Regulation Market Proposal

RMDSTF

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IMM

Monitoring Analytics

Regulation Signal/Products

- **One signal, filtered inverse of ACE.**
  - **Resource agnostic signal aligned with system needs.**
  - **Allows a simpler implementation for dispatch to operate and track.**
  - **Eliminates RegA/RegD settlement interactions that cause issues with prices, incentives and market signals.**

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Regulation Signal/Products

- **Retain bidirectional regulation market, with one clearing price.**
  - **Simple roll out, simple clearing.**
  - **Reduced cost for PJM to implement relative to reg up/reg down.**
  - **No complications associated with complex offers (reg up/reg down/reg both), iterative clearing**
  - **Allows batteries to maintain charge through reg set points**
  - **PJM has not presented a case where complex offers (up/down/both) can be cleared or what the resulting prices/regulation assignments would look like relative to bidirectional market.**
  - **PJM has stated it needs more time to sort out details of reg up/reg down markets.**

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Regulation Signal/Products

- **Bidirectional market removes risk of internally inconsistent results between clearing and pricing in separate reg up/reg down markets**
  - **Inconsistencies between ASO LOC and within hour LOC can change optimal clearing for reg up/reg down/reg both.**
- **Reg up/Reg down will require buying more MW and/or paying twice as much for the same MW of regulation**
  - **PJM examples assume double regulation ramp rates when providing one direction regulation (regulation up or regulation down).**
    - No basis for this assumption.
  - **Correcting that assumption increase prices.**
  - **Clearing bidirectional market as separate reg up/reg down causes prices/costs to potentially double relative to bidirectional market.**

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Bidirectional

Load	500		Reg needed up and down		25 MW

Reg requirement 25 MW (up and/or down)									Biddirectional					
	MC	Eco Min	Reg MW offer bidirectional	Reg offer down	Reg Offer up	Eco Max	Reg Assign		Projected output	Projected LMP	Desired Output	Projected LOC $/MW	Projected Reg Price	Reg Cost
Unit 1	$5.00	10	10	10	10	200	5		195	0	200	10		$50.00
Unit 2	$10.00	10	10	10	10	200	10		190	0	200	5		$100.00
Unit 3	$15.00	10	10	10	10	200	10		115	15	115	0		$100.00
Unit 4	$20.00	10	10	10	10	200	0		0	0	0	0		$0.00
Unit 5	$25.00	10	10	10	10	200	0		0	0	0	0		$0.00
						1000	25		500	15	515	10	10	$ 250.00

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Reg Up/Reg Down

Load	500		Reg needed up and down			25 MW		

	MC	Eco Min	Reg MW offer bidirectional	Reg offer down	Reg Offer up	Eco Max	Reg Down	Reg Up	Reg Total
Unit 1	$5.00	10	10	10	10	200	10		
Unit 2	$10.00	10	10	10	10	200	10		
Unit 3	$15.00	10	10	10	10	200	5	10	
Unit 4	$20.00	10	10	10	10	200	0	10	
Unit 5	$25.00	10	10	10	10	200	0	5	
						1000	25	25	50

Reg Down Cost		Reg Up Cost
$ 375.00		$ 375.00

Projected output	Projected LMP	Desired Output	Reg Down Price		Reg Up Price		
			Projected LOC $/MW	Projected Reg Price	Projected LOC	Projected Reg Price	Payments
200	0	200	$ -		$ -		$150.00
190	0	200	$ 15.00		$ 15.00		$150.00
90	0	200	$ 10.00		$ 10.00		$225.00
10	0	200	$ 5.00		$ 5.00		$150.00
10	25	10	$ -		$ -		$75.00
500	25		$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 750.00

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Reg Up/Reg Down: Clear Bidirectional MW

Load	500	Reg needed up and down							
	MC	Reg MW offer bidirectional	Reg offer down	Reg Offer up	Eco Max	Reg Down	Reg Up	Reg Total	
Unit 1	$5.00	10	20	10	10	200	5	5	
Unit 2	$10.00	10	20	10	10	200	10	10	
Unit 3	$15.00	10	20	10	10	200	10	10	
Unit 4	$20.00	10	20	10	10	200	0	0	
Unit 5	$25.00	10	20	10	10	200	0	0	
					25	25	50		

Reg needed up and down: 25 MW

Reg Down Cost		Reg Up Cost
$ 250.00		$ 250.00

			Reg Down Price		Reg Up Price		
Projected output	Projected LMP	Desired Output	Projected LOC $/MW	Projected Reg Price	Projected LOC	Projected Reg Price	Payments
195	0	200	$10.00		$10.00		$100.00
190	0	200	$5.00		$5.00		$200.00
115	15	115	$0.00		$0.00		$200.00
0	0	0	$0.00		$0.00		
0	0	0	$0.00		$0.00		
500	15		$10.00	$10.00	$10.00	$ 10.00	$ 500.00

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Regulation Requirement

- **Requirement (total regulation) based on expected system conditions**
  - **Defined, verifiable, systematic and algorithmic calculation of requirement**
  - **Transparent rules and definitions**
  - **Requirements based on seasonal and hourly moving average of historic ACE and CPS data.**

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LOC

- **LOC based on dispatched energy offer.**

- **LOC based on unit specific hourly differences between regulation set point and desired/achievable MW, calculated every five minutes.**

- **Physical ramp limited MW within the hour.**

- **Eliminate pay as bid end of hour uplift by including full LOC in price within hour.**

- **Shoulder ramp period reduced to 10 minutes from 15.**

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Offer Structure

- **Performance and Capability (Status Quo)**

- **Remove VOM VOM from regulation offer**

- **Eliminate $12 adder**

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Commitment Period

- **ASO: Clear the market every 30 minutes, with a 30 minute look ahead.**

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Clearing Price/Settlement

- **Clearing price based on marginal offer total ($/MW) for the commitment period (hour).**
    - **Total offers = LOC + components**
    - **Clearing price reflects actual mileage and performance score of marginal offer.**
    - **Resources paid based on their performance adjusted MW for the commitment period.**

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Performance Score

- **The performance score is defined as the precision score (replace the current method of three components).**

- **Precision calculation based on status quo formula for precision.**

$$Error = Avg\ of\ Abs\left|\frac{Response\ -\ Regulation\ Signal}{Hourly\ Average\ Regulation\ Signal}\right|$$

$$\frac{Precision}{Score} = 1 - \frac{1}{n}\sum Abs(\ Error)$$

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Performance Score

- **Market participation requirement of a 40 percent performance score, based on rolling 100 hour average (status quo).**

- **Minimum performance score required for compensation or to set price is 25 percent.**

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Performance Score

- **Self deselection results in zero score in the cleared commitment period.**

- **PJM dispatcher deselection does not affect performance score.**

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Regulation Set Point and Range

- **PJM should be able to move the regulation set point over time to minimize LOC.**

- **Regulation range (Regulation Min and Regulation Max) should match economic dispatch range (limited by ramp rates and by economic min and economic max), unless explained by physical limitations (not fuel limit).**

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Regulation is a Real Time Only Product

- **Regulation depends on unpredictable real time conditions.**

- **No must offer obligation creates gaming opportunities between DA and RT applications**

- **DA market would add modeling/market result differences between DA and RT market**

- **DA market would add unneeded deviation/settlement/uplift complications**

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