

California Energy Commission  
Electricity System Implications of 33 Percent Renewables

22 June 2009

Subject: Summary of RETI process for the Energy  
Commission Workshop on Electricity System  
Implications of 33 Percent Renewables

Dear Kevin Barker:

Thank you for the opportunity to participate in the Energy Commission's Joint Integrated Energy Policy Report and Renewables Committee Workshop on "Electricity System Implications of 33 Percent Renewables". Black & Veatch is pleased to submit these comments in response to your request for information.

Our comments are primarily related to our involvement in Phase 1 of the Renewable Energy Transmission Initiative (RETI); however, they are also influenced by our work on the Western Renewable Energy Zones (WREZ) project and various assignments for other public and private clients throughout the West. It is important to note that these comments are submitted by Black & Veatch and do not necessarily represent the viewpoint of our clients or any other participants in these activities. However, the information provided in these comments is largely adapted from the Executive Summary for the RETI Phase 1B report, available on the Energy Commission's website at [www.energy.ca.gov/reti](http://www.energy.ca.gov/reti).

Black & Veatch was hired as the primary technical and economic consultant to support Phase 1 of RETI, which was completed in January 2009. Black & Veatch has also had a much more limited role in Phase 2 of RETI, which is still ongoing and for which a draft report has recently been issued.

Answers to the questions you posed are provided below.

**1. What is/was the purpose and principle research questions of the study?**

The Renewable Energy Transmission Initiative (RETI) is a collaborative stakeholder planning process initiated as a joint effort among the California Public Utilities Commission (CPUC), the Energy Commission, and the California Independent System Operator (CAISO), together with publicly owned and investor owned utilities. RETI's work is undertaken by a Stakeholder Steering Committee (SSC) that involves a broad range of participants, first to gather information and advice, and then to build 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. The purpose of Phase 1 of was to identify those CREZs that can be developed in the most cost effective and environmentally benign manner.

The Phase 1A report, accepted by the SSC in May 2008, described the methodology, assumptions and resource information to be used in Phase 1B of RETI project. Phase 1B was a high-level screening analysis that applied a resource valuation methodology. Potential renewable energy projects were grouped into CREZs based on geographical proximity, development timeframe, shared transmission constraints, and additive economic benefits. CREZs were then 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 has refined the analysis of CREZ generation potential, including project siting constraints, and identified key transmission segments that support a statewide conceptual transmission plan. Phase 3 will advance this plan into proposals for specific transmission projects that can be approved, financed and built to provide renewable energy to customers across the state in the most cost-competitive and least environmentally harmful ways.

## **2. Brief description of methodology/links to documentation**

The Energy Commission maintains an active website that includes all documentation related to RETI: [www.energy.ca.gov/rete](http://www.energy.ca.gov/rete). The Phase 1 and 2 reports fully document the approach used. The Phase 1 methodology is summarized here.

RETI Phase 1 included assessments of both the economics of renewable energy and potential environmental impacts.

The economic assessment of renewable energy resources focused on California, with less detailed analysis of resources in Nevada, Arizona, Oregon, Washington, British Columbia, and the border region of Baja California. Maps and other supporting materials are available on the RETI website. The economic assessment estimates the cost of developing renewable resources throughout these areas and transmitting the energy to California. In addition, the assessment estimates the value of this energy by considering the energy (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.

At the direction of the SSC, an Environmental Working Group (EWG) assessed potential environmental concerns associated with CREZs identified by Black & Veatch and the renewable energy development areas within them. The EWG identified areas in which energy development is prohibited or significantly restricted by law or policy. CREZs identified by Black & Veatch were designed to be consistent with these restrictions.

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 relied 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 several different criteria.

Once the economic and environmental metrics were established, the CREZs were compared with the purpose to identify those areas which offer the greatest renewable energy potential, at the least cost, and with the lowest environmental impact.

## **3. Key drivers**

Key drivers identified in the Phase 1 RETI analysis include:

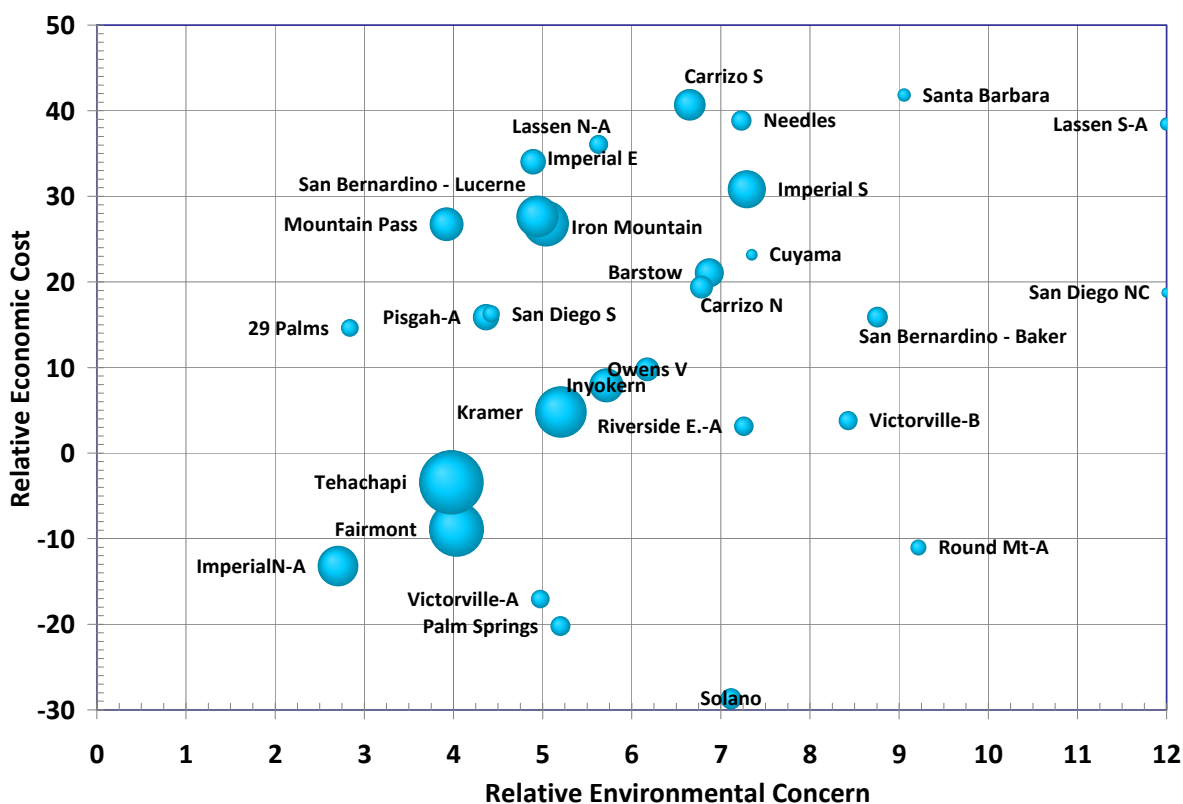
- Renewable energy demand
- Renewable energy potential and resource quality in various portions of the West, especially California
- Environmental and other restrictions on land available for renewable energy development
- Economics of different renewable energy technologies, including their differential value

- Potential for improvements in technology costs, especially related to solar technologies
- Cost of developing new transmission
- Time constraints for generation and transmission development

#### 4. Findings and conclusions

As a result of the Phase 1 study, 29 California CREZs capable of delivering total annual energy of approximately 200,000 gigawatt-hours per year (GWh/yr) were identified. 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 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.

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. It is impossible to develop a single formula for accurately combining the two sets of results. Nevertheless, the chart below is helpful to identify those CREZs that scored well (or poorly) in both metrics. CREZs in the lower left section of the chart have the lowest (best) combination of economic and environmental ranking scores. It is important to note that these Phase 1 scores focus on the impacts associated with the generation development in each CREZ, and not the transmission required to reach them (Phase 2).



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

In addition to the California CREZs identified in the chart above, various out-of-state resources were also found to be competitive with California CREZs. These are identified in the Phase 1B report and are undergoing additional evaluation in Phase 2.

## **5. Uncertainties**

The SSC helped to develop, and agreed in general on the assumptions used, as described in the RETI Phase 1 reports. 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 economic rankings included “uncertainty bands” to reflect this.

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). The full list of sensitivity studies includes: tax credits, high and low market energy value, high and low 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.

Tables summarizing CREZ rankings under different sensitivity scenarios are presented in the RETI Phase 1B report.

## **6. Lessons for implementing a higher level of renewable in California by 2020.**

Meeting the 33 percent renewable energy target by 2020 is an ambitious objective that will require continual stakeholder coordination through processes like RETI. There is no single solution that will allow the state to meet its targets. Numerous multi-billion dollar generation and transmission initiatives must simultaneously be advanced, each of which would likely be considered very ambitious in its own right. To provide the most cost-effective energy in an environmentally responsible manner will require many stakeholders to act in a coordinated manner to advance their common objectives.

## **7. Recommendations for further analysis**

The RETI process is continuing as described earlier in Phase 2 and Phase 3. In Phase 2, the SSC has refined the analysis of CREZ generation potential, including project siting constraints, and identified key transmission segments that support 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.

## **8. Input assumptions: matrix for comparing studies**

### **a. Load forecast used**

RETI used the CEC statewide load forecast prepared as part of the 2007 Integrated Energy Policy Report, which extends through 2018. (California Energy Commission, “California Energy Demand 2008-2018: Staff Revised Forecast, FINAL Staff Forecast, 2nd Edition”, Publication # CEC-200-2007-015-SF2, November 2007.) 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.

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**b. How was the “additional renewables” (amount required for 33 percent renewable energy by 2020) calculated for your study?**

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”. 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. The RETI Net Short calculation was updated as part of the Phase 2 RETI process.

**c. What did you assume for Renewable Portfolio Standard developments in the rest of Western Electricity Coordinating Council (WECC)?, how much fossil generation was added to replace once-through cooling retirements and how much was added to “back-up” intermittent renewable energy in California and the rest of the WECC?**

These questions were not addressed by RETI.

**d. What major transmission upgrades were included and in what year in California and the rest of WECC?**

These questions were not addressed by RETI.

We trust that this submittal meets your expectations and needs. Should you have any comments, please feel free to contact me at (925) 949-5929.

Very truly yours,

BLACK & VEATCH

Ryan Pletka, P.E.  
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RJP  
Enclosure[s]