Procurement of Replacement Capacity via Incremental Auctions

August 26, 2013

- Additional education
  - Procuring replacement capacity in an IA
  - Cost of capacity deficiency compared to cost of replacement
  - PJM “participation” in IAs
- Review of historical IA results
- Review of historical replacement rates
- PJM concerns with current IA design

Purposes of Incremental Auctions

- Allow Market Sellers with capacity resource commitments to submit Buy Bids for replacement Capacity Resources if unable to meet commitment
  - Market seller avoids capacity deficiency and associated penalty
  - **PJM maintains same level of reliability since original BRA capacity resource commitment is replaced by new capacity resource commitment made in IA (total committed MW level is unchanged)**
- Allow PJM to procure BRA "hold-back" quantity and adjust current committed capacity levels due to increases or decreases in the Reliability Requirement

Replacement Capacity

- Capacity resources that clear in an RPM auction are subject to capacity deficiency penalty if unable to physically deliver on commitment unless replaced
- Replacement capacity allows deficient resource to cure deficiency and avoid associated deficiency penalty while PJM maintains same level of reliability since total MW commitment level is unchanged
- If not replaced, deficient resource pays capacity deficiency penalty; PJM reliability is negatively impacted since total MW commitment level is reduced
- Replacement capacity may be purchased in IAs by submitting Buy Bid; specify Buy Bid MW quantity and maximum price willing to pay

Capacity Deficiency Penalty

- Deficiency penalty rate for resource cleared in BRA is equal to BRA CP plus (the higher of 20% of the BRA CP or $20)
- Deficient resource owner has no economic incentive to pay more than penalty rate for replacement capacity
- Some economic incentive to pay between BRA CP and penalty rate for replacement capacity as net replacement cost in this range less than alternative net penalty cost
- Economic incentive to pay BRA CP for replacement capacity as BRA commitment is replaced at no net cost
- Strong economic incentive to pay less than BRA CP for replacement capacity as BRA commitment is replaced for financial gain (gain equal to BRA CP minus replacement cost)

Cost of Deficiency Penalty vs Cost of Replacement

Table below compares net cost of capacity deficiency penalty to net cost of replacing deficient capacity resource at various replacement costs for capacity resource clearing 1 MW in BRA at BRA CP of $150/MW-day

		Replacement Cost relative to Penalty Rate and BRA CP				
	No Replacement	Replacement Cost > Penalty Rate	Replacement Cost = Penalty Rate	Penalty Rate > Replacement Cost > BRA CP	Replacement Cost = BRA CP	Replacement Cost < BRA CP
Auction Credit	$150	$150	$150	$150	$150	$150
Cost of Deficiency Penalty	$180	$0	$0	$0	$0	$0
Cost to Procure Replacement	n/a	$200	$180	$165	$150	$50
Net Cost to Resource Owner	$30	$50	$30	$15	$0	-$100
Capacity Deficiency (MW)	1	0	0	0	0	0

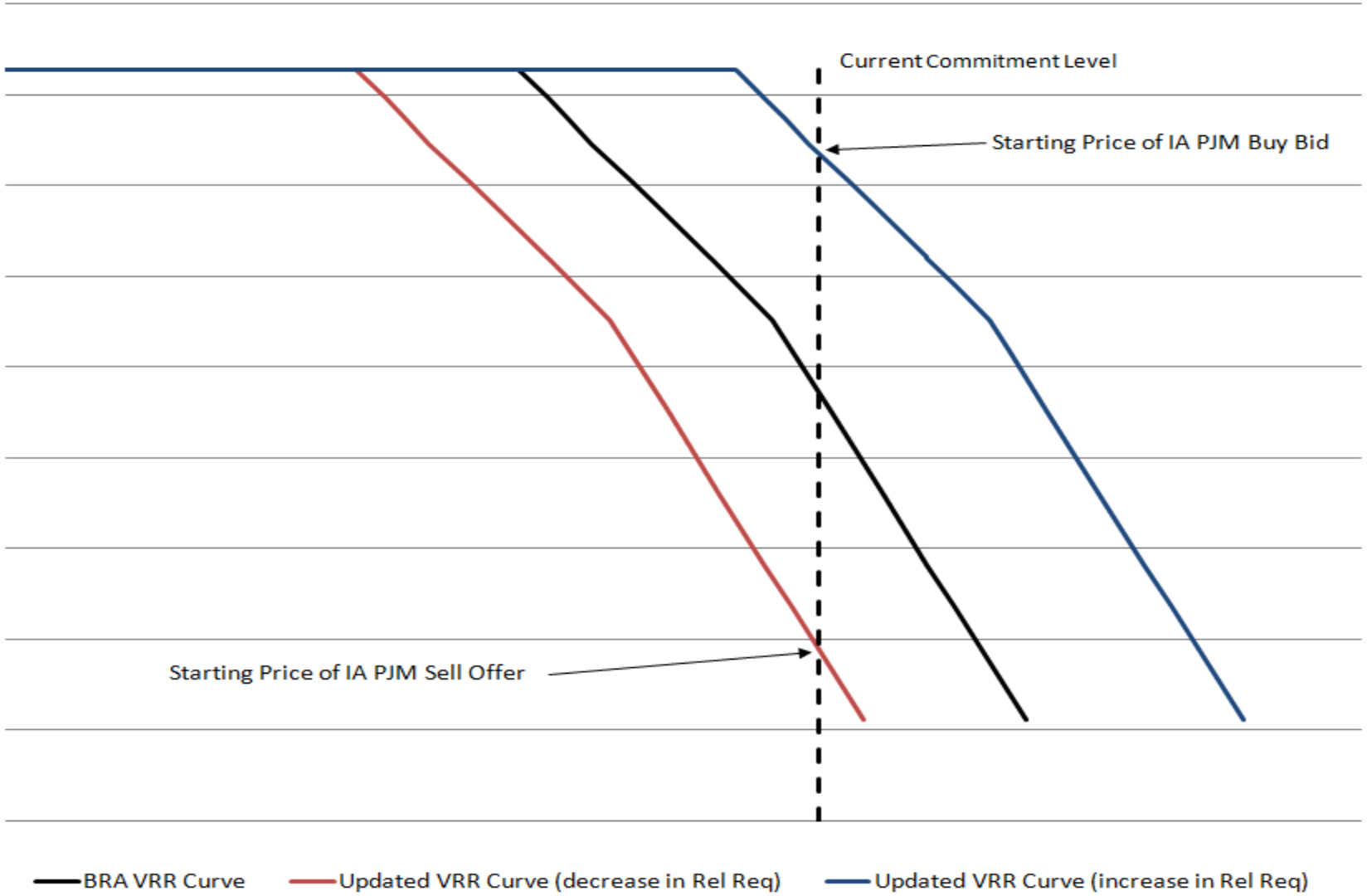
PJM "Participation" in IAs

- PJM will seek to procure capacity via PJM "buy bid" or release prior capacity commitment via PJM "sell offer" in a quantity based on net of change in Reliability Requirement plus hold-back quantity from BRA
  - For 1st and 2nd IA, change in Reliability Requirement is only considered if greater than 500 MW or 1% of prior auction's reliability requirement
- If BRA holdback quantity is 1,000 MW and Reliability Requirement has increased by 3,000 MW then PJM will submit 4,000 MW buy bid
- If BRA holdback quantity is 1,000 MW and Reliability Requirement has decreased by 3,000 MW then PJM will submit 2,000 MW sell offer

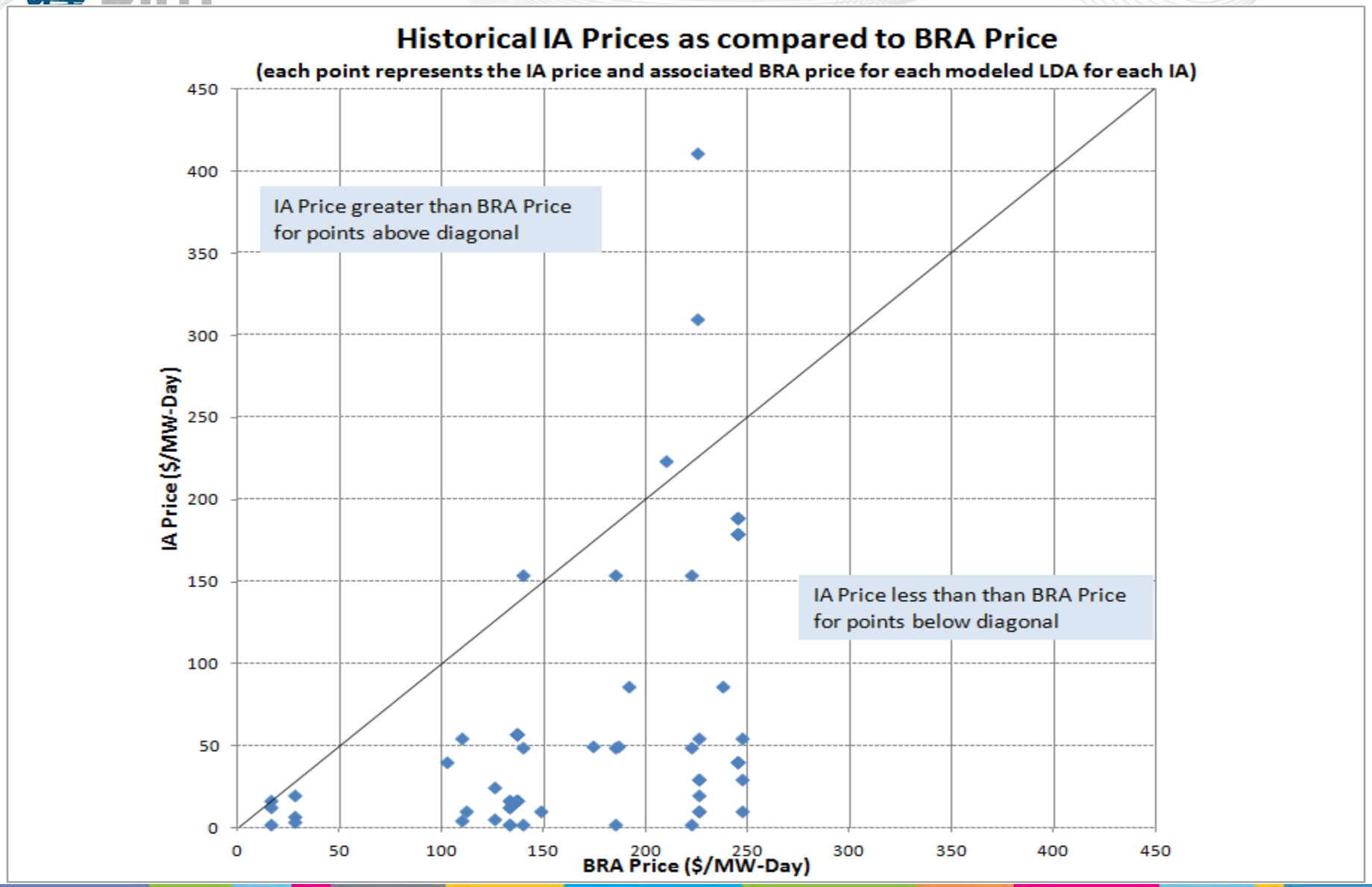
Offer Price of PJM "Buy Bids" and PJM "Sell Offers"

- The price of a PJM "buy bid" or PJM "sell offer" is based on the intersection of the updated VRR curve and a vertical line at current capacity commitment level
- A PJM "buy bid" price starts at a price greater than the BRA CP since the updated VRR curve is located to the right of the BRA VRR curve in this case and intersection point therefore occurs higher up the curve
- A PJM "sell offer" price starts at a price less than the BRA CP since the updated VRR curve is located to the left of the BRA VRR curve in this case and intersection point therefore occurs lower on the curve
  - The sell offer price can start as low as $0/MW-Day if the updated VRR curve has shifted significantly to the left of the BRA curve

Offer Price of PJM "Buy Bids" and PJM "Sell Offers"



Historical IA Price relative to BRA Price



IA Clearing Prices vs BRA Clearing Prices

- IA clearing prices have been consistently significantly lower than BRA clearing prices
  - Each point of the scatter plot of previous slide shows the IA CP and associated BRA CP for each of the thirteen IAs conducted to-date and for each modeled LDA (68 unique pricing points)
  - IA CP less than BRA CP for points located below the diagonal
  - IA CP greater than BRA CP for point above the diagonal
  - consistent pattern of IA CPs significantly below BRA CPs
- **average MW-weighted cost to purchase replacement capacity across all IAs conducted to-date has been just above 20% of the BRA price**

Cleared IA Supply by Capacity Resource Type

Cleared IA Sell Offer MW by Capacity Resource Type
Average of all 2012/13 & 2013/14 IAs

	Cleared Sell Offers (UCAP MW)	
Resource Type	MW	%
DR	1,601.6	13.9%
EE	161.0	1.4%
GENERATION	4,246.1	36.9%
PJM "Sell"	5,489.2	47.7%
TOTAL	**11,497.8**	**100.0%**

Cleared Supply in IAs (see table of prior slide)

- Nearly 50% of cleared IA supply is associated with PJM "Sell Offer" to release prior capacity commitments due to reduction in reliability requirement
  - reflects low PJM "sell offer" price relative to BRA CP
  - Load pays BRA CP for BRA commitment and receives IA price for released capacity; based on average buy-back cost of 20% of the BRA cost, load receives "rebate" of 20 cents on the dollar
- Remainder of cleared supply from capacity resources (mostly generation) apparently willing to accept price substantially below BRA price
  - new capacity not offered into BRA and uncleared BRA capacity
  - disproportionately compensated at reduced IA price by resources cleared in BRA now looking to buy-out potentially for financial gain
  - disproportionately compensated at reduced IA price by same resources by which displaced n BRA

IA Buy Bids (Bid and Cleared)

Submitted and Cleared Buy Bid MW grouped by IA Buy Bid Price (relative to BRA CP)
Average of all 2012/13 & 2013/14 IAs

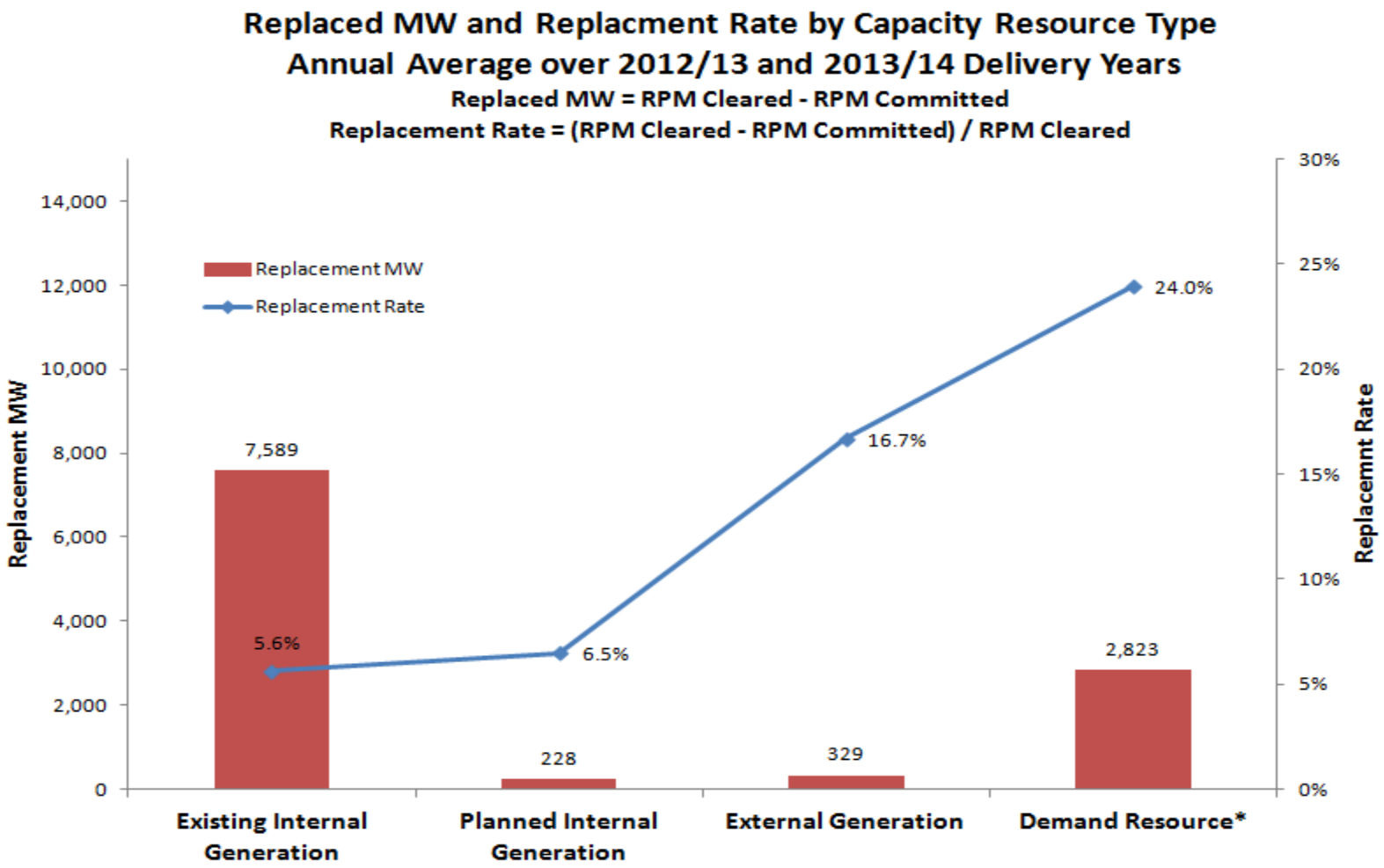
IA Buy Bid Price (relative to BRA CP)	Submitted Buy Bid MW	% of Total Submitted Buy Bid MW	Cleared Buy Bid MW	% of Total Cleared Buy Bid MW	Cleared to Submitted %
IA Bid Price ≥ BRA CP	6,660.4	19.7%	6,660.4	57.9%	100.0%
(0.5 x BRA CP) ≤ IA Buy Price < BRA CP	3,262.6	9.7%	2,342.4	20.4%	71.8%
IA Bid Price < (0.5 x BRA CP)	23,857.9	70.6%	2,495.0	21.7%	10.5%
TOTAL	**33,780.9**	100.0%	**11,497.8**	**100.0%**	34.0%

Note: IA Buy Bid Price is the price at which the Buy Bid was submitted (i.e., the maximum price the buyer was willing to pay)

Offered and Cleared Buy Bids in IAs (see table of prior slide)

- To avoid or reduce cost of capacity deficiency penalty, a deficient BRA resource owner should be willing to pay between 1.0 x BRA CP up to 1.2 X BRA CP
  - Based on table from prior slide, about 20% of IA buy bid quantities are submitted at a bid price in this range
- About 80% of IA buy bid quantities are submitted at a buy bid price below the BRA price indicating a willingness to replace to potentially achieve financial gain

Replacement Rate by Capacity Resource Type



*reflects adjustments for non-viable DR quantity due to M&V revisions as indicated in CSP buy-back notifications to PJM

Note: due to reliability requirement reduction, PJM was willing to release annual average of 6,105 MW (4.2 % of cleared MWs)

Historical Replacement Rates (see chart of prior slide)

- Replacement rates are significantly higher for capacity resource types having more uncertainty of 3-year forward physical capability:
  - Demand Resources
  - External Generation Resources
  - Planned Internal Generation Resources
- Cleared BRA quantities of external generation and planned internal generation have increased substantially in last 3 BRAs (see below)

BRA Delivery Year	Planned Internal Generation	External Generation	Demand Response
2016/17	5,463	7,483	12,408
2015/16	5,346	3,935	14,833
2014/15	757	3,017	14,118

PJM Concerns with Existing IA Design

- Consistently lower IA prices and ability for financial gain via IA buy-out of BRA commitment creates unintended perverse incentive for BRA sellers to over-estimate actual physical capability in BRA sell offer
- Over-estimated potential physical capability cleared in BRA displaces actual known physical capability which the deficient BRA seller then relies on in IA for replacement purposes
  - Potential for retirement of physical capability displaced in BRA leading to reduced availability of capacity for sale in IAs
  - Inability to obtain replacement capacity in IA at a price consistent with penalty rate negative impact on PJM reliability

PJM Concerns with Existing IA Design (cont.)

- RPM is a physical market, a resource cleared in BRA is expected to physically deliver, IA buy is intended to replace capacity that cannot delivery due to unforeseen event; therefore, it is unreasonable for IA buyer to profit from these inadvertent conditions.
- Increased cost to customers with no corresponding benefit; customers are disproportionately compensated for release of over-procured capacity at expense of those profiting from buy-out (load pays BRA price for BRA commitment and receives IA price for released capacity)