Testimony of Craig Glazer

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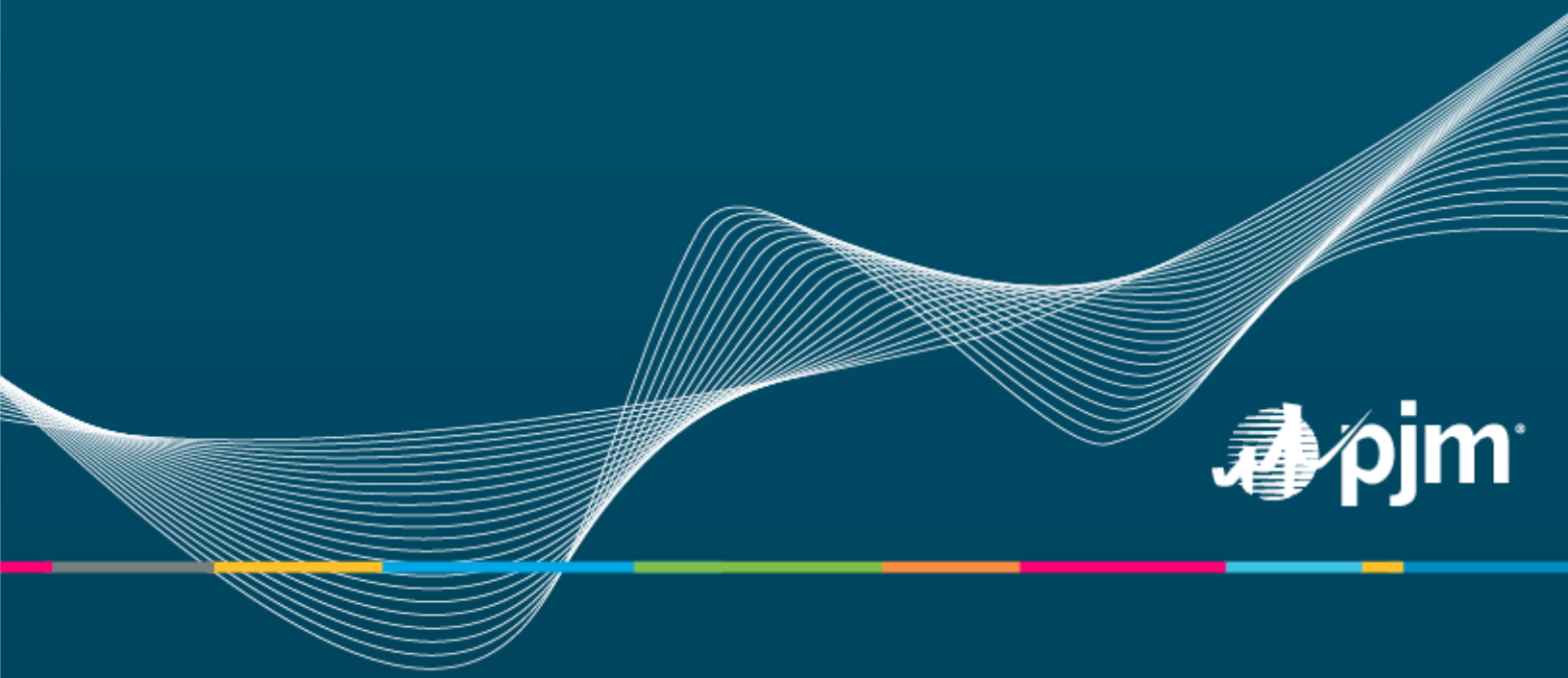
Before the Subcommittee on Energy
Committee on Energy and Commerce
U.S. House of Representatives

On "Powering America: A Review of the Operation and Effectiveness of the Nation's Wholesale Electricity Markets"

July 26, 2017



Executive Summary

As the Regional Transmission Organization serving all or parts of the states of Illinois, Indiana, Michigan, Ohio, Kentucky, Tennessee, West Virginia, North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey and the District of Columbia, PJM has brought reliable electric service and competitive wholesale electricity prices to over 65 million Americans. In addition, PJM and its markets have been widely and independently recognized by the investment community as a region whose market structure strongly supports investment in new generation, the upgrading of existing generation and the deployment of new innovative technologies. Given the capital-intensive nature of the electric industry, our combination of low competitive rates along with continued investment in generation and demand response resources is a sound testimonial that the markets have achieved much of what Congress intended when it first introduced competition into the wholesale electric industry through the Energy Policy Act of 1992.

The markets that PJM and other RTOs operate can be analogized to a kitchen blender. Like your kitchen blender, the markets produce the most efficient and cost effective results based on the ingredients put in. As a result, we need to continually examine the parameters surrounding the ingredients we put into the blender to ensure that those are designed to produce the outcomes that we seek. The RTO markets can then be counted upon, as they have in the past, to produce efficient and competitive outcomes consistent with the policy choices (i.e. the ingredients) that have been chosen.

PJM concurs with many of the past witnesses who have pointed out that portions of the generation fleet including coal and nuclear resources are challenged as a result of very low natural gas prices, limited growth in the demand for electricity and the impact of various environmental and safety requirements. The question however, is not *whether* these issues should be addressed but instead *how* they are addressed. Consistent with the move toward competition in the Energy Policy Acts of 1992 and 2005, the PJM model has shown that thoughtful market-based solutions, rather than policymakers at the state or federal level picking winners and losers, remains the best means to address such challenges. Consistent with its proactive philosophy, PJM is 'seizing the moment' to propose various initiatives to address these issues including:

- operating and planning the system to enhance the resilience of the grid;
- proposing to the Federal Energy Regulatory Commission ("FERC") reforms to its price formation rules so as to better recognize the attributes that key generators (including those which have come to be labelled 'baseload generation') bring to the grid; and

- working with our stakeholders on proactive rule changes that would ensure that the market can continue to accommodate individual state policies but do so in a manner which still preserves competitive outcomes and does not burden neighboring states that may not have endorsed that particular state policy.

In this testimony, PJM urges consideration by the federal government for these reforms, almost all of which appropriately are within the FERC's jurisdiction.

Our testimony outlines various steps that would be helpful for the federal government to take and some which would not be helpful. In this latter category of what would not be helpful, we note that this is a critical time when we need to encourage investment in new generation and new technology as well as existing generation. On this issue, words do matter. As a result, although debate on various market rules is perfectly appropriate, we caution against the potential to add greater uncertainty to the markets by signaling some kind of wholescale retreat from the competitive market model that has been in place since the mid-1990's and has worked well to keep prices low and investment certain. The PJM markets have weathered many challenges to the industry ranging from the impact of EPA's Mercury and Air Toxics rule on the coal fleet to the threats of cyberattacks on the grid itself. We are stronger as a result and are confident that innovative market-based solutions, which have been the hallmark of PJM since its inception, can continue to serve us well in addressing our new set of 21st century challenges.

Introduction

On behalf of PJM Interconnection, L.L.C. ("PJM"), I want to thank Chairman Upton, Ranking Member Rush and members of the Subcommittee and its staff for calling this important hearing today. My name is Craig Glazer. I serve as Vice President of Federal Government Policy for PJM. Based in suburban Philadelphia, Pennsylvania and honored to be a constituent of Rep. Ryan Costello of this Committee, PJM operates one of the nation's largest competitive wholesale electricity markets and ensures reliability of the bulk electric grid in all or parts of Illinois, Indiana, Michigan, Kentucky, Tennessee, Ohio, West Virginia, North Carolina, Virginia, Maryland, Pennsylvania, Delaware, New Jersey and the District of Columbia. Thank you for the opportunity afforded to PJM in offering our perspective on this topic and to participate in the subcommittee's *Powering America* series. By way of personal background, I came to PJM after having served for a decade as Chairman and Commissioner of the Public Utilities Commission of Ohio during a critical period when competition was successfully introduced into the state's electric, natural gas, telecommunications and transportation industries.

Turning to this morning's testimony, my comments are divided into three parts.

- First, I will offer a brief background concerning PJM. I will discuss the formation and role of PJM with a focus on (a) why policymakers, including this Congress, sought to restructure the industry and (b) how that process has worked;

- Second, I will cover the benefits delivered by PJM's wholesale electricity markets. There have been over $2.8 billion in savings to customers as a result of the efficiencies gained by operating the system more reliably and utilizing competitive markets as a tool to ensure that electricity is delivered at the lowest reasonable cost for consumers. As an aside, you don't have to take my word on these issues. In real dollars, at an average price of $29 per megawatt-hour, wholesale electricity prices are the lowest they have ever been in our region and the system is operating more reliably and efficiently than it ever has before the formation of Regional Transmission Organizations ("RTO");

- Third, and finally, I will outline some of the future challenges we all face. In the Energy Policy Act of 2005 Congress defined bulk electric system reliability as compliance with standards promulgated by the North American Electric Reliability Corporation ("NERC"). Under these criteria, and using our own market rules, PJM is extremely reliable and has enjoyed a strong reserve margin that has enabled us to get through the most recent incidence of hot weather without incident. Similarly, PJM managed the change-out of over 20,000 MW of generation that retired as a result of both low gas prices and EPA's Mercury and Air Toxics ("MATS") rule without reliability being degraded. But whether we are talking about potential cyber-attacks or

natural gas pipeline interruptions, we are undertaking a number of initiatives to make this *already reliable* system more *resilient* in the future. In this vein, I will briefly list on pages 10 to 14 those actions by the federal government that would be helpful to these efforts and, will outline a few actions which, quite candidly, would not be helpful.

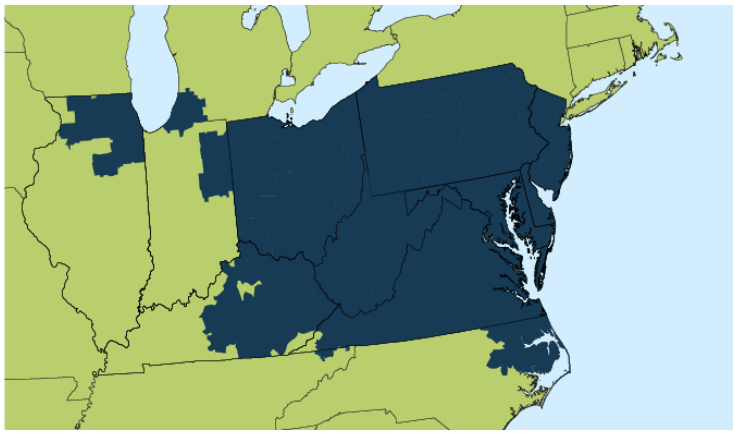
Background

The Role of PJM and Regional Transmission Organizations

This year marks PJM's 90th anniversary as an organization. In 1927, three contiguous utilities in Pennsylvania and New Jersey interconnected their respective transmission systems; for the first time allowing power to flow across their coordinated networks. The Pennsylvania – New Jersey Interconnection, an independent organization and the original name of PJM, was established to oversee the operation and planning of this coordinated system. In operating three distinct systems on a coordinated basis, reliability enhanced as costs decreased. As nearly a century passed, the industry evolved and so too did PJM's role and membership.

Today, PJM is officially classified as an RTO regulated by FERC. As shown on **Figure 1**, today PJM is responsible for the reliable operation of the power grid for all or parts of 13 states and the District of Columbia. The region serves over 65 million people with 21 percent of the nation's Gross Domestic Product being produced within our footprint. Our headquarters are located in Valley Forge, Pennsylvania and we are grateful for the work of Rep. Costello whose District includes the PJM campus.

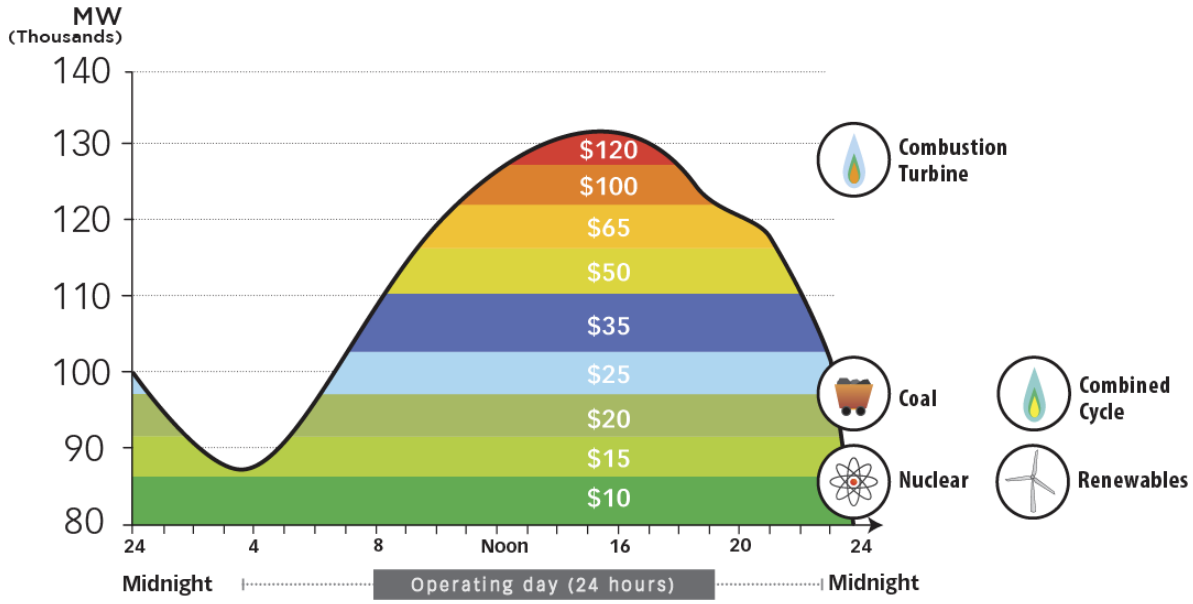
Figure 1. PJM Service Territory & Evolution



RTOs are voluntary organizations, entered into by the owners of high-voltage transmission assets – such as Pepco, Dominion Power, or AEP. Since I have been at PJM, our footprint has doubled in size as more utilities have seen value in being members of an RTO and through it, the value of coordinated system operations. *Value* is reflected as

cost savings for customers. *Value* is reflected as enhanced reliability. And *value* is also reflected in RTO markets serving as an effective platform for incenting deployment of new innovative technology. RTOs also enable the Congress' vision of open, non-discriminatory access to the transmission system by all parties to promote the nation's policy of enhanced electric supply competition. By way of example, **Figure 2** depicts PJM's energy market working in real-time operation to meet customer demand. As demand for electricity increases throughout the day, PJM utilizes a function - *economic dispatch* – to procure the most cost effective resources that will reliably serve demand at any five-minute increment of time. That supply can consist of any combination of power generation resources available at that time.

Figure 2. Economic Dispatch – Matching Supply with Demand



The benefits of coordinated system operations are as true today as they were when PJM was established 90 years ago. By leveraging economies of scale and diversity of footprint, utilities decrease their operating costs. Today, PJM's regional grid and market operations produce annual savings of $2.8 billion to $3.1 billion by ensuring reliability and least cost supply across the region served.

The Proven Track Record: Benefits Of PJM Wholesale Markets

In deregulating the wholesale electricity industry, Congress sought to use competition as a means to drive efficient pricing for customers. Competition would place downward pressure on electricity prices in two regards. First, with competition, plant operators would be incented to operate their plants as efficiently as possible to remain competitive. Second, easing both entry and exit of generating resources would yield the most economic portfolio of assets which are available for dispatch to meet demand in a given hour.

PJM's market enables electric energy to be exchanged economically and automatically when less expensive resources in one area can be used to meet consumer electricity demand in another area. Through managing lower energy production costs, minimizing costly reserve margins and attracting new investment, the PJM market accounts for nearly $2 billion of PJM's annual savings to customers.

Technology Innovation

Markets determine whether the theoretical promise of a new innovation is realized under real-world operating conditions. Through providing open, non-discriminatory access to the transmission system; through allowing all megawatts to evenly compete to supply demand; and, through the display of a transparent price signal, the wholesale markets attract investment and foster technology innovation.

Moreover, PJM developed the world's largest market for demand management technologies. To serve demand, the market has attracted annual commitments as high as 1,700 megawatts and 14,000 megawatts for energy efficiency and demand response, respectively. These technologies have the opportunity to economically compete against power generation as a measure to offset customer demand.

PJM has also been recognized as a leader in serving as a testbed for new technology deployment. PJM alone accounts for almost half of the nation's 724 megawatts of non-pumped hydro, grid-scale energy storage resources.

Market Pricing

When adjusting for inflation, market prices for energy were at an all-time low of $29 per megawatt-hour in 2016. This continues the general downward trend of energy prices experienced over the last six years in PJM.

Although some witnesses at the July 18 hearing criticized the PJM capacity markets, that market has worked well to attract new investment even in the face of low energy prices. Since its inception in 2007, the PJM capacity market has resulted in the development of over 49,000 megawatts of new, iron-in-the-ground power generation. The market has also brought in tens of thousands of megawatts of demand management technologies, as noted above. Similarly, PJM's most recent auction for system capacity – a forward market for all supply resources – procured the RTO's largest reserve margin at a price that is up to 66 percent of the net cost to build a new facility. This represents high levels of reliability at extremely competitive pricing outcomes for customers both today and into the future. I view this generation as a key 'down payment' on ensuring a resilient infrastructure that will serve the American economy well for many years.

The Facts Concerning 'Self-Supply' Opportunities for Public Power Entities

At the July 18 hearing, witnesses for public power may have created a number of misimpressions on the issue of whether these entities can 'self-supply'. A review of the facts on this subject is in order:

- For one, we do appreciate that ODEC witness Jack Reasor acknowledged in response to questions that PJM had put through rule changes that allowed public power entities in PJM the right to "self supply". Mr. Reasor referenced a recent Court of Appeals decision which overturned certain other parts of FERC's ruling on that matter but which did not overturn the specific agreed-to arrangement that PJM and its stakeholders worked out with public power entities. As a result, the right to self-supply in our capacity market and energy market has been negotiated with public power and fully honored by PJM and its stakeholders. To suggest otherwise, is simply not consistent with those facts.

- In addition, public power entities have been availing themselves of their ability to self supply and have been building new generation in PJM as a result. Since the inception of our capacity markets, we have seen public power develop and bring into commercial operation over 1,375 MW of new generation or uprates to existing public-power owned generation in order to "self supply" their own customers. Recent public power generation additions include:

    - Meldahl Hydro Electric Plant; OH (American Municipal Power)
    - Willow Island Hydro Generation Project; WV (American Municipal Power)

- Belleville Hydro Electric Plant; WV (American Municipal Power)
- Smyrna Natural Gas 1 – 2; DE (Delaware Municipal Electric Coop.)
- Orchard Hill Renewable Energy Station; IL (Hoosier Energy Rural Electric Coop.)
- Livingston Landfill Gas; IL (Hoosier Energy Rural Electric Coop.)
- Louisa Natural Gas 1 – 5; VA (Old Dominion Electric Coop.)
- Rocksprings Natural Gas 1 – 2; MD (Old Dominion Electric Coop.)
- Wildcat Point Natural Gas; MD (Old Dominion Electric Coop.)
- Kerr Dam Hydro; VA (Southeastern Power Administration)
- Vineland Oil Unit 9; NJ (Vineland Municipal Electric Utility)
- Down Natural Gas Power Plant; NJ (Vineland Municipal Electric Utility)
- Clayville Natural Gas Unit 1; NJ (Vineland Municipal Electric Utility)
- Elkhart Landfill Gas; IN (Wabash Valley Power Association)
- Jay Landfill Gas; IN (Wabash Valley Power Association)

Challenges

Just as in days past, the industry continues to face challenges. This period of sluggish growth in demand and low natural gas prices brings both benefits to customers and the grid but also a new set of challenges. Some of those are outlined below.

The Impact of the Evolving Resource Mix

Although the term 'baseload generation' connotes images of large nuclear and coal generators, today we are seeing efficient natural gas combined cycle units being dispatched often as 'baseload generation'. The economic challenges that some (but not all) nuclear and coal plants face are largely caused by a number of interrelated factors, each of which has an impact on retaining existing resources and incenting investment in new resources:

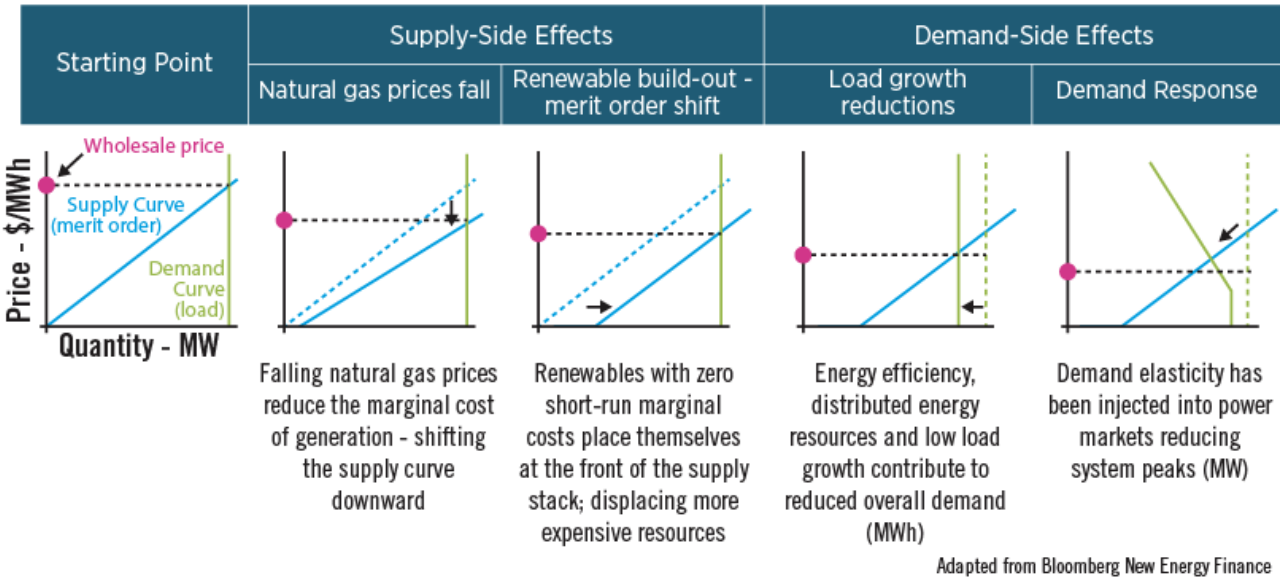
1. Intense competition from low gas prices and new, highly efficient gas resources, when coupled with sluggish demand growth have combined to drive wholesale power prices to some of their lowest levels—an obvious short term benefit for consumers. This competition, however, has reduced revenue for certain resources like coal and nuclear.

2. Although one can argue about degrees of impact, there is no doubt that federal tax policies and state subsidies to particular generating units have had their own distorting impacts on competitive market outcomes.

3. Increasing environmental / emission mitigation costs for coal resources and increasing Nuclear Regulatory Commission compliance costs for nuclear generation all have worked to increase economic pressures on these resources.

Figure 3 is a graphical illustration of how each specific trend combines to put its own downward pressure on wholesale prices in addition to competition among generators itself.

Figure 3. Trends Affecting Lower Wholesale Market Energy Pricing



Adapted from Bloomberg New Energy Finance

Some have raised concern that traditional resources are not being properly valued for their beneficial attributes such as zero emission attributes of nuclear units and on-site fuel security attributes for coal and nuclear. With FERC's support, PJM took a giant step forward in this area in 2014 by establishing a new "Capacity Performance" model which recognized (and rewarded through pricing mechanisms) the importance of generating resources having fuel available for immediate use upon call.

We at PJM agree that more can be done (and we intend will be done in the PJM region) to address these issues. ***The key question is therefore not whether these issues should be addressed but instead how they are addressed.*** At PJM, we believe that **market-based solutions** are a preferable means to address these issues rather than regulators or legislators guessing as to the ideal energy mix for the future, picking winners and losers and potentially creating new 'stranded costs' to be paid by customers if those regulatory guesses don't pan out. As a former regulator, I have seen the pitfalls of that old regulatory-heavy paradigm and urge that we do not end up stumbling into that paradigm again by default.

I like to view the markets working like my prized kitchen blender—they blend together all the inputs to produce the most efficient and cost effective outcome for the consumer. But as there are no specific policy directives for attributes such as low carbon resources or generation diversity, it would be unreasonable to blame the blender (in this case the market) if the recipe does not come out to one's liking. It is for this reason that we need to focus on the inputs to the market in order to diagnose the challenges going forward and devise appropriate solutions.

Addressing the Challenge

Given this state of the industry, the question then comes what can the federal government do that could be helpful and what would not be helpful. Let me posit lists of each:

Helpful Federal Actions

Energy Price Formation Reforms: PJM has recently posted a proposal which builds on an existing FERC Notice of Proposed Rulemaking but which goes further to ensure that all resources needed to serve load are able to set wholesale prices. Today's rules inadvertently limit the ability of large generating plants which are needed in the dispatch order to set prices given their relative inability to cycle their output up and down on very short notice. To be clear, those generators do recover their costs when called upon by PJM but their costs are not reflected in wholesale clearing prices. This has a suppressive effect on prices overall and fails to appropriately value these needed resources. PJM believes this very narrow and targeted reform would help to ensure that all generators, even those which have come to be referred to as 'baseload' generation, are treated fairly in the marketplace. As part of this package of reforms, PJM has proposed development of a new load following product that would incent the development of new innovative and flexible resources (including wind resources) needed to meet varying load demands throughout the operating day.

State and Federal Roles: Although certain states have taken action to subsidize particular generating units (including nuclear units), individual state action that has the effect of distorting wholesale competitive market outcomes is not fair to anyone—neither consumers in state A that pay the subsidies nor consumers in neighboring states that are deprived of other generating options due to the inevitable 'exporting' of the negative effects of state A's unit-specific subsidy. Because the grid is interconnected and because electrons do not respect state borders, there clearly is an interstate commerce aspect of electricity sales. After all, the very fact that electricity is bought, sold and transmitted across state lines (and therefore affects interstate commerce) was the original basis of the need for passage of the Federal Power Act in the first place. Unfortunately, this entire matter has ended up in the Courts which are struggling to define the limits of state versus federal authority in this area.

Addressing state policy choices in a nondiscriminatory way cannot be a zero sum game. Instead it requires a degree of cooperative federalism between the FERC and the states rather than any one set of state policymakers imposing their choice of winners and losers on neighboring states and regions. In PJM's view,(and my own view as a former state regulator) **accommodation** of state policies in a federally regulated market *should* happen but must happen in a way that recognizes the interstate nature of the grid and respect Congress' national call in the Energy Policy Act of 1992 as well as 2005 for the development of wholesale markets to ensure competitive outcomes. We have put forward a proposal that respects individual state actions affecting the generation fleet and demand response resources but avoids the impact of that policy choice affecting market prices in the rest of our large 13-state region.

In the broadest sense, "accommodation" of individual state policies (and especially conflicting environmental policies among states) is a two way street. Accordingly, "accommodation" of state policies will require action at the state level as well as at the RTO/ISO and FERC levels to ensure that one state's policy is not 'exported' to another state that has not adopted that policy choice. Our proposal is presently before our stakeholders and may ultimately result in a filing at FERC. But in the interim, we would urge Congress to recognize that this is not a black or white area and encourage both the states and the FERC to work on constructive and balanced ***market-based*** solutions.

Resilience: PJM has embarked on a number of initiatives to promote resilience of the power grid. These resilience efforts are anchored in, but give more teeth to, many of today's reliability standards. For an effective grid resilience plan to be developed, effective information sharing and assistance with identifying long term threats must continue to better help us sort through what, constitutes credible threats vs. those which are remote enough to not pass a reasonable cost/benefit analysis. This Committee can help to ensure that DHS, DOE and FERC all continue to work with the RTOs/ISOs as we embark on developing a more resilient grid, so that the credible threats are validated by those in the federal government with access to intelligence information to which the RTOs, by definition, are not privy.

PJM has embarked on an effort to incorporate resilience into our three core processes of planning, operations and markets. PJM's plan is underway and extends beyond 2018. The effort will evaluate our moving toward conservative operations when credible threats to fuel supplies or the grid itself are identified. The effort will also focus on the price formation issues I addressed previously as well as steps to build even more redundancy into the grid itself. As the system is reliable today and will remain so for the near future, these initiatives are designed to be proactive and forward-looking to ensure that the grid is not only reliable but resilient to address extreme events.

Continued attention to these issues by this Committee would be helpful as these initiatives will require a level of coordination and cooperation between the electric and natural gas pipeline systems that goes beyond what we enjoy today. And, as reliability oversight is split between FERC for the electric industry and TSA for the natural gas pipeline

industry, a level of cross-agency coordination will be needed as today the two industries operate under vastly different regulatory regimes.

Actions That Would Not Be Helpful

Although I've outlined certain actions that would be helpful, I would be remiss if I did not briefly flag some items that would not be helpful to the considerable work that RTOs/ISOs face. These include:

Imposing Greater Market Uncertainty By Calling for a Wholesale Reversal of the Competitive Market Model: This is a critical time when the generation fleet is getting older and new investment will be needed to retain critical 'baseload' facilities and attract the development of new facilities. It also is a time to incent financing of new technologies such as energy storage technologies to better manage the variable output resources we have on the grid such as wind and solar. As detailed above, the markets have proven themselves to be able to respond nimbly and efficiently to changing policies and system conditions. Moreover, the policies that both investors and consumers have come to rely upon were set by Congress some 25 years ago through the Energy Policy Act of 1992.

Of course, individual market rules as well as RTO operations should continue to be scrutinized. However, calls to simply reverse gears (assuming that is even possible) only sends a chilling effect on the market and makes needed new investments and technology innovation more costly and harder to bring to the market. As a result, we would caution against loose calls to 'reregulate' the market or blame the market itself for some of the issues outlined above that are simply the result of inputs into the market 'blender' I referenced previously.

Picking Winners and Losers Either By Technology or Even By Specific Generating Units: Prior to EPACT 1992 and much of the restructuring of the industry at the retail level, regulators at the state and federal level would be called upon to pick winners and losers—either adding to rate base or disallowing the costs of particular generators one by one after long and contentious hearings. Inevitably, the regulators sometimes got it wrong and saddled the investor or the consumer with billions of dollars in uneconomic costs.

There may be a temptation to selectively go back to that model to either "promote" or "save" a particular generating unit or type of generating unit in the name of 'reliability' or 'diversity'. Both reliability and diversity has and can continue to be maintained through the market itself. In fact, PJM's generation mix is far more diverse today than it has ever been. We are concerned about potential retirements of additional coal and nuclear resources. The relevant question is how best to respond. For policymakers to simply try to 'outguess' the market or supplant it with their particular policy choice is simply a recipe for building an unsustainable market outcome that no investor would seriously consider and for which no consumer would ultimately benefit. As a result, we urge holding our 'feet to the

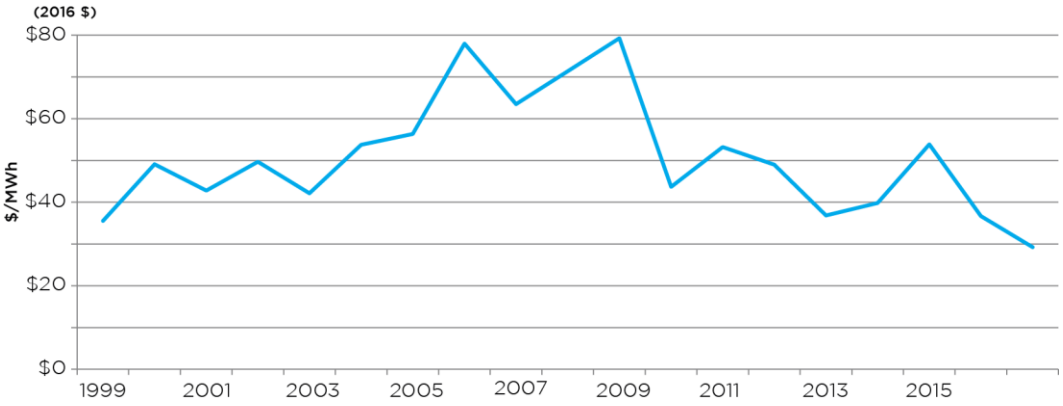
fire' to devise ***market-based solutions*** to these challenges such as those I have outlined above while resisting the temptation to step in to "choose" a particular generator class or type of generator for special treatment.

I thank you for this opportunity to testify and look forward to your questions.

Appendix

The following section outlines, in detail, each how each market fundamental – outlined in **Figure 3** – is influencing the PJM wholesale market price, specifically. Annual average PJM-wide energy prices, in real dollars, are at an all-time **low**.

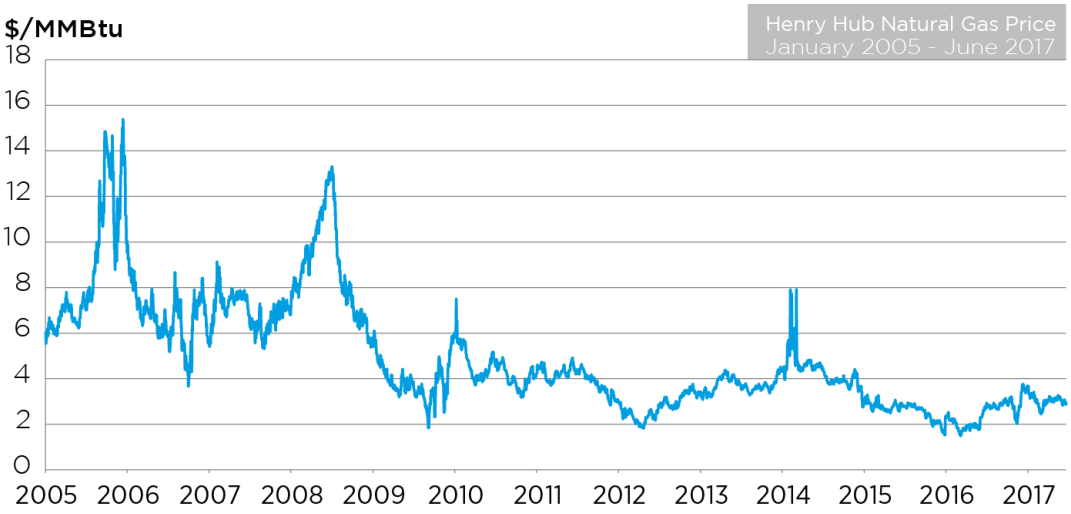
Figure 4. Annual Average Real-Time PJM Energy Prices ($/MWh, 1998 – 2016, 2016 USD$)



Natural Gas Prices Fall

Historically, natural gas as a fuel and power technology was more expensive than other forms of power generation. In a single clearing price market, like wholesale power, this meant the price of natural gas would have a large influence on wholesale pricing to all generation types. Brought on by shale development in the late 2000s, however, natural gas prices reaching historically low levels have influenced current wholesale electricity pricing trends. **Figure 5** displays the trend in natural gas prices at natural gas trading bellwether, Henry Hub.

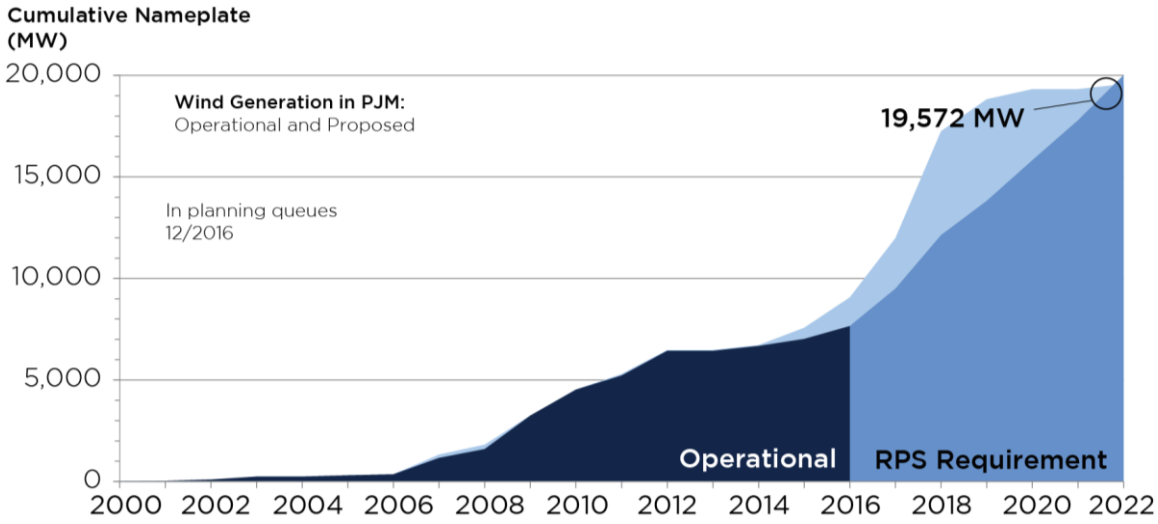
Figure 5. Henry Hub Natural Gas Prices



Renewable Build-Out – Merit Order Shift

Renewable generation such as wind and solar, with zero short-run marginal costs, oftentimes place themselves at the front of the supply stack in the economic dispatch of energy markets. This displaces otherwise more expensive resources at the margin. While system operators like PJM are seeing these resources as a relatively small portion of the overall resource mix, **Figure 6**, shows the projected deployment of these resources to meet existing state renewable policies. Moreover, federal tax policy, such as the production tax credit incents wind resources to bid negative prices into the market since the federal production tax credit makes up the 'delta' between the negative price offer and positive profitability in a given hour. Although over the entire PJM footprint, negative pricing has not had a major impact, it has in select locations on the grid where the production tax credit has worked to incent wind units to operate in low load periods and compete through negative pricing with nuclear units which do not have that same ability to cycle their output.

Figure 6. Operational and Projected Wind Capacity in PJM



Load-Growth Reductions & Demand Elasticity

Electricity consumption is uniquely influenced by the economy, weather and the efficiency of energy-intensive devices. Historically, demand for electricity increased annually at a rate of 2 - 4 percent. Given a variety of factors – including macroeconomic trends as well as enhanced energy conservation measures – demand for electricity in PJM, and most of the nation, has remained flat or has declined for about eight years. **Figure 7**, illustrates just the last five years of PJM's annual load forecast. In PJM's latest annual load forecast report, by 2027 PJM projects an aggregated increase across the entire RTO of 0.2 percent. Anemic demand obviously influences prices through generally lower around-the-clock prices.

Figure 7. Declining Electricity Demand Growth