



September 25, 2013

Via electronic mail

Mr. Babatunde Asere
DNREC – Division of Air Quality
655 South Bay Road, Suite 5N
Dover, DE 19901

Dear Mr. Asere,

PJM Interconnection operates the regional transmission system for Delaware as well as all or parts of 12 other states and the District of Columbia. We are a neutral, independent manager of competitive electricity markets, and are responsible to ensure the reliability of the power grid in real time and in the future.

Given our role, we are uniquely positioned to model potential impacts of climate control policies on both the prices and dispatch of electricity in the region we serve. And we did just that in early 2009 in a paper titled, "Potential Effects of Proposed Climate Change Policies on PJM's Energy Market." In that paper we looked at analyses performed by the Energy Information Administration (EIA) and the Environmental Protection Agency (EPA) of the various bills that were under consideration in the 111th Congress and compared them to our own simulations of the effect of CO₂ prices, gas prices, demand reductions and wind power penetration on PJM wholesale market outcomes.

However, since the release of the aforementioned PJM study in 2009, wholesale market and system conditions have changed dramatically with expanding natural gas production in the Marcellus Shale leading to low gas prices, in conjunction with increasing delivered coal prices. PJM, therefore, offers these limited comments to provide context for the conclusions from our 2009 analysis and an update on current market dynamics to assist your current deliberation of the proposed changes to the Delaware CO₂ Budget Trading Program noticed for public comment in August 2013. PJM does not offer a perspective or position on Delaware's policy but rather provides a factual context that may be useful to the discussion.

Fuel Price Environment and Changing Generation Mix

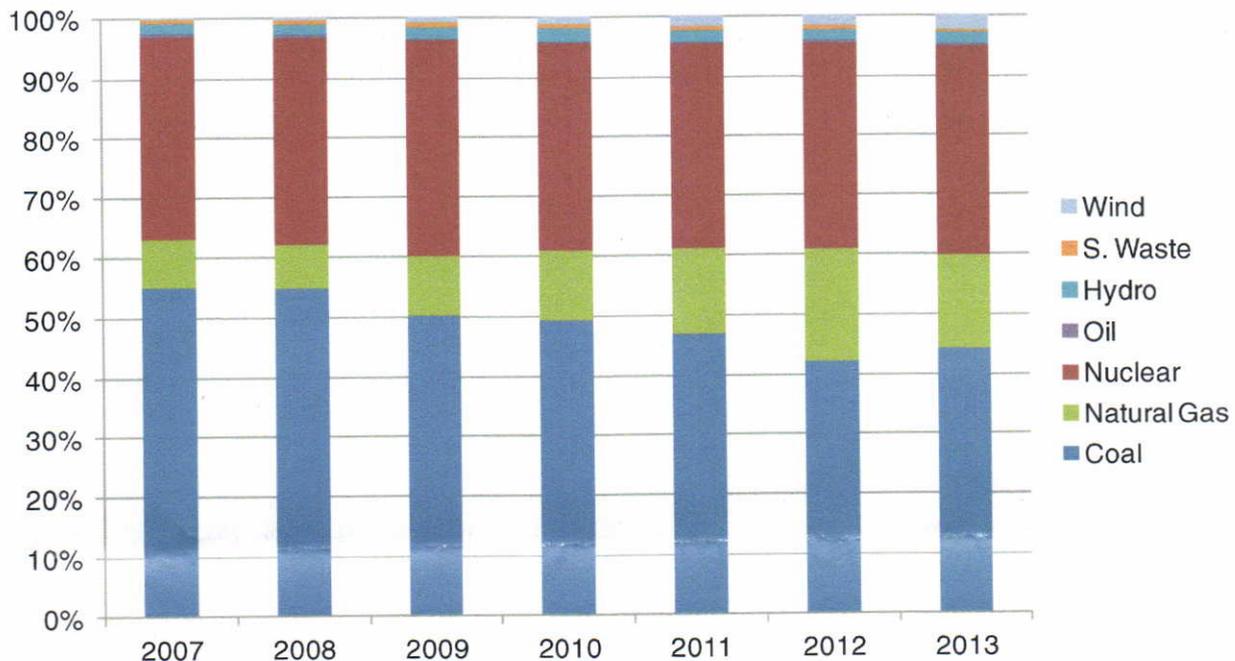
At the time of the release of the 2009 PJM study, Henry Hub natural gas prices were forecast to be at \$6.44/mmBtu in 2013. However, due to expanded shale gas production, especially in the Marcellus Shale areas of Pennsylvania, we are operating in an environment where gas prices have generally been below \$4/mmBtu on average in 2013. Henry Hub futures prices are indicating gas prices to remain below \$4.50/mmBtu through November 2017 and below \$5/mmBtu through November 2019.¹

¹ NYMEX future at http://www.cmegroup.com/trading/energy/natural-gas/natural-gas_quotes_settlements_futures.html for close on Tuesday September 24, 2013.

Additionally, the delivered prices of coal, based on updated spot coal prices and transportation costs have increased from the \$2.30/mmBtu price used in the 2009 study to approximately \$3.36/mmBtu for delivery of Central Appalachian or Northern Appalachian coal to Delaware in 2013.²

The implication of lower gas prices and higher coal prices is a significant change in the marginal cost of carbon dioxide (CO₂) reduction from switching away from coal-fired generation to combined cycle natural gas generation. In the 2009 study, a price of \$35.80/ton of CO₂ would be needed to induce switching from coal to combined cycle gas in the economic dispatch of generation. In today's current fuel price environment the marginal cost of CO₂ reduction from fuel switching is negative (-\$14 to -\$17/ton), which means that no CO₂ price would be needed to induce switching from coal to combined cycle gas, since combined cycle gas is already lower cost in the dispatch than coal would be in Delaware. Also, looking forward, even if delivered coal prices are assumed to stay at today's levels, combined cycle gas would be projected to be dispatched ahead of coal through 2019.

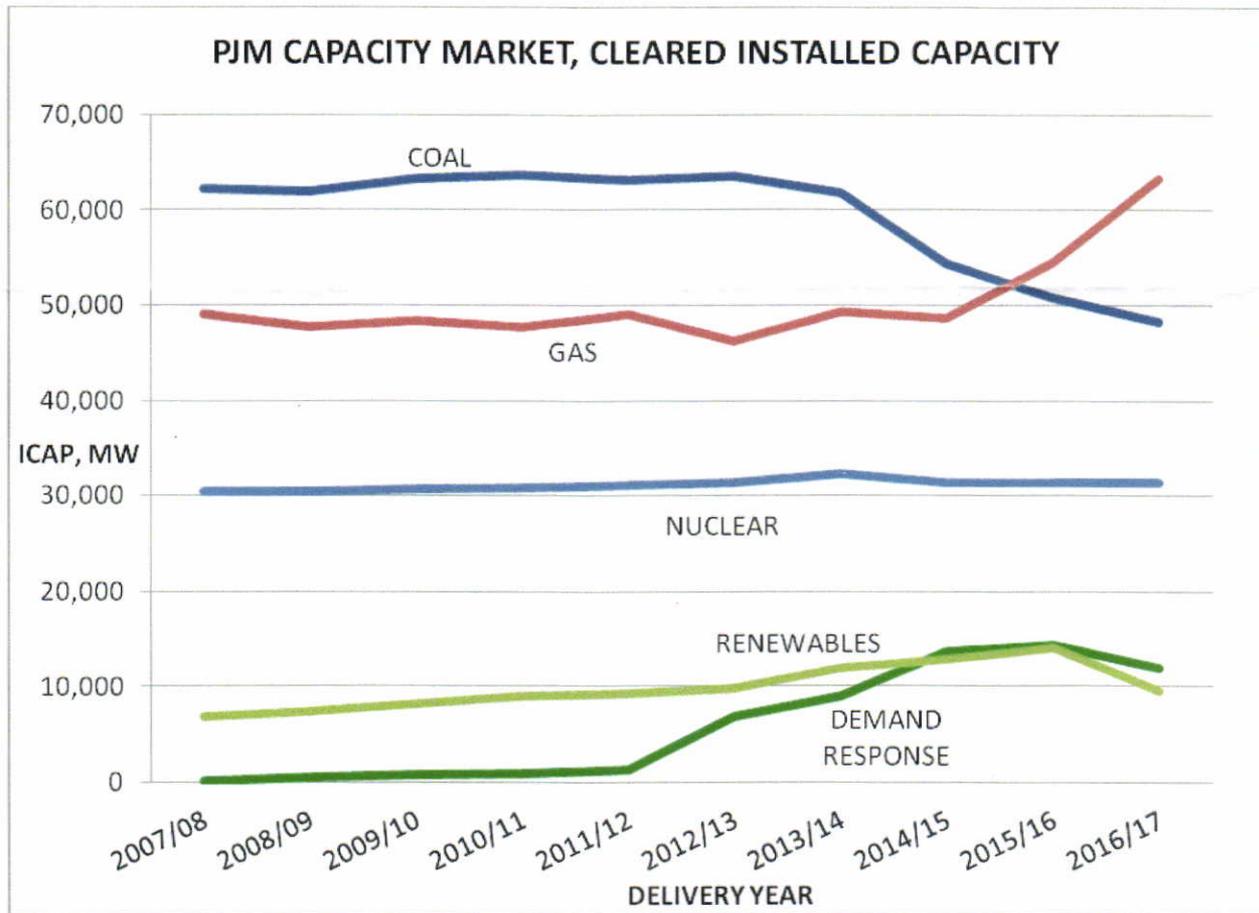
PJM has already witnessed a change in the generation dispatch, with combined cycle natural gas fired generation displacing coal-fired generation. Below is a graph of the fuel mix in the PJM region, with each fuel type represented as a percentage of the total fuel supply.



The share of natural gas generation has increased from approximately 7 percent in 2007 and 2008 to nearly 20 percent in 2012 and is currently about 15 percent of total generation in 2013. At the same time the coal share of generation has fallen from approximately 55 percent in 2007 to 42 percent in 2012 and bouncing back to about 45 percent so far in 2013.

² Rail transportation costs http://www.eia.gov/coal/transportationrates/pdf/table13_basin_state_eia_nominal.pdf and spot prices here http://www.eia.gov/coal/news_markets/ for September 20, 2013.

The prospects for low natural gas prices, along with the EPA Mercury and Air Toxics Standards (MATS) have also had a profound impact on the mix of capacity resources being committed in PJM's three year forward capacity market known as the Reliability Pricing Model (RPM). The figure below illustrates the significant change in the capacity mix from coal to natural gas starting with the Delivery Year beginning June 1, 2014 and ending May 31, 2015 through the 2016/2017 Delivery Year.

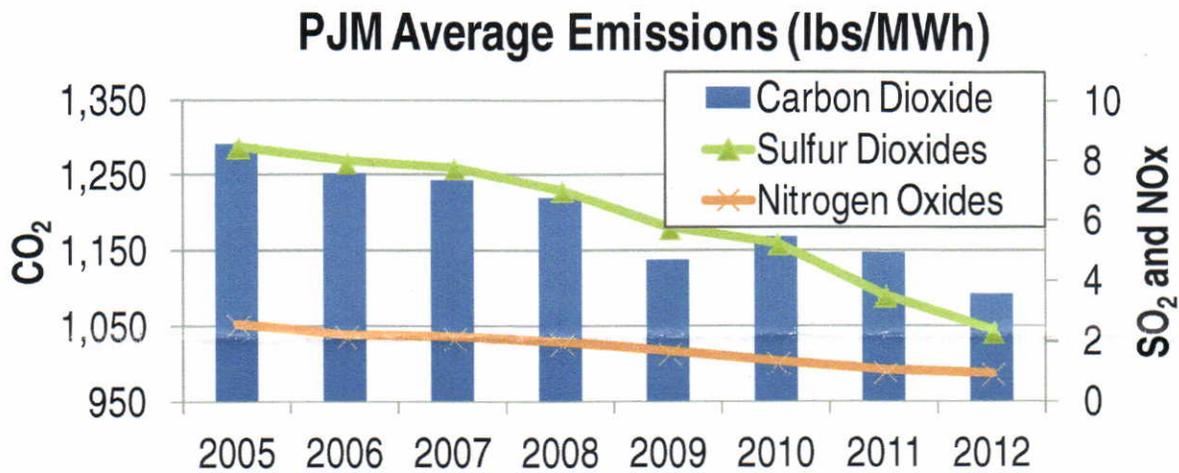


The implication of this evolving capacity mix is that an increasing amount of combined cycle gas generation will come on line that will likely be dispatched ahead of coal even without any price on CO₂ emissions.

Implication for CO₂ Emissions in PJM and in Delaware

Given the changing dispatch away from coal and toward combined cycle gas generation, the emissions rates, in pounds per megawatt-hour (lbs/MWh), for CO₂ and criteria pollutants such as sulfur dioxide (SO₂) and nitrogen oxides (NO_x) have declined significantly across the PJM footprint since 2005, as shown by the graphic below. CO₂ emissions rates have declined approximately 15 percent, SO₂ emissions rates have fallen 72 percent, and NO_x emission rates have fallen 63 percent. Given the move toward more natural gas-fired generation in the dispatch and in the capacity mix this trend in declining emissions rates should be expected to continue. Moreover, from 2005 to 2012, even with the expansion of the PJM footprint and load growth, total CO₂ emissions have fallen 6 percent or nearly 28 million tons footprint-wide.³

³ PJM-EIS Generator Attribute Tracking System. <https://gats.pjm-eis.com/gats2/PublicReports/PJMSystemMix/>



Impacts on the PJM Energy Market Operations

In addition to understanding the changing market trends since the 2009 study, it may be important to distinguish the energy market operation implications that PJM anticipated during its 2009 study from the energy market implications that may result from Delaware's proposed rules. Simulation results from the 2009 study indicated that for every \$1/ton increase in the price of CO₂ emissions, the load-weighted average LMP across PJM would increase 70 to 80 cents/MWh. In the context of the 2009 work, it is important to understand that all generation in PJM would face a CO₂ price as the GHG policies modeled were national. In contrast, the proposed rule in Delaware affects only Delaware. The impacts on prices in Delaware due to a price on CO₂ faced only by generation in Delaware is not clear, but intuitively should be less given the ability to move power from generation resources that do not face a price on CO₂ emissions from non-RGGI jurisdictions into Delaware. However, impacts on the running costs of different generator types in Delaware can be readily understood with coal units emitting approximately 1 ton of CO₂/MWh and combined-cycle natural gas units emitting about 0.4 tons of CO₂/MWh.⁴ At these emissions rates and, for example, the proposed CCR Trigger Prices the running costs of a coal and combined cycle unit would increase by \$10/MWh and \$4/MWh, respectively in 2017.

⁴ Assumes a coal plant with a 10 mmBtu/MWh heat rate and 205 lbs CO₂/mmBtu emission rate and combined cycle gas with a 7 mmBtu/MWh heat rate and 117.8 lbs CO₂/MWh.

PJM appreciates this opportunity to provide context for its 2009 climate change policy study as it relates to market conditions today. We stand ready to be of further assistance to your agency if the need arises as you consider changes to Delaware's CO2 Budget Trading Program.

Regards,

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