MA Scarcity Pricing Proposal: Price Targets and Related Issues

SPWG

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Proposed Scarcity Pricing Approach

- Concept: Add reserve constraints to the optimization model
- LMP is the incremental cost to serve incremental load at a location while controlling for *all* related constraints
- Reserves are additional constraints to the optimization
- LMP = Energy + Marginal Losses + Congestion + "Scarcity Adder"
- "Scarcity Adder" is an administrative contribution to marginal bus LMP(s) when short reserves



Defining the Reserve Requirement "LMP Target"

- Purpose is to signal scarcity and attract resources
- Purpose is to attract resources not committed via the capacity market
- Setting the resulting energy price too high will result in a wealth transfer, rather than meaningful increase in resources availability
- Determines the opportunity cost for reserves during scarcity



Synchronized Reserve Target

- Synchronized Reserve Target
- If system runs short of reserves:
 - LMP at the marginal unit buses set equal to \$1,000.
 - Resulting opportunity costs determined relative to LMP
 - Max opportunity cost for reserves = \$1,000
 - Hour ahead market for reserves incorporates opportunity cost in clearing price



Two approaches, same concept

- Use of Operating Reserve Penalty Factor Curve to drive within hour dispatch and optimization
 - PJM
 - Cumulative fixed \$850 penalty factors that drive dispatch
 - Penalty factor(s) applied to marginal bus LMP (max price \$2,700) during reserve scarcity
 - MA
 - \$1,000 penalty factor(s) that drive dispatch
 - Defined LMP targets (max price \$1,000) on marginal buses during reserve scarcity
 - · Adder to marginal bus endogenously determined
 - Maintains indifference between LMP and opportunity cost for reserves



Issues for discussion

- Operating Reserve Penalty Factor Curves
 - 10 minutes reserve target(s)—Synchronized Reserve (S.R.) vs. Primary and S.R.
 - Scarcity price targets (\$1,000 vs. \$2,700)
 - False Positive
 - Morning pickup/min gen events
 - Structure of Tier 2 market
 - Hour ahead structure vs. 5 minute optimization



"MA Approach" vs. "PJM Approach"

Gen	MC	Max Gen	Max Reserves
А	\$20	400	50
В	\$60	400	50
С	Q+\$100	400	50

Reserve Requirement = 100 MW

MA: LMP goes to \$1000 when scarce, Max Price for Reserves = \$1000 PJM: Penalty Factor = \$850

MA Approach

	"Market Pr	ice	s" (N	on RP	'M resour	rces price		Dispatch									
		Er	nergy														
Total	System		Price	Орр	ortunity	"Scarcity		"Scarcity		Energy	Reserves	Energy	Reserves	Energy	Reserves		
Load/Energy	Reserve	(LMP)		Cost	Adder"	MU	Adder"	MU	А	Α	В	В	C	C		
400	100	\$	20	\$	-		Α		Α	400	0	0	50	0	50		
500	100	\$	60	\$	-		В		В	400	0	100	50	0	50		
700	100	\$	60	\$	-		В		В	400	0	300	50	0	50		
750	100	\$	60	\$	-		В		В	400	0	350	50	0	50		
800	100	\$	150	\$	90		С		С	400	0	350	50	50	50		
850	100	\$	200	\$	140		С		С	400	0	350	50	100	50		
900	100	\$	250	\$	190		С		С	400	0	350	50	150	50		
950	100	\$	300	\$	240		С		С	400	0	350	50	200	50		
1000	100	\$	350	\$	290		С		C	400	0	350	50	250	50		
1050	100	\$	400	\$	340		С		C	400	0	350	50	300	50		
1100	100	\$	450	\$	390		С		C	400	0	350	50	350	50		
1110	90	\$1	,000	\$	940	\$ 940	В	\$ 550	С	400	0	360	40	350	50		
1140	60	\$1	,000	\$	940	\$ 940	В	\$ 550	С	400	0	390	10	350	50		
1170	30	\$1	,000	\$	530	\$ 530	С	\$ 530	С	400	0	400	0	370	30		



PJM Approach

	"Market Pr	rice	s" (Non	RPM	resource	es pri	ce)	Dispatch									
Total			Energy														
Load/	System		Price	Орр	ortunity	"Sca	arcity		"Scar	city		Energy	Reserves	Energy	Reserves	Energy	Reserves
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900	100	\$	250	\$	190			С			С	400	0	350	50	150	50
950	100	\$	300	\$	240			С			С	400	0	350	50	200	50
1000	100	\$	350	\$	290			С			C	400	0	350	50	250	50
1050	100	\$	400	\$	340			С			С	400	0	350	50	300	50
1100	100	\$	450	\$	390			С			С	400	0	350	50	350	50
1110	90	\$	1,000	\$	850	\$	850	В	\$ 4	160	C	400	0	360	40	350	50
1140	60	\$	1,000	\$	850	\$	850	В	\$ 4	160	С	400	0	390	10	350	50
1170	30	\$	1,000	\$	850	\$	850	С	\$8	350	C	400	0	400	0	370	30



LMP Target vs. Penalty Factor Additions to LMP

- Using the same reserve targets, the unit specific operational dispatch signals are identical
 - Using different targets will cause different potential outcomes
- Both mechanisms would move PJM from manual within hour dispatch for reserves to automated within dispatch for reserves
- Both represent a change from current operations
- Both would result in a change in what is considered to be "optimal" dispatch



Pricing Under Scarcity: \$2,700 vs. \$1,000

- No evidence that the scarcity signal in the energy market need exceed \$1,000 in order to maintain reliability
- Resources have responded below \$1,000 in the past
- Last and "only" scarcity event reached \$1,000 due to administrative process, not by the value of the most expensive *marginal* resource



Pricing Under Scarcity: \$2,700 vs. \$1,000

- Capping the market price at \$1,000
 - Makes it possible to arbitrage between DA and RT
 - Not possible to arbitrage between DA and RT at \$2,700.
 - Allows participants to better manage risks in DA market
 - Missed load prediction
 - Tripped unit

Pricing Under Scarcity: \$2,700 vs. \$1,000

- Capping the market price at \$1,000
 - Would set LMP consistently with current resource offer caps
 - Would ensure full resource stack is dispatched



Issues for discussion

- Structure of the Tier 2 Market: Hour ahead scheduling vs. "full 5 minute optimization"
 - Cycling of unit assignments
 - Location specific opportunity costs
 - Participation of DR
 - Effects on generation participation and incentives



Concerns with PJM's Approach

- System control issues with PJM's proposal
 - PJM proposes to largely eliminate hour ahead scheduling of Tier 2 Synchronized Reserve (S.R.)
 - PJM proposal, as presented, will reduce reserves and sources of reserves
 - Cycling within hour assignments
 - Participation of DR eliminated or reduced
 - May affect frequency of events
 - Affects on generation participation and incentives



Synchronized Reserve Optimization: MA concerns with PJM proposal

- Concerns with elimination of hour ahead tier 2 market):
 - Fewer reserves could be made available if hour ahead scheduling is lost:
 - **DR may need hour ahead notification to participate**
 - Significant source of Tier 2 S.R. under current structure
 - Generation may have less reserves available on "5 minute" basis
 - 10 minute ramp vs. 5 minute assignment
 - May have more available from predetermined set points (from hour ahead assignment)
 - Incentives under hourly integrated prices
 - Questionable transparency improvement with hourly integrated prices

Cycling within hour assignments

Area /	A Generatio	on	
Gen	MC	Max Gen: Re	serves
В	\$60	850	50
С	Q + \$100	400	50
Area l	B Generatio	on	
Gen	MC	Max Gen: Re	serves
D	\$600	100	50

Reserve Requirement = 100 MW



Cycling within hour assignment

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Cycling within hour assignment

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 | B Energy | B Reserves | MC |
 | "Local" Opportunity Cost | C Energy | C Reserves

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 | | "Local" Opportunity Cost | Area B LMP | D Energy | D Reserves | MC | "Local" Opportunity Cost
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MA S.R. Proposal: Enhance Current Market Structure

- MA proposes that PJM keep hour ahead Tier 2 Sync Market, market definitions and associated assignments
 - Tier 2 S.R. hour ahead assignments should be based on expectations of next hour system conditions and prices
 - Hour ahead Tier 2 S.R. assignments should continue to be taken as a "given" going into within hour optimization
 - As today, within hour adjustments (additions) to Tier 2 S.R. made in real time
 - Enhance within hour adjustments (additions) via use of reserves modeled as a constraint



MA Synchronized Reserve Proposal: Advantages

- Consistent with current market structures
 - "Known" methodology and still improves within hour dispatch
 - Better at dealing with resource limitations that may otherwise limit reserve availability
 - More consistent with reserve requirements (90 minutes to rebuild)
- Will avoid issues of 5 minute "cycling"
 - Should provide for and encourage availability of more reserve resources
 - Allows continued participation by less flexible units
 - Allows continued participation by DR
 - May allow a means to properly recognize scarcity and avoid false positives (morning ramp Monitoring Analytics

Frequency Issue: Morning Pickup and Scarcity

- There needs to be a way for the mechanism(s) to differentiate between the morning pickup situation and a scarcity event.
 - Supply stack is not "exhausted"
- Objective should be to develop a tool that internalizes the decision making process used by operations
- Morning pick up is normal. Not an emergency event.
- Repeated morning pick "emergencies" would indicate faulty mechanism and/or scheduling problem



Morning Pickup and Scarcity

- Mechanism needs to differentiate between a reserve draw down when it is not an issue and when it is an issue
- Operations knows that generation is on the way
 - Experience and DA schedules
 - Not an emergency
- Should look at ways to incorporate DA scheduling information to differentiate scarcity from non scarcity events
 - Look ahead capability (hour ahead mechanism, etc)

