Reliability Pricing Model

Updated Prototype Simulation

Using FERC Settlement VRR

December 1, 2006

(Updated December 27, 2006)

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Summary

- Participants requested a means to determine the impact of the new VRR curve on the RPM clearing.
- Therefore, the RPM Prototype Simulations were updated using the Variable Resource Requirement (VRR) Curve developed through the FERC Settlement Agreement.
- Intent is to provide a means to assess the impact of the new VRR curve
- Not intended to predict or forecast any potential RPM auction results
- The updated simulation results show a lower capacity price where the intersection of the supply and VRR curve occurred beyond the threshold point. This is due to the shape of the new VRR curve.
- Little or no change was seen in the unconstrained “MKT” area.

- Changed:
  - FERC Settlement Agreement Variable Resource Requirement (VRR) Curve

Simulation Updates

- Not-Changed
  - Generation Retirements and Additions
  - Supply curve MWs and Price points
  - CETO/CETL values
  - Forecast Load
  - Only the 2007/2008, 2008/2009, and 2009/2010 Planning Periods are simulated due to lack of CETO/CETL data for 2010/2011 at this time.
  - No external capacity modeled in simulation
  - Any capacity selling out of PJM is not included in simulations
  - No transmission or demand resource offers in simulation

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Resource Offer Data

- Hypothetical Net Going Forward cost by resource class
- Supplied by MMU in Fall of 2004
- Used in creation of resource offer data in the RPM Simulations
- Values in the table below were not changed from previous simulations or postings
- Used as a reference for generating offer data
- Offer data was created from zero to approximately 10% above these values for each Resource Class
- The values below are not the mean offer for each Resource Class
- The distribution of the offer data is not normal

Resource Class	$/MW-Day
Diesel	$99
Combustion Turbine	$87
Combined Cycle	$62
Steam	$10
Nuclear	$0

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PJM Filed VRR Curve

Reserve	UCAP (% Threshold)	ICAP Price ($/MW-Day)	UCAP Price ($/MW-Day)	Comments	Points
12%	**97.4%**	**182**	**195**	**IRM - 3%**	**Point 1**
13%	98.3%	167	179		
14%	99.1%	152	163		
15%	100.0%	137	146	**IRM or Threshold**	
16%	**100.9%**	**122**	**130**	**IRM + 1%**	**Point 2**
17%	101.7%	97	104		
18%	102.6%	73	78		
19%	103.5%	49	52		
20%	**104.3%**	**24**	**26**	**IRM + 5%**	**Point 3**
20%	104.3%	0	0		

- Table uses an average EFORd of 6.53%
- Forecast Pool Requirement (FPR) = 107.49%
- UCAP (% Threshold) = (1+Reserve) / (1+IRM)
- Example Table is for DC Region
- Table can be converted to other regions by substituting regional data into VRR Curve Table

Geographic Locations	Fixed Cost $/MW-Day	E&AS Rev ($/MW-Day)
NJ Region	$198	$99
DC Region	$203	$81
Chicago Region	$202	$80

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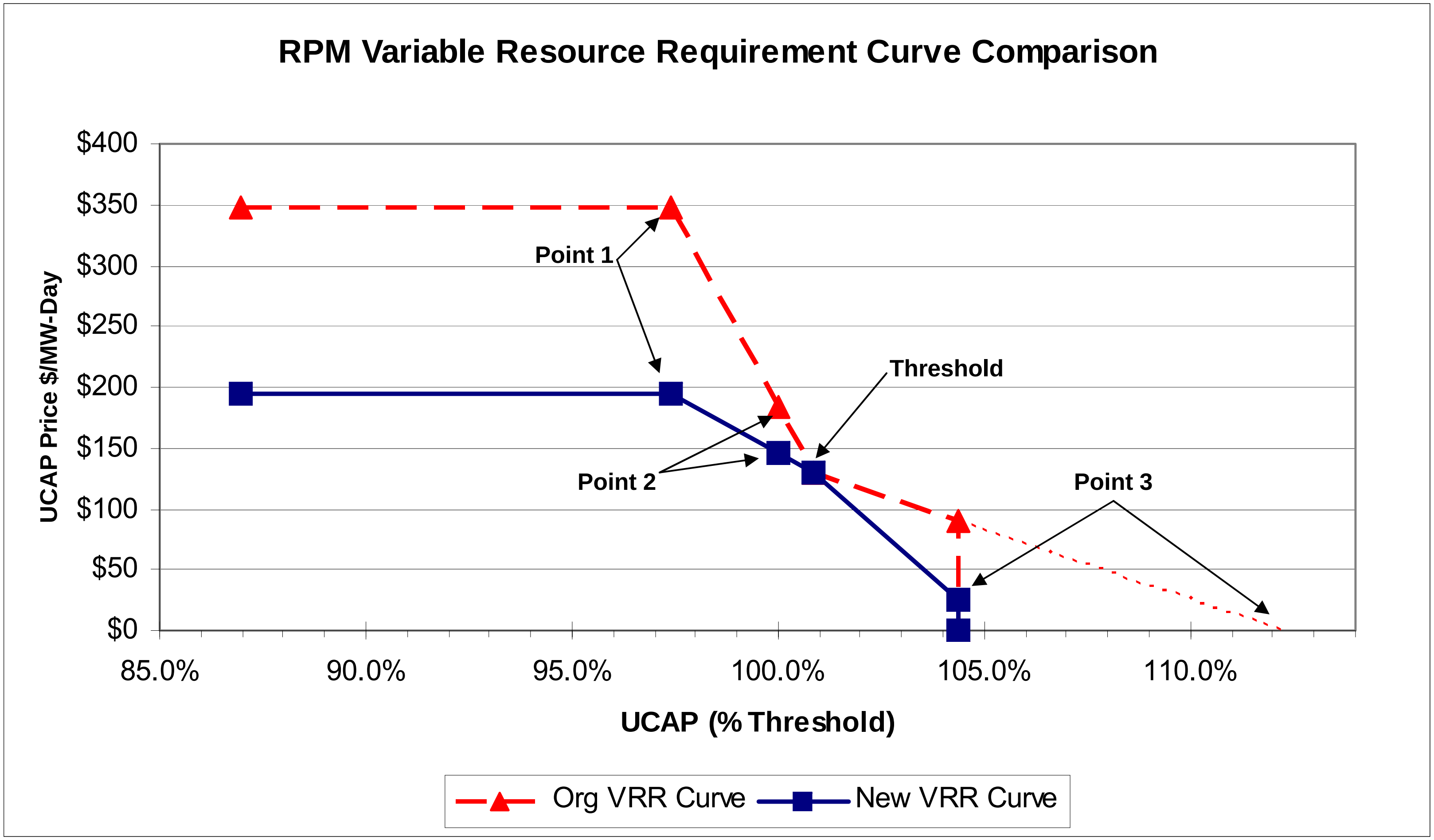
PJM Filed VRR Curve



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2007/2008 Input Data

- Transition LDA Modeling
- Two locational constraints modeled:
  - Southwest MAAC and Eastern MAAC

Planning Year	2007 / 2008
Coincident Peak (Unrestricted)	137672
ILR Forecast	1638
DR Factor	94.60%
ILR Credit = ILR Forecast x DR Factor	1550
Installed Reserve Margin (IRM)	15.00%
Pool Average EFORd	6.53%
Forecast Pool Requirement (FPR)	107.49%
ILR Obligation	1666
Total RTO UCAP Obligation	147984

2007/2008 – Simulation VRR Data

- Internal Capacity = Internal Capacity used in Load Deliverability Analysis.
- ILR Obligation = Forecast ILR x DR Factor x FPR
  - Values on previous slide
- VRR Curve Threshold = Internal Capacity – ILR Obligation + CETO
- RTO VRR Threshold = Total RTO UCAP Obligation – ILR Obligation
- MKT Threshold = RTO Threshold – ∑ LDA Threshold

Region	Internal Capacity (UCAP)	ILR Obligation (UCAP)	CETO	VRR Curve Threshold (UCAP)
Eastern MAAC	31860	352	7875	39383
Southwest MAAC	10856	445	4530	14941
Total				**54324**

MKT Threshold = 146319 – 54324
= 91994

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2007/2008 Eastern MAAC VRR Curve

- Column (A) “UCAP (% Threshold)” values are rounded from their true value to increase the readability of table
- Column (B) is obtained from the PJM file VRR Curve (See slide 6 for details)
- Column (C) is the addition of the Internal Capacity and CETO values from slide 9
- Column (D) is the multiplication of Columns (A) and (C)[1]
- Column (E) is the ILR obligation from slide 9
- Column (F) is calculated by subtracting Column (E) from Column (D)

(A) UCAP (% Threshold)	(B) UCAP Price ($/MW-Day)	(C) LDA Reliability Requirement	(D)[1] Col (A) x Col (C)	(E) ILR Obligation	(F) UCAP MW Obligation	Points
97.4%	159	39735	38698	352	38346	Point 1
100.0%	119	39735	39735	352	39383	Threshold
100.9%	106	39735	40081	352	39729	Point 2
104.3%	21	39735	41463	352	41111	Point 3
104.3%	0	39735	44572	352	41111	

[1] The value in Column (D) was calculated using the full precision of the “UCAP (% Threshold)” value and therefore may not match the value calculated using the data in the table.

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2007/2008 VRR Curves

- VRR Curves needed for Southwestern MAAC and RTO
- Process used to create the Southwestern VRR curve exactly follows the example of the Eastern MAAC VRR Curve creation on the previous slide
- Process for the RTO VRR Curve also follows the same process but uses the “Total RTO UCAP Obligation” from slide 9 as the Reliability Requirement, Column C.

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Generation Assumptions

- Future Generation
  - Snapshot of PJM Generation Queue taken in Fall of 2004
  - Generation that had a Feasibility Study Agreement (FSA) included as part of Future Generation
  - Additional generation determined by the PJM Generation Interconnection Department to have a high probability of being completed also included as part of Future Generation
- Retired Generation
  - All retirements announced by Fall of 2004 included as part of Retired Generation
  - Additional generation retired based on System Planning determination and included as part of Retired Generation.
- Values shown for Future Generation and Retired Generation are cumulative
  - 2008/2009 values include the 2007/2008 values
  - 2009/2010 values include the 2008/2009 and 2007/2008 values

2007/2008 Simulation

Input Data

Region	Import Limit	Existing UCAP	Future UCAP	Retirements (UCAP)	Available UCAP
Eastern MAAC	8000	32854	109	1245	31718
Southwest MAAC	4700	10858	0	2	10856
Market	N/A	114553	2144	2250	114447
RTO		**158265**	**2253**	**3496**	**157021**

Results

Region	Awarded UCAP	Import MWs	Clearing Price ($/MW-Day)	Import Shadow Price ($/MW-Day)
Eastern MAAC	31718	8000	$106.06	$89.92
Southwest MAAC	10856	4700	$35.94	$19.80
Market	108747	-12700	$16.14	$0.00
RTO	**151321**	**0**		

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2008/2009 Input Data

- Transition LDA Modeling
- Two locational constraints modeled:
  - Southwest MAAC and Eastern MAAC

Planning Year	2008 / 2009
Coincident Peak (Unrestricted)	140483
ILR Forecast	1613
DR Factor	94.60%
ILR Credit = ILR Forecast x DR Factor	1526
Installed Reserve Margin (IRM)	15.00%
Pool Average EFORd	6.53%
Forecast Pool Requirement (FPR)	107.49%
ILR Obligation	1640
Total RTO UCAP Obligation	151006

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2008/2009 – Simulation VRR Data

- Internal Capacity = Internal Capacity used in Load Deliverability Analysis
- ILR Obligation = Forecast ILR x DR Factor x FPR
- VRR Curve Threshold = Internal Capacity – ILR Obligation + CETO
- RTO VRR Threshold = Total RTO UCAP Obligation – ILR Obligation
- MKT Threshold = RTO Threshold – ∑ LDA Threshold

Region	Internal Capacity (UCAP)	ILR Obligation (UCAP)	CETO	VRR Curve Threshold (UCAP)
Eastern MAAC	32707	352	7804	40159
Southwest MAAC	10856	445	4830	15241
Total				**55400**

MKT Threshold = 149366 – 55400
= 93966

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2008/2009 Simulation

Input Data

Region	Import Limit	Existing UCAP	Future UCAP	Retirements (UCAP)	Available UCAP
Eastern MAAC	8000	32854	1594	1611	32837
Southwest MAAC	4900	10858	0	2	10856
Market	N/A	114553	5318	1917	117954
RTO		**158265**	**6913**	**3530**	**161647**

Results

Region	Awarded UCAP	Import MWs	Clearing Price ($/MW-Day)	Import Shadow Price ($/MW-Day)
Eastern MAAC	32808	8000	$86.91	$74.29
Southwest MAAC	10856	4900	$54.53	$41.91
Market	111265	-12900	$12.62	$0.00
RTO	**154928**	**0**		

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2009/2010 Input Data

- Transition LDA Modeling
- Two locational constraints modeled:
  - Southwest MAAC and Eastern MAAC

Planning Year	2009 / 2010
Coincident Peak (Unrestricted)	143798
ILR Forecast	1613
DR Factor	94.60%
ILR Credit = ILR Forecast x DR Factor	1526
Installed Reserve Margin (IRM)	15.00%
Pool Average EFORd	6.53%
Forecast Pool Requirement (FPR)	107.49%
ILR Obligation	1640
Total RTO UCAP Obligation	154569

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2009/2010 – Simulation VRR Data

- Internal Capacity = Internal Capacity used in Load Deliverability Analysis
- ILR Obligation = Forecast ILR x DR Factor x FPR
- VRR Curve Threshold = Internal Capacity – ILR Obligation + CETO
- RTO VRR Threshold = Total RTO UCAP Obligation – ILR Obligation
- MKT Threshold = RTO Threshold – ∑ LDA Threshold

Region	Internal Capacity (UCAP)	ILR Obligation (UCAP)	CETO	VRR Curve Threshold (UCAP)
Eeastern MAAC	32636	352	8387	40671
Southwest MAAC	10856	445	5062	15473
Total				**56144**

MKT Threshold = 152929 – 56144
= 96785

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2009/2010 Simulation

Input Data

Region	Import Limit	Existing UCAP	Future UCAP	Retirements (UCAP)	Available UCAP
Eastern MAAC	8500	32854	2074	1611	33317
Southwest MAAC	5100	10858	0	2	10856
Market	N/A	114553	11714	1917	124350
RTO		**158265**	**13788**	**3530**	**168523**

Results

Region	Awarded UCAP	Import MWs	Clearing Price ($/MW-Day)	Import Shadow Price ($/MW-Day)
Eastern MAAC	33214	8500	$64.65	$56.34
Southwest MAAC	10856	5100	$61.96	$53.65
Market	114593	-13600	$8.31	$0.00
RTO	**158663**			

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