



BPA's use of Uncertainty Forecasts in Reserve Procurement

UVIG 2017 Forecasting Workshop

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BPA's use of Uncertainty Forecasts in Reserve Procurement

- What Reserves are BPA forecasting?
- Why is BPA forecasting Reserves for Procurement?
- How does BPA's Uncertainty Forecast work?
- Uncertainty Forecast & Procurement performance to Date

What Reserves are BPA forecasting?

- BPA is creating an uncertainty forecast of the reserves needed for NERC defined Operating Reserves without consideration of Contingency Reserves, including the capacity needed for:
 - Regulating Reserves
 - Generation & Energy Imbalance Services (Schedule 9)
- BPA refers to these reserves as with-in hour Balancing Reserves
 - BPA posts these reserves held and deployed in real-time at:
 - <http://transmission.bpa.gov/Business/Operations/Wind/reserves.aspx>
- Uncertainty Forecast covers all needs of the Balancing Authority, including all generation station control errors and errors in Load forecasts.



Why is BPA forecasting Reserves for Procurement?

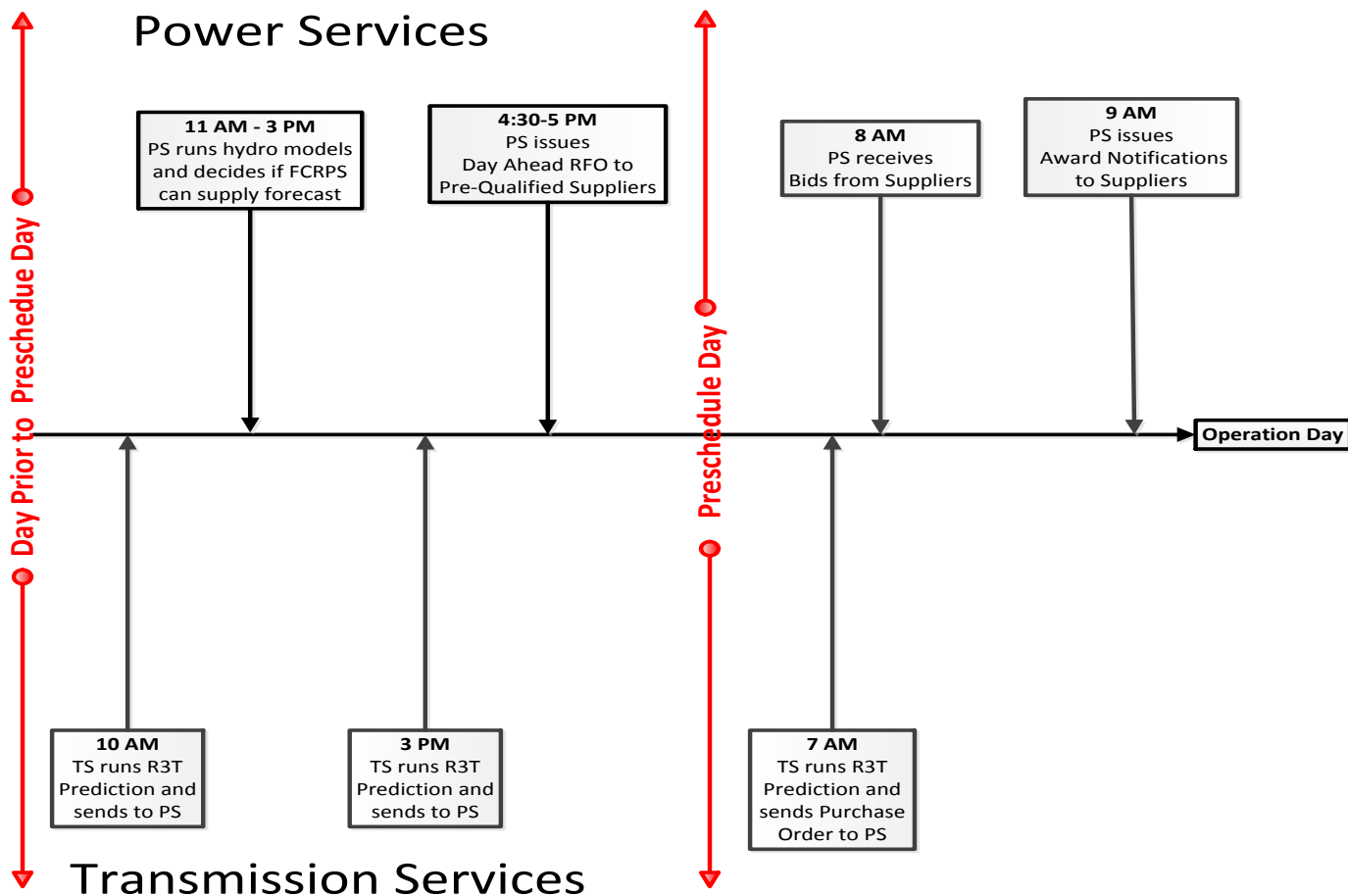
- BPA's current practice of holding Balancing Reserves is set in BPA's Rate Case process.
- The current Rate Period is dictated by the BP-16 Settlement:
 - 900 MW of Incremental Balancing Reserves during August-March served from the FCRPS Generation (BPA's Generation Fleet).
 - More flexibility and a budget for reserve procurement in April-July
 - 600 MW Minimum of Incremental Balancing Reserves with no less than 400 MW from the FCRPS.
 - 200 MW required to be purchased ahead for April-June.
 - Allows BPA to “consider...the projected reserve needs and expected impacts during the affected timeframe”.



Why is BPA forecasting Reserves for Procurement?

Preschedule 3PS Balancing Reserve Acquisitions

(Acquisitions made one day at a time in 25MW HLH or LLH blocks)



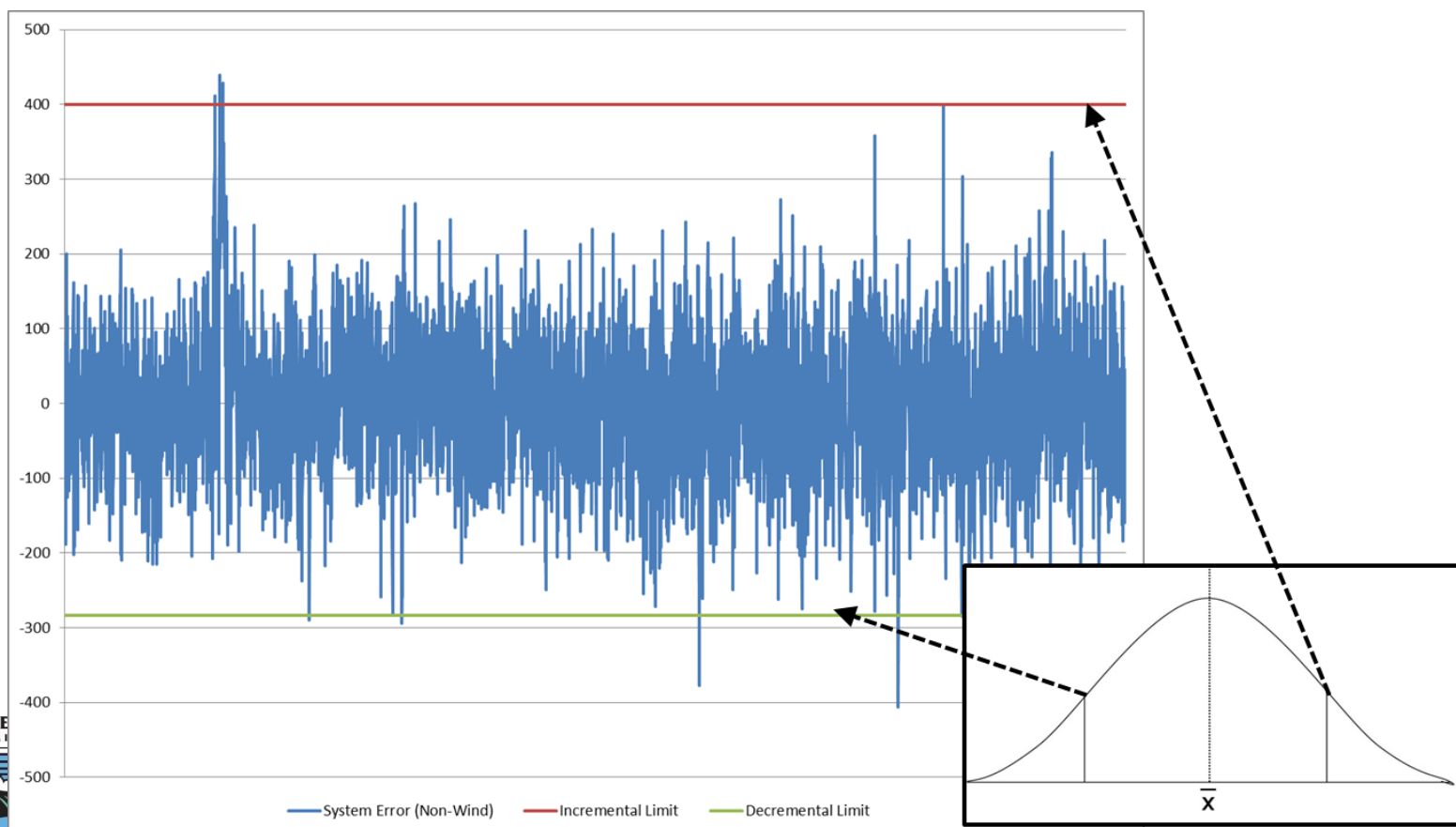
How does BPA's Uncertainty Forecast work?

- BPA's Uncertainty Forecast is called R3T, or the Real-time Reserve Requirement Tool
- The R3T Forecast has three main components:
 - Historical System Error – A look at the recent past for un-forecast Balancing Reserve usages (Load Error and Non-Wind Generation Error)
 - Wind Ramp Forecast – Forecast the wind ramp or change in generation that could be seen across the hour of forecast
 - Wind Variability Forecast – Forecast the uncertainty in the wind forecast for any given hour of forecast
- R3T is an hourly forecast out 168 hours
 - Diurnal maximums used currently in production.



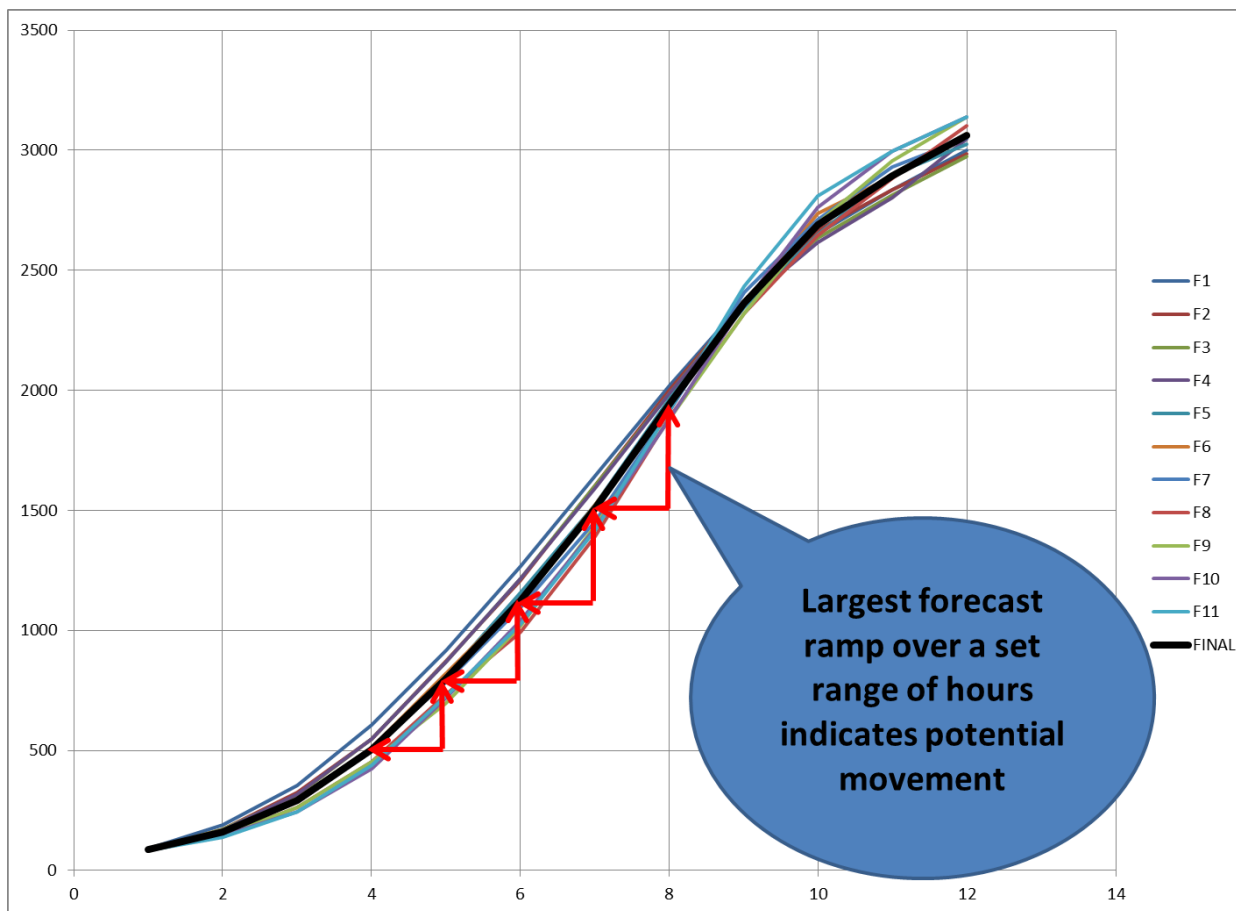
How does BPA's Uncertainty Forecast work?

Historical System Error



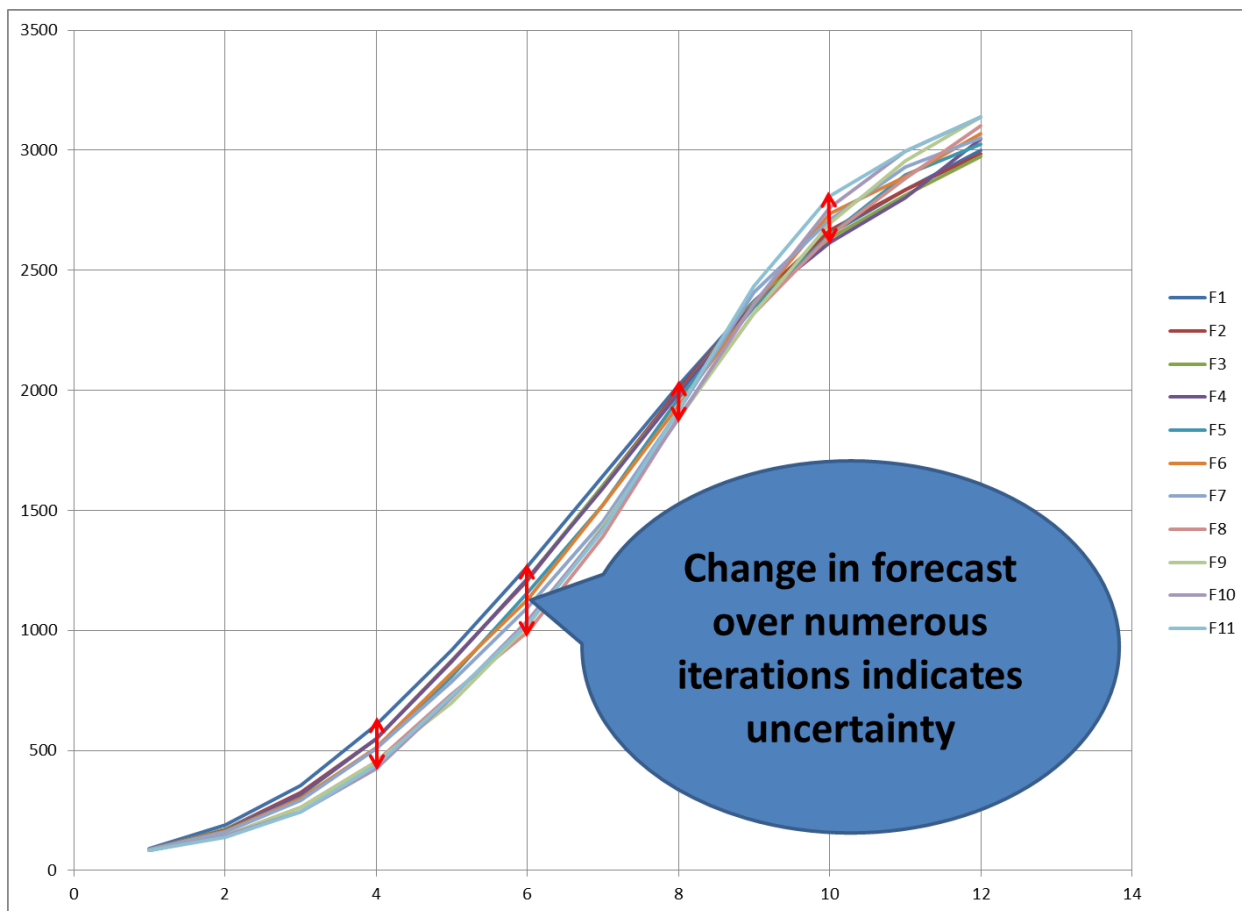
How does BPA's Uncertainty Forecast work?

Wind Ramp Forecast



How does BPA's Uncertainty Forecast work?

Wind Variability Forecast



Uncertainty Forecast & Procurement performance to Date

April-July 2016 Performance

- 15 events where Balancing Reserves Deployed exceeded the procured Balancing Reserves.
 - Includes times where BPA was unable to fulfill the R3T forecasted amount.
- SOY Budget was \$17.5 Million
- EOY Budget was ~\$9 Million
 - Remaining rolled over into FY17

Uncertainty Forecast & Procurement performance to Date

April-July 2016 Performance

	Average Reserves Held HLH (MW)	Average Reserves Held LLH (MW)	Average Reserves Deployed HLH (MW)	Average Reserves Deployed LLH (MW)
April	697	703	484	371
May	695	686	425	517
June	719	717	499	442
July	762	741	446	400
All Spring	721	714	465	427

Uncertainty Forecast & Procurement performance to Date

April-May 2017 Performance

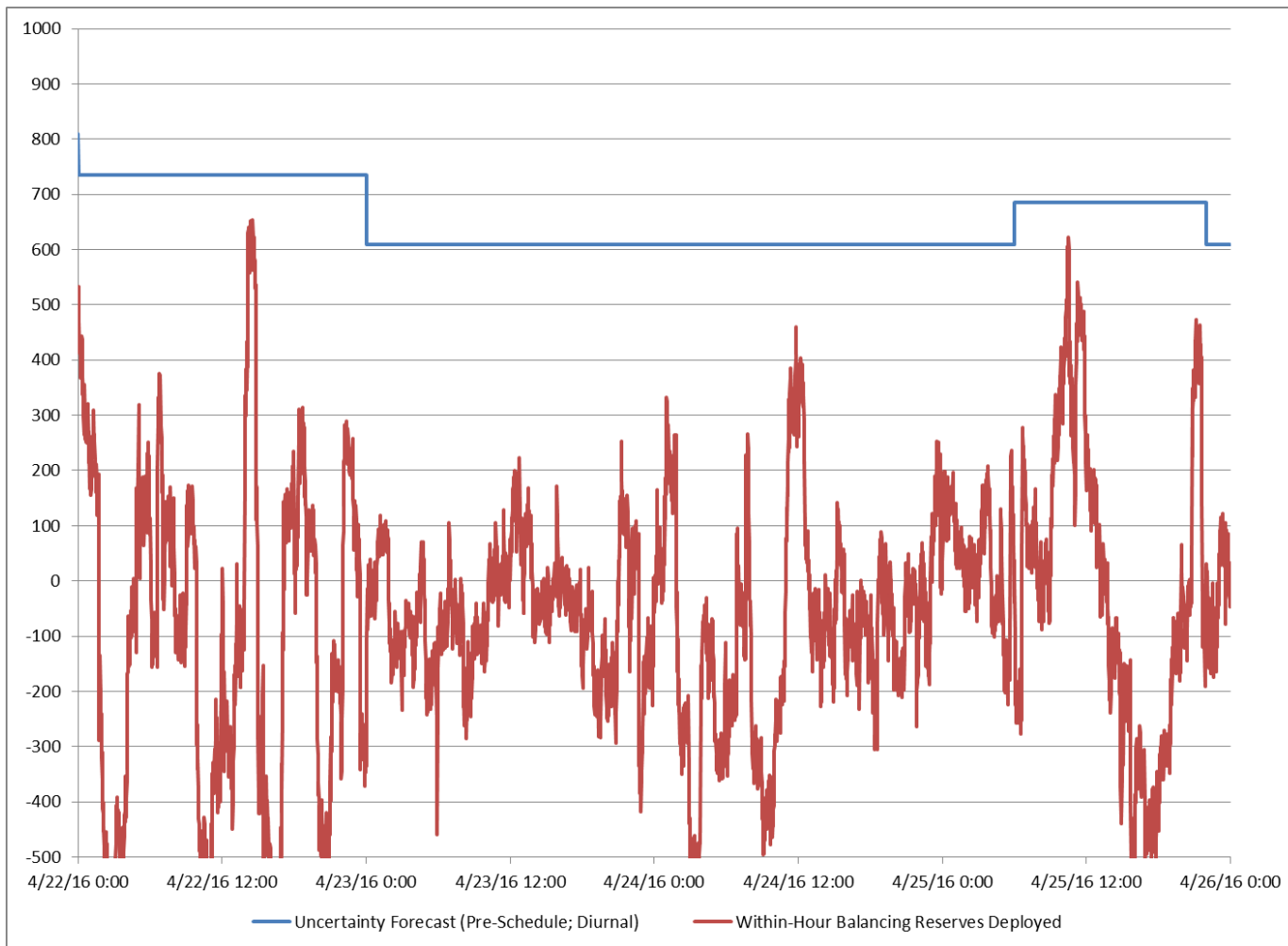
- 10 events where Balancing Reserves Deployed exceeded the procured Balancing Reserves.
 - Includes times where BPA was unable to fulfill the R3T forecasted amount.

Uncertainty Forecast & Procurement performance to Date

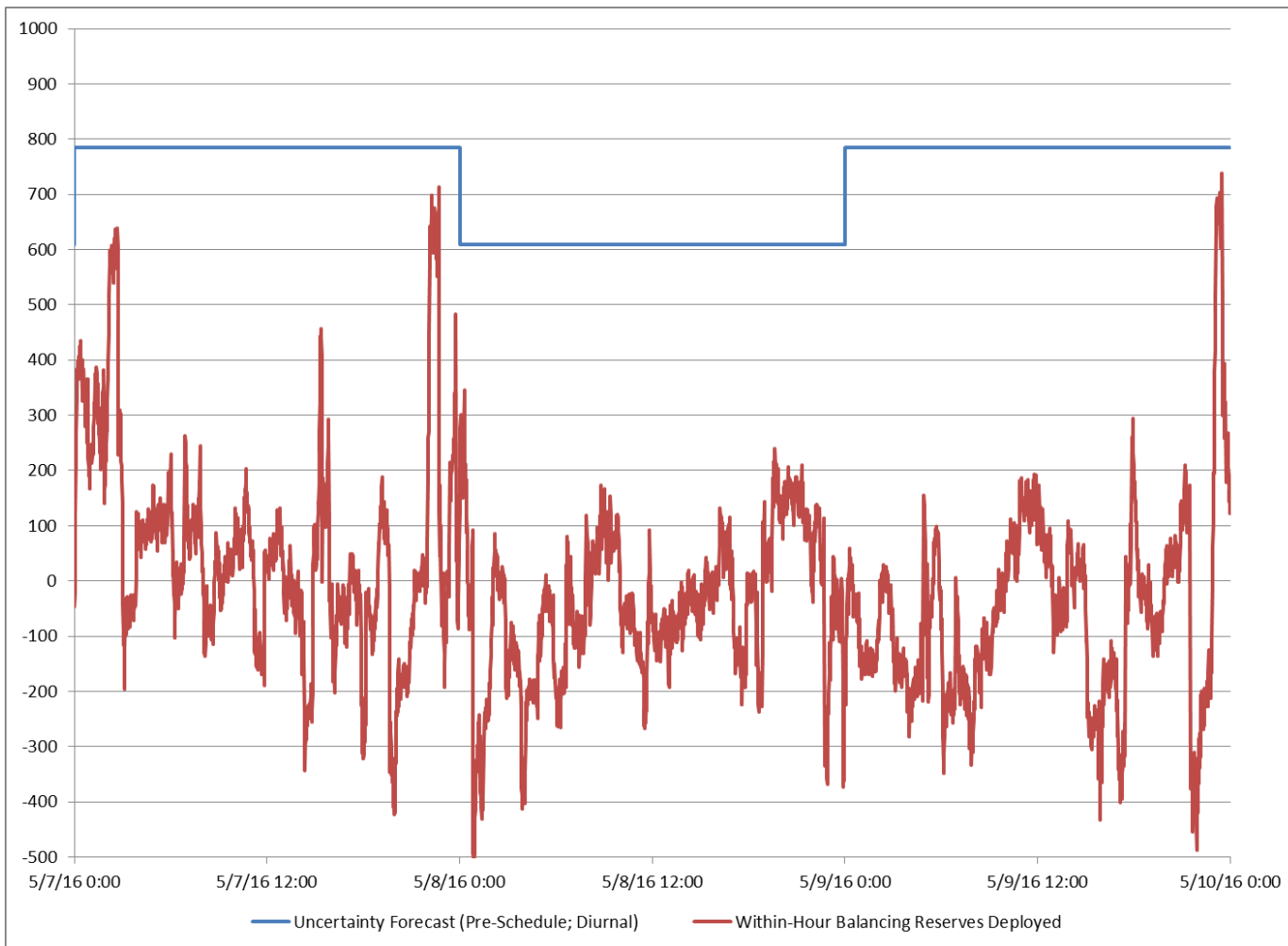
April-May 2017 Performance

	Average Reserves Held HLH (MW)	Average Reserves Held LLH (MW)	Average Reserves Deployed HLH (MW)	Average Reserves Deployed LLH (MW)
April	793	808	526	533
May	695	702	476	402

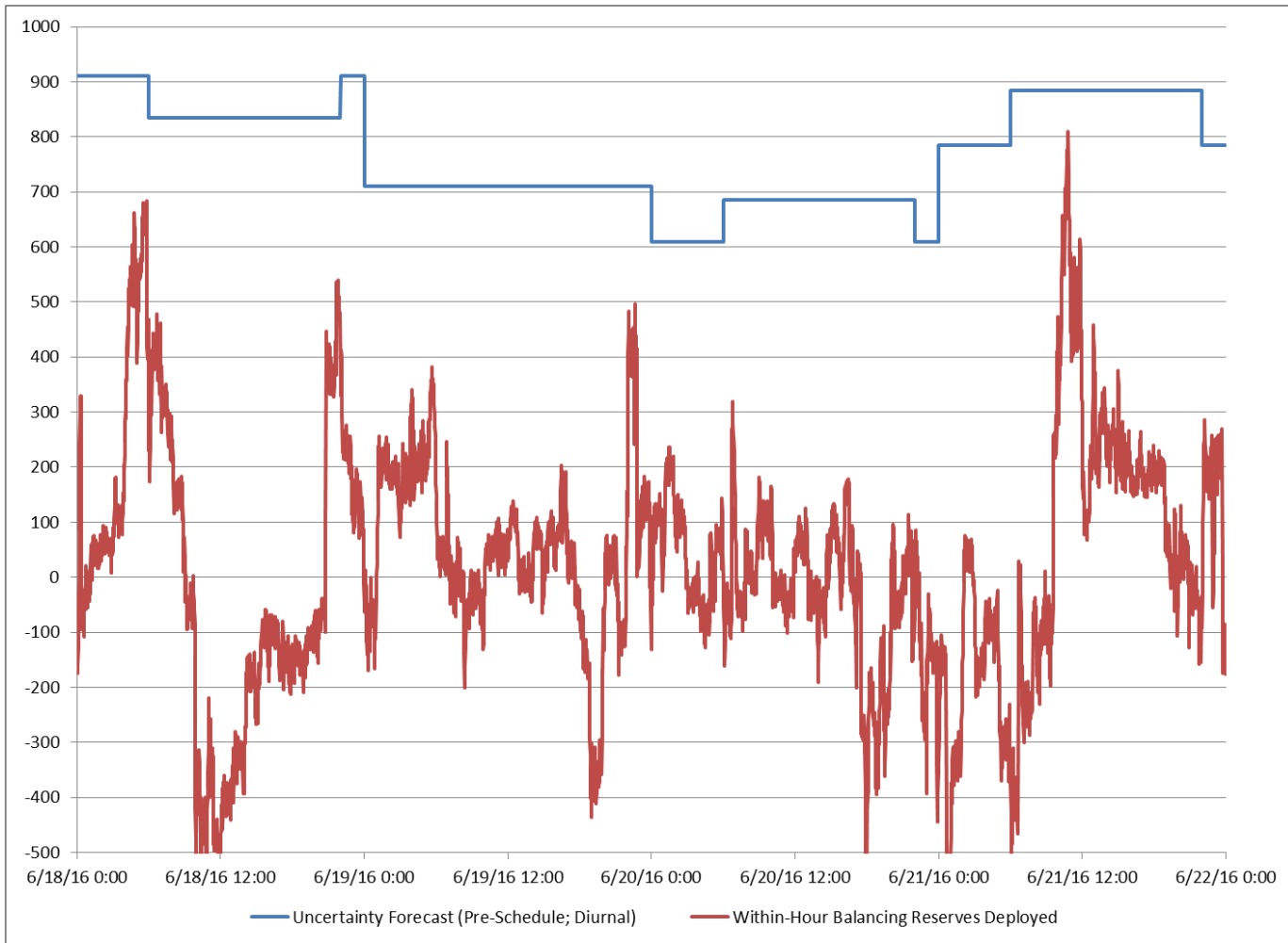
Uncertainty Forecast & Procurement performance to Date



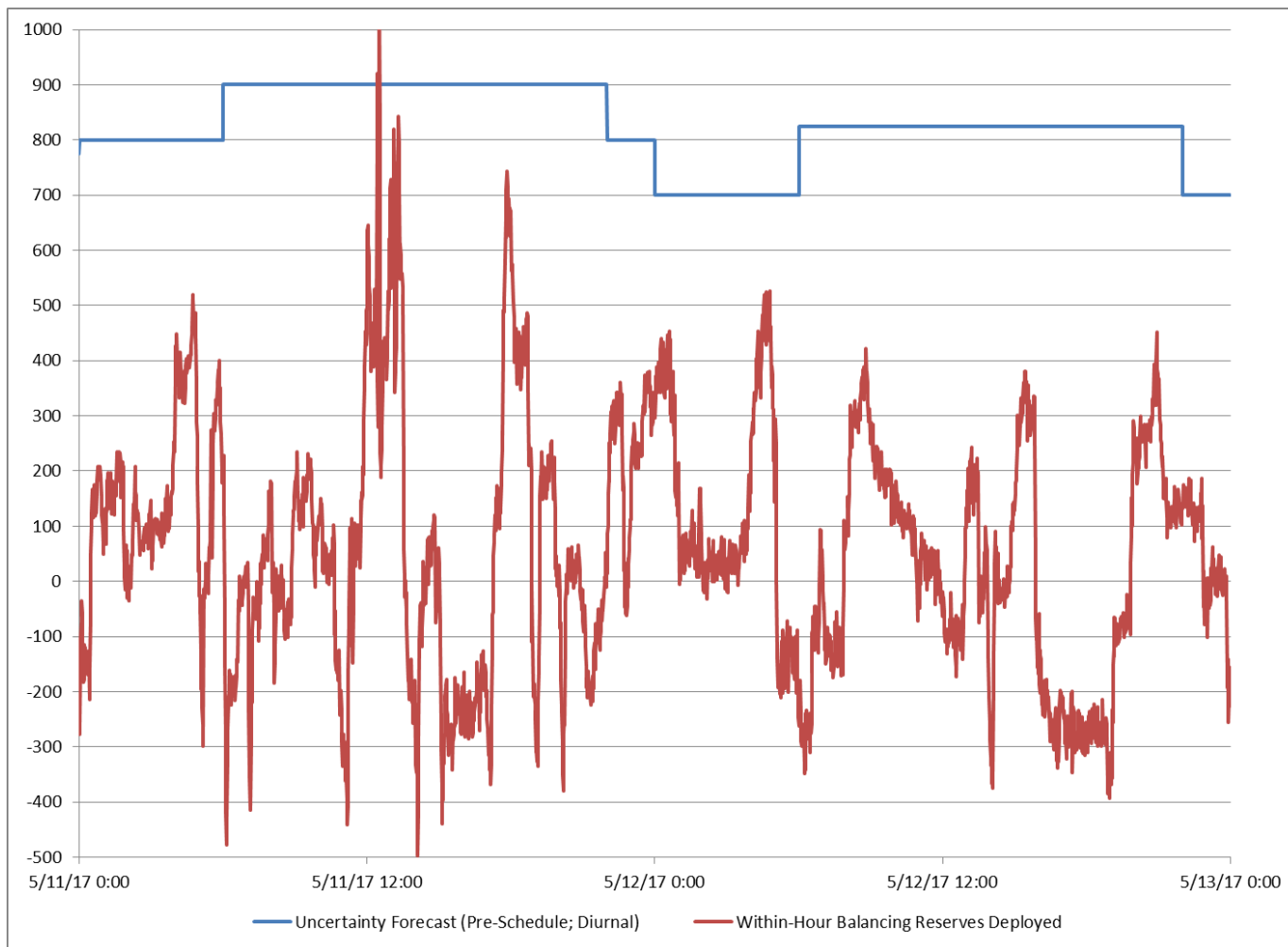
Uncertainty Forecast & Procurement performance to Date



Uncertainty Forecast & Procurement performance to Date



Uncertainty Forecast & Procurement performance to Date

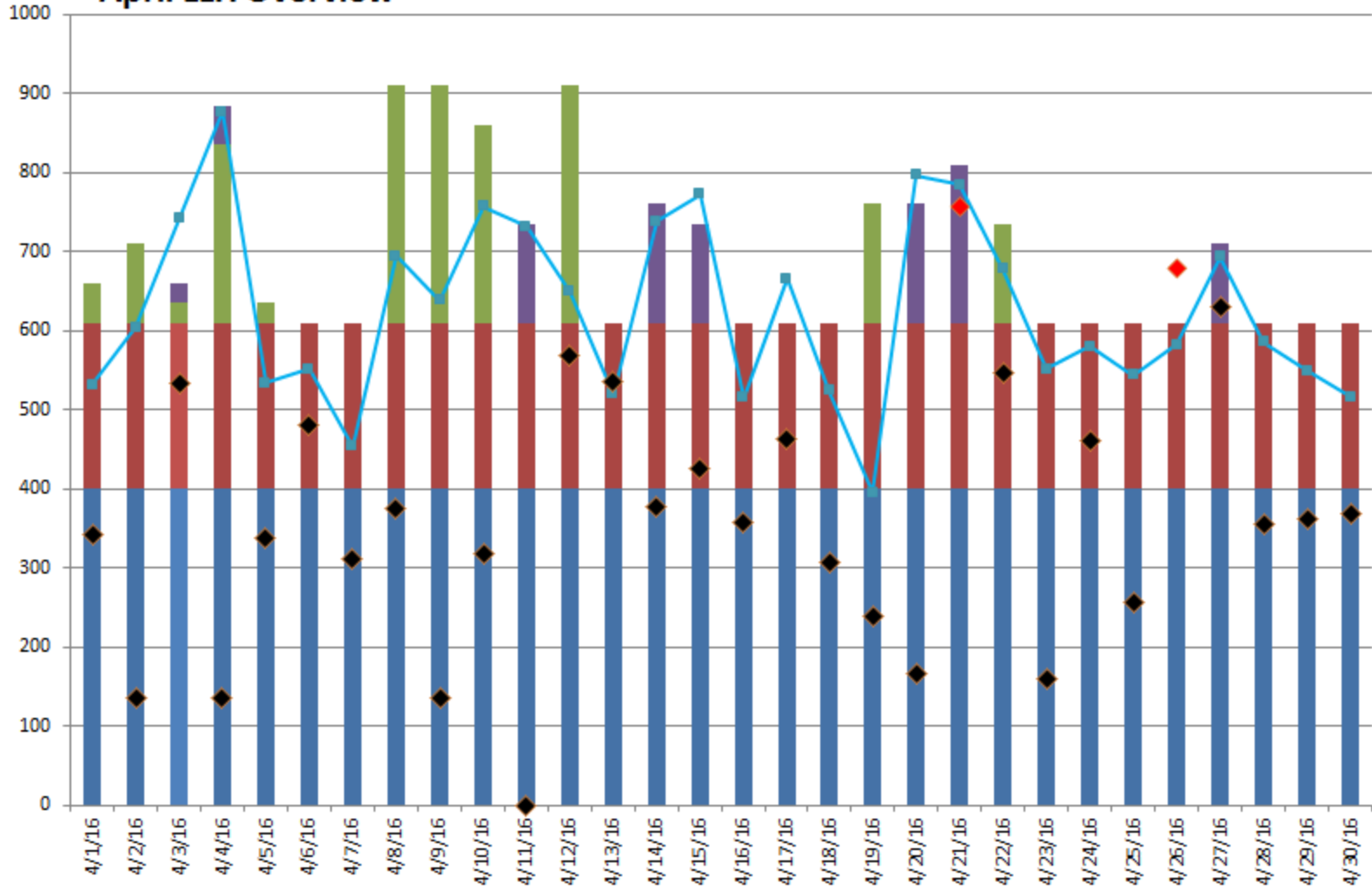




Appendix of 2016 Performance

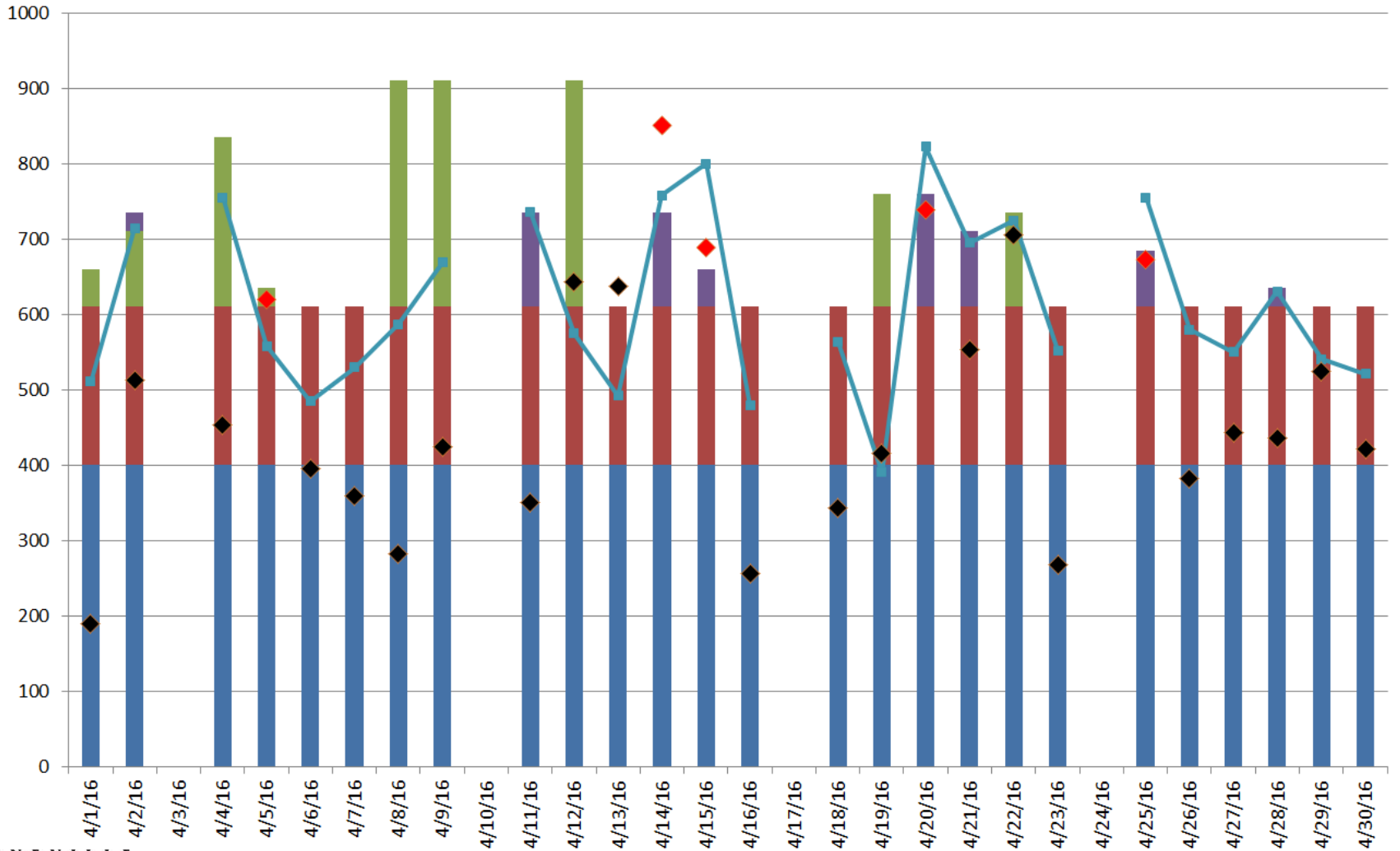


April LLH Overview



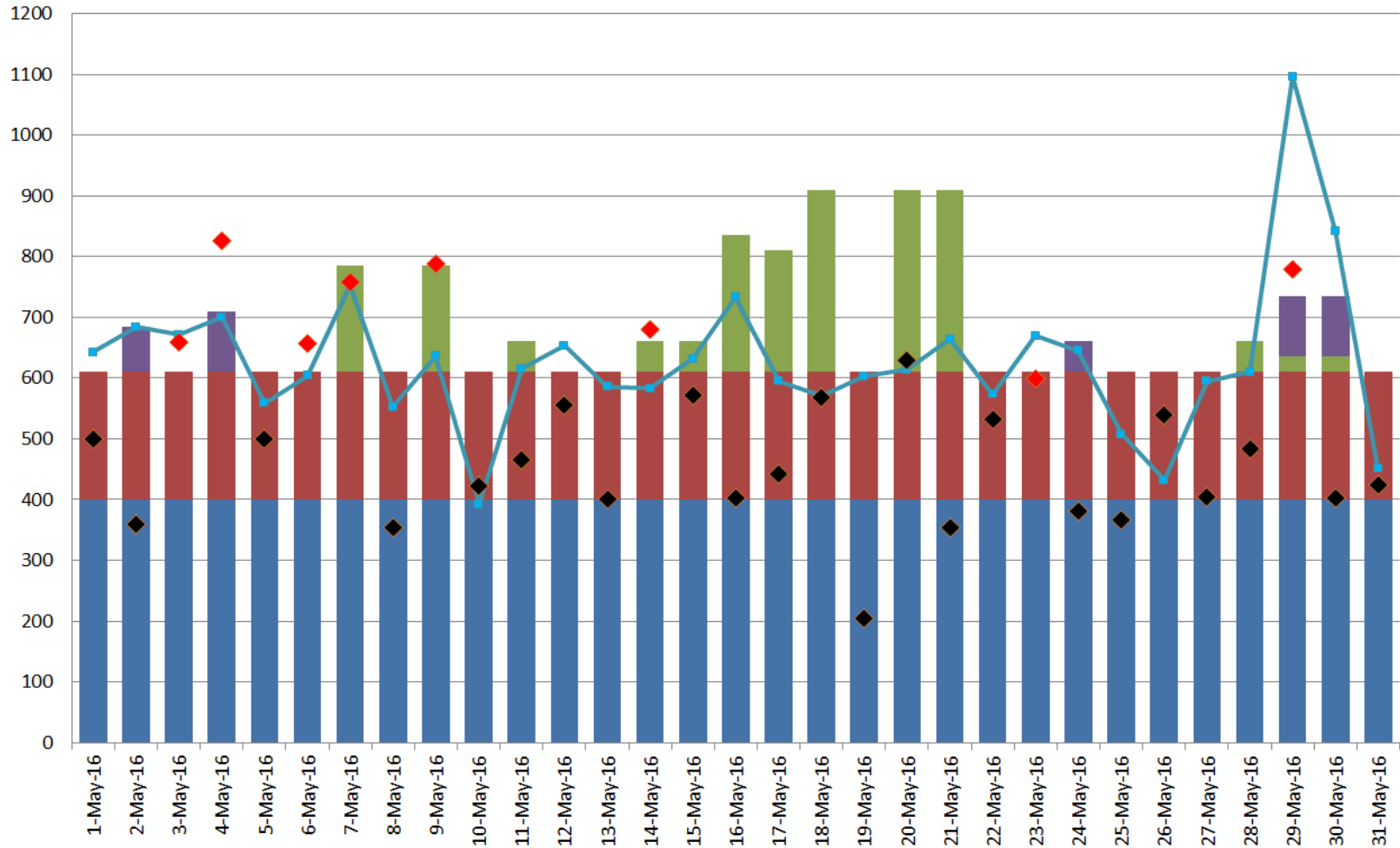
◆ OCBR Event
 ◆ Balancing Reserves Deployed
■ CRPS Base Obligation
 ■ Forward Purchase
 ■ FCRPS Supply Additional
 ■ 3PS LLH
 — LLH Forecasted Need

April HLH Overview



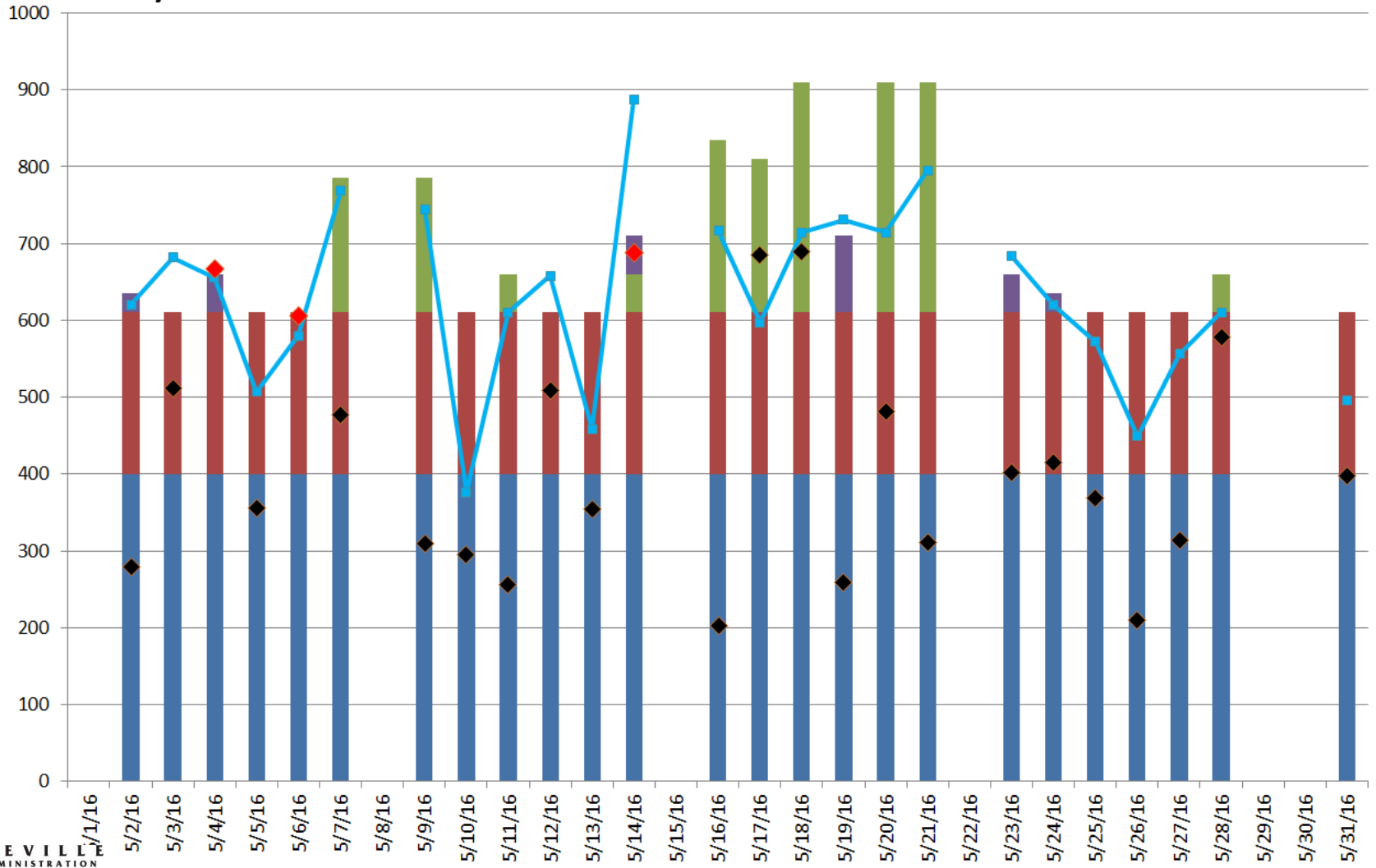
S Base Obligation Forward Purchase FCRPS Supply Additional 3PS HLH HLH Forecasted Need OCBR Event Balancing Reserves Deployed

May LLH Overview



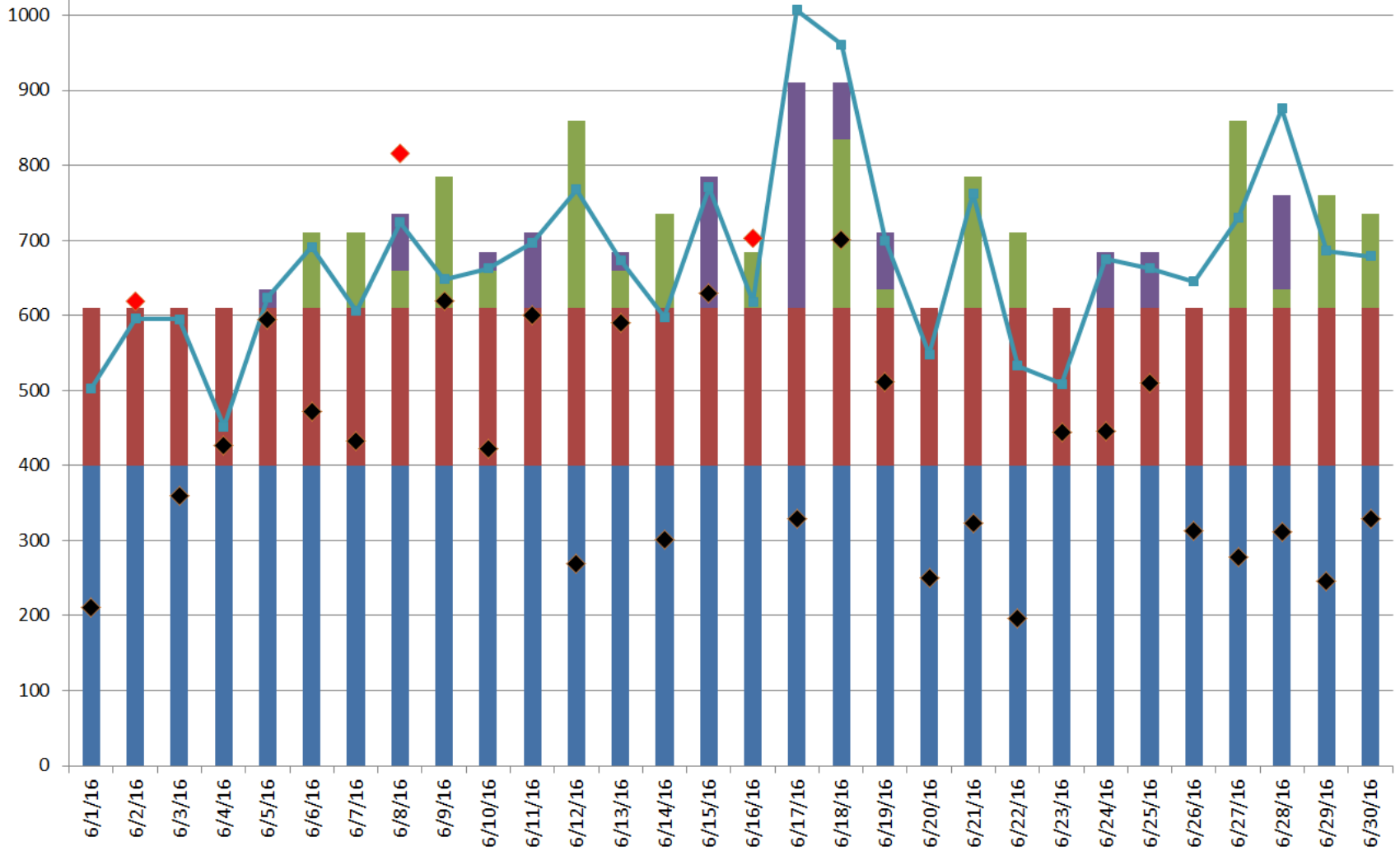
■ FCRPS Base Obligation
 ■ Forward Purchase
 ■ FCRPS Additional
 ■ 3PS LLH
 —■— LLH Forecast
 ◆ OCBR Event
 ◆ Balancing Reserves Deployed

May HLH Overview



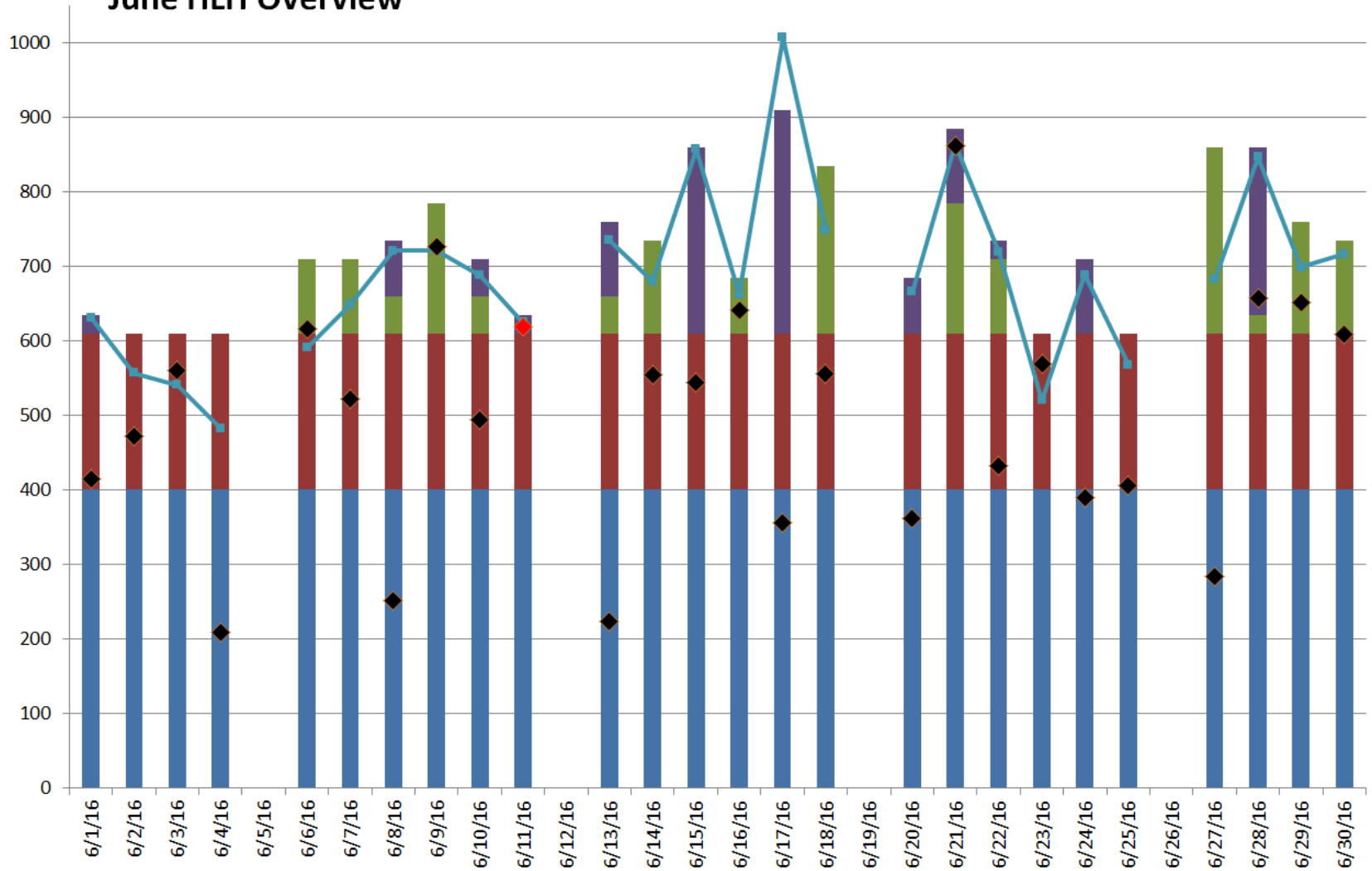
■ FCRPS Base Obligation
 ■ Forward Purchase
 ■ FCRPS Additional
 ■ 3PS HLH
 —■— HLH Forecast
 ◆ OCBR Event
 ◆ Balancing Reserves Deployed

June LLH Overview



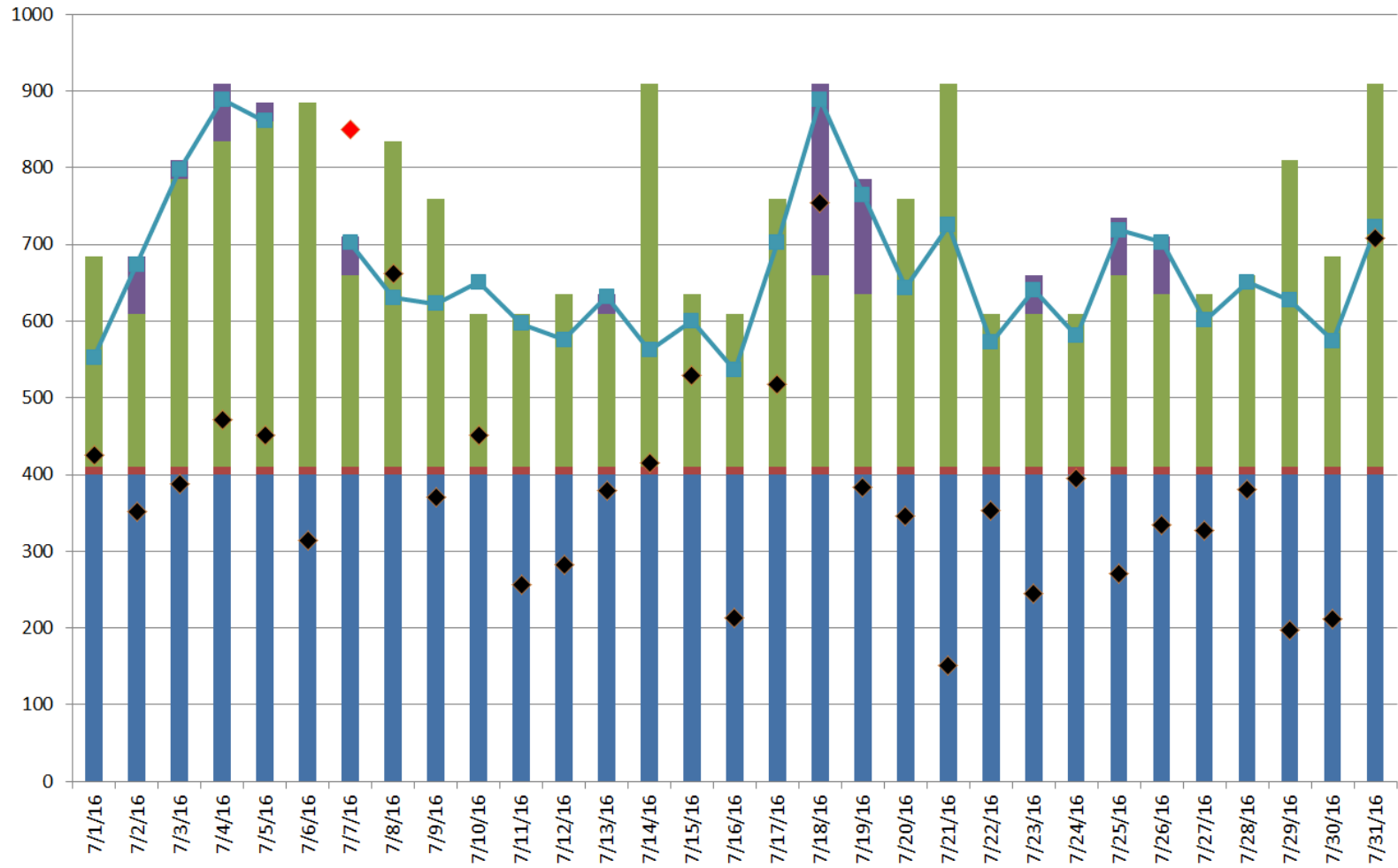
FCRPS Base Obligation Forward Purchase FCRPS Additional 3PS LLH LLH Forecast OCBR Event Balancing Reserves Deployed

June HLH Overview



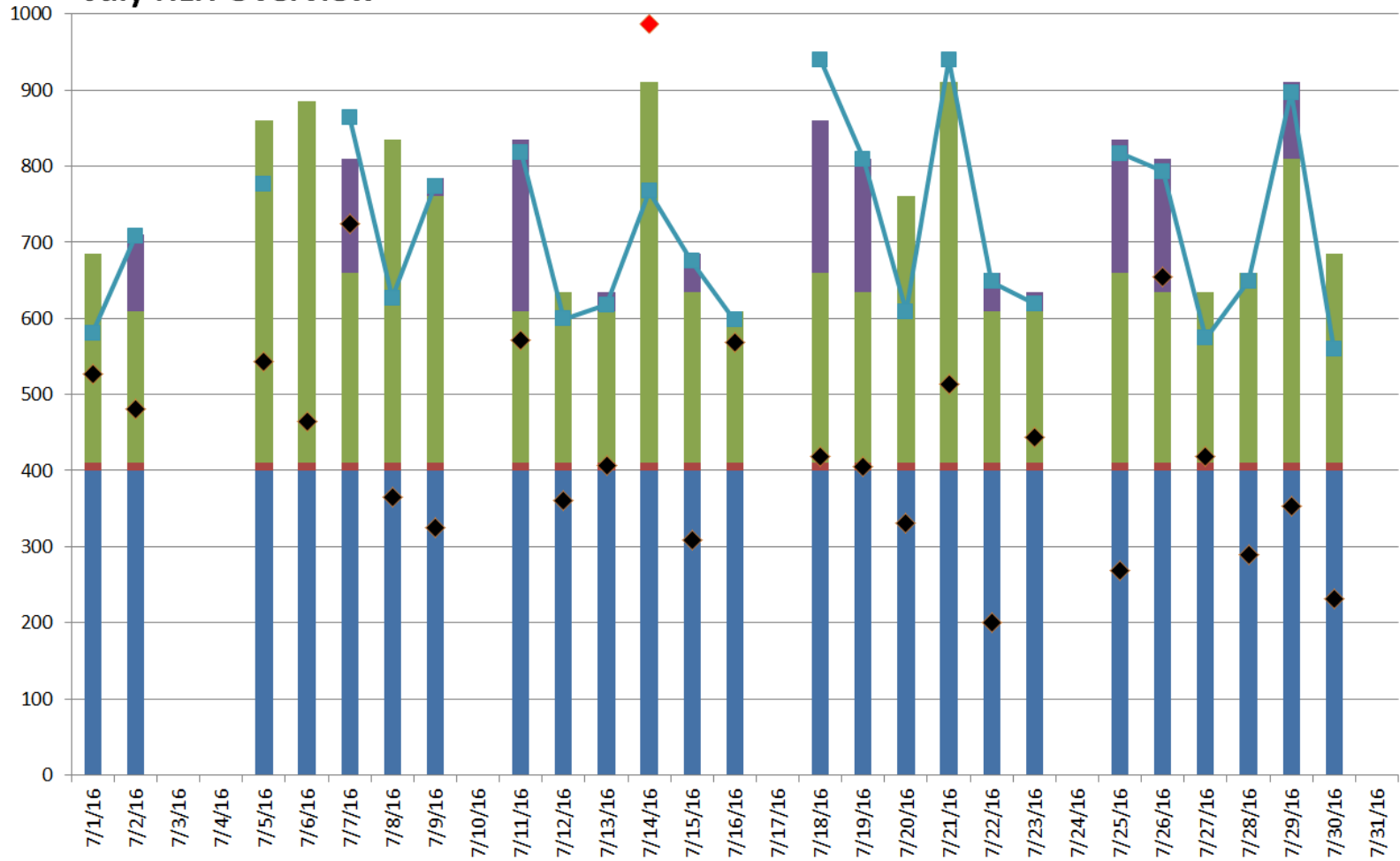
◆ OCBR Event
■ FCRPS Base Obligation ■ Forward Purchase ■ FCRPS Additional ■ 3PS HLH — HLH Forecast ◆ Balancing Reserves Deployed

July LLH Overview



■ FCRPS Base Obligation
 ■ Forward Purchase
 ■ FCRPS Supply Additional
 ■ 3PS LLH
 ■ LLH Forecast
 ◆ OCBR Event
 ◆ Balancing Reserves Deployed

July HLH Overview



■ FCRPS Base Obligation
 ■ Forward Purchase
 ■ FCRPS Supply Additional
 ■ 3PS HLH
 ■ HLH Forecast
 ◆ OCBR Event
 ◆ Balancing reserves Deployed