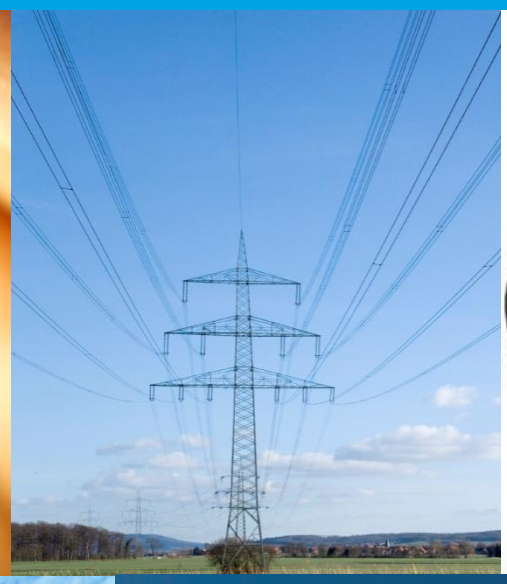
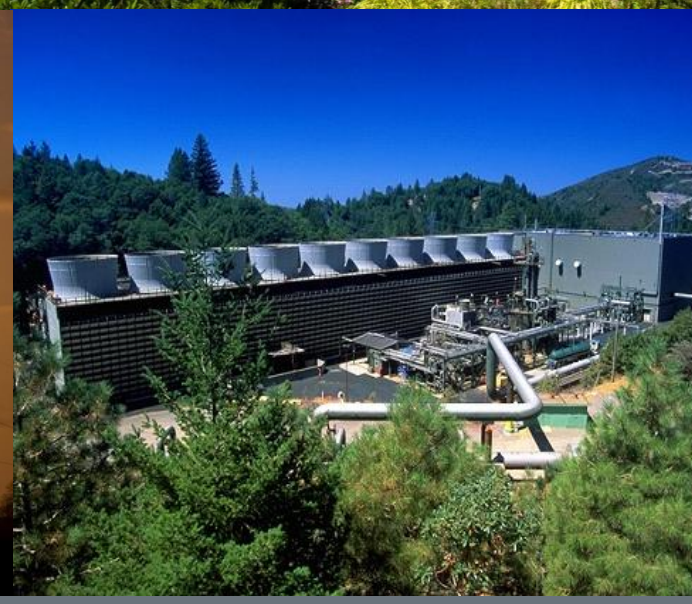
U.S. DEPARTMENT OF ENERGY







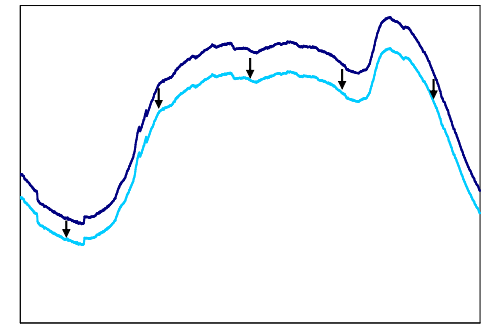
Load Participation in Ancillary Services

October 25, 2011

Washington, DC

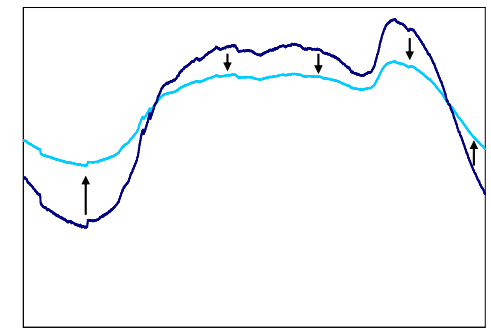
There Are Five Basic Types of Load Response (Participation)

1. **Energy Efficiency** programs reduce electricity consumption and usually reduce peak demand – *Historic program*

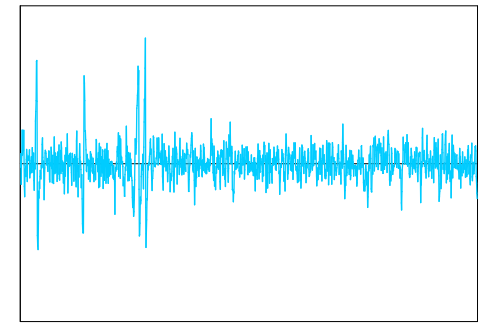


2. **Price Response** programs move consumption from day to night (real time pricing or time of use) – *Historic program*

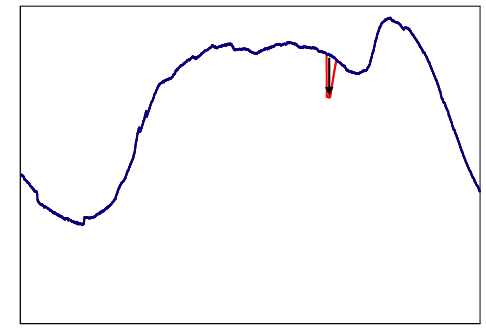
3. **Peak Shaving** programs require more response during peak hours and focus on reducing peaks every high-load day – *Historic program*



4. **Reliability Services – Regulation Response** continuously follows the power system's minute-to-minute commands to balance the aggregate system – *This is just beginning to be done*



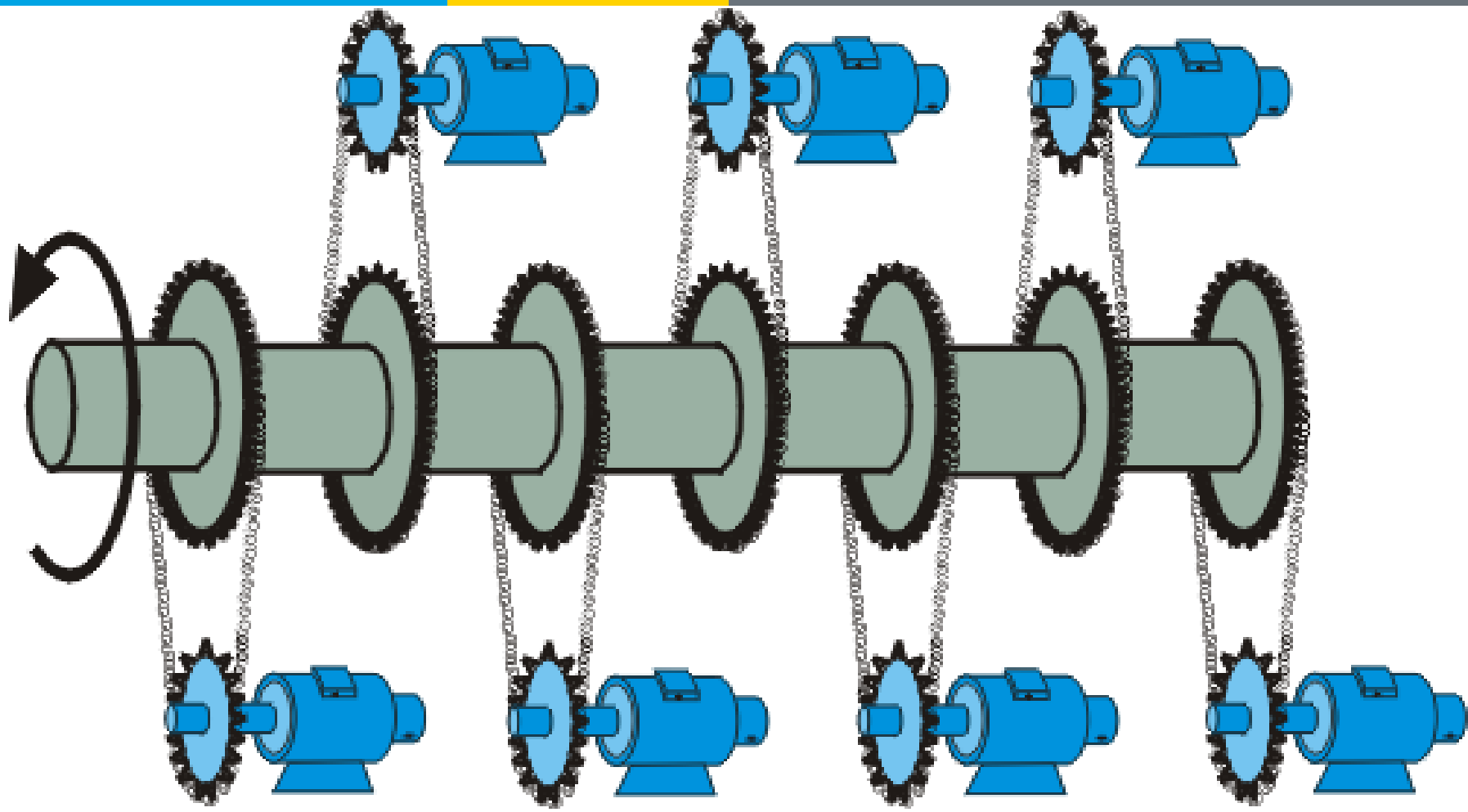
5. **Reliability Services – Spinning Reserve** requires the fastest, shortest duration response. Response is only required during power system "events" – *This is new and slowly developing*



This DOE Workshop Is Focusing On The Bulk Power System Reliability Services

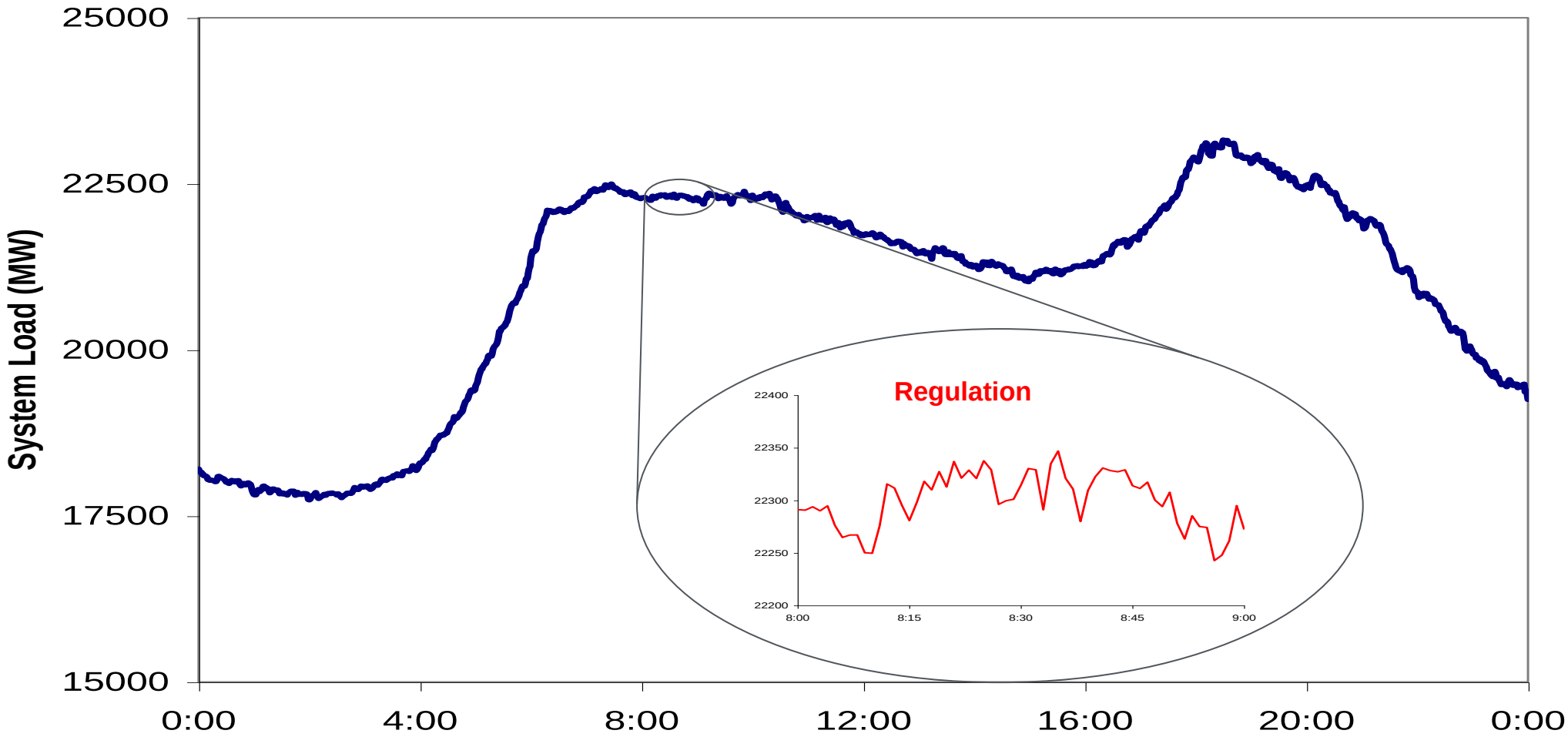
Frequency control (reliability service)

Speed of rotation is system frequency i.e. 60 Hz



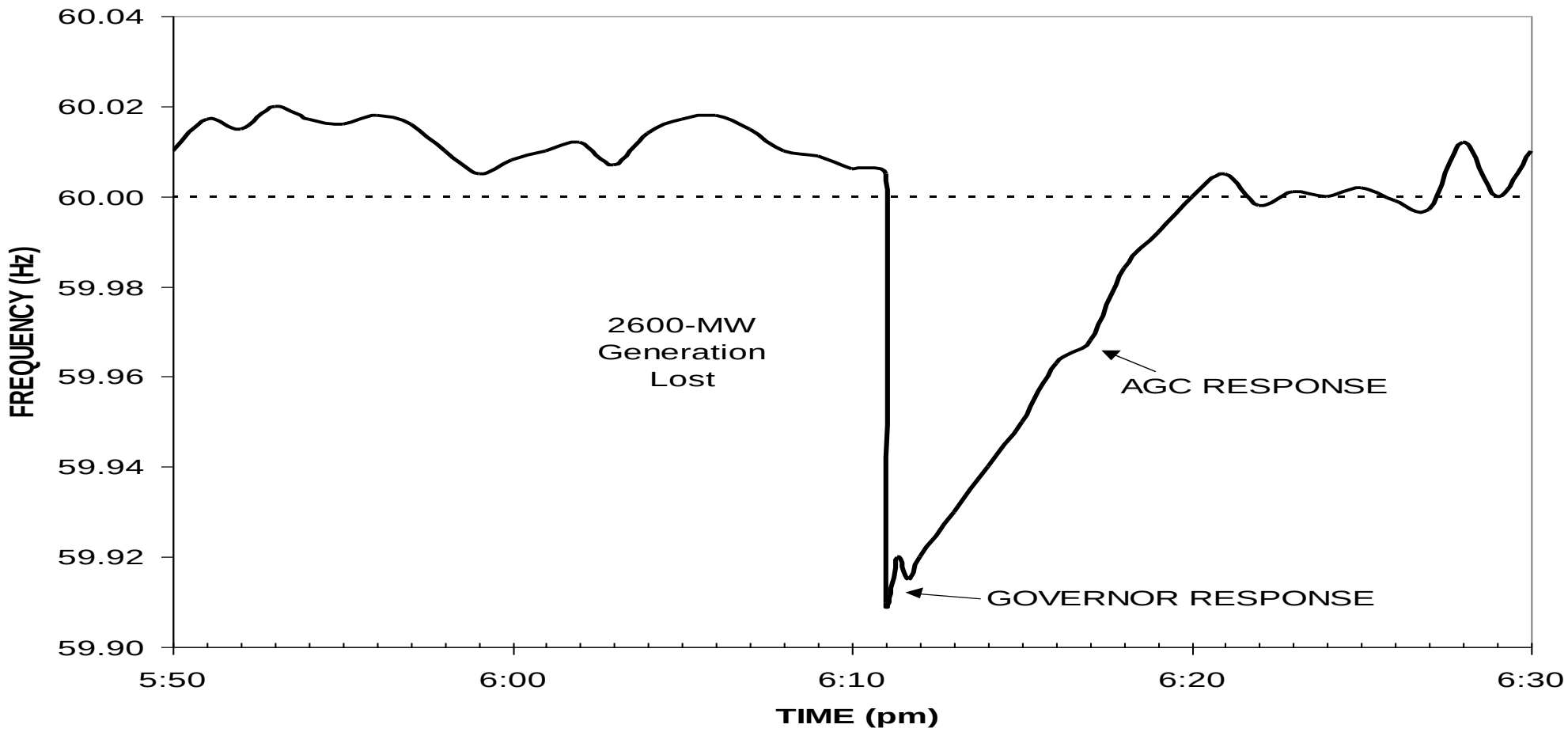
Frequency control requires minute-to-minute regulation and fast spinning reserve. These are highest value ancillary services. Relatively infrequent spinning reserve deployment & short regulation duration may align with some load capabilities.

Load Response for Ancillary Services - Regulation



- Minute-to-minute regulation (Automatic Generation Control: AGC) helps maintain frequency close to 60 Hz i.e. reliability
- Can load response provide regulation reliably and cost effectively?
  - Industrial? Commercial? Residential?

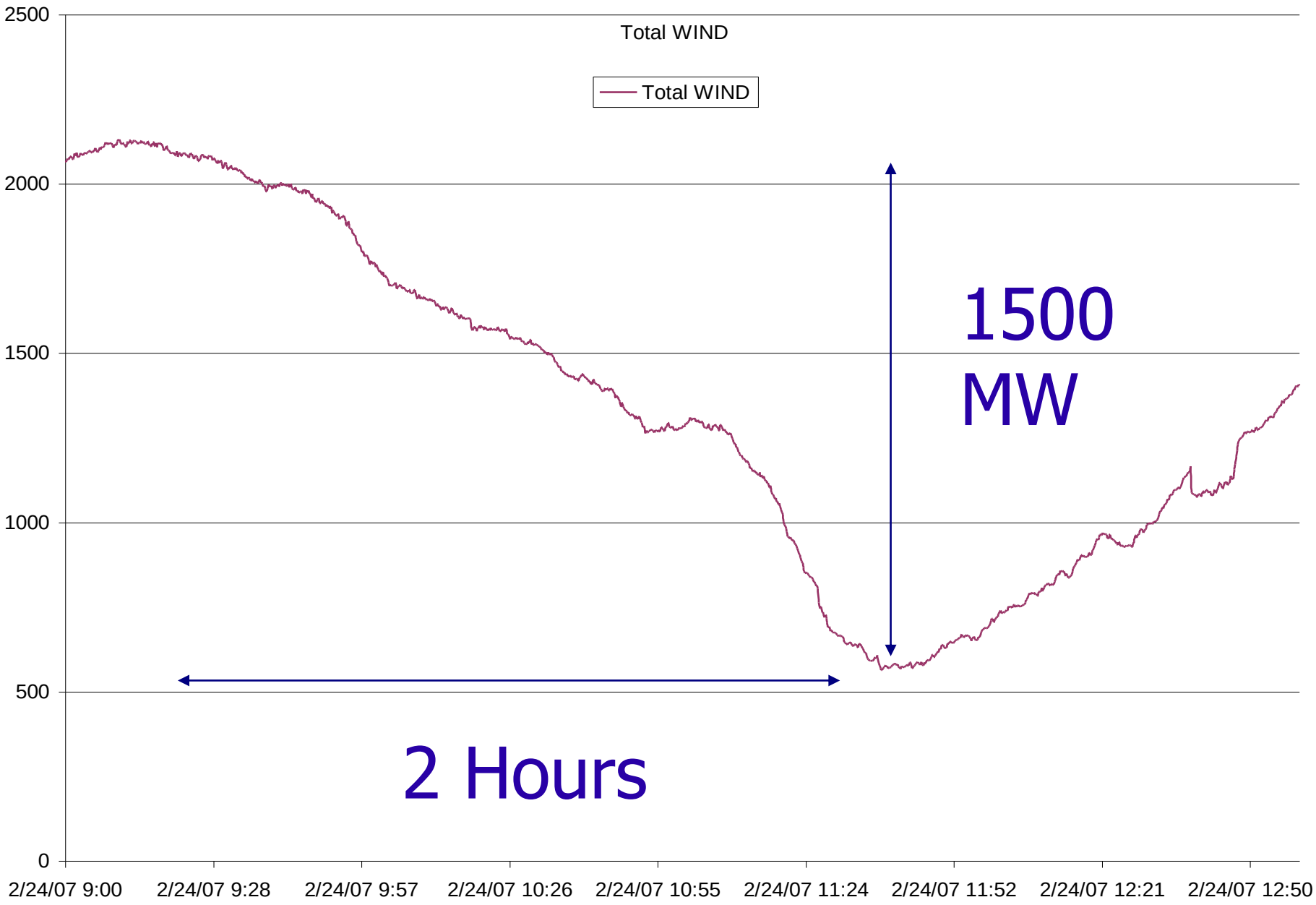
Load Response for Ancillary Services - Spinning Reserve



- Fast spinning reserve is needed in the event of a contingency (e.g. suddenly losing a large generator and hence rapid decline in frequency)
- Can load response provide spinning reserve reliably and cost effectively?
  - Industrial? Commercial? Residential?

Large Wind Ramps are Similar to Contingencies in Size and Frequency but are Much Slower

Additional Spinning &/or Non-Spinning Reserve-Like Response May be Needed



Terminology Differs – Physics Does Not

- ERCOT has “Responsive” reserve while others have “Spinning” reserve

- Regulation
  - CAISO & ERCOT separate up & down regulation MISO & NYISO have a bi-directional regulation

- Terminology is not important, physics is

Frequency control (reliability services) and energy markets

- Regulation compensates for net load fluctuations that are faster then the shortest energy market interval

- For example, regions with 5 minute energy markets require less regulation than regions with only hourly energy markets.
  - This may impact what energy limited technologies can provide regulation

- Choosing which spinning reserve resources respond to an event can be based on their energy price but the reserves must be made available ahead of the operating hour

Challenges

- Technical
  - Communications, Monitoring, Control
    - It may be appropriate to treat large aggregations of small resources statistically
    - Monitoring/assuring availability
  - Frequency responsive & droop
    - Frequency is ubiquitous
- Regulatory/Institutional/Reliability Rules
- Commercial

Workshop Questions

- Is it possible to use load response for ancillary services?
- Is it desirable?
- Is it worth the effort?
- What is required?
- What are the obstacles?
- How can DOE help?