

# What is the State of the Markets?

A Summary of the Primary Data Provided by FERC and RTO/ISO Market Monitors



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A Summary of the Primary Data Provided by FERC and RTO/ISO Market Monitors

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# Introduction

This paper provides a summary of the primary data on the wholesale electricity markets operated by Regional Transmission Organizations and Independent System Operators (RTO/ISOs), provided by the Federal Energy Regulatory Commission ("FERC" or "the Commission") annual State of the Market Report and annual market assessments issued by the RTO/ISO market monitors covering data for 2018. The annual market monitor assessments are the most comprehensive source of data on these markets.

An accompanying document, *Measuring the Performance of Wholesale Electricity Markets: A Review of the Primary Market Assessments and Recommendations for Improvement*, provides a critique of these assessments and recommendations for their improvements. This paper is not presenting the full scope of all data provided by FERC and the market monitors but provides a few key data points.

- RTO/ISO wholesale market costs.
- Operating resources, additions and retirements by fuel type.
- Measures of market power and competition.
- Net revenue analysis and discussions of resource adequacy.
- Virtual trading, financial transmission rights and the participation of financial entities

To summarize these data, the FERC and market monitor reports reveal the following:

- All-in energy costs vary significantly among the RTO/ISOs, although all regions saw cost increases to varying degrees in 2018. The primary drivers of energy cost increases were natural gas prices, load increases, and weather patterns.
- The highest all-in prices were in those RTO/ISOs with mandatory capacity markets.
- Despite capacity surpluses, PJM and ISO-NE report net revenues in excess of the cost of new entry for new units.
- The fuel types of generating resources currently operating, as well those added and retired in 2018, varies significantly by RTO/ISO.
- Market power does not appear to be a significant concern in the RTO/ISO-operated energy markets, but there are indications of high market concentration in certain areas.
- Where such data are available, financial entities tend to earn higher profits than physical entities in virtual trading and FTR ownership.

# 2018 FERC State of the Market Report

Below are the primary findings of the April 2019 report:

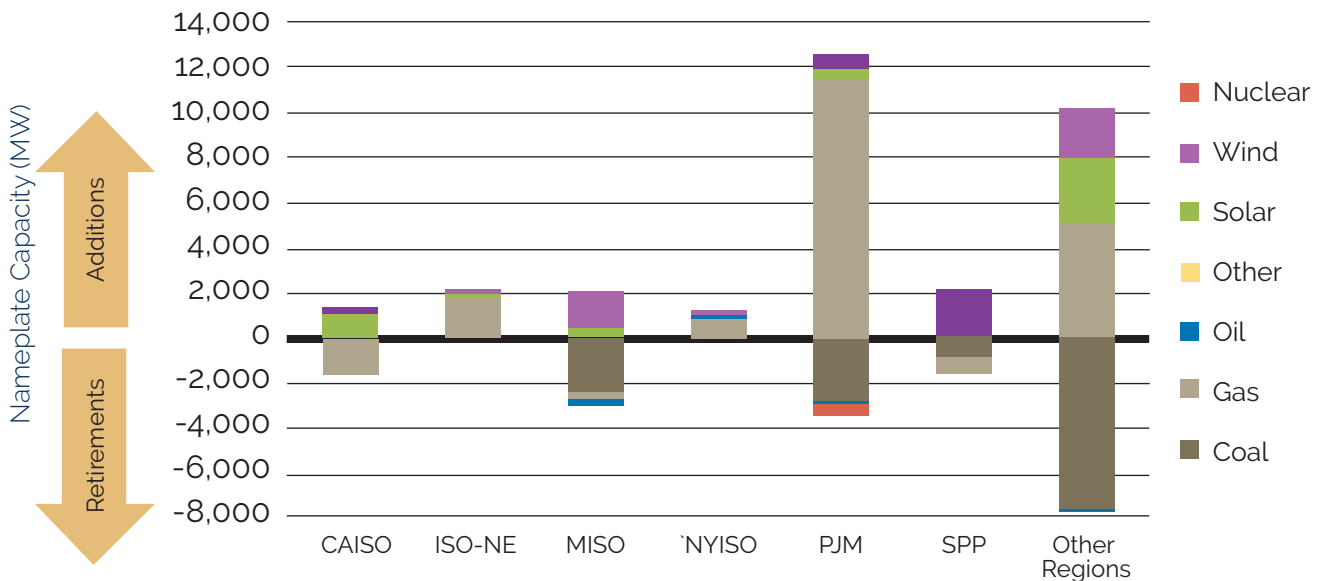
- RTO/ISO day-ahead energy and trading hub prices increased compared to 2017, reflecting an increase in natural gas prices, with the increases ranging from below 15 percent (SPP, MISO and CAISO) to 44 percent (ERCOT). Other than SPP, where the trading hub price did not increase, the RTO/ISO price changes matched or were below the trading hub changes.
- Non-RTO/ISO trading hubs increased by between 4 percent (Southeast) and 45 percent (Mid-Columbia), showing a similar range of price increases to the RTO/ISO regions.
- Capacity prices fell in the PJM and ISO-NE capacity market auctions, rose in parts of the NYISO and declined in others, and increased slightly in MISO. However, these capacity prices reflect the outcomes of the *auctions* held in 2018, which do not cover the same time frames in the RTO/ISOs.
- The SOM provided chart below shows the additions and retirements of capacity. PJM added the greatest amount of capacity, which was almost entirely natural

gas. Only MISO and CAISO appear to have greater retirements than additions. Based on this graph, the presence of an RTO/ISO or a capacity market does not appear to be a direct determinant of capacity additions or retirements. The report does not discuss whether these regions are currently exhibiting a surplus or deficit of capacity.

- Other findings included that electricity demand remained stable; the Western Energy Imbalance Market continued to expand; and the Northwest region had the largest volume of hourly and daily sales of energy and booked-out power at market-based rates in the non-RTO/ISO bilateral markets.

Note: FERC issued the 2019 SOM report while this report was in production.

**Figure 1. Capacity additions and retirements by RTO**



Source: U.S. Energy Information Administration (EIA) Form 860M. Data do not cover additions or retirements in Alaska or Hawaii.

# RTO/ISO Market Monitor 2018 Reports

The bulk of the data covered in this paper was obtained from the annual market monitor reports. Without providing the full range of the data contained in these reports, this summary contains highlights of some key data points.

## Wholesale Market Costs

All market monitors provide the all-in cost per megawatt-hour (MWh) for market participants. These data are shown in the table below with the highest to lowest prices shown from left to right.<sup>1</sup>

**Table 1. 2018 All-in RTO/ISO Cost Per Megawatt-Hour (MWh)**

RTO	ISO-NE	NYISO <sup>1</sup>	PJM	CAISO	ERCOT	MISO <sup>2</sup>	SPP
<b>All-in Price</b>	<b>\$79.0</b>	<b>\$33 - \$62</b>	<b>\$52.8</b>	<b>\$49.5</b>	<b>\$38.3</b>	<b>\$32.6</b>	<b>\$27.7</b>
Increase from 2017	36.2%	14.6 - 32.0%	20.9%	24%	27.1%	3.9%	14.8%
<b>% Breakdown of All-in Price</b>							
Energy	62.0%	69 - 86%	72.4%	94.5%	93.0%	97.5%	97.9%
Capacity	36.7%	10 - 27%	24.6%			15%	
RMR			0.1%	15%			
Ancillary Services	0.5%		1.6%	1.7%	4.2%	0.3%	1.1%
Administration			0.9%	0.9%	15%	0.7%	
Uplift	0.7%		0.4%	1.4%	1.0%		1.0%
Demand Response			0.02%		0.3%		

<sup>1</sup>Varies by zone. Estimated from a bar graph. Energy and capacity percentage breakdowns are from the text.

<sup>2</sup>Energy and capacity estimated from a bar graph. Others are from the text.

<sup>1</sup> 2018 Annual Markets Report, ISO New England, Inc. Internal Market Monitor, (ISO-NE Internal Market Monitor Report) May 23, 2019, Figure 2-1 at 27, available at: <https://www.iso-ne.com/static-assets/documents/2019/05/2018-annual-markets-report.pdf>; 2018 State of the Market Report for the New York ISO Markets, Potomac Economics – Market Monitoring Unit for the NYISO, May 2019 (NYISO SOM), at 3, available at: <https://www.nyiso.com/documents/20142/2223763/2018-State-of-the-Market-Report.pdf/b5bd2213-9fe2-b0e7-a422-d4071b3d014b?t=1557344025932>; 2018 State of the Market Report for PJM (PJM SOM), Monitoring Analytics, LLC – Independent Market Monitor for PJM, March 14, 2019, Table 1-8 at 16, available at: [http://www.monitoringanalytics.com/reports/PJM\\_State\\_of\\_the\\_Market/2018.shtml](http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2018.shtml); 2018 Annual Report on Market Issues and Performance, California ISO Department of Market Monitoring, (CAISO Annual Report), May 2019, Table 2-1 at 67, available at: <http://www.caiso.com/Documents/2018AnnualReportonMarketIssuesandPerformance.pdf>; 2018 State of the Market Report for the ERCOT Electricity Markets (ERCOT SOM), Potomac Economics - Independent Market Monitor for ERCOT, June 2019 at 2-3, available at: <https://www.potomaceconomics.com/wp-content/uploads/2019/06/2018-State-of-the-Market-Report.pdf>; 2018 State of the Market Report for the MISO Electricity Markets, Potomac Economics - Independent Market Monitor for the Midcontinent ISO (MISO SOM), June 2019 at 3-4, available at: <https://cdn.misoenergy.org/2018%20State%20of%20the%20Market%20Report364567.pdf>; 2018 State of the Market, Southwest Power Pool Market Monitoring Unit (SPP SOM), May 15, 2019, at 147-149, available at: <https://www.spp.org/documents/59861/2018%20annual%20state%20of%20the%20market%20report.pdf>.

**Figure 2: Comparison of All-in Prices Across Markets**

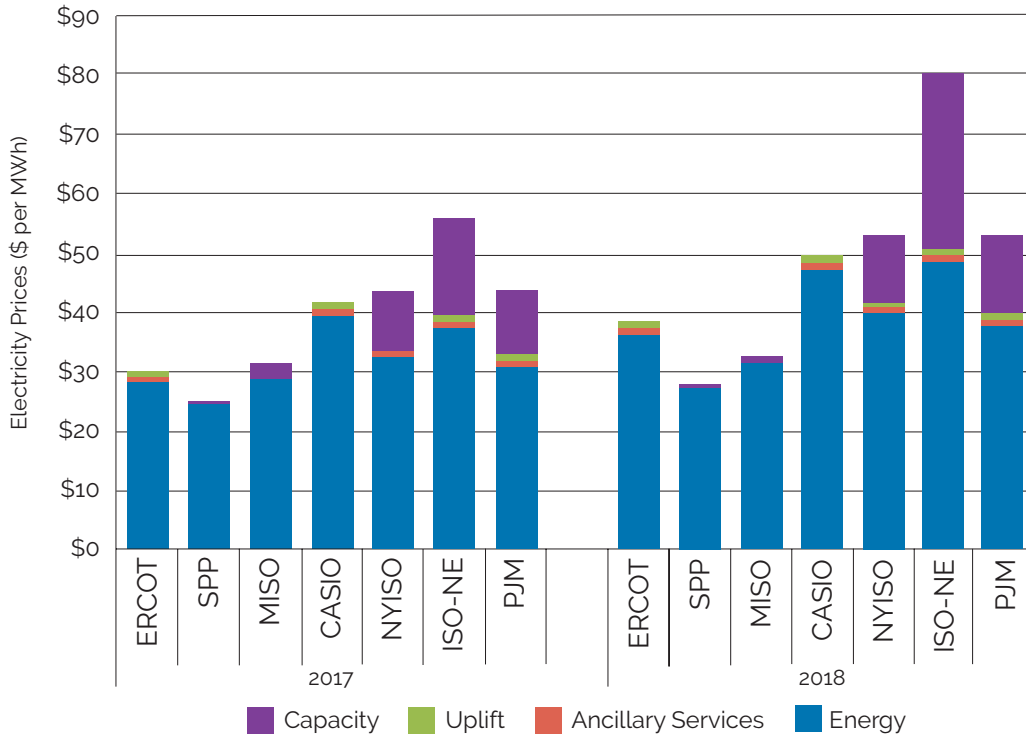


Figure 2 (figure 7 from the ERCOT SOM) also provides a visual image of the all-in costs across the RTOs in 2017 and 2018.<sup>2</sup>

A primary component of the overall cost increase was the rise in energy prices driven by higher natural gas costs in many regions. Other factors also played a role in energy price increases, including:

- In CAISO, energy prices that exceed those in other parts of the West were attributed to “greenhouse gas compliance cost associated with delivering energy into the state and the cost of congestion associated with limited transfer capacity with other balancing authority areas.”<sup>3</sup>
- Increases in load and episodes of extreme weather played a role in higher energy prices in MISO.<sup>4</sup>

- In SPP, where gas prices declined from 2017 to 2018, “higher loads driven by weather,” and “declines in the frequency of negative prices contributed to higher prices in 2018.”<sup>5</sup>

Capacity costs also play a significant role in determining the all-in price, with the highest all-in prices seen in those RTO/ISOs with the highest capacity costs (PJM, NYISO and ISO-NE). Other costs, including ancillary services and uplift, accounted for a very small portion of the costs. Although reducing uplift has been frequently provided as a primary rationale in a number of recent FERC rulemakings on price formation,<sup>6</sup> uplift accounted for about one percent of the all-in cost.

<sup>2</sup> ERCOT SOM at 8.

<sup>3</sup> CAISO Annual Report at 74.

<sup>4</sup> MISO SOM at 5.

<sup>5</sup> SPP SOM at 107.

<sup>6</sup> See for example, *Orders on Paper Hearing Regarding the Pricing of Fast-Start Resources, PJM*, 167 FERC ¶ 61,058 (April 18, 2019) at 10, and the *NYISO*, 167 FERC ¶ 61,057 (April 18, 2019) at 7.

This all-in cost does not however include the cost of transmission, which is provided only by the PJM and ISO-NE market monitors, shown below.

**Table 2. All-in RTO/ISO Cost Per Megawatt-Hour (MWh) with Transmission<sup>7</sup>**

RTO	PJM	ISO-NE
Transmission	\$9.47	\$19.0
All-in Price w/Transmission	\$62.29	\$98.0
Transmission %	15.2%	19.4%

CAISO does provide data on transmission costs outside of the market monitor report, in its Five-Year Summary of Comparable Statistics,<sup>8</sup> which shows that transmission in 2018 accounted for \$3.2 billion in charges to market participants, out of a total of \$13.6 billion or 23.6 percent of total charges.

Figure 3, from the ISO-NE SOM, shows both the transmission revenue collected and the congestion cost paid by load in the day-ahead markets in ERCOT, MISO, NYISO and ISO-NE.<sup>9</sup> As shown, while ISO-NE load pays a lower amount of congestion than the other RTO/ISOs (slightly below MISO and about \$2.5 per MWh below NYISO and ERCOT), ISO-NE load pays as much as \$10 per MWh more than other RTO/ISOs for transmission.

**Figure 3. Day-Ahead Transmission Revenues, 2016-2018**



<sup>7</sup> PJM SOM Table 1-8 at 16; ISO-NE Internal Market Monitor Report, Figure 2-1 at 27.

<sup>8</sup> Available at: [http://www.caiso.com/Documents/CAISO2018\\_5yearssummaryfinal.pdf](http://www.caiso.com/Documents/CAISO2018_5yearssummaryfinal.pdf)

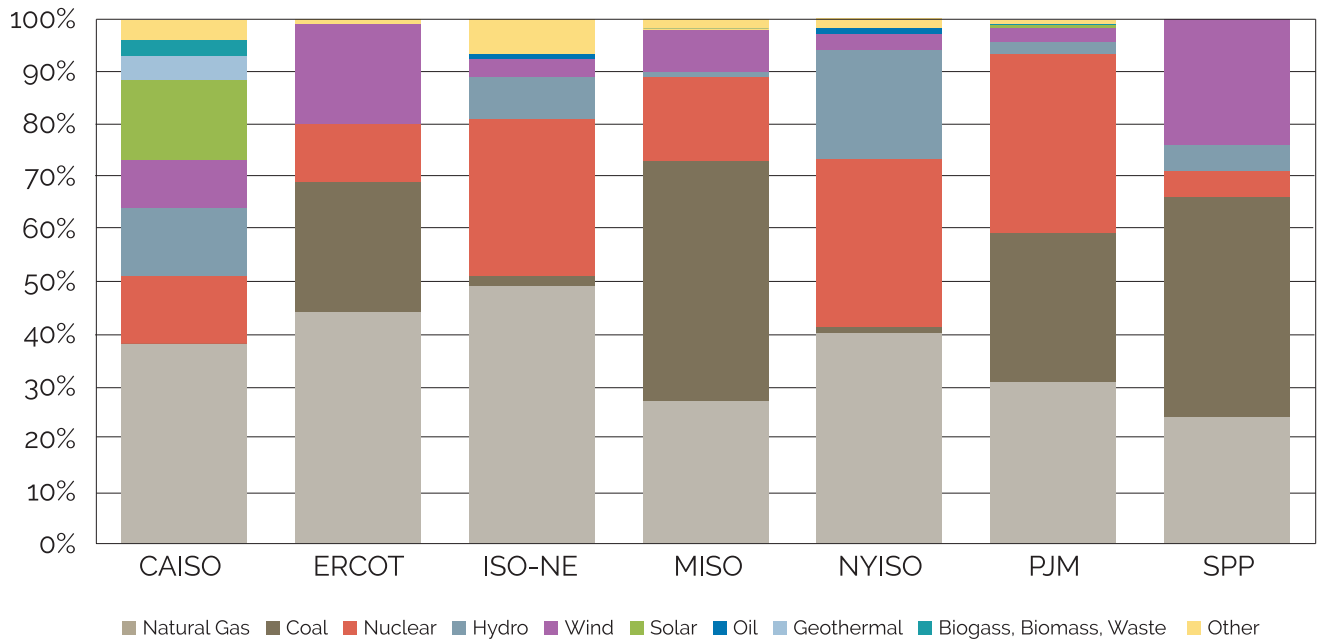
<sup>9</sup> ISO-NE SOM at 3.



## Resource Mix

Figure 4 combines the market monitor data provided on the 2018 generation by technology. There is significant variation in the amount of fuel diversity and the share provided by renewables. But as the prior chart from the FERC SOM showed, additions of natural gas (PJM, ISO-NE and NYISO) and renewables (wind in MISO and SPP and solar in CAISO), combined with coal retirements in MISO, PJM and SPP will result in a different mix of generation in future years.

**Figure 4. 2018 Generation by Fuel Type<sup>10</sup>**



<sup>10</sup> Imports not included. Data is from CAISO Annual Report at 32-34 (recalculated to remove imports); ERCOT SOM at 79; ISO-NE Internal Market Monitor Report Figure 2-2 at 28; MISO SOM Table 1 at 5; NYISO SOM Table 2 at 6; PJM SOM Table 3-9 at 122; SPP SOM at 35.

## Net Revenue and Resource Adequacy

All market monitor reports contain an analysis of whether the net revenues received from all RTO/ISO-operated markets (plus Renewable Energy Credits and Zero Emission Credits) would cover the annualized costs of constructing and maintaining a hypothetical new generating unit. Net revenue is determined by subtracting the short run marginal costs of energy production from total gross revenue and is therefore available to cover a generator's annualized fixed costs (also referred to as the Cost of New Entry or "CONE"), including return on investment, depreciation, income taxes, and avoidable costs. Avoidable costs represent the costs that must be incurred each year to keep a unit in operation, such as certain fixed operation and maintenance costs. Also relevant is the extent to which net revenue covers the avoidable cost of an existing unit, which is provided by some of the market monitors.

Table 3 shows the results of the net revenue analysis for new and existing units.

Relevant to the net revenue analyses is whether there is a surplus or deficit of generating capacity since net revenues at times of surplus should not signal the need for new resources. The market monitors report the following with regard to resource adequacy.

- PJM in the 2018-2019 delivery year had an actual reserve margin of 22.9 percent, compared to an installed reserve margin requirement of 16.1 percent.<sup>12</sup>
- ISO-NE had a surplus in capacity in all delivery years other than the 2018/19 delivery year.<sup>13</sup>
- In the NYISO, unforced capacity exceeded the requirement in all zones and time periods from the Summer 2017 through the Winter 2018-2019.<sup>14</sup>
- SPP had surplus system capacity that was 35 percent of the peak load, almost three times the required planning reserve margin of 12 percent.<sup>15</sup>

**Table 3. 2018 Net Revenue Analyses<sup>11</sup>**

RTO	Technology	New Unit: Above CONE?	Existing Unit: Above Avoidable Costs?
PJM	Combined Cycle (CC)	Yes	98% of units
	Combustion Turbine (CT)	Yes, in eleven zones	96% of units
	Coal, Nuclear, Diesel, Wind	No	63% (Coal), 84% (Nuclear), Diesel (97%), Wind not provided
	Solar	Yes, in four zones	Not provided
ISO-NE	CC	Yes	Not provided
	CT		Not provided
NYISO	CT, CC, Offshore Wind, Solar, Onshore Wind	No, but very close for onshore wind	Yes (Natural Gas CT) No (Natural Gas Steam Turbine)
SPP	CC, CT, Coal	No	Yes (CC and CT), No (Coal)
CAISO, ERCOT, MISO	CC, CT	No	Not provided

<sup>11</sup> PJM SOM at 336 – 342; PJM SOM Table 7-35 at 348; ISO-NE SOM Figure 3 at 4; NYISO SOM at 66 – 68; SPP SOM Figure 4-44 at 151; CAISO Annual Report at 59 and 63; ERCOT SOM at 112-113; MISO SOM at 69-70.

<sup>12</sup> PJM SOM Table 5-7 at 266.

<sup>13</sup> ISO-NE Internal Market Monitor Report at 32 and Figure 6-1.

<sup>14</sup> NYISO SOM Figures A-96 through A-99.

<sup>15</sup> SPP SOM at 195.

- In CAISO, "load-serving entities procured about 30,000 MW of capacity in local areas in 2018, compared to about 25,000 MW of required capacity," but that "procurement in some local capacity areas was significantly lower than the local requirement."<sup>16</sup>
- In the summer of 2019, ERCOT had "a historically low reserve margin of 7.4 percent, just over half of ERCOT's previously stated reserve margin goal of 13.75 percent."<sup>17</sup> But resource availability in the summer of 2019 was higher than originally expected.<sup>18</sup>
- MISO's market monitor reports a "prevailing surplus," but notes that this surplus is dissipating.<sup>19</sup> The SOM provides a range of reserve margin projections for the summer of 2019 while concluding that "the system's resources are likely adequate" but may run short if the peak demand conditions are substantially hotter than normal.<sup>20</sup> The market monitor's Summer 2019 Quarterly Report said the peak load was almost 5 GW below what was forecasted, although the actual reserve margin is not provided.<sup>21</sup>

## Measures of Market Power and Competition

### Market Structure

Market structure measures can indicate greater potential risk of the exercise of market power, but not necessarily whether such behavior is occurring. The primary market structure measures are the concentration of ownership of resources and whether there are pivotal suppliers. A common measure of market concentration is the Herfindahl-Hirschman Index (HHI), which is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. Another measure simply shows the percentage of a resource owned by the largest suppliers.

Below are data provided on these two measures.

**Table 4. HHI Measures<sup>22</sup>**

Energy Market		Demand Response		Generating Capacity	
<b>PJM</b>				<b>MISO</b>	
Overall	840	Economic	7,540	Overall	591
Base	895	Emergency*	1,922	Midwest	564
Intermediate	1,475			Wisconsin-Upper Michigan	2,708
Peak	5,009			South	3,673
<b>SPP</b>				<b>ISO-NE</b>	
Moderately Concentrated in 12% of hours				All New England	425
				Connecticut	887
				Boston	890

\* This type accounts for almost all of the demand response revenue in PJM.<sup>23</sup>

<sup>16</sup> CAISO SOM at 240

<sup>17</sup> ERCOT SOM at 124. The 13.75 percent is not a required reserve margin, but one that had been approved by the ERCOT Board of Directors in November 2010, based on a one in ten loss of load expectation (LOLE).

<sup>18</sup> ERCOT's Review of Summer 2019, October 11, 2019, [http://www.ercot.com/content/wcm/lists/172485/Review\\_of\\_ERCOT\\_Summer\\_2019\\_-\\_PUC\\_Workshop\\_-\\_FINAL\\_10-8-19.pdf](http://www.ercot.com/content/wcm/lists/172485/Review_of_ERCOT_Summer_2019_-_PUC_Workshop_-_FINAL_10-8-19.pdf)

<sup>19</sup> MISO SOM at 69 and 71.

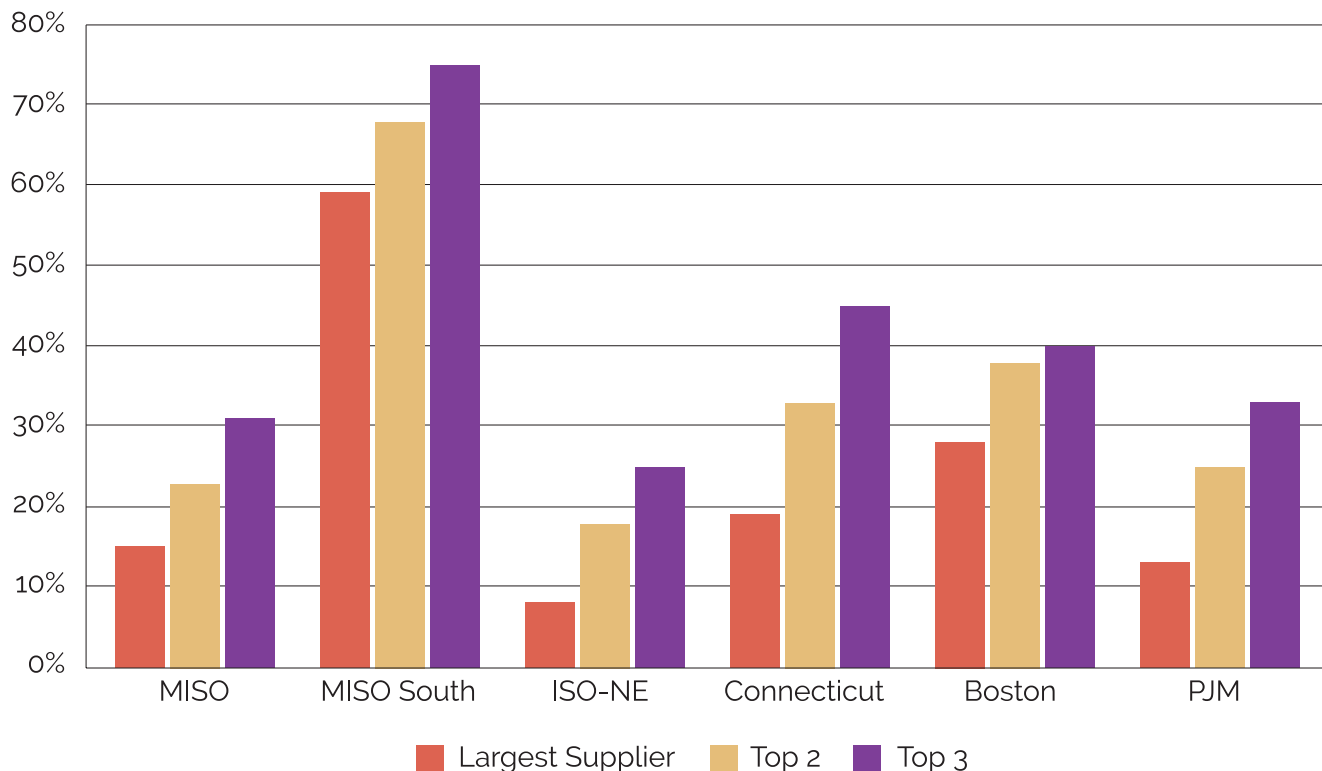
<sup>20</sup> MISO SOM at 69.

<sup>21</sup> IMM Quarterly Report: Summer 2019, MISO Independent Market Monitor, September 17, 2019, [https://www.potomaceconomics.com/wp-content/uploads/2019/09/IMM-Quarterly-Report\\_Summer-2019\\_Final.pdf](https://www.potomaceconomics.com/wp-content/uploads/2019/09/IMM-Quarterly-Report_Summer-2019_Final.pdf)

<sup>22</sup> PJM SOM Table 3-2 and 3-3 at 114; PJM SOM at 301; SPP SOM at 207; MISO SOM at 87; ISO-NE SOM Figure 5 at 11.

<sup>23</sup> PJM SOM at 301.

**Figure 5. Generation Capacity Market Shares<sup>24</sup>**



While the concentration measures provide some indication of potential market power opportunities, a third measure - the presence of pivotal suppliers - is seen by the market monitors as a more important measure. A single supplier is pivotal when its resources are necessary to satisfy load or manage a transmission constraint. Below are the data provided on pivotal suppliers:

- PJM: In the energy market, no supplier was singly pivotal, two suppliers were jointly pivotal on 42 days, and three were jointly pivotal on 212 days.<sup>25</sup> In the capacity market, all participants failed the three pivotal supplier test, as has occurred in almost every capacity auction.<sup>26</sup>
- MISO: A pivotal supplier could relieve 87 percent of the transmission constraints in the broad constrained areas, 95 percent in the Midwest's chronically constrained areas, and 100 percent in the South's chronically constrained areas, indicating that "local market power persists, with respect to these constraints" and that "mitigation measures remain critical."<sup>27</sup>
- ISO-NE: Five percent of the hours had one or more pivotal suppliers.<sup>28</sup>
- CAISO: Certain local capacity areas were found to not be structurally competitive because of a single pivotal supplier.<sup>29</sup>

<sup>24</sup> ISO-NE SOM Figure 5 at 11; MISO SOM Analytical Appendix Figure A-138 at 142; PJM SOM Table 5-4 at 263.

<sup>25</sup> PJM SOM at 116.

<sup>26</sup> PJM SOM at 251.

<sup>27</sup> MISO SOM at 87.

<sup>28</sup> ISO-NE SOM at 12.

<sup>29</sup> CAISO Annual Report at 161.

- SPP: Most regions did not have pivotal supplier conditions, other than New Mexico/West Texas (almost 100 percent of all hours), Iowa/Dakotas/Montana (52 percent of high demand hours) and Nebraska (12 percent of the high demand hours).<sup>30</sup>
- ERCOT: Pivotal suppliers existed in 30 percent of all hours, and 95 percent of the highest load hours. The market monitor found that local market power in transmission constrained areas raise more substantial competitive concerns.<sup>31</sup>

### Market Participant Behavior

While market structure measures demonstrate opportunities for the exercise of market power, indicators of market participant behavior are intended to reveal where such market power exercise may be occurring. One such measure is the price-cost markup, which is the average amount by which the clearing price exceeds the short-run marginal cost of the resource setting the price. Table 5 shows such data where provided by the market monitors. (The ISO-NE uses the Lerner Index, which divides the price-cost differential by the price. By using the price instead of cost as the denominator, the Lerner Index produces a lower percentage than the price-cost markup.)

**Table 5. Energy Price-Cost Markup Data<sup>32</sup>**

RTO	Day-Ahead Market		Real-Time Market	
	PJM		\$2.76	
ISO-NE*		4.9%	N/A	
CAISO	\$0.76	about 2%	N/A	
SPP	N/A	N/A	On Peak = (\$2.41)	Off Peak = (\$2.05)
MISO	N/A	N/A	-1.2%	

\*Lerner Index

### Financial Entity Participation in the Markets

Financial entities, such as banks and hedge funds, which do not own generation or serve load, can participate in the RTO/ISO-operated markets through two types of mechanisms: virtual transactions and purchases of Financial Transmission Rights, Congestion Revenue Rights and analogous instruments. These mechanisms also serve as price or congestion hedges for physical participants (those who own or purchase electric generation).

Table 6 shows the share of profits earned by financial and physical participants in virtual trades and Financial Transmission Rights (or similar instruments).

<sup>30</sup> SPP SOM Figure 7-6 at 216.

<sup>31</sup> ERCOT SOM at 131.

<sup>32</sup> ISO NE Internal Market Monitor Report at 114; CAISO Annual Report at 156; SPP SOM at 219; MISO SOM at 88; PJM SOM Table 3-58 at 174 and Table 3-81 at 188.

**Table 6. 2018 Financial Entity Shares of Virtual Transactions<sup>33</sup>**

PJM		MISO		CAISO		ERCOT	
Financial Entity Share		Virtual Profitability by Entity		Share of Virtual Revenue		Virtual Point-to-Point Profits	
Cleared INCs & DECs	80.5%	Financial (per MWh)	\$0.82	Financial	75.6%	Financial (per MWh)	\$0.34
Cleared UTCs	96.1%	Physical (per MWh)	\$0.51	Marketers*	22.4%	Physical (per MWh)	\$0.21
FTR Profits	82.2%	Financial Share of Profits	92.8%	Physical Generation	2.7%		
				Load Serving Entities	-0.7%		
				Financial Entity % of Virtual Transactions (Volume)	63%		
				<b>Share of FTR Net Revenue</b>			
				Financial	74%		
				Marketers*	20%		
				Physical Generation	14%		
				Load Serving Entities	-7%		

\*Marketers in CAISO are defined as "participants on the interties and participants whose portfolios are not primarily focused on physical or financial participation in the ISO markets."

<sup>33</sup> PJM SOM Tables 3-48 and 3-49 at 167

# Conclusion

In sum, the market monitors and FERC provide valuable data on both the RTO/ISO-operated markets and on the characteristics of the RTO/ISO regions, such as the generation mix. The presentation of these data show that important data are not always provided by all RTO/ISOs or are provided according to different measures. A more detailed set of recommendations for improving the FERC and market monitor reporting is provided in the paper, *Measuring the Performance of Wholesale Electricity Markets: A Review of the Primary Market Assessments and Recommendations for Improvement*.

