The Role of RETI and the Constraints Imposed by CREZs in Meeting California's Renewable Portfolio Standard — By Tynan McAuley

California's choice to conform to a 33% RPS necessitates capturing immense amounts of renewable energy, a resource that is widely distributed throughout California and the surrounding areas. To efficiently, sustainably secure renewable energy, California must make widespread changes to its electricity transmission infrastructure—an onerous task. To help coordinate this effort, a number of California's energy stakeholders—the California Public Utilities Commission (CPUC), the California Energy Commission (CEC), the California Independent System Operator (CAISO), along with various Investor-Owned Utilities and Public Utilities—have created the Renewable Energy Transmission Initiative (RETI).[1] According to RETI's website, their goals are to "help identify the transmission projects needed to [fulfill California's] energy goals [,] facilitate transmission corridor designation [,] facilitate transmission and generation siting permitting [, and] support future energy policy."[1] To accomplish these goals, RETI's Stakeholder Steering Committee (SSC)—a group of "transmission owners/providers; generators; utilities/power purchasers; local, state and federal permitting agencies; landowners; and environmental and public interest organizations"—commissions studies of California's renewable energy resources, and how best to acquire them.[2] The SSC creates smaller groups to carry out RETI's field and research work. Additionally, a Plenary Stakeholder Group (PSG), composed of any concerned parties that wish to join, oversees

[1] "Background on California Renewable Energy Transmission Initiative." California Energy Commission. http://www.energy.ca.gov/reti/background.html (accessed July 29, 2009).
[2] "Stakeholder Steering Committee." California Energy Commission. http://www.energy.ca.gov/reti/steering/index.html (accessed July 30, 2009).

and critiques the work of the SSC, so that any groups not represented in the SSC may have a say in RETI's work and the presentation of their findings.[3]

RETI has organized their studies into a series of phases, and recently (as of March 4, 2009) completed Phase 1, in which RETI conducted a preliminary assessment of the available renewable energy resources, or Competitive Renewable Energy Zones (CREZs). CREZs are pieces of land located throughout California, Nevada, Arizona, Baja California, and the Pacific Northwest, which prove to have promising development potential.[4] With the culmination of Phase 1, RETI presented a list of CREZs in the aforementioned locales ranked by three criteria: resource potential, development cost, and environmental impact. The following section will explore in more depth the assessment of CREZs so as the better understand the nature of the above criteria.

However, it is important to keep in mind that RETI's motivation for identifying these CREZs is to "inform RETI decisions regarding major electric transmission projects needed to access [available renewable energy]."[5] Indeed, the optimization of new transmission projects (or efficient use of existing transmission capital) is essential to California's success in meeting its RPS at all, not because of line-loss issues (which turn out to be minimal), but because of the enormous cost associated with building new transmission lines and substations. So, this RETI project seeks to determine where new transmission projects must be built to most effectively allow access to renewable energy resources and what existing transmission infrastructure can be used to transmit renewably-generated electricity.

Shifting focus back to the CREZ selection process, RETI must initially screen which areas it chooses to assess, after which it analyzes projects—either actual or hypothesized—that

---

[3] "Plenary Stakeholder Collaborative (Public)." California Energy Commission. http://www.energy.ca.gov/reti/plenary/index.html (accessed July 30, 2009).
[4] "Phase 1A: Final Report." *Renewable Energy Transmission Initiative*, April 2008.

make the best use of the CREZ. To determine what projects would be best, RETI evaluates the renewable resources present in each of the CREZs, which allows it to assign a rank cost to each zone. The rank cost is equal to the energy generation cost, plus the energy transmission cost, minus the energy value, minus the capacity value; as such, lower scores represent the most cost-effective CREZs (this equation will be explained in further depth later).[5] Another factor in developing this rank cost is evaluating the transmission costs (or lack thereof) depending on the proximity of transmission lines and substations. To develop this transmission information, RETI relied on both existing information and proprietary research conducted by the research firm they hired, Black & Veatch.

RETI's Environmental Working Group (EWG) conducted an environmental analysis on the CREZs identified in RETI's Phase 1 reports.[5] The EWG attempted to quantify the relative environmental concern in each CREZ using eight different factor; lower scores represented a lower level of environmental concern. The eight environmental factors were "energy development footprint," "transmission footprint," "sensitive areas in CREZs," "sensitive areas in CREZ buffer areas," "significant species," "wildlife corridors," "important bird areas," and "land degradation."[5] For all of these factors, the EWG summed the amount of the factor in question (for example, acreage of new power lines needed for "transmission footprint," or number of threatened species for "significant species") and then divided this number by the annual energy output of the CREZ, so as to normalize the results. It is important to note that for the "energy development footprint" criterion, the amount of acreage taken up for wind power was multiplied by 0.035, since the US Department of Energy (DOE) estimates that in a wind power area, only

[5] "Phase 1B: Final Report." *Renewable Energy Transmission Initiative*, March 2009.

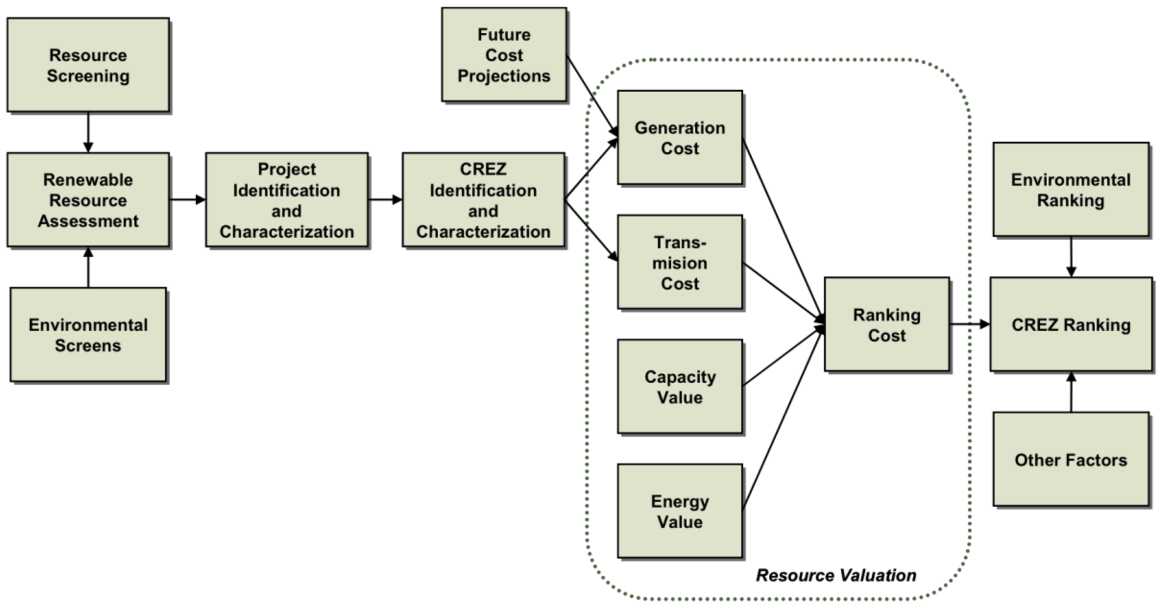

Figure 1: CREZ ranking methodology

3.5% of the land is actually occupied.[5] Figure 1 presents a simplified, graphical representation of the CREZ ranking process.[6]

Another subject worth delving into is the rank cost that RETI assigns to its CREZs. Understanding how RETI develops this cost will help the reader interpret the rank costs that will presented later in this paper. Four elements compose the rank cost: generation cost, transmission cost, energy value, and capacity value. The following section will describe these components as explained by RETI's Final Report from Phase 1B.

As stated in the RETI report, the generation cost is the "levelized cost of generating power over the life of the resource." Calculated in units of $/MWh, this metric is frequently used in the energy business to compare the cost efficiency of different forms of energy generation. RETI used a Microsoft Excel spreadsheet to calculate the LCOE in this report, and they have made that spreadsheet available on their website.[7] The main areas that the generation cost covers are "operations and maintenance costs, fuel costs (as appropriate), cost of equity

---

[6] Image taken from "Phase 1A: Final Report." *Renewable Energy Transmission Initiative*, April 2008.
[7] Spreadsheet available for download at http://www.energy.ca.gov/reti/steering/2008-06-18_meeting/2008-06-18_B&V_Cost_of_Generation_Spreadsheet.xls

investment in capital, cost of financing capital, [and] taxes, including investment and production credits."[5]

Next in the formula for the rank cost is the cost of transmission. Transmission costs are unique for each project, as various projects have different load sizes and are different distances from existing transmission lines and substations (note that RETI considers costs for connecting generation projects to substations to be part of capital costs, not transmission costs).[5] For each project, RETI considered the costs of either upgrading or building new substations to integrate the generation project into the grid; of building new lines to connect substations to existing high-voltage line; and of transmission along these lines to the existing grid (it is important to note that at this time, RETI is preparing the report for Phase 2, which will include a more in-depth load-flow analysis of electricity transmission, which is required to assess the need for upgrading existing transmission lines).[5] Furthermore, RETI included a 5% transmission loss factor for in-state transmission, and a loss factor of 0.2 MW per mile for out of state transmission.[5]

The previous two factors, generation and transmission costs, add to the rank cost of each CREZ, while the following to factors, energy and capacity value, subtract from the rank cost, and in some cases make the rank costs negative. The energy value is calculated by simulating the value of the produced energy, which varies with the time of day (divided into "the WECC traded periods: off-peak, on-peak, and super-peak").[4] To accomplish this, RETI projects the amount of electricity produced by each resource during these three periods, then multiplies than amount by an appropriate energy value for the period (higher or peak periods, lower for off-peak periods); this gives the annual value of energy for the resource in $/year.[4] To convert this to an average energy value, in $/MWh, they then divide by the resource's annual energy output; this final value is plugged into the rank cost equation.[4]

The final factor in rank cost, the capacity value, is "based on its ability to provide dependable and reliable capacity during peak period when the system requires reliable resources for stable operation."[5] RETI has determined that this "peak period" is 12:00 p.m. to 6:00 p.m. during the summer months (June through September); so to calculate the capacity value of a resource, they determine the "capacity credit" of a project (a percentage out of 100%, where 100% represents complete reliability in providing power during the peak period) and then multiply that by a "baseline capacity value."[5] RETI determined this baseline capacity value to be "the levelized fixed costs of a simple cycle gas turbine generator, owned by a merchant generator," which is $204/kW/year; this represents the "cost of the next most likely addition of low-cost capacity."[4] In summary, the final rank cost equation is indicated in Figure 2.

$$\textit{Rank Cost} = \textit{Generation Cost} + \textit{Transmission Cost} - \textit{Energy Value} - \textit{Capacity Value}$$

Figure 2: RETI Rank Cost Equation

Over the course of their Phase 1 research, RETI "identified over 2,100 renewable resource projects, with a combined generating capacity of over 153,000 MW."[5] To organize the locations of these resources, RETI distinguished between California resources, North Out-of-State resources (in Oregon; Washington; and British Columbia, Canada), Nevada resources, and Southern Out-of-State resources (in Arizona and Baja California Norte, Mexico).[5] RETI conducted more in-depth economic and environmental analysis on the in-state resources, so while this paper does include information on out-of-state solar resources, RETI did not gather any environmental data on the out-of-state resources, so the analysis on out-of-state CREZs will be less complete than the analysis on California CREZs. Table 1 presents the most cost-efficient CREZs, up to the amount that are needed to fulfill California's net short, or the amount of energy that RETI predicts California will need to produce in the year 2020 to fulfill the 33% RPS. RETI calculated the net short to be 59,710 GWh.[5]

CREZ Name	Annual Energy (GWh/yr)	Weighted Average Rank Cost ($/MWh)	Environmental Ranking
Solano	2,721	-29	7.11
Palm Springs	2,465	-20	5.20
Victorville-A	2,112	-17	4.98
Imperial North-A	10,095	-13	2.71
Round Mountain-A	1,598	-11	9.22
Fairmont	18,318	-9	4.03
Tehachapi	25,091	-3	3.98
Total Energy per year: 62,400 GWh			

Table 1: CREZ's needed to fulfill California's net short

While the rank costs in Table 1 paint a promising picture for renewable resources, the cost goes up considerably when only considering solar resources.[8] In total, RETI identified 194,083 GWh/year of generation capacity in their study of CREZs.[5] Table 2 shows the most cost-efficient CREZs that contain solar energy resources, up to the amount that are needed to fulfill California's net short.[8] It is important to note that the Weighted Average Rank Cost column is calculated by RETI when considering all of the resources in the entire CREZ, so that cost may not entirely reflect the value of the solar resources; the final column shows how much of the rank cost is calculated using Large Solar as the resource.

CREZ	Large Solar Generation (GWh/yr)	Weighted Average Rank Cost ($/MWh)	Environmental Ranking	% of CREZ resources that are Large Solar
Victorville-A	2112	-17	4.98	100% Solar
Fairmont	14179	-9	4.03	73% Solar
Tehachapi	15371	-3	3.98	58% Solar
Riverside East-A	2462	3	7.26	100% Solar
Victorville-B	2069	4	8.43	86% Solar
Kramer	16467	5	N/A	96% Solar
Inyokern	6798	8	5.72	90% Solar
Owens Valley	3613	10	6.17	100% Solar
Total Energy per year: 63071 GWh				

Table 2: CREZ's needed to fulfill California's net short

[8] Data from "Phase 1B: Final Report." *Renewable Energy Transmission Initiative*, March 2009.

A note on the environmental rankings: RETI only reported 30 environmental scores, which range from 2.71, at the best, to 26.19, at the worst, while the top 10 scores are all under 5.0. This should give some perspective when judging the environmental scores listed in the two tables above.