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Title: Trouble in Market Paradise: Development of the Regional Transmission Operator

JEL Codes: L1, L5, and L9

Short Abstract

Regional Transmission Organizations (RTOs) have evolved from "power pool" arrangements between utilities to complex organizations that operate the region's transmission system and power markets. These RTOs are administered with only peripheral public input. The result is that RTOs have developed very complex market structures that few can or do understand.

Long Abstract

Over the last twenty years, Regional Transmission Organizations (RTOs) have evolved from "power pool" arrangements between regulated and vertically integrated utilities to complex organizations that operate the region's high voltage transmission system and multiple power markets. In that time RTOs have become major enterprises with considerable influence that now plays a critical role in the U.S. utility infrastructure. These institutions did not evolve by design or from government fiat, but rather have developed and grown over time taking on increasing responsibility and importance. The result has been institutions that were not prescribed by legislation or regulation that now exert a powerful influence with little public input. These RTOs are governed by "independent" boards and committees of "stakeholders" that include market participants with strong economic interest in rules and procedures of the RTO. Public input is peripheral, at best. The result can be seen in how the RTOs have adapted to regulatory requirements and other perceived challenges as they arise—they have developed complex market structures that few can or do understand. An example is how RTO capacity markets have changed over time, with the result being something that is unrecognizable as a "market" or as a practical solution to providing incentives to ensure future reliability for customers in the RTO. Instead it appears that the capacity markets could swing from under-capacity to over-capacity positions, increasing risk, wasting resources and increasing cost. Ironically, the RTOs that exist today do not even serve the stakeholders very well, except the RTOs themselves. The paper will also discuss reforms that are needed to align the RTOs' behavior with Trebing's public interest regulatory philosophy.

Introduction

Professor Harry M. Trebing laid out five "major postulates" of the institutionalist model in his 1987 article, "Regulation of Industry: An Institutionalist Approach."[1] The first of these postulates states the institutionalist's argument for why government intervention is necessary. Trebing writes that intervention is needed because "industrialized societies give rise to concentrations of power, increased uncertainty, performance failures, uncompensated costs, and adverse distributional effects" and that for "many sectors, markets are not self-correcting and are incapable of assuring an adequate supply of goods and services at least cost."

It would difficult to find a better real-life and more current example of Prof. Trebing's first postulate than today's U.S. electricity supply business. Since those words were written by him nearly 30 years ago, Regional Transmission Organizations (RTOs) have evolved from "power pool" arrangements between regulated and vertically integrated utilities to very complex organizations that operate regional high voltage transmission system and multiple power markets in most of the U.S. RTOs over the last 20 years have become major enterprises with considerable influence that now plays a critical role in the U.S. utility infrastructure. The largest RTO by sales volume is PJM Interconnection, which covers a region that includes all or part of 13 states and the District of Columbia with over 61 million people.[2] In 2014, PJM produced 837,796 *Giga*watt hours of energy and had over $50 billion billings for the year.[3]

These RTOs did not evolve by design or from government fiat, but rather have developed and grown over time taking on increasing responsibility and importance. The result has been institutions that were not prescribed by legislation or regulation but now exert a powerful influence with little public input. These RTOs are overseen by the Federal Energy Regulatory Commission (FERC) and are governed by "independent" boards and committees of "stakeholders" that include market participants with strong economic interest in rules and procedures of the RTO. However, public input is peripheral, at best.

RTOs have grown and adapted to regulatory requirements and other perceived challenges over the years and this has led to considerable complexity. This includes multiple market structures that few can or do understand. A prime example, discussed here, is how RTO capacity markets have changed over time, with the result being something that is unrecognizable as a "market" or as a practical solution to providing incentives to ensure future reliability for customers in the RTO.

RTO Capacity Markets

The argument for creating a capacity markets within the RTO structure was that energy and ancillary services market revenues alone were insufficient to induce an adequate amount of new capacity or to prevent existing capacity from leaving the market.[4] Additional capacity payments would, in this view, induce new entry and encourage existing facilities to remain or expand.

In recent years, there has developed a heightened sense of urgency as power plants close or are scheduled to close soon. The cause of these closures and announcements has been attributed to the continued relatively low electricity energy prices (largely a consequence of relatively low natural gas prices), the impact on energy prices from intermittent power sources (primarily wind), and stricter environmental requirements for existing coal power plants. In response, some RTOs have altered or "enhanced" their capacity markets to improve performance by capacity resources. While there is renewed urgency, the overall goal is the same: How do RTOs attract sufficient new resources and retain existing resource capacity that will maintain acceptable levels of reliability, and do so at a reasonable cost to consumers?

PJM's "Capacity Performance"

In response to its own concerns, PJM recently changed its capacity market mechanism, the "Reliability Pricing Model" (RPM), to "Capacity Performance." In the filing with FERC,[5] PJM stated that they believe that the RPM capacity market has been successful in securing capacity commitments, but that the RPM rules on capacity performance have not kept pace with that growth, and did not adequately ensure actual performance.[6] They also noted that capacity resources committed in RPM did not face significant adverse consequences for failing to provide energy and reserves when needed.[7]

They also noted that the shift from coal to natural gas-fired generation has driven electricity prices sharply lower and inhibited needed investments in plant upgrades and modernization. Finally, the polar vortex in the winter of 2014 revealed that stronger incentives are needed to encourage investment for better generation performance.

To address these limitations, PJM proposed a new capacity "product," or "Capacity Performance" that is a requirement that generators must meet their commitments to deliver electricity whenever PJM determines they are needed to meet power system emergencies. This includes charges or penalties for poor performance (Non-Performance Charges) and credits for superior performance (Performance Bonus Payments).

In the 2015 auction, for the 2018/2019 "Delivery Year," PJM had two capacity products in the RPM auctions:

1) Capacity Performance, or "CP," resources that must be capable of "sustained, predictable operation" and be available throughout the entire delivery year.

2) Base Capacity resources that may not be capable of “sustained, predictable operation” and may not provide energy and reserves outside of the summer period. Base Capacity resources include:
   - Base Capacity Demand Resources (DR), which are expected to be available only during the summer months;
   - Base Capacity Energy Efficiency (EE) Resources, which are expected to provide permanent continuous load reduction, also only during the summer months; and
   - Base Capacity Generation Resources, which are expected to be available throughout the Delivery Year, but unlike Capacity Performance Resources, Base Capacity Generation Resources will be subject to non-performance charges only when they fail to perform when needed during the summer months.

PJM explains that since Base Capacity Resources do not have the same level of availability as CP Resources, constraints are needed to limit the quantity of Base Capacity Resources that can be procured in the RPM auction. Therefore, there is a maximum limit that can be procured in the auction on the total quantity of Base Capacity DR, Base Capacity EE and Base Capacity Generation Resources for the entire RTO and each “modeled” Locational Deliverability Area (LDA). (LDAs are constrained locations within PJM that have been determined to have resource and transmission limitations for the delivery year that results in the area not meeting PJM’s reliability requirement.[8])

Capacity Performance Results[9]

FERC approved PJM’s plan for Capacity Performance in June of 2015[10] and PJM held the first Capacity Performance BRA and two transitional auctions in August and September of 2015. For the 2018/2019 delivery year BRA, the clearing price for Capacity Performance resources (which includes generation, demand response and energy efficiency), was $164.77/MW-day for all of PJM. For two “constrained areas,” the Capacity Performance clearing price for the ComEd area was $215/MW-day and for the Eastern MAAC area, the price was $225.42/MW-day. The RTO clearing price in last year’s auction was $120/MW-day.

The *base* capacity clearing price for the RTO was $149.98/MW-day, about $15 less than the Capacity Performance price. The base capacity price in ComEd is $200.21/MW-day; in Eastern MAAC, $210.63/MW-day; and in the PPL delivery area in Pennsylvania, $75.

In total, the auction procured 166,837 megawatts of capacity and included over 3,500 megawatts of “new generation,” which PJM defines as including more than 2,900 MW of actual new generating units and over 500 MW of uprates to existing generating units. A total of 11,084 MW was from demand response, 1,484 MW of which is Capacity Performance. Energy efficiency totaled 1,247 MW, with 887 MW being Capacity Performance. Renewables resources, according to PJM, totaled 14,347 MW (nameplate).

Assessment of PJM's Capacity Performance Construct

Based on PJM's own evaluation, the previous version of the RPM capacity market was clearly inadequate to the task of securing sufficient capacity resources to maintain reliability—particularly when the system was under significant stress, such as the winter of 2014. The Capacity Performance construct was specifically designed by PJM to address this shortcoming. However, the main feature of the change is higher prices for the new CP "product"—that is, higher prices for the resource suppliers in exchange for greater availability of that resource.

While Capacity Performance product will transmit more revenue to the resource suppliers and may lead to more capacity availability, it does not really create a *market* for capacity. What PJM has done is simply enhance the previous RPM construct—that is, enhanced it to create more revenue. Ideally, as market conditions change (for example, from an exogenous change such as lower fuel prices), the price for energy, ancillary services, and capacity will change in response. In competitive markets, the supply and demand for a final product are continuously shifting as the underlying factors of production and demand shift.

In contracts, with RPM and the enhanced Capacity Performance RPM, the "demand curve" (specifically, the Variable Resource Requirement (VRR) curve) is actually an artificial construct based on net Cost of New Entry (or net CONE, as estimated by PJM's "Independent Market Monitor") and PJM's target reserve margin or resource requirements set by the RTO—not an actual *market* demand curve. The actual demand for capacity is unknown, of course. The auction prices change based on the bids and the VRR curve, not as consumer preferences and market condition changes. The designed intent is to increase the revenue to successful bidders, and it did so in the last auction when compared with the previous auction. However, the policy change *is* the response, not the market price responding to the changing market conditions and consumer preferences.

As an example of this non-market response, consider a change in the cost of production, such as the price of natural gas. A higher natural gas price would likely lead to higher energy prices for electricity, such as what occurred from about 2002 to 2008. The overall cap on auction prices may decrease (from a lower net CONE), but the actual auction clearing prices may not change significantly since the cap typically does not constrain the price. The result is that the total combined price for energy, ancillary services, and capacity will increase. This total price may exceed average cost of some suppliers and provide considerable economic profit.

This could work the other way as well, the energy price could decrease and result in the total combined price below average cost, resulting in, eventually, plant closures. Of course, it is likely that if this were to occur, the resource owners would request another change to the capacity market to increase their revenue. This would mean that the Capacity Performance product is no better at responding to overall price changes than the previous version of the RPM capacity construct.

Conclusion

Redesigned capacity markets, such as PJM's RPM, are generating more revenue for capacity owners, however, it may well still be insufficient, from the resource suppliers' perspective. From the customers' perspective, the cost continues to increase, even when energy prices have fallen and remained relatively low since the late 2000s. This seems to confirm Prof. Trebing's first postulate, particularly that markets for this type of product are not "self-correcting" and cannot assure "an adequate supply of goods and services at least cost."

Rather than self-correcting, most of the changes to PJM's RPM have been piecemeal, that is, small fragmentary changes that are actually adjustments to increase compensation, not to develop a better market mechanism. The changes have also been ad hoc, or unplanned adjustments to the limitations of the previous arrangement, after those limitations have revealed themselves. This has made RTO capacity constructs a never ending project, requiring constant adjustments and occasional significant overhaul.

There are two fundamental problems that can be identified. First, the capacity constructs are not responsive to changes in market conditions. As energy prices and other market conditions change, a capacity mechanism should adjust as well. A self-sustaining mechanism would not require constant large-scale changes. And second, there is a mismatch between the way RTOs dispatch their system, and the way resource suppliers are compensated for the value of the energy and capacity they supply. A self-sustaining system would encourage behavior by resource suppliers that are in their own and the public's interest, and not require constant adjustments and repairs.

Instead it appears that RTOs could swing from under-capacity to over-capacity positions, increasing risk, wasting resources and increasing cost. Ironically, the RTOs that exist today do not even serve the stakeholders very well, except the RTOs themselves, since generation suppliers complain that they are still not receiving sufficient revenues to cover cost. A witness for utilities operating in Ohio complained that "[m]arket-based revenues for energy and capacity have been at historic lows and are insufficient to permit [FirstEnergy Solutions Corp.] to continue operating the Plants and to make the necessary investments. Near-term forecasts for energy and capacity prices are unfavorable. While . . . forecasts that market prices for energy and capacity will increase over time, the Plants may not survive to see these better days."[11] This statement was made before PJM's Capacity Performance was implemented, however, to date, the companies' position has not changed when seeking more revenue from utility customers.

What reforms are necessary to align the RTOs' behavior with Trebing's public interest regulatory philosophy? Prof. Trebing's postulates of the institutionalist model are again useful here as well. His fourth postulate is that "strategies of actors in the regulatory process can have a significant impact on the outcome"—and that "success or failure of these strategies will be in direct proportion to the economic and political power that the participants can exercise."[12]

In a 1984 essay, Prof. Trebing summarized another institutionalist, Horace M. Gray's take on economic regulation the sharing of economic and political power, noting that "Gray argued that regulation involves a sharing of power between public and private authority, but such sharing is inherently unstable because private power will ultimately co-opt public power. This comes about because of government's failure to apply its power . . .."[13] FERC has only used oversight authority as RTOs were developing markets and other pricing mechanisms.

Needless to say, RTOs have already amassed considerable economic and political power, and, as Prof. Trebing warned, trying to reassert regulatory primacy, once lost, is difficult to regain. Perhaps FERC, or more likely now, legislators, will realize (let us hope sooner rather than later) that it is not a good idea to have so much economic and political power concentrated in the hands of one large private interest.

Prof. Trebing's fifth and final postulate was that regulatory intervention may change over time. Clearly, RTO's have evolved in ways that were unforeseen by the regulatory agency (FERC) that allowed them to turn into the colossuses that they have become. After multiple adjustments and further disappoints with the results, at some future date, perhaps FERC or federal legislators will become more reform-minded.

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[1] Harry M. Trebing, "Regulation of Industry: An Institutionalist Approach," *Journal of Economic Issues*, Vol. 21, No. 4, Evolutionary Economics II: Institutional Theory and Policy (Dec., 1987), pp. 1707-1737.
[2] See, http://www.pjm.com/about-pjm/who-we-are.aspx for a summary of PJM's operations.
[3] 2014 PJM Annual Report, http://www.pjm.com/~/media/about-pjm/newsroom/annual-reports/2014-annual-report.ashx
[4] For a more detailed explanation of these capacity markets, see Kenneth Rose, "An Examination of RTO Capacity Markets," IPU Working Paper No. 2011-4, September 1, 2011, http://www.ipu.msu.edu/research/pdfs/Working-Paper-Rose-Capacity-Markets.pdf.
[5] PJM Interconnection, L.L.C., Docket No. ER15-623-000, "Reforms to the Reliability Pricing Market ("RPM") and Related Rules in the PJM Open Access Transmission Tariff ("Tariff") and Reliability Assurance Agreement Among Load Serving Entities ("RAA")," December 12, 2014.
[6] PJM FERC Dec. 2014 filing, page 6.

[7] PJM FERC Dec. 2014 filing, page 7.
[8] Specifically, PJM defines a constrained LDA as an area with Capacity Emergency Transfer Limit (CETL) less than 1.15 times Capacity Emergency Transfer Objective (CETO). PJM identified 27 sub-regions as LDAs that are evaluated for locational constraints. PJM will add (if approved by FERC) new LDAs if warranted by reliability concerns. Also, others may propose possible LDAs, and PJM would then evaluate the request. For details, see "PJM Manual 18: PJM Capacity Market," http://www.pjm.com/~/media/documents/manuals/m18.ashx
[9] More detail of the Performance Capacity auction results will be in a forthcoming paper that updates the Rose, 2011 paper noted above.
[10] Federal Energy Regulatory Commission, Docket Nos. ER15-623-000, EL15-29-000, ER15-623-001, and EL15-41-000, Order on Proposed Tariff Revisions, Issued June 9, 2015.
[11] Direct Testimony of Donald Moul on behalf of Ohio Edison Company, the Cleveland Electric Illuminating Company, and the Toledo Edison Company, August 4, 2014, before the Public Utilities Commission of Ohio, Case no. 14-1297-EL-SSO.
[12] Trebing, "Regulation of Industry," p. 1715.
[13] Harry M. Trebing, "Public Utility Regulation," in *An Institutionalist Guide to Economics and Public Policy*, edited by Marc R. Tool, pub. M.E. Sharpe, Inc. 1984, p. 215.