



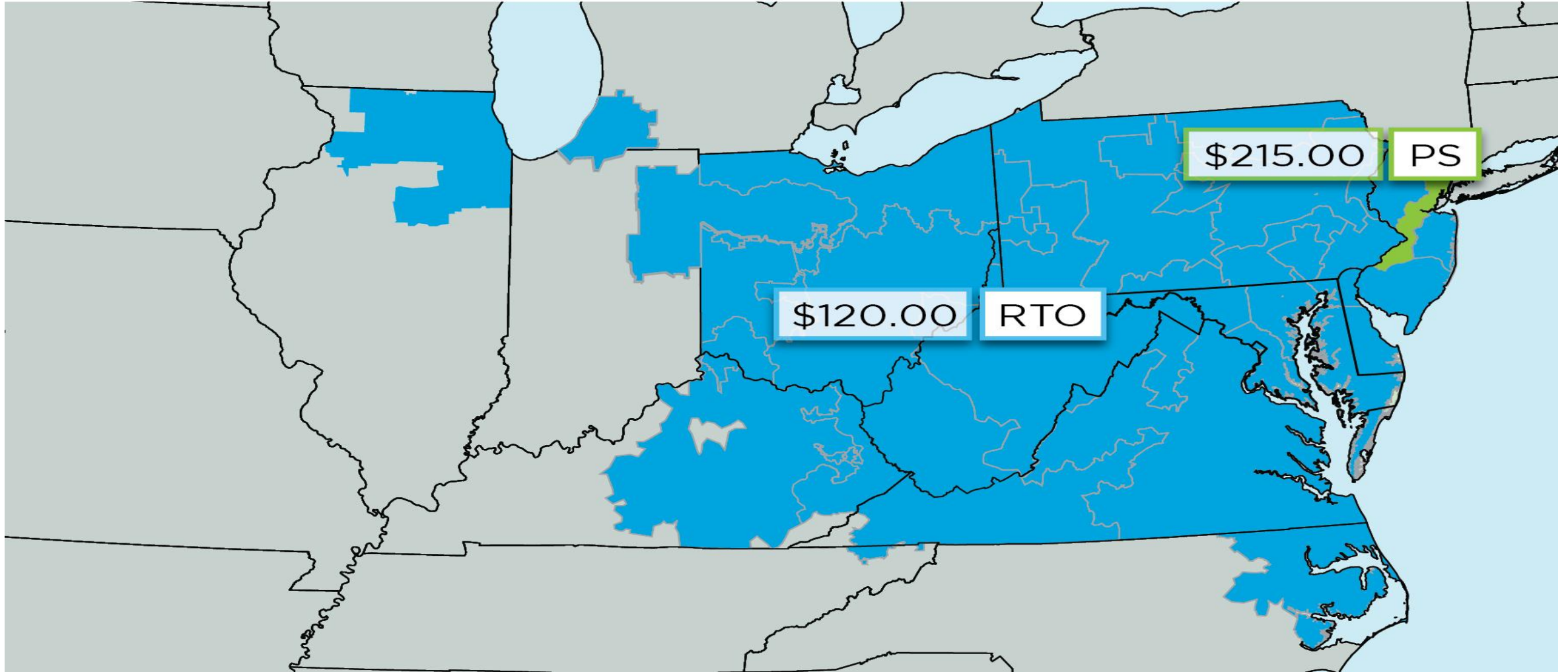
Impacts of DR on Energy and Capacity Market Prices

MADRI Meeting #34

June 17, 2014

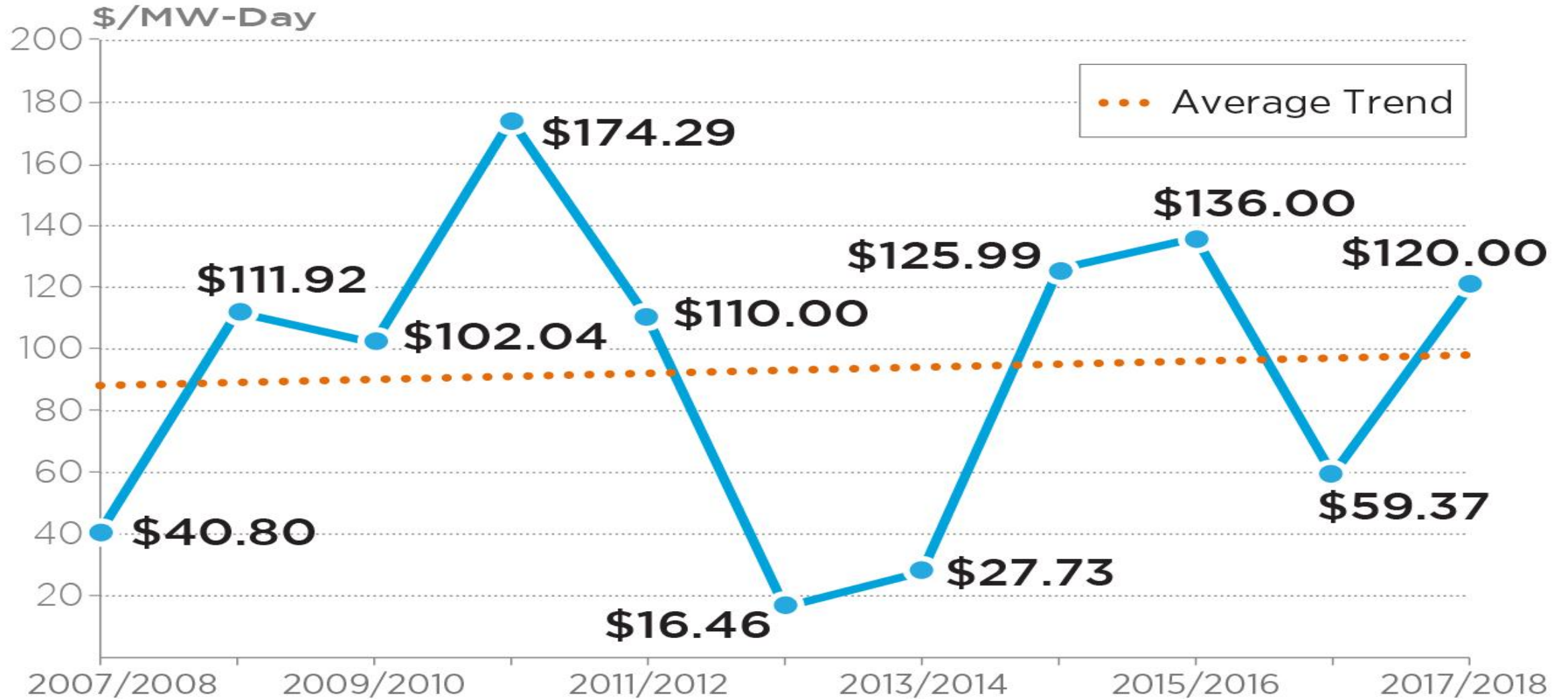
Stu Bresler
VP, Market Operations
PJM Interconnection, LLC

2017/2018 Base Residual Auction Clearing Prices (\$/MW-Day)





RPM Base Residual Auction Resource Clearing Prices





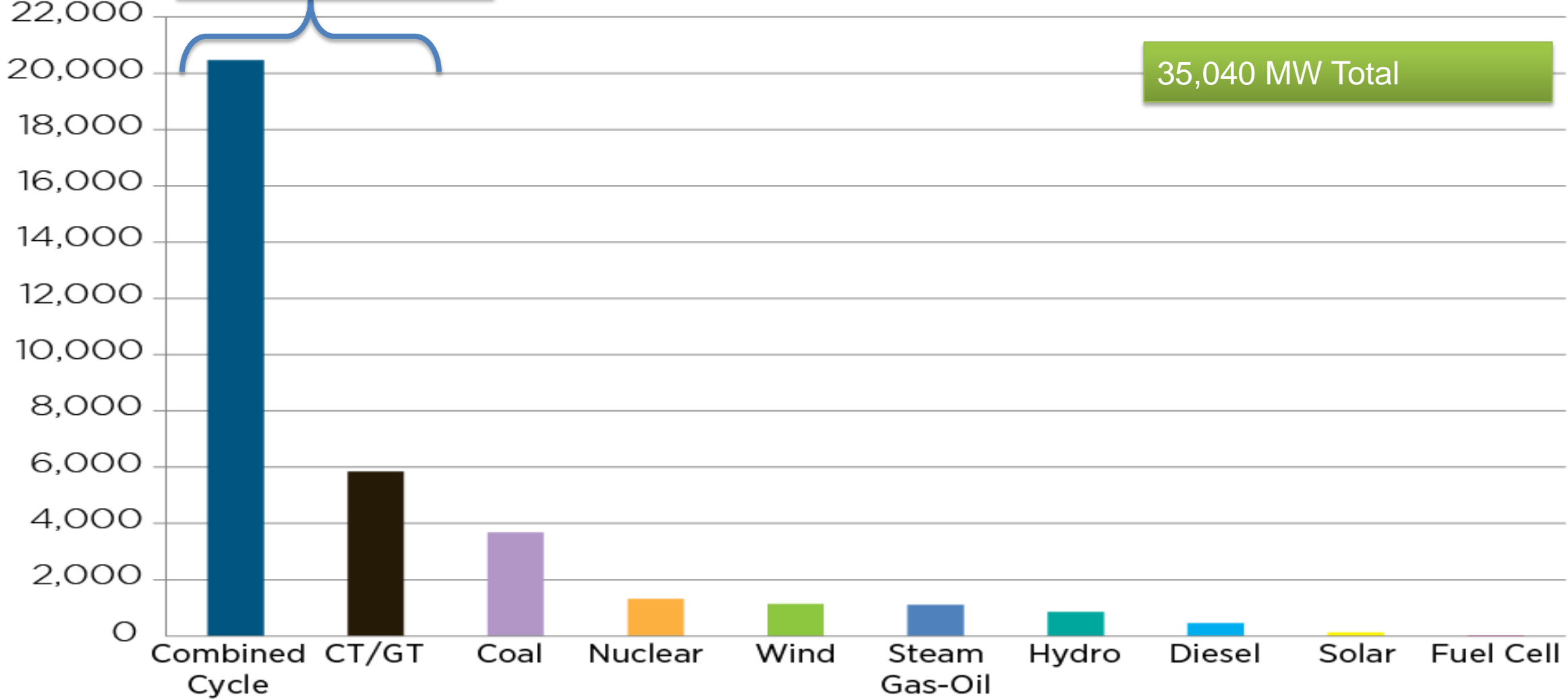
New Generation by Fuel Type

Since RPM Implementation in 2007

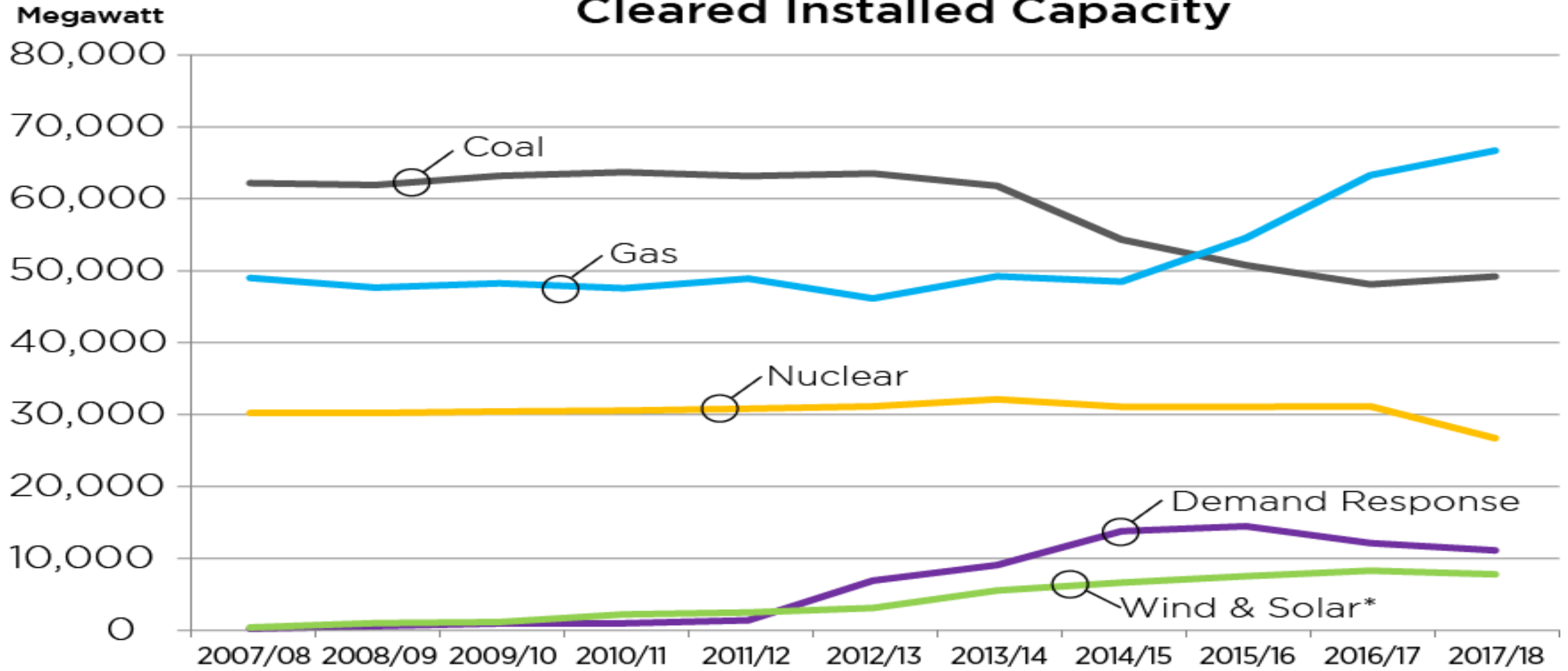
Dependable Capacity (MW)

Gas = 75%

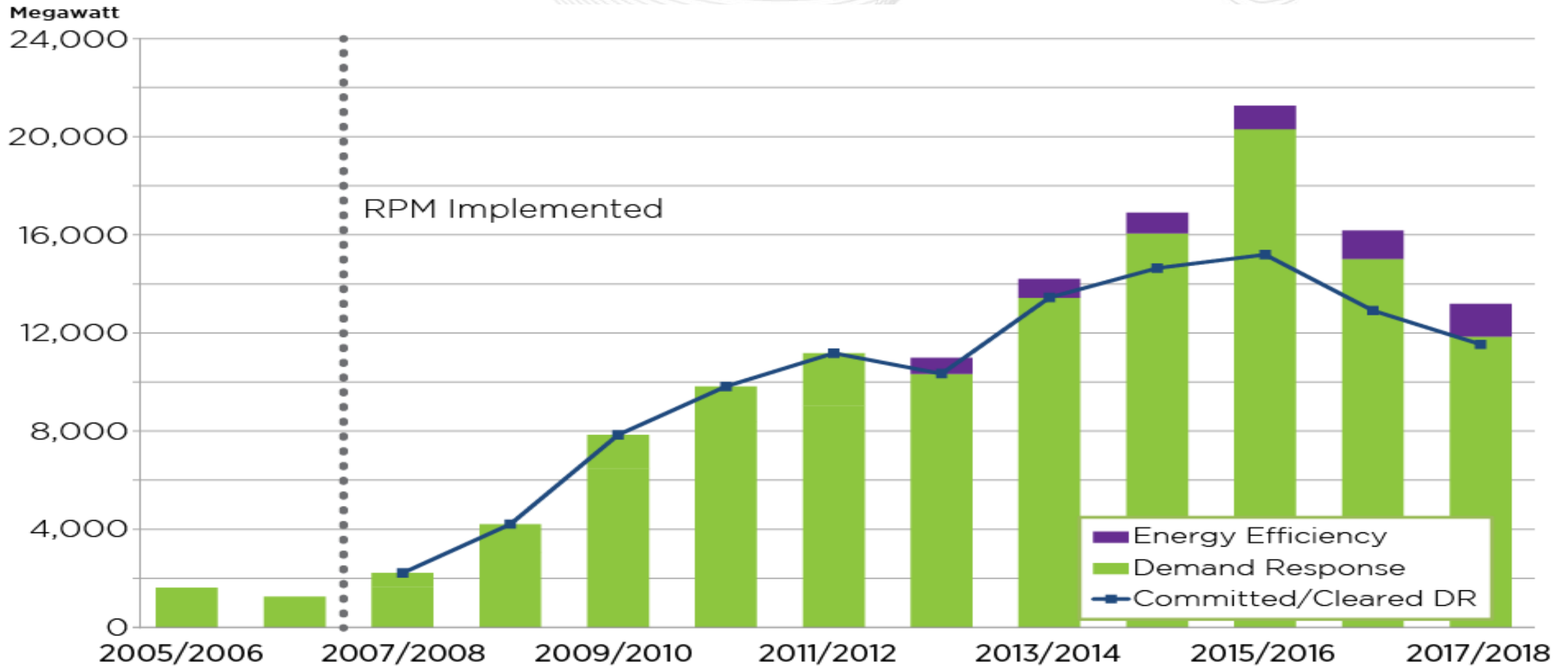
35,040 MW Total



Cleared Installed Capacity



* Nameplate



- Total of 10,975 MW of DR cleared (1,433 MW fewer than the May 2013 BRA)
 - 2,322 MW of Limited DR cleared (7,527 MW fewer than 2013)
 - 7,163 MW of Extended Summer DR cleared (4,693 MW more than 2013)
 - 1,489 MW of Annual DR cleared (1,401 MW more than 2013)
- Total of 11,294 MW of DR offered



Energy Efficiency (EE) Cleared in RPM Auctions

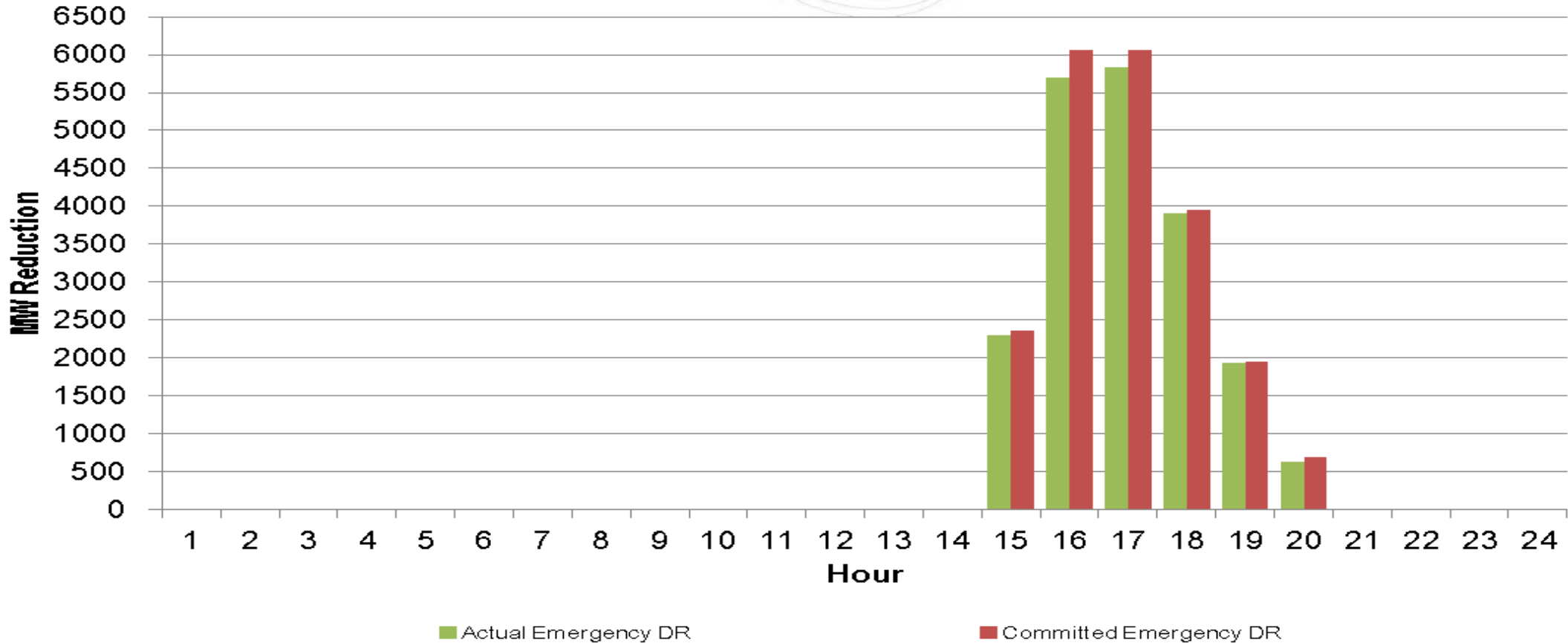
RPM Auction	Total EE Resources Offered in PJM (UCAP MW)	Total EE Resources Cleared in PJM (UCAP MW)
2011/2012 (3 rd IA)	92	78
2012/2013 (BRA)	653	569
2013/2014 (BRA)	757	679
2014/2015 (BRA)	832	822
2015/2016 (BRA)	940	923
2016/2017 (BRA)	1,157	1,117
2017/2018 (BRA)	1,340	1,339

- Corrected modeling of limits on Limited DR and Extended Summer DR
- Operationalization of DR based on experiences of PJM operations and new, smart-grid enabled DR capabilities. Docket No. ER14-822-000
 - Pre-Emergency category of Load Management
 - Default 30 minute notification time
 - Emergency event duration reduced from 2 hours to 1 hour
 - M&V applied when resource dispatched at least 30 minutes
 - Caps on strike-prices aligned with notification times



Load Management Compliance for RTO-wide Event on 9/11/2013

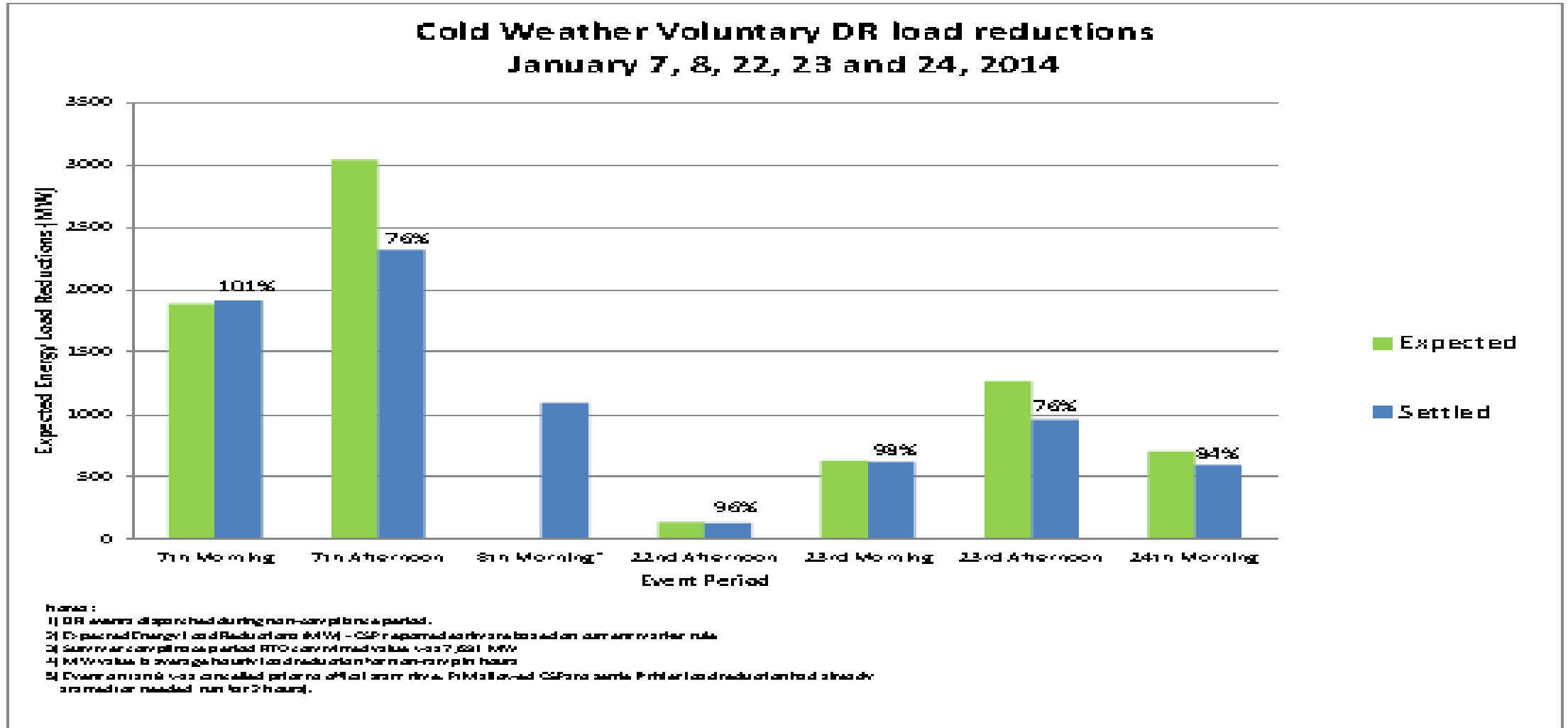
Actual¹ vs Committed Reductions² During Compliance Period September 11, 2013



- 1. Actual Emergency DR values are Emergency Compliance reductions (which may be different than reductions from Emergency Energy Settlements).
- 2. Committed Emergency DR values are final RPM commitment values.

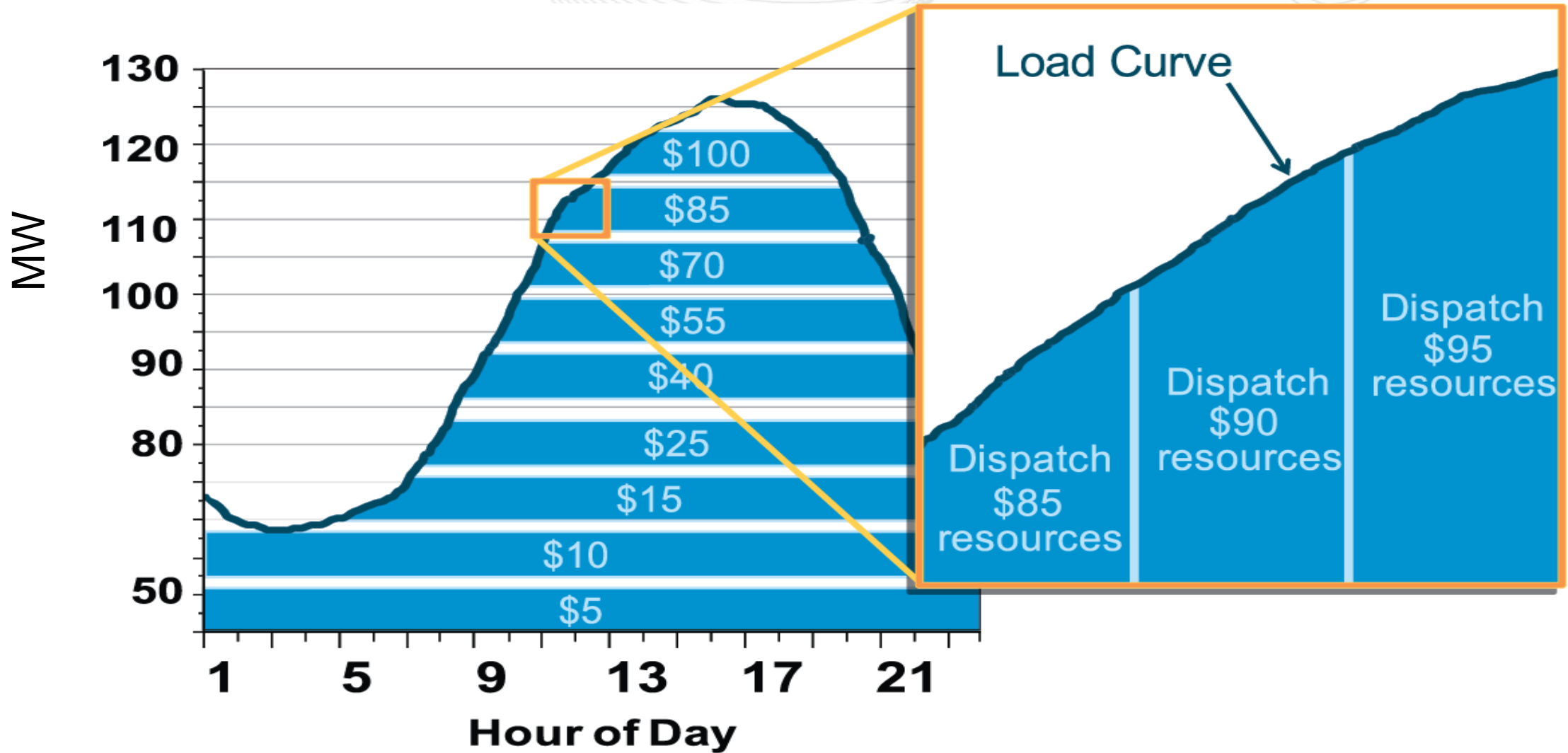
Accuracy of CSP Estimated Reductions Provided to PJM Operations

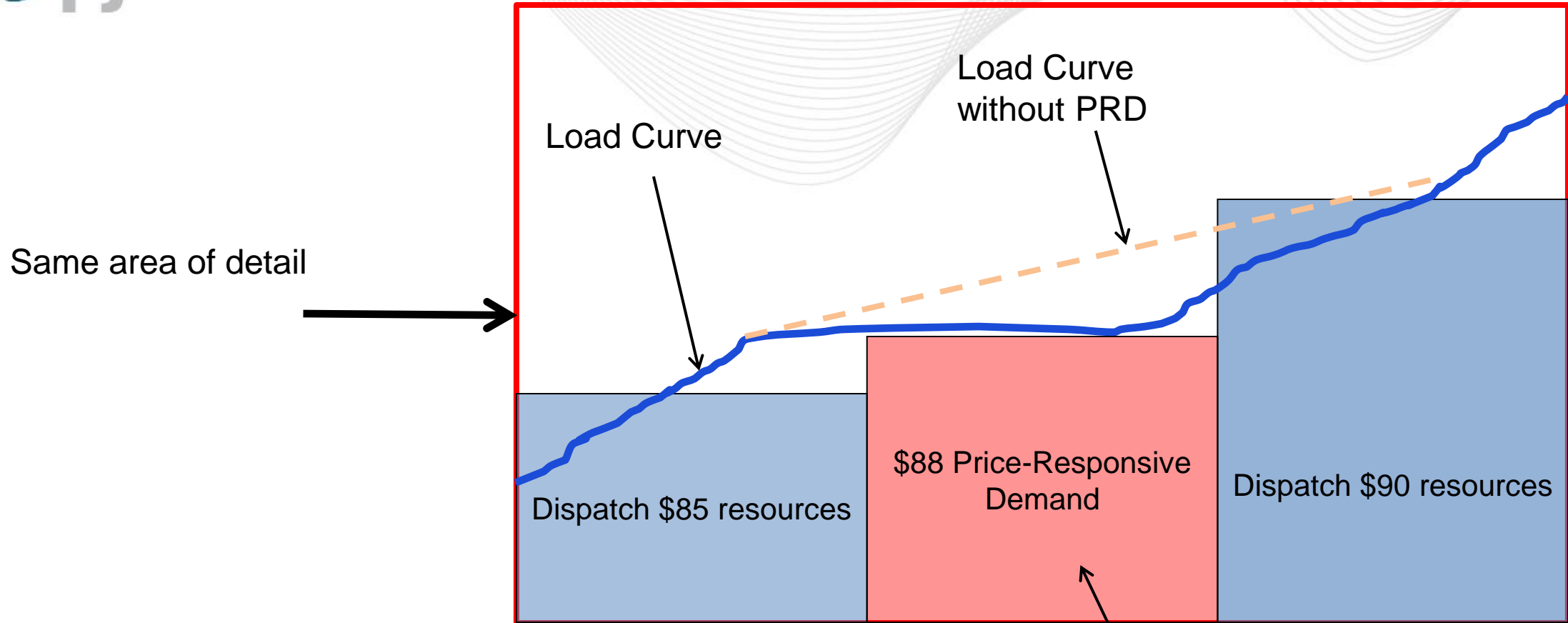
Figure 15: 2013/2014 Emergency DR (Load Management) Event Performance for Non-mandatory period



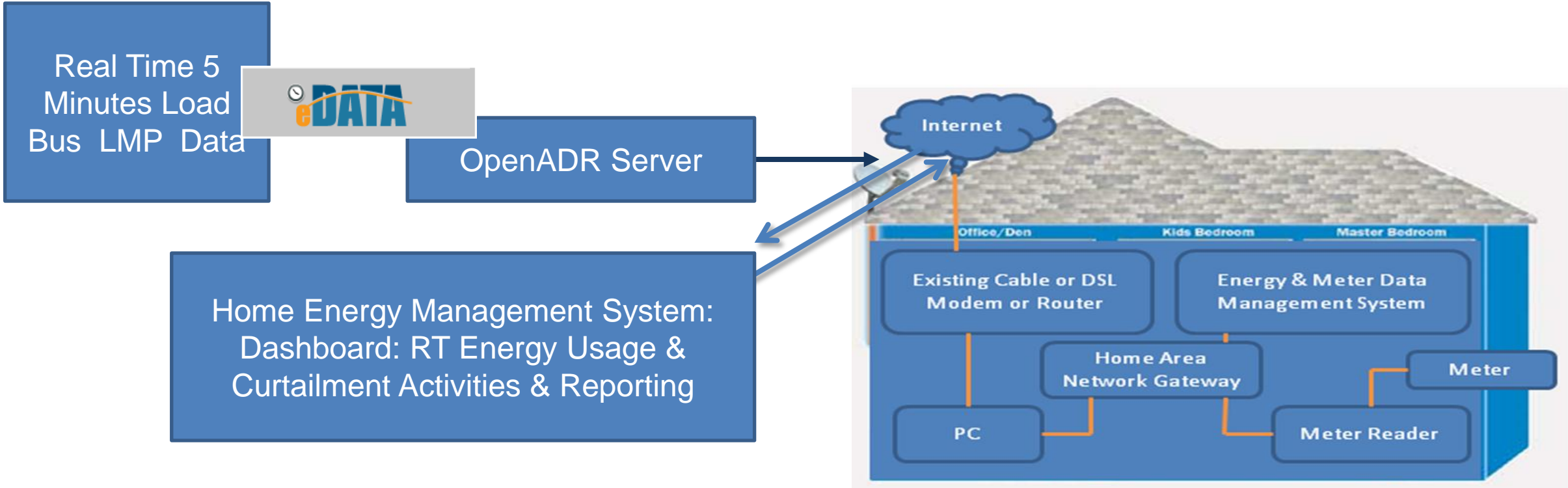
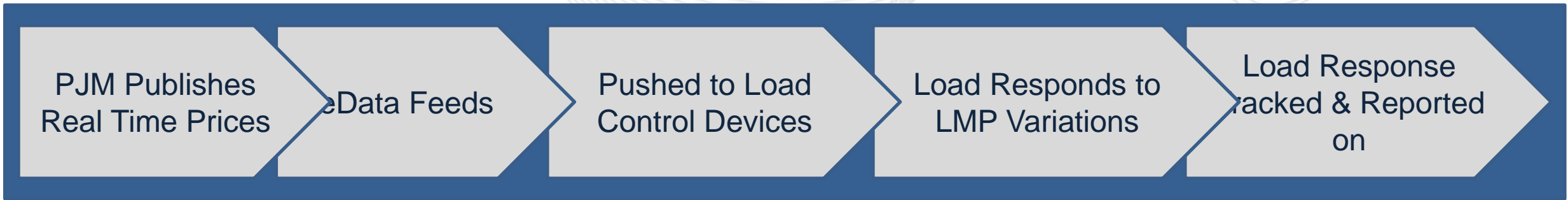
- New option for wholesale participation by load reduction capability
- Market rules require:
 - Metering capable of providing hourly interval usage values
 - Dynamic retail rates that are triggered by nodal Locational Marginal Prices in the PJM energy market
 - Automated response (and supervisory control for capacity market participants that can override automated controls)

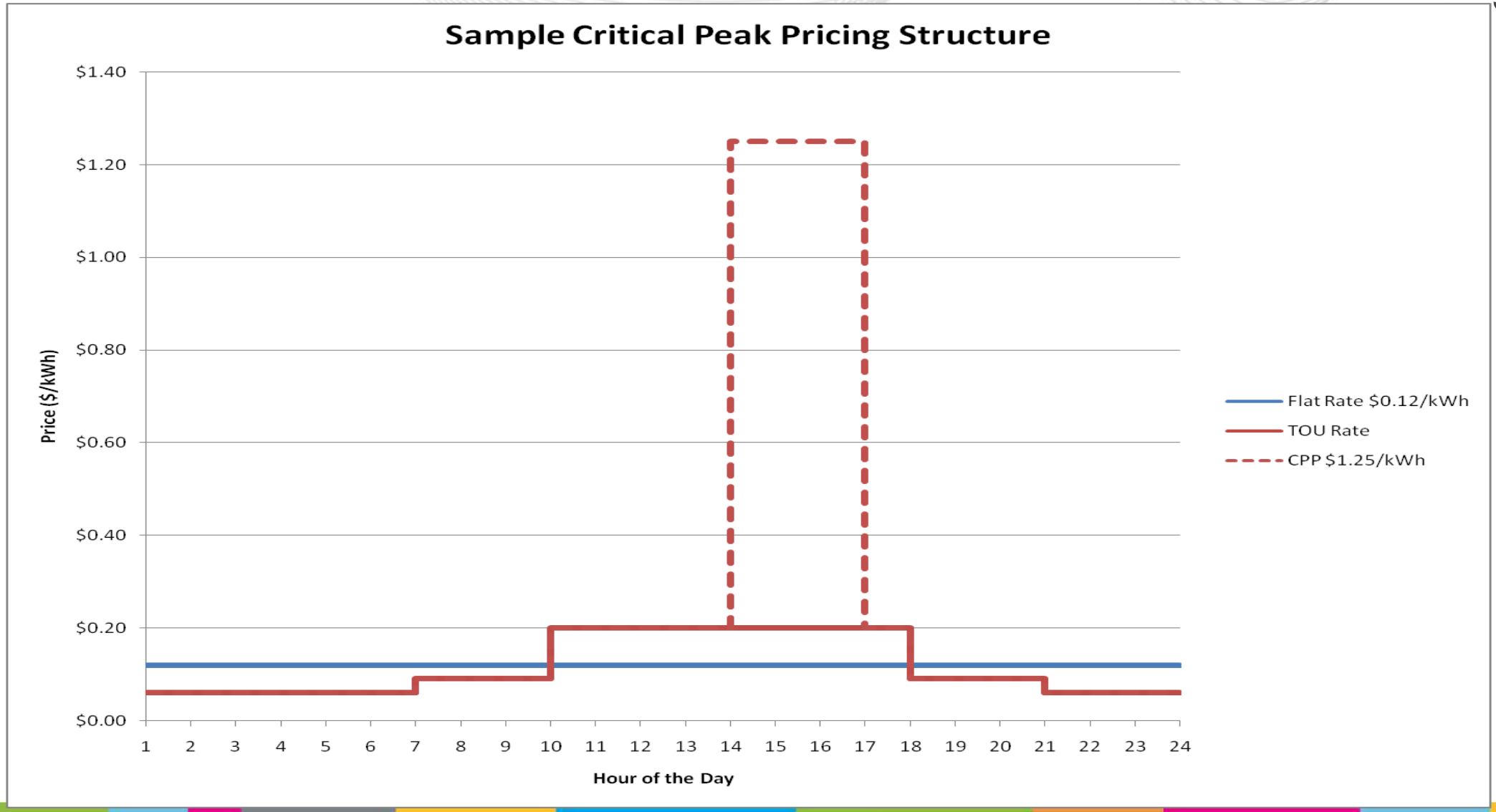
Appendix: Price Responsive Demand Details





No dispatch of additional resources due to demand response at indicated price level





- Flexible resources will be needed to offset the impacts of variable generating resources
- New market players:
 - Price Responsive Demand
 - Smart Grid Technologies
 - Energy Storage Resources
 - battery arrays
 - flywheels
 - compressed air energy storage
 - plug-in hybrid electric vehicles (PHEVs)
- Potential market changes:
 - Market for load following service from existing generators?
 - New tools to co-optimize energy and ancillary service markets, and improve forecasting and scheduling capabilities