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Generation Inputs Workshop

January 16, 2014

Agenda

- Landscape of Installed Wind Capacity
- Results of BPA's Acquisition Process for Imbalance Capacity
- Draft Work Flow Process for Purchasing Imbalance Capacity at Preschedule Time Period
- Balancing Reserve Forecast Performance Update
- Customer Presentations

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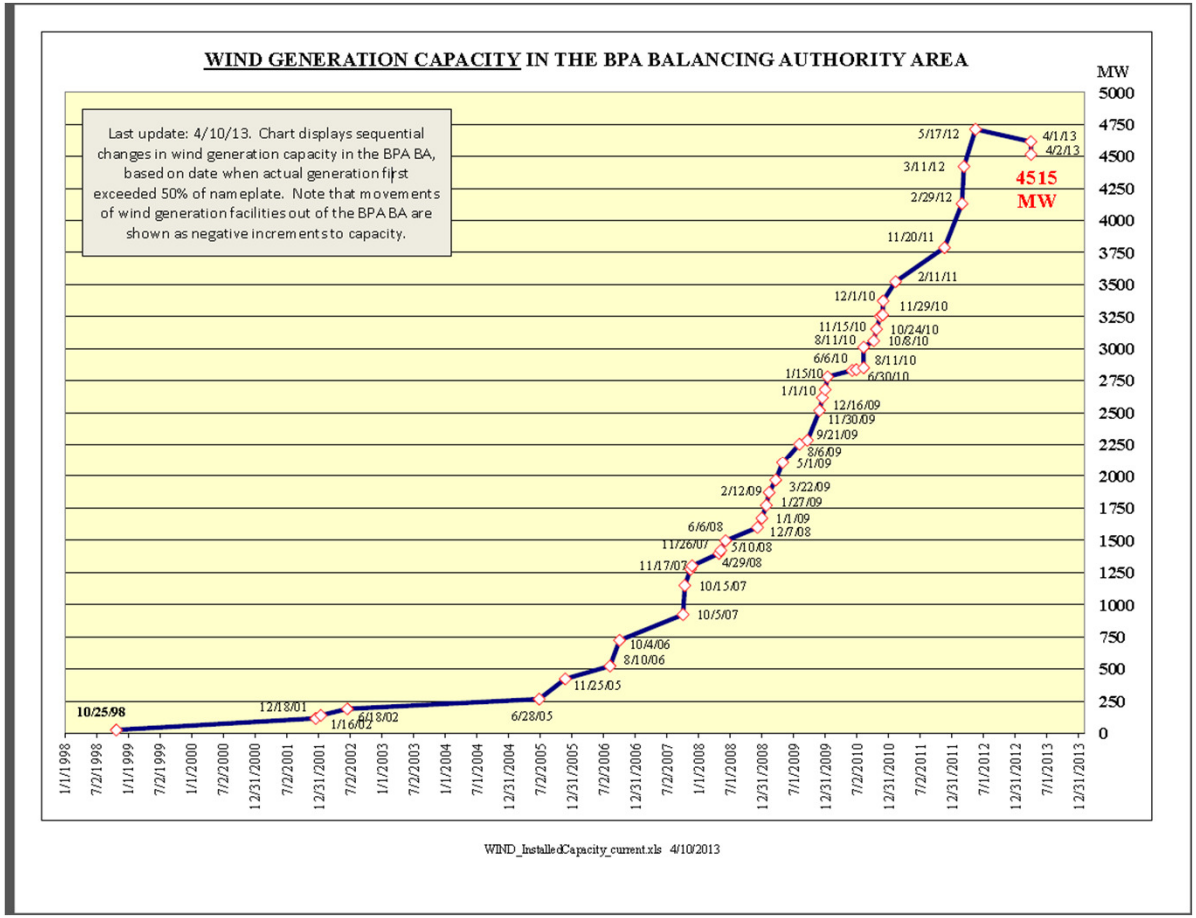
Landscape of Installed Wind Forecast

Content Overview

- Present Landscape
  - Current Installed Wind in BPA Balancing Authority Area (BAA)
  - Resource Changes in BPA BAA
  - Projected Wind Development in BPA BAA
  - Preliminary Forecast – Installed Resources in BPA BAA (during BP-16)

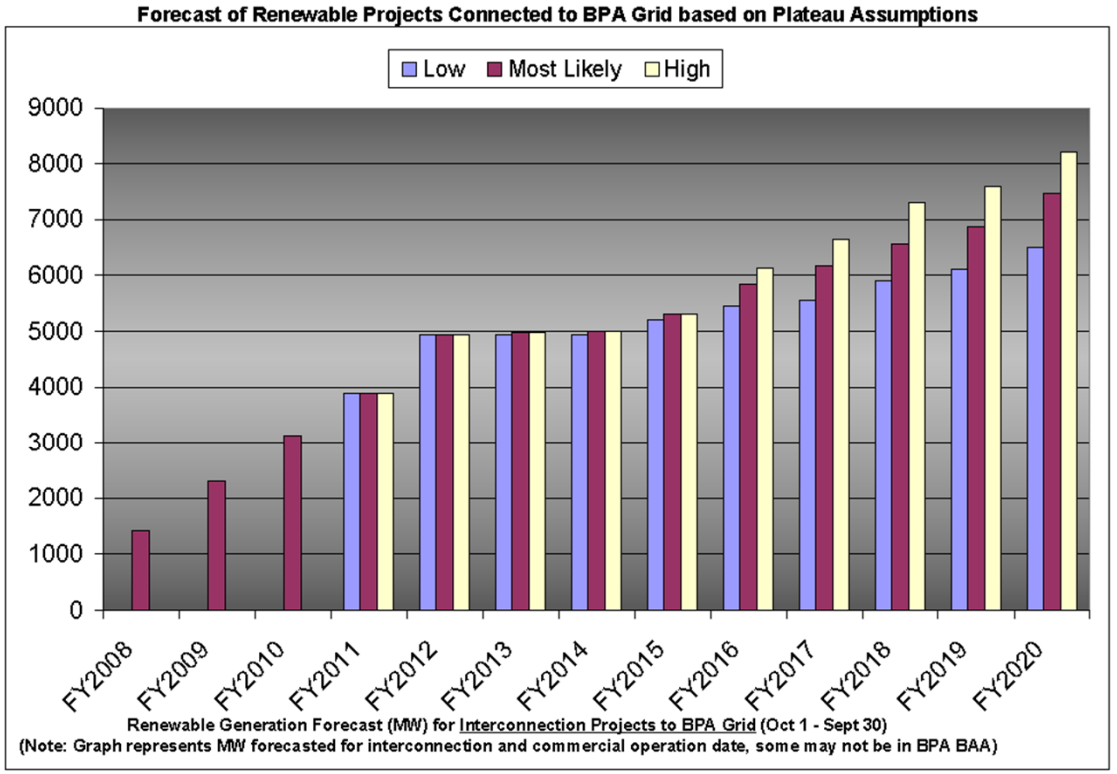
Wind Generation in BPA BAA



Resource Changes in BPA BAA

- 4,972 MW of Renewable Generation connected to BPA BAA
  - 4,515 MW operating in BPA BAA (Wind only)
- FY13 Additions – 32 MW (5 MW solar, 7 MW hydro, 20 MW co-gen)
- FY13 Decreases -196 MW of Wind and 520 MW of thermal left the BAA
  - Still connected to BPA (Part of dispatch, RAS schemes, other controls)
- FY14 Forecast – Addition of 25 MW solar
- FY15 Forecast – Addition of approximately 275 MW of wind
- FY16-17 Forecast – Addition of 400 to 850 MW of solar and wind, as end of pause in development nearing. New Production Tax Credit (PTC)?
- 2020 is next major Renewable Portfolio Standard milestone, requiring 15% in Washington and 20% in Oregon (1000 -1500 MW addition), so figure on new projects interconnecting 2-3 years before, sooner if PTC extended.

Renewable Development Forecast



NOTES:

S. Enyeart As of: 12/19/2013

1. Projections beyond FY12 may be impacted or delayed due to a need for Transmission system expansion.
2. Projected totals based on previous experience and present growth factors including Production Tax Credits and RPS Demand.
3. Generation shown is interconnected to BPA-T; amount within BPA Balancing Authority Area is not estimated.

Preliminary Forecast - Installed Resources in BPA BAA

Forecast	FY14 Average	FY15 Average	FY16 Average	FY17 Average
Avg Installed Wind	4517	47.17	5026	5441
End of FY Wind	4517	4784	5334	5656
Avg Installed Solar	10	32.5	35	35
End of FY Solar	20	35	35	35
Avg Non-Automatic Generation Control Hydro	2529	2529	2529	2529
End of FY Hydro	2529	2529	2529	2529
Avg Non-Federal Thermal	4430	4222	4222	4222
End of FY Thermal	4222	4222	4222	4222

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Results of BPA's Acquisition Process for Imbalance Capacity

Background

- Last March, we presented our Acquisition Framework to this group to share the approach we planned to use for acquiring any necessary reserves.
- Its worth reviewing a few of the guidelines we outlined:
  - Underlying Principles
  - Acquisition Goals and Timelines
  - Reserve Types
  - Pricing Guidelines
  - Contract Types

Underlying Principles in our Acquisition Process

- Minimize the total cost of supplying imbalance capacity to support customer elections while meeting Federal Energy Regulatory Commission (FERC) requirements for a Balancing Authority.
- Create a single process to use as a framework for acquiring all reserves required across the rate period, regardless of what products customers elect to sign up for.
- Quantity purchased will be a Transmission Services (TS) operations decision, executed through Power Services (PS).
- Any purchases of Imbalance Capacity would be made by a PS employee using a process that addresses any Standards of Conduct (SOC) concerns.
- Communication with customers in the product pool on our success (or failure) in procuring imbalance capacity would be done in a timeframe that allows them to ascertain their level of DSO 216 exposure prior to the operating hour or sooner.
- Costs of any acquisitions will be charged to Ancillary and Control Area Services customers according to the rate schedule.

Acquisition Goals and Timelines

- Both the need and type of acquisitions BPA makes will be defined by customer elections and customer resource management decisions.
- Acquisitions will be broadly broken into three categories:
  - Long-term – reserves purchased for several consecutive months or more
  - Mid-term – reserves purchased in individual monthly amounts
  - Short-term – reserves purchased in less than monthly amounts
- Currently, the amount of BPA required acquisitions is defined monthly, with shorter term purchases targeted for the future.
- Initially, it is recommended that acquisitions are NOT made in finer increments than the Western Electricity Coordinating Council (WECC) pre-schedule period (1-5 days) as defined by the WECC scheduling guidelines. As we move forward we will explore buying in smaller increments.

Types of Within-Hour Reserve Acquisitions for FY 2014 - 2015

- **Planned Acquisitions* (Type 1)** – Monthly purchases required to cover the shortfall, if any, between the planned Federal Columbia River Power System (FCRPS) balancing reserve capacity (900 MW INC, 1100 MW DEC) and the rate case planned balancing needs of base service (99.5% after adjusting for any self-supply of generation imbalance).
- **Operational Acquisitions* (Type 2) –** Purchases needed when BPA is either operationally unable or at risk of being unable to provide the planned FCRPS INC balancing reserve capacity necessary to meet the 99.5% reliability standard.
- **Full Service (Type 3) –** Purchases required to provide reserves for customers electing the VERB's Full Service balancing service plan. These will be made in smaller increments. Costs are charged to the full service customers.
- **Unplanned Service* (Type 4) –** Monthly purchases required to support an unplanned increase in balancing services required by the BPA BA. These costs are directly assigned to the customers that create the unanticipated increase.
- **VERBS Supplemental Service (Type 5) –** Optional monthly service where BPA purchases reserves on behalf of customers requesting an amount they define. This service would be in addition to the base service. Customers may also acquire their own Supplemental Service with less notice for shorter periods. Costs are charged to Supplemental Service customers.

*these acquisitions are for meeting or maintaining our base level service with the 99.5% reliability standard.

Process & Pricing Guidelines for Purchases

- Monthly, within-month, and up to pre-schedule acquisitions will be handled by a PS employee via an Request for Offer (RFO) process.
- Acceptable bids should balance deployment costs against capacity costs in a way that doesn't create cost shifts between within-hour Imbalance Capacity customers and other BPA customers.

Several potential examples follow for discussion purposes only:

- For non-thermal plants, the evaluation will consider capacity costs in conjunction with energy pricing. Energy pricing would be referenced to an approved energy index for deployed energy.
- For thermal plants, the evaluation will consider the total value offered based on the capacity charge and the heat rate bid in conjunction with approved gas indexes.
- We may also consider solicitations using defined energy pricing where only the capacity component of the bid is variable.

Contract Types

- Standardized Capacity Term Sheets could be developed providing both boiler plate language for options and operational performance standards. These one to two page confirms could then be used for any shorter term offers (one month or less).
- In addition to a capacity charge, the dispatched energy for an individual agreement would be referenced in a standard way to either a energy index or to a gas index.
- Valuation would be done based on:

  Total Cost = capacity cost + energy cost x estimated deployments

RFO #1

- The first RFO was issued on July 16, 2013, for 39 MW of Imbalance capacity for the Oct. 1, 2013, through Dec. 31, 2013, period to address rate case defined Planned Acquisitions (Type 1) needs.
- Firm Offers were due by August 7, 2013.
- Three offers were received which ranged in price from $3.70/kW-month to almost $7.00 kW-month.
- Two of the counterparties elected to bid the energy component of the offer using the used the % of Powerdex index while the third counterparty used the heat rate and gas index option.
- The group was comprised of one Public Utility, one Demand Response entity and one out-of-region supplier.
- The winning bid was for $3.70/kW-month with a Heat Rate bid of 20,000.

RFO #2

- The second RFO was issued on Oct. 3, 2013, for 29 MW of Imbalance Capacity for the Oct. 14, 2013, through Nov. 30, 2013, period to address 28 MW Planned Acquisitions (Type 1) and 1 MW of Direct Assignment (Type 4) needs.
- The need for these acquisitions came about due to a Independent Power Producer (IPP) not being able leave the BPA BA early as predicted and a wind supplier who didn't meet the testing criteria for the 30/60 scheduling election they made.
- Firm Offers were due by Oct. 8, 2013.
- Two offers were received. The capacity offers were $3.67/kW-month and almost $7.00 kW-month.
- One counterparty elected to bid the energy component of the bid using the heat rate and gas index option while the other used the % of Powerdex index.
- The bidders were comprised of one Public Utility and one out-of-region supplier.
- The winning bid was for $3.67/kW-month with a bid Heat Rate of 13,250.
- At the request of TS, this service request was extended to include service through the end of December.

RFO #3

- The third RFO was issued on Nov. 19, 2013, for 41 MW of Imbalance capacity for the January 1, 2014, through March 31, 2014, period to address rate case defined Planned Acquisitions (Type 1) needs.
- Firm Offers were due by December 2, 2013.
- Six offers were received. Exact pricing ranges will be released 90 days after bid selection.
- Four of the counterparties elected to bid the energy component of the bid using the heat rate and gas index option while two counterparties used the % of Powerdex index.
- The group was comprised of one Public Utility, one Demand Response entity, one IPP and three out-of-region suppliers.
- The winning bid details will be released 90 days after bid selection.

General Observations

- Each of the three RFOs issued to date have been awarded to a different counterparty.
- Winning bids got successively lower with each RFO.
- Participation in the quarterly RFO process appears to be on the rise.
- Other than the very first deployment request, deployment of the resources has gone well.
- The need to deploy these contract resources has been very limited due to the low output factor of wind during this period (Oct 1 – Dec 31st).
- The participation level in the next RFO is difficult to predict, but appears at this point to be somewhere between the 1st and last RFO.
- Most counterparties appear to need a much higher level of internal review and approval prior to submitting capacity offers on BPA RFOs.
- Generally speaking, BPA was satisfied with the pricing offered for the winning bids.

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Balancing Reserve Forecast Performance Update

Balancing Reserve Forecast Performance Update

- Balancing Reserve Forecast (BRF)
  1. Real-Time Reserve Requirement Tool (R3T) is the internal option or "build" option
  2. One vendor (WEPROG) is producing an external option or "buy" option.
  - Both Balancing Reserve Forecasts are produced every hour for 168 hours into the future.
- The purpose of this presentation is to present analytics on the R3T forecast performance.
- This presentation is NOT meant to address:
  - Presence and Depth of Market
  - Resource Sufficiency
  - Viability of business case

R3T Update

- R3T was originally intended to forecast only INC reserves.
- R3T INC forecasts are the actual output from the R3T prototype (stored in PI)
- Recently, an estimate of DEC reserves was constructed which mimics the algorithm for INC reserves.
  - A refined algorithm is currently being tested.
  - Once thoroughly tested, DEC reserves will be incorporated into the running prototype and stored in PI.

R3T Update Assumptions

- R3T performance was analyzed from 10/1/13 to 1/7/14.
  - Since mid-October 2013, R3T produced forecasts going out the entire timeframe required to meet all WECC preschedule requirements.
- Assumptions:
  - R3T forecast snapshot from 7:00 AM on day of preschedule timeframe used in analysis
  - Typical forecast timeframe used is for 36-60 hours into the future.
    - Forecast for 18-42 hours out on the low end
    - Forecast for 114-138 hours out on the high end
      - Due to weekends and WECC holidays

R3T Performance Update

- Assumptions:
  - Forecast performance analyzed in two manners
    - Hourly Forecast
    - 24-hour Maximum of Hourly Forecasts for that day
  - Performance measures
    - Possible DSO 216 Events (Limits/Curtailments Separate)
    - Un-deployed Capacity versus 100% of reserves forecast/held (MW of INC Only)

R3T Performance Update

DSO 216 Performance

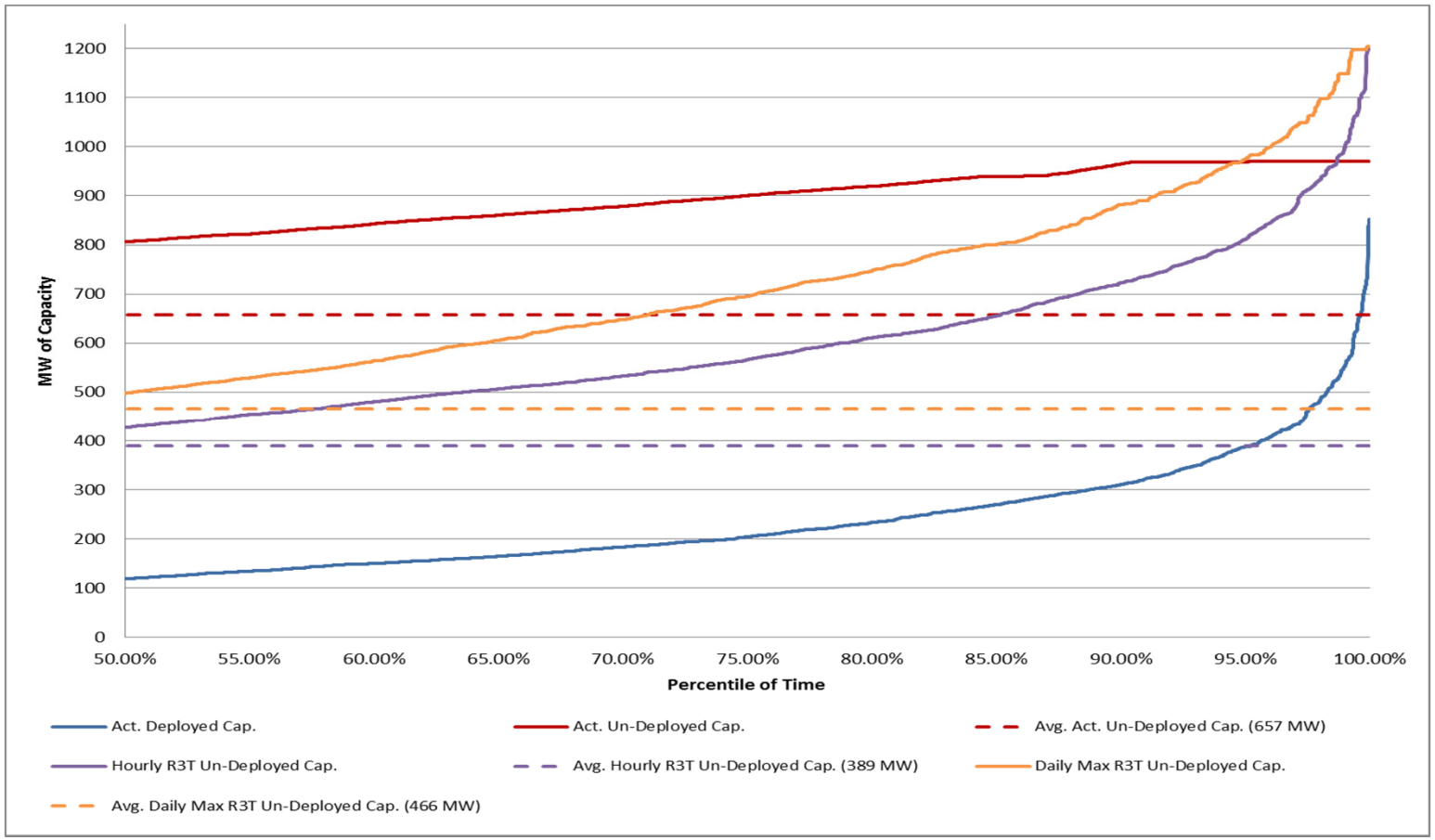
Scenario	Limitations	Curtailments
Actual Reserves Held	0	0
R3T Hourly Forecast	5	2
R3T 24-Hr Max Forecast	4	1

- These are for level 1 DSO 216 events (90% reserves deployed)
- NOTE: 99.5% coverage under the current BP-14 balancing reserves methodology does not have a direct translation into the coverage that could be given under the R3T forecast.
- NOTE: During this period, the Wind capacity factor was 20.8%.

R3T Performance Update

Percentile Distribution of Capacity Measures

INC only, Un-Deployment references 100% Cap Forecast/Held



R3T Performance Update

- Assumptions:
  - Hypothetical reserve "buying" analyzed in two ways
    - Above 0 or holding the R3T forecast in the manner identified above (24-hour max or hourly)
    - Above the actual reserves held (941 MW currently) in the manner identified above (24-hour max or hourly)
  - "Buying" measures
    - MW "bought" versus reserves held (INC/DEC separate)
    - Number of "purchase" periods for the above actual reserves held ONLY

R3T Performance Update

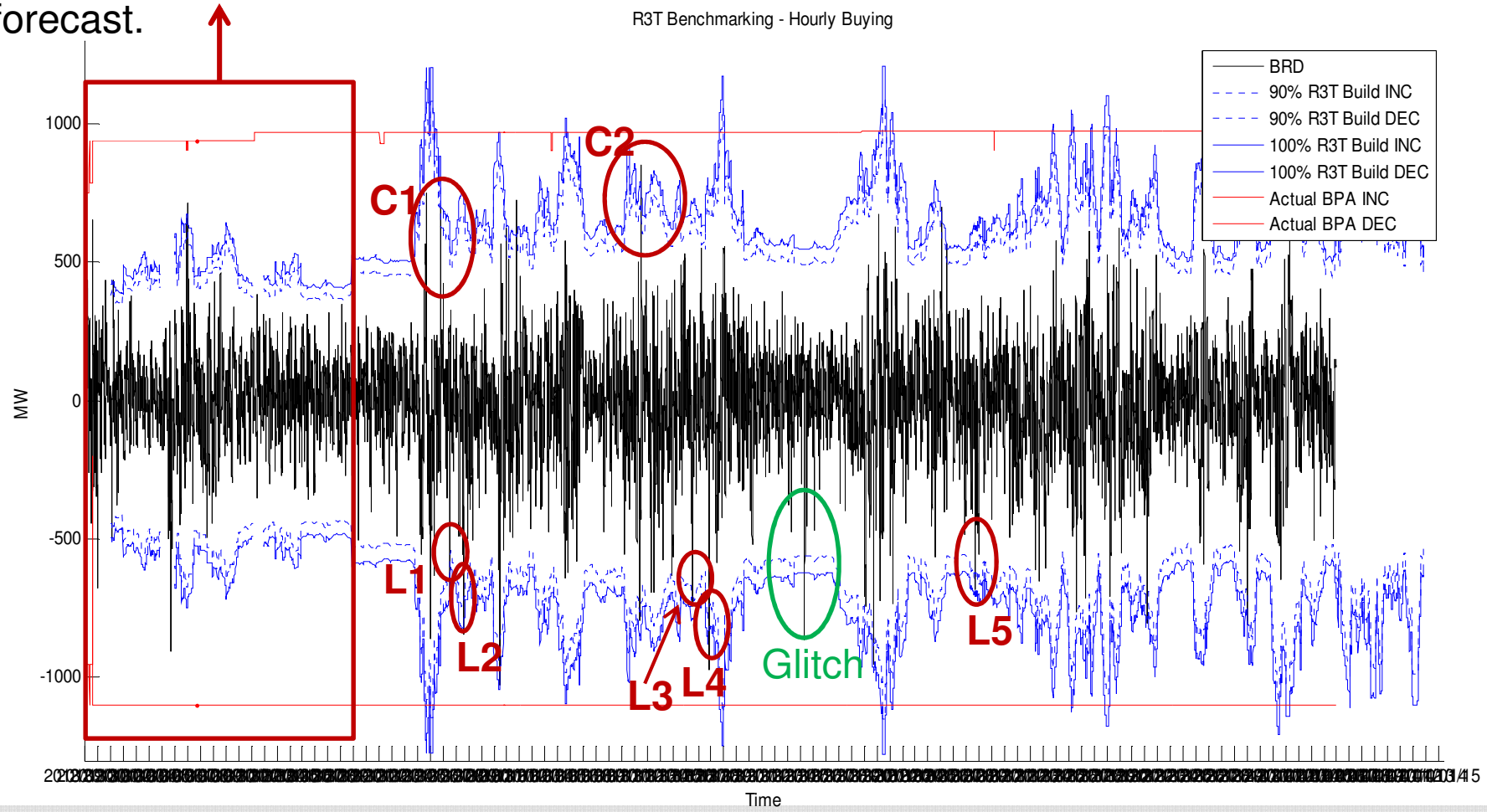
"Buying" Measures(INC Only, Period Avg.)

"Buying" Scenarios	Avg. Cap. Bought	Max Cap Bought	# of Periods
Actual Reserves Held	962 MW	970 MW	98 Days 2352 Hrs
Reserves "bought" above ZERO for R3T 24-Hr Max Forecast	758 MW	1204 MW	98 Days 2352 Hrs
Reserves "bought" above ZERO for R3T Hourly Forecast	655 MW	1204 MW	98 Days 2352 Hrs
Reserves "bought" above Reserves Held for R3T 24-Hr Max Forecast	120 MW	234 MW	15 Days 360 Hrs
Reserves "bought" above Reserves Held for R3T Hourly Forecast	95 MW	234 MW	97 Hrs

R3T Update - Hourly

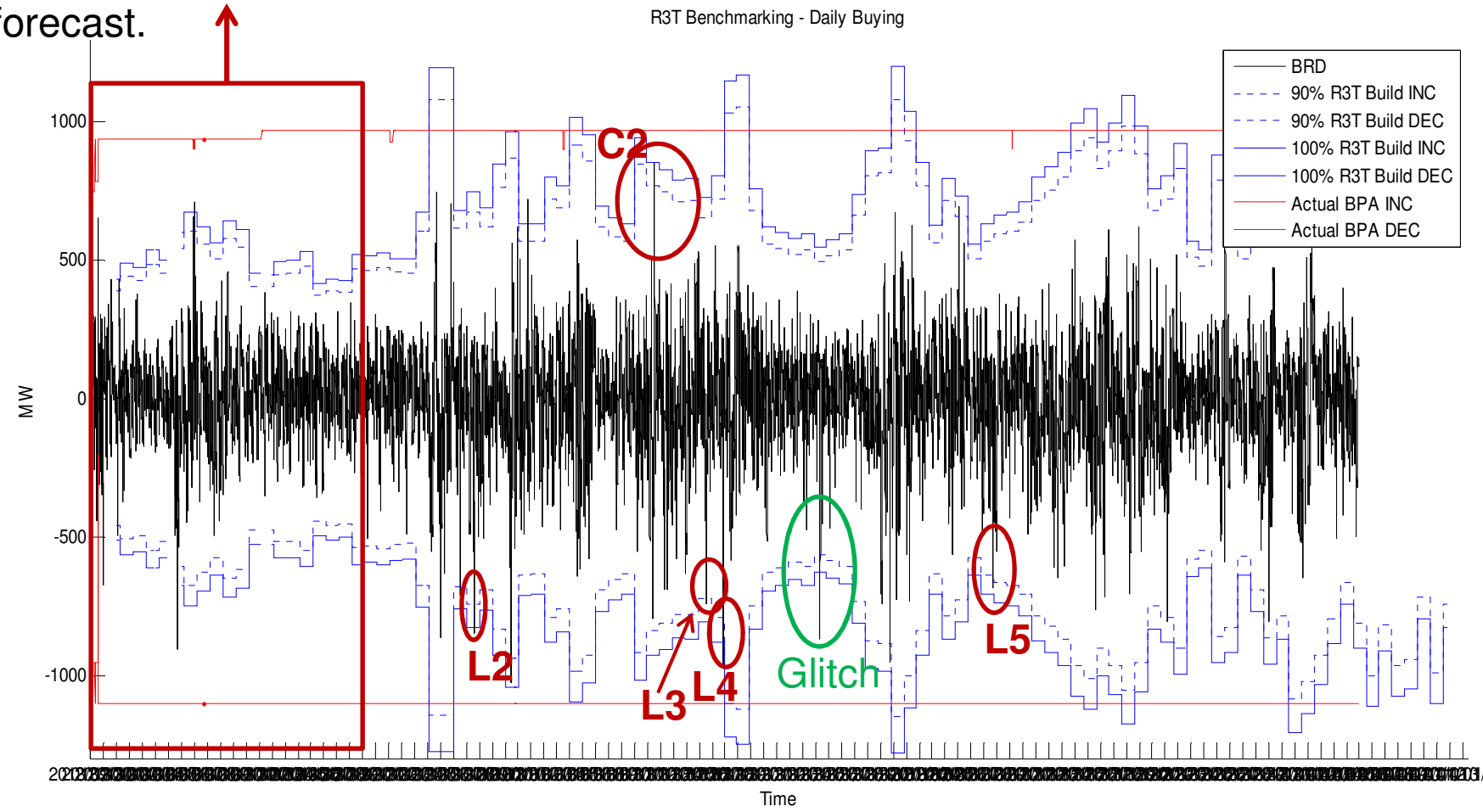
Missing segments primarily due not having the full 168-hour wind forecast.

10/1/2013-1/7/2014



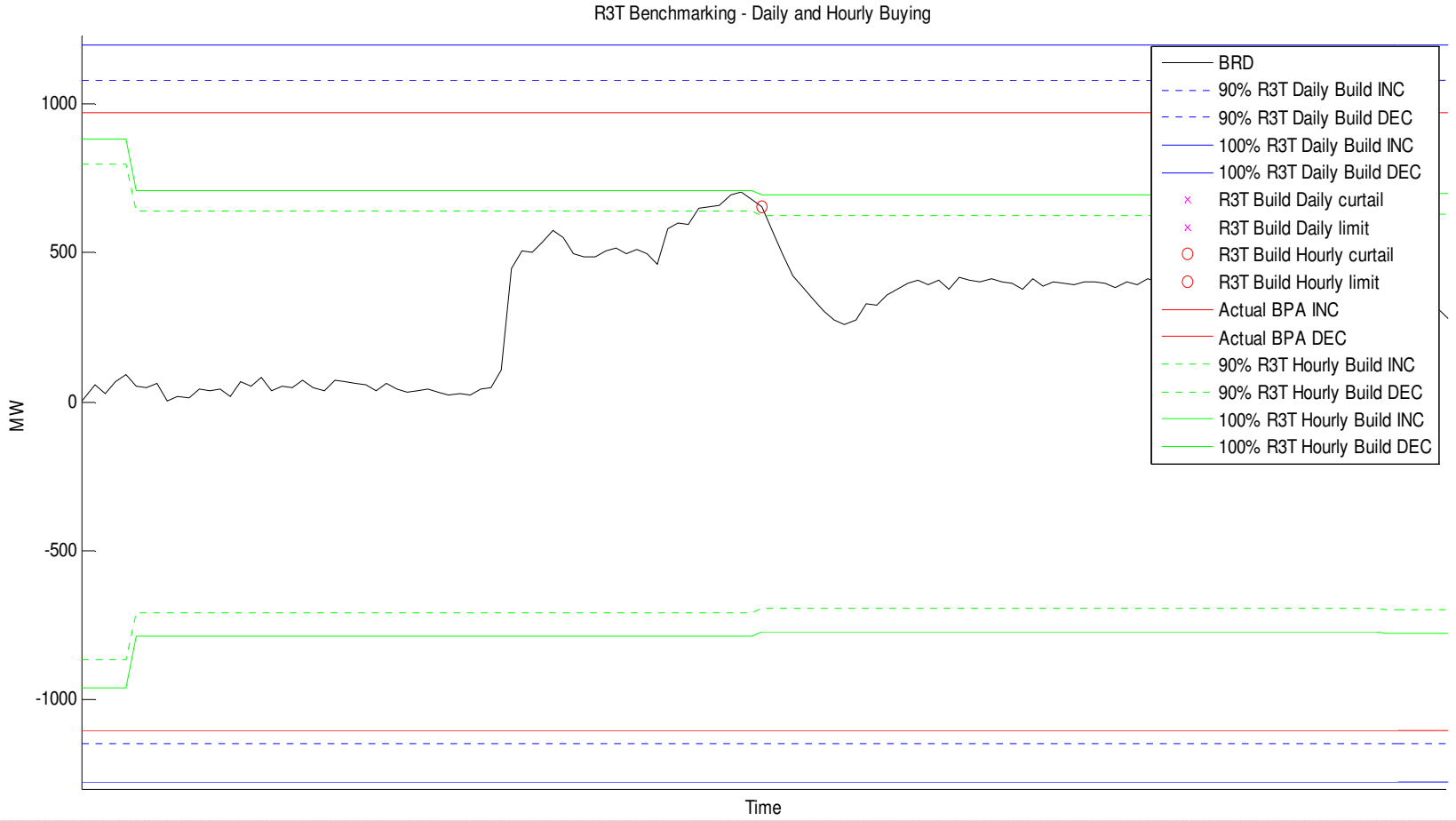
R3T Update - 24-hour Max

Missing segments primarily due not having the full 168-hour wind forecast.

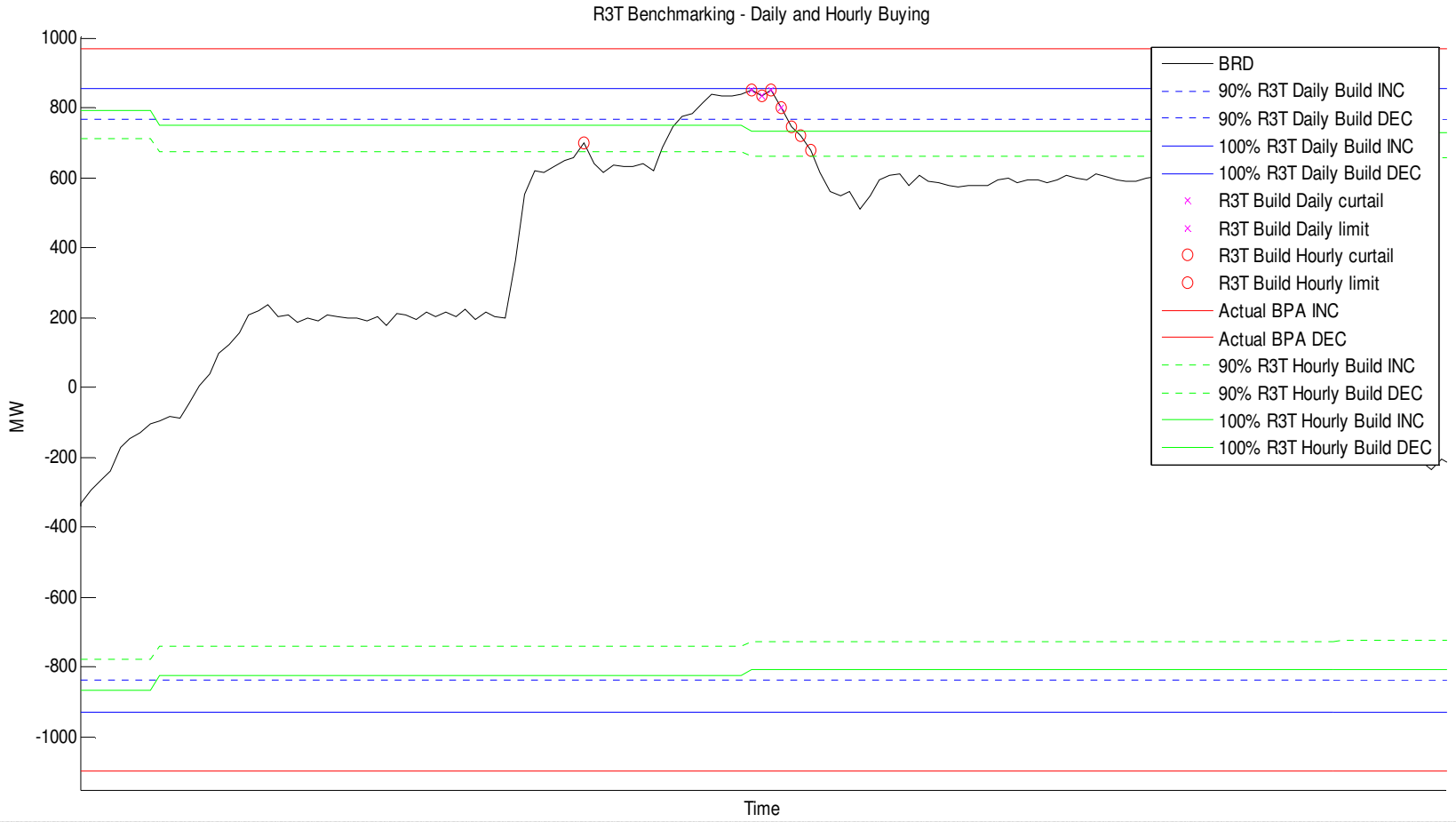


R3T Possible DSO 216 Close-Up

- R3T Hourly Possible Curtailment #C1 Close-up
  - No Daily Curtailment

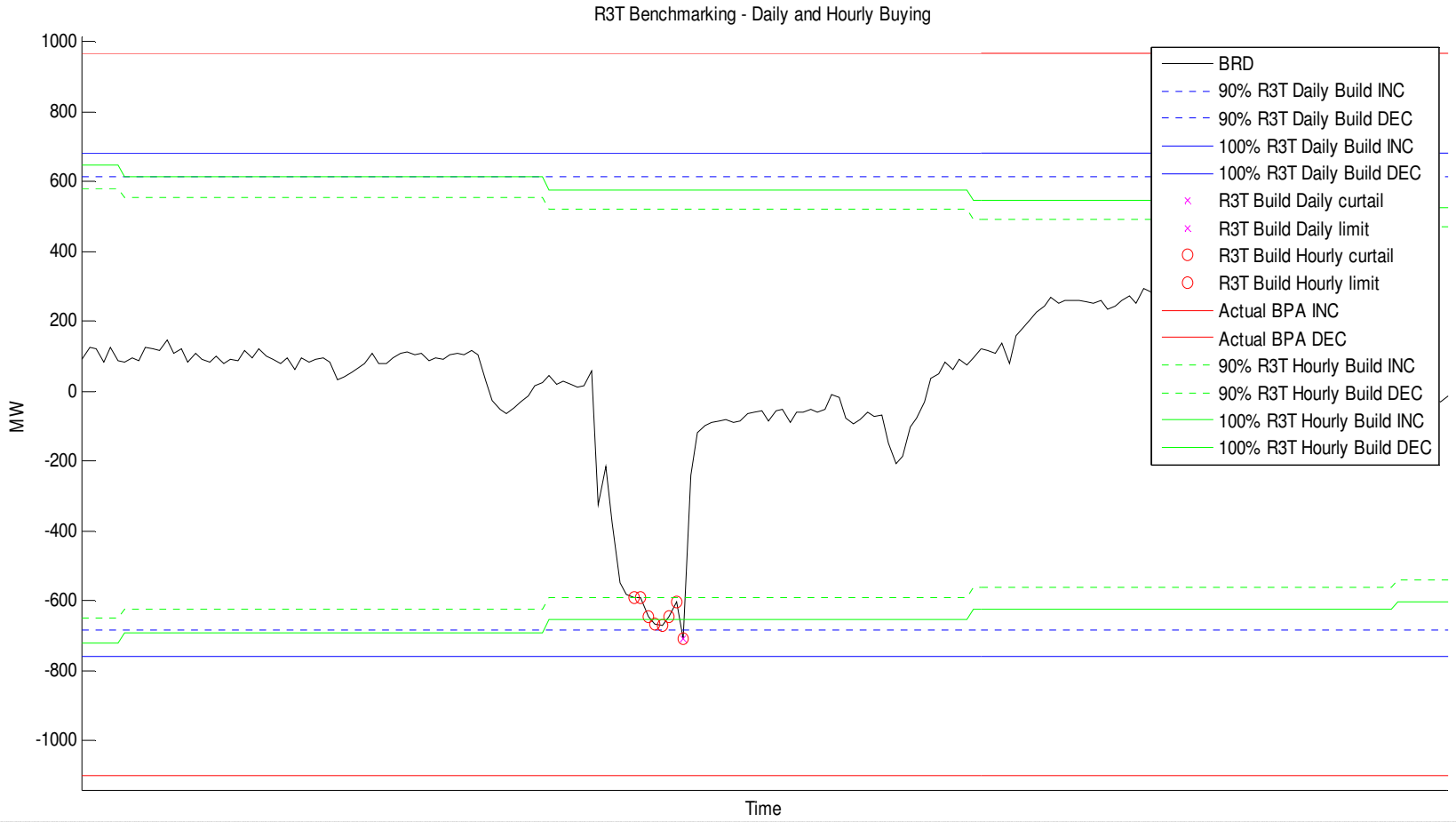


R3T Possible DSO 216 Close-Up



R3T Possible DSO 216 Close-Up

- R3T Hourly Possible Limit #1 Close-up
  - No Daily Limitation

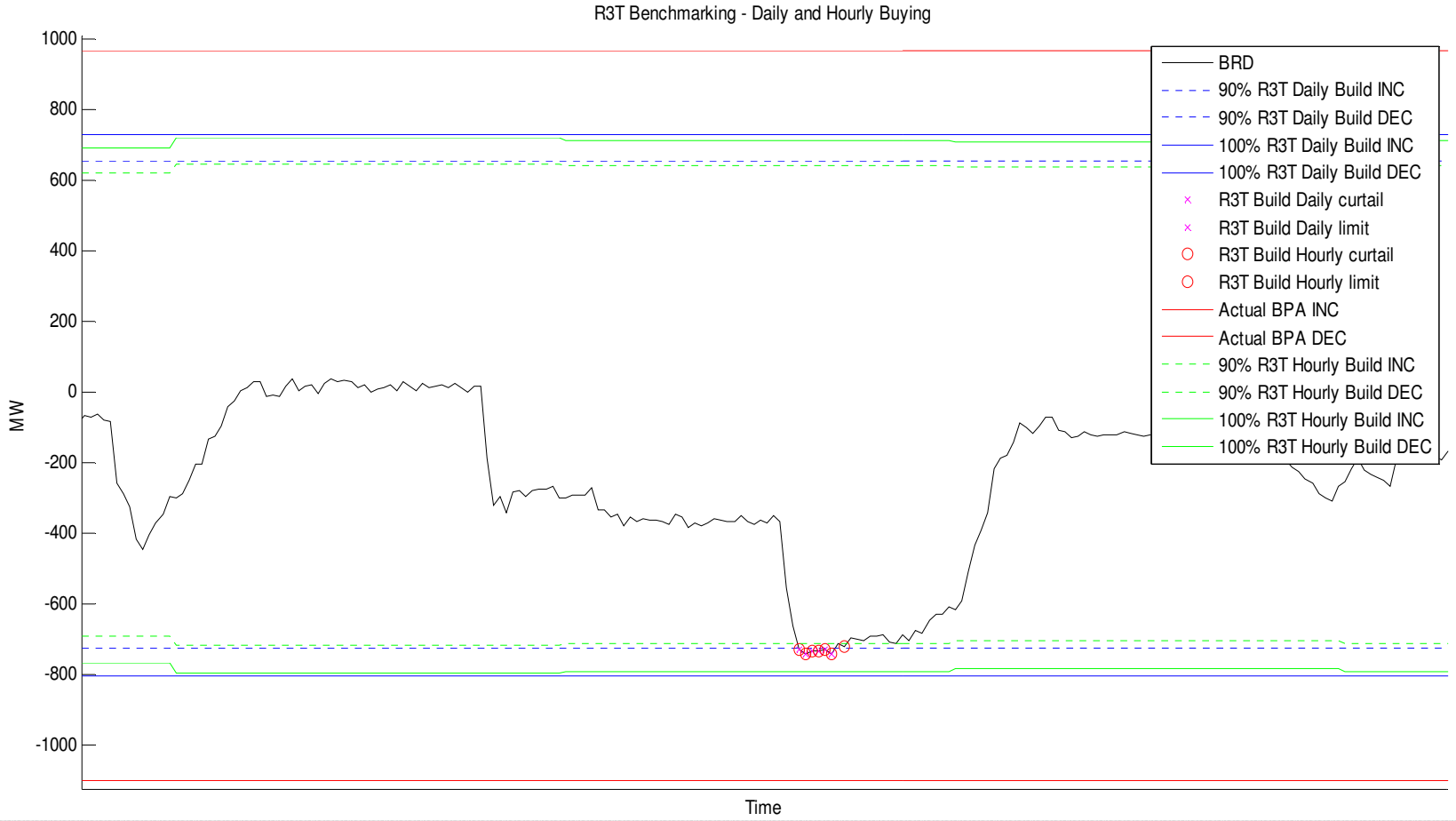


R3T Possible DSO 216 Close-Up

- R3T Hourly Possible Limit #L2 Close-up

R3T Possible DSO 216 Close-Up

- R3T Hourly Possible Limit #L3 Close-up

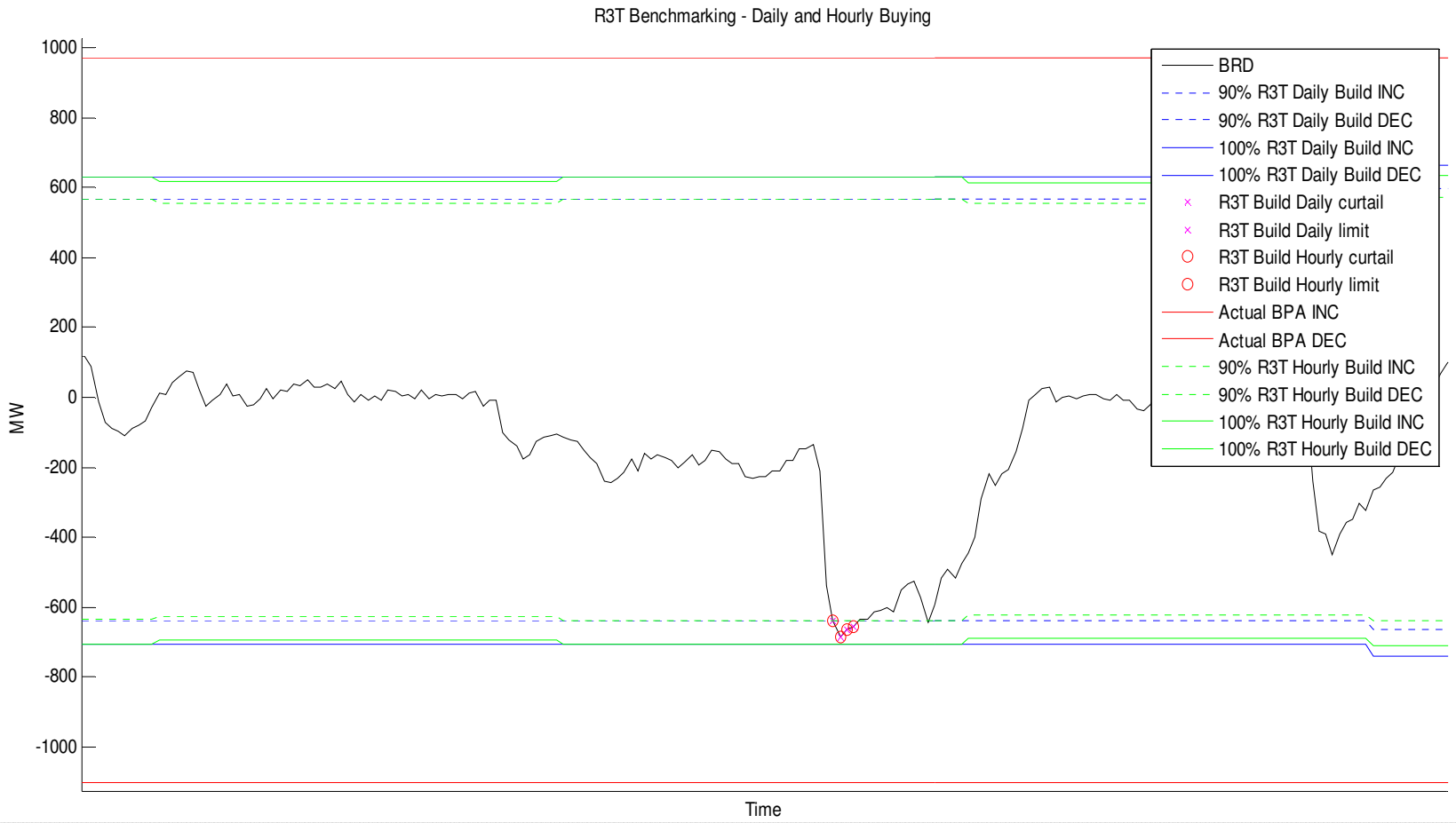


R3T Possible DSO 216 Close-Up

- R3T Hourly Possible Limit #L4 Close-up

R3T Possible DSO 216 Close-Up

- R3T Hourly Possible Limit #L5 Close-up



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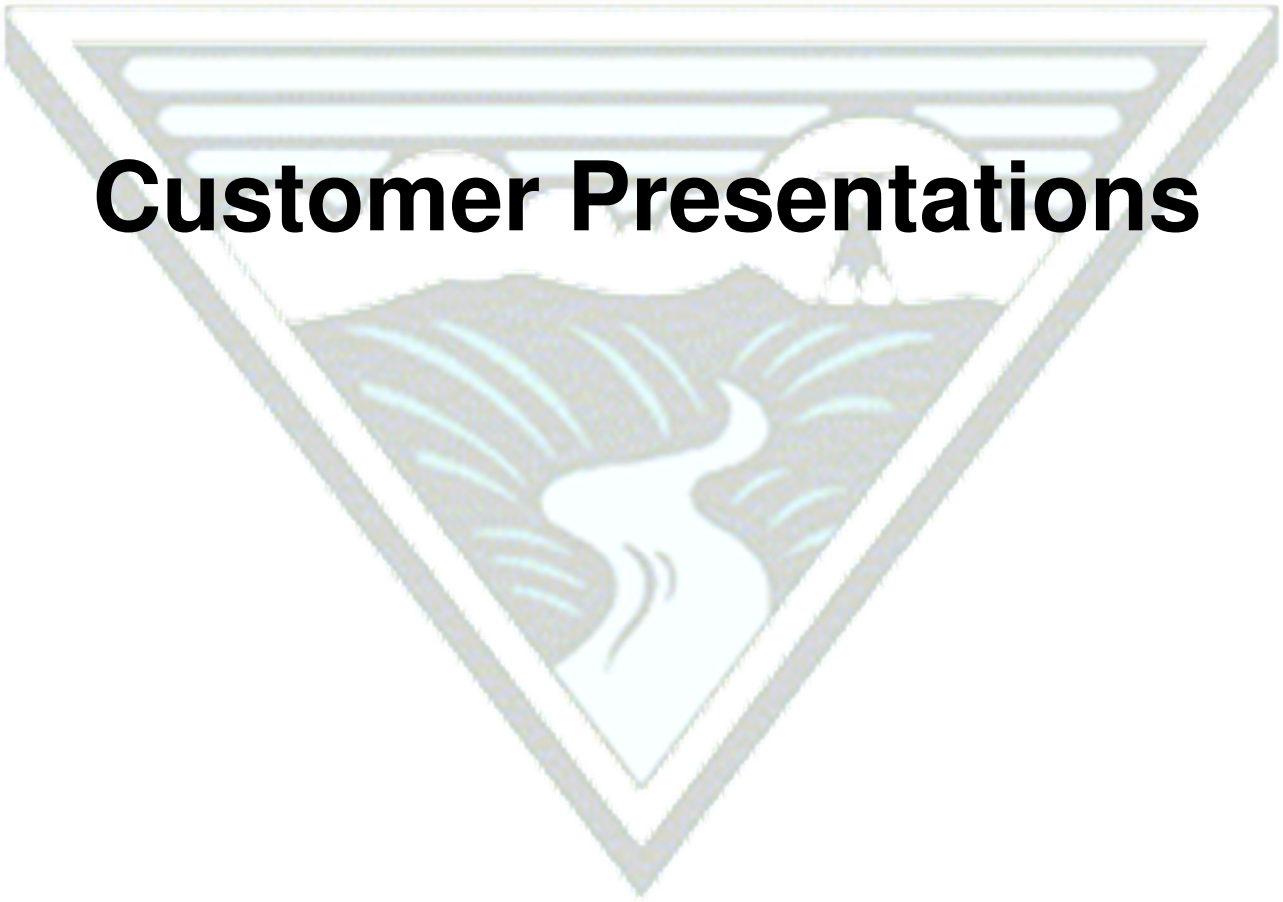

Customer Presentations