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Structural Challenges with California's Current Forward Procurement Construct

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This presentation is based in part on the October 2012 report "Resource Adequacy in California: Options for Improving Efficiency and Effectiveness," prepared for Calpine by Johannes Pfeifenberger, Kathleen Spees, and Sam Newell (http://www.brattle.com/_documents/UploadLibrary/Upload1088.pdf)

Evolving Resource Adequacy Challenges

Resource adequacy in CA

- Assuring sufficient supply for system and local reliability needs has been a policy priority since the Western power crisis of 2000-01
- Current framework relies on a mix of regulated planning (LTPPs), CAISO backstops (e.g., CPM), and market-based mechanisms (RA)

New Challenges since this design was last evaluated

- Once through cooling mandate will require approximately 16,000 MW of existing generation to retire or reinvest over the coming decade
- 33% renewables standard by 2020 will introduce a need for additional flexible resources that can compensate for intermittent resources
- Low natural gas, excess supply, declining market heat rates combined with disconnected price signals causes inefficient resource decisions

Enhancements of resource adequacy framework are needed to meet these challenges cost-effectively

- Can leverage significant experience from other markets over last years

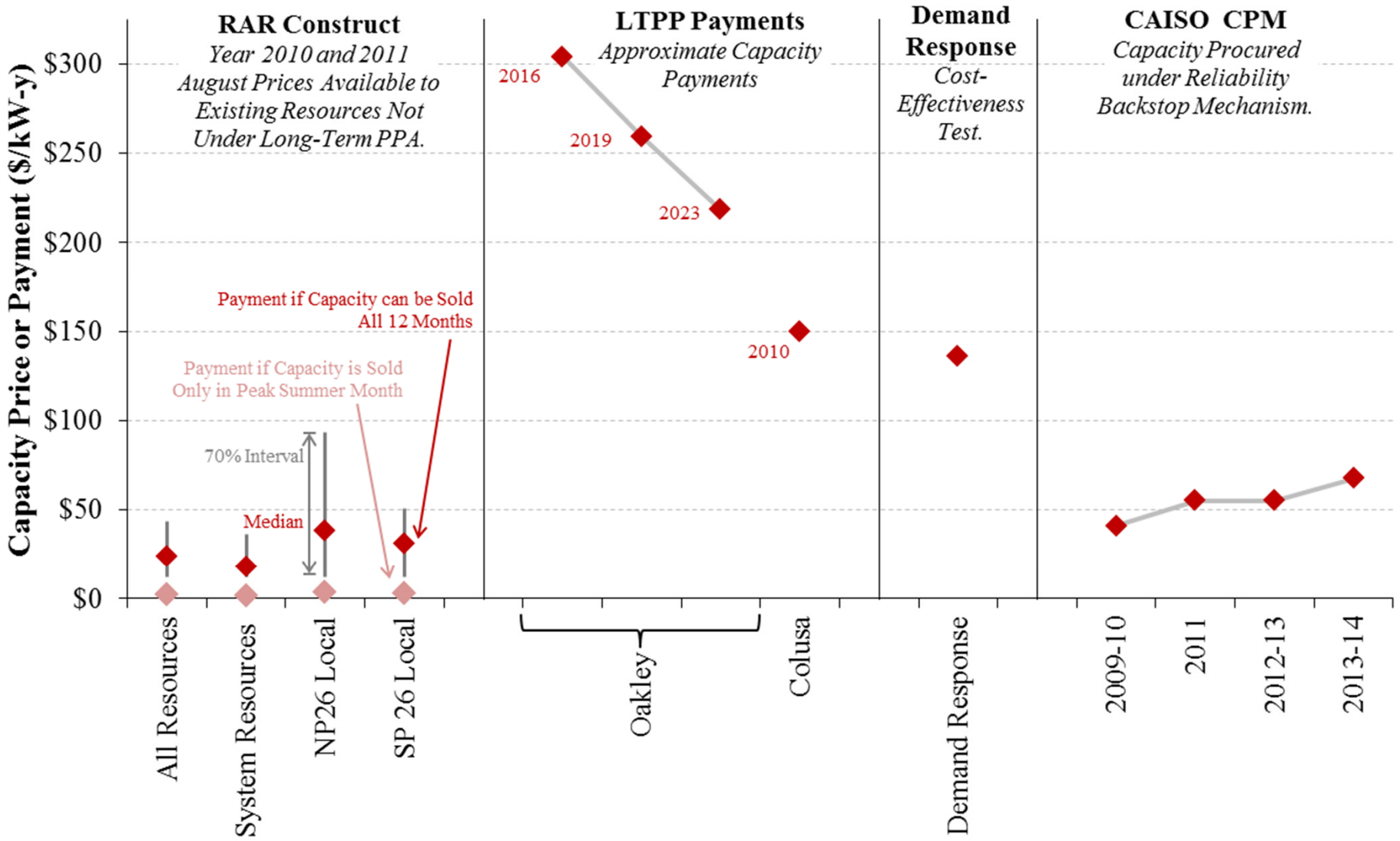
Inefficiencies in Current Framework

A number of inefficiencies reduce the cost-effectiveness of the current framework:

- ***Significant price discrepancies*** among different types of capacity resources including DR, existing generation, and new generation indicate that high-cost resources are procured when lower-cost alternatives exist
- ***Lack of competition*** between new resources (developed under LTPP at approximately $150-300/kW-yr) and existing resources (paid through RAR at approximately $18-38/kW-yr) means that high-cost new generation may be developed even as lower-cost existing generation may be forced to retire
- ***Uneconomic new generation*** investments can be driven by planning uncertainties such as overstated load and retirement forecasts
- ***Inefficient retirement or retrofit*** outcomes (e.g., for OTC units) if the cost-effectiveness of these retire/retrofit/upgrade decisions is not tested against alternative capacity supply options

Inefficiencies in Current Framework

Price Discrepancies Among Capacity Resources



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Inefficiencies in Current Framework (cont'd)

- ***Forward backstop mechanisms*** including CAISO's 2-year forward backstop procurement authority (while not used to date) have the potential to preempt the market from identifying lower-cost alternatives
- ***DR cost-effectiveness tests*** are not based on market conditions, currently over-valuing capacity from DR at $136/kW-yr compared to the going capacity price of $18-38/kW-yr under RAR (in the future, if supplies became tight, the same test could under-value DR capacity)
- ***Barriers to third-party DR*** caused by lack of a direct option to monetize the market value of capacity (only have limited opportunities and must currently work through utilities)
- ***Lack of liquidity and transparency*** in short-term bilateral RAR market increases transactions costs relative to centralized auctions or an over-the-counter exchange
- ***Front loading of LTPP contract payments*** makes today's customers overpay, distorts market prices, and leads to inefficient resource decisions

Value of Market-Based Resource Adequacy

Value of non-discriminatory procurement

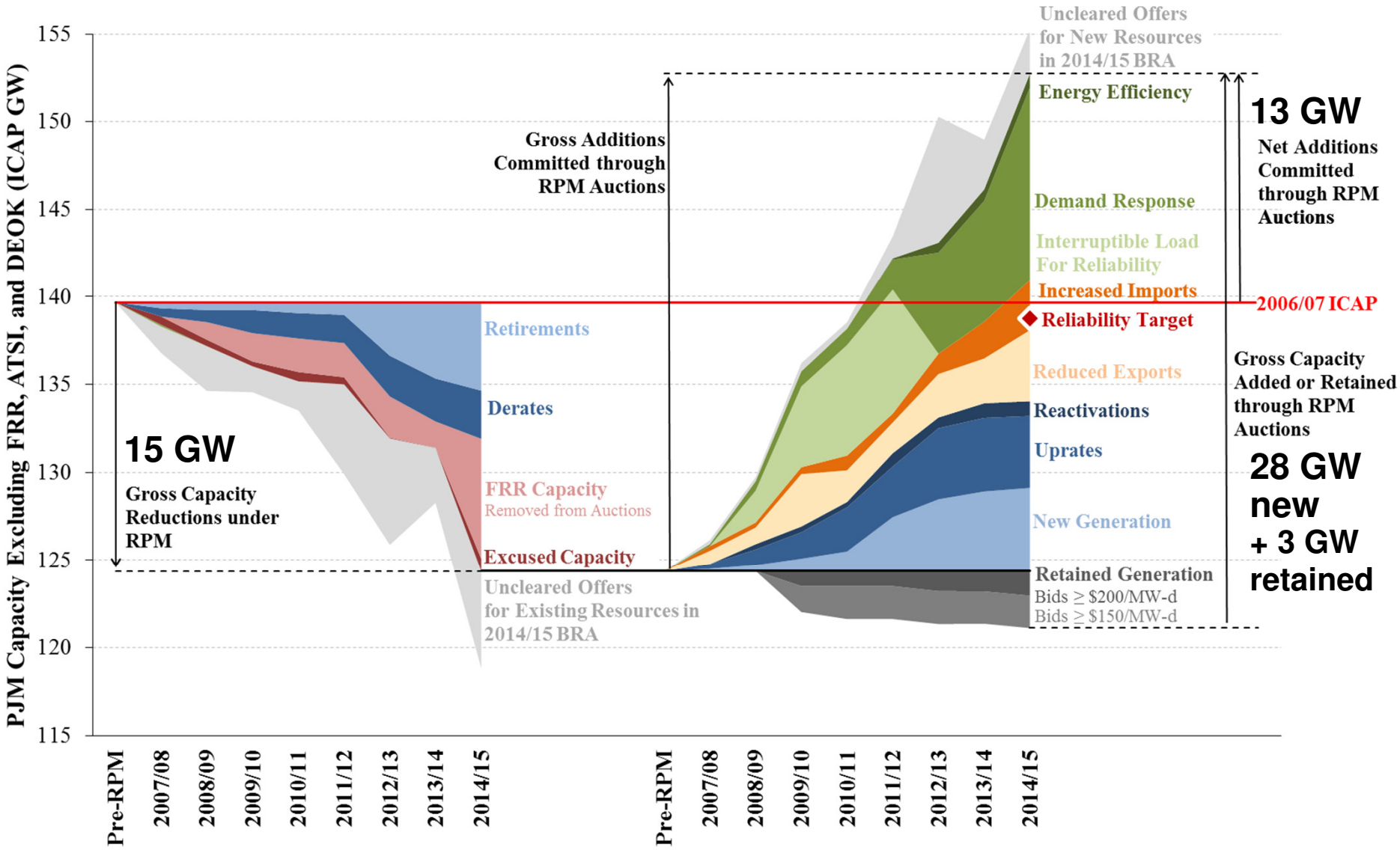
- Levels the playing field and creates competition among DR, existing generation, new generation, imports, retrofits, and repowering projects to achieve reliability objectives at lowest cost
- Attracts low-cost capacity alternatives (e.g., market-based DR, unit upgrades) that postpone the need for higher-cost investments in new generation
- With policy priorities (e.g., RPS, regulated DR/EE), requires residual needs are set aside for market-based, non-discriminatory procurement

Value of multi-year forward RA requirements

- Enable direct competition between existing resources and new generation
- Provide confidence that needs will be met on a forward basis
- Create visibility of future retirement levels, DR growth, and capacity prices
- Meet environmental mandates – proven ability to assure payments high enough to retrofit lowest-cost generators but low enough to allow efficient retirement of higher-cost resources (e.g., PJM 2014/15 MATS compliance; see Appendix)
- Attract new generation when needed (e.g., demonstrated ability to clear merchant plants in NYISO's and PJM's recent auctions)

Value of Market-Based Resource Adequacy

PJM Attracted Large Lower-Cost Capacity Additions



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Options for Improvement

We proposed several options for reforming LTPP and RA to resolve current inefficiencies and meet challenges and objectives at lower cost. Key elements are:

- **Non-Discriminatory, Flexible LTPP Procurement**:
  - Ideally, open LTPP procurements to existing generation and DR (instead of allowing only new generation)
    - Allow offers for commitments of any term (to avoid disadvantaging lower-cost, short-term resources such as DR and life extensions to existing plants)
  - Procure only a clearly-defined capacity product that can be substituted with RA capacity (will also allow to evaluate CTs, CCs, DR, storage, etc. on a level playing field)
  - Allow RA-market-based substitution of physical capacity obligations
  - Avoid procuring 100% needs projected 10 years out
    - Set aside portion of resource needs (e.g., 20-30%) for non-discriminatory, market-based forward and RA procurement

Options for Improvement (cont'd)

- **Improve RA Market Liquidity and Transparency**
  - Procure shorter-term residual system and local needs through CPUC, State, or CAISO-administered centralized, non-discriminatory RA **capacity auction**
  - Replace current LSE reporting and compliance procedures
  - Ideally, all imports, DR, existing gen, and new generation could compete to supply needs
  - Would create liquidity and price transparency
  - Would be platform to increase flexibility in adjusting LTPP commitments (buy-out/buy-in decisions) in response to changing market conditions and supply shocks (e.g. unexpected plant failures, retirements, environmental limitations)

Options for Improvement (cont'd)

- **3-4 Year Forward Procurement**
  - Would provide forward visibility into resource adequacy and retirement decisions, benefitting CAISO and CPUC planning efforts
  - 3-4 years consistent with time period before major irreversible financial commitments need to be made in plant development
  - CPUC, State, or CAISO-administered centralized, non-discriminatory **capacity auction** would provide additional efficiency, liquidity, transparency and opportunity for market monitoring/mitigation
    - Would also provide an efficient platform for co-optimizing procurement for both flexibility requirements and resource adequacy needs
  - Could either be supplement or substitute for LTPP/RAR
    - Could be combined with LTPP and RAR by "laddering" portion of total capacity obligations procured through LTPP, forward procurement, and RAR (e.g., 70%, 25%, 5%)
  - Self-supplied resources could either pass through the auction or be netted out ahead of time (with only residual quantities cleared)

Additional Reading

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Newell, Bhattacharyya, Madjarov, “Cost-Benefit Analysis of Replacing the NYISO’s Existing ICAP Market with a Forward Capacity Market," June 15, 2009.

Pfeifenberger, Spees, Schumacher, “A Comparison of PJM's RPM with Alternative Energy and Capacity Market Designs,” September 2009.

Pfeifenberger, Newell, Earle, Hajos, Geronimo, “Review of PJM's Reliability Pricing Model (RPM),” June 30, 2008.

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Note:

The views expressed in this presentation are strictly those of the presenter and do not necessarily state or reflect the views of *The Brattle Group, Inc.*

Johannes (Hannes) Pfeifenberger is an economist with a background in power engineering and over 20 years of experience in the areas of public utility economics and finance. He has published widely, assisted clients and stakeholder groups in the formulation of business and regulatory strategy, and submitted expert testimony to the U.S. Congress, courts, state and federal regulatory agencies, and in arbitration proceedings.

Hannes has extensive experience in the economic analyses of electricity wholesale markets and transmission systems. His recent experience includes reviews of RTO capacity market and resource adequacy designs, testimony in contract disputes, and the analysis of transmission benefits, cost allocation, and rate design. He has performed market assessments, market design reviews, asset valuations, and cost-benefit studies for investor-owned utilities, independent system operators, transmission companies, regulatory agencies, public power companies, and generators across North America.

Hannes received an M.A. in Economics and Finance from Brandeis University and an M.S. in Power Engineering and Energy Economics from the University of Technology in Vienna, Austria

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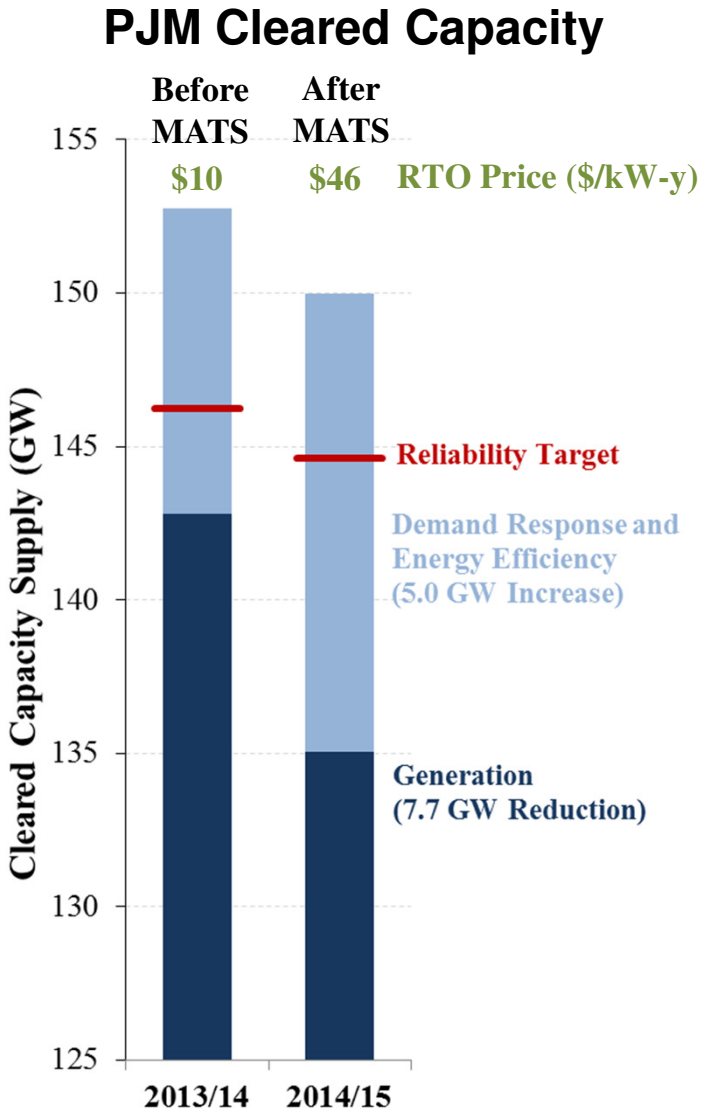
Ability to Address Large Environmental Mandates

PJM experience with MATS in 2014/15 and 2015/16

- Mercury and Air Toxics Standard (MATS) first affected RPM results in 2014/15
  - Imposes strict retire or retrofit decision on coal plants to reduce mercury and toxic air pollutants
  - 7,700 MW less generation cleared
  - Offset by a 5,000 MW increase in RTO DR that previously did not clear
- Additional retirements for 2015/16 offset by new merchant and regulated entry



Ability to Attract New Merchant Generation

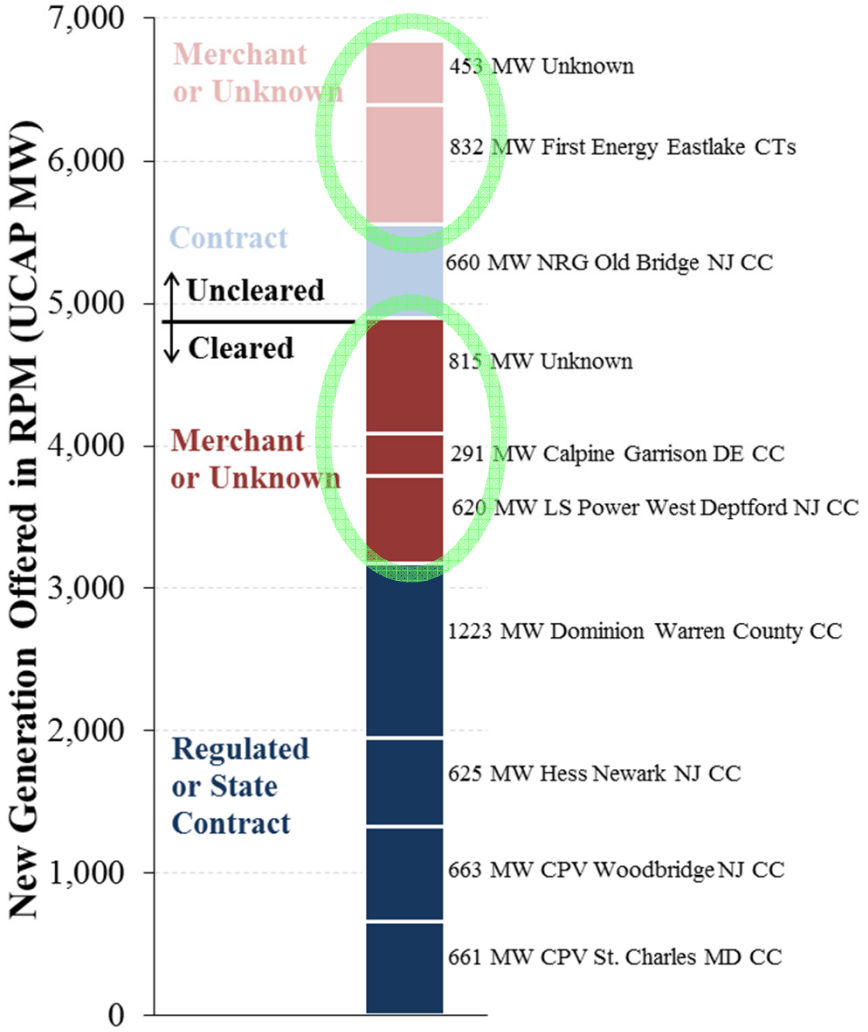
PJM's 2015/16 Auction

- 4,900 MW of new generation cleared (another 1,945 MW was offered at higher prices)
- Cleared new gen included:
  - 3,173 MW of regulated or state contracts
  - 620 MW Merchant LS Power Plant
  - 291 MW Merchant Calpine Plant
  - 815 MW other new builds
- Prices cleared far below Net CONE in most of PJM (almost exactly Net CONE in ATSI zone)

Higher-Cost State Contracts

- 1,949 MW cleared, 660 MW uncleared
- Market cleared with cost-based offer-floor mitigation at $61/kW-year compared to:
  - $80/kW-year for Hess Newark ($95 by 2030)
  - $104/kW-year for CPV ($158 by 2030)

New PJM Generation in 2015/16



Sources and Notes: PJM 2014/15 BRA Results, SNL Energy; Capacities may be inexact, reported in UCAP where available.

Pricing in PJM Capacity Market vs. NJ State-Sponsored Long-term PPAs