

FERC Conference Review of Wholesale Electricity Markets

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FEDERAL ENERGY REGULATORY COMMISSION

Review of Wholesale Electricity Markets Docket No. AD08-9-000

TESTIMONY OF TERRY BOSTON

PRESIDENT AND CEO, PJM INTERCONNECTION, L.L.C.

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Terry Boston
President and CEO
PJM Interconnection
July 1, 2008

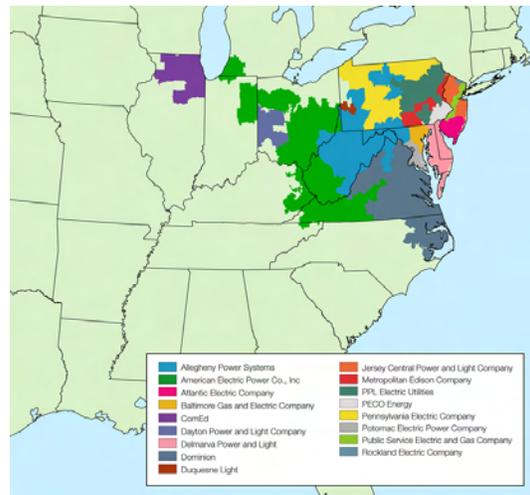


PJM's Purpose

In 1927, PJM Interconnection began with the recognition among three power companies that pooling their resources and operating regionally would improve reliability and lower costs for their customers. That's no less true today, and that simple concept has led to the evolution of an organization that includes 13 states and the District of Columbia, 17 transmission systems, more than 530 members and an electric grid and wholesale power market that serves more than 51 million people.



With the advent of wholesale spot electricity markets, PJM not only created an open, transparent means to bring buyers and sellers together but also a platform where grid reliability and financial incentives are synchronized. The Locational Marginal Pricing (LMP)-based market has made market participants partners with PJM operators to significantly enhance reliable grid operation and to increase the efficiency of asset utilization, which helps lower costs to customers. It's still surprising to me how often this critical reliability component is lost in the debate around competitive wholesale electricity markets.



Our mission is to ensure the safety, reliability and security of the bulk electric power system, and create and operate robust, competitive and non-discriminatory electric power markets. At the same time, we must understand customer needs and deliver valued service in a cost-efficient manner, while achieving productivity through the efficient union of a knowledgeable workforce and technology.

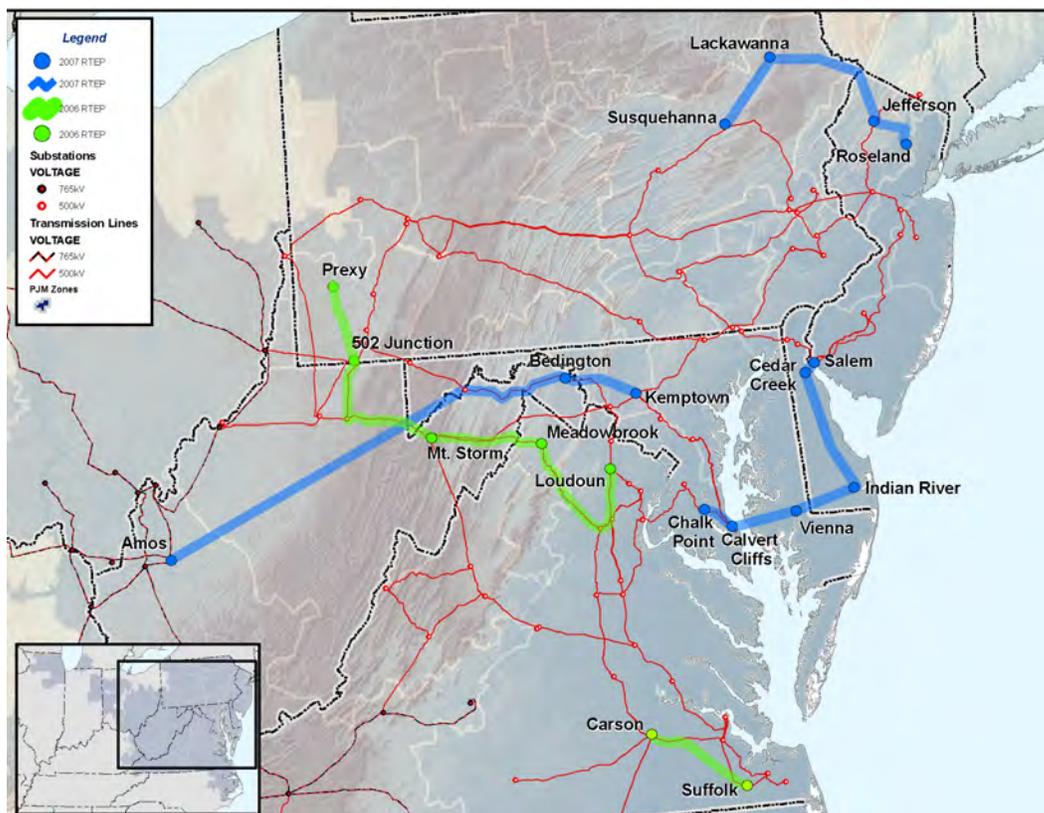
The bulk power system has evolved and grown. Customers' use of power has changed. States have fulfilled their regulatory responsibilities differently; federal laws that continue to shape the industry and markets by necessity have become more complex as the number of players increased. At the same time, the public and political focus has shifted to concerns over increasing fuel costs, climate change and energy efficiency.

Today I will speak to how PJM will continue to achieve its mission through operational excellence and high quality customer service. I will articulate how PJM has delivered tangible benefits in three areas: 1) reliability 2) fair and efficient markets and 3) infrastructure. I will also address the next generation of issues that we see on the horizon, both from a regional and national perspective.

Reliability Starts with Infrastructure

Ensuring future reliability starts with getting iron on the ground, wire in the air and demand-side resources in place. PJM's formal planning process, the Regional Transmission Expansion Plan (RTEP), examines a 15-year horizon for transmission needs, load growth, generation additions and retirements, demand-side response, energy efficiency and congestion and system constraints. The report is published annually but is updated constantly and reflects a process that is on-going among PJM's Planning Department and stakeholders that review and recommend solutions. Since the inception of the RTEP process, PJM's Board has authorized nearly \$10 billion of transmission improvements to the infrastructure, including these major projects in the past year:

- **502 Junction to Loudon.** This line 500-kilovolt (kv) line will run from Pennsylvania to West Virginia and to northern Virginia.
- **Amos to Kempton.** This 765-kv transmission line will extend about 300 miles from the Amos Substation in West Virginia to the Kempton substation in Maryland.
- **Susquehanna to Roseland.** This 500-kv line will run approximately 130 miles from northern Pennsylvania to northern New Jersey.



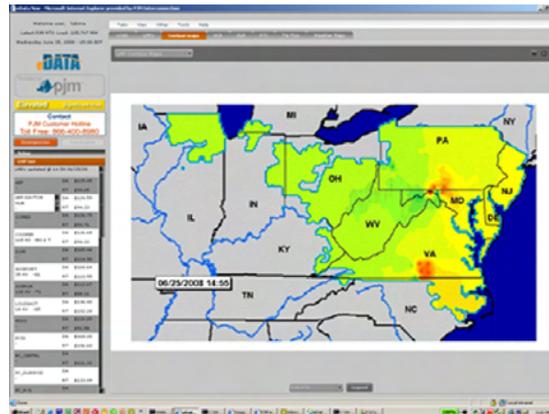
These recently approved 500-kilovolt and 765-kilovolt inter-state transmission lines are expected to address the North American Reliability Corporation (NERC) reliability violations that are projected to occur in the near future.

New generation often requires upgrades to the electric transmission system to ensure reliability by delivering power to any part of the PJM system without overloading existing facilities. Recently, PJM proposed revisions to its process that would expedite the review of interconnection of new generation projects. System impact studies for certain similarly affected projects now will be reviewed as a “cluster.” PJM will determine system upgrades required by adding the entire group to the system, rather than looking at each project incrementally, a process which saves time.

Real-Time Wholesale Markets Strengthen Grid Reliability

The economic incentives inherent in a regional transmission organization (RTO)-administered market are integral to and improve system reliability. While a centrally dispatched system requires a single operator to manage and direct every activity on the grid, a competitive market uses clear, transparent, commonly available information, such as LMP prices to communicate grid conditions simultaneously with hundreds of market participants.

Locational marginal prices signal to each market participant when congestion arises and indicate to market participants the appropriate response ranging from ramping generation up or down to reducing demand at the right locations on the grid. Locational prices make every market participant a partner in ensuring system reliability because when they respond to prices in real-time they are simultaneously acting in a way that is both financially beneficial and improves system reliability.



Security-Constrained Unit Commitment and Reliability

PJM also enhances power grid reliability through scheduling of regional generation resources in the Day-Ahead Energy Market, using a unit commitment process that provides a regional generation operating plan recognizing transmission limitations. The PJM Day-Ahead Market uses state-of-the-art unit commitment software to ensure sufficient generation resources are scheduled — based on projected system conditions and operating margins — to meet reliability standards. This forward-looking market and scheduling process ensures that sufficient notification is given to generators in the event that they are needed to respond to system events.

Advanced Technologies Improve Reliability

Reliable grid operations require substantial monitoring, communications technology and data. PJM and other RTOs continue to drive advancement of the technologies and processes used to monitor and manage the grid.

Because of its regional nature and central dispatching ability, PJM has a wide field of vision of system activity over the broad RTO footprint that allows operators to identify emerging factors that could affect reliability and to alleviate problems as they emerge.

For example, PJM's state estimator model contains nearly 13,000 pricing points, with data fed by systems spanning 13 states and the District of Columbia. PJM's security analysis application runs every minute, evaluating the grid and acting as an "early warning" system. Using telemetered data from nearly 74,000 points on the grid, PJM system operators receive a "big-picture" view of regional conditions and situations that could affect reliability, including those in neighboring systems. This broader field of vision helps PJM operators mitigate any operational problem they see quickly, before problems cascade.

Enhanced Reliability through Joint Operating Agreements

PJM also is working collaboratively to improve reliability across an even larger geographic region by addressing seams issues—those that bridge across the borders between control areas.

The seams collaboration is providing even greater reliability and market efficiencies to the industry. Together, PJM and the Midwest ISO developed an array of new processes, coordination protocols and new technical solutions to long-existing interconnection problems.

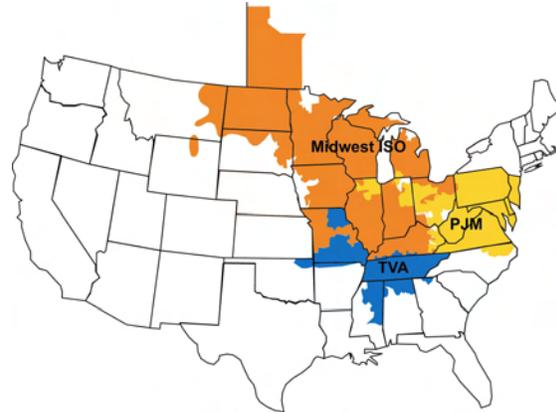
Much of the focus on these seams issues revolved around congestion management. PJM and the Midwest ISO worked side-by-side to develop the NERC- and the Federal Energy Regulatory Commission (FERC)- approved Congestion Management Process (CMP). The CMP has significantly changed the way in which the industry looks at congestion because this process uses powerful applications to provide greater detailed assessment, real-time data and real-time response and coordinates reciprocal flow gates.

The CMP uses real-time data to assess the impact of every megawatt of each RTO's operating generators on neighboring parties' flowgates. As a result of implementation of the CMP, PJM now calculates the impacts on about 500 flow gates in neighboring systems as far away as the Independent Electricity System Operator in Ontario and Duke Energy in the Carolinas, providing an expanded geographic view far beyond the PJM footprint.

In addition to the CMP, PJM and the Midwest ISO also developed the first Joint Operating Agreement, (JOA) which created the processes and procedures for how the two RTOs would address each seam issue (i.e., outage coordination, integrated planning, emergency procedures coordination, data sharing and the CMP). The JOA is

regarded as a template for enhancing coordination with neighbors and has been replicated by other RTOs and non-RTOs.

PJM, Midwest ISO and the Tennessee Valley Authority have established a Tri-Party Joint Reliability Coordination Agreement. The agreement encompasses data exchange, coordinated control of transmission facilities that the combined systems affect and reduced reliance on the NERC transmission loading relief procedure. It also coordinates Available Transfer Capacity/Available Flowgate Capacity calculations for transmission reservations to ensure that transmission service is not oversold and that congestion that could trigger reliability issues is appropriately managed.



Today, PJM continues to seek ways to address seams issues across other interconnections and is involved with NERC's development of standards and the North American Energy Standards Board's (NAESB) business practices.

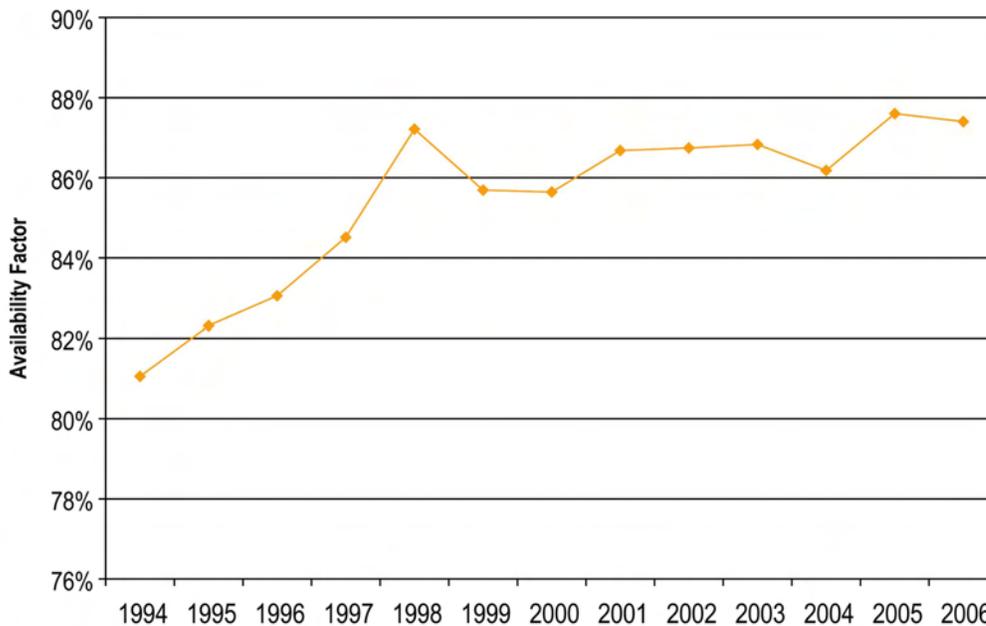
Regional Wholesale Electricity Markets Enhance Economic Efficiency/Customer Benefits

Large markets produce substantial economic benefits for consumers, who will realize benefits in systems where the least expensive, competitive resources available to serve consumers are selected from a geographically broad area. Larger market size means that, for any particular hour, there will be a wider variety of resources available to serve increments of load. Moreover, when multiple systems combine their resources, the diversity of resources will likely increase as well, thus providing the combined system with hedges against shortages or price increases in any one fuel.

The economic benefits of large RTOs have manifested themselves in a variety of ways. Following the enactment of the Energy Policy Act of 1992, generation availability improved. For example:

Since the commencement of the PJM market operations, generator forced-outage rates improved by an average of three percent. Additionally, the overall availability of generation resources has increased approximately four percent between 1997 when cost-based markets began operation to 2006. This increased availability provides direct benefits by maximizing the use of existing infrastructure.

Generator Availability in PJM



Retail consumers may see the most direct benefit with their electricity distributor having joined an RTO. The implicit economic access to the broader wholesale market has directly resulted in generation production cost savings. For example, Dominion reported that it saved \$110 million in the first 14 months of its participation in the PJM Market through fuel cost savings by buying electricity rather than self-generating.

The consulting firm LECG in 2006 examined the effectiveness of the organized wholesale electricity markets operated by PJM and the New York Independent System Operator (NYISO). It concluded that the RTOs' markets have reduced average electric rates between \$430 million and \$1.3 billion a year.

Building on Market Monitoring Relationship

We are working closely and cooperatively with the Market Monitoring Unit (MMU) on its transition to a distinctly external and independent entity by fall 2008. Both PJM and the MMU are committed to the full independence of the MMU. In order to support the MMU's independent, expert analysis and examination of trends and conditions, PJM will provide the MMU with access to all data and resources necessary to continue the effective monitoring of the PJM markets. I have met with Joe Bowring many times, and I believe this effort is going quite well. We are all committed to make the transition to an independent MMU work for the benefit of members and stakeholders.

Evolution of the Capacity Market

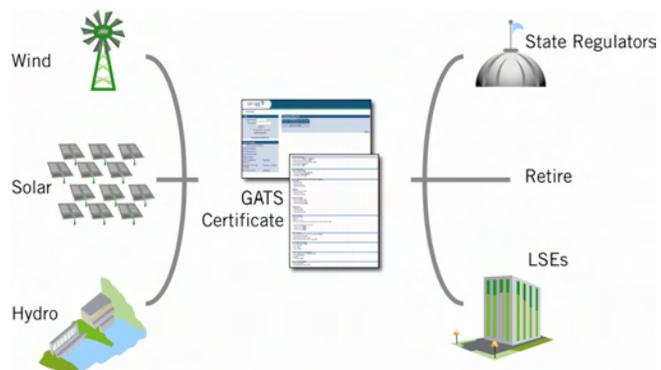
After an extensive stakeholder process that developed the Reliability Pricing Model (RPM) Capacity Market over a period of years, the new capacity auction was implemented last year. Although we won't be discussing the first four auctions because of the active FERC filing, the May 2008 annual auction for capacity for the operating year of 2011-2012 showed results that signaled significant changes in how capacity is procured. More than 4,200 megawatt (MW) cleared the May auction with more than 1,000 MW of base load. A record amount of demand-side resources was bid into auction, and the first solar generating plant was bid and cleared in the auction. PJM is working through the stakeholder process to bring energy efficiency resources into the RPM Capacity Market with the promise of even greater demand-side participation in the RPM in future auctions.

The recent release of The Brattle Group report launches an important examination of the RPM through stakeholders' assessment and review of the report's findings, including stakeholder recommendations for modifications to the RPM. It is urgent and important that we get new capacity and demand-side resources (DSR) in place and I want to emphasize that everything is on the table in an open process to solve the capacity problem. In the meantime, PJM will continue to reach out to all interested parties to better understand their resource adequacy needs and issues.

Meeting Public Policy Goals

PJM is helping states facilitate their renewable portfolio standards (RPS). In 2005, PJM implemented the Generation Attribute Tracking System (GATS). The system is an independent, centralized generation registry and emissions database that enables states to implement energy policies requiring renewable energy or imposing emission reporting requirements. GATS provides a framework for the continued development of state policies, designed to spur continued growth in the market for electricity from renewable sources.

GATS tracks the environmental and emissions characteristics of generators large and small to create a certificate for each megawatt hour (MWh) of electricity-produced identified by fuel source, emissions, location, state program qualification and ownership of attributes. The GATS provides state regulatory commissions, environmental agencies, market participants and customers with a single integrated regional system to document and track power generation attributes to help increase the liquidity of the renewable power market.



Whether a state requires electric suppliers to include a specific percentage of renewable resources in the electricity they sell to customers (i.e., a renewable portfolio standard) or requires suppliers to tell customers about

their fuel sources or emissions' profile, the GATS enables suppliers to demonstrate compliance with state requirements.

The GATS also enables the owners of renewable generators to obtain greater value for their renewable resource by letting them sell the energy produced and then separately sell the renewable energy certificate associated with it to suppliers who need clean energy certificates to comply with state renewable portfolio standards.

More Wind Generation



In recent years, the nameplate capacity value of wind generation projects entering the interconnection queues has steeply increased. There are currently 1,200 MW of nameplate wind capacity at about 20 facilities in operation, 1,500 MW under construction and approximately 38,000 MW nameplate capacity of wind generation in the interconnection queue in PJM. Approximately one-third of the wind capacity in the queue is from wind farms external to the PJM footprint, which is a strong indicator of the value wind resources see in participating in the PJM competitive capacity and energy markets.

It is difficult to get wind to the market because of siting issues for wind farms and siting transmission to move wind power from the wind farm to the load centers. Most of the proposed wind development is either along the Allegheny Mountains or in the western part of the PJM footprint, which is west of constraints crossing the mountains.

Demand-Side Resources and Energy Efficiency

We are enhancing our efforts to increase demand response and energy efficiency participation as a means of hedging higher fuel costs, reducing overall capacity needs in RPM, and as a hedge against overall energy expenditures and the costs of future environmental policy.

PJM has a Demand Response Steering Committee to set direction for other committees and working groups aimed at promoting effective demand response and energy efficiency participation through the development of clear and consistent market rules. PJM has been working with several states to help develop the framework for demand-side resource programs through the Mid-Atlantic Distributed Resource Initiative (MADRI) process, which includes Delaware, the District of Columbia, Maryland, New Jersey and Pennsylvania.

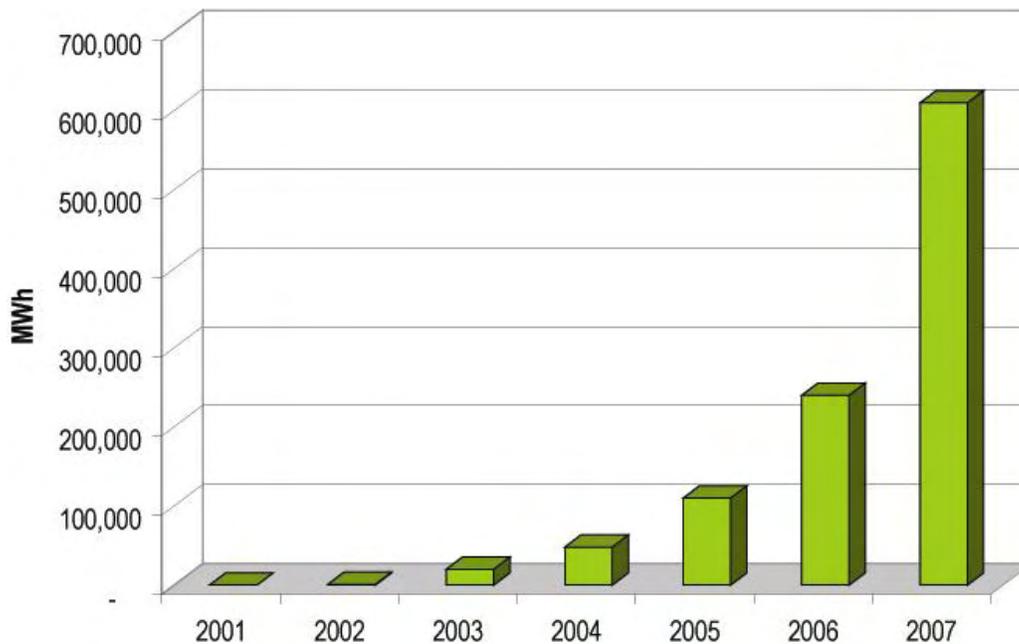
Demand-side resources have the opportunity to participate in PJM's Energy, Capacity, Synchronized Reserve and Day-ahead Scheduling Reserve. We even have the capability through a unique feature of our tariff to use demand-side response in the Regulation market. Participants are paid for the services they provide through their ability to reduce demand.

As of 2007, 4,898 sites totaling 2,944 MW were registered to participate in economic load response and 705 sites totaling 2,144 MW were registered to participate in emergency load response. This participation indicates that customers value the potential opportunity to reduce power use and save money.

Demand side demonstrated its value in the summer of 2007, when consumer reductions in electricity use set a single-day record for PJM early in August. On Aug. 8, when PJM had to order voltage reductions in its Mid-Atlantic region, demand response cut load by 1,945 MW, an amount similar to the usage of a mid-sized city.

In 2007, there was 609,750 MWh of load curtailed through demand-side resources, with payments to curtailment service providers totaled more than \$46 million. Demand-side resources provided 207,141 MWh of synchronized reserve and received payments of \$2.4 million in 2007 for provided synchronized reserves.

Demand Response Volume in MWh



Challenges and Opportunities

Although the introduction of new technologies and public policy pressures pose new challenges and opportunities to our business, PJM is committed to staying focused on our mission, purpose and role.

Reliability will continue to be paramount—job one. It is the one overarching priority for our business. Alongside that is our commitment to continue administering efficient, fair and transparent wholesale markets that support reliable operations and get infrastructure built for future economic growth.

Through regional planning, we are committed to fostering the development of transmission and generation infrastructure while ensuring capacity adequacy. At the same time, we look to reinforcing demand-side resources with infrastructure that already includes transmission and generation. Demand-side participation through the demand-side resources and energy efficiency is critical to managing load and ensuring capacity adequacy. Demand-side resources and energy efficiency provide the vehicle by which customers can reduce LMP and RPM prices and control their overall energy expenditures.

We will continue to examine the effectiveness of RPM. The Brattle Group report has initiated this process. We look forward to an open and honest discussion with the states and stakeholders going forward to improve the capacity market.

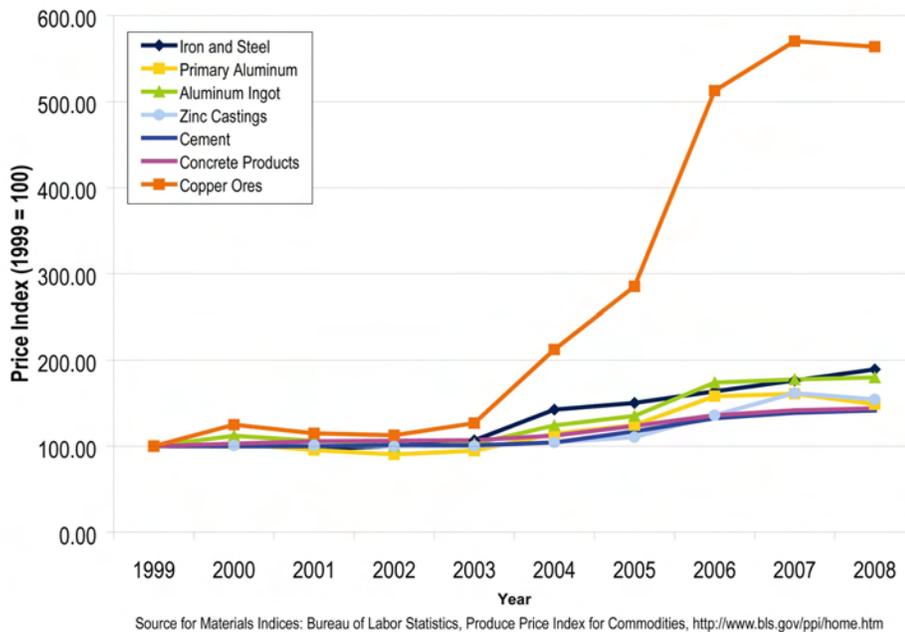
In addition to how the FERC and our tariff have defined PJM's role, we see ourselves as a problem-solver. We will fulfill that role in part by continuing to support our members in strengthening the transmission infrastructure. We will also fulfill the role in improving the generation interconnection queue process and make it more effective.

We will use the tools, technology and data we have to assess the impact of possible carbon dioxide (CO₂) legislation and other emissions controls for our members. We will not use this to set policy but to test the impact of environmental policy on reliability and market prices.

The Challenges

PJM, like the entire country, faces the impact of the high cost of fuel, the cost of environmental policy, and the increasing cost of new plant construction. These are the drivers for the increasing cost of power and the challenge we face as an industry is how to help mitigate the effects of those increasing costs on customers.

Change in Prices of Metals and Materials

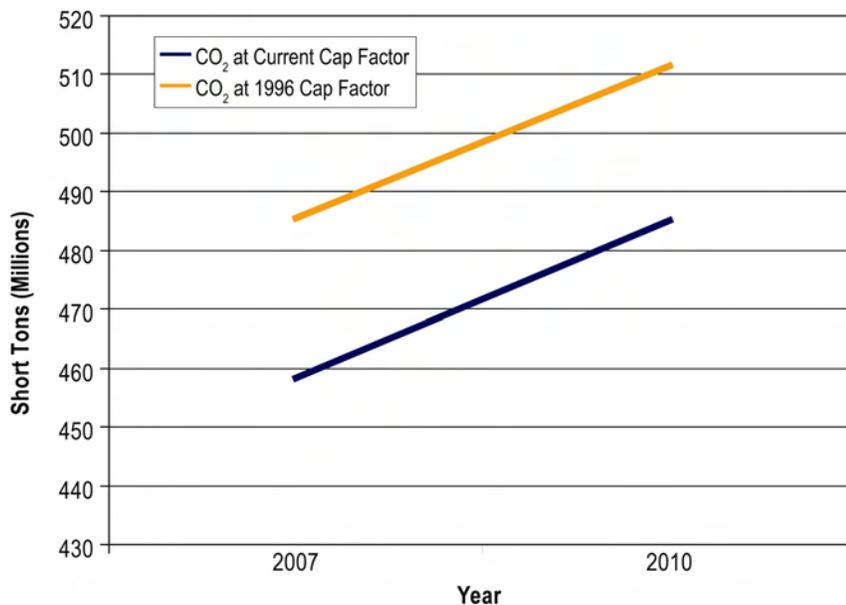


As we see load projections continuing to grow throughout our region, we are all looking for solutions to meet this demand. With an average peak load growth rate of 1.6 percent a year, we will need an additional 22,000 MW of generation, demand-side resources, and energy efficiency to meet peak demand by 2018. Currently we have 165,000 MW of generation making the necessary 13 percent-increase in capacity a challenge. The siting of both generation and transmission continue to be a challenge and the cost of new transmission and generation plant construction is another of the limiting factors affecting new infrastructure to be built. Since 1999, for example, the price of concrete and cement is up 40 percent, the price of aluminum has increased to more than 50 percent, the price of iron and steel has almost doubled and copper has increased by a factor of five. The cost and the risk of building new infrastructure are exacerbated by the uncertainty of the future of climate change policy in our country.

As Chairman Kelliher has stated, environmental and energy policy are becoming increasingly integrated. We see the inevitability of climate change legislation and potentially a carbon-cap-and trade structure developing. Over the past decade, there have been substantial improvements in the availability and capacity factors of the nuclear generating fleet which have already led to a substantial amount of CO₂ emissions avoided.

PJM has recently run simulations to estimate the emissions avoided due to the improvement in nuclear unit capacity factors. We simulated the 2007 calendar year energy markets under the assumption of nuclear capacity factors at 1996 levels using PROMOD and publicly available data for generator costs. The simulations show CO₂ emissions that were avoided to be approximately 27 million tons. And as a side benefit, LMP was reduced by approximately 10 percent, meaning the cost of these avoided CO₂ emissions had a negative cost to consumers in terms of reduced LMP. Looking ahead to 2010, PJM has simulated what the avoided CO₂ emissions would be due to improved nuclear unit capacity factors to be just over 26 million tons, with LMPs being about 9 percent lower than they otherwise would be.

CO₂ Emissions under Different Nuclear Capacity Factors



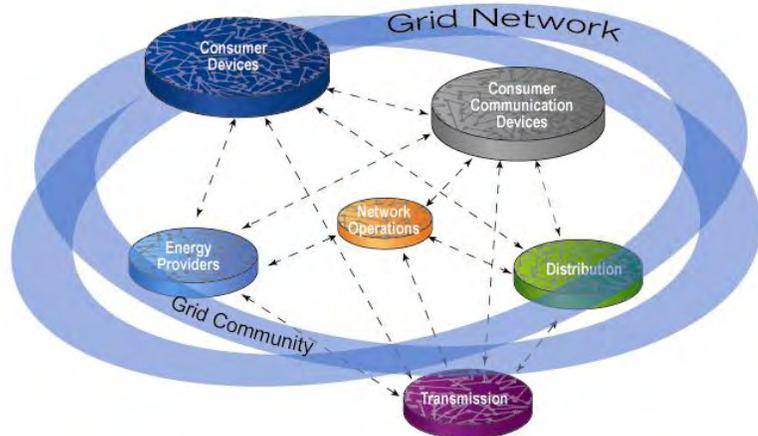
We are working hard on renewable resources, but unfortunately going forward, there are no low-cost means by which our industry can achieve the stringent carbon targets we foresee on the horizon. There is as yet no technology commercially available to capture and sequester CO₂. The potential for switching from coal to natural gas to reduce CO₂ will prove to be expensive with ever increasing fuel prices. And with PJM's generating mix so dependent upon coal setting the PJM Market clearing price in 70 percent of the hours, the short-term outlook for further substantial CO₂ reductions at low prices is, at best, limited.

What remains in the PJM Market to address climate change challenges, as well as the challenges of higher fuel and generating capacity costs, are the increasing amounts of renewable resources waiting to enter the market along with demand-side resources and energy efficient resources. We are working hard with stakeholders to incorporate energy efficiency into the RPM Market as well as working with stakeholders to expand demand-side resources in all of our markets.

Finally, with 38,000 MW of wind capacity in PJM's interconnection queues, we will be working diligently to implement our clustering approach for interconnection studies to bring as much of this wind on-line as soon as possible.

New Opportunities

Advanced technology will open a new frontier for the grid in many ways. A grid that is based on smart grid technology and electrification of transportation and delivering more real-time information will enable opportunities for consumer efficiency and smart appliances that increase the utilization of assets off peak. A Smart Grid Working Group was formed last September to develop a cohesive approach to be used by PJM Transmission Owners to provide recommendations for the implementation of technologies in PJM.



An outcome of the Transmission Owners working group was the formation of a similar group for synchrophasor technology with the view toward facilitating the installation of such devices across all of PJM, possible by using the RTEP process as a means to guide installations.

We intend to work in partnership with the group and other synchrophasor initiatives underway around the country. The goal is to decide the best practices that we think might work in PJM. We will continue to see the expansion of phasor technology and phasor measurement units will enable more operator knowledge on the real-time reliability of the system.



We see AMI helping to facilitate and integrate plug-in hybrid vehicles as petroleum and gasoline prices make the technology economically viable. Moreover, we believe the Advanced Metering Initiative (AMI) will empower consumers to take greater control over their usage and costs which will also enhance reliability.

In fact, last October, PJM participated in a demonstration of a hybrid vehicle at FERC headquarters. The vehicle, an AC Propulsion eBox EV, is the brainchild of the Mid-Atlantic Grid-Interactive Car (MAGIC) Consortium that includes the University of Delaware, Pepco Holdings Inc. (PHI), PJM and

AC Propulsion. PJM has been providing technological support to the consortium to enable the technological advancement of the vehicle and to demonstrate how the grid can facilitate plug-and-play technology.

Conclusion

PJM has developed and operates some of the most sophisticated programs in the world, providing information and access to more than 500 participant members to transact within our markets. This is all done in real-time while simultaneously maintaining our primary function of assuring reliable grid operation. The size and financial importance of our responsibility are hallmarks of the PJM and a continuing challenge to provide nothing short of excellence.

Nonetheless, in the final analysis, what we have come to realize that as far as we have come, as much as we have achieved, our journey is far from over. In fact, we're here today because, despite what differences we may have or what shortcomings we may have, we are probably united in wanting to make this vitally important competitive construct realize its full potential in providing 1) reliability, 2) fair and efficient markets, and 3) infrastructure for our future.

Speaking for PJM, I believe we have the firm foundation of a fully integrated operations and market model that is flexible enough to embrace change yet resilient enough to stand for the core elements of regional transmission organizations: independence, transparency, openness, fair treatment for our constituents. At the same time, we have built an organization that has much to share, much to offer in helping solve the problems facing our industry and our nation. That's reflected in the 80 years of our history and I firmly believe the future, despite the challenges we face today, offer the same opportunity to make a difference. With your help and guidance, we'll do just that.