Regulation Market Proposal

RMDSTF   IMM

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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 more for the same MW of regulation, if there is an LOC and/or positive price for both Reg up/Reg down.**

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Bidirectional

Load	500			Reg needed up and down				25 MW		Biddirectional					
Reg requirement 25 MW (up and/or down)															
	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

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

				Reg Down Price		Reg Up Price		
Projected output	Projected LMP	Desired Output	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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Regulation Requirement

- **Requirement (total regulation) based on expected system conditions (Same proposal as PJM)**
  - **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.**

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LOC

- **LMP based energy desired MW for LOC calculation within the hour based on cumulative movement over the commitment period based on physical ramp limit relative to regulation set point at the beginning of each commitment period.**

- **Shoulder ramp period reduced to 10 minutes from 15 (assuming a move to 30 minute commitments).**

- **Portions of the energy offer where physical limitations prevent measurable energy ramping within the commitment period are not eligible to contribute LMP desired MW for LOC calculations.**

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Offer Structure

- **Performance and Capability (Status Quo)**
- **Remove VOM from regulation cost offers**
- **Eliminate $12 adder**

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Commitment Period

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

Clearing Price/Settlement

- **Clearing price determined every 5 minutes within the commitment period based on the true (ex post) marginal offer in each interval ($/MW).**
  - **Total offers = LOC + components**
  - **Clearing price reflects actual mileage (ex post) and performance score (ex post) of marginal offer.**
  - **Resources paid based on their (ex post) performance adjusted MW for the commitment period.**

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Testing

- **Status Quo and PJM determined test times.**

- **Status quo testing requirements:**

  - **"New unit tests -Meet or exceed 75% on 3 consecutive test (limited to one test per calendar day.) Up-rate tests- Meet or exceed 75% on 1 test (limited to one test per calendar day.) Signal change tests- Meet or exceed 75% on 1 test (limited to one test per calendar day.)"**

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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

- **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).**

- **Portions of the energy offer where physical limitations prevent measurable energy ramping within the commitment period are not eligible to contribute LMP desired MW for LOC calculations.**

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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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