

# CAISO Supporting Integration of Renewables



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California ISO  
Your Link to Power

BPA/CAISO International Wind forecasting  
Workshop  
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# Individual States take lead in fight against global warming

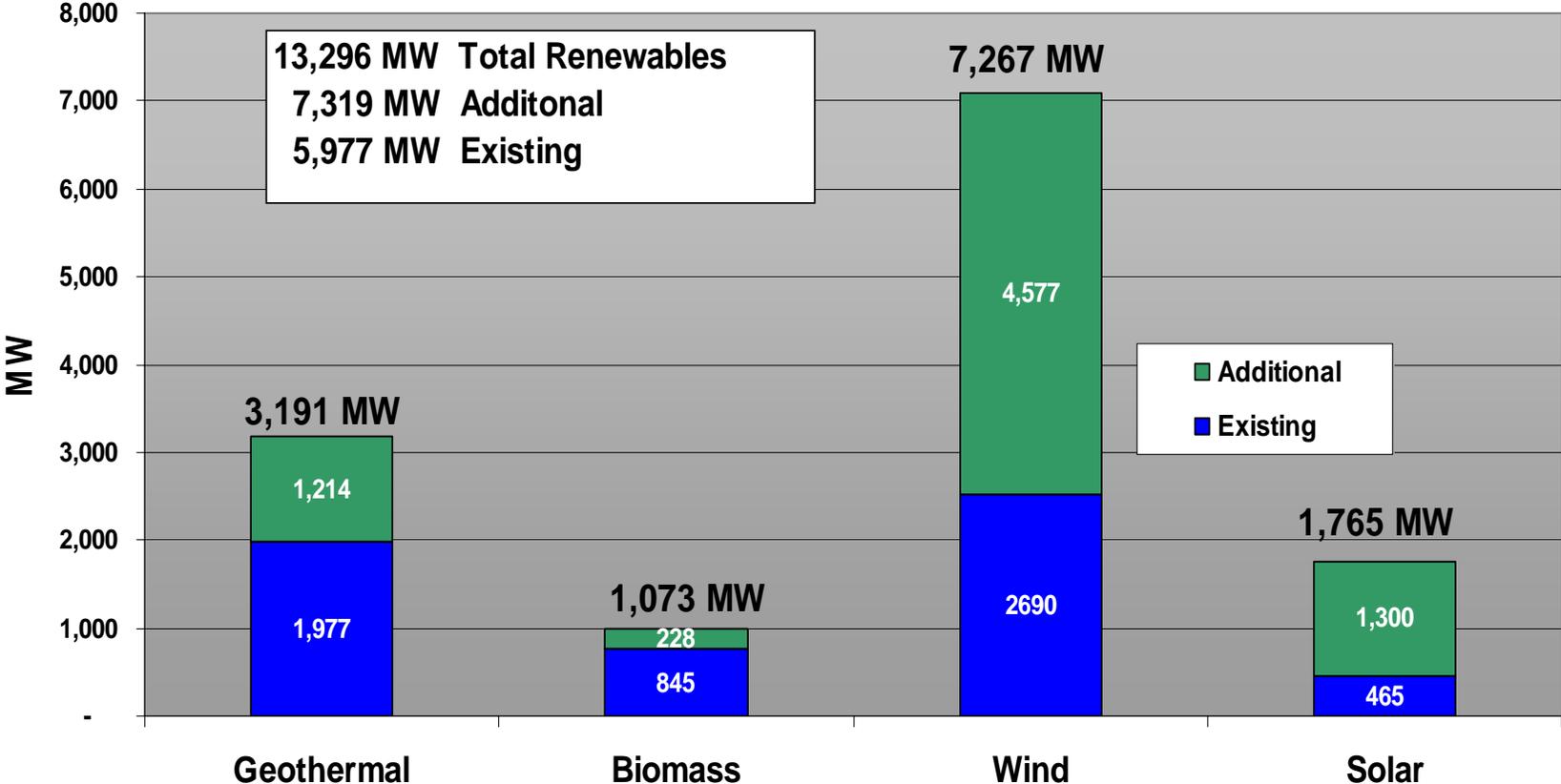


 “Today California will be a leader in the fight against global warming”

Governor Schwarzenegger. (*United Nations' World Environment Day conference in San Francisco, June 1, 2007*)

# Getting to 20% Renewables

## Existing California Renewable Generation and Possible Additions to meet the 20% RPS Goal

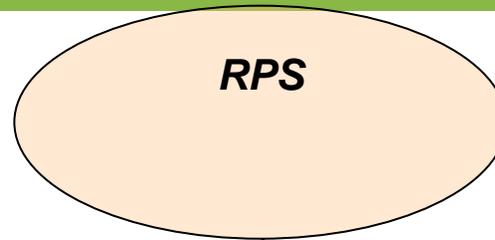


\* Data on additional renewable resource is based on a current CEC studies on renewables. Potential retirements of existing resources and repowering projects are not included.

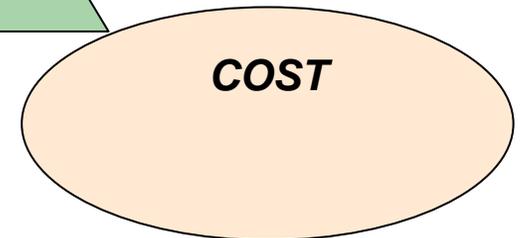
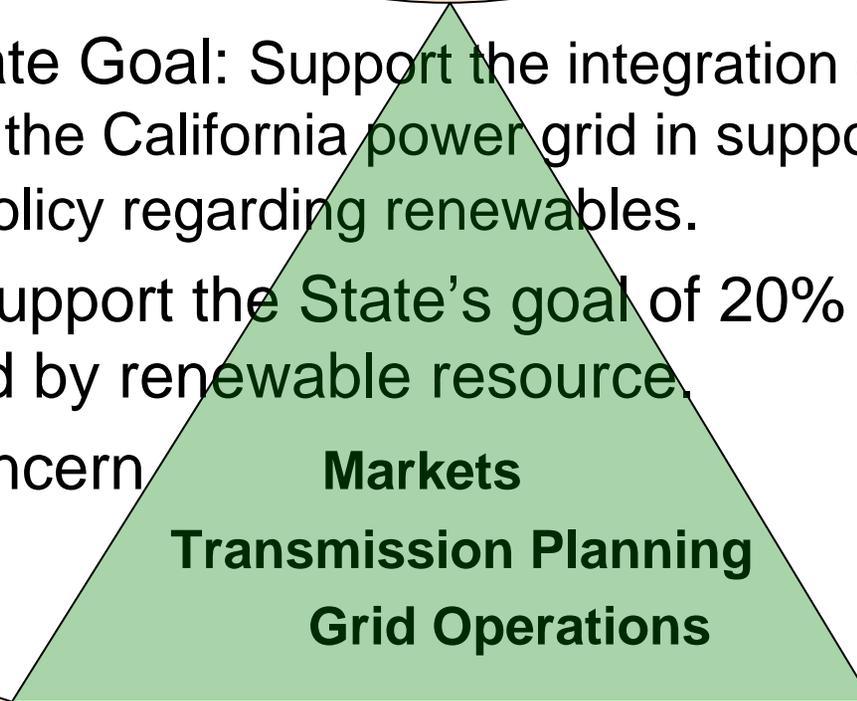
# California's abundant wind resources have a key role to play.



# CAISO Renewables Integration Program



- ISO Corporate Goal: Support the integration of renewable resources on the California power grid in support of the State of California's policy regarding renewables.
- Objective: Support the State's goal of 20% of customer load being served by renewable resource.
- Areas of Concern



# PIRP – A Vanguard Program for Over 5 Years

PIRP- Participant Intermittent Resource Program

Developed in 2002 jointly with:

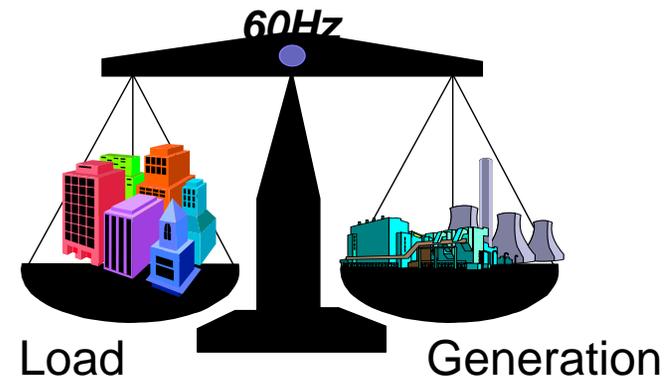
- Wind Developers
- AWEA
- IOUs
- Governors Office
- CEC
- CPUC

Production in 2004



# Meeting CA's Renewables Goals and Supporting Investments

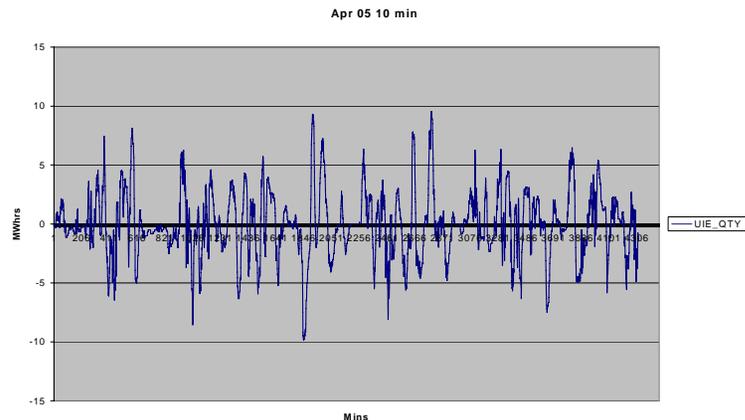
- Work with Stakeholders
- Mitigate Financial Risk To Wind Producers
- No Surprises
  - Predict Wind in Real-Time
- Support CA's RPS Goal



# PIRP Provisions and Impacts

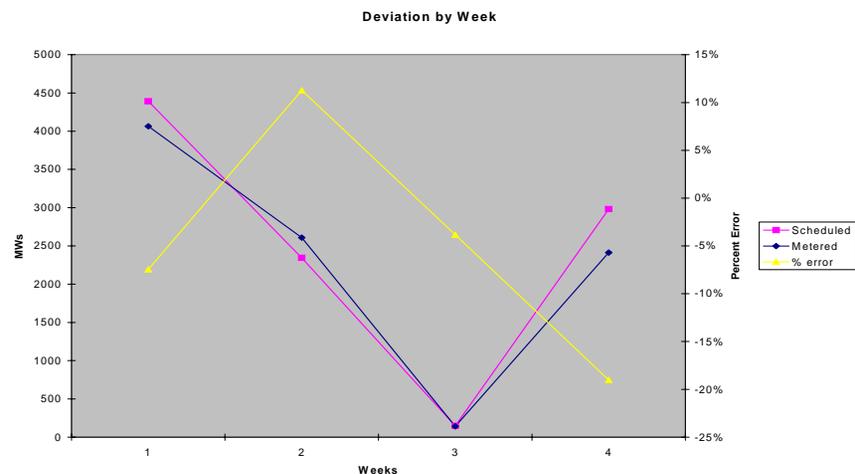
## Special Bid Rules in Hour Ahead Market

- Deviations Netted Over Month
- Paid Or Charged At Weighted Monthly Average MCP
- Imbalance Penalties Waived
- Various Market Charges Waived



## Participation Rules

- Install Telemetry
- Report Outages
- HA Schedule Must Equal Forecast
- \$0.10/MWH Forecasting Fee



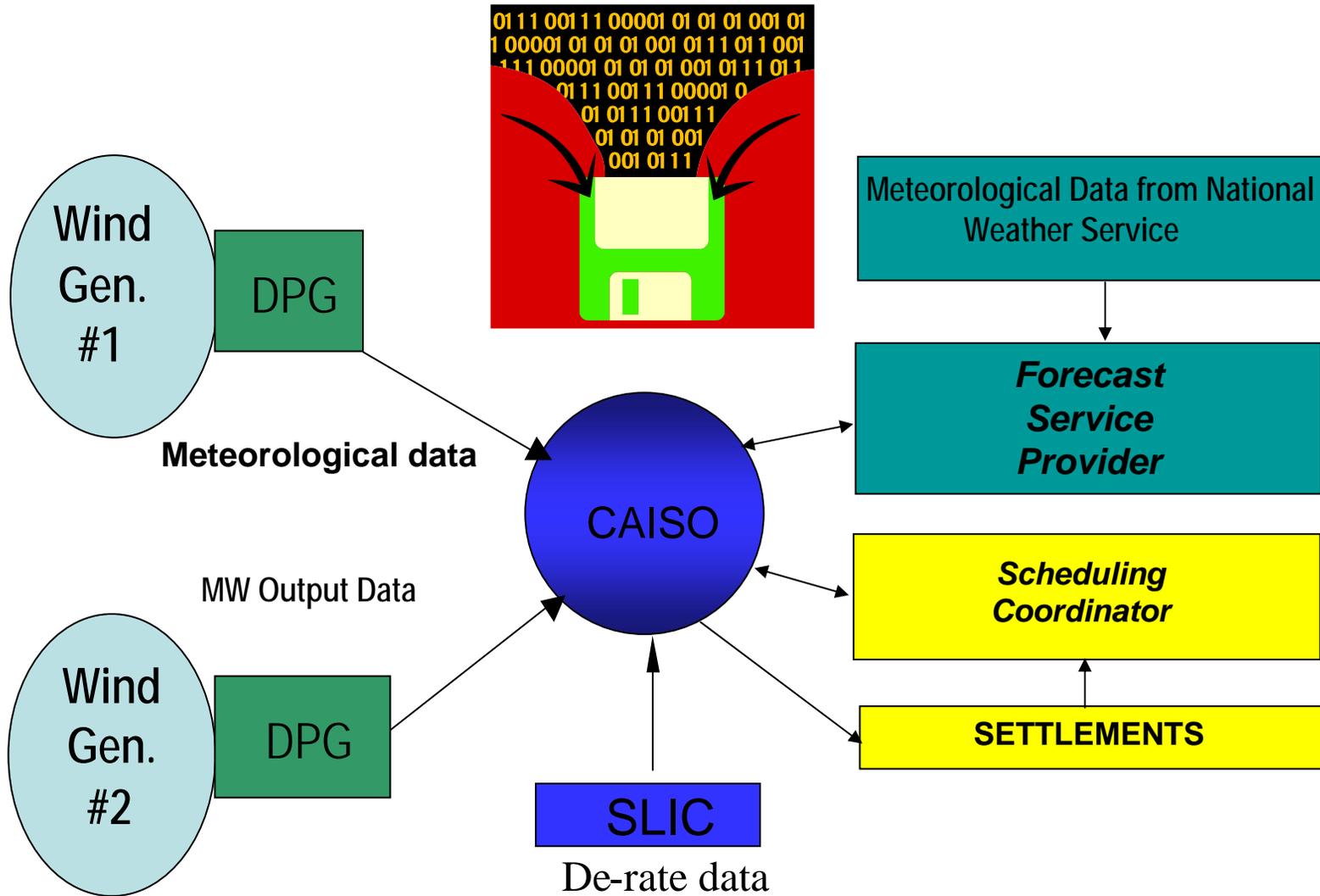
# Telemetry Data Requirements

- 🌍 Wind Speed
- 🌍 Wind Direction
- 🌍 Barometric Pressure
- 🌍 Ambient Temperature
- 🌍 Real Time MW Production
- 🌍 MW Production Metering
- 🌍 Outage Reporting
- 🌍 Minimum 1 Met tower

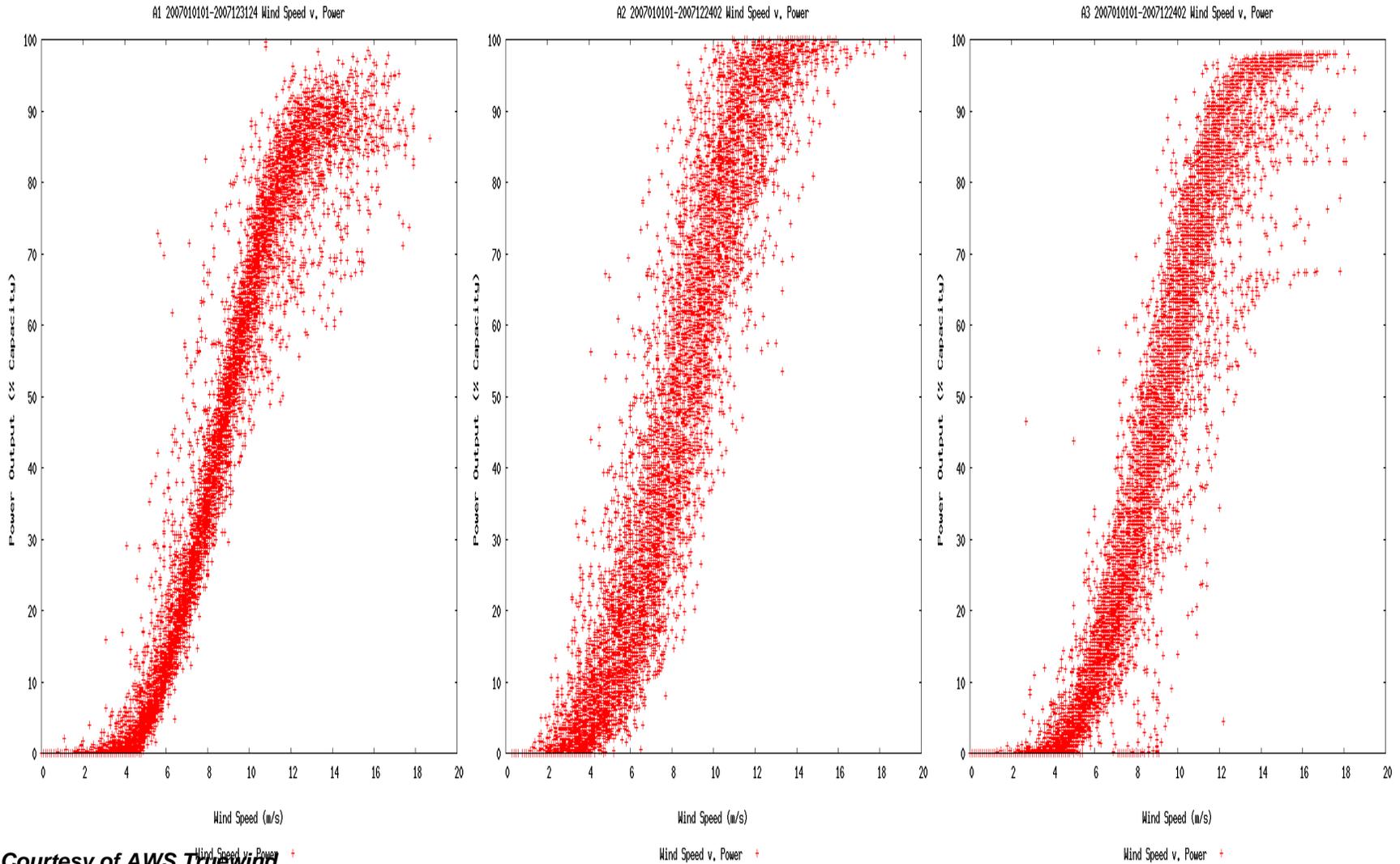


“The Higher The Data Quality, The Better The Forecast”

# Information Exchange is the Heart of the System

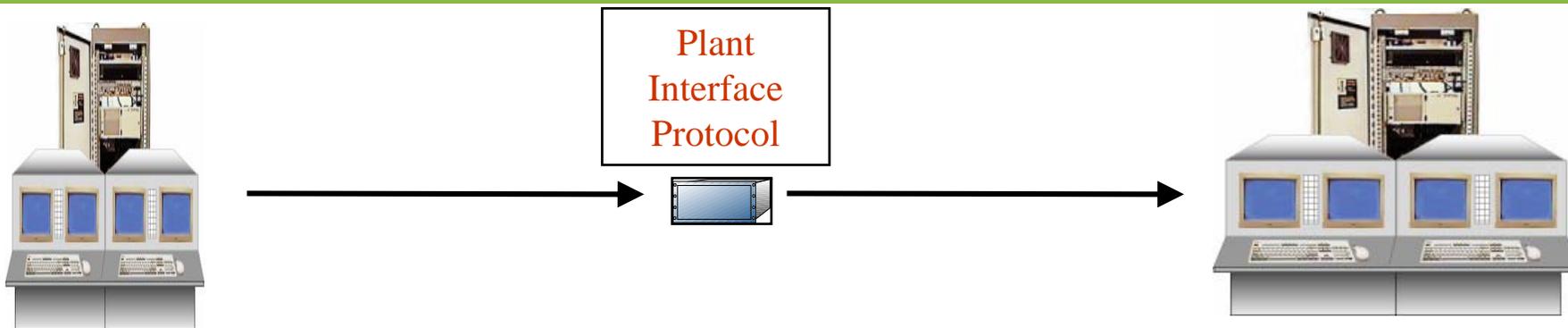


# “The Higher the Data Quality, The Better The Forecast”



Slide Courtesy of AWS Truewind +

# "The Higher the Data Quality, The Better The Forecast"



Facility	Data Availability	Next Operating Hour Forecast Annual MAE	Next operating Hour Forecast Annual Net Deviation
A.1	98.37%	11.30%	-0.18%
A.2	87.18%	14.59%	2.18%
A.3	86.92%	12.43%	1.07%

# Lessons Learned

- 🌐 Data Quality
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- 🌐 Reporting of Data Monthly
- 🌐 Minimum of 2 Reporting Met Stations per Site
- 🌐 More Emphasis on Outage Reporting
- 🌐 Use Wind Turbine Anemometers
  - E.G. 20 turbines 20 pieces of information
- 🌐 Competitive Forecasting



# PIRP RFB Objective

- 🌐 Ensure the HA PIRP Forecast is the most accurate.
- 🌐 HA PIRP Forecast uses latest technology available
- 🌐 Reduce operating costs to the CAISO.
- 🌐 Reduce market cost to the Market Participants
- 🌐 Develop Accurate Day Ahead Forecast (RUC Input)
- 🌐 Develop Accurate Hour Ahead Forecast (HASP input)
- 🌐 Develop RTUC forecast (Real Time input)

# PIRP Methodology

- 🌐 Send RFB to qualified vendors only
- 🌐 Receive cost estimate and vendor understanding of services needed
- 🌐 60+ day evaluation period of vendors with “best cost” and understanding
- 🌐 Negotiate with vendor(s) with best accuracy, price and understanding of need

# RFB Error Metrics

 Root Mean Square Error

$$RMS = \sqrt{\frac{\sum \varepsilon^2}{n}}$$

 Mean Absolute Error

$$MAE = \frac{\sum |\varepsilon|}{n}$$

 Error

$$\text{sum of error} = \sum \varepsilon * \frac{\text{Capacity}}{\sum MW_{gen}}$$

 Absolute Error

$$\text{absolute error} = \frac{\sum |\varepsilon|}{\sum MW_{gen}} \cdot \text{Capacity}$$

# PIRP RFB Anticipated Accuracy Error

- 🌐 DA Forecast
  - <15 % RMS
- 🌐 HA Forecast
  - <7% RMS
- 🌐 RTUC Forecast
  - <4% RMS

# Removing Barriers to Efficient Interconnection Policies

- 🌐 **Problem: Current Interconnection Policies Creating a Barrier**
  - **Long standing FERC policy :**
    - Network transmission facilities rolled into Transmission Access Charge
    - “Tie-line” facilities paid for by power plant owners
- 🌐 **CAISO/Stakeholder Solution: Distinct new category of transmission**
  - Facilitates capturing economies of scale associated with renewable energy development
  - Promotes overall development of diverse renewable resource opportunities

# Removing Barriers to Efficient Interconnection Policies

## Key elements of new interconnection policy for locationally constrained resource areas

- Financing Mechanism Allows Appropriate Sizing
- Lines paid for by transmission owners
- Risk of Stranded Costs Systematically Mitigated
- California Energy Commission and CPUC designation as a significant resource area
- Multiple projects in the area
- CAISO must find the project to be cost-effective

# Eligibility Criteria for Transmission to Locationally Constrained Resource Areas

- Must be non-network
- Must provide access to an area with significant potential for development of locationally constrained resources (i.e., renewables) as designated by the CA organizations.
- Must be turned over to ISO control
- Transmission to serve multiple facilities
- Cannot exceed 15% of the sum total of the high-voltage network plant included in the Transmission Access Charge
- Must meet a commercial interest test - i.e. sufficient generator interest through Large Generator Interconnection Process

Approved by FERC Dec 2001

# Generation Interconnection Process Reform

In our Strategic Plan, CAISO committed to development of grid resources, aligned with state and federal policies.

 FERC called for nationwide reforms:

- December 2007 technical conference
- March 2008 order

 CAISO response:

- January 2008 stakeholder process initiated to reform the generator interconnection process

# Active projects in the queue today exceed the CAISO all-time system peak of 50,270 MW.

- 361 interconnection requests active as of June 27, 2008
  - Total 105,342 MW
  - Renewable projects total 68,556 MW

- Interconnection requests for renewable projects are growing year to year:

■ January 2006	5,700 MW
■ January 2007	11,000 MW
■ January 2008	42,526 MW
■ June 2008	68,556 MW

Renewable generation is typically located in areas with inadequate transmission infrastructure.

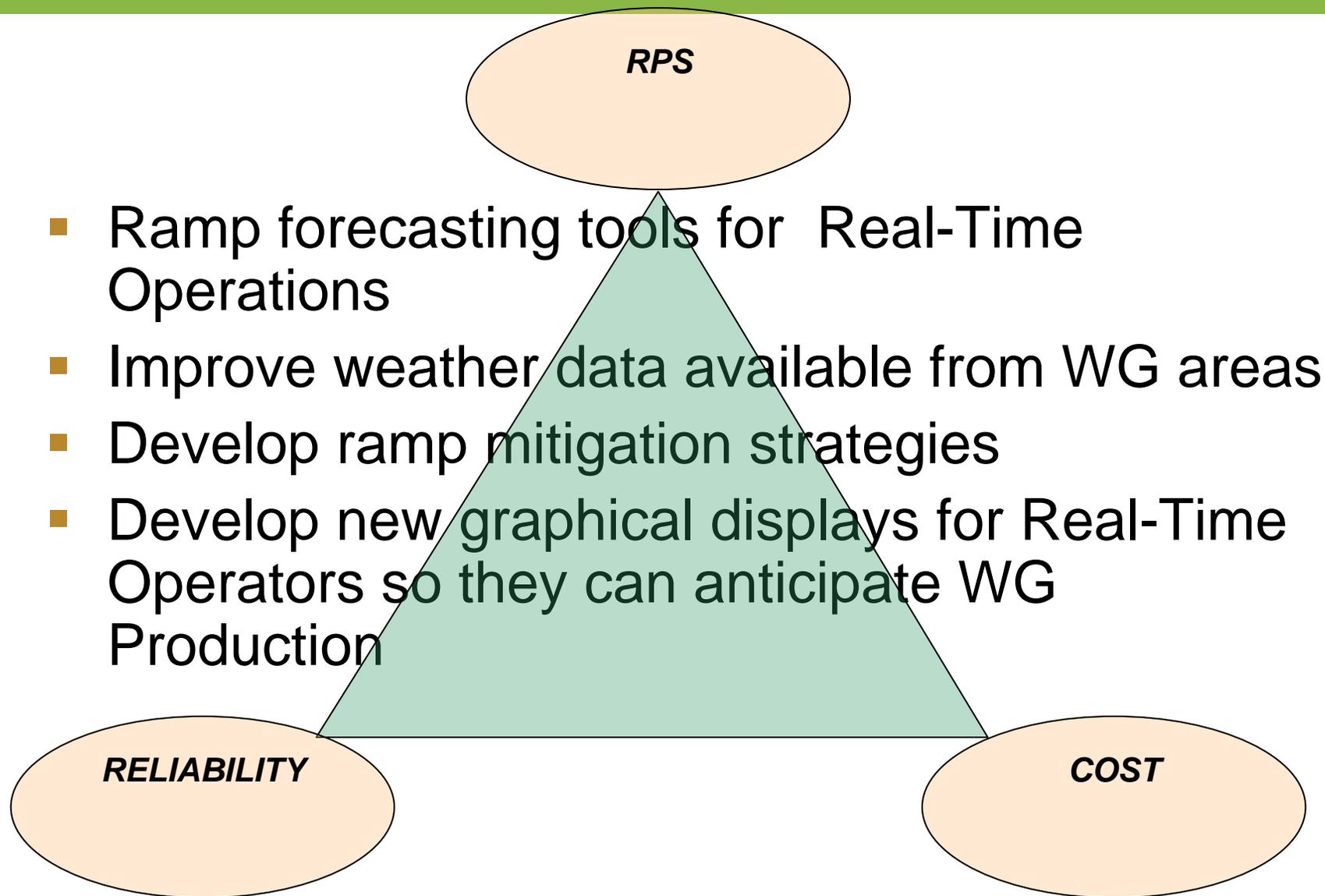
# CAISO reform proposal has three main objectives:

- 🌐 Clear the backlog
- 🌐 Increase overall process efficiency
- 🌐 Support the timely interconnection and development of new generating capacity to:
  - Meet future demand
  - Achieve state environmental policy goals

# The reform proposal achieves the stated objectives in several ways.

- 🌐 Expedites processing of projects in late stages of the current process
- 🌐 Adopts a more efficient group study approach
- 🌐 Accelerates and increases developer commitment to ensure viability of projects associated with interconnection requests
- 🌐 Facilitates investment by providing process and cost certainty
- 🌐 Promotes greater efficiency in transmission planning

# Grid Operations



# Major Tasks in CAISO Action Plan

1. Improve accuracy of Day Ahead Energy Forecasts for wind generators
2. Improve accuracy of Same Day Energy Forecasts for wind generators
3. Develop Ramp management strategies
  1. Ramp forecasting tools for Real-Time Operations
  2. Improve weather data available from WG areas
  3. Develop ramp mitigation strategies
4. Develop new graphical displays for Real-Time Operators so they can anticipate WG Production
5. Develop strategies for mitigating over generation conditions
6. Link renewables forecasting with MRTU

# Major Tasks in CAISO Action Plan

7. Treatment of Exports of Energy from WG in PIRP Program
8. Transmission Line Loading and overload mitigation strategy
9. Scheduling Imports and Exports of Renewables
10. Identify Information needed for Grid Operators
11. Identify Information needed for Market Operators
12. Analyze the Additional Regulation and Load Following Requirements with seasonality adjustment factors

# CAISO Supporting Integration of Renewables

QUESTIONS PPP