



# **2012 Integrated Energy Policy Report Update Proceeding**

## **Renewable Integration Costs, Requirements, and Technologies**

California Energy Commission  
June 11, 2012

<b>DOCKET</b>	
<b>12-IEP-1D</b>	
DATE	JUN 11 2012
RECD	JUN 12 2012



## Background

- CEC prepares IEPR every two years and update in intervening years
- Governor's Clean Energy Jobs Plan in 2010 directed CEC to prepare renewable plan
- *Renewable Status and Issues Report* in 2011 IEPR laid foundation for plan with 5 high-level strategies to address challenges
- Renewable Strategic Plan developed under 2012 IEPR Update



## Renewable Strategic Plan Workshops

- April 12: Evaluating and Capturing Benefits of Renewable Energy
- May 10: Identifying Priority Geographic Areas
- May 14: Minimizing Interconnection Costs/Time
- May 22: Retail Rate and Cost Issues
- May 30: In-state Jobs and Economic Benefits
- June 6: R&D, ARRA, and Financing
- ***June 11: Minimizing Integration Costs and Requirements***



## Strategy 3

“Develop a strategy that minimizes interconnection costs and time, and also minimizes integration costs and requirements at the distribution level (such as the use of remote telemetry and other smart grid technologies) and the transmission level (such as improved forecasting, the development of an energy imbalance market, and procurement of dispatchable renewable generation), and that strives for cost reductions and improvements to integration technologies, including storage, demand response, and the best use of the state’s existing natural gas-fired power plant fleet.”

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# Today's Agenda

- Panel 1: Integration Issues Associated with Increased Renewable Penetration
- Panel 2: Operational Characteristics of Natural Gas Plants Needed to Support Renewable Integration
- Public Comment
- ~ LUNCH ~
- Panel 3: Assessing Demand Response Potential to Provide Renewable Integration Services
- Panel 4: The Role of Energy Storage in Supporting Renewable Integration
- Public Comment



# Renewable Power in California: Status and Issues Report

- Chapter 5: Grid-Level Integration Issues
- Chapter 6: Distribution-Level Integration Issues

*Full report available at:*

*[www.energy.ca.gov/2011publications/CEC-150-2011-002/CEC-150-2011-002-LCF-REV1.pdf](http://www.energy.ca.gov/2011publications/CEC-150-2011-002/CEC-150-2011-002-LCF-REV1.pdf)*



## **Grid-Level Integration**

- System operators have to balance customer demand and generation supplies, maintain voltage and frequency within established standards
- Operating characteristics of variable renewables pose integration challenges
- Variable renewables could comprise 22% of electricity mix by 2020



# Challenges with Variable Renewable Resources

- Variable fuel source
- Generation pattern does not match load
- Cannot flow predictable product onto grid
- Unable to dispatch on command
- Unable to contribute to system inertia or frequency control



## Ancillary Services and Related Terms

<b>Regulation</b>	Units can change output in response to signals every four seconds provided through automatic generation control to maintain a balance between load and generation in real time.
<b>Load Following</b>	Similar to Regulation, but slower (10 minutes to a few hours).
<b>Spinning Reserve</b>	On-line (synchronized) and available to increase output immediately; reach full output within 10 minutes and maintain for 30 minutes.
<b>Non-spinning Reserve</b>	Similar to spinning reserve, but the unit may be offline and capable of quickly restarting.
<b>Black Start</b>	Generation able to come on-line without an external source of electricity following a system blackout; energize transmission and start other units.
<b>Voltage Control</b>	Adding or subtracting reactive power to keep system transmission voltages in required range for stability.
<b>Inertia/ Frequency Response</b>	Sufficient spinning mass to dampen changes in frequency to avoid Area Control Error (also called “ride-through”).



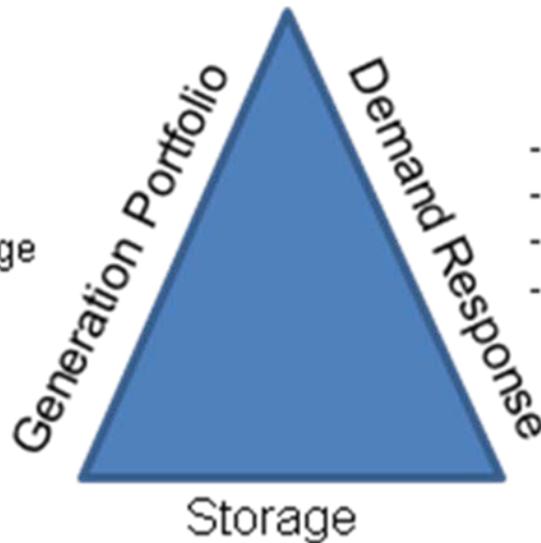
# Integration Services and Other Issues

- Large hydro and natural gas provide current integration services
- Challenges will increase as more variable resources added to system
- Will also need to address overgeneration issues and improve forecasting for wind and solar



# Integration “Partners for Success”

- Quick Start Units
- Fast Ramping
- Wider Operating Range
- Regulation Capability



- Price Sensitive Load
- Responsive to ISO Dispatches
- Frequency Responsive
- Responsive to Wind Generation Production

- Shift Energy from Off-Peak to On-Peak
- Mitigate Over Generation
- Voltage Support
- Regulation Capability



# Distribution Integration Challenges

- Potential for backflow
- Islanding
- Voltage variations
- Lack of coordinated transmission/distribution system planning
- Need for uniform/open standards



## Addressing Grid-Level Challenges

- CAISO
  - *33 Percent RPS Integration Study*
  - Market and product review
  - DR products
  - Regulation energy market
  - Improved forecasting
- Lessons learned from other ISOs
  - PJM - DR for regulation and spinning reserve



## Addressing Grid-Level Challenges

- CPUC
  - Integration studies as part of LTPP
  - Energy storage proceeding
  - Expansion of utility DR programs
- CEC
  - PIER program – research funding for improved forecasting tools, develop/demonstrate storage technologies, DR for integration, smart grid development



## Addressing Distribution-Level Challenges

- Smart grid development - Senate Bill 17, utility smart-grid deployment plans
- Utility investments in infrastructure upgrades
- PIER research on voltage, power flow, harmonics effects from distributed PV
- SMUD pilot to demonstrate inverter communications
- KEMA, Inc. study: *Distributed Generation in Europe*



## Next Steps

- Written comments due COB June 18
- For instructions on submitting written comments, see June 11 heading at:  
[www.energy.ca.gov/2012\\_energy\\_policy/documents/index.html](http://www.energy.ca.gov/2012_energy_policy/documents/index.html)
- Release of draft *Renewable Strategic Plan* anticipated early September