



# Inside Energy

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**RE: Carbon dioxide cap and trade dramatically lower power plant efficiency and increase emissions**

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Experience with the nine-state Regional Greenhouse Gas Initiative (RGGI) has shown it may actually increase emissions at power plants forced to purchase emission allowances by lowering operating efficiency by turning baseload power plants into load followers with intermittent operation. I calculate a 13% decline in efficiency from lower operating hours, compared to a potential 6% gain from all energy efficiency strategies in the Clean Power Plan.

The latest RGGI auction is adding about \$4.17/megawatt-hour to coal-fired Electric Generating Units (EGUs) in Delaware and Maryland. In addition, an Environmental Protection Agency spreadsheet calculates the cost to run Selective Catalytic Reduction (SCR) pollution control equipment under various operating conditions (also attached). Since RGGI began, the SCR operation costs may have risen by \$2.45/megawatt-hour, and increased coal usage may have added another \$0.54, for a grand total of \$7.16/megawatt-hour in added costs. This is a significant amount considering the average PJM Delmarva Zone wholesale price in 2017 was \$35/megawatt-hour and leads directly to fewer operating hours and lower efficiency.

Merchant coal-fired Electric Generating Units (EGU) in two RGGI states, Delaware and Maryland, in the PJM Interconnection Regional Transmission Organization were reviewed. Table 1 provides the combined operating information for coal-fired Chalk Point, MD units 1 and 2, Dickerson, MD, units 1, 2, and 3, and Indian River, DE unit 4.

Table 1: Operating Information for six coal-fired EGU's in MD and DE

Year	MMBTU	MWh	Tons CO2	Heat Rate	tons CO2/MWh	Operating Hours	Efficiency
2009	77,892,841	8,339,131	7,985,161	9341	0.958	40750	36.5%
2010	83,006,579	8,492,233	8,721,474	9774	1.027	41701	34.9%
2011	62,291,965	5,759,548	6,390,655	10815	1.110	32428	31.5%
2012	43,386,334	4,108,110	4,401,386	10561	1.071	26261	32.3%
2013	51,535,606	4,745,005	5,280,418	10861	1.113	30877	31.4%
2014	48,906,883	4,480,833	5,141,322	10915	1.147	26898	31.3%
2015	27,507,453	2,394,986	2,621,515	11485	1.095	15534	29.7%
2016	27,930,508	2,335,968	2,816,511	11957	1.206	16466	28.5%

Source: MMBTU, Ton CO2, and operating hours are from RGGI COATS at <https://rggi-coats.org/eats/rggi/index.cfm?hc=ISkgICAK> , MWh are from US Energy Information Agency Form 923 at <https://www.eia.gov/electricity/data/eia923/> , other columns calculated



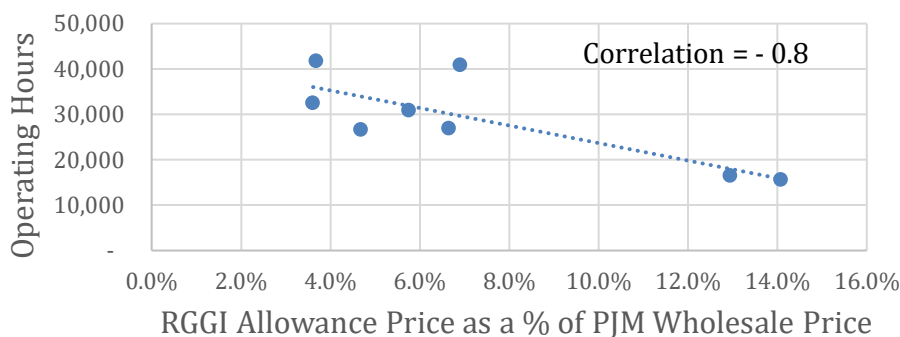
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Graph 1 uses information from Table 1 and shows how increasing RGGI emission allowance prices reduce operating hours. Coal-fired generation in non-RGGI states continued at about twice the RGGI state average.

Graph 1

DE/MD Merchant Coal-Fired Generating Units  
Operating Hours vs. RGGI Allowance Cost



Graph 2 also uses information from Table 1 and shows operating efficiency falls approximately 18.5% when operating hours are cut 60%. In the Clean Power Plan, estimates of potential energy efficiency improvements totaled about 6%, so the impact of lower operating hours is about three times as large as all other energy efficiency improvements combined! Lower operating efficiency increases CO<sub>2</sub> emissions. The Indian River Power Plant in Delaware saw a 32% rise in emissions per MWh from 2012 when each MWh emitted 0.87 tons of CO<sub>2</sub> to 2017 when each MWh emitted 1.15 tons. More coal was used to produce each MWh.

Lower operating hours over the period has two probable sources; the rapidly falling fuel cost of natural gas compared to coal and the added cost of carbon dioxide emission allowances. According to the US Energy Information 2017 Agency Annual Energy Outlook, the national average Capacity Factor for coal-fired EGUs, the actual operating hours compared to potential operating hours, for coal-fired EGUs dropped from 65.1% in 2009 to 51% in 2016, or about 1235 hours in reaction to lower natural gas prices. Average operating hours at the six EGU's in Maryland and Delaware fell 4048 hours between 2009 and 2016. So, the ratio of hours lost because of lower natural gas prices to RGGI allowance cost is about 30% to 70%. Therefore, RGGI accounted for about a 13% decline in energy efficiency at the six EGU's (18.5% X 70%). EPA should consider expanding this study beyond six operating units.



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Graph 2

**Six Merchant Coal Fired Power Plants in MD & DE  
Operating Efficiency v. Operating Hours**

