Competitive Electricity Markets

Weening Markets from Rent-Seeking Subsidies and Capacity Markets

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26 October 2017

Nodal Trader Conference

New York, NY

FERC's Electricity Market Competition Agenda Big Picture – Bigly Success

- Markets operate efficiently with LMP and least-cost dispatch
- Reserve margins are high with significant excess capacity
  - PJM PY17-18: 20%
  - PJM PY20-21: 23%
- Competitive new entry with proper locational signals / ratepayers not on the hook

Megawatts of Unforced Capacity Procured by Type from the 2014/2015 BRA to the 2020/2021 BRA

Delivery Year	New Generation	Generation Uprates	Imports	Demand Response	Energy Efficiency
2020/2021	2,389.3	434.5	3,997.2	7,820.4	1,710.2
2019/2020	5,373.6	155.6	3,875.9	10,348.0	1,515.1
2018/2019	2,954.3	587.6	4,687.9	11,084.4	1,246.5
2017/2018	5,927.4	339.9	4,525.5	10,974.8	1,338.9
2016/2017	4,281.6	1,181.3	7,482.7	12,408.1	1,117.3
2015/2016	4,898.9	447.4	3,935.3	14,832.8	922.5
2014/2015	415.5	341.1	3,016.5	14,118.4	822.1

*All MW Values are in UCAP Terms

- Wholesale prices reflect marginal cost – which are low due to shale boom

PJM "Value Proposition"

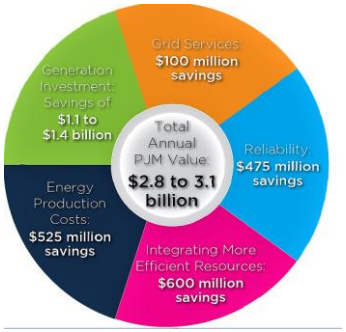


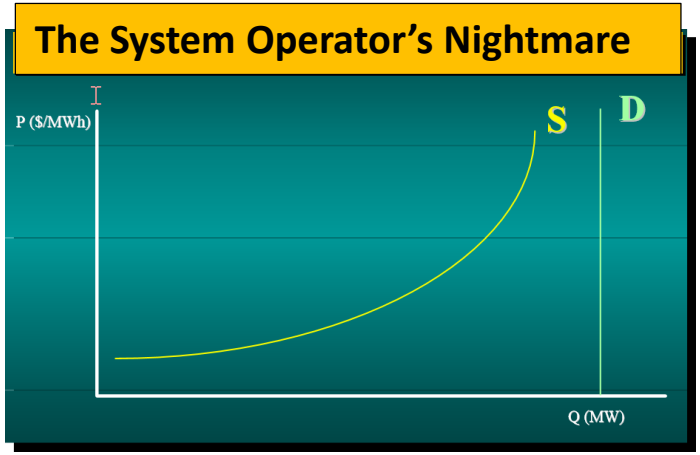
Figure 1: PJM CCGTs Currently Under Construction

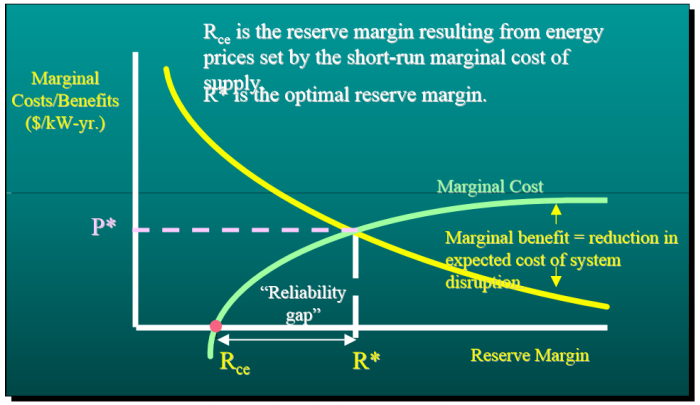
Constructor/Owner	Plant Name	Capacity (MW)	Prob. Of Bidding	State	Est. COD	PJM Q	Capacity Region	Notes
PJM CCGTs Under Construction (Excl. OH and PA)								
CPV	CPV St. Charles	725	100%	MD	Feb-17	n/a	PEPCO	Osaka Gas holds a 25%. Marubeni holds a 25%, CPV holds a 25%, and Toyota Tsusho holds a 20% equity stake; a $585 Mn debt package was led by GE, while a $45 Mn bridge loan was provided by Ares
Old Dominion Coop	Wildcat Point Generation Facility	1,000	100%	MD	Jun-17	Y3-102	DPL-S	
Panda	Stonewall	778	100%	VA	Jun-17	X4-039	RTO	Sale process for 100% ownership lead by Goldman Sachs was launched in Sep 2016
PSEG Fossil	Keys Energy Center	755	100%	MD	May-18	n/a	PEPCO	
AresEIF	St. Joseph	650	100%	IN	Jun-18	AB1-080	RTO	$477 Mn debt financing; sponsored by AresEIF (80%) and Toyota Tsusho (20%)
PSEG Power	Sewaren 7	540	100%	NJ	Jun-18	n/a	PS-N	Replacing older Sewaren 1-4 which will be deactivated
Dominion	Greensville	1,588	100%	VA	Dec-18	Z1-086	RTO	
Capacity Under Construction		**6,036**	**6,036**					
PJM CCGTs Under Construction (OH and PA)								
Clean Energy Future	Oregon Energy Center	960	100%	OH	Jun-17	AA1-056	ATSI	Sponsored by AresEIF
Calpine	York 2	874	100%	PA	Jun-17	AA1-034	EMAAC	
Advanced Power	Carroll County	700	100%	OH	Oct-17	Y2-050	RTO	Prudential, TIAA-CREF, Chubu and Ullico invested $411 Mn in equity commitments; $488 Mn in debt financing closed in Apr 2015, led by BNP Paribas and Credit Agricole
Panda	Hummel	1,000	100%	PA	Dec-17	AA2-171	PPL	Existing financing includes $250 Mn TLA, $460 Mn TLB, and $125 Mn preferred equity; Panda is also looking to refi a bridge loan provided by Ares
First Reserve	Caithness Moxie	1,050	100%	PA	May-18	AA1-066	PPL	$600 Mn financing closed in Nov 2015; $300 Mn in preferred equity
First Reserve, Invenergy	Lackawanna Energy Center	1,480	100%	PA	Jun-18	AA1-077	PPL	Invenergy and First Reserve recently closed on project-level debt financing and agreed to invest $509 Mn of equity; First Reserve is looking to sell down its equity position Lackawanna cleared the 2018/19 PJM auction at $164.77/MW-month
Clean Energy Future	Lordstown	940	100%	OH	Jun-18	Z2-028	ATSI	Closed $519 Mn debt financing in Apr 2016 for 50/50 debt/equity; CFE, Macquarie and Siemens hold the equity interests
NTE Energy	Middletown	525	100%	OH	Jun-18	Z1-079	RTO	$402 Mn debt financing closed in Oct 2015
Tenaska	Westmoreland	925	100%	PA	Dec-18	T174	RTO	$780 Mn debt package closed; Tenask, J-Power and Diamond Generating hold the equity
CPV	CPV Fairview Energy Center	1,040	99%	PA	Mar-21	AA1-076	MAAC	A group of lenders including Credit Agricole and BNP Paribas will be leading financing (close targeted 1Q17); CPV owns a 70% interest in the project, with GE owning the rest. CPV and GE are currently exploring the sale of to 50% interest
Capacity Under Construction		**9,494**	**9,484**					
Total PJM CCGTs UC (MW)		**15,530**	**15,520**					

Source: SNL Financial, Spark Spread, Power Finance and Risk

Is "Missing Money" a Market Failure?

- Competitive markets at a cross-roads
- Widely accepted that capacity markets needed to assure adequate reserves
- Who believes?
  - Missing money is a market failure
  - Capacity is a "positive externality" – i.e. energy prices alone do not internalize the social benefit of capacity in terms of its contribution to reliability, and would yield sub-optimal reserves

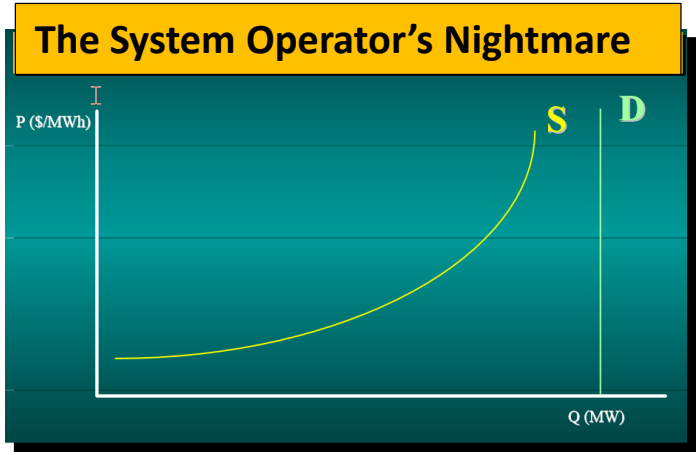


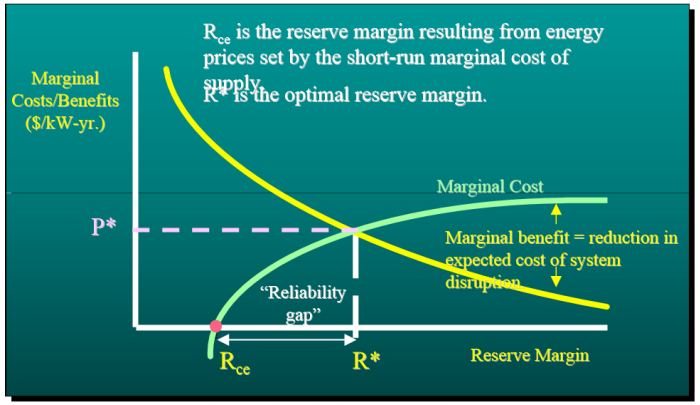


Source: Jaffe and Felder, *The Electricity Journal*, Dec. 1996.

Is "Missing Money" a Market Failure? …but the capacity market never seems to "work"

- Over $10B transfer from consumers to Gencos to solve "missing money"
- Yet capacity market structure is perpetually in disrepair
  - Locational Capacity (FERC ER05-1410)
  - MOPR (for state intervention to suppress prices) (FERC ER11-2875)
  - "Capacity performance" (so units that don't operate in shortage don't get paid for reliability they did not contribute to)
  - External capacity "pseudo ties" (FERC ER17-1138)
  - MOPR for ZECs? (FERC AD17-11)
  - Fuel diversity / "attributes"
  - Grid resiliency / baseload capacity (DOE NOPR)





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Is "Missing Money" a Market Failure? Rent-seeking and ROI on political activity

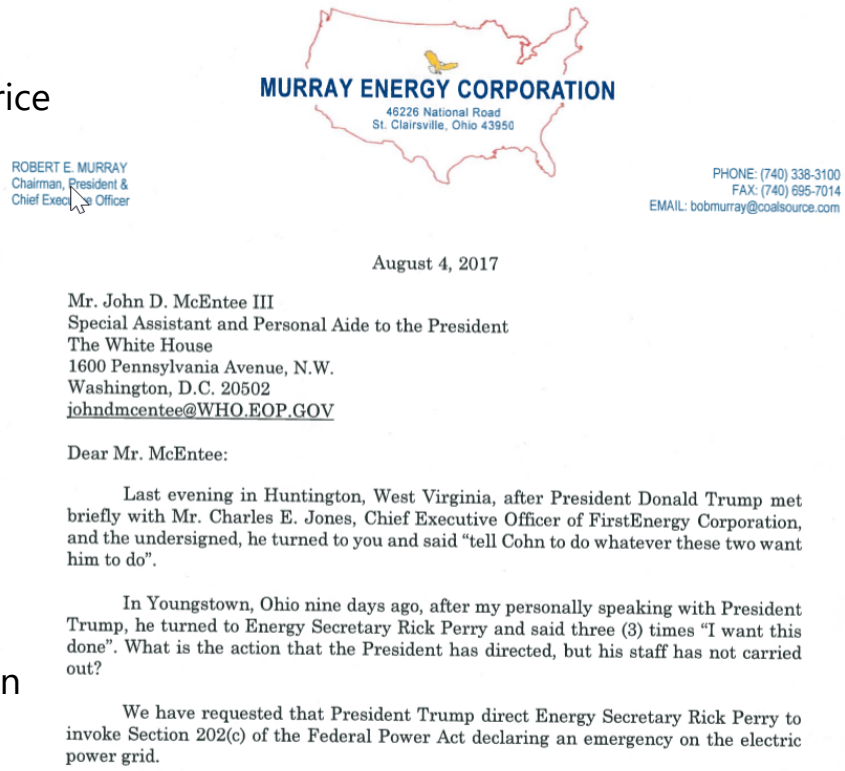
- With competition, uneconomic assets should retire, but ratepayers are being asked to bailout uneconomic assets

- Illinois: Exelon nuclear assets
  - Effectively economic withholding to drive up price
  - Added benefit of getting paid anyway

- Ohio: coal and nuclear plants

- New York: Exelon upstate nuclear plants

- DOE NOPR for "Grid Resiliency"
  - We are Overinvested in generation/transmission
  - Underinvested in distribution networks



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August 4, 2017

Mr. John D. McEntee III
Special Assistant and Personal Aide to the President
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20502
johndmcentee@WHO.EOP.GOV

Dear Mr. McEntee:

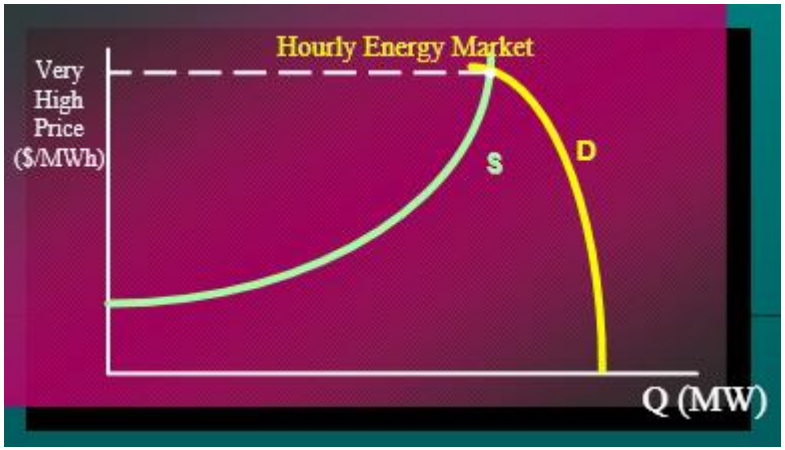
Last evening in Huntington, West Virginia, after President Donald Trump met briefly with Mr. Charles E. Jones, Chief Executive Officer of FirstEnergy Corporation, and the undersigned, he turned to you and said "tell Cohn to do whatever these two want him to do".

In Youngstown, Ohio nine days ago, after my personally speaking with President Trump, he turned to Energy Secretary Rick Perry and said three (3) times "I want this done". What is the action that the President has directed, but his staff has not carried out?

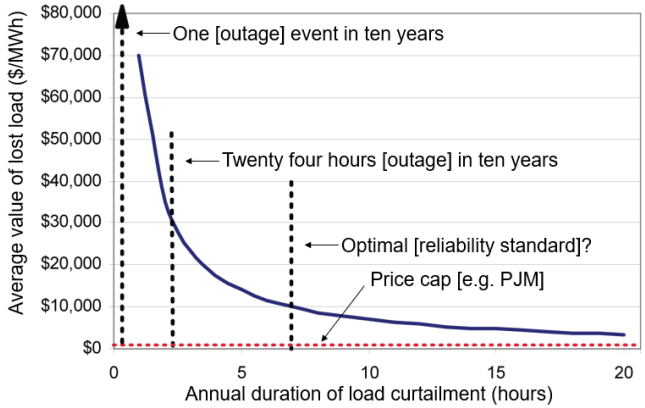
We have requested that President Trump direct Energy Secretary Rick Perry to invoke Section 202(c) of the Federal Power Act declaring an emergency on the electric power grid.

"Missing Money" is NOT a Market Failure Energy-only markets: Dynamic Growth of DR a benefits of Competition

- Reliability is not an externality: a relic of planning model where demand is inelastic
- Energy market will always clear if prices are allowed to rise – consumers will voluntarily curtail rather than pay exorbitant energy prices
- Market incentives determine installed capacity and reserve margins
- The "true" market failure:
  - Get the energy prices right! (improper energy market pricing, especially scarcity (but also uplift))
  - Inadequate demand response (this is changing)
  - Inadequate real-time metering and ability to segregate circuits and curtail less essential loads
- We can transition away from capacity markets – this should be the priority for federal policy



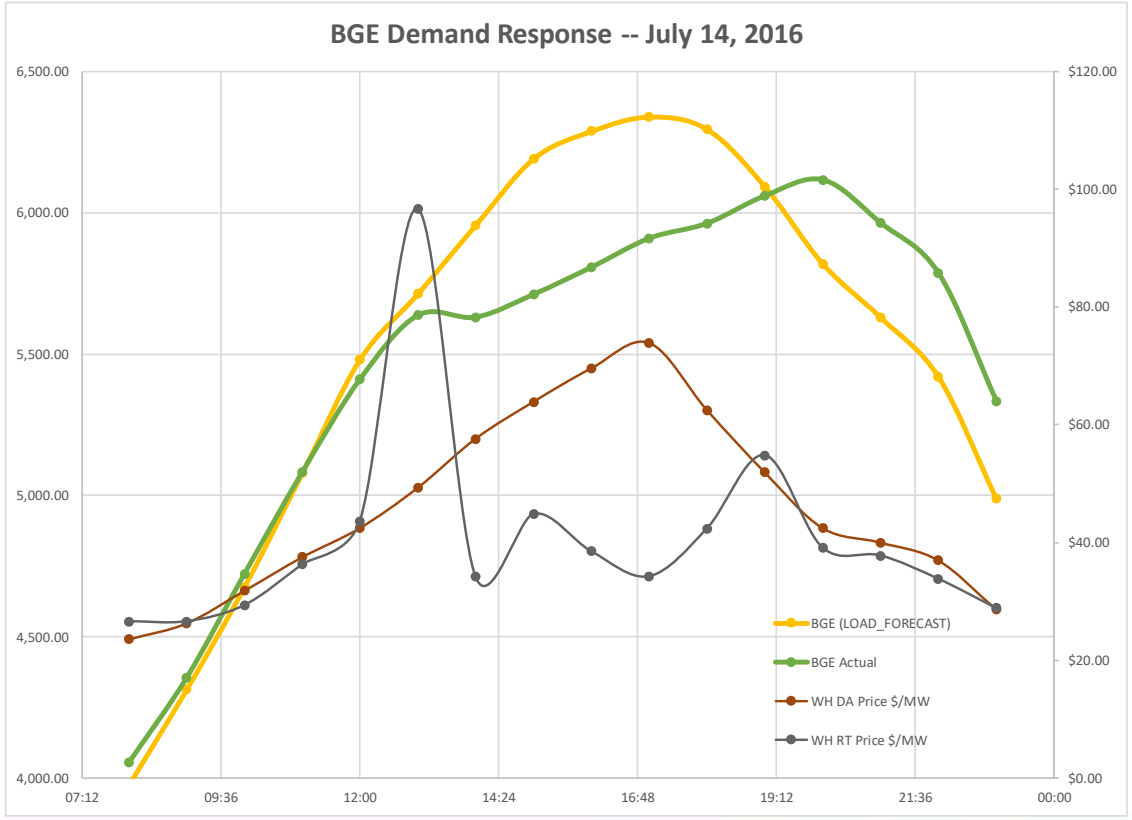
Implied value of lost load for different reliability standards



Source: W. Hogan, EIA, "Market models for coordination and pricing" (2008), https://www.eia.gov/conference/2008/conf_pdfs/Tuesday/Hogan.pdf

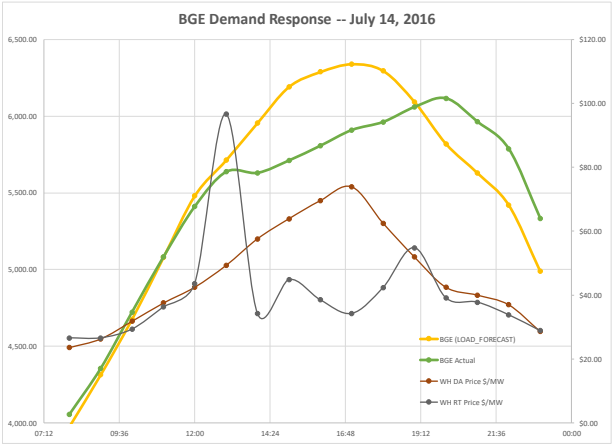
FERC Price Formation and Scarcity Pricing Impact of State / LDC-Level Demand Response

- Scarcity pricing suppressed by DR that occurs outside the ISO-scarcity pricing mechanisms: this is the biggest barrier to proper scarcity pricing



FERC Price Formation and Scarcity Pricing Impact of State / LDC-Level Demand Response

- ISOs have revised tariffs and price-setting mechanisms to allow scarcity pricing when ISO-visible DR programs kick in (a FERC priority)
- But much of the DR is not visible to the ISOs
  - Example: BGE behavioral program pays $1,250/MWh for demand response (see example)
  - Example: PA state program spends ~$90 MM/yr on DR programs
  - These DR programs are happening everywhere
- We need a concerted effort to integrate LDC and retail DR into the ISO price-setting mechanisms
- The future: Electric vehicles, distribution networks & addressing climate challenge / carbon



Policy Recommendations

- If "resiliency" is the problem (it's not!), focus on distribution investments
- Transition from capacity markets over multi-year period to energy-only markets once DR and metering technical issues are solved
- Recover capacity revenue requirement during transition through hourly energy price adder – to incentivize DR and ensure that the transition can be successful (i.e. mirroring high energy prices)
  - Incentive for demand response
  - Incentives for generator availability (pure capacity performance)

$$\text{Hourly Reliability Charge for LSE}_A = \frac{\text{LOLP}_h}{\sum_{N=1}^{876} \text{LOLP}_N} * \frac{\text{Load}_{\text{LSE}_A h}}{\text{Load}_{\text{Pool h}}} * \text{Annual Capacity Payments to Generators}$$

- Revisit Order 745 – DR on the Demand side, not the supply side. Have ISO's set criteria for DR to set price and ensure market clearance when market is tight