Written Testimony of

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Financial trading and the presence of financial market participants play a critical role in allowing the regional electricity markets operated by the independent system operators ("ISO") and regional transmission organizations ("RTO") (collectively, "ISO/RTO") to deliver benefits to all participants in those markets, including consumers. Unique among market participants, financial participants focus solely on how prices are formed, and profit only when they contribute to better forward market prices. The same incentives do not exist for physical participants, meaning that the only stakeholders working to ensure that the ISO/RTO markets provide useful price signaling for short-term and long-term decision-making are financial participants.

Market Basics

Broad themes like liquidity, price formation, outcome forecasting, competition and efficiency are central to any discussion of how markets work, but truly appreciating the value that financial participants drive in the context of regional electricity markets comes from better understanding the nuts and bolts of the markets, and the predictable ways in which they fail in the absence of financial participants.

The ISO/RTOs operate a number of markets that provide price signals for a range of times, ranging from minutes to years into the future. Financial transactions in the ISO/RTO wholesale markets happen primarily in the longer-term Financial Transmission Rights ("FTR") auctions which will be addressed by a colleague on the panel, and the Day-Ahead markets. I note there is also energy derivatives trading outside of the ISO/RTO markets, such as on the Intercontinental Exchange ("ICE") and other platforms, but derivatives are outside the scope of our conversation today.

The cornerstone of ISO/RTO markets is Locational Marginal Pricing ("LMP"). All of the ISO/RTO markets differentiate pricing by location. All demand and supply pay (or are paid) the same prevailing price, and that price is the marginal cost of satisfying the next megawatt of demand. LMP consists of three components:

- **System Energy Price**: the price of serving the last MW of demand across the entire grid
- **Marginal Loss:** a *de minimis* amount reflecting grid conductor properties
- **Congestion Price**: This is only non-zero when the system is constrained – i.e., when lower cost units could produce more if not for grid transmission issues

The congestion component is the driver of different prices in different locations on the grid. When constraints in grid transmission restrict the availability of generation, prices differentiate resources near to demand from those that are far away, or that cannot reach demand due to the unavailability of constrained transmission lines.

The power of LMP is that it intertwines short-term dispatch instructions with clear signaling to the rest of the market. Lowering the output of a given plant is accomplished by sending that particular plant (and other generators in the same region) a lower price. Should other plants need to produce more power, those plants and others nearby are signaled to do so by a higher price.[1] In each case, the short term outcome (more or less power) is accompanied by a transparent signal to any other interested stakeholder: lower prices equate to relatively less need, and higher prices equate with relatively more need.

These market signals are sent through the Day-Ahead (forward) and Real-Time (spot) markets. The Real-Time market thus relies heavily on the Day-Ahead market to posture the right resources to allow for reliable operation of the grid; failure of the Day-Ahead market to make

[1] ISO/RTO operators retain the ability to dispatch specific facilities as needed, through out-of-market mechanisms, including to meet reliability needs.

those correct resources available results in high volatility in the Real-Time market, as the system operator struggles to satisfy instant demand, with a set of resources poorly matched to the location and magnitudes of demand.

Unfortunately for the grid operator, the Day-Ahead market naturally contains incentives for physical participants to behave differently than they will in the Real-Time market. In general, those serving load can maximize their short run profits by purchasing less power in the Day-Ahead market than they expect to use in Real-Time. By purchasing less than they know they will need, they shift the supply and demand intersection in a way that reduces price. On the other hand, generators can maximize their short run profits (or manage their Real-Time risks) by offering slightly less power into the Day-Ahead market than they expect to be able to produce. This has the effect of shifting the supply demand intersection in the opposite direction. Figures 1 and 2 demonstrate the impacts on pricing of both load (demand) and generation (supply) underbidding into the Day-Ahead market.

Fig. 1 – Example of Load Underbidding

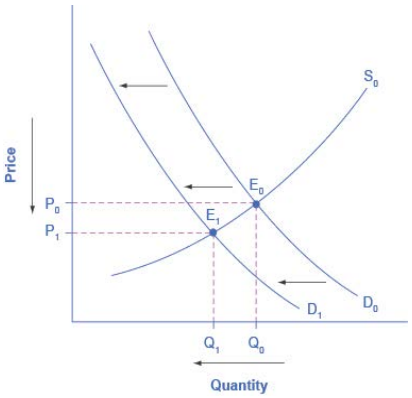
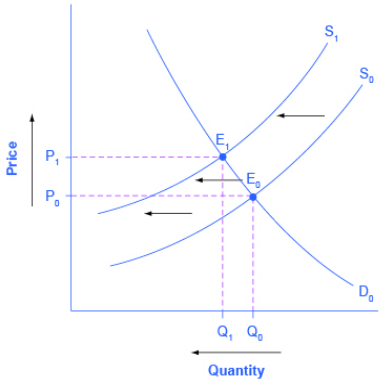


Fig. 2 – Example of Generation Underbidding



In each case, the supply curve is shifted as a result of the underbidding. In the case of load underbidding, less power is procured in the Day-Ahead market resulting in lower Day-Ahead prices. In the case of generation underbidding, less power is available in the Day-Ahead market,

resulting in higher Day-Ahead prices. The market prices power on a locational basis, so both dynamics can play out at the same time at different locations on the power grid. The long term effect of this push-pull of the supply and demand curves are Day-Ahead market prices that diverge further and further from the Real-Time market. Fortunately, there are participants in the market whose sole avenue for profiting comes from identifying where the forward market is failing to price things correctly, and pushing the forward market behavior to more closely match the spot market outcomes. Figures 3 and 4, below, demonstrate how financial market participants can converge the Day-Ahead and Real-Time markets by more accurately forecasting Real-Time conditions to pre-position the Day-Ahead market.

Fig 3. Actual MISO DA Market Demand Curves, 6/3/2016, Physical Market Participants Only

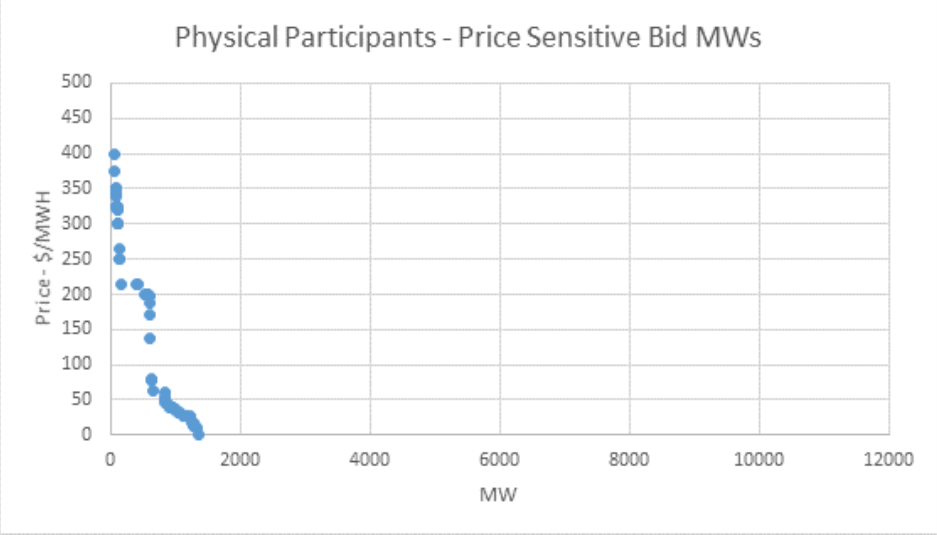
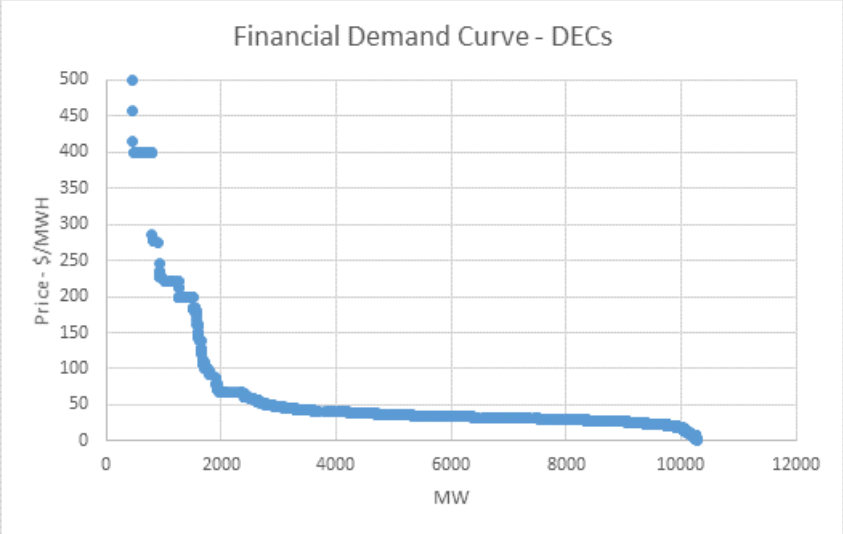


Fig. 4. Actual MISO DA Market Demand Curves, 6/3/2016, With Financial Market Participants (DECs)



On June 3, 2016 in the Real-Time, actual physical demand was 85 GW but physical load participants purchased only 95% of that amount, thus underbidding by 5% or almost 4 GW. Only 2% of the load bid in Fig. 3 was bid in a price sensitive manner. In Fig. 4 above, financial market participants added nearly 10 GW in liquidity, sending a strong signal to the market of the need for additional power.

Availability of Financial Products

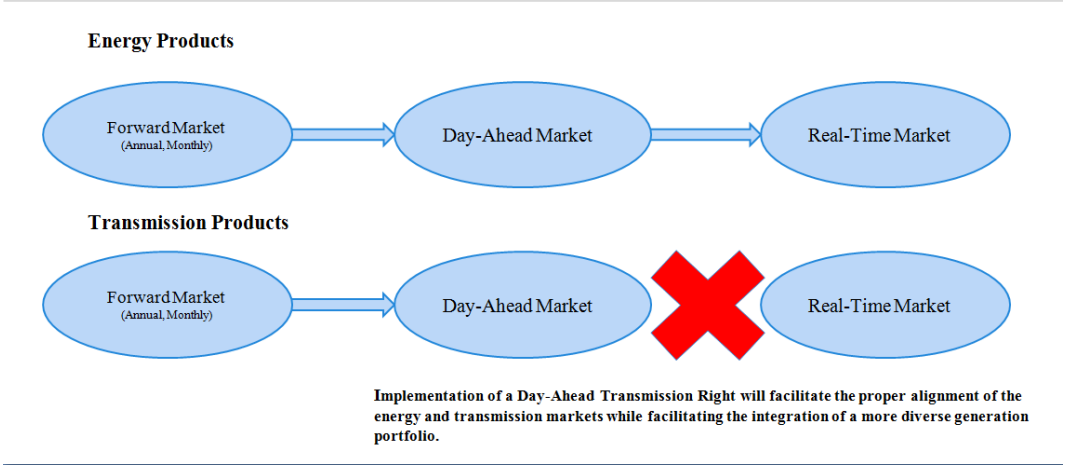
Each of the ISO/RTOs have varying financial products available. While FTRs, as well as virtual supply and demand bids, are fairly common, transmission congestion products are less common. The existence of these products is essential not only to price formation, but also the ability of market participants to hedge in a price sensitive manner. In particular, hedging is relevant not only to financial market participants, but all forms of market participants, including competitive retail electric suppliers, who need to hedge transmission congestion risks.

Fig. 5. Financial Products in the ISO/RTO Markets

ISO	Energy	Congestion	FTR	Multi-year FTR
ERCOT	✓	✓	✓	3-year
PJM	✓	✓	✓	3-year
MISO	✓	✗	✓	✗
NYISO	✓	✗	✓	2-year
ISO-NE	✓	✗	✓	✗
CALISO	✓	✗	✓	✗
SPP	✓	✗	✓	✗

The energy products in most ISO/RTO markets are increment offers ("INC") and decrement bids ("DEC"), which allow a market participant, financial or otherwise, to take a position on the LMP at a given node. That position is exposed to all three elements of LMP: energy price, congestion and losses. As such, the position bears not only risks associated with transmission congestion, but also with resulting energy prices. A product allowing market participants to take a position on the transmission congestion between two given points without exposure to the fluctuations of energy prices, allows for more granular contributions to price formation without the risk and exposure that can prove challenging to market participants whose goal is to utilize the product specifically to hedge risk.

Fig 6. Lack of an Hourly Congestion Product is a Concern



While ERCOT offers the Point-to-Point product and PJM offers the Up-To Congestion ("UTC") product, most of the other markets do not offer a congestion and losses product in their Day-Ahead markets. We note that the ERCOT market is particularly vibrant and liquid, due in part to the presence of the Point-to-Point product, which facilitates hedging by load-serving entities.[2] While PJM does offer the UTC product, its availability is limited. NYISO, MISO and CAISO have considered adding such a product and are at various stages of development, with NYISO and MISO estimating a 2020 deployment. We believe that the expansion of financial products in ISO/RTO markets, to include the development of a congestion and losses product in the Day-Ahead market, should be a priority.

Value of Competition and Proper Price Formation

As discussed above, financial transactions move the supply and demand curve to help compensate for potential underbidding by other market participants, including load and

[2] Interestingly, in ERCOT, physical asset owners are the primary users of the Point-to-Point product, with financial market participants representing 20% or less of entities engaging in these transactions. In PJM, those numbers are reversed. *See, e.g.*, ERCOT State of the Market Report at 32, *available at* https://www.potomaceconomics.com/wp-content/uploads/2017/06/2016-ERCOT-State-of-the-Market-Report.pdf

generation. Another way to view this shift in the supply curve is through the lens of depth and liquidity, which are highly valuable and essential to market efficiency in all commodity markets. In organized markets with LMP pricing, depth and liquidity are even more essential because electricity, unlike other commodities, cannot be stored. Depth in a market is a significant number of bids and offers at each of the nodes within the system. If a load-serving entity wishes to purchase electric energy in the Day-Ahead market, it would like to see a wide variety of offers to sell, which are tightly spaced. For example:

Bid Stack A	Bid Stack B
50 MW for $50.00	50 MW for $50.00
10 MW for $65.00	5 MW for $52.00 ← INC offer
25 MW for $75.00	5 MW for $54.00 ← INC offer
15 MW for $85.00	10 MW for $55.00
	25 MW for $60.00
	15 MW for $63.00

The load-serving entity would prefer to meet its Day-Ahead needs in a market that looks more like Bid Stack B because there are more choices available to the system operator and the presence of more bids has exerted a downward pressure on the prices. In this example, the two virtual offers in Bid Stack B have smoothed out the "lumps" in the bid stack, introduced competition which has exerted downward pressure on prices, and added liquidity and depth to the market.

Additionally, electricity markets must balance every hour at every location. If demand is low in the Day-Ahead market compared to what is likely in the Real-Time market, then DECs placed in the Day-Ahead market will help bring that demand up to what it is expected to be. Conversely, if supply is low in the Day-Ahead market, then INCs placed in the Day-Ahead market will help bring that supply closer to what it is expected to be in the Real-Time market. Convergence between the Day-Ahead and Real-Time markets is important because converged

markets yield lower prices to consumers. Second, energy markets are inherently volatile and risky because it can be hard for market participants to predict, in the Day-Ahead market, what the Real-Time market will look like. Financial marketers shoulder this risk on behalf of other market participants, allowing market participants to hedge the prices that they will pay against the trades placed by a financial market participant. Financial marketers also bring needed liquidity and competition to markets, and introduce competition where otherwise none (or little) may exist.

Wholesale Competitive Electricity Markets Work and Must Be Allowed to Continue Working

The Financial Marketer Coalition's focus is on strong, competitive markets. We believe that markets work and should be allowed to work with minimal government intervention, particularly in the form of out-of-market subsidies. Such out-of-market payments can distort market outcomes, yielding competitive advantages to one (or two) class of market participants, who may not otherwise be competitive. In late September, the Department of Energy submitted a draft Notice of Proposed Rulemaking ("NOPR") to FERC, proposing to compensate electric generation facilities for stockpiling fuels, in essence particularly providing subsidies to coal and nuclear fueled facilities. As you are aware, a bipartisan group of former FERC Chairmen filed comments with FERC stating that the DOE NOPR proposal will "fundamentally distort" markets, and urging FERC to reject or significantly modify the proposal.

Many have raised concerns about the potential damage to the ISO/RTO markets from financial subsidies and out-of-market payments given to certain classes of generators, particularly given the generous incentives already provided to such resources, including the benefits associated with paying the lowest effective federal tax rate of any business sector. Of the 40 U.S. publicly held utility companies that were profitable in 2015, 23 paid no federal

income taxes and 16 paid no state taxes, while earning a combined $43.9 billion dollars in pre-tax profits.[3] Regulated utilities have the luxury of building corporate taxes into the rate plans set by regulators and passed on in charges to the customer. Special tax laws and utility rate plans further provide the opportunity for utilities to postpone taxes through accelerated depreciation, allowing companies to delay paying tax on the cost of their investments while receiving essentially interest-free loans. The 23 profitable utilities that paid no federal tax in 2015 reported $11.5 billion in benefits from special tax rules that allow corporations to write off the costs of infrastructure investments.[4]

A direct result of this special tax treatment is increased costs to consumers stemming from prolific and unnecessary infrastructure enhancements. Although there is a need to replace aging infrastructure and accommodate distributed generation resources, a recent trend demonstrates an increase in transmission enhancements lacking a legitimate driver such as reliability, market efficiency or operational performance criteria.[5] The majority of new transmission projects are not needed are used merely as vehicles for utilities to amortize costs and increase profits by passing on depreciation rates to customers.

The NOPR will effectively provide a bailout for utility companies making billions in profits per year, to the harm of low-income consumers. Utilities profit by purchasing power on the wholesale market and reselling the same power to retail consumers at a premium. In August, which is a peak month, the price of wholesale power in California was approximately

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[3] Anderson, Sarah et al., *Utilities Pay Up: How Ending Tax Dodging by America's Electric Utilities Can Help Fund a Job-Creating, Clean Energy Transition*, Institute for Policy Studies at 1 (July, 2016), *available at* http://www.ips-dc.org/wp-content/uploads/2016/07/IPS-Utilities-Tax-Report-FINAL.pdf.

[4] *Id.*

[5] American Municipal Power, Inc., *Transmission Costs Drivers* at 10 (Sept. 21, 2017), *available at* http://www.amppartners.org/Assets/AMP_Rose_Transmission.pdf.

$39/MWh.[6] In contrast, the price of retail power for residential end-users was 19.02 cents per kWh, or $190/MWh.[7] In addition to profiting from the price difference between wholesale and retail power, certain types of generation resources benefit from federal and state incentive programs, such as Zero Emission Credits ("ZECs") for carbon neutral resources. Nuclear resources could be eligible for ZEC environmental subsidies even when found to be leaking radiation in the environment.[8] Providing additional subsidies to uneconomic and environmentally harmful resources is inconsistent with market fundamentals and results in actual harm to consumers. If there are important externalities that the market currently does not value, whether that is the environmental and global impact of carbon or the need for resiliency, then those externalities should be brought into the market. This has been done in other contexts – through mandatory reliability standards as well as the creation (and expansion) of the ancillary services markets within the ISO/RTO markets.

The wholesale competitive electricity markets operated by the ISO/RTOs work, and subsidies harm market equilibrium by distorting market signals and prices for consumers. The benefits brought by these markets have been quantified in many ways, including through lower costs to retail consumers in consumer-choice states. Recently the COMPETE Coalition released a report showing the demonstrable benefits of competitive electricity markets, noting that from 1997 through 2014, prices in consumer-choice jurisdictions increased 4.5% less than inflation,

[6] This number was calculated by Red Wolf Energy Trading internally, based on CAISO's published data.

[7] Electric Power Monthly Data for August 2017, Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector, by State (Oct. 24, 2017), *available at* https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

[8] Chase, Brett et al., *Radioactive Water Leaks from Illinois Nuclear Plants*, Better Government Association (Nov. 17, 2017), available at https://projects.bettergov.org/power-struggle/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202017-11-20%20Utility%20Dive%20Newsletter%20%5Bissue:12938%5D&utm_term=Utility%20Dive.

while prices in regulated jurisdictions rose 8.4% more than inflation. Stated another way, the authors found that "[b]etween 1997 and 2014, all-sector nominal weighted average prices in Customer Choice Jurisdictions rose by 41%, but rose by 60% in the Monopoly States."[9] These prices are real costs – and real savings – to real consumers.

Academic Studies Have Confirmed and Quantified the Benefits of Financial Transactions

In the past several years, the value that financial marketers bring to the market has been questioned. Some have asked whether the value financial marketers bring to the market exceeds the value that they extract from the market. We firmly believe that financial marketers bring benefits to the market significantly in excess of the cost of their participation. A study by two economists at Stanford University found that the introduction of Convergence Bidding in California created significant economic and environmental savings for consumers.[10] The study found that those savings specifically came in two areas.

- First, the annual total cost of fossil fuel energy decreased by about roughly $70 million dollars per year in the year following the introduction of Convergence Bidding, through more efficient unit commitment.
- Second, the study found, Convergence Bidding resulted in a reduction of greenhouse gas emissions of approximately 2.8%, or between 537,000 and 650,000 pounds of emissions annually, again through better underlying unit commitment.[11]

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[9] O'Connor, P. and O'Connell-Diaz, E., *Evolution of the Revolution: The Sustained Success of Retail Electricity Competition* at 5-7 *available at* https://sites.hks.harvard.edu/hepg/Papers/2015/Massey_Evolution%20of%20Revolution.pdf

[10] JHA, A AND WOLAK, F, *Testing for Market Efficiency with Transaction Costs: An Application to Convergence Bidding in Wholesale Electricity Markets* at 23 (May 7, 2013) available at http://web.stanford.edu/group/fwolak/cgi-bin/sites/default/files/files/CAISO_VB_draft_V8.pdf.

[11] This occurred through the pre-positioning of the Day-Ahead market, allowing more efficient units to run instead of the system operator calling on less-efficient units in the Real-Time market.

At the same time that year, the profits extracted from the market by entities trading Convergence Bidding was approximately $13 million in 2011 and $18 million in 2012.[12] While this study was done in the smaller CAISO market, it shows profound savings – with Convergence Bidding bringing value ***over four times greater*** than the cost of such trading in fuel costs alone, not including the value of avoided carbon emissions, and the longer term value of better pricing in the forward market to all market participants. Specifically, the study noted:

> Although it was possible to implicit virtual bid before the introduction of explicit virtual bidding, the evidence from our analysis is that the introduction of this product significantly improved the degree of price convergence between the day-ahead and real-time markets ***and reduced the cost of serving load*** in the California ISO control area.[13]

Dr. John Parsons, in conjunction with the FERC Office of Enforcement, performed an analysis of convergence bidding in the CAISO markets, questioning the value of virtual transactions and referencing certain virtual bidding as "purely parasitic." Dr. Parsons' paper was highly skewed against virtual trading, seeking to find examples to prove that such transactions are not beneficial to competitive wholesale electricity markets. Dr. Parsons' analysis focused on ramping events in CAISO where virtual traders were consistently buying Day-Ahead energy and profiting from the ramping and scarcity pricing that occurs during the peak hours in California

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Note that the dollar value of reduced greenhouse gas emissions is not included in the $70 million savings.

[12] California Independent System Operator, *Market Issues and Performance: 2011 Annual Report* at 87 (2011), http://www.caiso.com/Documents/2011AnnualReport-MarketIssues-Performance.pdf; California Independent System Operator, *Market Issues and Performance: 2012 Annual Report* at 109 (2012), http://www.caiso.com/Documents/2012AnnualReport-MarketIssue-Performance.pdf. We note that we refer only to the profits associated with internal Convergence Bidding, and do not include values associated with Convergence Bidding at the interties or in imports/exports.

[13] Wolak Study at 23 (emphasis added). *Cf.* Parsons, J, Colbert, C., et al., Financial Arbitrage and Efficient Dispatch in Wholesale Electricity Markets at 1 (Feb. 2015) (setting out to demonstrate in which circumstances virtual trading does not bring benefits, but not defining how frequently the hypothesis actually occurs).

when load is rising quickly and renewables are simultaneously ramping offline. The fatal flaw of Parson's analysis was in not rerunning the Real-Time results. Dr. Parsons failed to answer the critical question of whether the virtual transactions that were committing additional resources were lessening the frequency and severity of the shortage pricing events. Regardless, virtuals were committing additional generation in the Day-Ahead and making CAISO more reliable during scarcity events.

But There Are Flaws in the ISO/RTO Markets

While the Financial Marketers Coalition strongly supports the concept of the ISO/RTO markets, in practice, there are issues to be addressed. The primary issue faced by minority interests such as financial market participants, is the strength of entrenched utility interests in the stakeholder process, the resistance of those interests to new market entrants and the deference that the staff of the ISO/RTOs give to these incumbent interests. During the last Powering America hearing, Ranking Member Bobby Rush (D-IL) welcomed discussion on the market issues associated with RTOs beholden to incumbent utilities:

> As we will soon hear, Mr. Chairman, many consumer advocacy groups believe that the RTOs are too beholden to the utilities than they are trying to administrate. And consumers do not have a large enough seat at the table to make their voices heard. Many of these advocates argue that the whole process for reforming energy markets have become more and more complex, while at the same time consumer voices have been diluted to the point of being completely shut out. There also seems to be, a new consensus, Mr. Chairman, among today's witnesses, that FERC and DOE have become too tolerant of the RTOs' ability to shut out public interests, and participation, and policymakers must act to address this challenge.[14]

Ranking Member Rush's concerns are very accurate, but they extend past consumers to encompass all minority interests in the ISO/RTO stakeholder process, among them financial

[14] Transcript of Powering America: Consumer-Oriented Perspectives on Improving the Nation's Electricity Markets at 3-4 (Oct. 7, 2017), *available at* http://docs.house.gov/meetings/IF/IF03/20171005/106470/HHRG-115-IF03-Transcript-20171005.pdf

market participants. Recent initiatives in the PJM stakeholder process to essentially eliminate the UTC product by imposing a double tax through uplift payments and reducing by over 90% the points at which such transactions may be placed, highlight these stakeholder process concerns. These proposals are currently pending at FERC, where we have strongly argued that FERC must act to protect financial trading and send a strong message to the ISO/RTO, its staff and stakeholders regarding voting and process irregularities.

Conclusion

In conclusion, the Financial Marketers Coalition greatly appreciates the opportunity to testify to the Subcommittee on the role and importance of financial trading in wholesale competitive electricity markets operated by the ISO/RTOs. We believe that the markets work, and should be allowed to continue working. We also believe that financial trading is a key element in maintaining competition, liquidity and good price formation in those markets. We do see areas for improvement and look forward to working with the Subcommittee, FERC and the ISO/RTOs on these issues.