



MMU Analysis of Combined Regulation Market

MIC

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- PJM temporarily modified the regulation market on August 1, 2005
- PJM combined the PJM Regulation Market and the Western Region Regulation Market
- Final decision on combining markets is contingent on a report from the MMU and a decision by PJM members

- Combined market is better operationally than separate markets
- Combined market is more competitive than separate markets
- Combined market still exhibits structural market power in a substantial number of hours
- MMU concludes that it is preferable to retain the combined market, if appropriate mitigation can be implemented

- Prior mitigation included:
 - All cost based offers (prior to Dominion integration)
 - Cost-based offers for dominant owners (following Dominion integration)
- Proposed mitigation – flexible real time approach:
 - Real time application of three pivotal supplier test
 - Apply test using exactly the same logic applied in the energy market
 - Offer capping only in hours that fail test
 - Offer capping only for owners that fail test in hour; and that are needed to provide regulation in hour



Combined Regulation Market HHIs

		Minimum	Average	Maximum	Percent of Hours > 1800	Percent of Hours > 2500
Eligible		799	1067	1563	0	0
Eligible with Price	$\leq 1.5 \times \text{RMCP}$	793	1119	2221	0	0
Eligible with Price	$\leq 1.05 \times \text{RMCP}$	830	1199	3106	0.2	0



Combined Regulation Market Pivotal Supplier Results

		Percent of 1-Pivotal Hours	Percent of 2-Pivotal Hours	Percent of 3-Pivotal Hours
All Offers		1%	3%	20%
Eligible Price	$\leq 1.5 \times \text{RMCP}$	13%	56%	87%
Eligible Price	$\leq 1.05 \times \text{RMCP}$	64%	95%	99%



- The following slides describe the application of the three pivotal supplier test to the regulation market



- The analysis is based on PJM actual operation of the regulation market.
- Detailed unit characteristics are explicitly accounted for in the same way that PJM market software does:
 - Hourly availability status;
 - Economic maximum limit $>$ economic minimum limit;
 - Operational status;
 - Start and notification time.

- FERC delivered price test (one pivotal supplier)
 - Based on portion of supply curve with marginal cost below 105% of market clearing price.
- Three pivotal supplier test
 - Based on portion of supply curve with marginal cost below 150% of market clearing price.

- Market share
 - $\text{Output}_1 / \text{Total output}$
 - $\text{Ownership}_1 / \text{Total Supply}$
- Market concentration
 - HHI
- Pivotal supplier

- A generation owner is pivotal when output of its units required to meet demand
- $RSI_1 = (\text{Total supply} - \text{supply}_1) / (\text{Total demand})$
- If $RSI_1 < 1.0$, owner is pivotal
- Generation owners are jointly pivotal when output of owners' units required to meet demand
- $RSI_3 = (\text{Total supply} - \text{supply}_{1,2,3}) / (\text{Total demand})$
- If $RSI_3 < 1.0$, owners are jointly pivotal

- Three examples of application of pivotal supplier analysis
 - Hypothetical examples
 - Illustrate possible ranges of outcomes
 - Supply curve in example includes all units with marginal cost below 150% of market clearing price.



Structural Test Results – Example 1

Company	Owner Total MW	Cumulative MW	Market Total MW	Owner Market Share	HHI	RSI ₃	Three Pivotal Fail ?
Company A	1274	1274	3680	35%	2170	6.23	No
Company B	850	2124	3680	23%	2170	4.03	No
Company C	625	2749	3680	17%	2170	2.41	No
Company D	320	3069	3680	9%	2170	3.20	N/A
Company E	200	3269	3680	5%	2170	3.51	N/A
Company F	180	3449	3680	5%	2170	3.56	N/A
Company G	160	3609	3680	4%	2170	3.62	N/A
Company H	40	3649	3680	1%	2170	3.93	N/A
Company I	30	3679	3680	1%	2170	3.95	N/A
Company J	1	3680	3680	0%	2170	4.03	N/A

*Example assumes demand of 386 MW

- HHI results are below 2500 but indicate high levels of concentration
- Market share test is failed
- Single pivotal supplier test is passed for all owners
- Three pivotal supplier test is passed for all owners

- Market fails market share test
- Market would not be competitive under FERC test
- Three-pivotal supplier results demonstrate diversity of excess supply ownership
- Three-pivotal results permit exemption from offer capping rules
- Result: No offer capping in this market



Structural Test Results – Example 2

Company	Owner Total MW	Cumulative MW	Market Total MW	Owner Market Share	HHI	RSI ₃	Three Pivotal Fail ?
Company A	800	800	4215	19%	1332	8.85	No
Company B	650	1450	4215	15%	1332	7.16	No
Company C	575	2025	4215	14%	1332	5.67	No
Company D	550	2575	4215	13%	1332	5.74	N/A
Company E	500	3075	4215	12%	1332	5.87	N/A
Company F	475	3550	4215	11%	1332	5.93	N/A
Company G	390	3940	4215	9%	1332	6.15	N/A
Company H	200	4140	4215	5%	1332	6.65	N/A
Company I	50	4190	4215	1%	1332	7.03	N/A
Company J	25	4215	4215	1%	1332	7.10	N/A

*Example assumes demand of 386 MW

- Market concentration test is passed
- Market share test is passed
- Single pivotal supplier test is passed for all owners
- Three pivotal supplier test is passed for all owners

- Market competitive under FERC test
- Three-pivotal supplier results demonstrate diversity of excess supply ownership
- Three-pivotal results permit exemption from offer capping rules
- Result: No offer capping in this market



Structural Test Results – Example 3

Company	Owner Total MW	Cumulative MW	Market Total MW	Owner Market Share	HHI	RSI ₃	Three Pivotal Fail ?
Company A	130	130	676	19%	1439	1.41	Yes
Company B	125	255	676	18%	1439	1.09	Yes
Company C	120	375	676	18%	1439	0.78	Yes
Company D	90	465	676	13%	1439	0.86	Yes
Company E	60	525	676	9%	1439	0.94	Yes
Company F	55	580	676	8%	1439	0.95	Yes
Company G	50	630	676	7%	1439	0.96	Yes
Company H	40	670	676	6%	1439	0.99	Yes
Company I	5	675	676	1%	1439	1.08	No
Company J	1	676	676	0%	1439	1.09	No

*Example assumes demand of 386 MW

- Market concentration tests are passed
- Market share test is passed
- Single pivotal supplier test is passed for all owners
- Three pivotal supplier test is failed for identified owners

- Market is competitive under FERC test
- Three-pivotal supplier results demonstrate lack of diversity of excess supply ownership
- Offer capping of owners that fail three pivotal supplier test
- No offer capping of owners that pass three pivotal supplier test
- Only owners failing the three pivotal supplier test and that are required to provide regulation are offer capped