

Dynamic Analysis of Demand Curves for PJM Reliability Pricing Model: Update

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- Updated cases using new cost of entry and E&AS revenues
- Sensitivity analysis:
 - Non-zero bid for new generation
 - Non-zero bid for existing and new generation
- Interpretation of reserve margin fluctuations ("capacity cycle") from an example excerpted from the long-term simulations.
- Proposals from stakeholder for additional work





Demand Curve Parameters:

- Cost of New Entry = \$72/kW-yr.
- Net Energy & Ancillary Revenue Offset = \$28/kW-yr.

Modeling Uncertainty in E&AS Revenue:

- 1999-2004 data analyzed.
- Modeled a minimum value of \$10/kW-yr and the rest as scarcity revenue as a function of actual peak load driven by random weather and actual capacity procured.





Revised Energy / Ancillary Services Revenue Function







Demand Curves (price before net E&AS revenue offset)





Determination of ICAP Price





Base Case: Average (std dev) – All Units Bid Zero Price

Case	% Years meet or Exceed IRM	Average % Reserve over IRM	Generation Profit \$/kW-yr	Scarcity Revenu e \$/kW-yr	E&AS Revenue \$/kW-yr	ICAP Payment \$/kW-yr	Scarcity + ICAP Payment by Consumers (Peak Ld Basis)
1. No Demand Curve	37	-0.4 (2.0)	64 (116)	51 (90)	10	75 (56)	143 (127)
2. Original PJM Curve, Based on VOLL	28	-0.1 (0.6)	29 (79)	43 (77)	10	48 (12)	104 (86)
3. Alternate Curve with New Entry Net Cost at IRM + 4%	100	3.6 (0.8)	10 (34)	14 (31)	10	58 (10)	85 (36)
4. Alternate Curve with New Entry Net Cost at IRM	53	0.3 (0.8)	24 (73)	38 (71)	10	48 (8)	98 (79)
5. Alternate Curve with New Entry Net Cost at IRM + 1%	89	1.1 (0.7)	19 (64)	31 (62)	10	50 (9)	93 (69)

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Average (std dev) – New Units Bid at \$30/kW-yr

Case	% Years meet or Exceed IRM	Average % Reserve over IRM	Generation Profit \$/kW-yr	Scarcity Revenue \$/kW-yr	E&AS Revenue \$/kW-yr	ICAP Payment \$/kW-yr	Scarcity + ICAP Payment by Consumers (Peak Ld Basis)
1. No Demand	56	-0.1	48	43	10	66	125
Curve		(0.7)	(96)	(79)		(46)	(105)
2. Original PJM	29	-0.1	28	42	10	48	102
Curve, Based on VOLL		(0.6)	(78)	(76)		(11)	(85)
3. Alternate	100	3.6	10	14	10	58	85
Curve with New Entry Net Cost at IRM + 4%		(0.8)	(34)	(31)		(10)	(36)
4. Alternate	53	0.3	24	38	10	48	98
Curve with New Entry Net Cost at IRM		(0.8)	(73)	(71)		(8)	(79)
5. Alternate Curve with New Entry Net Cost at IRM + 1%	89	1.1 (0.7)	19 (64)	31 (62)	10	50 (9)	93 (69)

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pmAverage (std dev) – New Units Bid at \$30/kW-yr; Existing Bid at \$15/kW-yr

% Years meet or Exceed IRM	Average % Reserve over IRM	Generation Profit \$/kW-yr	Scarcity Revenue \$/kW-yr	E&AS Revenue \$/kW-yr	ICAP Payment \$/kW-yr	Scarcity + ICAP Payment by Consumers (Peak Ld Basis)
57	-0.1	47	43	10	66	124
	(0.6)	(94)	(77)		(45)	(103)
29	-0.1	28	42	10	48	102
	(0.6)	(78)	(76)		(11)	(85)
100	3.6	10	14	10	58	85
	(0.8)	(34)	(31)		(10)	(36)
53	0.3	24	38	10	48	98
	(0.8)	(73)	(71)		(8)	(79)
89	1.1 (0.7)	19 (64)	31 (62)	10	50 (9)	93 (69)
	% Years meet or Exceed IRM 57 29 100 53 53	% Years Average meet or % Exceed % IRM Reserve 57 -0.1 (0.6) (0.6) 29 -0.1 (0.6) (0.8) 53 0.3 (0.8) (0.8) 89 1.1 (0.7) (0.7)	% Years Average Generation meet or % Reserve Profit RM -0.1 47 0.6) (94) 29 -0.1 28 (0.6) (78) 100 3.6 10 (0.8) (34) 53 0.3 24 (0.8) (73) 89 1.1 19 (0.7) (64)	% Years Average Generation Scarcity meet or % Reserve %/kW-yr Revenue %/kW-yr 57 -0.1 47 43 (0.6) (94) (77) 29 -0.1 28 42 (0.6) (78) (76) 100 3.6 10 14 (0.8) (34) (31) 53 0.3 24 38 (0.8) (73) (71) 89 1.1 19 31 (0.7) (64) (62) (62)	% Years meet or Exceed IRM Average % Reserve over IRM Generation Profit \$/kW-yr Scarcity Revenue \$/kW-yr E&AS Revenue \$/kW-yr 57 -0.1 47 43 10 57 -0.1 47 43 10 29 -0.1 28 42 10 (0.6) (78) (76) 10 10 100 3.6 10 14 10 (0.8) (34) (31) 10 53 0.3 24 38 10 (0.8) (73) (71) 10 10 89 1.1 19 31 10 (0.7) (64) (62) 10 10	% Years meet or Exceed IRM Average % Reserve over IRM Generation Profit \$/kW-yr Scarcity Revenue \$/kW-yr E&AS Revenue \$/kW-yr ICAP Payment \$/kW-yr 57 -0.1 47 43 10 66 (0.6) (94) (77) 10 48 (0.6) (94) (77) 43 10 48 (0.6) (94) (77) 10 48 (11) 100 3.6 10 14 10 58 (10) 100 3.6 10 14 10 58 (10) (11) 53 0.3 24 38 10 48 (8) 89 1.1 19 31 10 50 (9) 89 1.1 19 (62) 10 50 (9)

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ICAP Price with No Demand Curve













ICAP Price with IRM+1% Curve







Analysis of Capacity Cycle: W/N and Actual Peaks





Cycle: Low Profits in Early Years, High Profits Later



1 Cycle: Sustained Low Profits Mean Less Capacity Additions



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- Retirements (either fixed %/year, or profit-dependent)
- Backstop modeling.
- Modifying/fine tuning demand curve every X years.
- No increase in price for shortages (flat curve left of IRM)
- Changing bidding behaviors; strategic bidding to increase capacity price; irrational bidding.
- Smaller peaking units.
- Modeling changing natural gas prices.
- Simulation of constrained locations.

