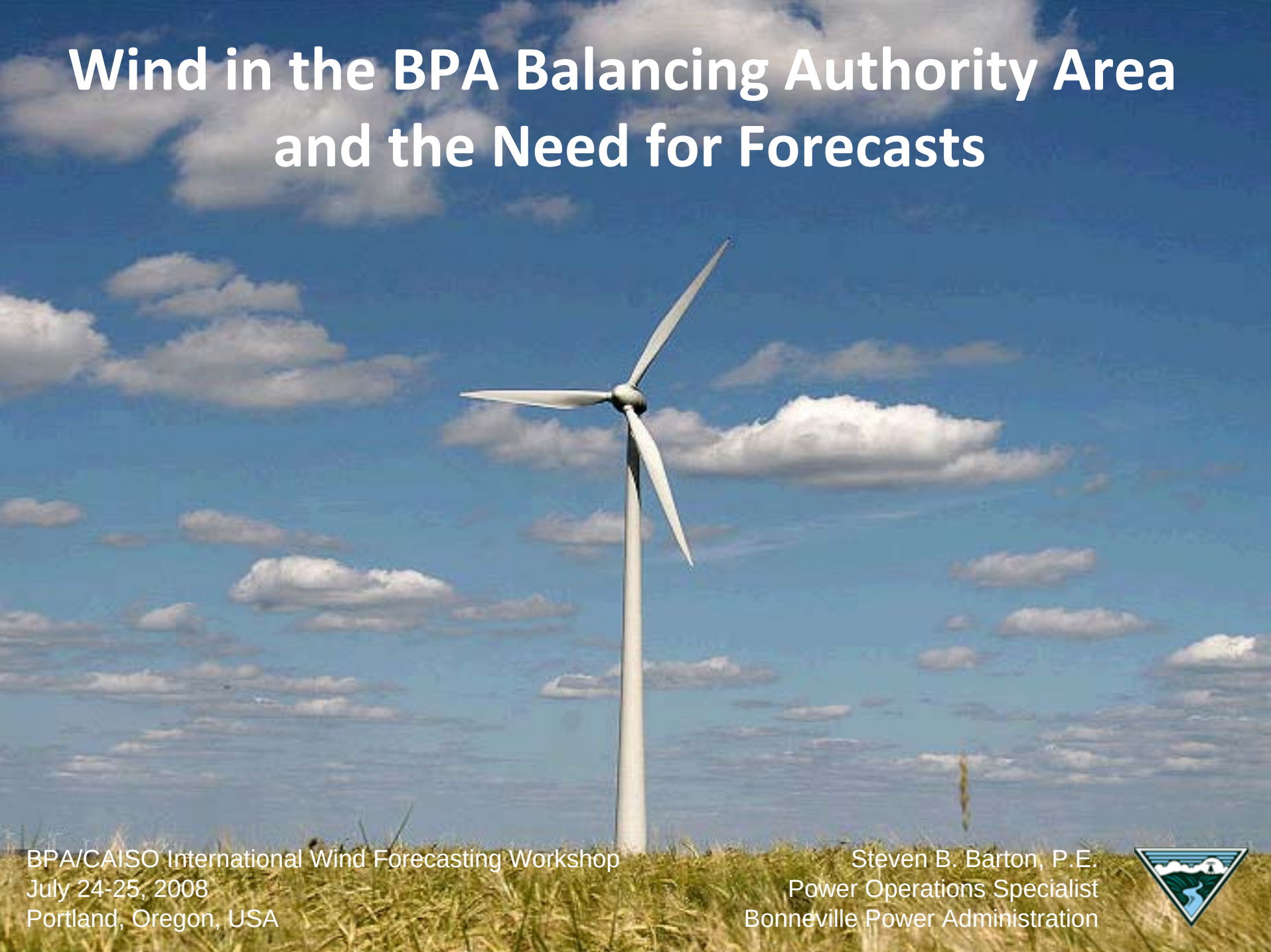
Wind in the BPA Balancing Authority Area and the Need for Forecasts



BPA/CAISO International Wind Forecasting Workshop
July 24-25, 2008
Portland, Oregon, USA

Steven B. Barton, P.E.
Power Operations Specialist
Bonneville Power Administration

Wind Generation in the BPA BAA

- Approximately 1,500 MW of wind generation capacity, or 14% penetration (wind capacity : peak area load).
- Approximately 55% of all wind generation in the Northwest is interconnected to the BPA BAA.
- Less than a quarter of the capacity installed in the BPA BAA serves federal loads.

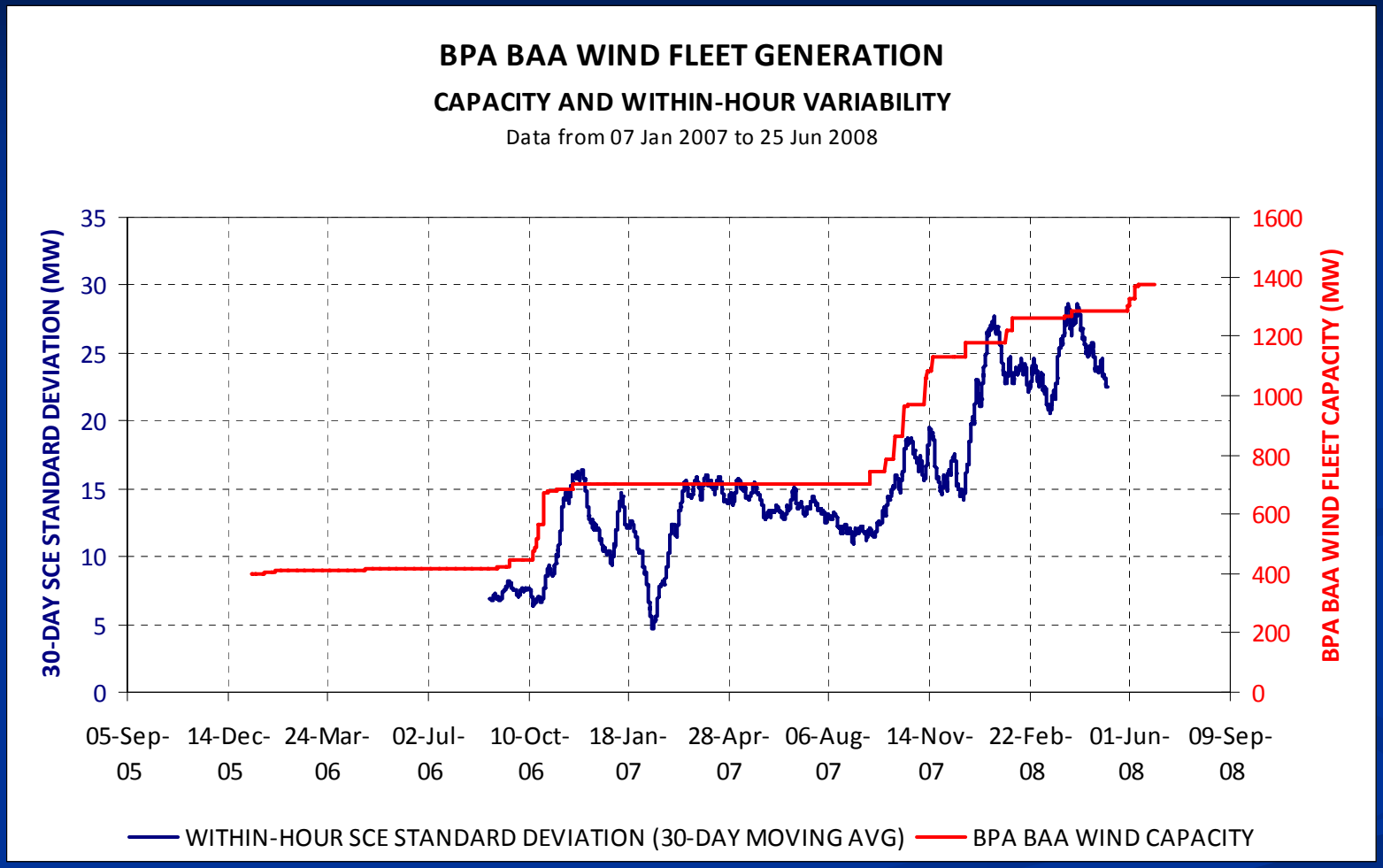
Wind Generation in the BPA BAA

- Wind generation capacity is expected to grow above 3,000 MW by late 2009.
- Approaching 6,000 MW by 2011.
- Most of this is expected to serve loads outside the BPA BAA.

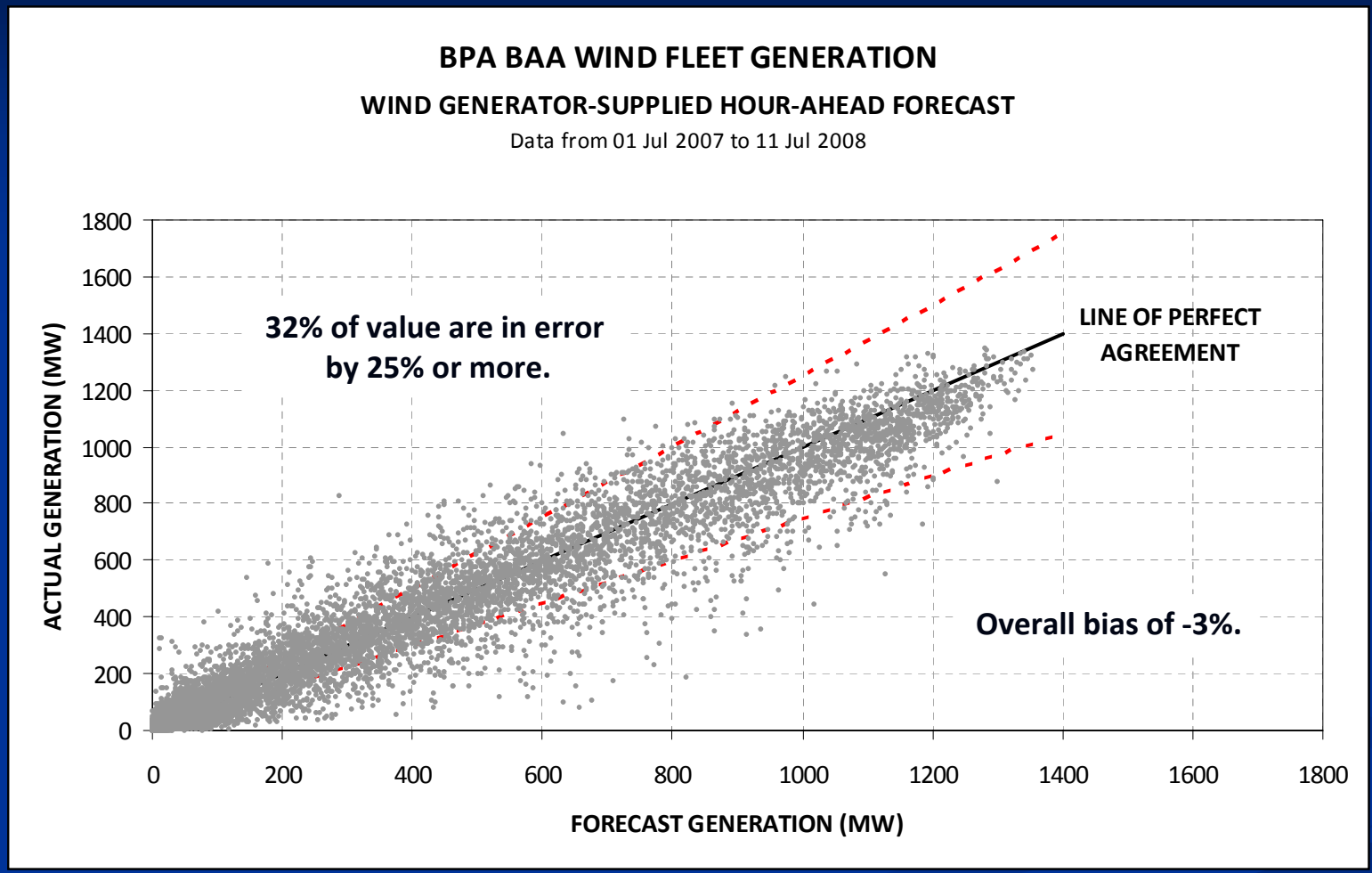
Wind Generation in the BPA BAA

- Wind generation is backed up by hydro resources.
- Large penetration levels and wind generation serving non-BAA loads in a constrained, multi-purpose reservoir system pose unique operational challenges.
- Need accurate forecasts to manage the resources.

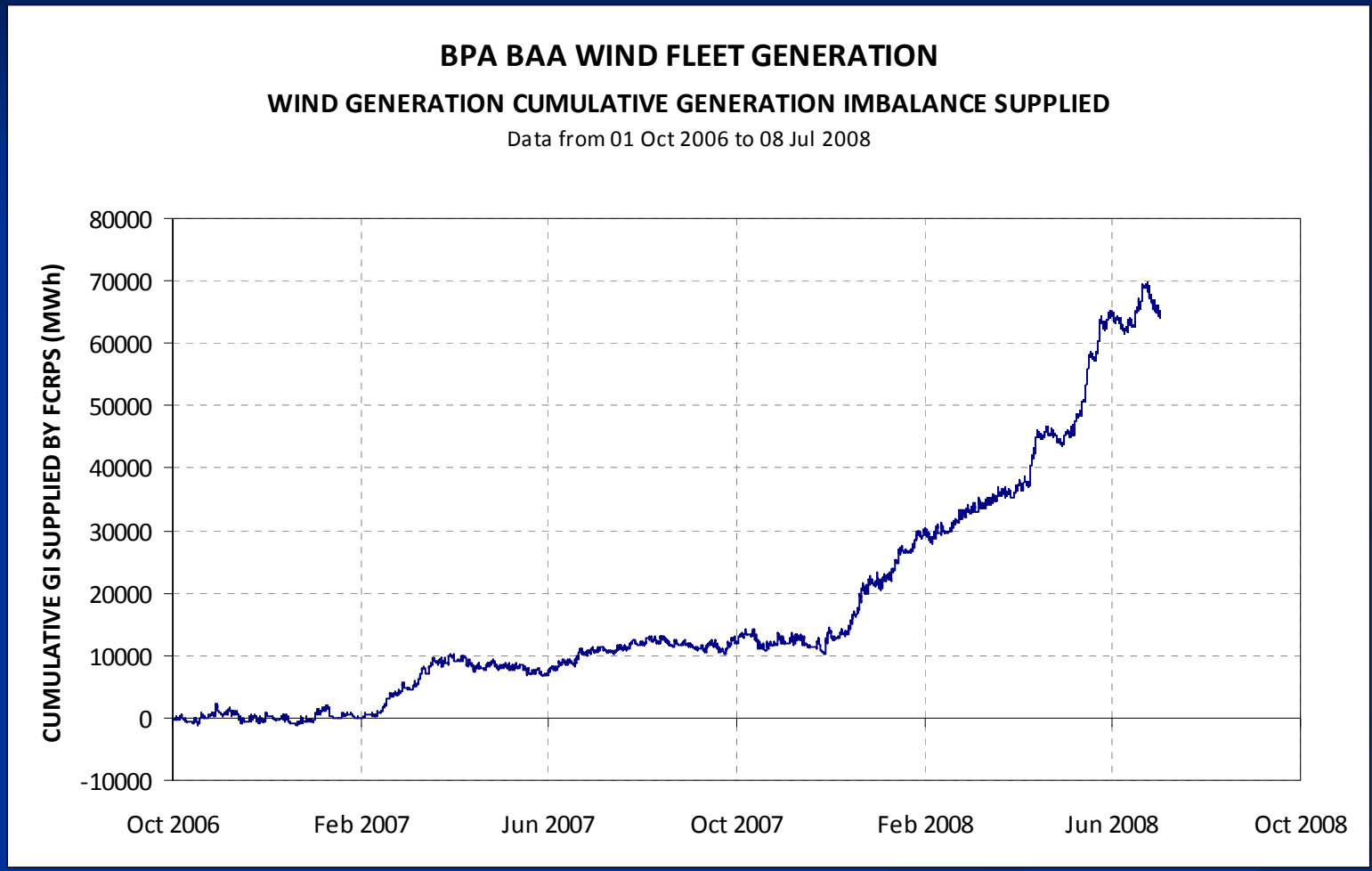
Wind Generation Characteristics to Date



Wind Generation Characteristics to Date

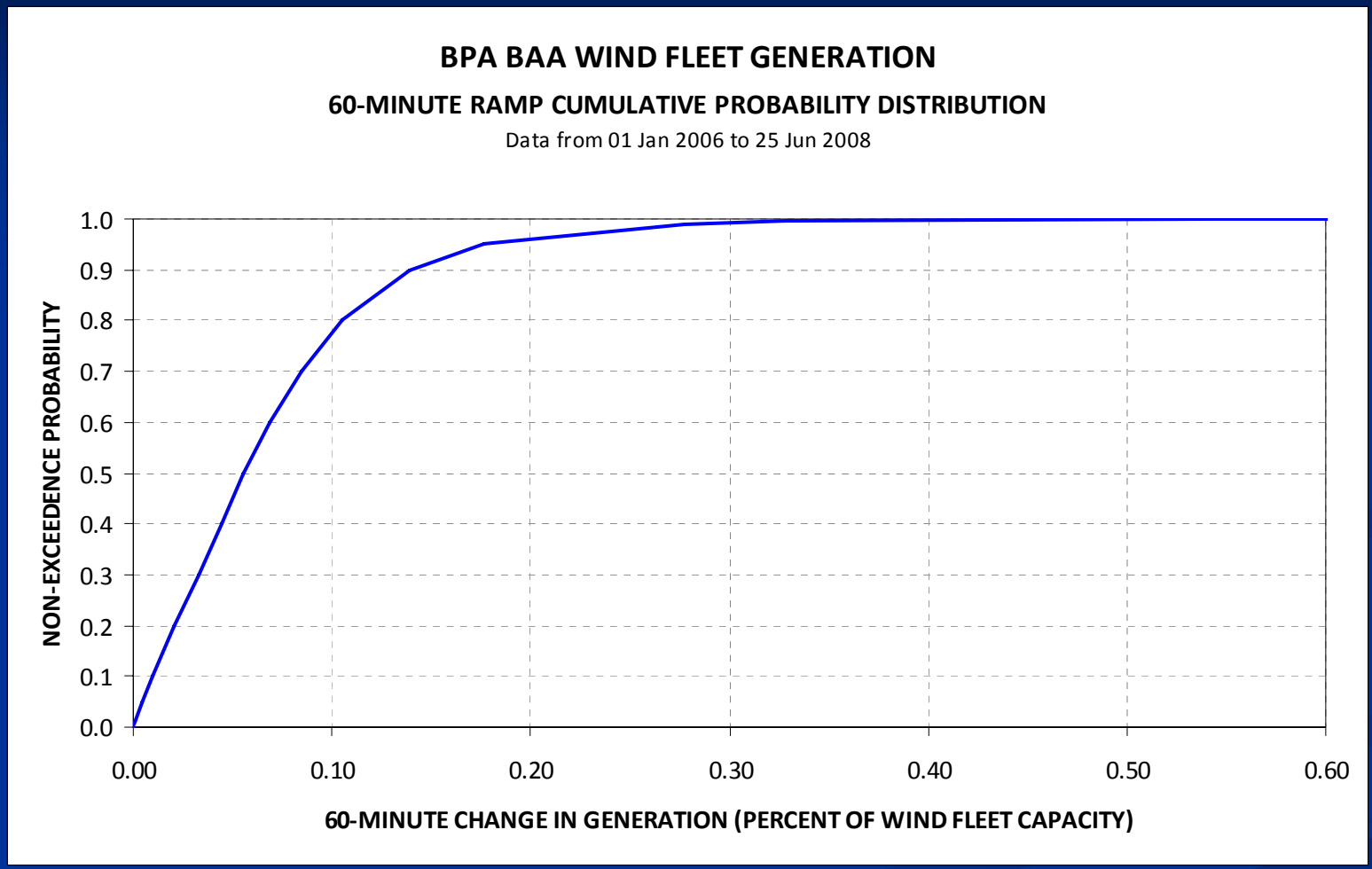


Wind Generation Characteristics to Date

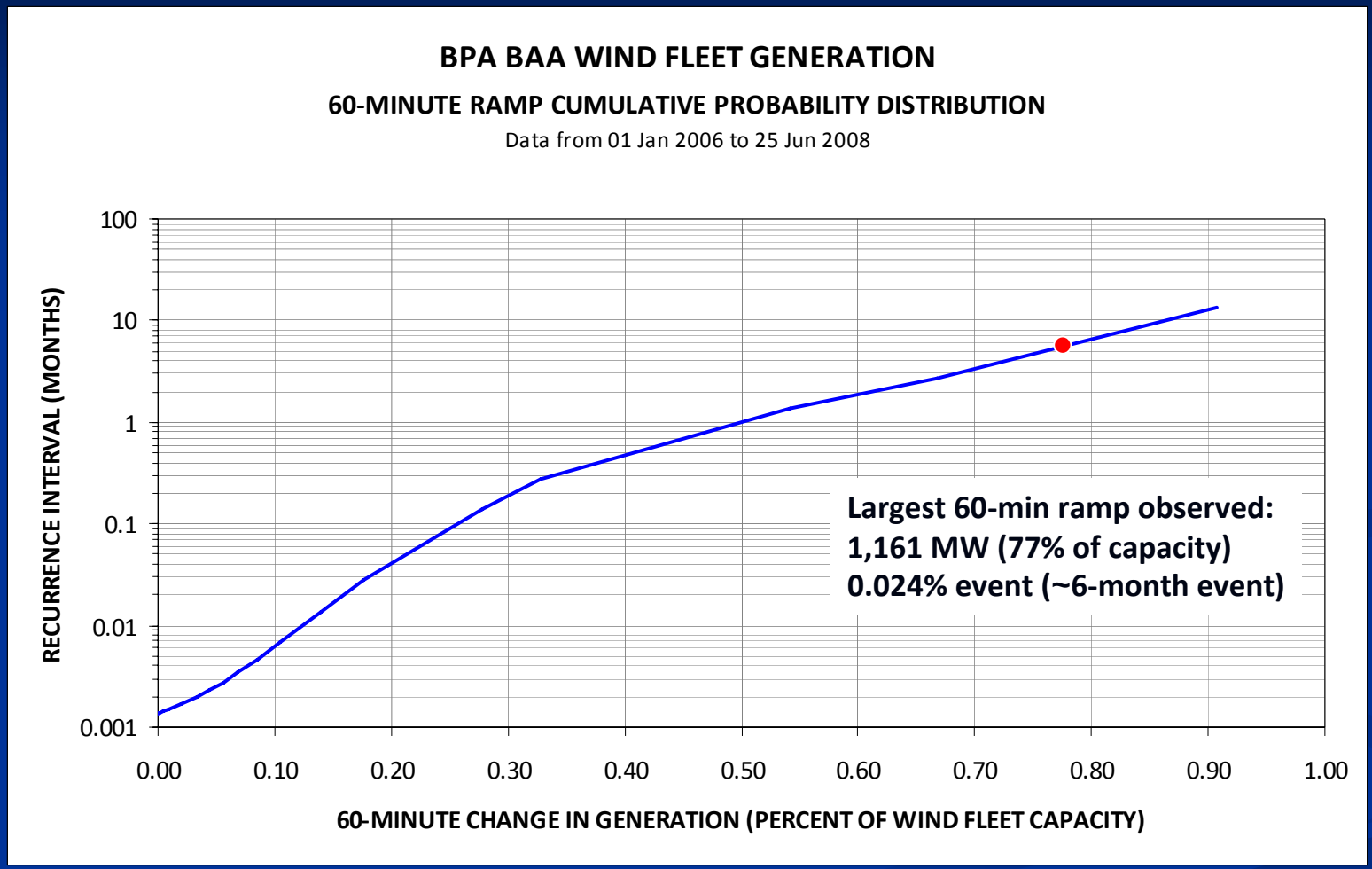


Positive values indicate wind over-generation relative to forecast, resulting in storage in the FCRPS.

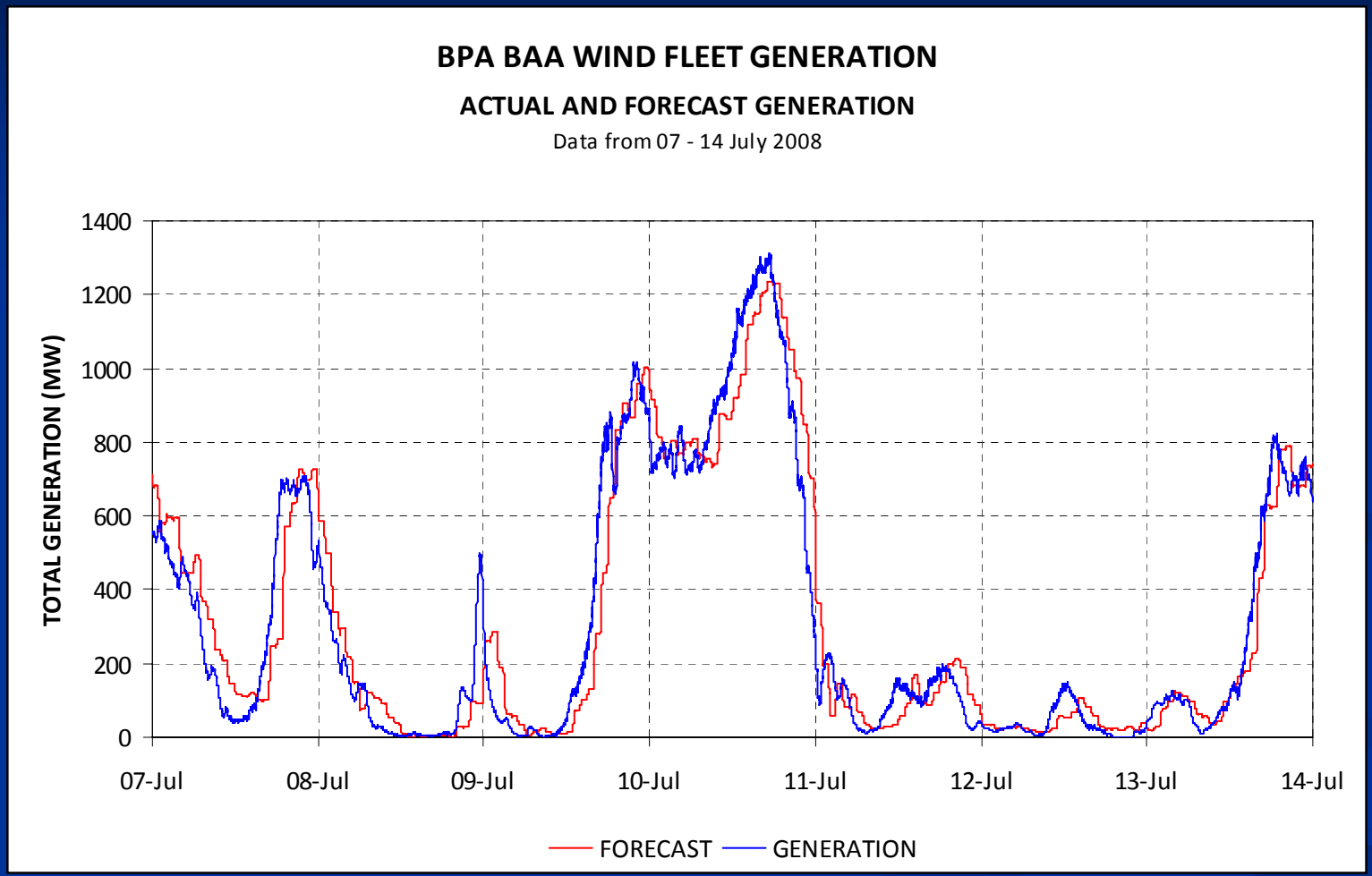
Wind Generation Characteristics to Date



Wind Generation Characteristics to Date



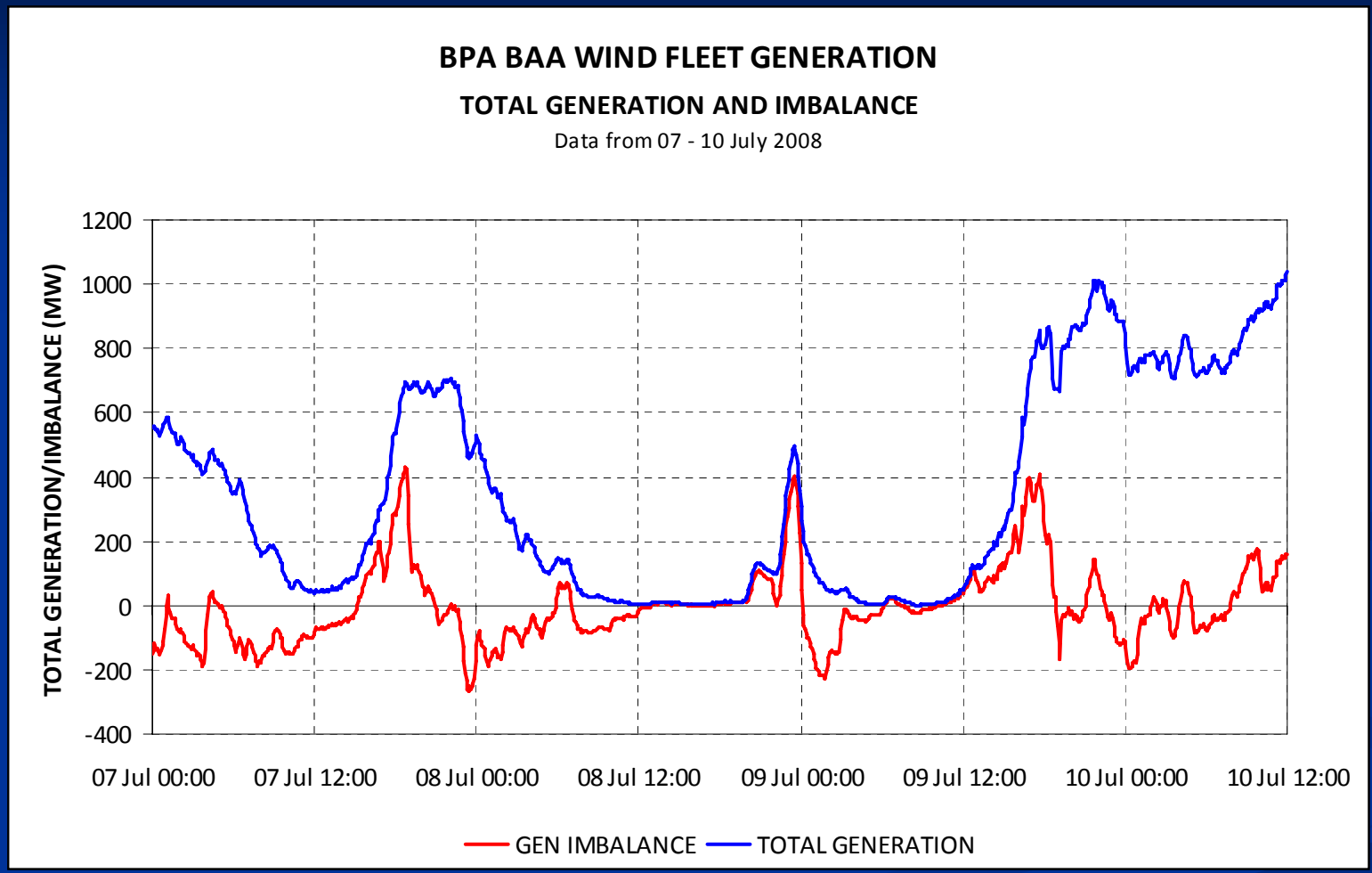
Wind Generation Characteristics to Date



Wind Generation Forecasts

- The intermittent nature of wind generation requires some level of reserves to be held on the balancing resources to manage within-hour variability and uncertainty (e.g. regulation, generation following).
- Forecasts lead to accurate schedules and can help by reducing uncertainty.
- Forecasts are not perfect, so the balancing resources must also stand ready to provide generation imbalance.

Wind Generation Characteristics to Date



Largest 20-minute changes since May 8, 2008: -618 MW and +508 MW.

Wind Generation Forecasts

- For a forecast to provide value, it must be accurate and timely enough to free up those reserves held to manage variability and uncertainty in a time frame where that capacity can be used for other purposes.

Wind Generation Forecast Value

- General Forecast Products
  - Historical reconstruction
  - Days-ahead
  - Hours-ahead
  - Within-hour

Wind Generation Forecast Value

- Historical Reconstruction
  - Historical wind records are short, sparse, and fractured.
  - Need to understand long-term wind patterns and generation potentials to assess resource adequacy issues.
  - Estimate characteristics of future wind fleet.
  - Input to multi-year, probabilistic system studies to better plan all system resources.

Wind Generation Forecast Value

- Days-Ahead
  - Hourly time-step out for several days.
  - Estimate daily energy and within-day profile.
  - Wind generation not serving BAA loads should be energy neutral (net wheeling = 0 MW).
    - Forecast may still provide some insight to within-hour balancing requirement when generation is forecast to move rapidly.
  - BAA load served by wind generation reduces residual load served by hydro resources, affecting physical water movement.

Wind Generation Forecast Value

- Hours-Ahead
  - Hourly time-step out for balance of day.
  - Estimate hourly energy and balance-of-day profile.
  - Wind generation not serving BAA loads should still be energy neutral (net wheeling = 0 MW).
    - Forecast may still provide some insight to within-hour balancing requirement when generation is forecast to move rapidly.
  - BAA load served by wind generation reduces residual load served by hydro resources, affecting physical water movement.

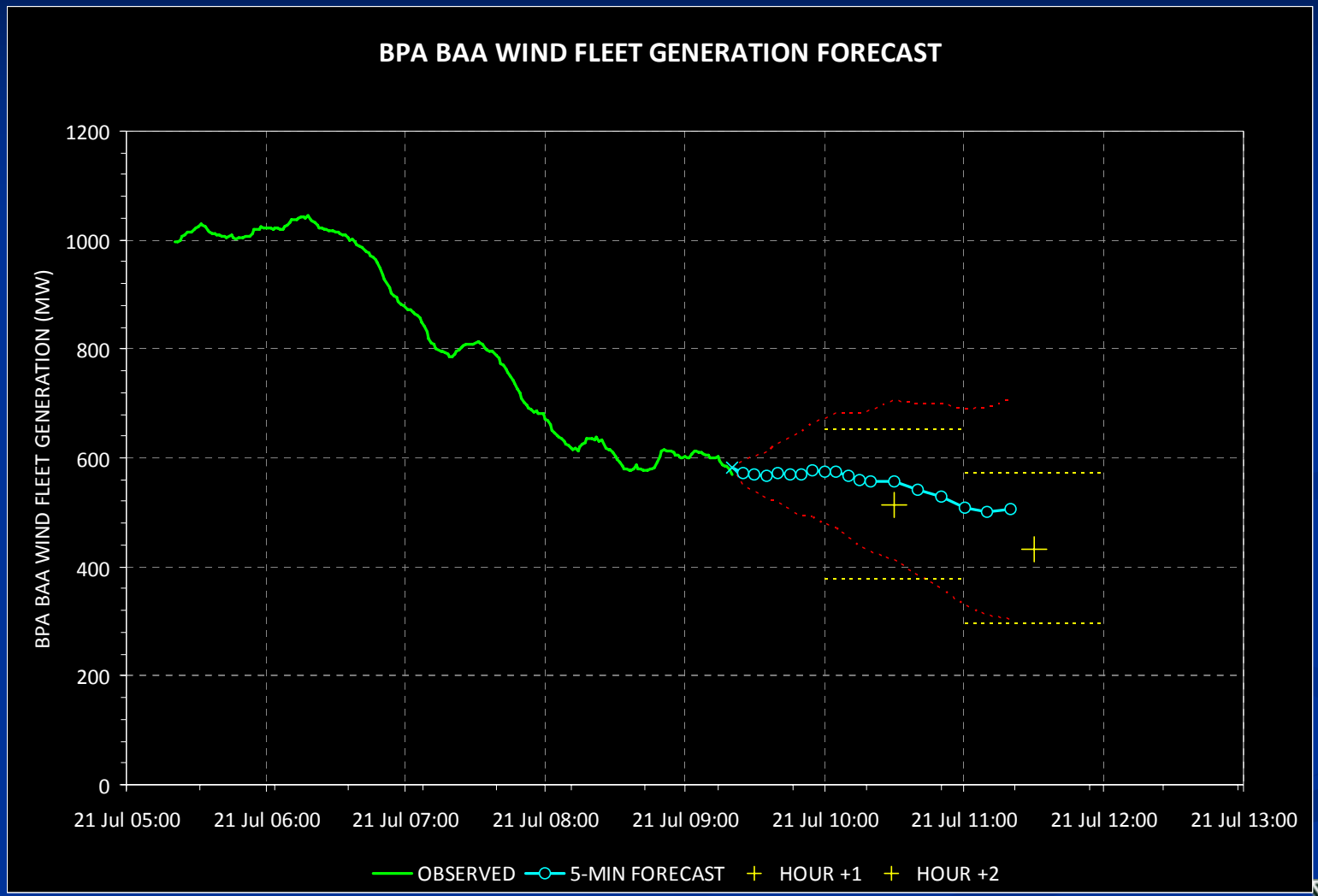
Wind Generation Forecast Value

- Hours-Ahead
  - The BA balances to the wind generators' schedules (e.g. forecasts).
  - The BA is interested in accurate schedules.
  - A BA's forecast is of little value in this time horizon since balancing is on an schedule basis.

Wind Generation Forecast Value

- Within-hour
  - Sub-hourly instantaneous estimates out 60 minutes or more.
  - Estimates within-hour balancing requirements for all generators requiring balancing services (e.g. all interconnected wind generators).
  - Used for predictive control, positioning of reserves, and better management of hydraulic resources.

Wind Generation Forecast Value



Summary

- Accurate schedules are needed for Balancing Authorities have accurate information for reliability and control.
- Accurate schedules and forecasts help generation owners plan and operate the resources balancing wind.
- Accurate forecasts reduce the balancing requirements needed by wind project owners, reducing their costs.

Summary

- The forecasts must be accurate and timely enough for operators to free up capacity that would otherwise be used for uncertainty for some other purpose.