Testimony of Andrew Ott on Behalf of PJM Interconnection

Ohio Energy Mandates Study Committee
March 18, 2015

Good morning, Co-Chairs Balderson and Roegner and members of the Energy Mandates Study Committee. My name is Andrew Ott, and I am Executive Vice President, Markets for PJM. I appreciate the opportunity to appear before you today and to answer any questions you may have about PJM's role in maintaining the reliability of the high voltage transmission system and the evolution of generation supply mix and its impacts on wholesale electricity prices and emission rates. PJM is the sole Regional Transmission Organization (RTO) operating in Ohio. Its day-to-day operations, market structure, and transmission system planning provide a foundation at the wholesale level for reliable and reasonably priced retail electricity. As you consider energy policy for the State of Ohio, it's important to understand the critical role that PJM plays in assuring an adequate supply of electricity to Ohio's consumers as well as the evolution of market conditions.

As shown on page 2 of the attachment, PJM covers an area encompassing all or parts of 13 states, and its member utilities serve 61 million people in a 243,417 square mile market area encompassing all or part of the states of Delaware, Indiana, Illinois, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. PJM's market transactions – which by definition are wholesale transactions and as such part of interstate commerce -- totaled approximately $50 billion in 2014. The PJM market does not encompass Ohio retail transactions or Ohio's retail market, which is under the jurisdiction the Public Utilities Commission of Ohio. Nevertheless developments in PJM's wholesale space have a significant impact on retail prices, particularly in states such as Ohio that have adopted a deregulated retail model.

I have several goals today. I will try to convey a sense of how PJM employs its wholesale energy and capacity markets and its regional transmission expansion planning process to accomplish its core missions – maintaining electric system reliability and providing value for consumers in Ohio and throughout the region we serve. In discussing PJM's markets I will describe the evolution of supply mix, driven by US EPA regulations, state policies and shale gas developments. I will discuss developments in the participation of demand response resources and energy efficiency resources as well as renewable resources such as wind and solar power. I will briefly address the impacts of coal-fired generation retirements in Ohio. I will explain how PJM's regional transmission expansion planning process assures the continuing reliability of the high voltage power system into the future. I'll describe how PJM is evaluating the impact of state public policy directives regarding power generated from renewable resources, as well as the allocation of costs associated with public policy-driven transmission system investments. PJM, in its role as independent wholesale power market and grid operator, stands ready to provide impartial information to policy makers.

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How PJM Maintains Bulk Power System Reliability

PJM is responsible for ensuring safe and reliable regional grid operations – "keeping the lights on." PJM largely does so through wholesale power grid operation, through administration of competitive wholesale electricity, capacity and ancillary service markets, and through coordinated long-term, regional transmission planning.

As an RTO, PJM operates as a not-for-profit corporation; PJM does not own transmission or generation facilities, nor do we generate electricity; we do not buy energy for resale; we do not have retail customers, and we do not administer a long-term, forward bilateral market.

To be "independent," PJM must remain free from undue influence by market participants and neither PJM's Board nor PJM's employees may own stock in member companies or their affiliates.

As a "system operator," PJM coordinates the operation of transmission and generation facilities so that all market participants have equal access to the benefits of the regional grid operation. PJM ensures that energy deliveries are scheduled reliably and are coordinated inter-regionally. Since electricity cannot be stored in significant quantities, electricity supply and demand must be balanced on a minute-by-minute basis. PJM performs this region-wide, real-time balancing of load and generation while ensuring that all regional transmission reliability constraints are respected and overall costs of reliable grid operation are minimized.

PJM administers a set of rules and market clearing procedures that governs how participants can buy and sell energy and related services in the PJM wholesale energy market. The PJM regional wholesale market provides economic benefit to Ohio by providing operational diversity and access to efficient purchases and sales of electricity. The market provides utilities and wholesale customers with various participation alternatives that allow them to maximize value. The regional market allows participants in Ohio and throughout the region we serve to monetize benefits of investments in new generation, energy efficiency, and other innovations like energy storage. Our analysis indicates the regional market provides up to $2.2 billion in benefits annually across the region. These savings are achieved through economies of scale in grid operation, competitive investment incentives, and regional coordination. The Federal Energy Regulatory Commission has regulatory oversight of PJM and its wholesale markets.

Participation in PJM's wholesale energy market is voluntary: market participants may schedule their own generation resources to meet their native load obligations, may engage in bilateral transactions scheduled through PJM, or may choose to transact in PJM's wholesale energy market. PJM's markets provide price transparency, which gives both large and small wholesale customers instant access to pricing information,

and thereby provides a platform for efficient energy trading and asset utilization across a large regional pool of generation resources. Price transparency is very desirable, as it allows state commissions and market participants to "benchmark" the appropriateness of bilateral transactions. The market enables this by revealing the operational cost of all transactions necessary for utilities or other retail suppliers to provide energy to their customers cost effectively.

Evolution of Electricity Supply and Demand Response Resources

PJM ensures there are adequate resources to meet the forecasted demand of customers plus a reserve margin. The reserve margin is a sort of insurance policy to account for operational issues, necessary maintenance of generating resources or increases in customer demand above the forecasted level. The resource adequacy mechanism is called a capacity market and the capacity product ensures that each wholesale customer procures sufficient resources to meet expected demand plus reserves. The PJM regional capacity market is a forward auction held three years in advance of the planning year to allow new resources to compete with existing resources to serve customers capacity requirements.

As illustrated on page 3 of the attachment, in 2011, shortly after the US EPA issued its final Mercury and Air Toxics Standards rule, PJM began to receive notification of retirements from generation owners. Some of the retirements have already occurred and most will be complete by May 31, 2015. As you can see, many of the retirements are occurring in Ohio. The operation of the power grid will remain reliable because the PJM forward capacity market is attracting investment in new gas-fired resources and alternative resources, as illustrated on page 3, and the PJM's regional transmission planning process has identified transmission upgrades necessary to maintain reliable power grid operation. However, the costs of the replacement resources and transmission upgrades will increase costs to customers because of the volume of retirements.

In order to ensure ongoing reliable grid operations, PJM has a proposal pending before the Federal Energy Regulatory Commission to enhance the capacity product in order to provide incentive for higher resource performance and to require resources to produce power during hours when they are most needed to maintain grid reliability. This Capacity Performance refinement will incent investment in dependable, flexible and efficient resources and will incent intermittent resources, such as wind, to contract with other resources to provide firm power during peak system conditions. This proposal will likely result in modest cost increases to consumers but we believe it is necessary to ensure ongoing grid reliability.

As shown on page 4 of the attachment, the PJM capacity market has successfully attracted over 35,000 MW of new generators or upgrades to existing generators across

the PJM region. It has also attracted over 12,000 MW of demand response resources and over 1,300 MW of energy efficiency projects. Here in Ohio approximately 2,075 MW of demand response resources and 271 MW of energy efficiency resources were committed in the most recent PJM capacity auction for 2017. Over the past five auctions 2,922 MW of new generation and generation upgrades were offered, of which 2,012 were committed.

Previously, increases in forward capacity prices in Northern Ohio caused by generation retirements had attracted much attention, but the forward prices in 2016 and 2017 have reduced due to new generation entry and transmission system upgrades identified through PJM's regional transmission expansion planning process. These transmission upgrades increased the access of Northern Ohio to lower priced generation capacity elsewhere in the market.

The evolution of installed generation by fuel type and demand resource capability in the PJM market is illustrated on page 5 of the attachment. The coal retirements and EPA regulations coupled with shale gas opportunities are causing a shift from coal to gas-fired generation and the penetration of demand resources and renewable resources is also apparent. Because wind and solar are intermittent renewable resources, PJM values their capacity contribution at 13 percent and 38 percent respectively of their nameplate capacity. This means for example that of the 8,800 MW of wind resources that are expected to be in operation by 2017, these resources contribute only about 1,150 MW of capacity or reliability value.

PJM has evaluated the impact of potential increases in intermittent resources on the regional power grid and found that such resources can be integrated reliably as long as they are supported with adequate transmission infrastructure upgrades.

Page 6 of the attachment illustrates the evolution of annual electricity production by fuel type in the PJM market. The primary driver of increased electricity production from gas-fired resources is the reduction in gas prices due to shale gas developments. The reduction in electricity demand growth due to the economy, the economics of fuel supply and the increased costs for coal plants due to environmental regulations have significantly altered power market operations. Wholesale electricity prices have decreased substantially since 2008 due to these factors. Page 7 of the attachment provides additional information regarding electricity production by fuel type in the PJM market for 2014.

In addition to providing for wholesale electricity price reductions, these factors have had a substantial impact on emission rates for electric power production. Page 8 of the attachment illustrates the trend of emissions of carbon dioxide, sulfur dioxides and nitrogen oxides in the PJM market. While emission control technology installations have played a role, the acceleration of these reductions since 2008 has been primarily driven

by economic displacement of coal-fired generation by gas-fired generation. I believe it is important to consider this evolution as you address Ohio energy policy for the future.

PJM's Regional Transmission Expansion Planning process

Managing the future growth of the electric transmission system is another integral aspect of PJM's role as an RTO. PJM conducts a long-range regional transmission expansion planning process that identifies what changes and additions to the grid are needed to ensure reliability and the successful operation of the wholesale markets. PJM's process employs a 15-year planning horizon to address major transmission investments and upgrades that will maintain grid reliability and improve economic efficiency. Transmission-owning members of PJM are obligated contractually to implement transmission upgrades and expansion plans that are included in PJM's Regional Transmission Expansion Plan and deemed necessary to maintain electric system reliability by PJM's Board of Managers. PJM's Regional Transmission Expansion Plan may also include market efficiency projects: ones that are necessary to maintain reliability, but are accelerated or modified to improve market efficiency by alleviating persistent congestion that increases energy prices, or ones justified solely on a market efficiency basis. It may also include Public Policy Projects, for example projects undertaken to achieve public policies associated with achieving renewable portfolio standards. Funding for such projects that PJM includes in its Regional Transmission Expansion Plan is the responsibility of the states that authorize them. Such projects are not subject to review by the PJM Board, as are other projects included in the Regional Transmission Expansion Plan.

In 2011 PJM implemented a new reliability criterion to address an emerging issue associated with dispatching generation facilities powered by intermittent renewable generation resources. PJM system operators had begun to experience thermal overloads driven by dispatching wind resources under the light load system conditions that generally prevail in the night, when the wind typically blows. PJM's 2014 Regional Expansion Transmission Plan includes over $391 million for transmission upgrades necessary to alleviate reliability problems under light load system conditions. Although none of these upgrades are in Ohio, Ohio ratepayers may incur some of those costs, depending on how the transmission costs are ultimately allocated by the Federal Energy Regulatory Commission.

PJM has evaluated the impact of potential increases in intermittent resources driven by renewable resource portfolio standards enacted by state authorities across PJM. Our analysis has indicated that such resources can be integrated reliably as long as they are supported with adequate transmission infrastructure upgrades and appropriate backup generation capability is maintained to deliver power and reserves when intermittent resources are not available. The transmission projects necessary to incorporate larger scale renewable resource penetration are likely to be public policy driven transmission

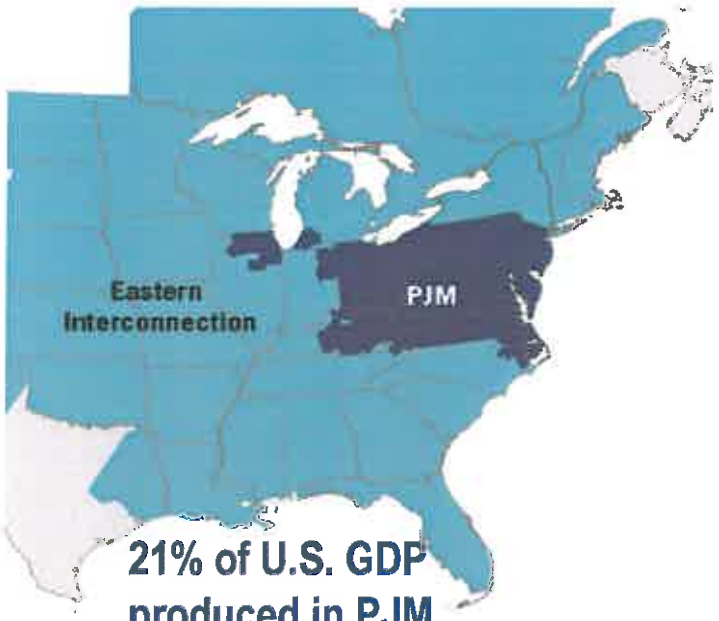
projects. Under PJM's transmission planning protocols, such public policy upgrades would be driven by the states and the states would need to determine the appropriate cost allocation for such projects.

Thank you for the opportunity to present my testimony today. Because of the nature of its operations, PJM has a multitude of data at hand, and is positioned to provide impartial information to energy policy makers such as you serving on the Energy Mandates Study Committee.

The PJM regional power grid is the highway that physically enables energy transactions between sellers and buyers, which, in turn, literally fuel the states' – and a large part of the nation's -- economic engine. The PJM wholesale market has enabled the power grid to be operated in a more efficient manner, providing economic benefits to the regions we serve, including Ohio. The reliability of the bulk power system is a fundamental pre-requisite of the transactions that are structured by the intersecting regulatory and market frameworks of the retail marketplace, the wholesale marketplace, and the forward bilateral markets. Co-Chairs Balderson and Roegner and distinguished members of the Committee, I respectfully request that as you consider the development of an energy policy for Ohio, you keep in mind the system reliability imperative with which PJM's operations and markets are aligned. I invite you to visit PJM's campus in Valley Forge, Pennsylvania, and also offer you access to PJM's extensive training resources so that you may learn more about PJM. I would be happy to answer any questions you may have.

ATTACHMENT TO TESTIMONY OF ANDREW OTT
OHIO ENERGY MANDATES STUDY COMMITTEE
MARCH 18, 2015

PJM as Part of the Eastern Interconnection

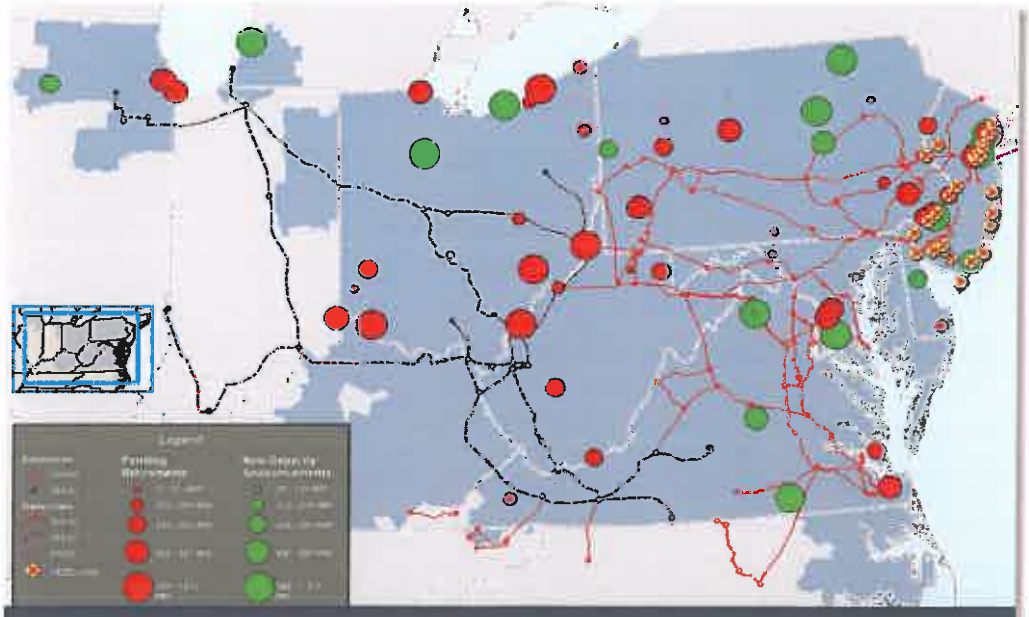


21% of U.S. GDP produced in PJM

KEY STATISTICS	
Member companies	925+
Millions of people served	61
Peak load in megawatts	165,492
MWs of generating capacity	183,604
Miles of transmission lines	62,556
2013 GWh of annual energy	791,089
Generation sources	1,376
Square miles of territory	243,417
States served	13 + DC

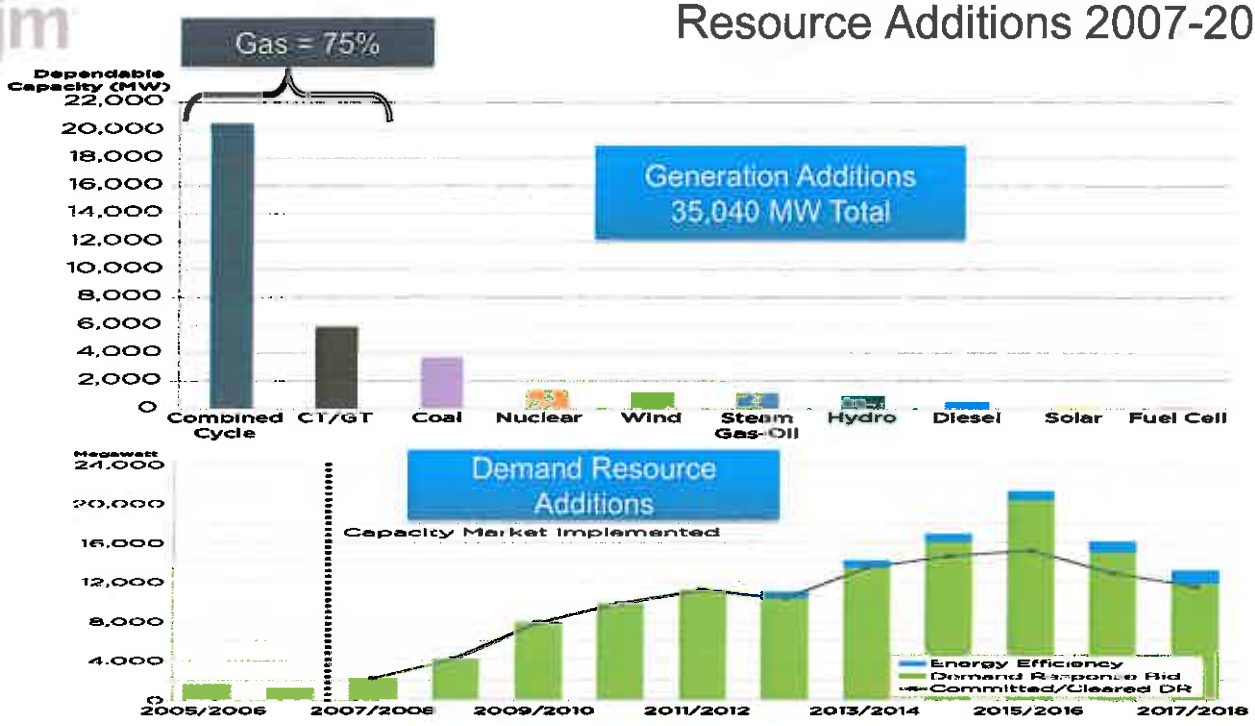
As of 12/2014

Fuel Switch - Transitioning from Coal to Gas

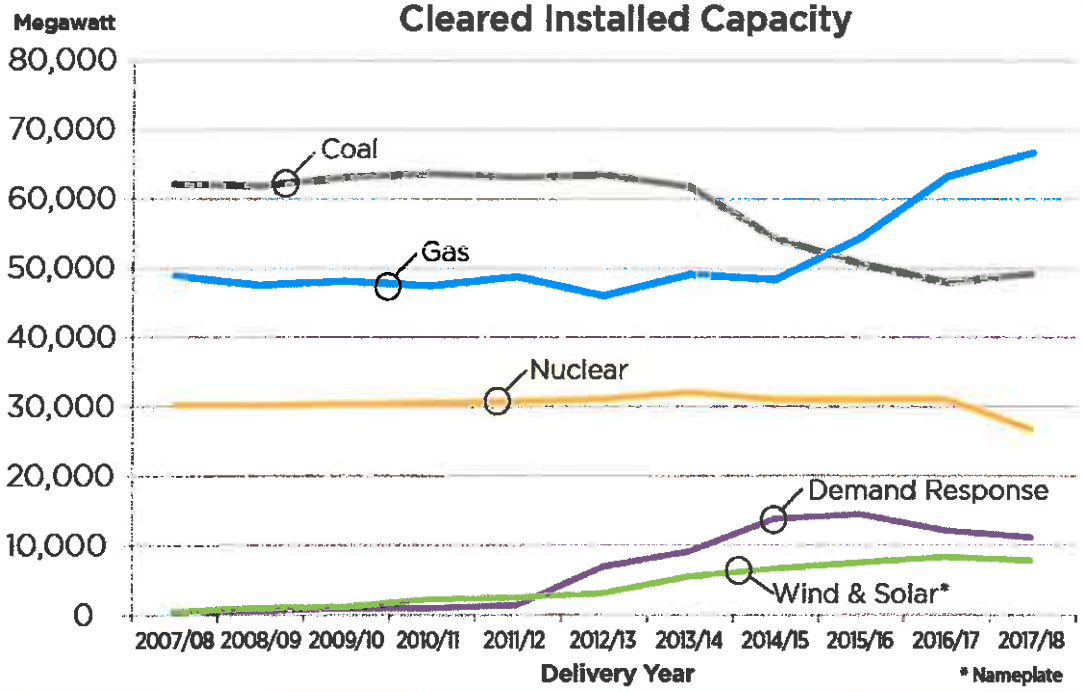


2009 to Date: 26,000 MW in Retirement Notices

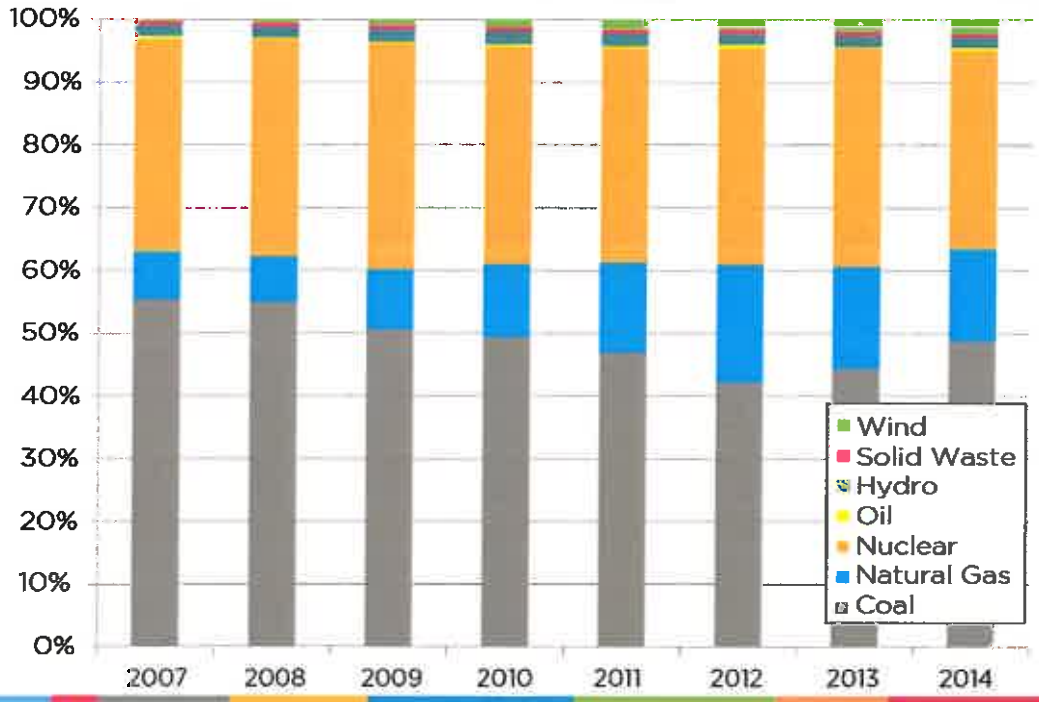
Resource Additions 2007-2017



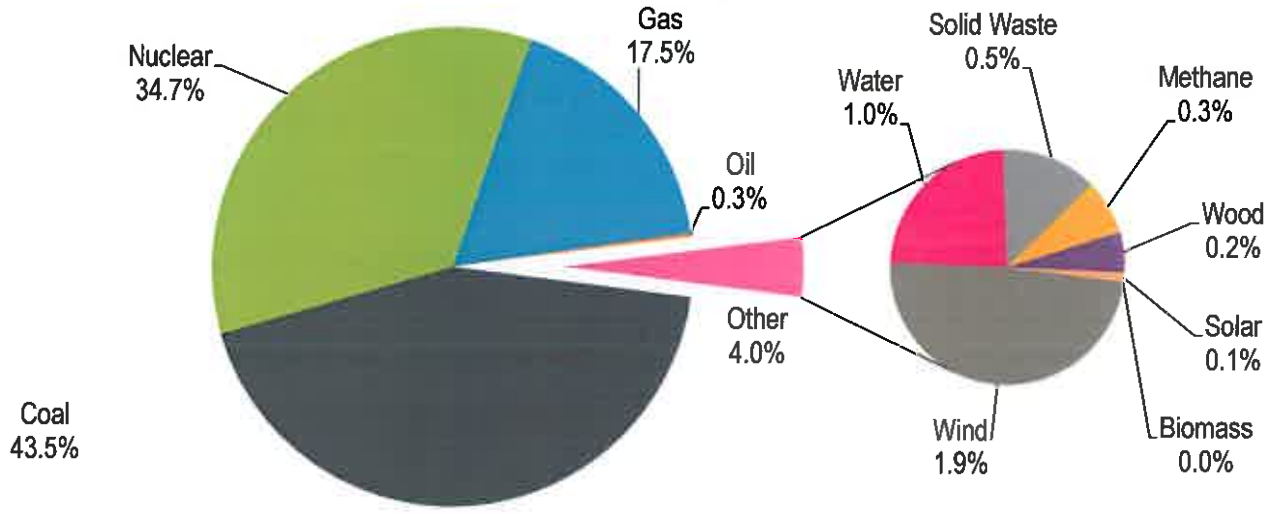
PJM Capacity Resources by Fuel Type



PJM Fuel Mix

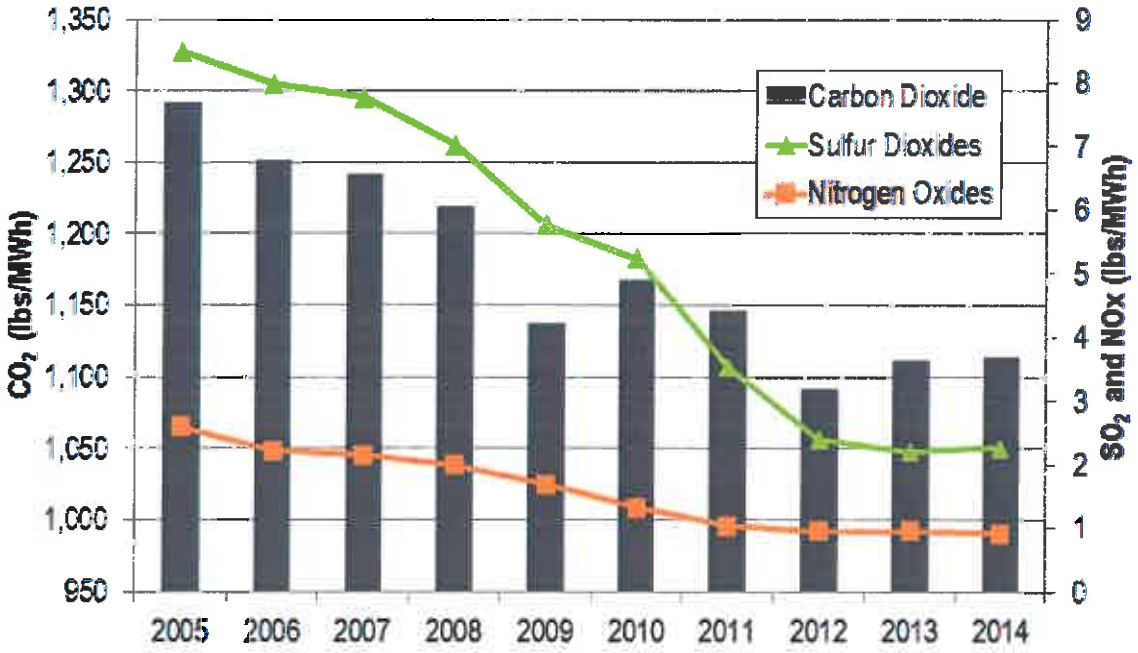

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2007
2008
2009
2010
2011
2012
2013
2014
Wind
Solid Waste
Hydro
Oil
Nuclear
Natural Gas
Coal

PJM Electricity Production by Fuel Type - 2014



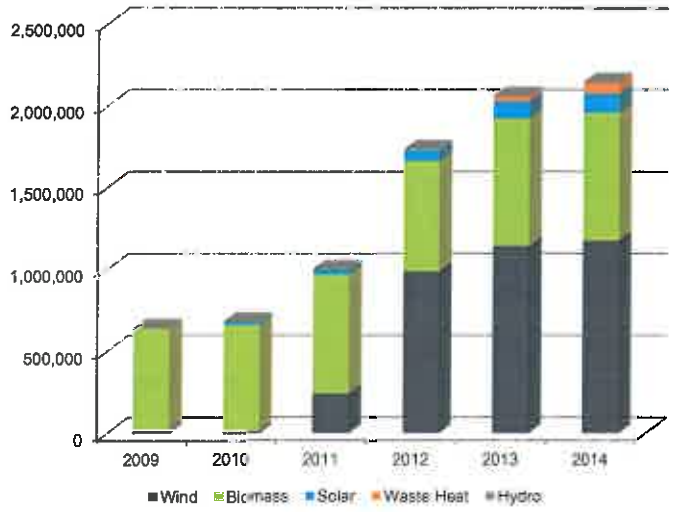
PJM Fuel Mix - 2014

PJM Average Emissions (lbs/MWh)

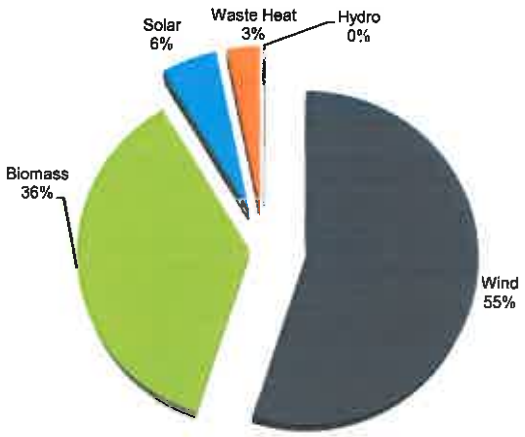


Ohio In-State Renewable Energy Certificate Production (MWh)

2009 to 2014



2014



Summary: Exhibit Attachment EWH-4 to the Direct Testimony of Edward W. Hill electronically filed by Mrs. Kimberly W. Bojko on behalf of OMA Energy Group