

California Independent System Operator Renewable Integration Study



September 26, 2007



California ISO
Your Link to Power

Achieving California's 20% Renewable
Portfolio Standard

The CAISO's role is to operate the grid reliably.

- 🌐 We operate in a manner that is aligned with state and federal policy.
- 🌐 We must understand the reliability and planning implications of policy initiatives such as California's Renewable Portfolio Standard (RPS)
- 🌐 We must maintain reliability.

We have completed studies addressing what is necessary to integrate renewable generation that satisfies California's 20 % RPS.

 **The draft of the report was published last week.**

- Includes engineering studies
- Describes what is needed to accomplish integration
- Written comments due in early October

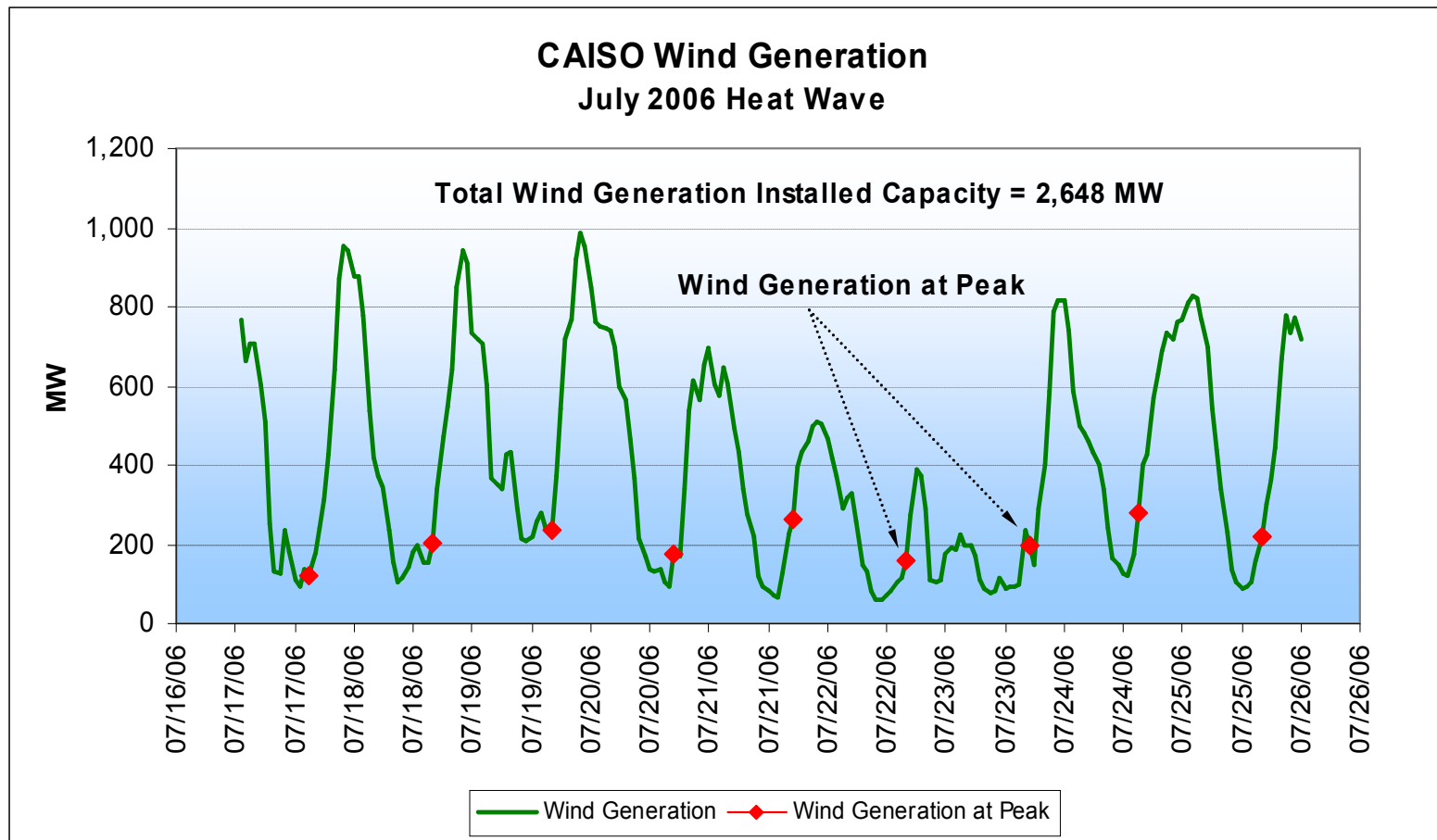
 **Today's presentation provides a preview.**

- Study goal and approach
- Study results
- Key conclusions and recommendations

The study builds on the CEC's intermittency analysis for the 2007 Integrated Energy Policy Report.

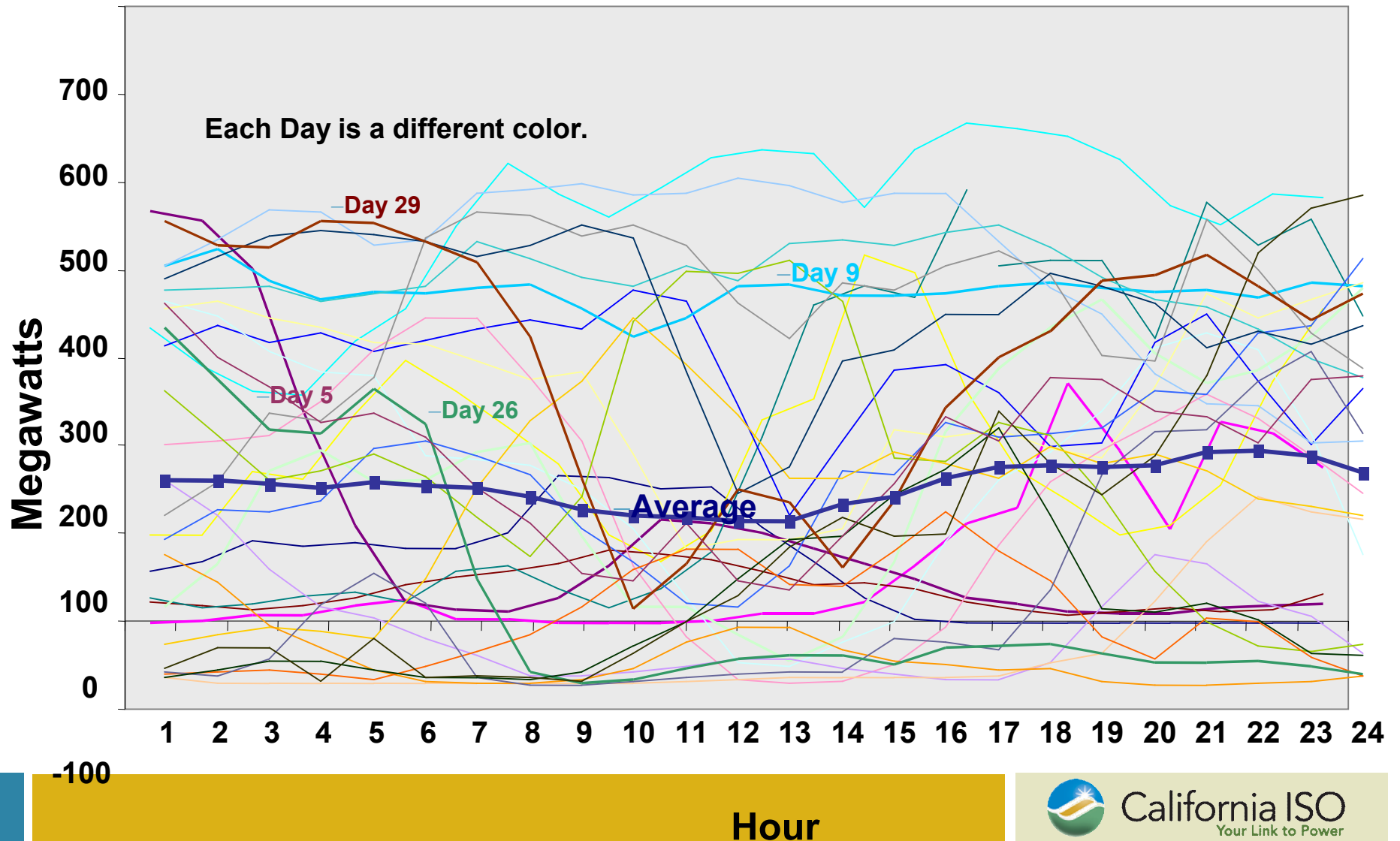
- 🌐 **Took the analysis to the next level of detail**
 - System stability analysis
 - More accurate modeling of operations
 - Constraints on existing operations
- 🌐 **Goal – Identify operational changes to meet 20% RPS**
- 🌐 **Challenges largely associated with intermittency**
- 🌐 **Conclusion -- It can be done.**

Wind vs. Actual Load on a Typical Hot Day in 2006



Tehachapi Wind Generation in April – 2005

Could you predict the energy production for this wind park either day-ahead or 5 hours in advance?



We can reliably integrate 20% renewable generation.

- 🌍 Intermittency and timing of wind generation creates need for integration services.
 - Increased need for morning and evening ramp resources by 20-30%
 - Increased need for regulation capacity and a much deeper supplemental energy stack due to potential wind forecast errors
 - Over-generation during certain hours – possible to mitigate by minimal curtailment.
- 🌍 Needed integration services can be provided by:
 - Hydro, IF there is enough water
 - New thermal, IF it has the right characteristics
 - Existing thermal, IF it is kept operating at certain levels
- 🌍 Other mitigation measures are also necessary:
 - Curtailment mechanisms
 - Improved technology
 - Better forecasting tools
- 🌍 Maintaining existing generation is essential (although replacement or re-powering can work).

The presentation is organized into three sections.

Section 1: Transmission System Analysis

- Incorporate expected generation
- Optimize deliverability & reliability

Section 2: Operations & Market Issues

- Frequency control – Area Control Error
- Balancing load and generation
- Ramping – rapid changes in generation and loads

Section 3: Conclusions and Recommendations