

Real-Time Reserve Requirements Tool (R3T)

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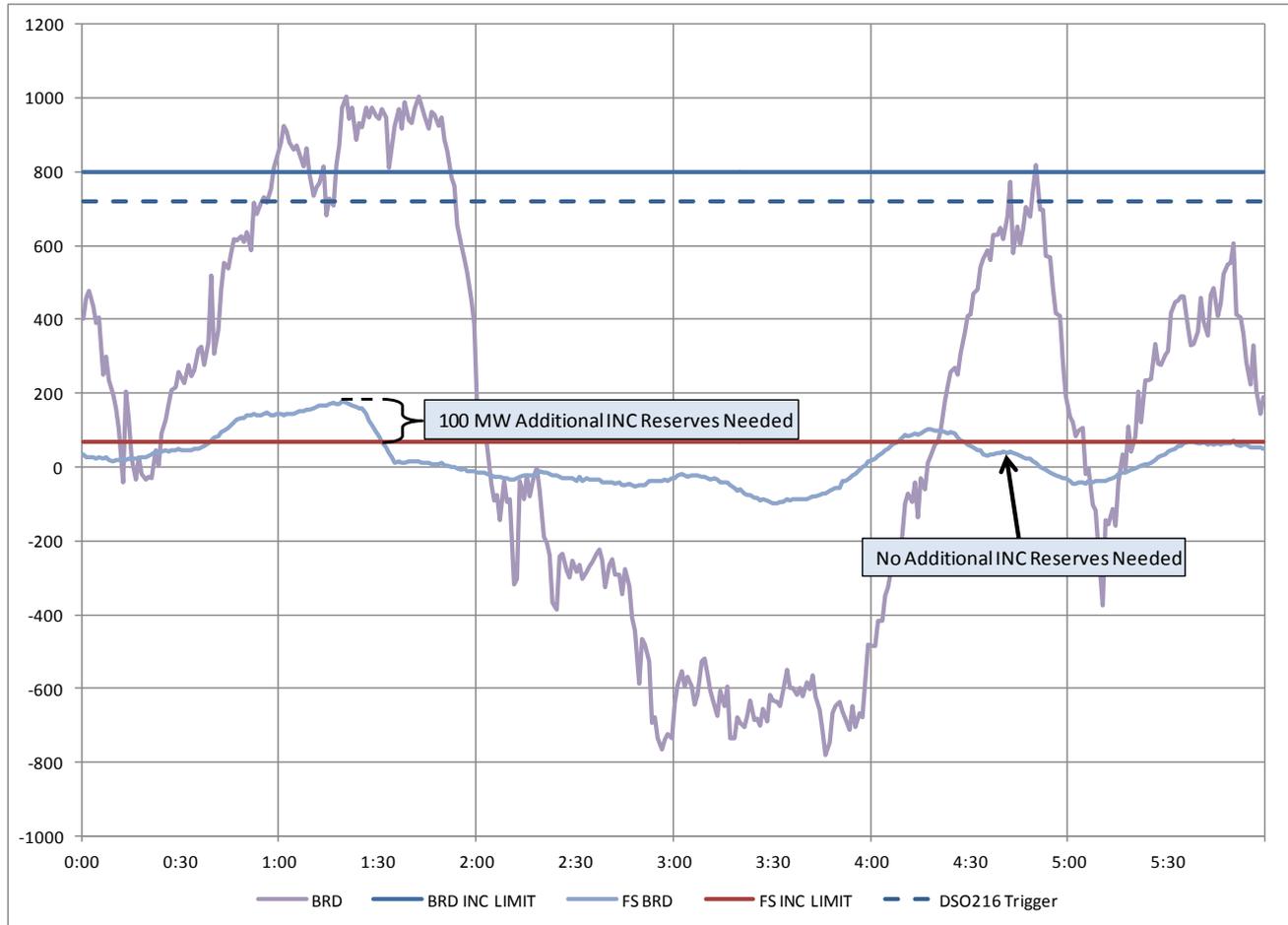


PRELIMINARY

Real-Time Reserve Requirements Tool

1. R3T Problem and Objectives
2. Cross-Walk from BA Balancing Reserves Deployed to Full Service Participant Reserve Needs
3. Update on R3T Options
4. Buy vs. Build Option

R3T Problem

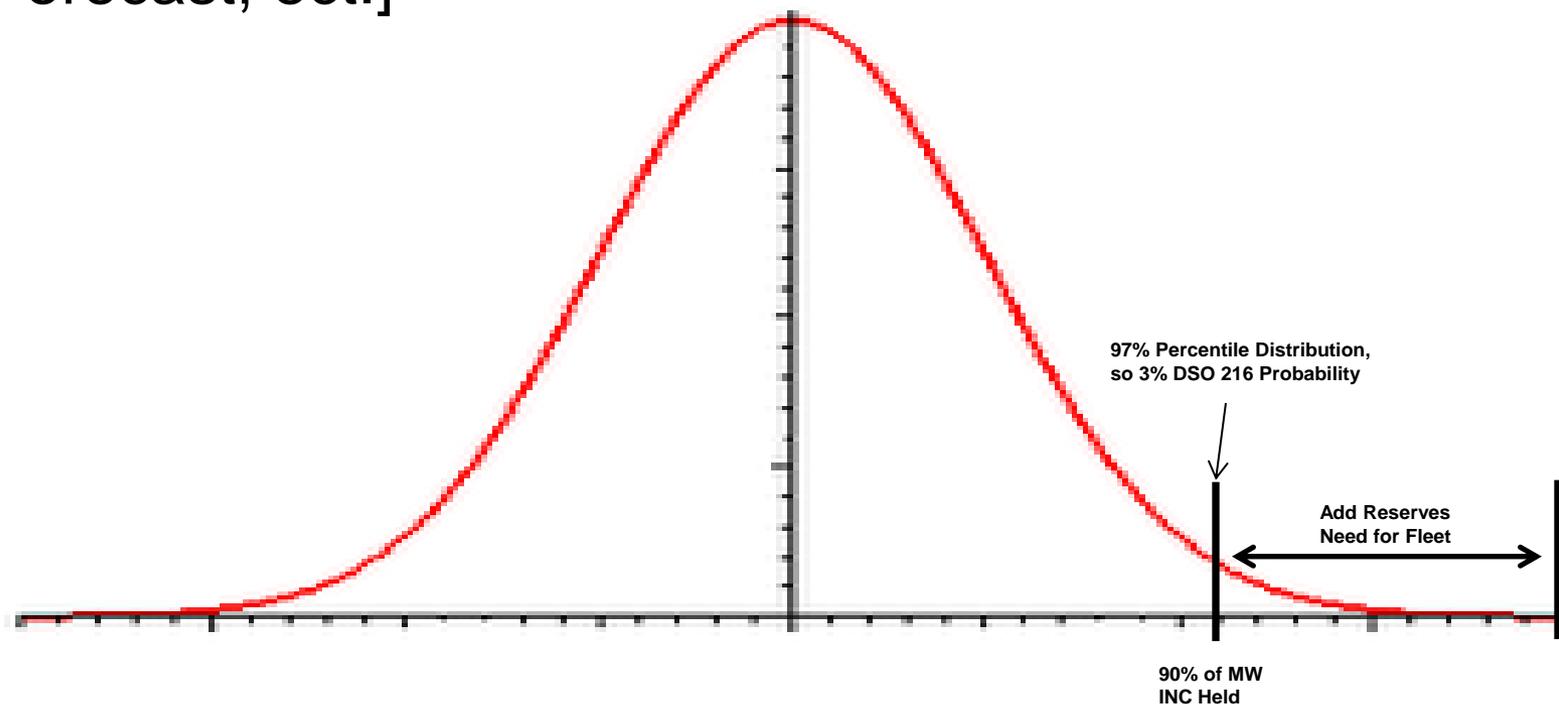


R3T Objectives

- The R3T will be developed for three objectives:
 1. Inform BPA of the additional reserves to purchase for Full Service Participants
 2. Confirm additional reserves purchased for Full Service participants is sufficient **X** hours ahead of the delivery hour
 3. Predict the likelihood of a DSO 216 curtailment event occurring during any given hour at **Y** hours ahead of time for BAA's use

Cross-Walk from BRD to FS Participants

Percentile Distribution of Balancing Reserves Deployed for given conditions [Wind Forecast, Hour of Day, Load Forecast, ect.]



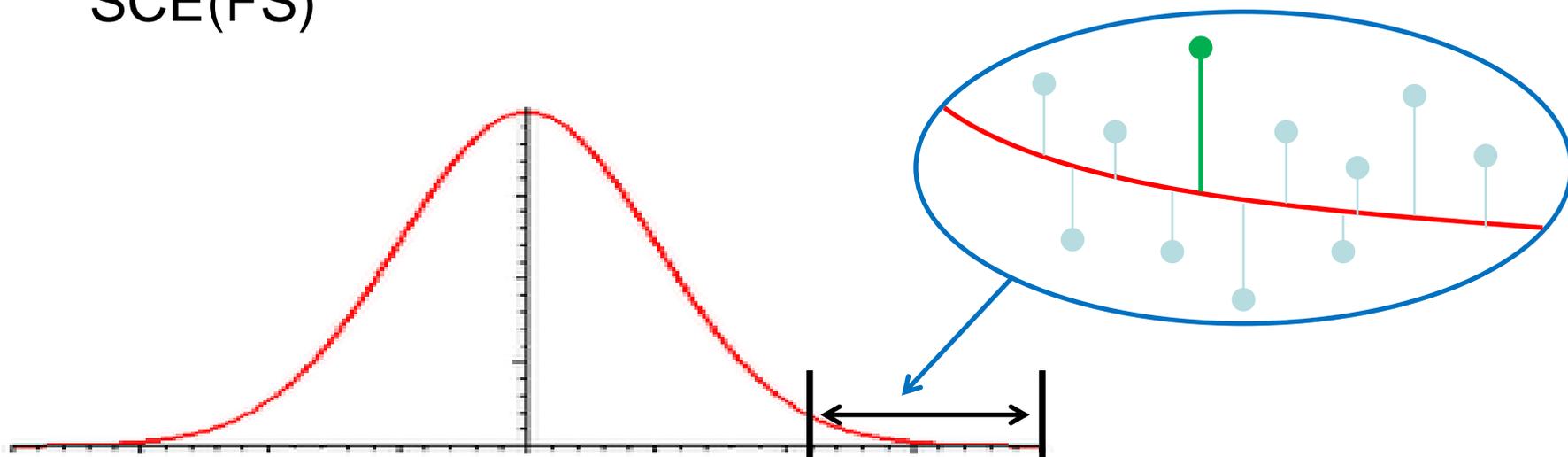
Cross-Walk from BRD to FS Participants

- **Cross-Walk Option 1: Incremental Standard Deviation (ISD)**
 - Implement ISD on data to allocate Additional INC needed for the Fleet.
 - Additional INC needed for the Fleet given current conditions is the delta from the percentile distribution that results from the 90% of Reserves Held (i.e. 97% from prior slide) to the 100% Percentile.
 - Additional Full Service INC ISD:

$$\text{AddINC}(\text{FS}) = \text{AddINC}(\text{Wind Fleet}) * \text{corr}[\text{SCE}(\text{FS}) \text{ to } \text{SCE}(\text{Fleet})] * \text{STD}[\text{SCE}(\text{FS})] / \text{STD}[\text{SCE}(\text{Fleet})]$$

Cross-Walk from BRD to FS Participants

- Cross-Walk Option 2: Paired Approach
 - Isolate points in time where the BRD (given current conditions) was above the 90% MW INC Held.
 - Retain the “paired” SCE(FS) for each BRD point in the range above the 90% MW INC Held.
 - Additional Reserves would be the maximum “paired” SCE(FS)



R3T Options Update

■ R3T Options

- Matrix Approach

- Calculate Reserves based on bins of historical BRD using data available ahead of time (forecasts, hour of day, etc.).

- Regression Approach

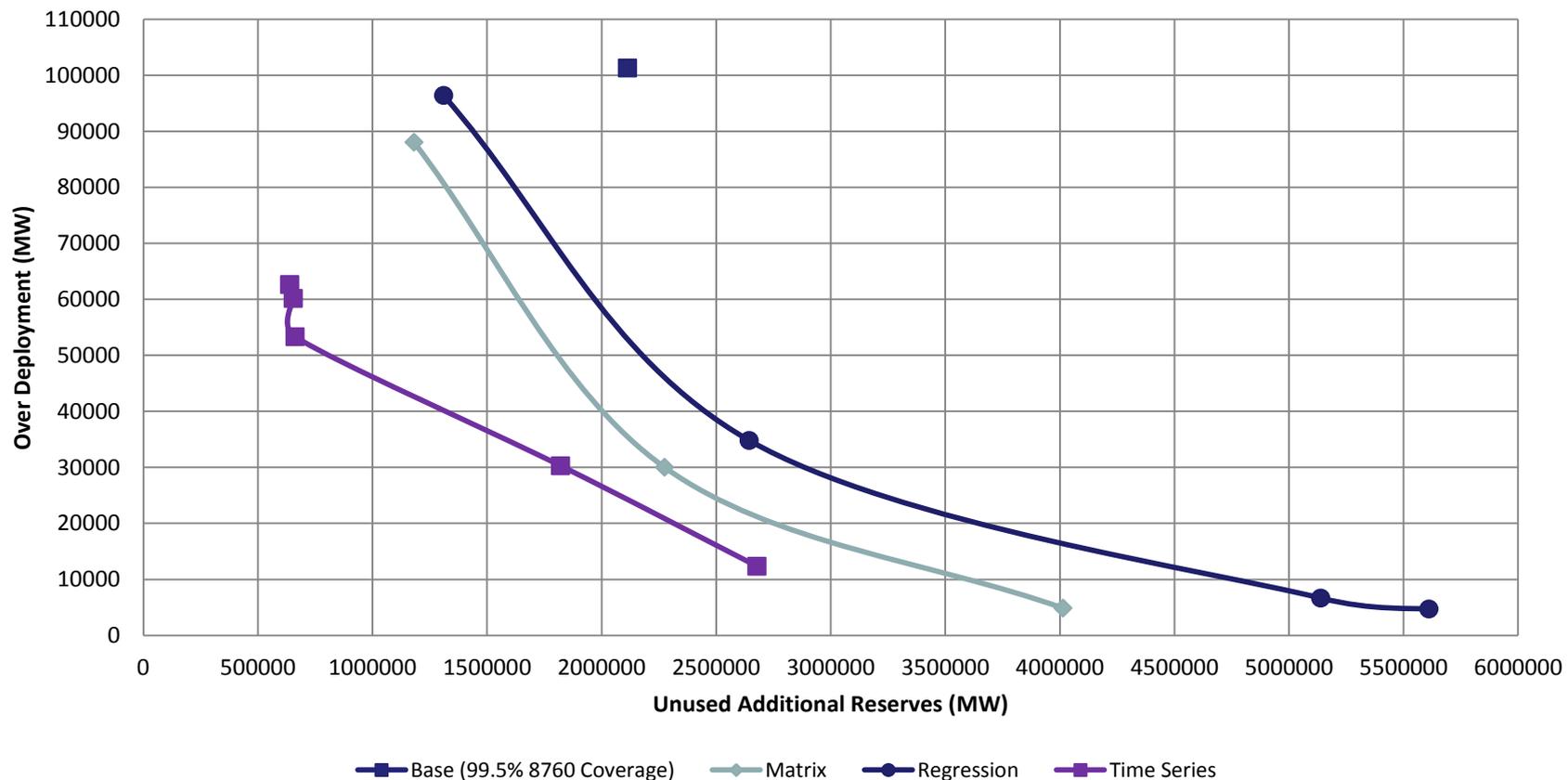
- Calculate Reserves based on regression analysis from historical BRD using data available ahead of time (forecasts, hour of day, etc.).
- Regression tree logic has given best results for the regression type approach.

R3T Options Update

- R3T Options [continued]
 - Time Series Approach
 - Analyze recent historical data (past two weeks or less) binned by hour of day to determine future reserves.
 - A simplified version of the Matrix Approach

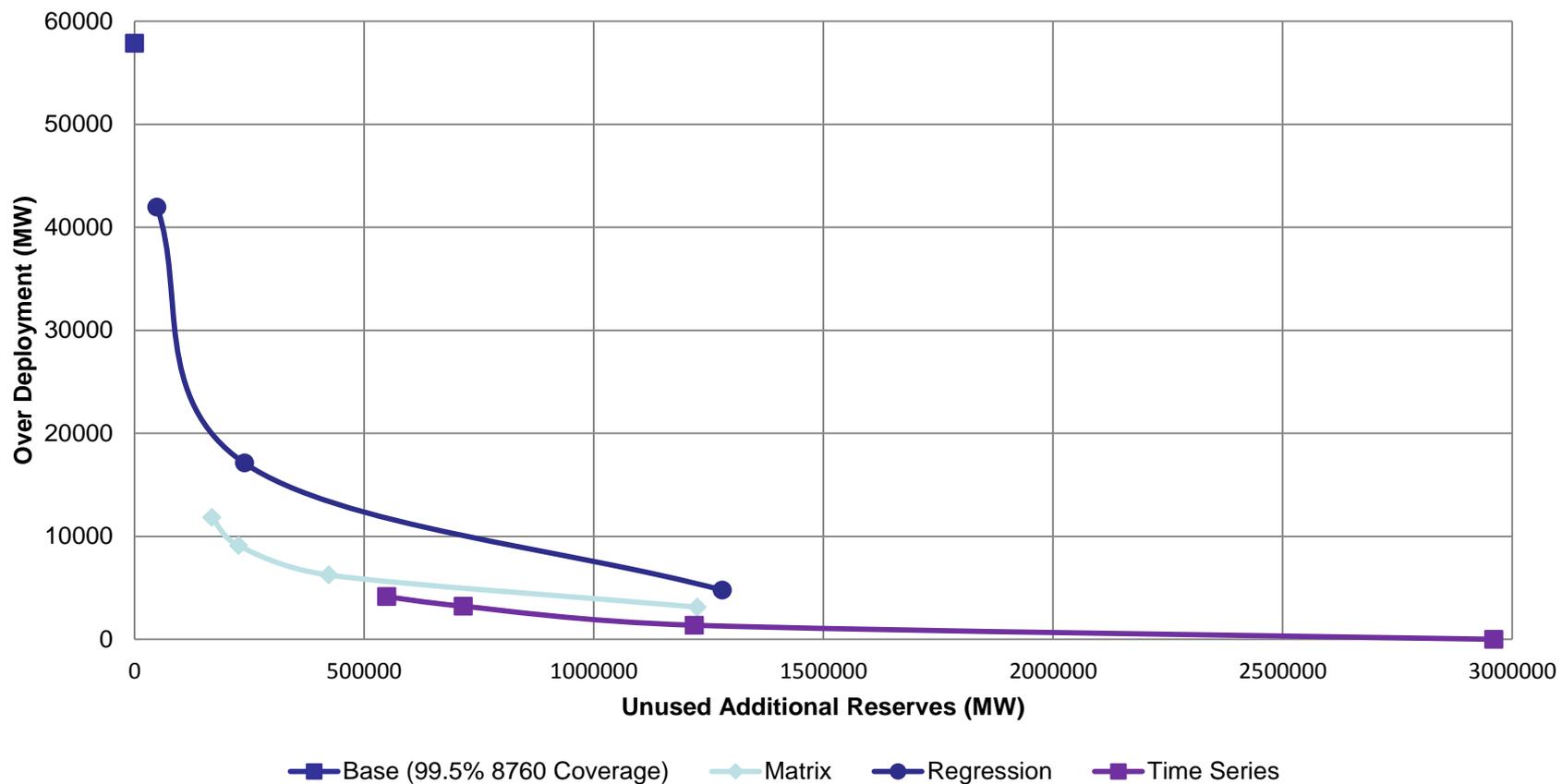
R3T Options Update

R3T Options Benchmark from a Test Base of 400 MW INC

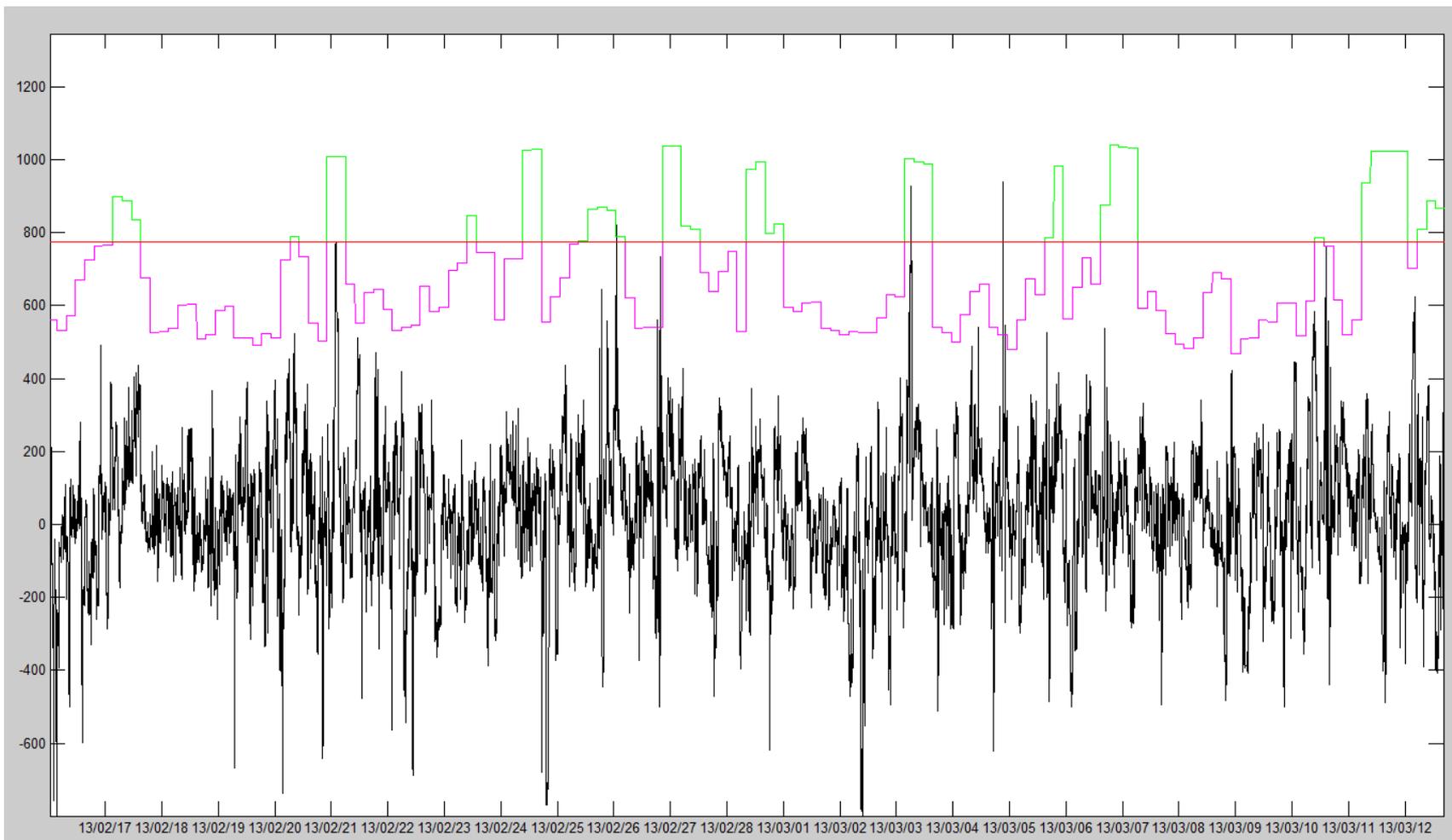


R3T Options Update

R3T Options Benchmark from current Base of 99.5%



R3T Options Update



R3T Buy versus Build

- BPA Wind Forecast RFP for FY14 due out in Late Spring.
- RFP will include an “optional” product for Real-Time Reserve Forecasting or a “Buy” option for R3T.
- If proposals are accepted, BPA will likely run “Build” (in-house R3T option) and “Buy” (vendor option) to evaluate the performance of each.

Real-Time Reserve Requirement Tool

Questions?