



# **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



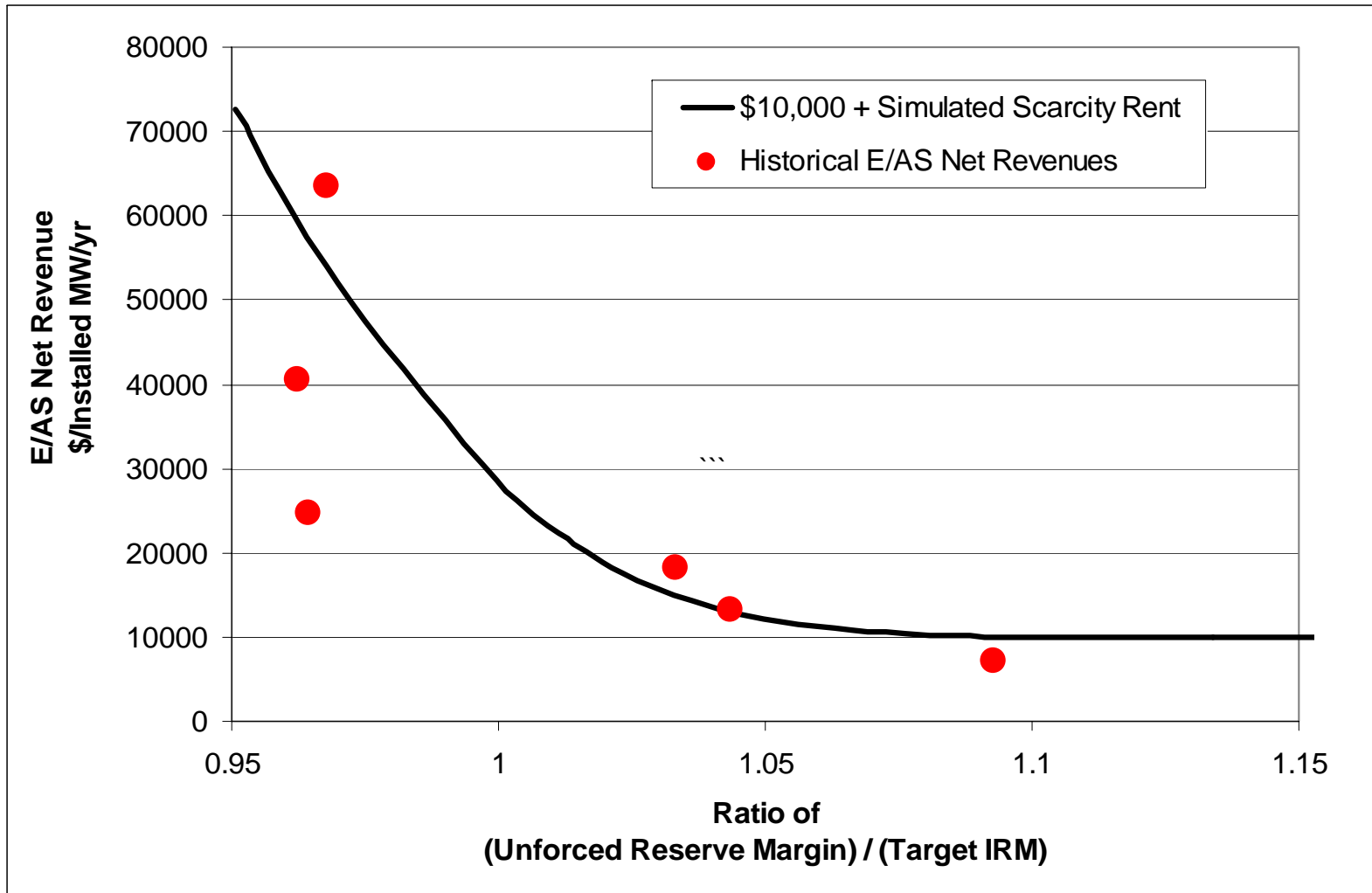
## Demand Curve Parameters/ Energy & Ancillary Services Revenue

### Demand Curve Parameters:

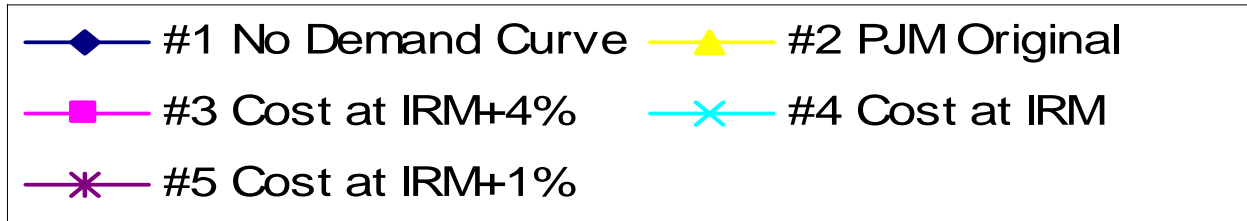
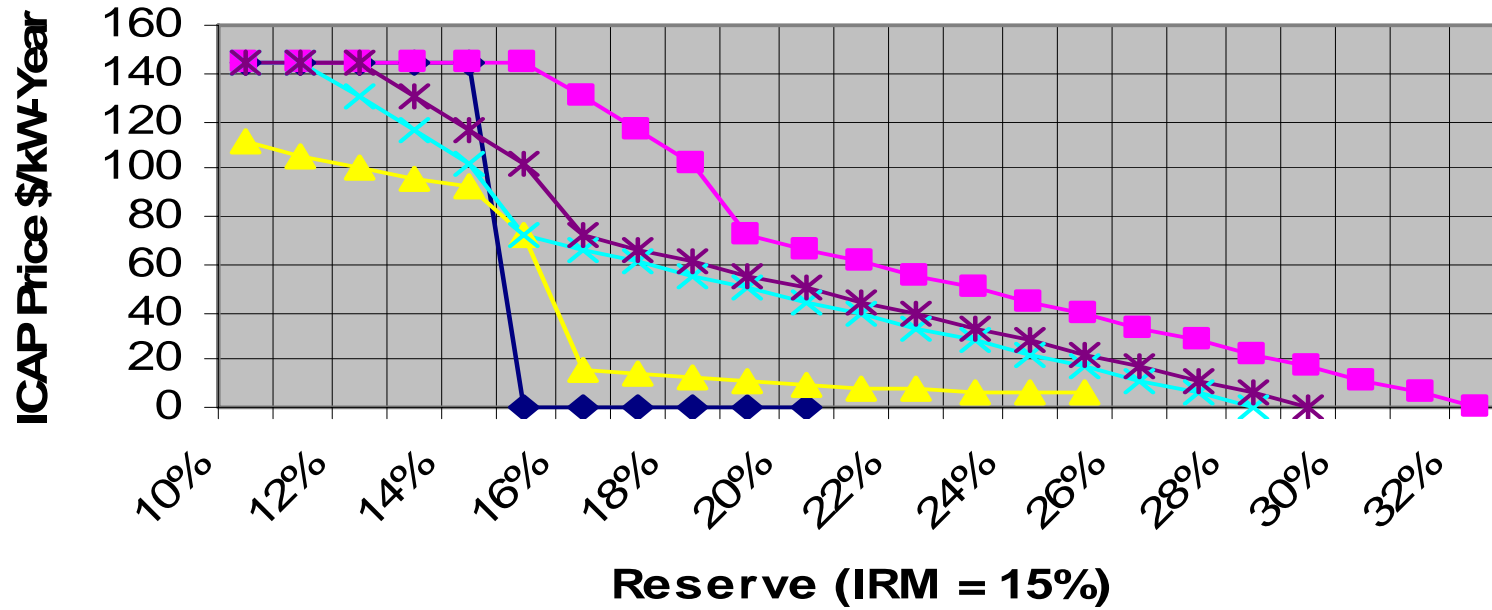
- Cost of New Entry = \$72/kW-yr.
- Net Energy & Ancillary Revenue Offset = \$28/kW-yr.

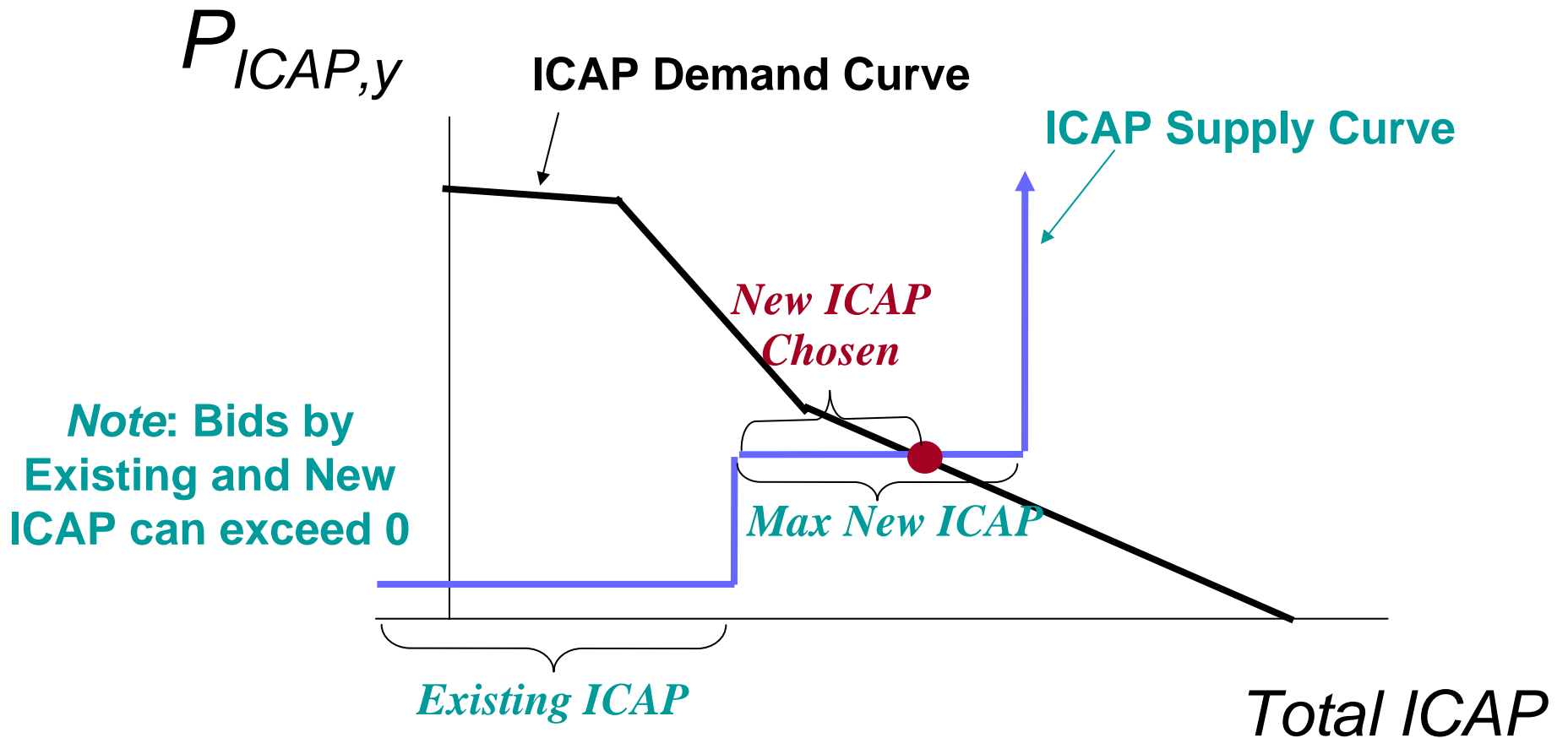
### Modeling Uncertainty in E&AS Revenue:

- 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.



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







## 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 Revenue \$/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)



## 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 Curve	56	-0.1 (0.7)	48 (96)	43 (79)	10	66 (46)	125 (105)
2. Original PJM Curve, Based on VOLL	29	-0.1 (0.6)	28 (78)	42 (76)	10	48 (11)	102 (85)
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)

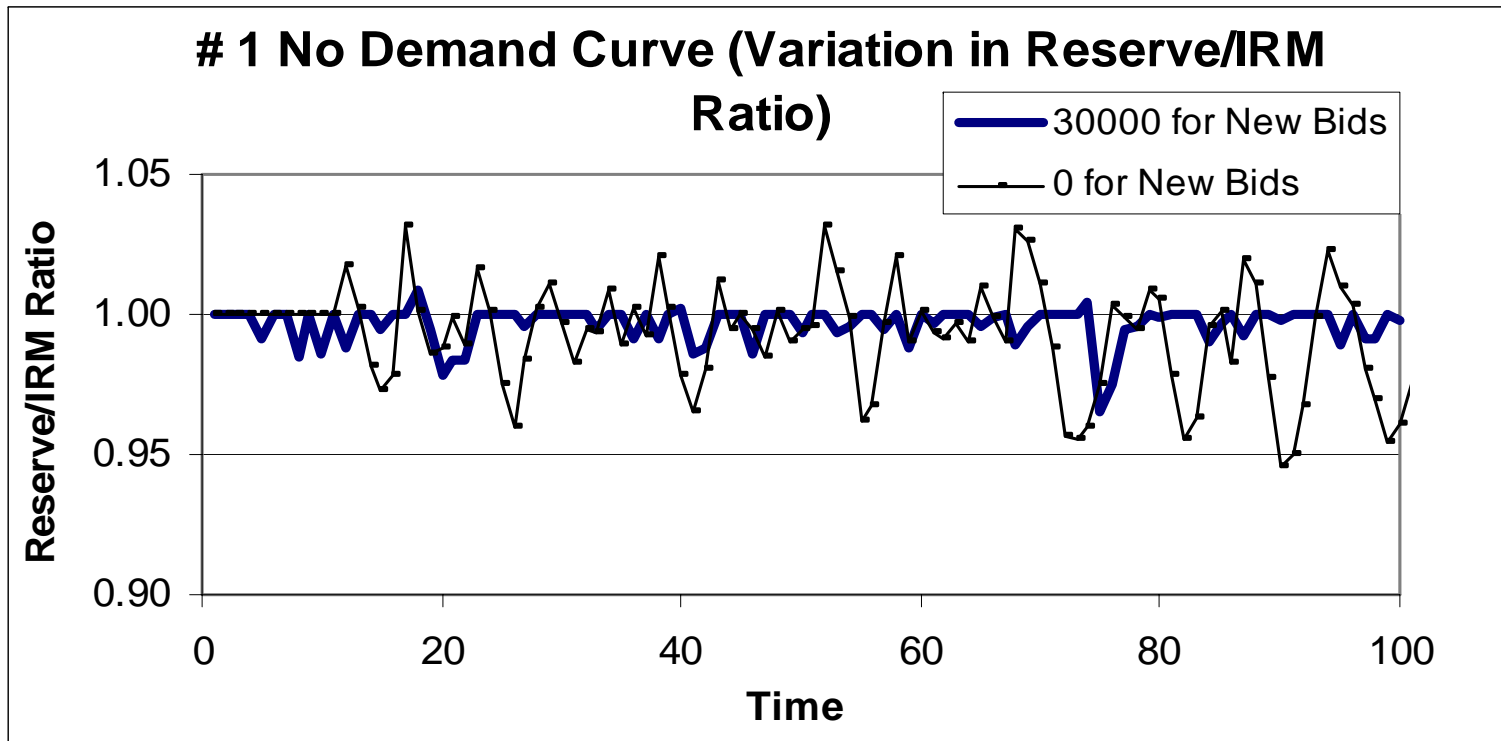


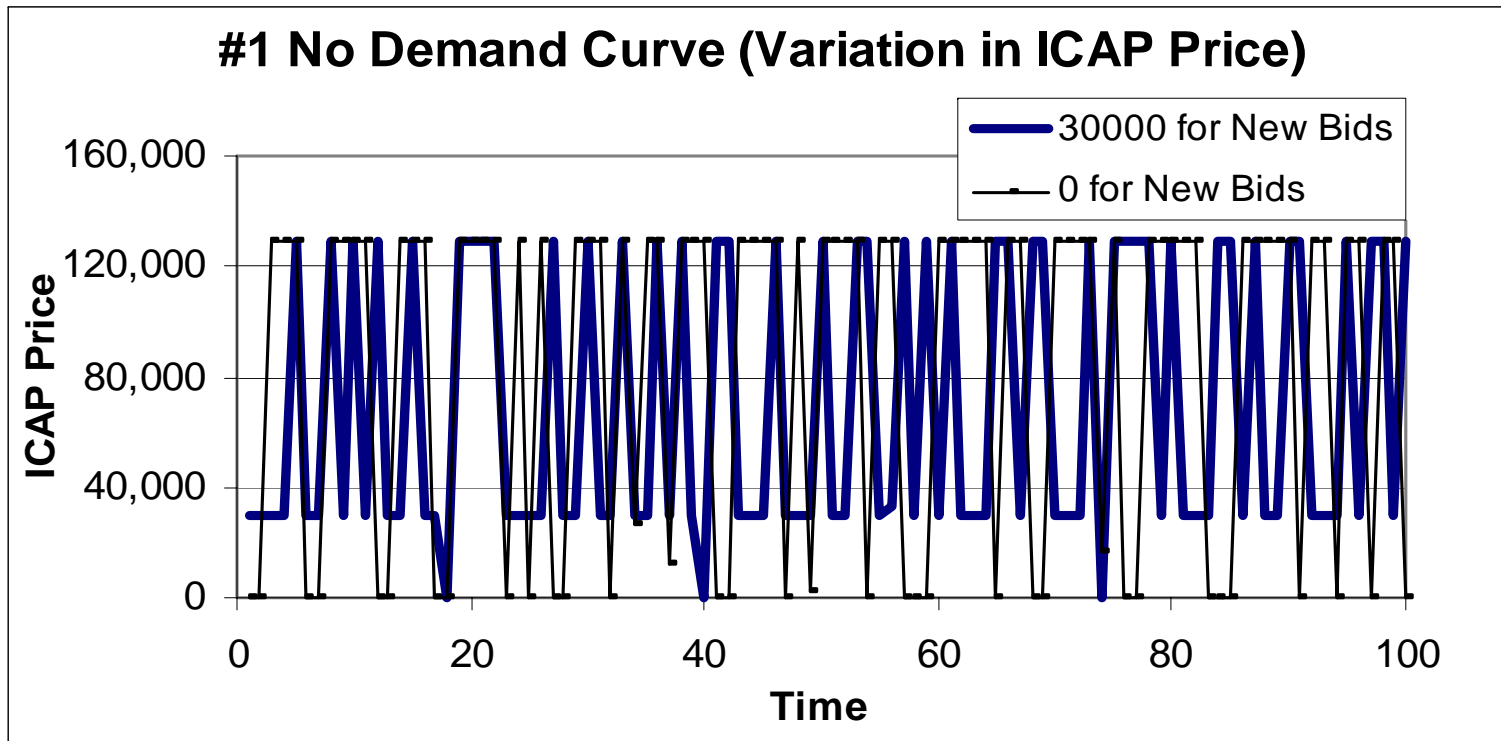


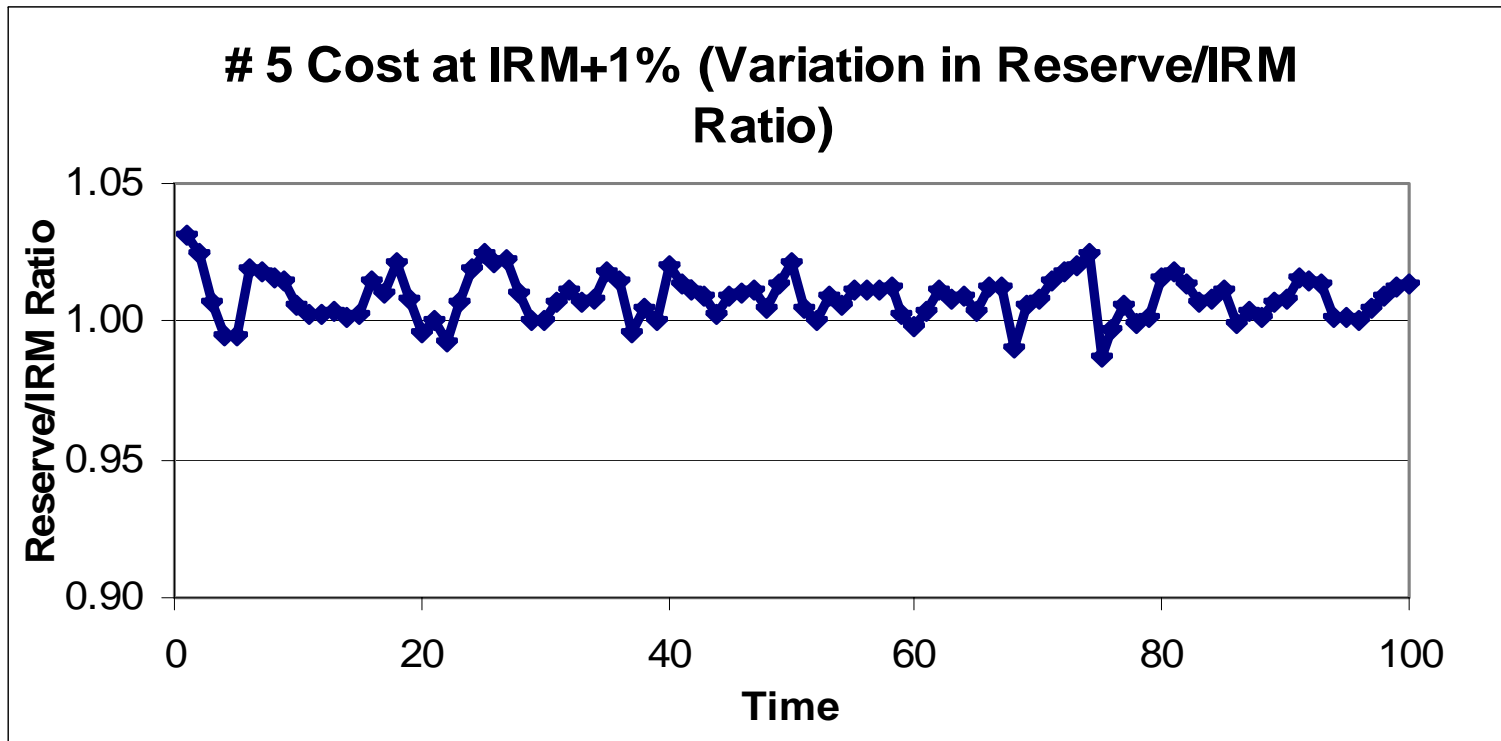
Average (std dev) – New Units Bid at \$30/kW-yr; Existing Bid at \$15/kW-yr

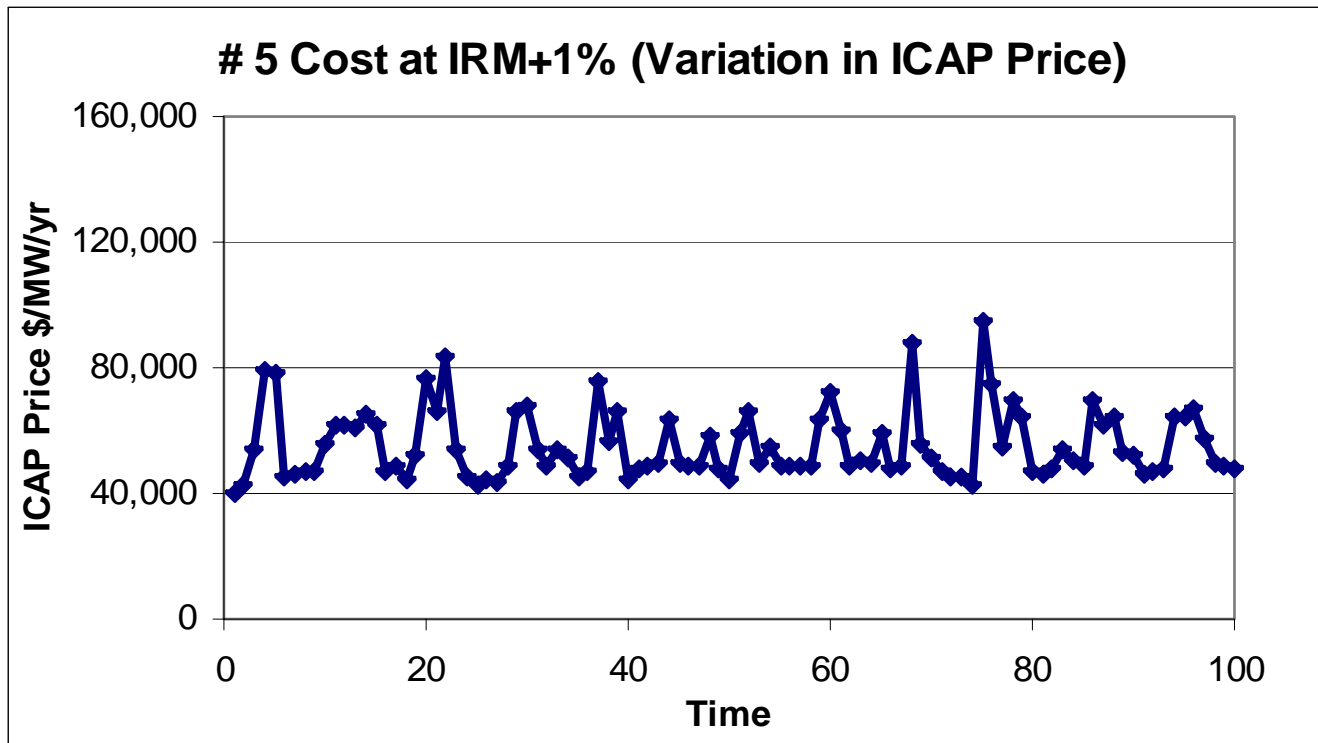
Case	% Years meet or Exceed IRM	Average % Reserve over IRM	Generation Profit \$/kW-yr	Scarcity Revenue \$/kW-yr	E&AS Revenue \$/kW-yr	ICAP Payment \$/kW-yr	Scarcity + ICAP Payment by Consumers (Peak Ld Basis)
1. No Demand Curve	57	-0.1 (0.6)	47 (94)	43 (77)	10	66 (45)	124 (103)
2. Original PJM Curve, Based on VOLL	29	-0.1 (0.6)	28 (78)	42 (76)	10	48 (11)	102 (85)
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)
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**(Non-zero bid reduces the variation)**

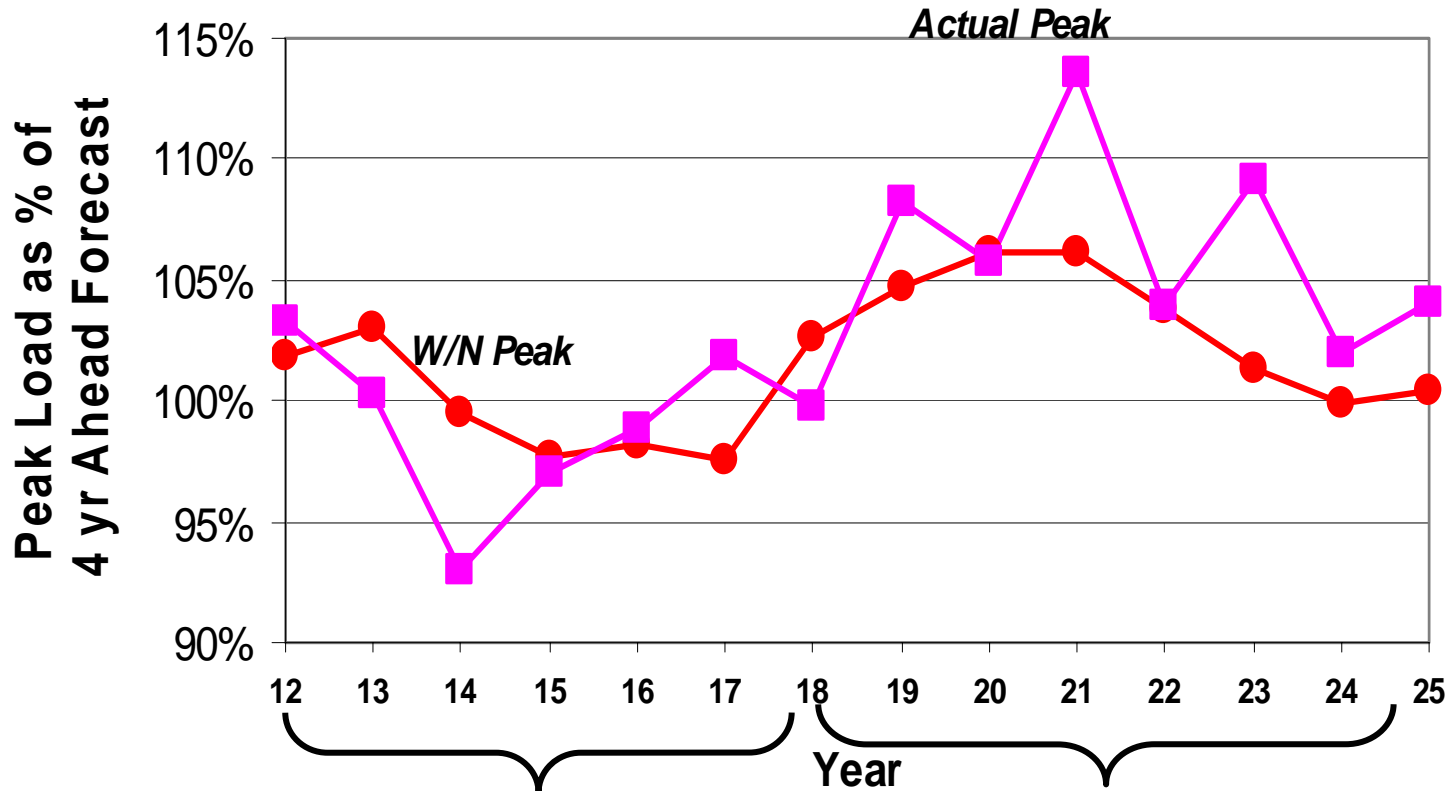








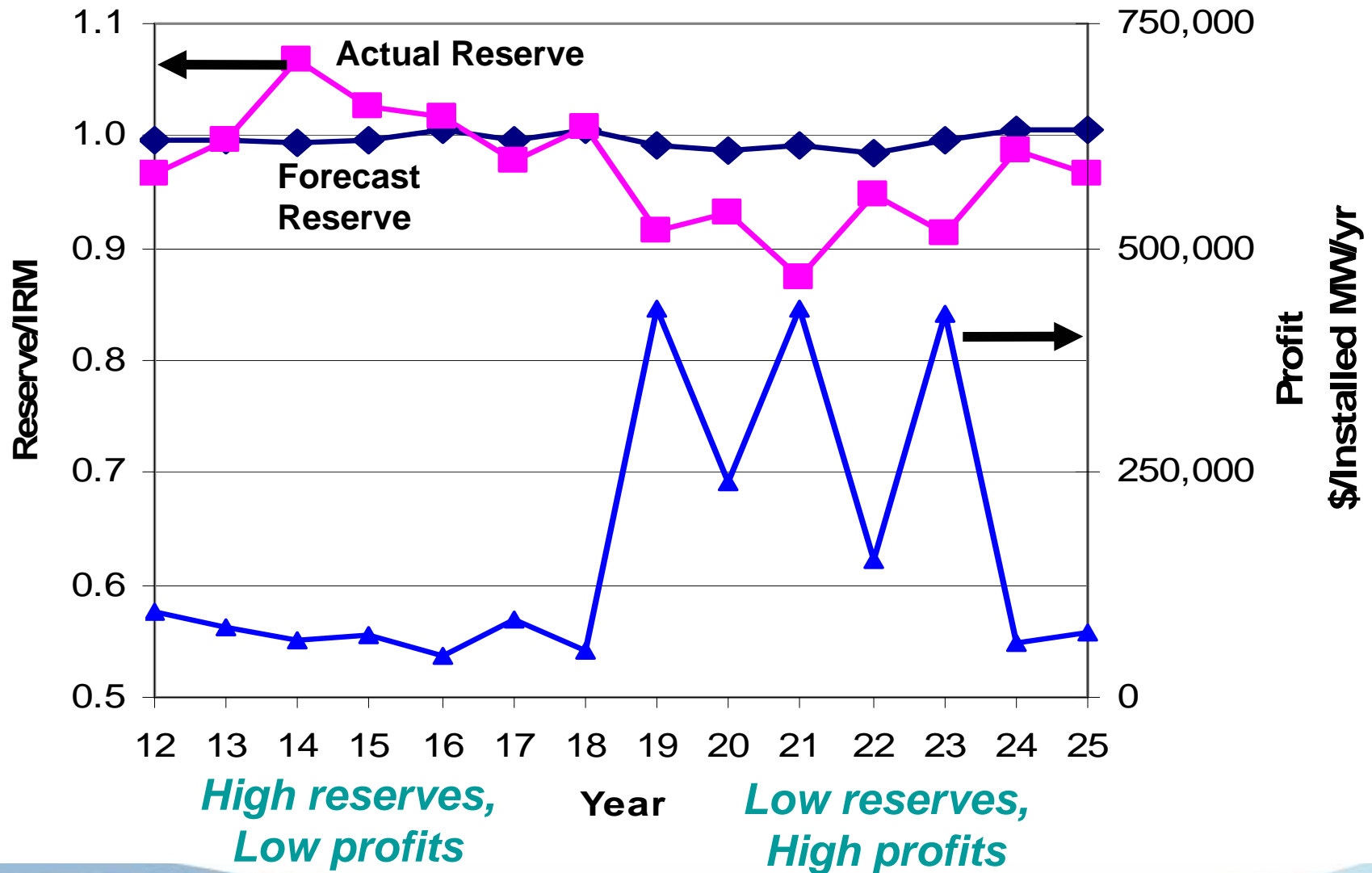
# Analysis of Capacity Cycle: W/N and Actual Peaks

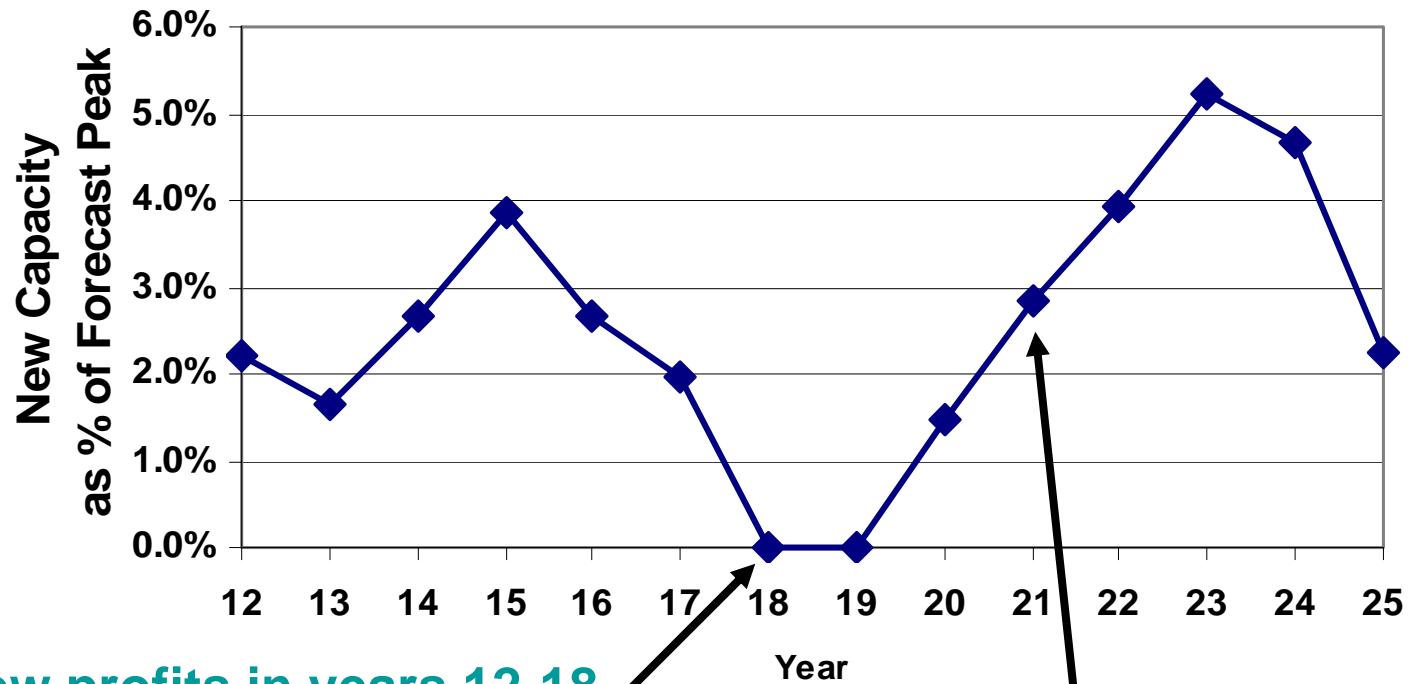


Low load growth (<1.7%)  
& cool weather  
(so overbuilt)

High load growth (>1.7%)  
& hot weather  
(so too little capacity)

# Cycle: Low Profits in Early Years, High Profits Later





Low profits in years 12-18 cause CT additions to crash. When demand surges in 19-21, capacity is inadequate

Only after several years of sustained high profits (19-21) does capacity growth resume (too late to avoid shortages in 19-23)



- 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.