

OPUC Flexibility Planning Guidelines

Pacific Northwest Demand Response Project

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OPUC's New IRP Guidelines*

- Integrated Resource Plans to include:
 - Forecasts of flexibility needs and flexible capability in all time intervals, 20 year horizon
 - Evaluate all flexible resources to fill any needs on a consistent and comparable basis
- Response to planning challenges/opportunities
 - Increasing net load variability
 - Emergence of new tools, including **demand management**, to absorb that variability, maintain reliability
 - Need a planning approach that differentiates between capacity and flexibility; value of different resources/strategies across multiple time dimensions

* OPUC Order 12 013 issued January 19, 2012 in Docket UM 1461 (Electric vehicle investigation)

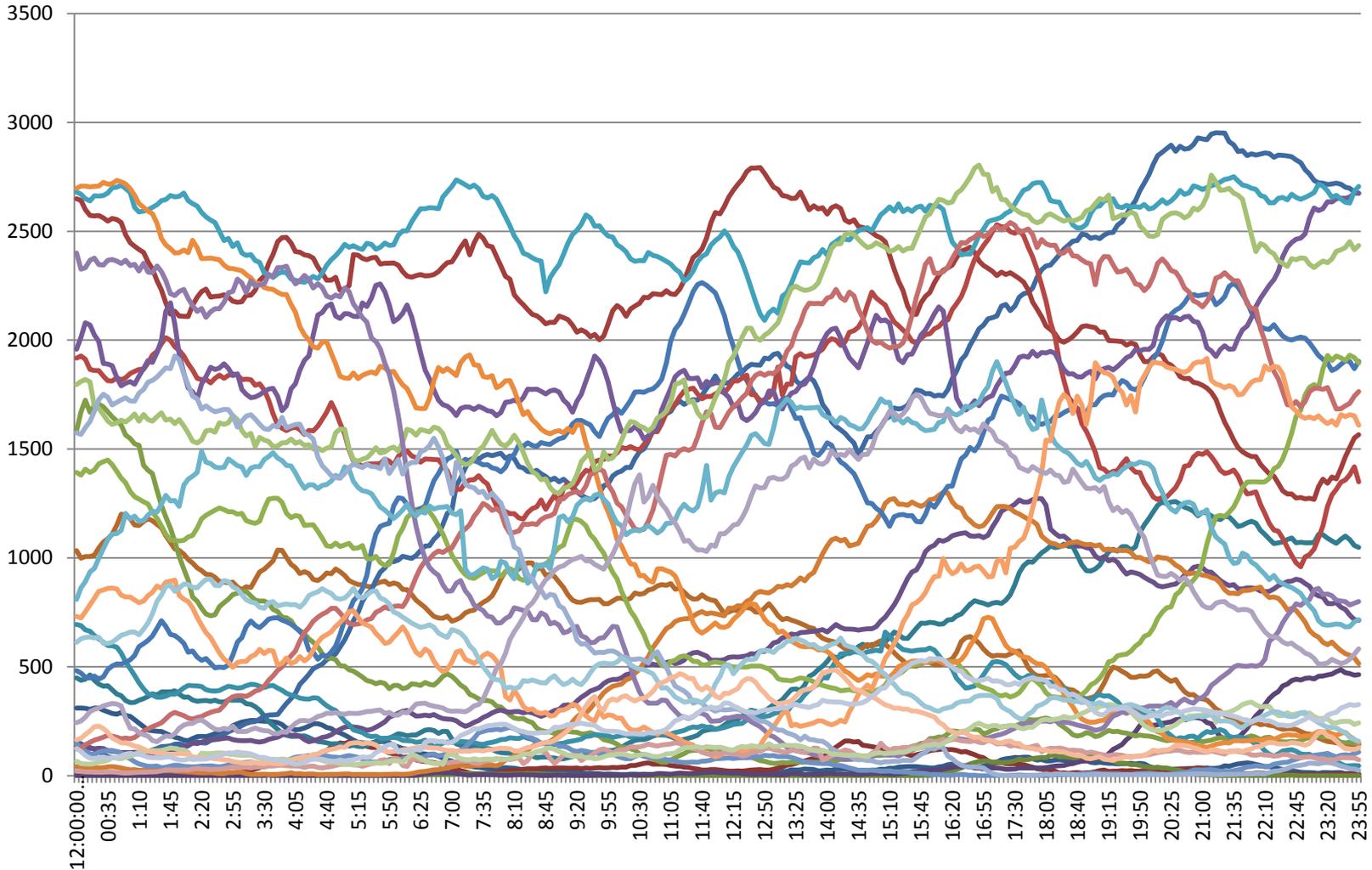
Net Load Variability

- Frequency, amplitude and duration of VER variability precludes single or easy solution
 - Continuous short-term production variability puts premium on speed/accuracy of response
 - Fast, large magnitude ramps may not align with load ramps
 - Extended periods of low/no VER production
- Demand for flexibility dramatically increased at higher penetration levels of VERs
- SCCTs (& low gas prices) the default solution, but there is a growing list of alternatives
- Reforms and new technologies suggest a more operational view of planning, including comprehensive multi-faceted VER integration strategy

Daily Wind Production

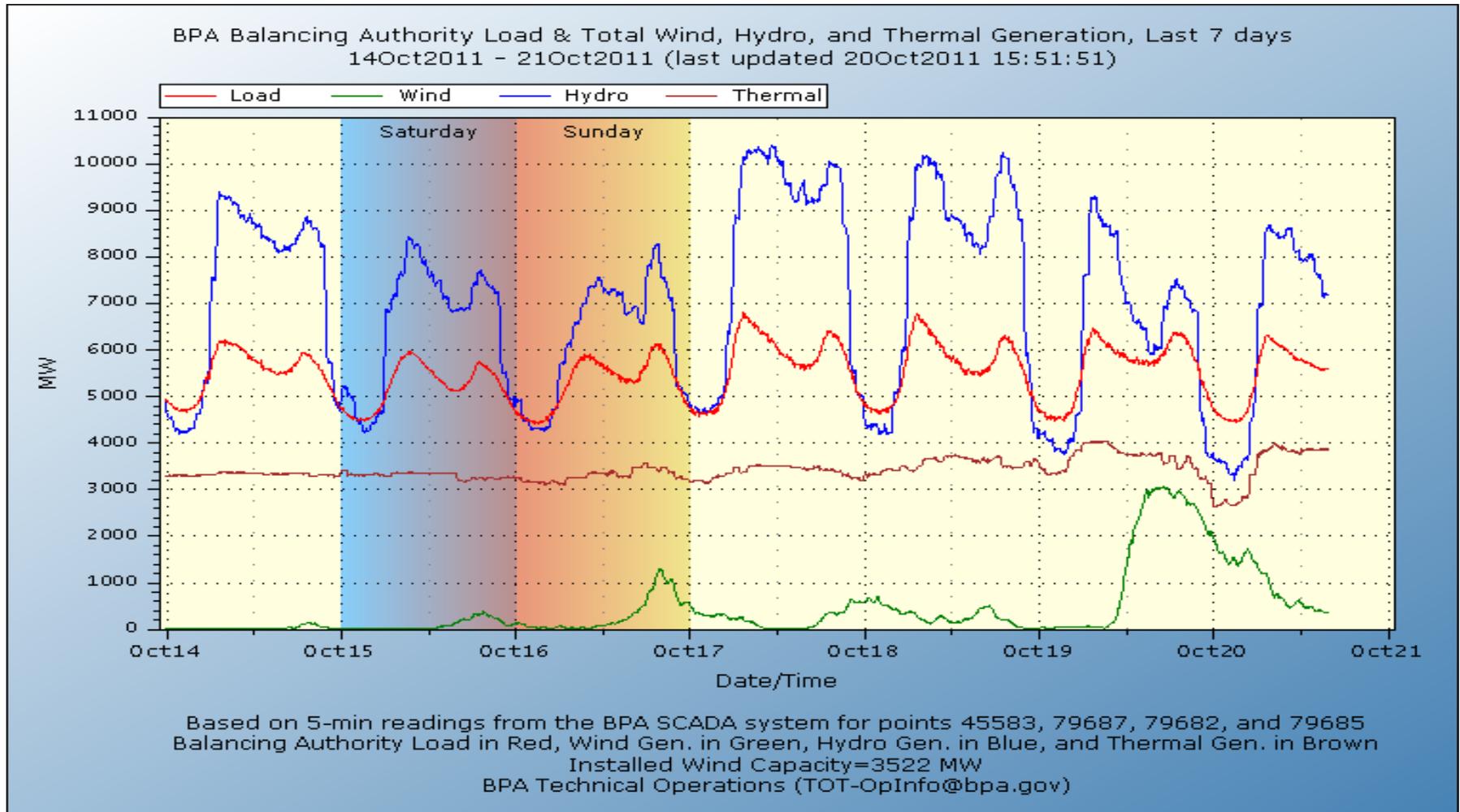
BPA Balancing Area – January 2011

MWs 5-minute data (one 24-hour day per colored line)



BPA 7-Day Generation & Load - Fall

Oct 14 – 20, 2011

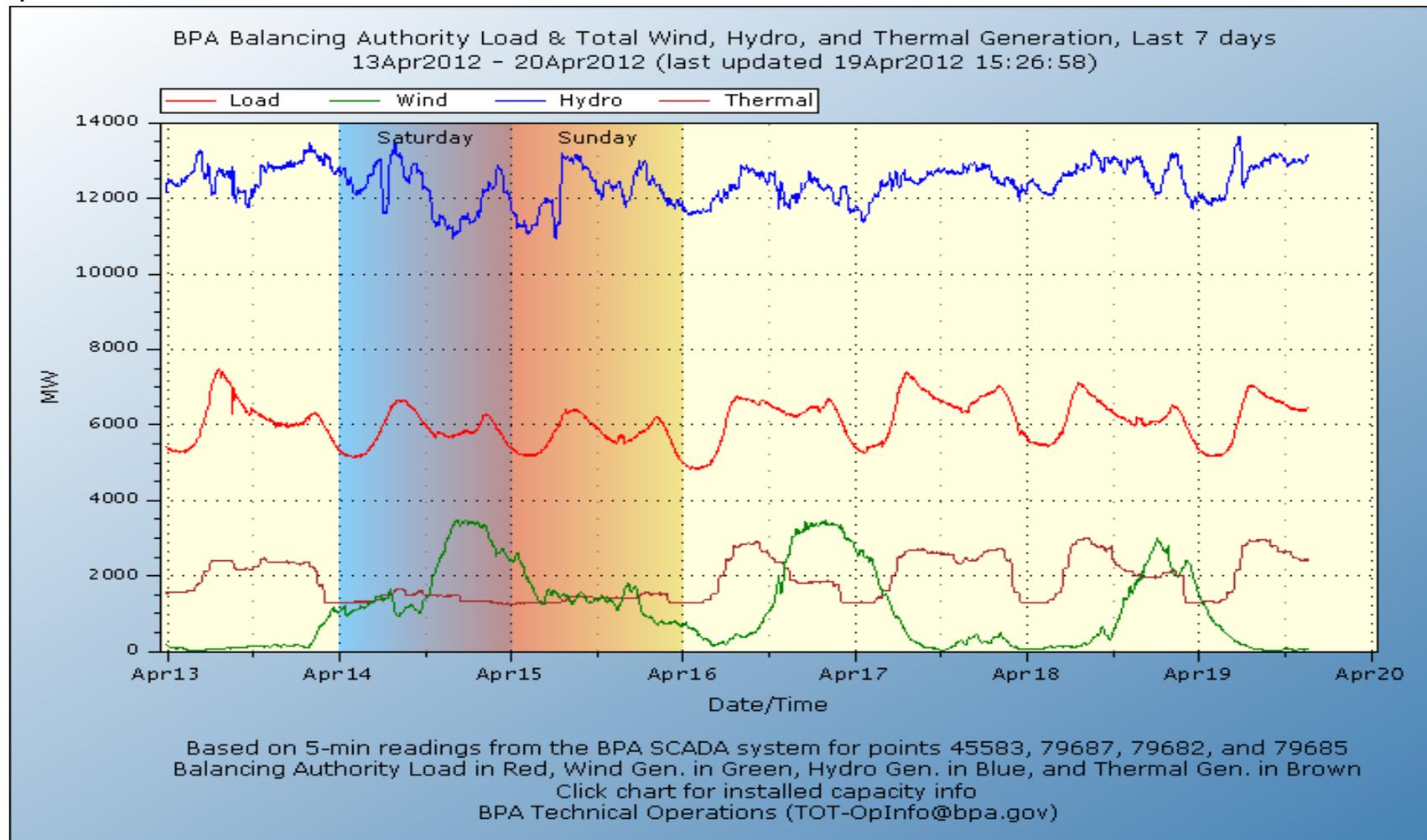


One 3,000 MW wind ramp in 7 days

5,000 + MW of hydro system flexibility, thermal reasonably stable

BPA 7-Day Generation & Load – Spring

April 13-20, 2012



Similar load 5-7,000 MW

Three days of significant wind production

Hydro output higher with less flexibility; thermal at lower output and absorbing variability

Flexibility Sources

- Diversity (access) strategies – geographic/technology diversity, BA consolidation/cooperation, markets
- Generation – fast responding hydro, CTs, reciprocating engines
 - CT/recips “wear & tear”, response range a fraction of nameplate, potentially degraded fuel/emissions performance
- Storage – response range 2X nameplate
 - Short, limited capacity (batteries, flywheels) fast, accurate
 - “Bulk”, longer duration (pumped hydro, CAES)
 - Thermal storage (molten salt, ice, hot water)
- Demand management – smart grid controllable “withdrawal” and “recharge”

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What is the piece of the flexibility question
that we have not talked about?

And don't forget your valentine!!

Flexibility Sources

Institutional Reforms

- Break with traditional hour-based operating regimes
 - Sub-hourly generation and transmission scheduling intervals closer to the operating period
- Refine ancillary services definitions; align value recognition and compensation with performance
- Reform planning & resource acquisition processes
 - Identify operating/flexibility needs, alternative solutions
 - Full operations benefit/value comparisons, technology neutrality
 - Inclusive RFP bidding rules/evaluation; example, shorter/smaller A/S performance minimums
- Balancing area cooperation to broaden flexibility choices
 - Rate accommodation (avoid TX rate pancaking)
 - Adequacy of transmission
 - Markets (i.e., EIM) and liquidity

Flexibility Sources

Storage 1

- Regulatory and business model issues remain
 - Definition/regulatory authority - generation asset or transmission asset? Or neither?
 - Utility ownership (ratebase), independent 3rd party ownership with PPAs or tolling agreements
- Storage is not just a VER integration tool, can unlock value of existing assets (G or T, or D) regardless of VERs
 - Short to long continuum of technologies
- Flywheels (<15 min) and batteries (up to hours)
 - Faster/more accurate response to frequency excursions - full up/down capacity available in less than a second (2X nameplate) versus CT's fractional operating range
 - Advances, scale and full recognition of benefits to system making costs increasingly competitive with CTs
 - Modularity of batteries & flywheels/siting simplicity advantage
 - Commercial projects around the world

Flexibility Sources

Storage 2

- Compressed air energy storage (CAES)(up to 24 hours)
 - 2nd generation technology near commercial maturity
 - High quality (faster than CT) reserves, low fuel burn “bulk” storage, fast recharge
 - Unique siting/geology requirements (salt dome, aquifer, depleted gas fields, deep water, abandoned mines)*
 - Pilots under way in California and New York, other proposals
- Pumped hydro (hours)
 - Mature technology “bulk” storage
 - Dynamic controls for generation and recharge improve value
 - Difficult siting possibly eased with closed systems
 - Many proposals, no new construction....yet

*Above ground pipe storage vessel designs generally limited to several hours

Flexibility Sources

Demand Response/Demand Management

- DR & time-based rates and VERs developing on own tracks; little regard for complimentary operations
- Potential of the demand resource and related technologies has been demonstrated
- Communication & control technologies within reach
- Financial incentives to induce participation
 - TOU rates
 - Rebates on interrupted service
 - Market solutions, allow/encourage aggregators