

Overview of Three Pivotal Supplier Test

MMUAC

December 4, 2015

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TPS Background

- **The three pivotal supplier test is a reasonable application of the Commission's delivered price test**
 - **Tests for whether the level of excess supply results in an adequately competitive market structure.**
 - **Need at least four suppliers to pass test.**
 - **Permits targeted mitigation in the relevant market.**

TPS: Relevant Market

- **The three pivotal supplier test measures the degree to which the supply from three suppliers is required in order to meet the demand in the relevant market.**

TPS: Formula

$$RSIB_j = \frac{\sum_{i=1}^n (S_i) - \sum_{i=1}^2 (S_i) - S_j}{D}$$

where,

- **D = Total demand for the product**
- **$\sum_{i=1}^n (S_i)$ = total available supply in relevant market**
- **$\sum_{i=1}^2 (S_i)$ = supply from two largest suppliers**
- **S_j = supply from the supplier being tested**

TPS: Applications

- **Applied in:**
 - **Real-Time Energy Market**
 - **Day-Ahead Energy Market**
 - **Regulation Market**
 - **Capacity Market**



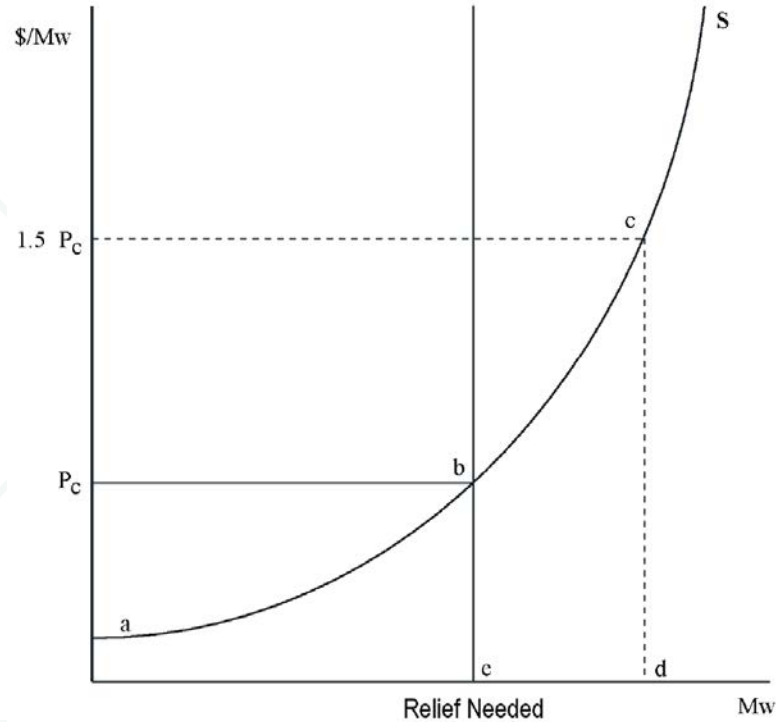
Energy Market: Relevant Market

- **The three pivotal supplier test measures the degree to which the supply from three suppliers is required in order to meet the demand for relief of a constraint, which defines the relevant market.**
- **Relevant supply tested in the energy market is constraint relief MW for a particular constraint.**

Relevant Market

- **Two key variables in the analysis are the demand for and the supply of constraint relief MW**
 - **Demand consists of the incremental, effective MW required to relieve the constraint.**
 - **Supply consists of effective MW of supply incrementally available to relieve the constraint at a distribution factor (DFAX) greater than or equal to the DFAX used by PJM in operations**

Relevant Market



TPS: Real Time Energy

- **Objective, ex ante test of market structure, behavior and impact for localized markets for incremental relief**
- **TPS replaced approach that capped local energy markets all the time**
 - **Pass the test, taken on current offer, price or cost**
 - **Fail the test, taken on the lesser of price or cost**
- **TPS only results in a cost offer dispatch (capping):**
 - **When there is a determination of structural market power**
 - **When unit price offer > unit cost offer**
 - **When the unit is actually dispatched for the constraint and would therefore affect the price**

TPS and Type I vs. Type II Error

- **Type 1 error is detecting market power when none exists**
 - **Mitigation results in setting offer equal to MC**
 - **Mitigation results in a competitive outcome**
 - **Cost of type 1 error is zero**
- **Type 2 error is a failure to detect market power when it exists**
 - **Failure to mitigate results in market power and prices above competitive level**
 - **Cost of type 2 error is large**

TPS: Effective mitigation with flexible offers

- **TPS applied to aggregate market**
- **General:**
 - **Eliminate crossed price and cost curves: constant markup**
 - **Physical based parameters (most flexible) in both price and cost**
 - **MW segments need to be the same in both price and cost offers**
 - **Changing offers within day requires a cost basis**
 - **Changing offers within day requires approved fuel policy**

TPS: Application to Aggregate Energy Markets

- **Objective, ex ante test of market structure, behavior and impact for aggregate energy market**
- **Recognize the development of market power in the aggregate market during relative high load conditions**
- **Change in aggregate mitigation (\$1,000 cap may be going away)**
- **TPS would be applied to test jointly pivotal suppliers for aggregate energy**
 - **Pass the test, taken on current offer, price or cost**
 - **Fail the test, taken on the lesser of price or cost**

TPS: Application to Aggregate Energy Markets

- **TPS would only result in a cost offer dispatch (capping):**
 - **When there is a determination of structural market power**
 - **When unit price offer $>$ unit cost offer**
 - **When the unit is actually dispatched for energy**

PJM hourly Energy Market HHI: January through June 2014 and 2015

	Hourly Market HHI (Jan - Jun, 2014)	Hourly Market HHI (Jan - Jun, 2015)
Average	1138	1117
Minimum	891	916
Maximum	1407	1468
Highest market share (One hour)	29%	30%
Average of the highest hourly market share	21%	21%
# Hours	4,343	4,343
# Hours HHI > 1800	0	0
% Hours HHI > 1800	0%	0%

PJM hourly Energy Market HHI (By supply segment): January through June 2014 and 2015

	Jan - Jun, 2014			Jan - Jun, 2015		
	Minimum	Average	Maximum	Minimum	Average	Maximum
Base	1029	1174	1454	1021	1148	1489
Intermediate	727	1719	5693	693	2016	8147
Peak	713	6119	10000	802	6080	10000

Marginal unit contribution to PJM real-time, load-weighted LMP (By parent company): January through June 2014 and 2015

2014 (Jan-Jun)		2015 (Jan-Jun)	
Company	Percent of Price	Company	Percent of Price
1	18.2%	1	17.8%
2	14.6%	2	15.6%
3	12.1%	3	11.4%
4	8.8%	4	9.9%
5	7.6%	5	8.3%
6	6.6%	6	8.2%
7	6.2%	7	5.3%
8	4.8%	8	5.0%
9	3.8%	9	2.8%
Other (58 companies)	17.3%	Other (57 companies)	15.7%

Marginal resource contribution to PJM day-ahead, load-weighted LMP (By parent company): January through June of 2014 and 2015

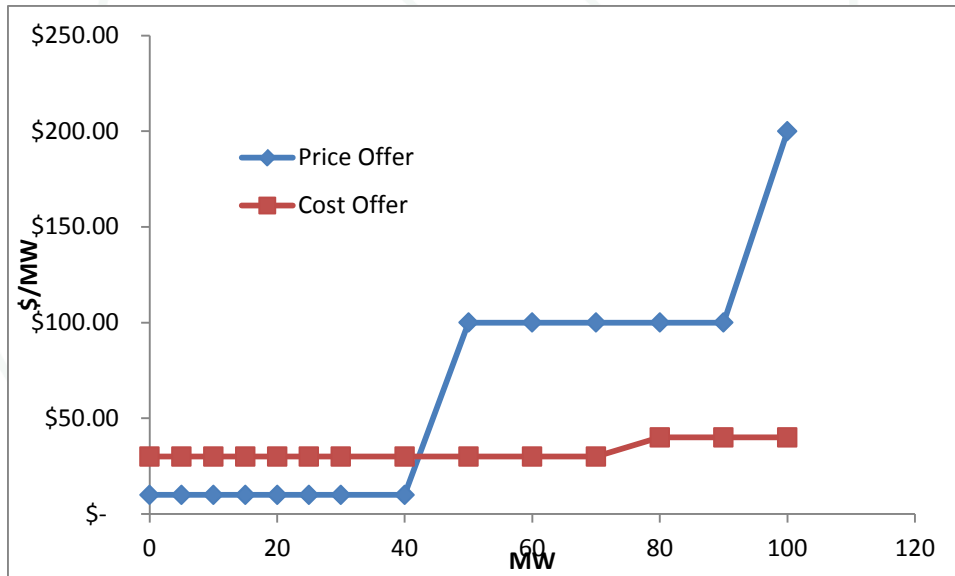
2014 (Jan - Jun)		2015 (Jan - Jun)	
Company	Percent of Price	Company	Percent of Price
1	10.5%	1	16.5%
2	7.3%	2	10.7%
3	7.0%	3	7.6%
4	6.2%	4	5.8%
5	6.1%	5	5.2%
6	5.7%	6	5.1%
7	4.3%	7	4.7%
8	3.8%	8	4.5%
9	3.3%	9	3.5%
Other (133 companies)	45.9%	Other (136 companies)	36.4%

TPS: Effective mitigation with flexible offers

- **General:**
 - **Eliminate crossed price and cost curves: constant markup**
 - **Physical based parameters (most flexible) in both price and cost**
 - **MW segments need to be the same in both price and cost offers**
 - **Changing offers within day requires a cost basis**
 - **Changing offers within day requires approved fuel policy**

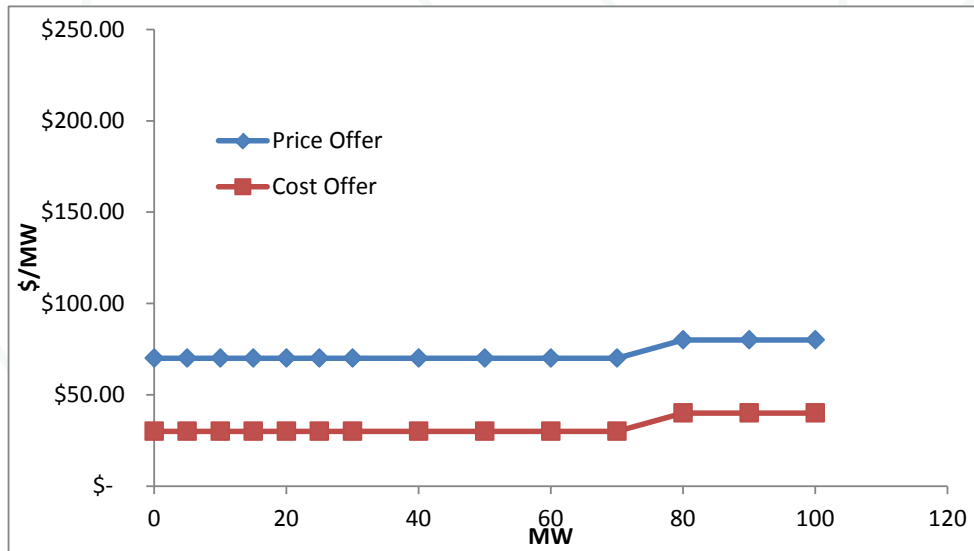
TPS: Effective mitigation with flexible offers

- Which is the lower?
- Eliminate crossed price and cost curves: constant markup



TPS: Effective mitigation with flexible offers

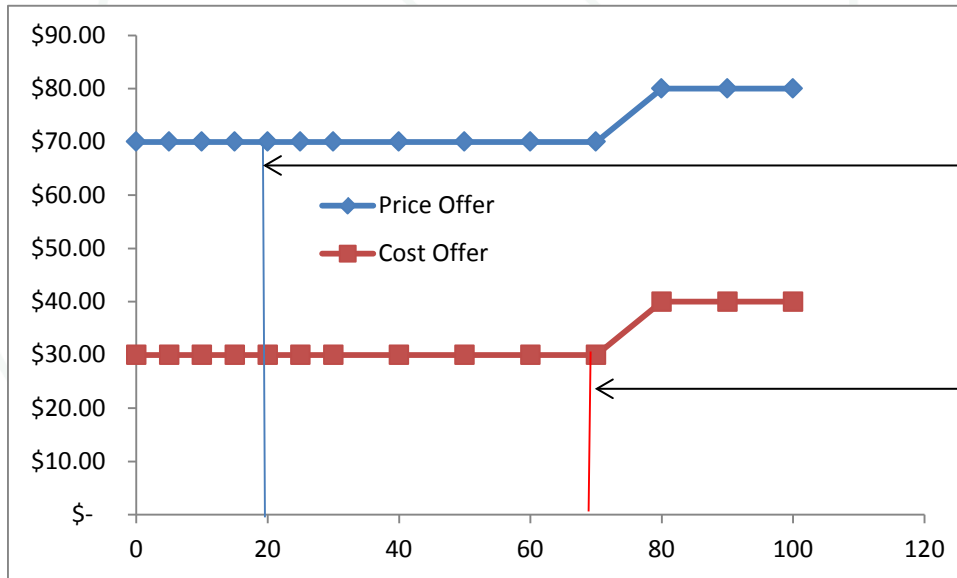
- **Constant markup**
- **MW segments need to be the same in both price and cost offers**



TPS: Effective mitigation with flexible offers

- Physical parameters (most flexible) applied to all schedules

- E_c



Eco Min Price

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