

CAISO's Plan for Integration of Renewable Resources



July 21, 2008 CEC 33% Renewables Workshop



California ISO
Your Link to Power

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Program Tracks – 2008-9 CAISO Work Plan

Track 1 - Develop Operational Tools

- Wind and Solar energy forecasts and graphic displays for grid operators

Track 2 - Identify market and operational barriers

Track 3 - Engineering studies:

- Analyze impact of solar generation, storage technology, transmission constraints, ramping and regulation requirements - 20% & 33% studies

Track 4 - Development of Market Products

Track 5 - Changes to Large Generator Interconnection and Transmission Planning Processes

What does it take to get to 33% renewables?

Key questions:

1. Should 33% be based on per cent of total energy delivered to retail customers?
 - a) How should it be calculated?

While the easy answer is yes it is the total amount of energy to serve retail customer load, the key question truly is how to calculate this number. In reality, there will probably be 5000 MW or more of PV or other local generation that is “behind the meter”. With net metering, how will this renewable generation be counted? What will be the gross load number that is used in the denominator of the equation to calculate the 33%? Will direct access customers be counted? Will Muni customers be included in the calculation? How will imports of renewable energy be tagged and counted? How do we continue demand response programs and include them in the calculations?

Suggestion: $33\% = 25\%$ renewable energy grid supplied + 8% renewable generation at customer sites. Use Smart Grid metering to measure.

The answers to these questions require some research and policy decisions.

What does it take to get to 33% renewables?

Key questions:

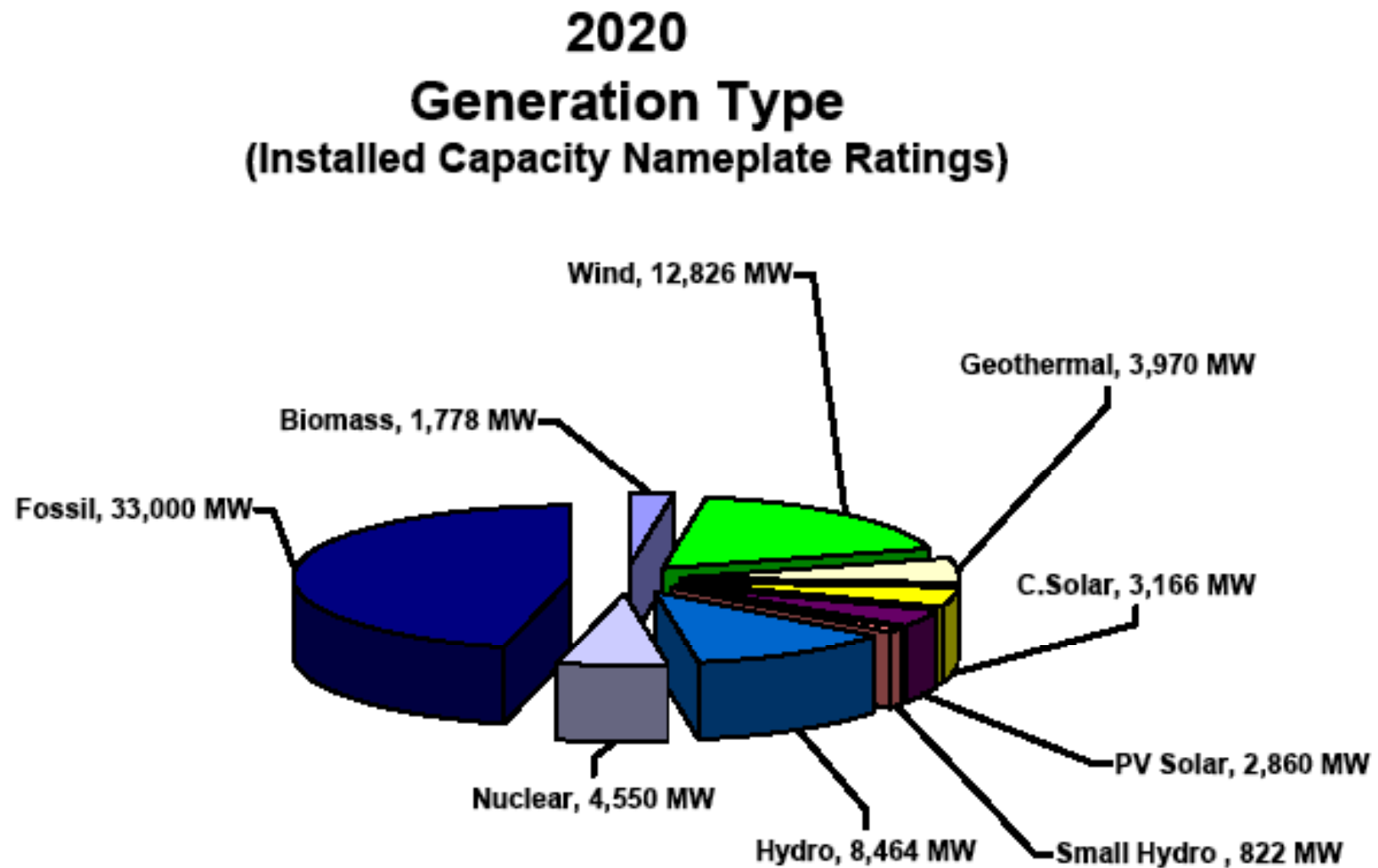
2. What resource mix do you expect for 33%?

- a) What would be the “ideal” resource mix?
- b) What assumptions are reasonable for resource mix?

The next 2 slides show the resource mix we have been assuming for our studies. They are based on the CEC IAP study. There is no perfect generator. Each type of generation has its own characteristics, strengths, and limitations. The goal should be to create a portfolio of resources (generation, fuel supply, transmission capacity, energy storage, and demand response) and an intelligent network (smart grid) to ensure reliability of the electric energy delivery to California customers at a reasonable cost.

Key assumptions are solar energy resources will be economically competitive and major quantities will be added to the system in the next ten years. Significant transmission investments will be approved and built.


33% Renewables – Generation Resource Mix



Forecasted Generation by Type – nameplate ratings

		<u>20% RPS</u>	<u>33% RPS</u>
	<u>2007</u>	<u>2012</u>	<u>2020</u>
Biomass	787	1,008	1,778
Wind	2,688	7,723	12,826
Geothermal	1,556	2,620	3,970
Concentrated Solar	466	1,412	3,166
PV Solar	25	533	2,860
Small Hydro LT 30MW	822	822	822
Hydro	8,464	8,464	8,464
Nuclear	4,550	4,550	4,550
Fossil	27,205	29,100	33,000

What does it take to get to 33% renewables?

 Key questions:

3. Impacts of contract delays & cancellations?

- a) Will the current procurement process achieve 33%?
- b) How does California's plan synchronize with other states?

The CAISO is not directly involved in the current procurement process so we are not in a position to comment on the first question

The Western Governor's Association project on renewables is one of the efforts to develop a regional renewables plan. It is too early to say if it will produce a synchronized regional plan. Each state still appears to be doing their own plans.

The CAISO is working with BPA to synchronize our plans and operating strategies.

What does it take to get to 33% renewables?

- 🌐 Key questions:
 4. What will be the price/cost impact on wholesale and retail rates?

Forecasts of future prices and costs will be driven by many different variables.

Cost impact studies must still be performed. A key driver will be the future cost of natural gas and the impact of climate change on the snow pack and resulting hydro generation available

What does it take to get to 33% renewables?

Key questions:

5. What will be the operational impact? What changes will be needed?

The CAISO is still completing work on operational impacts of 20% renewables. Work on analysis of 33% renewables is scheduled to begin later this year.

A major driver will be the mix of ALL renewable resources – Solar and Geothermal as well as wind generation. A second critical issue will be how much of the renewable energy will be imported and how much will be from within the state. A third issue is what thermal generation will be available after once through cooling and greenhouse gas requirements are implemented. We need to assess these drivers to determine the operational impacts of 33%.


What does it take to get to 33% renewables?

Key questions:

6. What will be the impact on natural gas demand, supply and prices?

Wind generation and other renewable resources is expected to displace thermal generation for significant periods of the year. The result will be increased volatility to the natural gas supply system. If wind suddenly ramps up and thermals shut down, the gas transmission network is impacted. If wind suddenly shuts down, we will have to start 1000's of megawatts of gas turbine generators and the gas system will see a sudden surge in demand. This is going to be a potential issue unless we coordinate electric operations with the gas supply companies. An increase in gas storage in California may be essential to meet these changes in demand.

What does it take to get to 33% renewables?

 Key questions:

7. What will be the environmental impact with large scale renewable resources?

Hopefully very positive. There is no perfect generation resource. Each does have an impact.

What does it take to get to 33% renewables?

- 🌐 General questions:
 8. What studies have been completed on 33% renewables?
 9. What studies are either planned or underway?
 10. What additional studies are needed?

The CEC IAP study is the only one that we know of that has looked at the impact of 33% renewables. The CAISO participated in this study but believe it only begun to analyze some of the issues. There is a lot more work to be done.

We need more data on the operating characteristics of the new types of solar generation for our studies. We also need to finish the RETI studies and determine the transmission required to interconnect the renewables proposed for these designated areas.

Requirements for Integration of Renewables

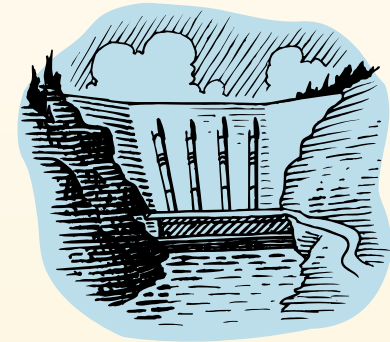
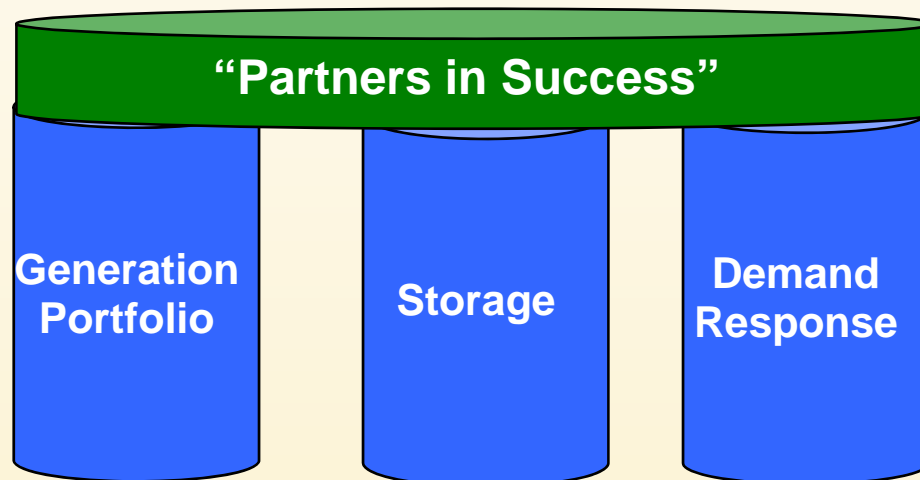


Wind Generation



Solar Generation

Resources Required for Renewables Integration



Hydro Generation

Quick Start Units
Fast Ramping
Wider Operating Range (lower P_{min})
Regulation capability

Shift Energy from off-peak to on-peak
Mitigate Over Generation
Voltage Support
Regulation capability

Price sensitive load
Responsive to ISO dispatches
Frequency Responsive
Responsive to Wind Generation Production

Summary

- Investments in new generation, storage technology and demand response programs will be increasingly important for integration of renewables.
- New wind generation forecasting tools are needed
- New conventional generation with greater flexibility— wind needs partners
- New wind power management procedures
- New tools for grid operators to anticipate changes from wind
- New transmission upgrades and regional transmission plans
- Continued investment in R&D will help create new solutions