



MEMORANDUM

Subject:	Analysis of Impact of PADEP's RGGI Rule on Combined Heat and Power Vicinity Energy, Gray's Ferry Plant, Philadelphia, PA
To:	Jaclyn Bliss, Vicinity Energy, jaclyn.bliss@vicinityenergy.us
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ALL4 LLC (ALL4) has conducted a review of the 2014-2019 operating, dispatch, and pricing data for the Vicinity Energy (Vicinity) Gray's Ferry (GF) combined heat and power (CHP) plant located in Philadelphia with regard to the to the impact that Regional Greenhouse Gas Initiative (RGGI) Allowance pricing could have on their economic dispatch and carbon dioxide (CO₂) emissions. ALL4 has confirmed the data analysis by Vicinity of the impacts of implementing Pennsylvania's RGGI rule as presently drafted. The results of the Vicinity analysis was previously provided to PADEP by Vicinity in the Spring of 2020. This analysis illustrates that, with the implementation of the proposed RGGI rule and requirements to purchase allowances, the GF plant will realize a reduction in operating days due to the increased cost of producing electricity for sale to the PJM regional electric grid for certain times of the year. This reduction in GF's CHP operating days and electric output to the grid will result in the electric power being replaced and produced by less efficient, non-baseload electric generating units (EGUs), which also results in a net increase in the amount of CO₂ emissions generated to supply power to the PJM region.

The GF CHP plant operates year round, producing and selling electric power to the PJM regional electric grid and providing steam to local commercial, institutional, and residential properties such as universities, hospitals, businesses, and apartment buildings. When compared to large power plants that operate EGUs with a sole purpose of producing and selling power, operating costs for the GF CHP plant are higher, with a smaller margin of economic benefit. Unlike most power plants that are located in suburban or rural areas, GF is located in an urban environment, requiring the facility to purchase natural gas at a higher cost from a third-party downstream supplier, rather than tap into a more cost-effective major interstate gas pipeline. Unlike large price-setting EGUs, the GF CHP plant will bid into the market, and generate and sell power depending on their cost to produce the electric power. The variable costs of natural gas purchased, and electric megawatts sold, define the economic viability of the CHP plant, and any additional costs incurred, such as RGGI required carbon allowances, will disproportionately impact the facility.



Vicinity's analysis of CO₂ emissions saved by CHP units is based on the methodology developed by the U.S. EPA Combined Heat and Power Partnership, dated February 2015¹. ALL4 reviewed this methodology and actual annual operating data from the period 2014-2018, including power generated, steam generated, and fuel consumption, and actual dispatch data from 2019, including power generated, economic heat rate, daily natural gas fuel price [\$/million British thermal units (MMBtu)], and daily market power price (\$/MW). In order to conduct an economic impact analysis, Vicinity calculated a variable RGGI cost-factor (\$/MMBtu) using the carbon intensity of natural gas (117 lb CO₂/MMBtu)² and the historical RGGI carbon allowance costs (\$/ton CO₂)³, which, over 12 years of RGGI implementation, has ranged between 10 and 44 cents per MW. The variable RGGI cost-factor was then added to the GF plant's marginal cost to generate power, and compared to Vicinity's 2019 local market power price, to assess the impact of additional periods when it would not be economical to produce power at the increased price.

ALL4 reviewed the GF plant's 2014-2019 historical operating data to establish a conservative estimate of CO₂ emissions resulting from a normal year of operating 339 days (nearly 93%), during all seasons, generating an average of over 999,000 MW and nearly six million MMBtu of steam energy. ALL4 developed four potential future operating cases to determine the economic impact of the RGGI rule's "Useful Thermal Energy Exemption" (UTE Exemption), as presently drafted, for CHP. The UTE Exemption for CHP requires the purchase of RGGI allowances only for fuel consumed for electric sold to the grid, eliminating the requirement to purchase allowances for the amount of CO₂ emissions that are emitted as a result of providing useful thermal energy (i.e., steam) supplied directly to a co-located facility or customers. Further, ALL4 evaluated the variable impact of what an increasing RGGI allowance cost could mean for future operating years to determine the point where, without significant exemptions under the rule, CHP electric generation ceases to be economically beneficial.

- For Case 1, ALL4 was able to confirm that, based on historical operating data and the most recent RGGI allowance price of \$7.41 from the auction held December 2, 2020, the GF plant operation would decrease by at least 10% with the RGGI UTE Exemption. This decrease in GF CHP operation would result in an increase of CO₂ emissions of nearly 53,000 tons.
- For Case 2, ALL4 applied a price increase rate of 30% over the December 2, 2020 allowance price, resulting in a RGGI allowance price of \$9.63. The 30% increase was based on the actual rate of increase of the December 2020 allowance price compared to the December 2019 allowance price and the average annual 2019 allowance price.

¹ "Fuel and Carbon Dioxide Emissions Savings Calculation Methodology for Combined Heat and Power Systems," February 2015 https://www.epa.gov/sites/production/files/2015-07/documents/fuel_and_carbon_dioxide_emissions_savings_calculation_methodology_for_combined_heat_and_power_systems.pdf

² <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

³ <https://www.rggi.org/auctions/auction-results/prices-volumes>



With this moderate increase in RGGI allowance price, the GF plant operation would decrease by at least 15% with the RGGI UTE Exemption. This decrease in CHP operation would result in an increase of CO₂ emissions of more than 68,600 tons.

- For Case 3, applied a price increase rate of 30% over the Case 2 allowance price, resulting in a RGGI allowance price of \$12.52. With this increase in RGGI allowance price, the GF plant operation would decrease by at least 23% with the RGGI UTE Exemption. This decrease in GF CHP operation would result in an increase of CO₂ emissions of nearly 92,000 tons.
- For Case 4, applied a price increase rate of 30% over the Case 3 allowance price, resulting in a RGGI allowance price of \$16.28. With this increase in RGGI allowance price, the GF plant operation would decrease by at least 42% with the RGGI UTE Exemption. This decrease in GF CHP operation would result in an increase of CO₂ emissions of more than 148,000 tons.

In a normal operating year, due to the cost of natural gas and price of power, the CHP plant sells less power to the grid during the spring and fall “shoulder months”. The plant does not operate as a baseload or peaking plant, as the units do not come “online” or “off-line” quickly, due to operating system limitations and costs. While the GF plant may choose to weather a few days of operation and sell power at a loss prior to shutting down, conversely, if off-line, the GF plant may opt out of production for a more significant period of time to avoid additional economic impact from cycling on and off.

Any increase in operating costs with the RGGI allowance cost will reduce the number of economically viable CHP operating days, and the power that would have been generated by the GF plant, would be generated by other, less efficient, and higher carbon-emitting EGUs, thus increasing the region’s carbon emissions. It is important to understand that any decrease in electric generation supplied to the grid from a CHP unit, which is replaced by generation from a non-CHP unit, will result in increased carbon emissions.