Summary of 33% RPS Implementation Analysis Preliminary Results report
California Public Utilities Commission Staff Report
Available at www.cpuc.ca.gov/renewables

Discussion Questions for Joint Integrated Energy Policy Report and Renewable Committee Workshop "Electricity System Implications of 33 Percent Renewables"

June 29, 2009

Questions for Participants in the Panel of Authors

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

   The CPUC's Energy Division staff initiated this study in August 2008 in order to provide a quantitative analysis of the costs and risks of alternative means of achieving a 33% RPS by 2020. The report seeks to answer two key questions: 1) How much will it cost to meet a 33% RPS, and 2) how will the state reach a 33% RPS by 2020? This report does not recommend a preferred strategy on how to reach a 33% RPS, but rather provides an analytical framework for policymakers to weigh the tradeoffs inherent in any future 33% RPS program for California.

   This study provides a more in-depth, granular, and comprehensive analysis of different possible renewable scenarios compared to these previous studies. It draws heavily on most of the sources described above for data and assumptions, including the Renewable Energy Transmission Initiative (RETI) and the greenhouse gas (GHG) Calculator, both of which were scrutinized and evaluated through stakeholder processes. The analysis also used a stakeholder working group to vet and refine the study methodology, assumptions, and inputs, especially when the assumptions differed from existing studies. For example, the renewable technology cost numbers from RETI were used, except the financing assumptions were modified to incorporate recent changes in financial markets. This report also incorporates new resource potential identified in RETI and other sources, existing resources from the Western Electricity Coordinating Council's (WECC) most recent west-wide study cases, and proposed projects under development (identified through utility procurement solicitations). As a result, the renewable energy project and cost data underlying this analysis is the best publicly available data to date.

   In addition, this study is the first effort to create comprehensive generation and transmission timelines that illustrate the many steps required to bring renewable energy projects in California from conception to commercial operation. This study elevates the analysis from a general discussion of perceived barriers into illustrative timelines that depict the magnitude of the coordination challenge associated with a 33% RPS.

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

   See Appendix B of the report for a more detailed discussion (www.cpuc.ca.gov/renewables).

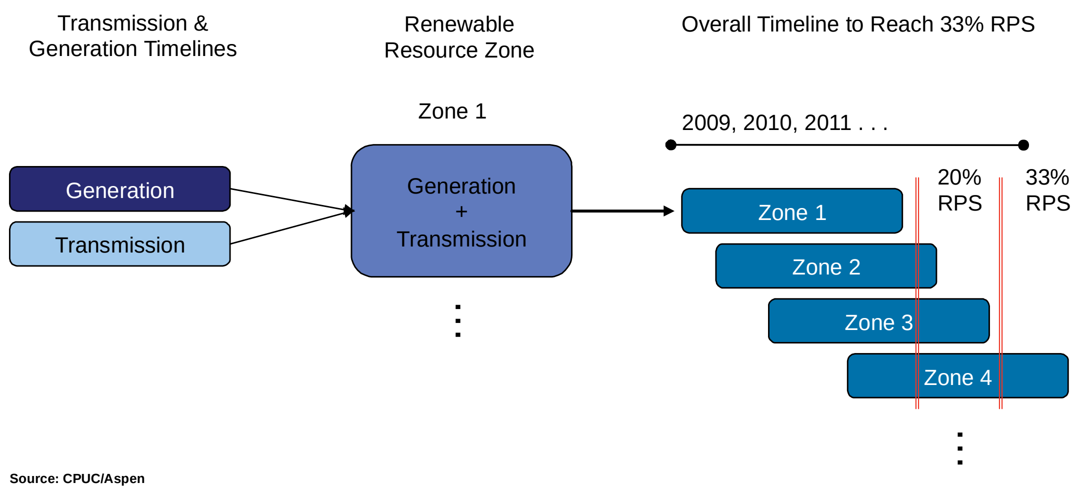
Renewable Resource Portfolios and Costs Methodology Overview

E3 first created an RPS Calculator, which is a Microsoft Excel spreadsheet model developed to aggregate the renewable cost and performance data and select renewable resources needed to meet the RPS target. The model identifies transmission investments that deliver renewable resources to load and conventional resources that are needed to meet energy and peak demand growth. It also calculates the cost and GHG impacts of a given portfolio of resources in 2020. Second, Energy and Environment Economics (E3) calculated the renewable resource need to determine how much renewable energy the state needs to procure between now and 2020 to meet the 33% RPS. E3 used the Energy Commission's 2007 Integrated Energy Policy Report (IEPR) load forecast to project statewide electricity load in 2020, which included assumptions on the state's achievement of energy efficiency, demand response, combined heat and power, and the California Solar Initiative. In order to fill this need, data was collected drawing from the sources described in Appendix B. Next, each renewable project was placed into a resource zone, which is an aggregation of renewable resources in a contained geographic area. These zones were then ranked by both economic and environmental factors. From this data, the study team developed five different renewable energy cases.

Timeline Methodology Overview

In order to construct illustrative timelines for the 33% RPS Reference Case, the study team first created generic timelines that estimate the permitting and construction times for generation projects – by technology, size, and permitting jurisdiction – and for transmission projects. These generic generation and transmission timelines were then used to create timelines for each resource zone selected in the 33% RPS Reference Case. Finally, the resource zone timelines were combined to create an overall timeline for the 33% RPS Reference Case. Figure 1 illustrates this process.

Figure 1. Process for Developing 33% RPS Reference Case Timelines



3. Key drivers

The key drivers that determine when the state can reach a 33% RPS include:

- Timing of transmission planning and processing of transmission permit applications
- Timing of generation permitting
- External Risks
    - New technology/new company
    - Financing
    - Environmental/land use
    - Legal challenges/public opposition

There are different procurement strategies to reach a 33% RPS and perhaps mitigate the time delay associated with some of these processes and external risks. Key questions the state should consider when designing a 33% RPS include:

- Should California focus public investment and system planning efforts on developing and integrating technologies with significant long-term transformational potential such as solar thermal or solar photovoltaics (PV)?
- Should California focus on developing in-state resources? Up to what cost? What is the correct balance between in-state economic development and higher customer costs?
- Is California willing to delay the 2020 target in order to develop primarily California resources and stimulate new technologies and market transformation?
- Should California waive renewable energy delivery requirements for out-of-state resources if it is necessary to meet the 2020 target or pursue a lower cost strategy?
- Should the CPUC encourage the utilities to procure increased amounts of (currently) high-cost solar PV to mitigate the potential negative impact of delay due to failure of a resource zone?

4. Findings and conclusions

See Section 5 of the report for a more detailed discussion.

The findings of this analysis include:

- Achieving a 33% RPS will require tradeoffs between various policy goals and objectives
- Several critical process reforms have been implemented or are in the early stages of development and implementation that can help speed achievement of a 33% RPS

- Achieving a 33% RPS by 2020 is highly ambitious, and California must start implementing mitigation strategies if a 33% RPS by 2020 is the most important policy priority
- The magnitude of a 33% RPS is unprecedented and will require nearly a tripling of renewable electricity in the next 10 years
- Electricity costs will be higher in 2020 compared to 2008, regardless of whether California mandates a 33% RPS or not
- A 33% RPS could theoretically serve as a potential hedging strategy against volatile fossil fuel prices, but only if natural gas and CO_2 price allowances are very high
- The interplay between energy efficiency achievement and renewable energy procurement highlights the need to analyze and plan for interactions among the state's various policy goals
- Dramatic cost reductions in solar PV could make a solar distributed generation (DG) strategy cost-competitive with central station renewable generation

5. Uncertainties

Costs are uncertain for a number of reasons. Chief among these are:

- Use of planning-level data regarding technology cost and performance from RETI and other sources rather than contract prices associated with any particular project
- Assumption of no changes in renewable technology costs or performance over time
- Use of high-level estimates of transmission and renewable integration costs
- Natural gas prices are highly volatile and may be very different from forecasted values
- Use of a number of assumptions about GHG regulation including the cost of carbon dioxide allowances in 2020 and the allocation of allowance auction revenues to electric utility ratepayers.

While new data that is forthcoming from RETI and the California ISO may help to refine cost estimates, uncertainty is inherent in any long-term planning exercise, which should be kept in mind when interpreting the results.

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

- Achieving a 33% RPS will require tradeoffs between various policy goals and objectives
- California must start implementing mitigation strategies if a 33% RPS by 2020 is the most important policy priority

7. Recommendations for further analysis

This report captures the preliminary results and conclusions from Phase 1 and Phase 2 of the 33% RPS Implementation Analysis. Phase 3, which CPUC staff intends to finalize by the end of 2009, will integrate the California ISO's renewable integration analysis, RETI and the California ISO's conceptual transmission plans, and the Energy Commission's analysis of once-through cooling fossil plant retirements. In addition, CPUC staff will attempt to identify and articulate possible solutions to many of the risks and challenges identified throughout this report.

8. Input assumptions: matrix for comparing studies

a. Load forecast used

IEPR 2007 Load Forecast

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

The analysis starts with a statewide calculation of the renewable resources that California utilities must procure between 2008 and 2020 to meet a 33% RPS by 2020. The resources needed are calculated as the total required quantity of renewable energy in 2020 (33% of retail sales) minus the actual renewable generation that was claimed by California utilities in 2007.

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?

RPS requirements for the rest of the WECC were based on existing statute in each jurisdiction, with a minimum of 5% for jurisdictions without formal RPS targets. Other jurisdictions assumed to meet in-state RPS requirements with the best available local resources. Remaining resources are made available for export to California. 6600 MW of fossil was assumed to retire due to once-through cooling, of which 2890 MW was assumed to be repowered on-site.

For ranking and selection purposes (but not cost numbers), E3 used a flat adder of $7.50/MWh for wind and solar PV. E3 assumed no integration costs for solar thermal. When calculating the actual integration costs that are reflected in the statewide revenue requirement, E3 used the same methodology as for the GHG study, where the per-MWh costs increase with penetration. E3 calculated the integration costs as a function of penetration separately for wind and solar PV.

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

The analysis identified seven new transmission lines needed to reach a 33% RPS by 2020, which serve nine resource zones. Phase 3 of the study will incorporate the latest information from RETI, which will provide transmission information on a more granular level.

Table 1. Renewable Resource Zones that Need New Transmission for 20% and 33% RPS Reference Cases

Resource Zone	MW	GWh
Included in 20% and 33% RPS Reference Cases		
Tehachapi	3,000	8,862
Solano	1,000	3,197
Imperial North	1,500	9,634
Riverside East	1,350	3,153
Included in 33% RPS Reference Case Only		
Riverside East (incremental)	1,650	3,869
Mountain Pass	1,650	4,041
Carrizo North	1,500	3,306
Needles	1,200	3,078
Kramer	1,650	4,226
Fairmont	1,650	5,003
San Bernardino - Lucerne	1,800	5,020
Palm Springs	806	2,711
Baja	97	321