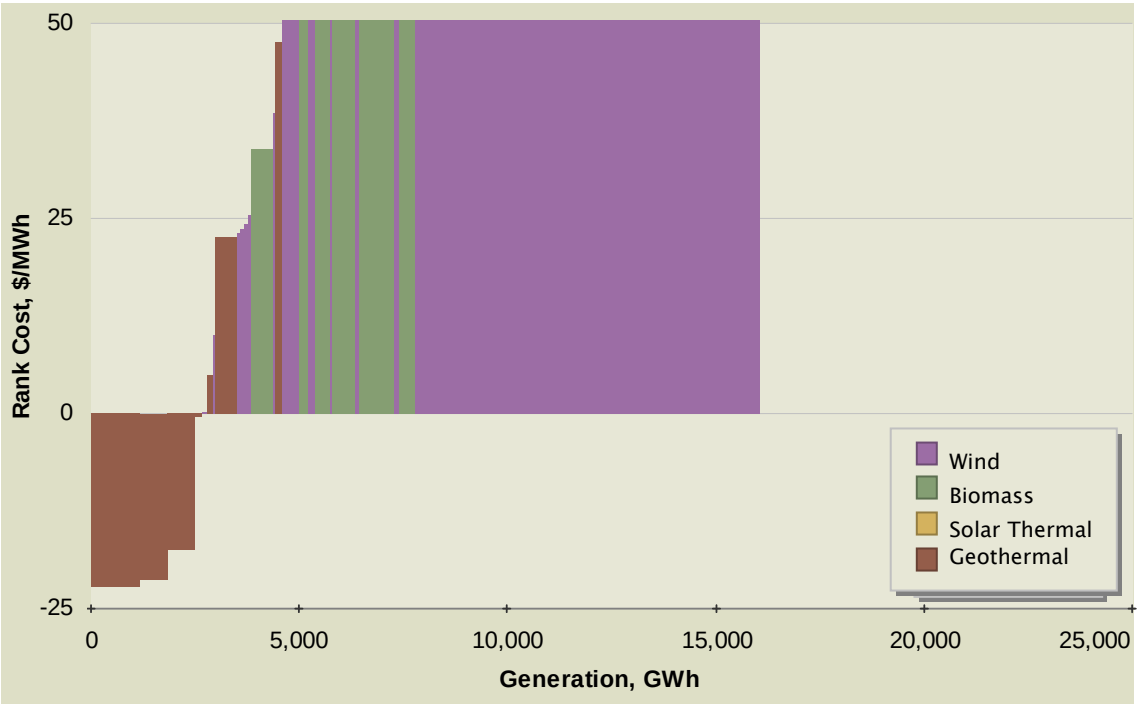

Figure E-36. Oregon Resource Supply Curve

Rank costs over $50/MWh not shown on chart.

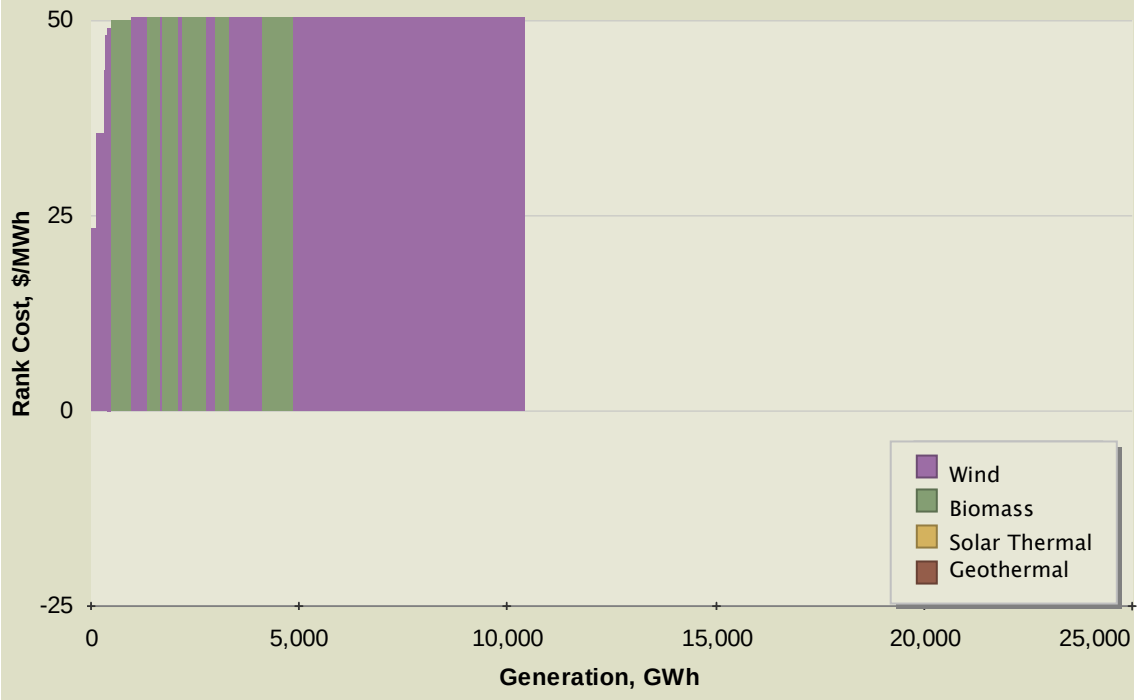

Figure E-37. Washington Resource Supply Curve
Rank costs over $50/MWh not shown on chart.

III. Environmental Assessment of Competitive Renewable Energy Zones

RETI Stakeholder Steering Committee

Renewable Energy Transmission Initiative

RETI Phase 1B – Environmental Assessment of Competitive Renewable Energy Zones

Prepared by the RETI Environmental Working Group

FINAL REPORT

December 2008

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1.0 Overview and Summary

1.1 Overview

RETI's goal is to identify electric transmission facilities needed to provide access to areas which can provide renewable energy most cost effectively and with the least impact to the environment.[1] In addition to the economic assessment of competitive renewable energy zones (CREZs) being performed for RETI by Black and Veatch[2] in Phase1, the RETI Stakeholder Steering Committee (SSC) formed an Environmental Working Group (EWG) at its March 19, 2008 meeting to make recommendations regarding consideration of environmental issues to enable RETI to meet its goals.

The EWG is chaired by Johanna Wald of the Natural Resources Defense Council (NRDC) and Carl Zichella of the Sierra Club, the two environmental representatives on the SSC, and meets weekly via Internet and teleconference links. Voting representation on the EWG is limited to SSC members, but meetings and discussions are open to all interested parties. Decisions are made by consensus of the participants to the extent possible. The EWG maintains an active email list of approximately 50 RETI participants, and materials are posted on the RETI web site.

This report describes the work by RETI's Environmental Working Group to identify:

1. Those areas in which energy development is prohibited or severely restricted by existing law or policy; and
2. Those CREZs in which renewable energy development is expected to raise fewer environmental concerns.

The assessment performed by the EWG of potential environmental concerns associated with energy development in CREZs is intended to provide guidance to RETI on the relative merits of development in these areas for the purpose of designing conceptual and specific transmission plans, and is *not* intended for use in evaluating the merits of individual projects. The EWG did not consider specific issues related to any individual project which may be proposed to be developed within the CREZs or outside them. Moreover, the EWG's assessment of CREZs was limited to issues for which statewide data were available. Accordingly, the EWG's CREZ assessments do not reflect the actual environmental impacts or issues relating to any individual project. All individual projects must undergo site-specific environmental review by the appropriate permitting agency on all issues of potential significance as required by law; the EWG's

[1] RETI Mission Statement: http://www.energy.ca.gov/reti/Mission_Statement.pdf
[2] Phase 1A report: http://www.energy.ca.gov/reti/documents/index.html

CREZ assessments do not supersede local, state and/or federal permitting processes and are not intended to be used in the context of permitting individual projects. Furthermore, the EWG recognizes that neither the delineation of these CREZs nor the assessments or rankings will preclude proposals to site projects outside of CREZ boundaries. Just as lands within CREZ boundaries have not been determined to be appropriate for development, lands outside those boundaries have not been rejected for development save where development has been precluded, limited or mitigated as appropriate by federal, state and local policies.

The process of identifying CREZs in which development is expected to raise fewer environmental concerns (Task #2) has been completed for this phase of RETI, and the results are included in this report. In the next phase of RETI, Phase 2, the CREZs delineated by Black & Veatch will be subjected to further analysis with the goal of identifying what problems, if any, each presents as well as determining the implications of those problems for renewable energy generation projections

1.2 Summary

1.2.1 Restricted Areas

A variety of federal, state, and local policies restrict commercial energy development in certain areas. These policies serve to protect special environmental features by precluding, limiting and, in some cases, mitigating development as appropriate. In some areas, identified by the EWG as Category 1 Lands, such restrictions are absolute. Commercial energy development in national parks, for example, is absolutely prohibited. In other areas, referred to as Category 2 Lands, some development may be permitted but restrictions impose significant limits on both the scope and location of projects.[3] Lands in both categories and the legal basis for the restrictions are described below. The Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) are currently considering adopting new policies for renewable energy development on lands within their respective jurisdictions. Final adoption of such policies may warrant reconsideration of the assumptions and decisions made here.

As described in Chapter 1 of this report, no renewable energy projects have been placed in Category 1 Lands. Only pre-identified projects, as defined in Chapter 1, have been placed in Category 2 Lands, on the assumption, for purposes of this analysis only,

[3] These restrictions may also be applicable to transmission, but this report focuses only on generation projects. Transmission will be addressed in Phases 2 and 3 of RETI.

that they do not conflict with the policies governing these areas. In fact, this assumption over-estimates the amount of development currently allowable in the California Desert Conservation Area, because it does not take into account the 1% development cap imposed by the BLM on specific areas it has designated "desert wildlife management areas" or other limitations adopted by that agency.[4] For lands which are not in either Category 1 or 2, Black & Veatch has identified "proxy projects" as placeholders for possible future development as well as pre-identified projects.[5]

It should be noted that prohibitions and restrictions on energy development may nevertheless allow transmission rights-of-way and access roads to be permitted in some areas of Category 1 and 2 Lands. Only potential energy development has been considered in RETI Phase 1A and in this report.[6] Environmental issues associated with transmission will be considered in RETI Phases 2 and 3.

1.2.2 Rating Criteria and Data

In addition to identifying areas in which energy development is prohibited or restricted, the EWG identified eight criteria which serve as indicators of potential environmental concern likely to be associated with renewable energy development in a CREZ. These criteria consider the amount of land needed for development of energy projects and associated transmission facilities; existing land disturbance; proximity to protected areas; and wildlife abundance and corridors. The criteria used by the EWG are described in detail below. Consensus could not be reached with the wind industry on how the project footprint for wind projects should be defined and applied. The industry concerns are described below. [7]

Some of the rating criteria, such as the area impacted by development, rely on assessments performed by Black & Veatch described earlier. Other criteria rely on data that have been quantified by an appropriate federal, state, or local agency in publicly available data sets. Data sources are also identified below.

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[4] This fact was pointed out by many desert advocates in their comments on the interim draft and draft versions of this section. The CREZ confirmation process referred to above that will take place during RETI Phase 2 was adopted in response to such concerns. It will involve state and federal agencies as well as the EWG.

[5] Refer to B&V Phase 1 report

[6] The amount of land needed for associated transmission rights-or-way, as estimated by Black & Veatch, is included as a criterion for estimating potential environmental concerns related to development, however.

[7] As indicated in the interim draft version of this report, the wind industry challenged several of these criteria. One of the criteria, Criterion #7, Important Bird Areas, was changed following publication of the interim draft version of this report, in response to that industry's concerns. Additional formulas have been tested and new text has been added to this version also in response to those concerns. In addition, other changes to the text were made in response to comments submitted by on the interim draft by environmentalists, utilities, concerned individuals and others.

The EWG criteria do not represent all environmental concerns potentially associated with renewable development in a CREZ. For example, although the EWG acknowledged that visual impacts of development and transmission are an issue of concern, statewide data were unavailable for use in assessing this concern.

Environmental concerns associated with biomass projects are primarily associated with production, collection and transportation of fuels for which no acceptable data exist. Biomass CREZs are therefore not included in the EWG ranking process. To date the EWG also has been unable to consider any CREZ located outside of California for lack of sufficient data. Pursuant to direction from the Steering Committee, the EWG will continue to pursue obtaining the necessary data as promptly as possible in order that assessment of the out of state CREZs and integration of the results can be carried out as soon as feasible.

During the development of the criteria formulas, the identity of the CREZs remained hidden from EWG participants. The names of the CREZs associated with the ranking results are being identified to stakeholders for the first time with the publication of this report. Anonymity of the CREZs during the assessment has been essential to maintain objectivity throughout the process.

The data values used in the criteria formulas are shown in Appendix A – Data.

1.2.3 CREZ Rating Formulas

For each of the rating criteria, the EWG developed a formula which uses appropriate data to provide a numerical value that is indicative of the relative magnitude of the potential environmental concern associated with each criterion in each CREZ. Each of the formulas used by the EWG to evaluate potential concerns associated with CREZ development is described below. The formulas are designed so that lower values indicate lower levels of environmental concern. CREZ ranking scores, described below, are based on the formula values.

Each of the formulas has the same form: a numerator which quantifies an environmental concern and a denominator which equals the estimated annual energy production. This form ensures that if two CREZs have the same level of concern, the CREZ producing the most energy will receive the lower (better) score.

For example, the formula used to quantify the relative concern associated with transmission infrastructure for a CREZ is:

Acres of new transmission right-of-way ÷ Gigawatt-hours[8] of energy produced per year.

[8] One gigawatt-hour equals one million kilowatt-hours.

The formula results for each criterion and each CREZ are shown in Appendix B - Criteria.

1.2.4 CREZ Ranking Scores

In order to provide a uniform ranking system for all criteria, the largest formula result in each category was assigned a ranking value of 5. Ranking scores for the other CREZ results were assigned in proportion to the formula results. The formula used to assign ranking scores to formula results for each criterion is:

$$5 \times \text{Formula Result} \div \text{Maximum Formula Result}$$

To obtain a total ranking score for each CREZ, the individual scores for each criterion were summed. With the exception of the degraded lands criterion (see below) lower total ranking scores are associated with CREZs in which potential environmental concerns are expected to be least, and higher scores indicate the likelihood of more environmental concerns, lower energy intensity, or a combination of both.

The ranking scores for each criterion and each CREZ are shown in Appendix C – Ranking.

1.2.5 Environmental "Supply Curve"

The total ranking score for each CREZ is a relative measure of the potential environmental concerns associated with energy development in a CREZ as compared to other CREZs, with higher scores indicating potentially greater environmental concerns. As indicated, these scores are not intended to represent all potential environmental concerns that development may raise in any CREZ; nor do they reflect any assessment of any actual environmental harm that development may cause in any CREZ. While the total score for a CREZ may also be thought of as a measure of the relative environmental "cost" of potential energy development in the CREZ, analogous to the relative economic cost estimated for each CREZ by Black & Veatch, the scores do not represent monetized values of any environmental concerns, nor would they necessarily be associated with any financial cost for renewable or transmission development. Rather, the scores are simply rough indicators of the relative potential for environmental harm – and thus the projected level of concern – that actual project development could cause in each CREZ.

The environmental ranking scores were combined with the expected annual energy output for each CREZ to obtain an environmental "supply curve" analogous to the economic supply curve obtained by Black & Veatch.[9] Those CREZs having the lowest

[9] Refer to B&V supply curve in report.

ranking scores and sufficient energy output to provide the additional annual renewable energy required by California policies, plus an allowance for uncertainty, are considered by EWG to be the most promising for development and thus to qualify as the basis for Phase 2 planning which involves designing a conceptual transmission plan.[10] In identifying these CREZs, the EWG acknowledges that its methodology – i.e., its environmental criteria, rating formulas and ranking scores – represents a first ever effort, that the results – i.e., the CREZ rankings and environmental supply curve – constitute the first ever use of this methodology, and that this methodology has not been subjected to a thorough statistical analysis.[11]

1.2.6 Unresolved Issues and Recommendations

In the process of identifying potential concerns which could be evaluated and used as rating criteria for prioritizing CREZ development, the EWG limited itself to using readily available statewide data and clear policy direction. Unfortunately, the EWG was unable to address some important issues of concern because acceptable data were unavailable. In addition, the EWG identified issues for which existing state policies appear to conflict. The EWG recommends that SSC members and their respective institutions address the gaps that exist in relevant data and resolve policy conflicts.

These issues are described below. As a result of its analysis, the EWG makes the following recommendations to improve future assessments:

1. Consistent statewide scenic quality data should be developed so that visual impacts associated with energy development can be included as a criterion for assessing CREZs;
2. Statewide data on Native American cultural sites should be collected and formatted for ready access, and a methodology should be developed for consideration of potential impacts on these sites by CREZ development; and
3. Assessment of the CREZs outside of California and integration of the results should be pursued as soon as feasible.
4. The state should pursue efforts to identify and map "vacant or disturbed land" because of the potential value of such land for renewable energy development.

The resource areas considered by the EWG were limited to the California CREZs identified by Black & Veatch due to the lack of comparable data for resource areas in other states and countries. The EWG is actively working to obtain environmental data for Nevada and Baja California which are comparable to the data used to assess California resources and to develop a methodology for assessing development of these out of state

[10] Refer to B&V discussion of net short plus error margin.

resources. At the present time, the EWG makes no recommendation regarding the relative levels of environmental concern related to California and out of state resources.

In addition, the EWG notes that environmental issues related to new transmission facilities needed to provide access to preferred CREZs have not been considered in Phase 1 of RETI but will be considered in Phases 2 and 3. The EWG therefore recommended that the SSC direct it to develop data and methodologies for assessing the environmental impacts of proposed transmission facilities as these are identified in Phases 2 and 3. In response, the SSC has directed the EWG to perform an assessment of conceptual transmission plans identified in Phase 2 as well as to confirm the preferred CREZs through examining them to identify whether they present problems such as ownership fragmentation and site-specific development limitations and, if so, what implications these problems have for renewable energy generation projections.

1.2.7 Results Summary

The California CREZs to which the EWG assessment assigned the lowest (best) scores are shown in Table ES-2 below.[12] Complete results are shown in Section 5 Results.

Table ES-2. Environmental Ranking of California CREZs.

CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Environmental Ranking Score
Imperial North-A	10,095	10,095	2.7
Twentynine Palms	1,944	12,038	2.8
Mountain Pass	6,942	18,980	3.9
Tehachapi	25,091	44,072	4.0
Fairmont	18,318	62,390	4.0
Pisgah-A	4,283	66,673	4.4
San Diego South	1,829	68,502	4.4
Imperial East	3,991	72,493	4.9
San Bernardino - Lucerne	10,722	83,215	4.9
Victorville-A	2,112	85,327	5.0
Iron Mountain	12,713	98,040	5.0

[11] See also Response to Comments on Section III, Environmental Assessment of CREZ, "Need for sensitivity analysis of EWG approach",

[12] As indicated elsewhere, these results are the product of an approach developed by the EWG for the specific purpose of assessing the potential environmental concerns associated with energy development in one CREZ as compared to other CREZs. They represent the first use of this approach and have not been subjected to a thorough statistical analysis.

1.3 Conclusions

Despite limitations, including significant data limitations, the methodology developed by the EWG provides a consistent and quantitative means of estimating the relative environmental concerns associated with potential energy development in the California CREZs identified by Black & Veatch.

This report describes the methodology developed by the EWG for ranking California CREZs according to potential environmental concerns and, unlike the previous version, includes the draft results as compiled by the EWG using the draft CREZs delineated by Black & Veatch. CREZs identified as preferred in both the economic and environmental rankings will be considered for transmission access in RETI Phases 2 and 3.

2.0 Identification of Lands in Which Development is Restricted

A variety of federal, state, and local policies restrict commercial energy development in certain areas. These policies serve to protect special environmental features by precluding, limiting or, in some cases, mitigating development as appropriate. In some areas, identified by the EWG as Category 1 Lands and mapped in black, such restrictions are absolute.[13] Commercial energy development in national parks, for example, is absolutely prohibited. In other areas, referred to as Category 2 Lands and mapped in yellow, some development may be permitted but restrictions impose significant limits on the scope and location of projects.[14] Tables summarizing the lands in both categories are presented below as are descriptions of the legal bases for the restrictions.

No potential energy development has been considered in Category 1 Lands. In Category 2 Lands, potential development has been limited to pre-identified projects which are assumed, for purposes of this analysis only, not to conflict with the policies governing these areas. As noted above, this assumption in fact over-estimates the amount of development allowable in certain lands managed by the BLM in the California Desert Conservation Area, including in designated "desert wildlife management areas".[15]

It should be noted that, in some areas, prohibitions and restrictions on energy development may nevertheless allow transmission rights-of-way and access roads.

Only potential energy development has been considered in RETI Phase 1 and in this report.[16] Environmental issues associated with transmission projects will be considered in RETI Phases 2 and 3.

Below we summarize the areas in which energy development is prohibited or restricted by law or policy, referred to as Category 1 and Category 2 lands respectively.

[13] A statewide map of restricted areas can be found at http://www.energy.ca.gov/reti/steering/workgroups/environmental/maps/draft-EWG-maps/DRAFT_RETI_EWG_CA_Statewide_Rev5_Black_and_Yellow_combined.pdf

[14] As noted above, these restrictions may also be applicable to transmission, which will be addressed in Phases 2 and 3 of RETI.

[15] See note 4 above. These designated wildlife areas are subject to a 1% development cap adopted by the BLM.

[16] The amount of land needed for associated transmission rights-or-way, as estimated by Black & Veatch, is included as a criterion for estimating potential environmental concerns related to development.

Table 2-1. Category 1 Lands*.

Designated Federal Wilderness Areas	Private preserves of The Wildlands Conservancy
Wilderness Study Areas	
National Wildlife Refuges	
Units of National Park System (National Parks, National Monuments, National Recreation Areas, National Historic Sites, National Historic Parks, National Preserves)	Existing Conservation Mitigation banks under conservation easement approved by the state Department of Fish and Game, U.S. Fish and Wildlife Service or Army Corps of Engineers
Inventoried Roadless Areas on USFS national forests	CA state defined wetlands
National Historic and National Scenic Trails	CA State Wilderness Areas
National Wild, Scenic and Recreational Rivers	CA State Parks
BLM King Range Conservation Area, Black Rock-High Rock National Conservation Area, and Headwaters Forest Reserve	DFG Wildlife Areas and Ecological Reserves
BLM National Recreation Areas	
BLM National Monuments	
Lands precluded by development under Habitat Conservation Plans and Natural Community Conservation Plans	
Lands specified as of May 1, 2008 in Proposed Wilderness Bills (S. 493, H.R. 3682)	

* Some of these lands may allow transmission lines and access roads under certain circumstances.

Table 2-2. Category 2 Lands*.
BLM Areas of Critical Environmental Concern
USFWS designated Critical Habitat for federally listed endangered and threatened species
Special wildlife management areas identified in BLM's West Mojave Resource Management Plan. I.e., Desert Wildlife Management Areas and Mojave Ground Squirrel Conservation Areas
Lands purchased by private funds and donated to BLM, specifically the California Desert Acquisition Project by The Wildlands Conservancy
"Proposed and Potential Conservation Reserves" in HCPs and NCCPs
* Some Category 2 lands have restrictions unique to each area. Some may prohibit development entirely, while others may permit development under certain conditions, or employing certain technologies. Moreover, in some cases involving these lands, renewable developers and land managers may be able to reach agreements allowing development to proceed. Nonetheless, for the purposes of project identification and CREZ descriptions, development in Category 2 areas has been assumed to be limited in the absence of site-specific information or analyses.

2.1 Category 1 Lands

Category #1 — Areas where law or policy currently prohibits renewable development (mapped as black areas)

- **Units of the National Park System** – established by Congress to conserve outstanding resources – both natural and historic – of importance to the nation. Management must preserve the values for which each unit was designated from degradation for the enjoyment of present and future generations. These units include, in addition to national parks, national monuments and national preserves managed by the National Park Service as well as national recreation areas and national historic parks.
- **National Wildlife Refuges** – part of the National Wildlife Refuge System and managed by the U.S. Fish and Wildlife Service (FWS). In accordance with the National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. §§ 668dd-668ee), the FWS may permit the use or grant an easement in, over, across, upon, through, or under any areas within the System, whenever determined that such uses are "compatible with the purposes for which these areas are established. These are to: (1) maintain biological integrity, diversity, and environmental health of the refuge system and (2) facilitate compatible wildlife-dependent recreation." There are a total of 51 National Wildlife

Refuges and Wildlife Management Areas covering 2.3 million acres in CA, NV and the Klamath Basin of Oregon, but it appears that few of them would potentially be affected by RETI. See: http://www.fws.gov/cno/refuges/planning/index.cfm

- **Designated federal Wilderness Areas and Wilderness Study Areas (WSAs)** – the former are designated by Congress, the latter by the BLM. In both kinds of areas, there are no roads and the "hand of man" is not visible. Wilderness Areas' values of solitude, natural quiet, and "wildness" as well as their non-motorized recreation opportunities and scenery are all intended to be preserved forever. In WSAs those values are to be preserved until Congress determines otherwise. In general, roads, machines, power tools are prohibited.
- **USFS Inventoried Roadless Areas** – designated by the USFS to preserve roadless areas on the National Forests and the ecological services and social values that are associated with those areas. In general, road construction and logging are prohibited.
- **BLM National Conservation Areas** – specifically: King Range National Conservation Area, Black Rock-High Rock National Conservation Area, and Headwaters Forest Reserve. These areas were designated by Congress to protect and preserve the unique, sensitive and/or important natural and historic resources of each, including their scenery, plant and animal habitats and/or archeological values.
- **BLM national monuments** – established by presidents to protect and preserve the unique, sensitive and/or important natural and historic resources of each designated area, such as scenery, habitat for significant numbers of endemic plant and animal species and/or archeological values.
- **National historic and scenic trails** – designated by Congress as parts of the National Trails System. National scenic trails are long-distance (over 100 miles each), and national historic trails commemorate major, nationally significant routes of historic (and pre-historic) travel in the US. Both must provide for significant outdoor recreation.
- **National wild, scenic and recreational rivers** – free flowing streams that are mostly inaccessible, scenic and primitive and that possess "outstandingly remarkable values" such as scenery, recreation, fish and wildlife, historic. All such rivers are designated by Congress.
- **California state parks –** California state parks contain the largest and most diverse natural and cultural heritage holdings of any state agency in the

nation. According to Public Resources Code § 5002, the State Park System consists of all parks, public camp grounds, monument sites, landmark sites, and sites of historical interest established or acquired by the State, or which are under its control. Further, § 5001.65 declares that commercial exploitation of resources in units of the state park system is prohibited.

- **California State Wilderness Areas** – Public Resources Code § 5019.68 declares that state wildernesses "are hereby recognized as areas where the earth and its community of life are untrammeled by man and where man himself is a visitor who does not remain." A state wilderness is further defined to mean an area of relatively undeveloped state "without permanent improvements or human habitation." Wilderness Act §§ 5093.30-5093.40. These areas are intended to be preserved in perpetuity.
- **DFG wildlife areas and ecological reserves** – uses of these Department of Fish and Game (DFG)-managed areas are restricted to those "compatible with wildlife values." Energy development is not allowed on these lands (geothermal drilled from outside the reserves might be an exception). Some reserves have existing easements for transmission which may allow upgrades with mitigation (additional lands purchased). DFG may also require undergrounding transmission lines in some circumstances.
- **Existing conservation and mitigation banks under conservation easements approved by the DFG, FWS or Army Corps of Engineers** – conservation areas generally protect endangered and threatened species; mitigation areas are specifically for wetland restoration, creation and enhancement. The latter are undertaken to compensate for unavoidable wetland losses. All are protected by conservation easements either before or upon commencement of mitigation.
- **Lands precluded from development in Habitat Conservation Plans** –The purpose of the habitat conservation planning process is to ensure that there is adequate minimizing and mitigating of the "incidental take" of the significant species involved. While early plans were typically project-specific, more recent plans are broad-based, landscape level plans utilized to achieve long-term biological and regulatory goals. Once the plan and the permit are approved by county officials and state and federal agencies, it becomes a binding document. Only approved plans were included in this analysis. Once the plan and the permit are approved, private property owners (and other non-federal actors) can proceed with actions that would otherwise result in the illegal take of species. Environmental analysis and public participation are

required in the development of these plans (except for plans with "minor effects" on species involved and their habitats). Participating landowners receive a "no surprises" commitment from the FWS, assuring them that, if unforeseen circumstances arise, they will not need to make additional commitments of money or land, or face additional restrictions.

Lands precluded from development within an HCP include, but are not limited to, lands that have been protected by conservation easement or deed within the meaning of Cal. Civ. Code § 815 et seq., or by conveyance to any agency or organization authorized to hold a conservation easement or deed under Cal. Civ. Code § 815 et seq., in accordance with the terms of an HCP or a Natural Community Conservation Plan.

(Note: for Black & Veatch's analysis all HCP conservation reserves were counted as Category 2 lands because the restrictions on development are unique to the individual plan and could not be assessed in detail for that analysis. The Ventura office of the FWS provided the EWG with data identifying the hard line reserves in its approved HCPs for use in applying environmental rating criteria 4 and 5. Similar data for the HCPs approved by the Carlsbad and Sacramento offices of the FWS were unavailable.)

- **Lands precluded from development under Natural Community Conservation Plans –** developed under California state law, each plan "identifies and provides for the regional or area-wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity." CA Department of Fish and Game. 2008. "The program seeks to anticipate and prevent the controversies and gridlock caused by species' listings by focusing on the long-term stability of wildlife and plant communities and including key interests in the process." Id. There are 32 active NCCPs covering more than 7 million acres of which 11 have been approved and permitted.

  (Note: for Black & Veatch's analysis all NCCP conservation reserves were counted as Category 2 lands because the restrictions on development are unique to the individual plan and could not be assessed in detail for that analysis. However the EWG will categorize NCCPs into hard and soft line reserves for the criteria 3 and 4 of the environmental ranking.)

- **Private preserves of The Wildlands Conservancy (TWC)** – private land areas that are owned and managed by TWC for public benefit and use. TWC manages six preserves in California: http://www.wildlandsconservancy.org/twc_preserve.html. Unlike private

lands managed under conservation easements, these lands are open to the public.

- **State wetlands, as currently (May 1, 2008) defined by California -** California's wetland policy states "no net loss in the short-term and an increase in wetlands in the long-term." CA wetlands are defined as "land where the water table is at near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentration of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some during each year and their location within, or adjacent to vegetated wetland or deepwater habitats." (14 CCR § 13577) While the definition may change, the EWG uses the current definition. See: http://ceres.ca.gov/ceres/calweb/wetlands/wetlands_management.html and for GIS maps: http://gis.ca.gov/catalog/BrowseRecord.epl?id=1507

2.2 Category 2 Lands

Category #2 — Areas where existing restrictions are intended to limit potential renewable development (mapped as yellow areas)

- **BLM Areas of Critical Environmental Concern** (ACECs) – designated by BLM to protect and prevent irreparable damage to "important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards." Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a). Designation typically takes place during the land use planning process for a larger BLM-administered area and involves environmental review and public participation. One hundred forty-five such areas have been designated by BLM on the 15.2 million acres that it administers in California.
- **Designated critical habitats for federally listed endangered and threatened species** – species are put on the federal list by the FWS following its determination that they are either in danger of extinction throughout all or a portion of their ranges ("endangered") or likely to become endangered in the foreseeable future ("threatened") according to criteria established by Congress, including impacts to habitat, overuse by humans, and disease or predation, 16 U.S.C. § 1533(a)(1), and more detailed regulatory criteria

adopted by the agency, see 50 CFR § 424.14(b)(2). Generally, Congress intended for critical habitat to be proposed at the same time as the listing of a species was proposed and to be designated at the time of listing, if its critical habitat was determinable and prudent; if not determinable at the time of listing, the FWS can propose and designate critical habitat at a later date. A proposed designation involves review and comment by the public, state and local governments and others. Areas can be excluded from final designation as critical habitat, which is defined as the area "essential to the conservation of the species," for economic and other reasons, if the exclusion will not jeopardize the continued existence of the species. Around 80 critical habitats have been finally designated in CA, including habitats for fish.

- **Special wildlife management areas in West Mojave** – the West Mojave Resource Management Plan – adopted following completion of an environmental impact statement and public participation – established Desert Wildlife Management Areas (DWMAs) and Mojave Ground Squirrel Conservation Areas (MGSCAs) with rigorous protections. In particular, the plan makes both kinds of areas subject to a 1% cap on surface disturbance.[17] The cap in the ground squirrel areas is applicable to federal land only, while the cap in the former areas applies to lands managed by participating jurisdictions.
- **Lands purchased with private funds and donated to the federal government** –approximately 272,000 acres of former railroad lands in the Mojave Desert were purchased by The Wildlands Conservancy with private funds and donated to BLM between 1999 and 2004. Another 315,000 acres that were donated are in parks or wilderness areas.
- **Proposed and potential conservation reserves in HCPs and NCCPs –** see definitions of HCPs and NCCPs above. These lands are also termed "softline reserves" and can be defined as requiring conservation measures of less than 100%. (Note: for Black & Veatch's analysis all HCP and NCCP conservation reserves were counted as Category 2 lands because the restrictions on development are unique to the individual plan and could not be assessed in detail for that analysis. However, the FWS will help the EWG categorize HCPs and NCCPs into hard and soft line reserves for the criteria 3 and 4 of the environmental ranking.)

[17] See West Mojave Final Environmental Impact Statement, Chapter 4, p. 4-21 (2d paragraph), p. 4-45 (3rd paragraph) (both cites to DWMAs), and p. 4-153, Table 4-49 (1st box) (ground squirrel).

- **Lands specified as of May 1, 2008 in proposed wilderness bills** – two bills were currently pending when the SSC adopted these criteria: Boxer Statewide Wilderness Bill (S. 493), and the Riverside County Wilderness Bill (H.R. 3682). The majority of the areas proposed for wilderness designation in these bills lie in Category 1 areas. Areas proposed for wilderness designation in these bills that are not in Category 1 areas have been placed in Category 2.

3.0 Agricultural Lands, Disturbed Lands and Water Issues

A variety of issues arose during the EWG's meetings and discussions about categorizing lands and assessing environmental concerns associated with potential development of CREZs. This section describes three of those issues.

3.1 Agricultural Lands

The issue of potential energy development on agricultural lands is one of the most controversial facing RETI. California has long-standing policies to protect agricultural land such as the Williamson Act. In addition, California has policies promoting renewable energy development which underlie the RETI process. These policies clearly conflict when potential conversion of agricultural lands to non-agricultural energy development is considered.

Concerns were raised about the identification by Black & Veatch of proxy projects on private property generally and on agricultural lands specifically.[18] Agricultural lands may be highly valued for renewable development, particularly for solar facilities, because of the open undeveloped acreage inherent in these properties. The EWG has striven to ensure that the identification of CREZs is consistent with state and local law and policies, including protection of agricultural lands such as:

1. The Williamson Act –authorizes private landowners to voluntarily restrict the uses of their land to agricultural and open-space uses. The vehicle for these agreements is a rolling term 10 year contract. In return, restricted parcels are assessed for property tax purposes at a rate consistent with their actual uses, rather than their potential market value. Not all counties participate in the program. Currently 16.9 million acres are enrolled in the program. Government Code section 51200 et seq.
2. Planning and Zoning Law – The Legislature intends for cities and counties to conserve open space whenever possible, including productive agricultural land. Government Code 65562

Agricultural land is designated and mapped in California among the following categories: prime farmland, farmland of statewide importance, unique farmland, farmland of local importance and grazing land. Together those designations total approximately 29 million acres as of 2004.

[18] See Black & Veatch Phase 1 report.

In some instances renewable generation facilities are compatible with agricultural uses. Wind projects are routinely sited on agricultural lands in many parts of the US. Solar facilities, however, require significant acreage and take the affected land completely out of production. The EWG faced the issue of whether categories of agricultural lands should be screened out as ineligible for proxy projects in order to be consistent with state law and policy regarding preservation of agricultural lands. The EWG agreed that the draft report would treat prime farmland under Williamson Act contracts as Category 2 land and exclude prime farmland (along with the other Category 2 land) from the siting of proxy projects. Proxy projects may be identified on other Williamson Act farmlands but the EWG instructed Black & Veatch to recognize where appropriate in the methodology that existing contracts are likely to limit development for 9 years or more.

While no consensus was reached by the EWG as to whether a different screen for proxy projects should be used in the future, no comments were received on either the interim draft or draft versions of this chapter suggesting that this approach should be abandoned – even though some of the best solar energy resources are found on lands currently used for agricultural purposes.

The EWG recommends that the SSC affirm the assumptions regarding conversion of certain agricultural lands to energy development that have been utilized to date for future use in the context of RETI.

3.2 Disturbed Lands

All members of the EWG agreed that energy development on lands already disturbed by previous human activity is preferable to development in more pristine areas and struggled to come up with a criterion which would give preference to CREZs on disturbed lands. The group came to the consensus that abandoned mine lands, brownfields, and lands on which oil and gas development had occurred should be considered as disturbed lands, but could not agree on which, if any, agricultural lands should be included in this category. Because important solar resources, as well as wind resources, are located on lands currently designated agricultural lands, the issue was a significant one. Efforts were made to distinguish agricultural lands that might be appropriate for development, but no data were available that would meet the needs of the process. Moreover, the environmental advocates participating in the EWG felt strongly that at least some agricultural lands needed to be included in order to prevent renewable energy development from being skewed towards federal public lands.

The latter concern was reduced in light of Black & Veatch's analysis of the amount of acreage of lands in federal and non-federal ownerships within the CREZs.

They found that the acreage in the CREZs was almost equally divided between federal lands and lands in non-federal land ownership, although some CREZs had no federal land and others were almost exclusively federal. The largest number of CREZs were a mix of both kinds of land ownership. A table showing the breakdown between federal and non-federal ownership by CREZ is included at Appendix D – Land Ownership. For all California CREZs considered by the EWG, 930,409 acres are in federal ownership (46% of the total) and 1,100,880 acres (54%) are owned by others, including the state, tribes and private individuals.

In addition, the EWG learned that the state Department of Conservation (DOC) had begun mapping "vacant or disturbed land." Unfortunately, this mapping had only been completed in four counties, none of which had any CREZs. The absence of usable data on "disturbed" lands led the EWG to adopt instead a criterion which rewards development on what are being called "degraded lands" – those which have been mined or drilled, or are Superfund sites.

Some environmental commentators on the interim draft version of this report provided information about significant disturbed acreage in the California Desert with lower environmental values located adjacent to existing transmission and outside identified sensitive areas that might be suitable for renewable energy development. Black & Veatch will investigate whether these lands were included in CREZs and, if not, why not.

3.3 Water Issues

Electric generation from thermal power plants is most efficient when a source of cooling is available to remove waste heat in the thermal cycle. When available, water is commonly used to remove this heat and boost plant efficiency. Unfortunately, California's supplies of cooling water are limited, especially in arid regions where sunshine is most abundant. Moreover, California policy discourages the use of pristine water for power plant cooling.[19] The geographical and policy limitations on the use of water conflict with the goal of generating electricity from renewable energy resources most efficiently. The EWG was asked to provide guidance to Black & Veatch and the SSC on the use of water in the CREZ assessment.

The EWG assumes that groundwater is unlikely to be available for cooling thermal power plants, and that treated urban wastewater can be used. The EWG advised Black & Veatch to assume that solar projects within 10 miles of populated areas would have access to waste water suitable for cooling. It is assumed that for each 7,000 people, enough recycled water will be available to cool a 100 MW solar thermal plant.

[19] California Energy Commission policy.

3.4 Wind Industry Issues

As noted above, there was no consensus regarding how the project footprint for wind projects should be defined and applied in assessing potential environmental concern. The U.S. Department of Energy 20% Wind Vision report (May 2008) found that wind projects in the U.S. directly disturb on average 2.5%-5% of total project lease area for turbine tower foundations, access roads and substations.[20] The EWG used the midpoint of this range, 3.5% of total project area, in its criterion used to assess generating project footprint. At the same time, EWG formulas for two criteria intended to assess the relative potential effect on sensitive species (in buffer areas around CREZ and on wildlife corridors) use the full lease area of wind projects. This is the first instance in which the environmental effect of wind projects has been characterized as proportional to the entire project lease area. The wind industry takes strong exception to such formulas, pointing to the lack of data and systematic study of such impacts. The formulas should not be considered to establish a precedent for evaluating wind project impacts.

In response to wind industry concerns about these specific criteria, the formulas that the industry preferred – i.e., using a footprint area equivalent to 3.5% of the lease area in Criterion #3 (sensitive areas in CREZs) and Criterion #6 (wildlife corridors) were tested along with the other EWG criteria. The California CREZs which received the lowest (best) scores using the wind industry formulas are shown in Table 3-1 below along with the CREZ rankings using the EWG formulas. This comparison reveals that although the results of these two scenarios differ somewhat, they are largely consistent.

[20] U.S. Department of Energy, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply*, May 12, 2008, p. 110. Avaiable at: http://www1.eere.energy.gov/windandhydro/

Table 3-1. CREZ Environmental Ranking Results Using Wind Industry Formulas.

CREZ Name	Annual Energy (GWh/yr)	Score Using Wind Formulas	Score Using EWG Formulas
Mountain Pass	6,942	2.8	3.9
Twentynine Palms	1,944	3.0	2.8
San Diego South	1,829	3.0	4.4
Imperial North-A	10,095	3.1	2.7
Tehachapi	25,091	3.6	4.0
Fairmont	18,318	4.0	4.0
Palm Springs	2,465	4.0	5.2
Barstow	5,106	4.1	6.9
Pisgah-A	4,283	4.5	4.4
San Bernardino - Lucerne	10,722	4.5	4.9
Imperial East	3,991	4.6	4.9

4.0 Rating Methodology—Criteria, Data Sources, and Formulas

This section describes the criteria used by the EWG to estimate quantitatively the level of environmental concern associated with potential energy development in CREZs. In reviewing these criteria, it is important to note that they do not represent all potential concerns that development may raise in any CREZ. Nor do they reflect any assessment of actual environmental impacts or harms that development may cause in any CREZ or substitute for any decision-making process required by law. The criteria which are described below were subject to two requirements: 1. that they were measurable and 2. that state-wide data were available to quantify them. Some of the data were supplied by Black & Veatch. Other data came from publicly-available data sets obtained from appropriate federal, state, or local agencies or, in one case, from a non-governmental organization.

Sources of and links to data relied upon by the EWG are identified in Appendix A - Data. The formulas used to quantify the environmental concerns associated with each criterion and to provide a score for ranking the CREZs can be found in Appendix B - Criteria. The formulas used to provide the ranking scores are found in Appendix C – Ranking. Several different modifications of these formulas were tested to ensure that the final ranking results are robust against minor changes.

In particular, the EWG's October 28 version of Criterion #7 included a "5x" weighting factor for wind projects to take into account their use of air space. A comparison of results using two other factors – 1 and 3, with 1 being the factor assigned to solar and geothermal projects – was performed and revealed that these different factors made no significant difference in the overall rating. In addition, at the wind industry's request, a similar exercise was conducted involving Criteria #s 3 and 6, Sensitive Areas in CREZs and Wildlife Corridors. The formulas for those two criteria both use the full lease area of wind projects. A comparison of the results using 3.5% of the total project area – representing the area that would be directly physically affected by a wind project (see section 4.1 below) – revealed that, while the top ranked CREZs under the two different scenarios differed somewhat, they were largely consistent. See Table 3-1 above. Accordingly, we concluded that the selection of either assumption would not significantly affect the outcome for a majority of CREZs, although several CREZs had significant changes in rank. The complete results for all CREZs using the wind industry assumptions, together with a chart showing the combined economic and environmental rankings, are included in Appendix E.

All of the formulas used to provide quantitative values indicating the relative levels of concern for the environmental criteria are of the form:

$$\frac{\text{Environmental Indicator for CREZ}}{\text{Annual Energy Produced by CREZ}}$$

For example, the formula indicating the relative level of concern associated with transmission rights of way (Criterion #2, described below) is:

$$\frac{\text{Areas of ROW required for CREZ access (acres)}}{\text{Annual energy produced (gigawatt-hours per year)}}$$

If two CREZs have the same environmental indicators (numerators), dividing by energy production (denominators) ensures that a lower, i.e. better, score will be appropriately assigned to the CREZ that produces the most energy.

4.1 #1 Energy Development Footprint

The amount of land needed for renewable energy collection and electric generation, the development "footprint," is one useful measure of potential environmental concern. Since acreage affected in part determines energy output, CREZ footprints have been normalized for annual energy output, as described above.

Data Source — Black & Veatch provided the EWG with wind and solar project areas for each CREZ considered. In addition, Black & Veatch estimated the development footprint of geothermal projects as one acre per megawatt of capacity. Black & Veatch also estimated the annual energy output for each CREZ.

After considerable debate, the EWG agreed that—for purposes of this criterion—only 3.5% of the wind project area should be included, reflecting the fraction of ground disturbance from turbines and roads as estimated by the US Department of Energy.

Rating Formula Inputs — Areas impacted by energy development by technology, including access roads (acres); annual energy production (GWh/yr).

Rating Formula — [(0.035 x wind acreage + solar acreage +geothermal acreage] ÷ [Total annual energy output of CREZ]

4.2 #2 Transmission Footprint

The amount of land needed for new transmission rights-of-way (ROW), the transmission "footprint," is a second useful measure of potential environmental concern. As in Criterion #1, the area of new ROW has been normalized for annual energy output.

Data Source — Estimates of new transmission rights-of-way for each CREZ provided by Black & Veatch.

Rating Formula Inputs — Areas of new transmission ROW (acres); annual energy production (GWh/yr).

Rating Formula — [Acres of new ROW] ÷ [Annual energy output]

4.3 #3 Sensitive Areas in CREZs

A CREZ includes areas of potential renewable energy development but may also include sensitive areas in which development is restricted or prohibited (mapped as yellow or black areas.) The amount of sensitive land inside CREZ boundaries provides a measure of the extent to which potential energy development may raise concerns about possible impacts to the values being protected in the sensitive lands.

Evaluation of this criterion is complicated by the fact that some CREZs are comprised of widely dispersed areas in which energy development is expected. Sensitive lands inside these CREZs may be a considerable distance from potential development and relatively unaffected by development.

Data Source — The area of Category 1 and 2 lands within each CREZ is provided by the California Energy Commission from maps compiled by Black & Veatch.

Rating Formula Inputs — Area of Category 1 and 2 lands within CREZ; annual energy output (GWh/yr)

Rating Formula — [Area of Category 1 & 2 lands] ÷ [Annual energy output]

4.4 #4 Sensitive Areas in CREZ Buffer Areas

Potential impacts associated with energy development do not disappear at CREZ boundaries. Thus, energy development in areas remote from sensitive lands is preferable to areas in proximity to these lands. The EWG has agreed that lands within 2 miles of a CREZ boundary may be affected by development in the CREZ. This criterion therefore is scored on the amount of Category 1 and 2 lands within 2 miles of a CREZ boundary.[21]

Data Source — Areas of Category 1 and 2 lands within 2 miles of CREZ boundaries is provided by the California Energy Commission from maps compiled by Black & Veatch.

Rating Formula Inputs — Areas of Category 1 and 2 lands within 2 miles of CREZ boundary; annual energy output (GWh/yr)

Rating Formula — [Areas of Category 1 and 2 lands within 2 miles of CREZ] ÷ [Annual energy output]

[21] This criterion is intended to encompass concerns beyond the project area, including (but not limited to) impacts to sensitive species and their habitats. However, this criterion does not identify whether affected species are sensitive to particular types of development within a range of two miles.

4.5 #5 Significant Species

State and federal policies identify species of wildlife that are of significant concern. The threat that development may pose for these species, also known as sensitive species, must be addressed when siting projects. For purposes of rating CREZs, this criterion gives preference to CREZs in which fewer significant species are known to occur.[22]

Data Source — California significant species database, DFG.

Rating Formula Inputs — Number of significant species in CREZ; annual energy output (GWh/yr)

Rating Formula — [Number of significant species in CREZ] ÷ [Annual energy output]

4.6 #6 Wildlife Corridors

In recent years, biologists have recognized the importance of preserving the integrity of wildlife corridors that enable animals to move as needed from one habitat to another. These corridors, including floodways and riparian areas, are expected to become especially important as habitats change in response to changing climate. Unfortunately, these corridors are not well understood and existing data are preliminary. Nevertheless, the importance of this criterion is such that the EWG has included it to give preference to those CREZs that minimize conflicts with wildlife corridors.

Data Source — California DFG

Rating Formula Inputs — Length of known wildlife corridors in CREZ (meters); annual energy output (GWh/yr)

Rating Formula — [Meters of known wildlife corridors in CREZ] ÷ [Annual energy output]

4.7 #7 Important Bird Areas

Potential impacts of energy development on avian species are of significant environmental concern. This concern is not limited to wind development, although the

[22] As members of the EWG learned in developing this criterion, statewide data regarding wildlife are limited. The data used in this criterion represent positive siting data only. That is, they measure only the number of different species seen in, reported at and recorded for an individual area and not the numbers of individual species present. Thus, they do not provide any indication of high or low populations. Moreover, because not all lands in California have been surveyed, the fact that an area receives a low score on this criterion does not mean no species of concern inhabit it. Last but not least, these data do not address a major wildlife issue of concern, namely the rarity of species in CREZ. Unfortunately, there is no good statewide data base on species rarity. However, the CREZ confirmation process that will be part of RETI Phase 2 should provide opportunities to consider species rarity and other available species information for specific CREZs.

potential impacts of that kind of development are perhaps best known. Areas designated as "Important Bird Areas" by the National Audubon Society working with landowners, agencies and others using internationally accepted definitions, are areas that are vital to bird species, including common and game species as well as rare species. "Air space" and ground space needed by birds are included in these designated areas. The EWG agreed to adopt a criterion that gives preference to those CREZs that minimize conflicts with Important Bird Areas.[23]

Data Source — National Audubon Society provided the Important Bird Area data. Black & Veatch provided the acreage of wind, solar and geothermal projects within each CREZ and the annual energy output.

Rating Formula Inputs — Acreage of Important Bird Area(s) within CREZ; acreage of wind, solar and geothermal projects within CREZ; annual energy output. Although the EWG originally agreed to a weighting factor for this criterion for wind projects, as discussed above, that factor was subsequently dropped.

Rating Formula — [IBA area with CREZ] ÷ [Annual energy output]

4.8 #8 Land Degradation

The EWG agreed that energy development on lands already disturbed by previous human activity is preferable to development in more pristine areas. The degraded lands included in this category are abandoned mine lands, brownfields, and lands on which oil and gas development had occurred. Unlike the previous seven criteria, a higher score in the degraded lands criterion indicates a *lower* level of concern. The formula result was therefore treated as a negative number to be subtracted from the totals of the other seven results. This treatment is tantamount to providing "bonus points" for CREZs with a high density of degraded lands.

Data Source –The BLM supplied data on oil and gas development lands. The Department of Conservation supplied the data for abandoned mines from digitized USGS maps and has started field checking mapped sites within California. The U.S. Environmental Protection Agency provided brownfields data. Only the number of sites in each CREZ was used, since more complete data on areas and the degree of disturbance were unavailable.

[23] The EWG's October 28 version of Criterion #7 included a "5x" weighting factor for wind projects to take into account their use of air space. The wind industry objected to this factor on the ground that impacts of other technologies such as water use and emissions were not being considered. The EWG tested the use of two other weighting factors – 1 and 3, with 1 being the factor assigned to solar and geothermal projects, and found that these different facts made no significant difference in the overall rating. Therefore, the weighting factor was removed.

Rating Formula Inputs – Number of degraded sites within CREZ (number); CREZ area; Annual energy production (GWh/yr)

Rating Formula – [Number of degraded sites within CREZ] ÷ [CREZ area] ÷ [Annual energy output]

5.0 Other Concerns

As noted above**,** the criteria developed by the EWG do not represent all potential concerns that renewable energy development in a CREZ may raise. Three of the issues for which the EWG has no criteria deserve specific mention and are described in this section.

5.1 Visual Impacts

The visual impact of energy development and associated transmission facilities is of paramount importance to the public. The EWG therefore examined the possibility of including a rating criterion to evaluate the significance of scenic concerns for each CREZ. The scenic quality of some areas has been rated by relevant land management agencies, such as the BLM. Unfortunately, similar data is unavailable for all areas of the state, and the EWG reluctantly dropped the visual impact criterion from consideration for purposes of this report. The EWG notes that although not included in this statewide comparison of CREZs, visual impacts of individual energy and transmission projects must be thoroughly addressed when these projects undergo review in the siting process.

The absence of a visual concern criterion in the present CREZ rating methodology should not be interpreted as an indication of its unimportance. The decision not to consider visual concerns in this report was made solely because appropriate statewide data were unavailable for this report.

The EWG recommends that consistent statewide scenic quality data be developed so that visual concerns can be included as a rating criterion in future updates of the EWG's work.

5.2 Native American Concerns

Another issue considered by the EWG for CREZ rating purposes was the potential effect of energy development on Native American cultural and historic sites. Relevant data are available statewide from the Native American Heritage Commission and the California Historical Resources Information System. Unfortunately, these data are not centrally located nor in a format that is readily accessible for EWG purposes. Moreover, it remains unclear how the data could be used to provide a meaningful measure of the extent to which potential energy development would raise concerns about cultural values. The EWG therefore reluctantly omitted cultural concerns from consideration in this report. As with visual concerns, this decision in no way reflects on the importance of Native American concerns, which are thoroughly considered in energy project siting cases.

The EWG recommends that data on Native American cultural sites be collected and formatted for ready access, and that a methodology be developed for inclusion of potential concerns related to these sites be developed, so that this criterion can be included in future updates of EWG work.[24]

5.3 United States Forest Service Lands

The EWG did not arrive at a consensus for considering potential renewable energy development on United States Forest Service (USFS) lands. That agency, like the BLM, is currently considering adopting various guidelines for renewable energy development. Final adoption of such guidelines may warrant reconsideration of the approach taken here.

Additionally, only two USFS management plans have specifically considered whether certain land use zones are "suitable" for "Renewable Energy Resources" activity and determined that such activity is compatible in some zones. Because those plans are now the subject of litigation,[25] the EWG did not incorporate their determinations into its environmental screens.

In order to move forward, the EWG directed Black & Veatch to treat USFS lands not in Category 1 as Category 2 lands. Black & Veatch will thus limit potential development on USFS lands in California to "pre-identified projects" for energy testing and/or development. The EWG also requested, however, that Black & Veatch provide the SSC and policymakers with information regarding the nature of the renewable resources that this Category 2 treatment eliminates from consideration.

[24] During the comment period on the interim draft version of this chapter, the EWG received a report on cultural resources within the California Desert Conservation Area (CDCA) from the Mojave Land Trust along with GIS data locating such resources. Because these data relate only to one region of the state, and because the EWG has not yet been able to define a criterion for assessing these resources, the EWG has not yet been able to incorporate a cultural resource criterion into its rating methodology. However, the CREZ confirmation process in Phase 2 should provide opportunities to use some of these data in connection with reviews of specific CREZs.

[25] Center for Biological Diversity, et al. v. U.S. Dep't of Agriculture, et al., (N.D. Cal.), filed earlier this year. The outcome of this litigation may also warrant reconsideration of the approach taken by the EWG.

6.0 Results

6.1 Ranking Scores

In order to provide a uniform ranking system for all criteria, the largest formula result in each category was assigned a ranking score of 5. Ranking scores for the other CREZ results were assigned proportional to the formula results. Lower ranking scores indicate lower levels of environmental concern The formula used to assign ranking scores to formula results for each criterion is:

$$5 \times \text{Formula Result} \div \text{Maximum Formula Result}$$

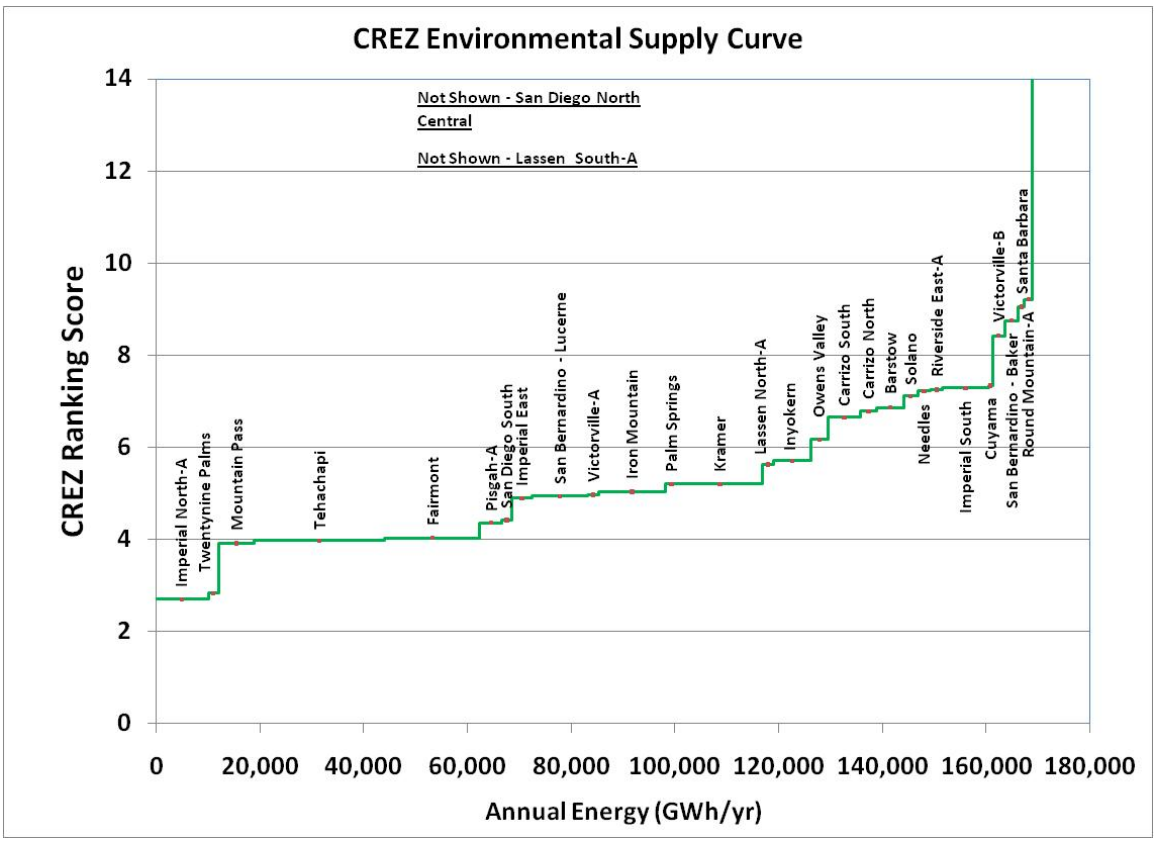
To obtain a total ranking score for each CREZ, the individual scores for each criterion were summed. With the exception of the degraded lands criterion (see below) lower total ranking scores are associated with CREZs in which potential environmental concerns are expected to be least, and higher scores indicate the likelihood of more severe environmental concerns.

6.2 Environmental Supply Curve

The list of all CREZs considered, their annual energy output and their total rating scores based on the criteria described above are sorted from lowest score to highest. The total rating score for each CREZ is a relative measure of the potential environmental concerns associated with energy development in that CREZ, relative to other CREZs. One can also think of these scores as a measure of the environmental "cost" of energy development in each CREZ, analogous to the relative economic cost estimated for each by Black & Veatch, although the scores do not represent monetized values of any environmental concerns. Nor are they necessarily associated with any financial cost on renewable or transmission development.

On the basis of the total scores, an environmental "supply curve" can be developed which is analogous to the economic supply curve developed by Black & Veatch,[26] as illustrated below.

[26]Black & Veatch Phase 1B report.



Insert figure here (don't "float over text")

Figure 6-1. Environmental "Supply Curve" of California CREZs.[27]

The CREZs which received the lowest (best) ranking scores are shown in Figure 6-1. The complete list of CREZs and their ranking scores is shown in Appendix C - Ranking.

CREZs identified as preferred for development must, at a minimum, provide the amount of renewable energy that must be developed to meet the state's goals. In addition, allowance must be made for the uncertainty in the estimates and the methodology used in the ranking process. Moreover, to promote competition between energy developers a surplus of energy potential is needed. The RETI Stakeholder Steering Committee will consider appropriate energy targets in its choice of CREZs for which transmission access will be planned in Phase 2.

[27] Again, as previously noted, the rankings shown on this chart have not been subjected to a thorough statistical analysis and represent the first-time results of applying the methodology that the EWG developed specifically for RETI Phase 1 to CREZs

7.0 Conclusions

This report from the EWG describes the methodology developed for rating CREZs on the basis of potential environmental concerns and includes the results of the EWG's application of that methodology. This report also identifies CREZs in which renewable energy development is expected to minimize both economic costs and environmental concerns. CREZs identified as preferred in both the economic and environmental rankings will be considered for transmission access in RETI Phase 2 and Phase 3.

Despite limitations, including significant data limitations, the methodology developed by the EWG described here provides a consistent and quantitative means of estimating the relative environmental concerns associated with potential energy development in the CREZs identified by Black & Veatch.

Appendix A. Data

#1 Energy Development Footprint

Data Source — Black & Veatch provided wind and solar project areas for each CREZ considered. In addition, Black & Veatch estimated the development footprint of geothermal projects as one acre per megawatt of generating capacity.

Black & Veatch also estimated the annual energy output for each CREZ (used for all Criteria.)

#2 Transmission Footprint

Data Source — Estimates of new transmission rights-of-way for each CREZ are provided by Black & Veatch.

#3 Sensitive Areas in CREZs

Data Source — Areas of Category 1 and 2 lands within each CREZ are provided by California Energy Commission from maps complied by Black & Veatch.

LINK – Category 1 and 2 maps

http://www.energy.ca.gov/reti/steering/workgroups/environmental/maps/draft-EWG-maps/DRAFT_RETI_EWG_CA_Statewide_Rev5_Black_and_Yellow_combined.pdf

#4 Sensitive Areas in CREZ Buffer Areas

Data Source — Areas of Category 1 and 2 lands within 2 miles of CREZ boundaries are provided by California Energy Commission from maps compiled by Black & Veatch.

#5 Significant Species

Data Source — California Department of Fish and Game CNDDB and CWHR.

CNDDB- The California Natural Diversity Database (CNDDB) is a product of the California Department of Fish and Game's Biogeographic Data Branch (BDB).

The CNDDB is both a manual and computerized library of the status and locations of California's rare species and natural community types. The CNDDB includes in its inventory all federally and state listed plants and animals, all species that are candidates for listing, all species of special concern, and those species that are considered

"sensitive" by government agencies and the conservation community. The CNDDB contains over 56,000 locational records for over 2,300 elements.

CWHR- The California Wildlife Habitat Relationships (CWHR) data set is produced by California's Department of Fish and Game's Biogeographic Data Branch. The data set is an intersection of all 694 vector polygon ranges in the CWHR System with a statewide grid of 10 square mile hexagon cells. That uses a community-level matrix model associating 692 wildlife species to 59 standard habitats and stages - rating suitability for reproduction, cover, and feeding.

Links - CNDDB

http://www.dfg.ca.gov/biogeodata/cnddb/

CWHR

http://www.dfg.ca.gov/biogeodata/cwhr/

#6 Wildlife Corridors

Data Source — California Department of Fish and Game.

DFG provided a data set that covers an evaluation of landscape linkages, choke-points, and missing connectivity links throughout California. This was accomplished in November 2000, in a conference environment where participants used and shared their knowledge of their ecoregion of expertise by identifying, marking, and documenting movement corridors and choke-points for each delineated link.

Link- Corridors:

http://www.calwild.org/resources/pubs/linkages/index.htm

#7 Important Bird Areas

Data Source — National Audubon Society.

Audubon provided the Important Bird Area data. Black & Veatch provided the acreage of wind, solar and geothermal projects within each CREZ.

Audubon collected census data from across California and defined sites that fit into one or more of the following four criteria: 1. Over 1% of Global or 10% of California population of one or more sensitive taxa(breeding and/or wintering), 2. More than 9 listed/sensitive species (incl. federally and state threatened and endangered) regularly occurring, 3. Over 10,000 shorebirds possible on a 1-day count, 4. Over 5000 waterfowl possible on a 1-day count (not just flyovers).

Link- IBA:

http://ca.audubon.org/iba/index.shtml

#8 Land Degradation

Data Source – US Bureau of Land Management (BLM), California Department of Conservation, and US Environmental Protection Agency.

The BLM supplied data on oil and gas development lands. The California Department of Conservation supplied the data for abandoned mines from digitized USGS maps and has started field checking mapped sites within California. The U.S. Environmental Protection Agency provided brownfields data. Only the number of sites in each CREZ was used, since more complete data on areas and the degree of disturbance were unavailable.

Links – BLM: oil and gas leases

http://www.blm.gov/ca/st/en/prog/energy/og/contacts.html

DOC: abandoned mine land:

http://www.conservation.ca.gov/omr/abandoned_mine_lands/Pages/index.aspx

EPA: Brown field sites:

http://www.epa.gov/brownfields/

Data Used in EWG Assessment – Ranking Order (part 1)

CREZ Name	Wind Area (acres)	Adjusted Wind Area (acres)	Solar Area (acres)	Geothermal Area (acres)	Total Adj Project Area (acres)	CREZ Area (acres)	ROW Area (acres)	Total Annual Energy (GWh/yr)
Imperial North-A	0	0	0	1,370	1,370	52,286	1,503	10,095
Twentynine Palms	0	0	5,120	0	5,120	23,441	1,183	1,944
Mountain Pass	44,295	1,550	12,800	0	14,350	92,284	4,279	6,942
Tehachapi	180,074	6,303	38,400	0	44,703	330,083	2,876	25,091
Fairmont	52,462	1,836	34,560	0	36,396	152,274	540	18,318
Pisgah-A	0	0	11,520	0	11,520	12,360	799	4,283
San Diego South	24,607	861	0	0	861	25,807	1,202	1,829
Imperial East	11,852	415	10,240	0	10,655	53,661	3,122	3,991
San Bernardino - Lucerne	47,313	1,656	23,040	0	24,696	166,109	1,345	10,722
Victorville-A	0	0	5,120	0	5,120	17,522	158	2,112
Iron Mountain	6,089	213	35,840	0	36,053	96,149	5,706	12,713
Palm Springs	17,364	608	0	0	608	30,871	316	2,465
Kramer	16,544	579	40,960	24	41,563	118,487	3,180	16,251
Lassen North-A	45,580	1,595	0	0	1,595	80,270	6,450	2,195
Inyokern	22,935	803	16,640	0	17,443	57,738	2,012	7,136
Owens Valley	0	0	8,960	0	8,960	11,547	2,140	3,433
Carrizo South	0	0	19,200	0	19,200	47,708	5,278	6,118
Carrizo North	0	0	10,240	0	10,240	45,869	2,004	3,225
Barstow	49,929	1,748	7,680	0	9,428	103,466	1,481	5,106
Solano	27,990	980	0	0	980	34,395	315	2,721
Needles	15,261	534	5,120	0	5,654	51,149	2,621	2,517
Riverside East-A	0	0	6,400	0	6,400	32,327	1,004	2,339
Imperial South	2,710	95	23,040	64	23,199	76,063	4,319	8,776
Cuyama	0	0	2,560	0	2,560	6,150	848	847
Victorville-B	27,005	945	5,120	0	6,065	74,334	268	2,267
San Bernardino - Baker	0	0	7,680	0	7,680	43,869	934	2,705
Santa Barbara	30,285	1,060	0	0	1,060	37,464	2,004	1,121
Round Mountain-A	0	0	0	240	240	42,228	1,059	1,598
San Diego North Central	18,631	652	0	0	652	37,755	85	702
Lassen South-A	19,981	699	0	0	699	34,427	8,345	1,106

Data Used in EWG Assessment – Ranking Order (part 2)

CREZ Name	CREZ Yellow & Black Area (acres)	Buffer Yellow & Black Area (acres)	IBA Area (acres)	Signif Species (# species)	Corridors (meters)	Degraded (# sites)
Imperial North-A	16,866	57,102	31,486	56	7,799	0
Twentynine Palms	0	8,324	0	17	1,644	31
Mountain Pass	28,784	132,626	5,420	39	0	365
Tehachapi	33,944	98,584	15,686	71	45,583	717
Fairmont	3,364	52,990	14,667	59	15,355	22
Pisgah-A	157	14,199	0	16	0	5
San Diego South	3,815	37,962	96	38	8,349	9
Imperial East	11,940	58,914	3,971	51	4,662	146
San Bernardino - Lucerne	20,206	111,745	252	93	15,923	286
Victorville-A	0	0	0	22	3,833	0
Iron Mountain	5,079	31,730	0	18	0	5
Palm Springs	7,848	28,390	2,428	67	14,843	4
Kramer	64,604	186,154	16,366	35	15,642	594
Lassen North-A	1,036	17,034	0	31	10,324	5
Inyokern	26,487	76,168	0	29	5,318	13
Owens Valley	0	6,223	3,335	31	8,029	0
Carrizo South	0	4,794	6,695	33	7,886	0
Carrizo North	3,784	17,540	0	30	3,603	0
Barstow	55,702	127,986	3,869	33	17,318	213
Solano	137	37,839	29,663	52	6,234	4
Needles	29,894	78,248	0	31	0	62
Riverside East-A	13,775	50,672	0	25	0	6
Imperial South	13,142	62,546	34,041	48	10,676	8
Cuyama	94	6,005	0	24	0	0
Victorville-B	25,646	36,019	214	33	3,651	22
San Bernardino - Baker	10,329	80,483	163	19	16,417	14
Santa Barbara	5,122	38,099	0	44	7,964	6
Round Mountain-A	24,000	98,382	0	53	4,560	9
San Diego North Central	10,559	54,243	9,057	64	3,104	34
Lassen South-A	24,413	113,662	12,231	41	18,724	11

Appendix B. Criteria

	Formulas for Evaluating EWG Environmental Criteria
Criterion #1	(0.035 x wind project area + solar project area + geothermal project area) divided by (Total Annual Energy of CREZ)
Criterion #2	(ROW) divided by (Total Annual Energy)
Criterion #3	(Yellow and black areas within CREZ) divided by (Total Annual Energy)
Criterion #4	(Yellow and black areas within CREZ buffer) divided by (Total Annual Energy)
Criterion #5	(Number of significant species in CREZ) divided by (Total Annual Energy)
Criterion #6	(Length of wildlife corridors within CREZ) divided by (Total Annual Energy)
Criterion #7	(IBA Area within CREZ) divided by (Total Annual Energy)
Criterion #8	(Number of degraded sites within CREZ) divided by (CREZ Area) divided by (Total Annual Energy)

Criterion Values from Formulas – Ranking Order

CREZ Name	#1 Affected Area (acres/GWh/yr)	#2 ROW (acres/GWh/yr)	#3 CREZ Yellow & Black Area (acres/GWh/yr)	#4 Buffer Yellow & Black Area (acres/GWh/yr)	#5 Significant Species (# species/GWh/yr)	#6 Corridors (meters/GWh/yr)	#7 IBA (acres/GWh/yr)	#8 Degraded (# sites/GWh/yr)
Imperial North-A	0.14	0.15	1.67	5.66	0.0055	0.77	3.12	0.000000000
Twentynine Palms	2.63	0.61	0.00	4.28	0.0087	0.85	0.00	(0.000000680)
Mountain Pass	2.07	0.62	4.15	19.10	0.0056	0.00	0.78	(0.000000570)
Tehachapi	1.78	0.11	1.35	3.93	0.0028	1.82	0.63	(0.000000087)
Fairmont	1.99	0.03	0.18	2.89	0.0032	0.84	0.80	(0.000000008)
Pisgah-A	2.69	0.19	0.04	3.31	0.0037	0.00	0.00	(0.000000094)
San Diego South	0.47	0.66	2.09	20.75	0.0208	4.56	0.05	(0.000000191)
Imperial East	2.67	0.78	2.99	14.76	0.0128	1.17	1.00	(0.000000682)
San Bernardino - Lucerne	2.30	0.13	1.88	10.42	0.0087	1.49	0.02	(0.000000161)
Victorville-A	2.42	0.07	0.00	0.00	0.0104	1.82	0.00	0.000000000
Iron Mountain	2.84	0.45	0.40	2.50	0.0014	0.00	0.00	(0.000000004)
Palm Springs	0.25	0.13	3.18	11.52	0.0272	6.02	0.99	(0.000000053)
Kramer	2.56	0.20	3.98	11.45	0.0022	0.96	1.01	(0.000000308)
Lassen North-A	0.73	2.94	0.47	7.76	0.0141	4.70	0.00	(0.000000028)
Inyokern	2.44	0.28	3.71	10.67	0.0041	0.75	0.00	(0.000000032)
Owens Valley	2.61	0.62	0.00	1.81	0.0090	2.34	0.97	0.000000000
Carrizo South	3.14	0.86	0.00	0.78	0.0054	1.29	1.09	0.000000000
Carrizo North	3.18	0.62	1.17	5.44	0.0093	1.12	0.00	0.000000000
Barstow	1.85	0.29	10.91	25.07	0.0065	3.39	0.76	(0.000000403)
Solano	0.36	0.12	0.05	13.90	0.0191	2.29	10.90	(0.000000043)
Needles	2.25	1.04	11.88	31.09	0.0123	0.00	0.00	(0.000000482)
Riverside East-A	2.74	0.43	5.89	21.66	0.0107	0.00	0.00	(0.000000079)
Imperial South	2.64	0.49	1.50	7.13	0.0055	1.22	3.88	(0.000000012)
Cuyama	3.02	1.00	0.11	7.09	0.0283	0.00	0.00	0.000000000
Victorville-B	2.68	0.12	11.31	15.89	0.0146	1.61	0.09	(0.000000131)
San Bernardino - Baker	2.84	0.35	3.82	29.76	0.0070	6.07	0.06	(0.000000118)
Santa Barbara	0.95	1.79	4.57	33.98	0.0392	7.10	0.00	(0.000000143)
Round Mountain-A	0.15	0.66	15.02	61.57	0.0332	2.85	0.00	(0.000000133)
San Diego North Central	0.93	0.12	15.04	77.28	0.0912	4.42	12.90	(0.000001283)
Lassen South-A	0.63	7.55	22.07	102.77	0.0371	16.93	11.06	(0.000000289)

Appendix C. Ranking

Ranking Score = 5 × (Criterion value) ÷ (Maximum criterion value)

California CREZ Environmental Ranking Results – Ranking Order

CREZ Name	#1 Affected Area	#2 ROW	#3 CREZ Yellow & Black Area	#4 Buffer Yellow & Black Area	#5 Significant Species	#6 Corridors	#7 IBA	#8 Degraded	TOTAL
Imperial North-A	0.21	0.10	0.38	0.28	0.30	0.23	1.21	0.00	2.71
Twentynine Palms	4.15	0.40	0.00	0.21	0.48	0.25	0.00	(2.65)	2.84
Mountain Pass	3.26	0.41	0.94	0.93	0.31	0.00	0.30	(2.22)	3.92
Tehachapi	2.81	0.08	0.31	0.19	0.16	0.54	0.24	(0.34)	3.98
Fairmont	3.13	0.02	0.04	0.14	0.18	0.25	0.31	(0.03)	4.03
Pisgah-A	4.24	0.12	0.01	0.16	0.20	0.00	0.00	(0.37)	4.37
San Diego South	0.74	0.44	0.47	1.01	1.14	1.35	0.02	(0.74)	4.42
Imperial East	4.20	0.52	0.68	0.72	0.70	0.34	0.39	(2.66)	4.89
San Bernardino - Lucerne	3.63	0.08	0.43	0.51	0.48	0.44	0.01	(0.63)	4.94
Victorville-A	3.82	0.05	0.00	0.00	0.57	0.54	0.00	0.00	4.98
Iron Mountain	4.47	0.30	0.09	0.12	0.08	0.00	0.00	(0.02)	5.04
Palm Springs	0.39	0.09	0.72	0.56	1.49	1.78	0.38	(0.20)	5.20
Kramer	4.03	0.13	0.90	0.56	0.12	0.28	0.39	(1.20)	5.21
Lassen North-A	1.14	1.95	0.11	0.38	0.77	1.39	0.00	(0.11)	5.63
Inyokern	3.85	0.19	0.84	0.52	0.22	0.22	0.00	(0.12)	5.72
Owens Valley	4.11	0.41	0.00	0.09	0.50	0.69	0.38	0.00	6.17
Carrizo South	4.94	0.57	0.00	0.04	0.30	0.38	0.42	0.00	6.65
Carrizo North	5.00	0.41	0.27	0.26	0.51	0.33	0.00	0.00	6.78
Barstow	2.91	0.19	2.47	1.22	0.35	1.00	0.29	(1.57)	6.87
Solano	0.57	0.08	0.01	0.68	1.05	0.68	4.22	(0.17)	7.11
Needles	3.54	0.69	2.69	1.51	0.68	0.00	0.00	(1.88)	7.23
Riverside East-A	4.31	0.28	1.33	1.05	0.59	0.00	0.00	(0.31)	7.26
Imperial South	4.16	0.33	0.34	0.35	0.30	0.36	1.50	(0.05)	7.29
Cuyama	4.76	0.66	0.03	0.34	1.55	0.00	0.00	0.00	7.35
Victorville-B	4.21	0.08	2.56	0.77	0.80	0.48	0.04	(0.51)	8.43
San Bernardino - Baker	4.47	0.23	0.87	1.45	0.39	1.79	0.02	(0.46)	8.76
Santa Barbara	1.49	1.18	1.03	1.65	2.15	2.10	0.00	(0.56)	9.05
Round Mountain-A	0.24	0.44	3.40	3.00	1.82	0.84	0.00	(0.52)	9.22
San Diego North Central	1.46	0.08	3.41	3.76	5.00	1.31	5.00	(5.00)	15.02
Lassen South-A	1.00	5.00	5.00	5.00	2.03	5.00	4.29	(1.13)	26.19

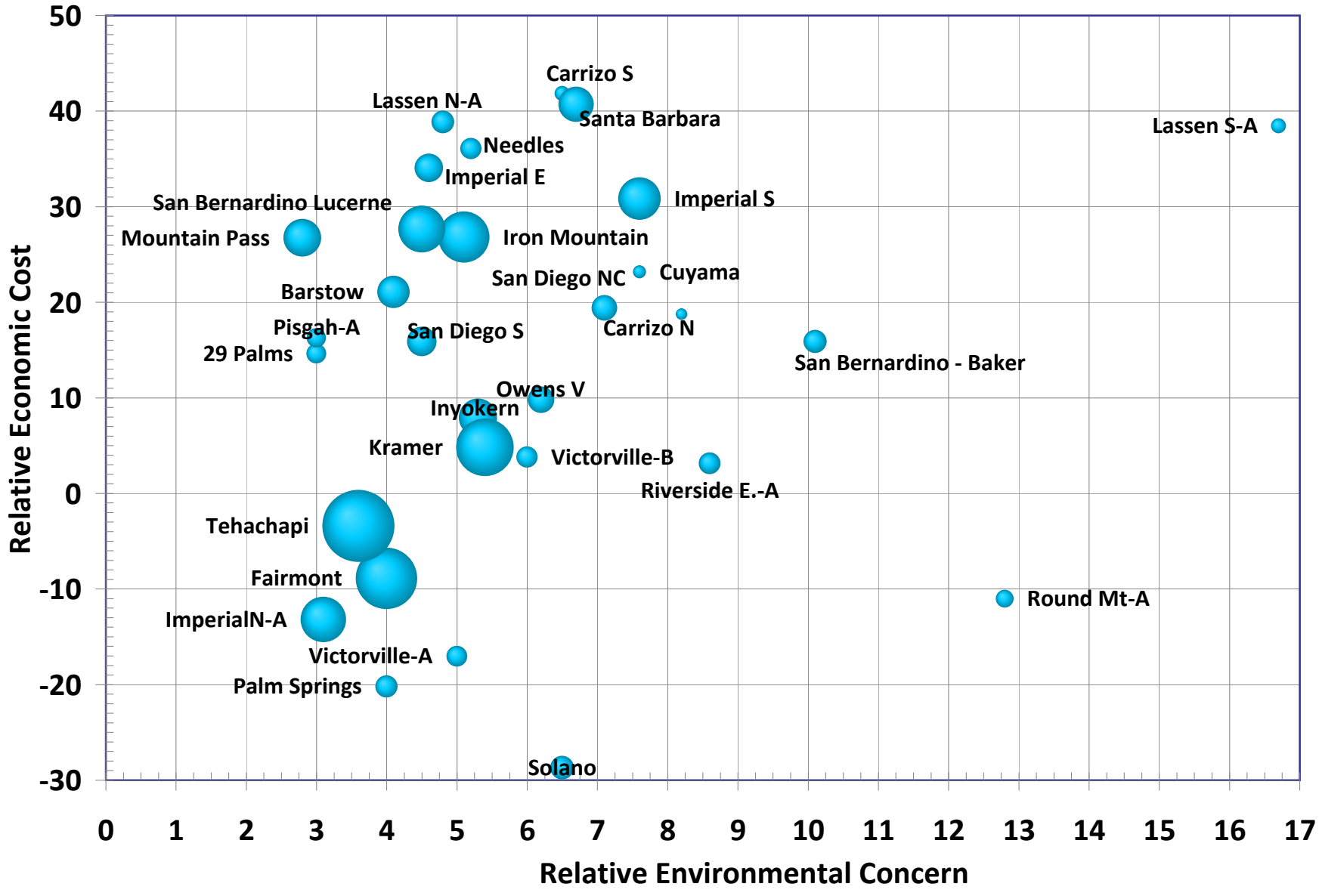
Appendix D. Land Ownership

CREZ_NAME	Total CREZ Area (Acres)	Federal Area (Acres)	Non-Federal Area (Acres)	% Federal
Barstow	103,466	61,049	42,417	59%
Carrizo North	45,869	0	45,869	0%
Carrizo South	47,708	76	47,632	0%
Cuyama	6,150	0	6,150	0%
Fairmont	152,274	3,053	149,221	2%
Imperial East	53,661	51,076	2,584	95%
Imperial North - A	52,286	12,200	40,087	23%
Imperial South	76,063	43,637	32,426	57%
Inyokern	57,738	39,537	18,201	68%
Iron Mountain	96,149	83,986	12,163	87%
Kramer	118,487	46,093	72,394	39%
Lassen North - A	93,417	71,000	22,416	76%
Lassen South - A	60,648	47,392	13,255	78%
Mountain Pass	92,284	87,982	4,302	95%
Needles	51,149	39,831	11,319	78%
Owens Valley	11,547	148	11,398	1%
Palm Springs	30,871	9,939	20,932	32%
Pisgah - A	16,187	12,878	3,309	80%
Riverside East - A	32,327	26,136	6,191	81%
Round Mountain - A	42,228	24,217	18,011	57%
San Bernardino - Baker	43,869	42,750	1,119	97%
San Bernardino - Lucerne	166,109	100,353	65,756	60%
San Diego North Central	37,755	6,853	30,902	18%
San Diego South	25,807	17,523	8,284	68%
Santa Barbara	37,464	0	37,464	0%
Solano	34,395	0	34,395	0%
Tehachapi	330,083	59,164	270,919	18%
Twentynine Palms	23,441	6,662	16,779	28%
Victorville-A	17,522	0	17,522	0%
Victorville - B	74,334	36,874	37,460	50%
TOTALS	**2,031,288**	**930,409**	**1,100,880**	**46%**

Appendix E. Wind Industry Results

Table 3-1. CREZ Environmental Ranking Results Using Wind Industry Formulas.

CREZ Name	Annual Energy (GWh/yr)	Score Using Wind Formulas	Score Using EWG Formulas
Mountain Pass	6,942	2.8	3.9
Twentynine Palms	1,944	3.0	2.8
San Diego South	1,829	3.0	4.4
Imperial North-A	10,095	3.1	2.7
Tehachapi	25,091	3.6	4.0
Fairmont	18,318	4.0	4.0
Palm Springs	2,465	4.0	5.2
Barstow	5,106	4.1	6.9
Pisgah-A	4,283	4.5	4.4
San Bernardino - Lucerne	10,722	4.5	4.9
Imperial East	3,991	4.6	4.9
Needles	2,517	4.8	7.2
Victorville-A	2,112	5.0	5.0
Iron Mountain	12,713	5.1	5.0
Lassen North-A	2,195	5.2	5.6
Inyokern	7,136	5.3	5.7
Kramer	16,251	5.4	5.2
Victorville-B	2,267	6.0	8.4
Owens Valley	3,433	6.2	6.2
Solano	2,721	6.5	7.1
Santa Barbara	1,121	6.5	9.1
Carrizo South	6,118	6.7	6.7
Carrizo North	3,225	7.1	6.8
Imperial South	8,776	7.6	7.3
Cuyama	847	7.6	8.4
San Diego North Central	702	8.2	15.0
Riverside East-A	2,339	8.6	7.3
San Bernardino - Baker	2,705	10.1	8.8
Round Mountain-A	1,598	12.8	9.2
Lassen South-A	1,106	16.7	26.2


Relative Economic Cost
Relative Environmental Concern
50
40
30
20
10
0
-10
-20
-30
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Carrizo S
Lassen N-A
Santa Barbara
Lassen S-A
Needles
Imperial E
Imperial S
San Bernardino Lucerne
Mountain Pass
Iron Mountain
San Diego NC
Cuyama
Barstow
Carrizo N
Pisgah-A
San Diego S
29 Palms
San Bernardino - Baker
Owens V
Inyokern
Kramer
Victorville-B
Riverside E.-A
Tehachapi
Fairmont
Round Mt-A
ImperialN-A
Victorville-A
Palm Springs
Solano