Potomac River Generating Station: Update on Reliability and Environmental Considerations

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1. EXECUTIVE SUMMARY

The American Clean Skies Foundation retained Analysis Group to evaluate: (1) whether the operation of the Potomac River Generating Station ("PRGS") is still required to ensure that the District of Columbia and neighboring areas have adequate and reliable sources of electric power; and (2) the potential reductions in air pollution that could result if the PRGS were retired.

The PRGS is a 482 MW coal-fired electric generating station owned by a subsidiary of GenOn Energy, Inc. ("GenOn"). The Station comprises five separate steam turbines built between 1949 and 1957, all of which remain in operation. The facility sits on the banks of the Potomac River in the northern part of the city of Alexandria, Virginia.

In 2005, state environmental officials in Virginia cited the plant as having violated various air pollutant standards and ordered its owners to upgrade the plant or shut it down. In response, the owners chose to shut down the facility, but were prevented from doing so when the U.S. Department of Energy ("DOE") required the plant to continue operating in order to maintain electric reliability in the District of Columbia area. The Federal Energy Regulatory Commission ("FERC") also directed the local District of Columbia utility, Potomac Electric Power Company ("PEPCO"), and the Pennsylvania New Jersey Maryland Interconnection ("PJM" – the Regional Transmission Organization serving that area) to submit a plan for preserving reliability in the area without relying on the PRGS. PEPCO and PJM recommended investing in various transmission upgrades so that the District would be able to meet local reliability requirements. Subsequently, most such transmission upgrades were made and have gone into commercial operation. Meanwhile, the plant's owners made various equipment changes at the plant to improve its emissions profile. Even so, the plant has continued to operate less and less over time. New questions have also arisen about the future of the plant in light of the changing economics of power generation (e.g., the price of natural gas relative to coal), upcoming federal environmental regulations, and other factors.

We analyzed the reliability and air emission impacts of a potential retirement of the PRGS. Our main conclusions are as follows.

First, with respect to electric reliability issues:

- Based upon the substantial transmission system upgrades that have been put in place since 2005, we do not think that relevant authorities would find the PRGS needs to remain in operation in order for the District of Columbia to have reliable power supply. Our conclusion is consistent with the prior 2008 determinations of PEPCO and PJM.
- The plant no longer operates very much, in any event. Last year, the combined output of all PRGS units represented only five percent of the total generation in the local "PEPCO area" of the PJM electrical region. And PRGS supplied only two percent of

the total generation in the local MidAtlantic area of PJM and just 0.3 percent of the wider PJM grid.

- Prior to any future retirement of the PRGS plant, reliability issues would need to be analyzed by PJM and PEPCO. Such analyses could result from a request by PRGS's owner to deactivate the facility. Alternatively, an analysis of the need for continued operation of the PRGS could come from a request or requirement of FERC or the Public Service Commission of the District of Columbia ("PSC").

Second, as regards air pollution:

- Based on our simulation analysis of regional power system operations in the local region with and without PRGS, we found that the retirement of the PRGS would likely reduce air pollutants in the region – especially compared to the potential for PRGS to emit nitrogen oxides ("NO_x"), sulfur dioxide ("SO_2"), and carbon dioxide ("CO_2"), rather than its emissions levels in recent years.
- We estimate that retirement could reduce emissions of CO_2 by up to as much as 600,000 tons annually, if PRGS' potential output were replaced by other plants.
- The results related to impacts on the formation of ground-level ozone are similar. Total NO_x emissions could drop very substantially.
- Perhaps even more importantly from the perspective of local/regional air quality associated with ozone and particulates, PRGS retirement would reduce NO_x and SO_2 during the summer months, when air quality is typically at its worst in the northern Virginia/District of Columbia area. We estimate that plant closure could lead to reductions during the period June – August of approximately 1.9 million lbs of NO_x emissions, and 325,000 lbs of SO_2 emissions, if PRGS' potential generation were replaced by other plants in the region.
- These are upper limits on emissions reductions, since in recent years PRGS has run far less than its potential output.

In short, significantly lower emissions would likely result from retirement of PRGS, particularly in summer months, resulting in mitigation of the risks associated with climate change and improvement in local and regional air quality.

Our report provides an overview of the PRGS; summarizes historical background on environmental and reliability concerns associated with the power plant and its operation within the Washington DC area; explains changes that have occurred in the regional electrical system to address the reliability issues; reports data on recent operating history and emission control commitments made by the owners of the PRGS facility; and provides the results of our analysis of potential emissions from power station operations.

2. INTRODUCTION AND BACKGROUND ON THE POTOMAC RIVER GENERATION STATION

The PRGS is a 482 MW[1] coal-fired electric generating station owned by a subsidiary of GenOn Energy, Inc. ("GenOn"). The Station has five separate steam turbines built between 1949 and 1957, all of which remain in operation today. See Table 1. Further, the Station sits on an approximately 25-acre waterfront property in the rapidly-growing area of Alexandria, Virginia.[2]

Table 1

Potomac River
Power Plant Units - Details

	Potomac River ST 1	Potomac River ST 2	Potomac River ST 3	Potomac River ST 4	Potomac River ST 5
Generator Information					
Prime Mover	Steam Turbine	Steam Turbine	Steam Turbine	Steam Turbine	Steam Turbine
In-Service Month/Year	9/1949	6/1950	6/1954	2/1956	5/1957
Nameplate Capacity (MW)	92	92	110	110	110
Summer Net Capacity (MW)	88	88	102	102	102
Winter Net Capacity (MW)	88	88	102	102	102
Primary Fuel Type	Bituminous Coal	Bituminous Coal	Bituminous Coal	Bituminous Coal	Bituminous Coal
Secondary Fuel Type	Distillate Fuel Oil	Distillate Fuel Oil	Distillate Fuel Oil	Distillate Fuel Oil	Distillate Fuel Oil

The PRGS has for many decades burned substantial amounts of coal, with relatively high emissions of air pollutants, exacerbating air quality concerns in the heavily populated region around Washington DC (and beyond), and contributing to the accumulation of greenhouse gases in the atmosphere.[3] With some of the older generating units in the region, and being located in a densely populated area, the PRGS has been the subject of environmental concerns for some time. In 2005 the Virginia Department of Environmental Quality ("Virginia DEQ") cited the facility as being in serious violation of the National Ambient Air

[1] Net summer capability.
[2] U.S Department of Health and Human Services, "Review of Ambient Air Monitoring Data, Mirant Potomac River Generating Station, Alexandria, Virginia", March 21, 2011, Appendix C.
[3] In 2010, PRGS burned 400,187 tons of coal and emitted 1.1 million tons of CO_2, 2.9 million pounds of NO_x, and 2.8 million pounds of SO2. Data from SNL.

Quality Standards ("NAAQS") for sulfur dioxide ("SO_2"), nitrogen dioxide ("NO_2") and particulate matter, requiring the unit to take action or shut down.[4]

From an electrical point of view, the PRGS is part of PJM's interconnected and integrated electric system serving not only parts of Northern Virginia and the District of Columbia, but also much of the MidAtlantic region and parts of the Midwest. In the PJM area, power plants are dispatched to provide reliable and economical supplies to the region's electricity consumers.

Within PJM, there are various zones reflecting the systems of various participating transmission companies. The PRGS is located electrically in the PEPCO load zone, in the Mid-Atlantic Sub- Region of PJM ("Mid-Atlantic" or "MAAC") – comprised of the PEPCO, Baltimore Gas & Electric ("BGE") and other utility transmission areas, as shown in Figure 1. The Mid-Atlantic Southwest ("Mid-Atlantic-SW") Zone is comprised of PEPCO and BGE.

Figure 1: Map of the PJM Region, with MAAC, SW-MAAC and the PEPCo Areas

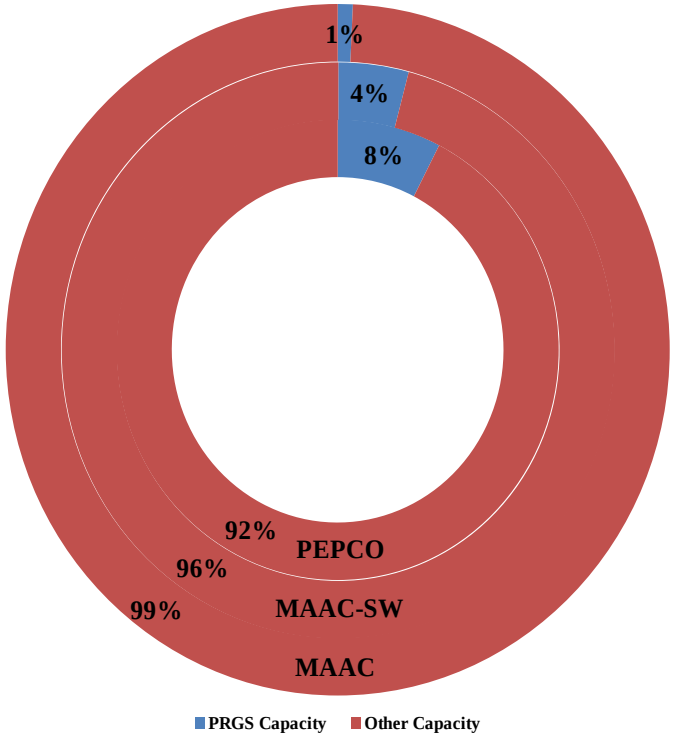
Source: Analysis Group based on PJM maps

[4] Letter from Robert G. Burnley, Director, Commonwealth of Virginia Department of Environmental Quality, to Lisa D. Johnson, President, Mirant Potomac River LLC, August 19, 2005.

The PRGS represents a small fraction of the total generating capacity in the areas of interest. In 2010, the combined capacity of all PRGS units represented approximately eight percent of the total capacity (6,345 MW) in the PEPCO region, four percent of the total capacity (11,751 MW) in the Mid-Atlantic-SW region of PJM, and one percent of total Mid-Atlantic capacity (a total of 66,047 MW). See Figure 2.

Figure 2

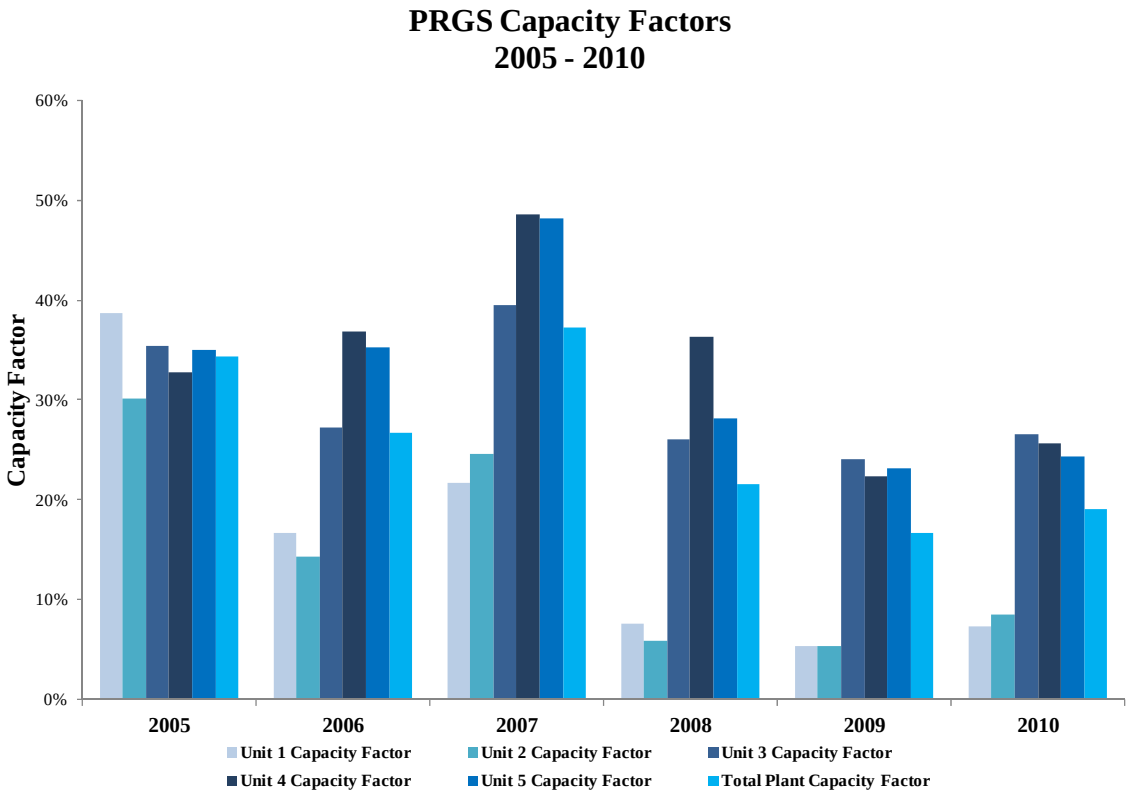
PRGS Share of Capacity in PEPCO, MAAC-SW, and MAAC Regions



Note: The MAAC-SW region is defined as the PEPCO region plus the BGE region. The MAAC region is defined as the PJM Mid-Atlantic Area Council region.
Source: Energy Velocity Data.

Power production at the PRGS units has varied, up and down, since 2005, with some years having much higher output than others. As shown in Figure 3, the facility's capacity factor ("CF") ranged between 17 and 37 percent.[5] Individual unit capacity factors over this time period have ranged from a low of 5 percent (for Unit 1, the oldest unit, in 2009) to a high of 49 percent (for Unit 4 in 2007).

Figure 3



Source: SNL Data.

Thus, reliance on the PRGS from the perspective of total energy output is less than its contribution to total regional generating capacity. With 8 percent of the capacity, the PRGS units together represented only 5 percent of the total generation in the PEPCO region, 2

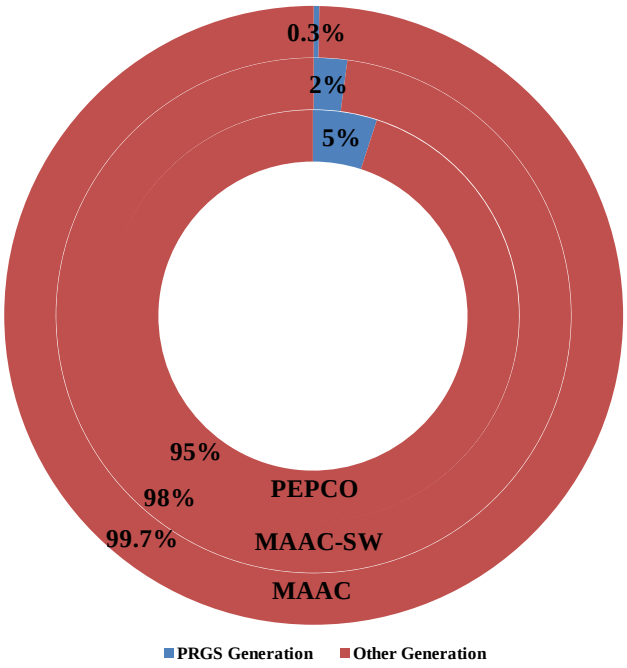
[5] Capacity factor measures the actual production of energy from the facility compared to what its production would be over the same time period if operating continuously at maximum output. Consequently, a CF of 10 percent means the unit produced only about one tenth of what it could have produced.

percent of the total Mid-Atlantic-SW generation, and just 0.3 percent of total power production in the Mid-Atlantic region.[6] See Figure 4.

At various times over the past decade, public concerns have been raised with regard to two issues relating to the PRGS: (1) its role in assuring reliable electricity to consumers in the local areas, and how that would be affected if the plant were to retire; and (2) its environmental impacts, such as those that led the Virginia DEQ to cite the facility as being in serious violation of air quality standards and ordering the plant to take action or shut down.

Figure 4

PRGS Share of 2010 Generation in PEPCO, MAAC-SW, and MAAC Regions



Note: The MAAC-SW region is defined as the PEPCO region plus the BGE region. The MAAC region is defined as the PJM Mid-Atlantic Area Council region.
Source: Energy Velocity Data.

[6] Total PEPCO region output in 2010 was 17 Terawatt-hours (TWh). Total Mid-Atlantic-SW output was 40 TWh; and total Mid-Atlantic generation of 277 TWh.

3. PRGS OPERATIONS AND LOCAL ELECTRIC SYSTEM RELIABILITY – HISTORY AND CONTEXT

Reliability Concerns Emerge[7]

Concerns over electric system reliability in the Washington DC area began with a PJM evaluation of the potential retirement of the PRGS in June 2005.[8] The report identified a number of potential reliability issues that could flow from the PRGS' retirement and highlighted the following technical issues:

- An outage of either of two parallel transmission lines (the Palmers Corner – Blue Plains – Potomac River 230 kV circuits) would result in an overload of the other remaining circuit. This potential reliability concern could be mitigated by new transmission lines (i.e., two new 230 kV circuits parallel to the existing circuits).
- Numerous voltage criteria violations could occur on the PEPCO system, requiring different equipment solutions – the installation of reactive compensation, with substation upgrades – to remedy this problem.
- Substation upgrades would also be required to address potential overloads due to line fault from potential stuck breakers.
- Line loading concerns could also arise on five high voltage circuits and two 500/230 kV transformer facilities, with resolution of these concerns best evaluated as part of a more comprehensive study for the area.

The potential for the identified reliability concerns to become reality emerged at about the same time. In August of 2005 the Virginia DEQ sent a letter to Mirant (PRGS' owner at the time), stating that the plant was in serious violation of the NAAQS for SO_2, NO_2, and particulate matter (specifically, PM10).[9] DEQ requested that Mirant "immediately undertake such action as is necessary to ensure protection of human health and the environment, in the area surrounding the Potomac River Generating Station, including the potential reduction of levels of operation, or potential shut down of the facility."[10] Mirant responded, stating that as of midnight on August 21, 2005, the output of all burners at the PRGS was reduced to the lowest possible level, and in light of not having found a way to operate the plant in

[7] To conduct this review, Analysis Group relied on public documents tracking the performance of the PRGS, reliability issues related to it, progress of transmission system upgrades to address reliability issues in the DC area, data from SNL on power plant unit operations and costs, and PJM data on hourly electrical load.
[8] "Reliability Evaluation for the Potential Retirement of Potomac River Generation," PJM, June 10, 2005.
[9] Letter from Robert G. Burnley, Director, Commonwealth of Virginia Department of Environmental Quality, to Lisa D. Johnson, President, Mirant Potomac River LLC, August 19, 2005.
[10] Letter from Robert G. Burnley, Director, Commonwealth of Virginia Department of Environmental Quality, to Lisa D. Johnson, President, Mirant Potomac River LLC, August 19, 2005.

accordance with NAAQS, Mirant planned to "shut down all five units at the power plant no later than midnight tonight, August 24, 2005."[11]

On August 25, 2005, the Office of the People's Counsel ("OPC") of the District of Columbia filed a motion with FERC related to closure of the PRGS.[12] The OPC raised its concern that if the plant closed, residential customers would not only be subject to reliability concerns but would also have to pay for any transmission upgrades that may be necessary in the event of the closure of the PRGS. The OPC requested, therefore, that FERC and the Secretary of Energy take steps to prevent the shutdown of the power plant. On the same day, the DC PSC filed an emergency petition with FERC requesting that FERC require the PRGS to continue operating.[13]

Several months later, the Secretary of Energy, using its emergency powers under the Federal Power Act,[14] issued an order declaring that an emergency existed due to a shortage of generation and transmission capacity in the area surrounding the PRGS.[15] DOE's order found that the central area of the District of Columbia was essentially served only by the PRGS and flows over two 230 kV transmission lines, and that the transmission infrastructure was inadequate to move power into the DC area from neighboring facilities (Benning Road and Buzzard Point generating facilities) if the PRGS facility were to retire. DOE raised concerns about the importance of power supply to critical federal agencies in the DC area and the Blue Plains wastewater treatment plant which, according to PEPCO, would have to release untreated sewage into the Potomac River within 24 hours of an electrical outage. Consequently, DOE ordered that:

- If one or both of the 230 kV transmission lines were out of service, the PRGS would be needed, with an amount of power specified by PJM.
- When producing electricity, Mirant would be required to use pollution control equipment and measures to minimize violations of NAAQS.
- Mirant would have to take all feasible steps to minimize the start-up time of PRGS for the purposes of providing electric reliability.[16]

[11] "Mirant Potomac River," Letter from Lisa D. Johnson, President, Mirant Potomac River LLC, to Robert G. Burnley, Director, Commonwealth of Virginia Department of Environmental Quality, August 24, 2005.
[12] "Notice of Filing of Emergency Petition and Complaint," District of Columbia Public Service Commission, FERC Docket No. EL05-145-000, August 25, 2005.
[13] "Office of the People's Counsel of the District of Columbia's Motion to Intervene," Office of the People's Counsel, District of Columbia, FERC Docket No. EL05-145-000, August 25, 2005.
[14] The Secretary of Energy is granted such powers by section 202(c) of the Federal Power Act (FPA), 16 U.S.C. § 824a(c), and section 301(b) of the Department of Energy Organization Act, 42 U.S.C. § 7151(b), which state, in part, that during "a shortage of electric energy or of facilities for the generation or transmission of electric energy…the Commission shall have authority…to require by order such temporary connections of facilities and such generation, delivery, interchange, or transmission of electric energy as in its judgment will best meet the emergency and serve the public interest."
[15] United States Department of Energy Order No. 202-05-3, District of Columbia Public Service Commission Docket No. EO-05-01, December 20, 2005.
[16] Ibid.

Given the air quality concerns with regard to continued operation of the PRGS plant under these conditions, additional steps followed.

The Transmission Response and PRGS Plans

At the beginning of 2006, FERC initiated a sequence of steps to accomplish an upgrade of the regional power system around Washington, DC, so as to assure reliable power system operations. FERC directed PJM, as the regional grid operator, and PEPCO, as the local transmission company, to "develop and implement a comprehensive plan to preserve reliability in the region."[17] PJM and PEPCO submitted their reliability plan in response to FERC's order on February 8, 2006.[18]

The plan included certain near-term and longer term plan elements.[19] Specifically, PEPCO proposed in the near-term to install two 69kV lines between the Palmers Corner and Blue Plains substations (with a planned in-service date of June 2006) in order to serve the Blue Plains wastewater treatment plant from the Palmers Corner substation rather than from the Potomac River substation and to reduce the total amount of load served from the PRGS.

Looking to longer-term plan elements, PEPCO proposed to construct two 230kV transmission lines between the Palmers Corner substation and the Blue Plains switching station, with an anticipated in-service date of June 2007. According to PEPCO, construction of these lines was anticipated to resolve all reliability concerns, including those that would result from the retirement of the PRGS. PEPCO also requested extension of DOE's order for continued operation of the PRGS until construction for the transmission projects were completed, and committed to continue to evaluate the potential need for additional transmission infrastructure on PEPCO and neighboring systems in order to address the permanent loss of the PRGS generating capacity.[20]

Throughout the rest of 2006 and into 2007, a number of factors indicated a change in outlook for continued operation of the PRGS. The reliability issues meant that at least temporarily, the plant would need to remain in service. In June of 2006, EPA issued an order allowing the PRGS to return to near capacity generation, provided the plant does not exceed federal air

[17] "PEPCO, PJM Directed to Develop Comprehensive Plan to Assure Continued Power Grid Reliability," Federal Energy Regulatory Commission News Release, January 9, 2006.
[18] Letter from Kirk J. Emge, General Counsel, Potomac Electric Power Company, and Vincent P. Duane, Deputy General Counsel, PJM Interconnection LLC, to Magalie R. Salas, Secretary, Federal Energy Regulatory Commission, RE: District of Columbia Public Service Commission, Docket No. El05-145-000 Joint Compliance Filing of Potomac Electric Power Company and PJM Interconnection, LLC, February 8, 2006.
[19] The information we have relied upon in our analysis is the public portion of this report, since much of the information in the Plan is redacted as Critical Energy Infrastructure Information (CEII).
[20] Letter from Kirk J. Emge, General Counsel, Potomac Electric Power Company, and Vincent P. Duane, Deputy General Counsel, PJM Interconnection LLC, to Magalie R. Salas, Secretary, Federal Energy Regulatory Commission, RE: District of Columbia Public Service Commission, Docket No. El05-145-000 Joint Compliance Filing of Potomac Electric Power Company and PJM Interconnection, LLC, February 8, 2006.

quality standards.[21] In this context, a PEPCO spokesperson stated that the absence of the PRGS put PEPCO's reliability "at risk."[22] At the beginning of 2007, the DC PSC urged DOE to "think twice" before allowing the expiration of its emergency order, which kept the PRGS running for reliability reasons.[23] The DC PSC suggested that only if a new reliability study, performed after the installation of the additional transmission resources into DC, were to indicate that reliability concerns no longer existed should the DOE emergency order be allowed to end. Mirant argued that the completion of transmission upgrades should not be presumed to lead to the retirement of the PRGS, without a thorough review of the reliability situation.[24]

In February 2007, PJM addressed these issues for the first time in its 2006 Regional Transmission Expansion Plan ("RTEP").[25] RTEP noted an expectation that the plant would remain available under certain circumstances until at least July 2007. It also stated that the potential violations of reliability criteria associated with plant closure would not be fully rectified until "various RTEP upgrades are completed in 2008."[26] The plan stated that the final status of the PRGS "has not yet been established, pending the outcome of regulatory decisions on whether and to what extent the plant must be upgraded to meet environmental standards."[27]

The Apparent Elimination of the Need for PRGS

For the remainder of 2007 and into 2008, progress was made on the transmission system upgrades. Technical review of PEPCO and PJM transmission plans by the state and federal authorities all point to an expectation that once these lines entered service, there would no longer be a need for the PRGS in order to maintain power system reliability in the Washington DC area. For example, on July 9, 2007, in consideration of PJM's installation of the additional 230 kV transmission lines into the DC area, DOE allowed its 2005 emergency order forcing the PRGS to operate to expire, and noted "now that we have seen the installation of the added lines…the emergency condition we felt existed has passed and there is no reason for the department to extend the order."[28]

[21] Gowen, Annie, "EPA Lets Mirant Increase Output," The Washington Post, June 3, 2006.
[22] Gowen, Annie, "EPA Lets Mirant Increase Output," The Washington Post, June 3, 2006.
[23] "DC Regulators Press Energy Secretary to Keep Mirant Plant in Virginia Running," Platts Global Power Report, January 18, 2007.
[24] E-Mail from Debra Raggio Bolton, Vice President & Assistant General Counsel, Mirant Potomac River LLC, to Anthony J. Como, Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy, RE: Special Environmental Analysis, DOE/SEA-04, Potomac River Generating Station, Reply to Comments, January 30, 2007.
[25] PJM 2006 Regional Transmission Expansion Plan, PJM, February 27, 2007
[26] PJM 2006 Regional Transmission Expansion Plan, PJM, February 27, 2007, p. 71.
[27] PJM 2006 Regional Transmission Expansion Plan, PJM, February 27, 2007, p. 71.
[28] Loveless, Bill, "With New Transmission Lines to DC, DOE Lets Emergency Order Run Out," Platts Inside Energy, July 9, 2007.

In July 2007, PEPCO submitted its monthly progress report to FERC on progress addressing the reliability concerns surrounding the potential retirement of the PRGS.[29] In this progress report, PEPCO indicated the completion of construction of the 230 kV transmission lines as well as all related tasks as outlined in the February 8, 2006 plan. PEPCO also requested relief from the requirement to submit monthly progress reports to FERC. In response, in August 2007, FERC found that the construction of the new transmission lines had "provided new capacity to adequately serve load absent the Potomac River Generating Station power plant," and that PEPCO and PJM had completed the long-term plan that they had earlier filed with FERC.[30] However, FERC did require PEPCO and PJM to respond to additional reliability questions that had been identified in response to a previously-issued FERC discovery question and noted in the February 2007 PJM RTEP.

On September 24, 2007, PJM responded with a report to FERC saying that: "PJM and PEPCO are confident that they successfully have addressed the potential reliability problems they identified earlier, including actual and projected violations of any reliability standards and/or reliability criteria, in the Washington, D.C. area absent the Potomac River Generating Station power plant." [31] This was accomplished through the installation of additional transmission lines, and the installation of additional equipment serving the transmission systems for the DC area as well as the Baltimore area. The transmission facilities identified as needed to resolve reliability issues are presented in Table 2, below, including the upgrade identification and description, projected completion date, and status/percent complete. This was the status of these facilities as of the filing of the September 24, 2007 PJM Report to FERC. On January 10, 2008 FERC issued a decision accepting the PJM report as having met FERC's requirements and indicating that the "order constitutes final agency action."[32]

[29] Letter from Amy L. Blauman, Assistant General Counsel, Potomac Electric Power Company, to Kimberly Bose, Secretary, Federal Energy Regulatory Commission, RE: District of Columbia Public Service Commission, Docket No. EL05-145-000, Monthly Progress Report for June, 2007, and Request to Confirm Termination of Reporting Requirement, July 13, 2007.
[30] "Order on Reporting Requirements," FERC Docket Nos. EL05-145-000 & EL05-145-001, August 24, 2007.
[31] Letter from Jeffrey W. Mayes, Senior Counsel, PJM Interconnection LLC, and Craig Glazer, Vice President, Federal Government Policy, PJM Interconnection LLC, to Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, RE: District of Columbia Public Service Commission, EL05-145 -001, September 24, 2007.
[32] Letter from Joseph H. McClelland, Director, Office of Electric Reliability, Federal Energy Regulatory Commission, to Craig Glazer, Vice President of Federal Government Policy, PJM Interconnection LLC, RE: Submission of Report on Potomac River Generating Station and Washington, D.C. Area Reliability Problems, January 10, 2008.

Table 2 – Transmission Upgrades

Upgrade ID	Description	Trans. Owner	PJM Required Date	TO Projected Date	Status Code	Percent Complete	Cost Estimate	State
b0039.1	BGE Reactive Upgrades	BGE	6/1/2007	6/1/2004	In-Service	100%	$ 9.12	MD
b0039.2	PEPCO Reactive Upgrades	PEPCO	6/1/2007	6/1/2005	In-Service	100%	$ 2.64	MD
b0039.5	Install Waugh Chapel 230kV 360MVAR capacitor bank	BGE	6/1/2006	6/1/2006	In-Service	100%	$ 1.70	MD
b0247	Install 14 MVAR of 69kV bus capacitors at Quince Orchard	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.45	MD
b0248	Install 14 MVAR of 69kV bus capacitors at Norbeck	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.45	MD
b0249	Install 28 MVAR of 69kV bus capacitors at Bells Mill	PEPCO	6/1/2006	12/2/2005	In-Service	100%	$ 0.72	MD
b0250	Install 108 MVAR of feeder capacitors at various locations	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 2.76	MD
b0251	Install 100 MVAR of 230kV capacitors at Bells Mill	PEPCO	6/1/2009	6/1/2010	Eng. & Planning	15%	$ 3.90	MD
b0252	Install 100 MVAR of 230kV capacitors at Bells Mill	PEPCO	6/1/2009	6/1/2010	Eng. & Planning	10%	$ 3.00	MD

Upgrade ID	Description	Trans. Owner	PJM Required Date	TO Projected Date	Status	Percent Complete	Cost Estimate	State
b0002	Increase emergency rating of Windy Edge - Lakespring - Texas 115 kV	BGE			In-Service	100%	$ 3.77	MD
b0010	Replace Northwest 230/115 kV transformers with 500 MVA transformers	BGE		5/1/2003	In-Service	100%	$ 9.00	MD
b0030	Construct a new 230kV tower line to separate the existing Brancon Shores-Riverside DCTL to eliminate MAAC 2C violation	BGE	6/1/2005	1/1/2007	In-Service	100%	$ 4.00	MD
b0031.1	Replace one (1) Conastone 230 kV breaker #6 (GCB) (2322/2302 line)	BGE		5/14/2004	In-Service	100%	$ 0.50	MD
b0031.2	Replace one (1) Conastone 230 kV breaker #5(ATB) (5C0-2/2322 line)	BGE		3/7/2003	In-Service	100%	$ 0.22	MD
b0032	Upgrade two Waugh Chapel 230 kV breakers	BGE			In-Service	100%	$ -	MD
b0035	Change Calvert Cliffs Unit 1 & 2 GSU tap settings	BGE		5/1/2004	In-Service	100%	$ -	MD
b0039.1	BGE Reactive Upgrades	BGE	6/1/2007	6/1/2004	In-Service	100%	$ 9.12	MD
b0039.2	PEPCO Reactive Upgrades	PEPCO	6/1/2007	6/1/2005	In-Service	100%	$ 2.64	MD
b0039.5	Install Waugh Chapel 230kV 360MVAR capacitor bank	BGE	6/1/2006	6/1/2006	In-Service	100%	$ 1.70	MD
b0146.1	Replace Quince Orchard 230kV circuit breaker for line 23029	PEPCO	6/1/2006	6/1/2006	In Service	100%	$ 1.75	MD
b0146.2	Installation of two additional 230kV circuit breakers at Quince Orchard substation on circuits 23028 and 23029	PEPCO	6/1/2006	12/31/2006	In-Service	100%	$ 3.04	MD
b0150	Modify fixed tap settings of Waugh Chapel 500/230 kV transformers	BGE	6/1/2005	6/1/2005	In-Service	100%	$ -	MD
b0152.1	Add 1-230 kV breakers at High Ridge	BGE	6/1/2005	6/1/2005	In-Service	100%	$ 0.59	MD
b0152.2	Install 230kV breaker at High Ridge for line 2336	BGE	6/1/2006	6/1/2006	In-Service	100%	$ 0.59	MD
b0167	Upgrade Oak Grove 230kV Breaker 13C	PEPCO	6/1/2006	12/31/2005	In-Service	100%	$ 0.20	MD
b0168	Upgrade Oak Grove 230kV Breaker 5C	PEPCO	6/1/2006	12/31/2006	In-Service	100%	$ 0.21	MD
b0187	Upgrade Dickerson Station "D" 230kV 1A	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.21	MD
b0188	Upgrade Dickerson Station "D" 230 kV 1B	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.21	MD
b0189	Upgrade Dickerson Station "D" 230 kV 2A	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.21	MD
b0190	Upgrade Dickerson Station "D" 230 kV 2B	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.21	MD
b0191	Upgrade Dickerson Station "D" 230 kV 3A	PEPCO	6/1/2006	12/31/2006	In-Service	100%	$ 0.21	MD
b0192	Upgrade Dickerson Station "D" 230 kV 3B	PEPCO	6/1/2006	12/31/2006	In-Service	100%	$ 0.21	MD
b0193	Upgrade Dickerson Station "D" 230 kV 5A	PEPCO	6/1/2006	12/31/2006	In-Service	100%	$ 0.21	MD
b0194	Upgrade Dickerson Station "D" 230 kV 6C	PEPCO	6/1/2006	12/31/2006	In-Service	100%	$ 0.21	MD

Upgrade ID	Description	Trans. Owner	PJM Required Date	TO Projected Date	Status	Percent Complete	Cost Estimate	State
b0219	Install two new 230kV circuits between Palmers Corner and Blue Plains	PEPCO	6/1/2007	7/1/2007	In-Service	100%	$ 91.00	MD
b0228	Upgrade Burtonsville - Sandy Springs 230kV circuit	PEPCO	6/1/2010	6/1/2010	Eng. & Planning	0%	$ 0.40	MD
b0238.1	Modify Dickerson Station H 230 kV	PEPCO	6/1/2009	6/30/2009	Eng. & Planning	5%	$ 2.00	MD
b0244	Install a 4th Waugh Chapel 500/230kV transformer, terminate the transformer in a new 500 kV bay and operate the existing in-service spare transformer on standby and other assoc. configuration changes	BGE	5/31/2008	6/1/2008	Eng. & Planning		$ 29.80	MD
b0247	Install 14 MVAR of 69kV bus capacitors at Quince Orchard	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.45	MD
b0248	Install 14 MVAR of 69kV bus capacitors at Norbeck	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 0.45	MD
b0249	Install 28 MVAR of 69kV bus capacitors at Bells Mill	PEPCO	6/1/2006	12/2/2005	In-Service	100%	$ 0.72	MD
b0250	Install 108 MVAR of feeder capacitors at various locations	PEPCO	6/1/2006	6/1/2006	In-Service	100%	$ 2.76	MD
b0251	Install 100 MVAR of 230kV capacitors at Bells Mill	PEPCO	6/1/2009	6/1/2010	Eng. & Planning	15%	$ 3.90	MD
b0252	Install 100 MVAR of 230kV capacitors at Bells Mill	PEPCO	6/1/2009	6/1/2010	Eng. & Planning	10%	$ 3.00	MD
b0288	Brighton Substation - Add 2nd 1000 MVA 500/230kV transformer, 2 500kV circuit breakers and miscellaneous bus work	PEPCO	6/1/2009	6/1/2009	Eng. & Planning	30%	$ 33.10	MD
b0298	Replace both Conastone 500/230kV transformer banks with larger transformers, replace breakers #4 & #7 and other configuration changes	BGE	5/31/2009	5/31/2009	Eng. & Planning		$ 43.50	MD
b0298.1	Replace Conastone 230kV breaker 500-3/2323	BGE	5/31/2008	9/23/2007	Eng. & Planning		$ 1.00	MD
b0319	Burches Hill Substation - Add 2nd 1000 MVA 500/230kV Transformer	PEPCO	6/1/2011	6/1/2011	Eng. & Planning	20%	$ 36.70	MD
b0366	Install 4th Ritchie 230/69kV transformer	PEPCO	6/1/2011	6/1/2011	Eng. & Planning	10%	$ 11.50	MD
b0367	Reconductor 230kV Quince Orchard to Dickerson circuits 33 & 35	PEPCO	6/1/2011	6/1/2011	Eng. & Planning	10%	$ 20.00	MD
b0375	Upgrade Dickerson - Pleasant View 230kV Circuit	PEPCO	6/1/2011	6/1/2011	Eng. & Planning	10%	$ 5.00	MD/WA
b0467.1	Reconductor the Dickerson - Pleasant View 230kV circuit	PEPCO	6/1/2011		Eng. & Planning		$ 5.00	MD
b0474	Add a fourth 230 / 115 kV transformer, two 230 kV circuit breakers and a 115 kV breaker at Waugh Chapel	BGE	6/1/2012		Eng. & Planning		$ 17.00	MD
b0475	Create two 230 kV ring buses at North West, add two 230 / 115 kV transformers at North West and Create a new 115 kV station at North West	BGE	6/1/2012		Eng. & Planning		$ 20.00	MD
b0476	Rebuild High Ridge 230kV substation to Breaker and Half configuration.	BGE	6/1/2012		Eng. & Planning		$ 65.50	MD
b0477	Replace the Waugh Chapel 500/230 kV transformer #1 with three single phase transformers	BGE	6/1/2012	6/1/2011	Eng. & Planning		$ 26.00	MD
b0478	Reconductor the four circuits from Burches Hill to Palmers Corner and replace terminal equipment	PEPCO	6/1/2012		Eng. & Planning		$ 14.50	MD
b0496	Replace existing 500/230 kV transformer at Brighton	PEPCO	6/1/2012		Eng. & Planning		$ 18.00	MD
b0497	Install a second Conastone - Graceton 230 kV circuit and replace Conastone 230 kV breaker 2323/2302	BGE	6/1/2012		Eng. & Planning		$ 13.00	MD
b0499	Install third Burches Hill 500/230 kV transformer	PEPCO	6/1/2012		Eng. & Planning		$ 35.00	MD

As can be seen in Table 2, while much progress had been made in completing the upgrades needed to address the reliability concerns, a number of upgrades were still in progress, primarily in the engineering and planning phase of development. However, as of May 2011, a review of the PJM transmission upgrade status list shows that only 5 projects remain in the engineering and planning phase, with all but two of the remaining projects expected to be in-service by the end of 2012. See Table 3.

Table 3

Projects Noted by PJM in 2007 as Necessary for Reliability After June 2008
Projects Currently Less Than 100% Complete

Upgrade ID	Description	PJM Required Date - 2007	PJM Required Date - Current	TO Projected Date - 2007	TO Projected Date - Current	Percent Complete	Project Phase
b0319	Burches Hill Substation - Add 2nd 1000 MVA 500/230 kV Transformer	6/1/2011	6/1/2011	6/1/2011	6/8/2011	85%	Construction Activities
b0367	Reconductor 230 kV Quince Orchard to Dickerson circuits 33 & 35	6/1/2011	6/1/2011	6/1/2011	6/19/2011	40%	Construction Activities
b0375[1]	Upgrade Dickerson - Pleasant View 230 kV circuit	6/1/2011		6/1/2011			
b0467.1	Reconductor the Dickerson - Pleasant View 230 kV circuit	6/1/2011	6/1/2011		6/1/2011	40%	Construction Activities
b0474	Add a fourth 230 / 115 kV transformer, two 230 kV circuit breakers and a 115 kV breaker at Waugh Chapel	6/1/2012	6/1/2012		6/1/2012	15%	Engineering and Planning
b0475	Create two 230 kV ring buses at North West, add two 230/115 kV transformers at North West and Create a new 115 kV station at North West	6/1/2012	6/1/2012		6/1/2012	44%	Construction Activities
b0476	Rebuild High Rdige 230 kV substation to Breaker and Half configuration	6/1/2012	6/1/2012		6/1/2012	27%	Construction Activities
b0477	Replace the Waugh Chapel 500/230 kV transformer #1 with three single phase transformers	6/1/2012	6/1/2012	6/1/2011	6/1/2011	40%	Construction Activities
b0478	Reconductor the four circuits from Burches HILl to Palmers Corner and replace terminal equipment	6/1/2012	6/1/2012		6/1/2012	15%	Engineering and Planning
b0496	Replace existing 500/230 kV transformer at Brighton	6/1/2012	6/1/2013		6/1/2013	15%	Engineering and Planning
b0497	Install a second Conastone - Graceton 230 kV circuit and replace Conastone 230 kV breaker 2323/2302	6/1/2012	6/1/2014		6/1/2014	5%	Engineering and Planning
b0499	Install third Burches Hill 500/230 kV transformer	6/1/2012	6/1/2013		12/31/2012	20%	Engineering and Planning

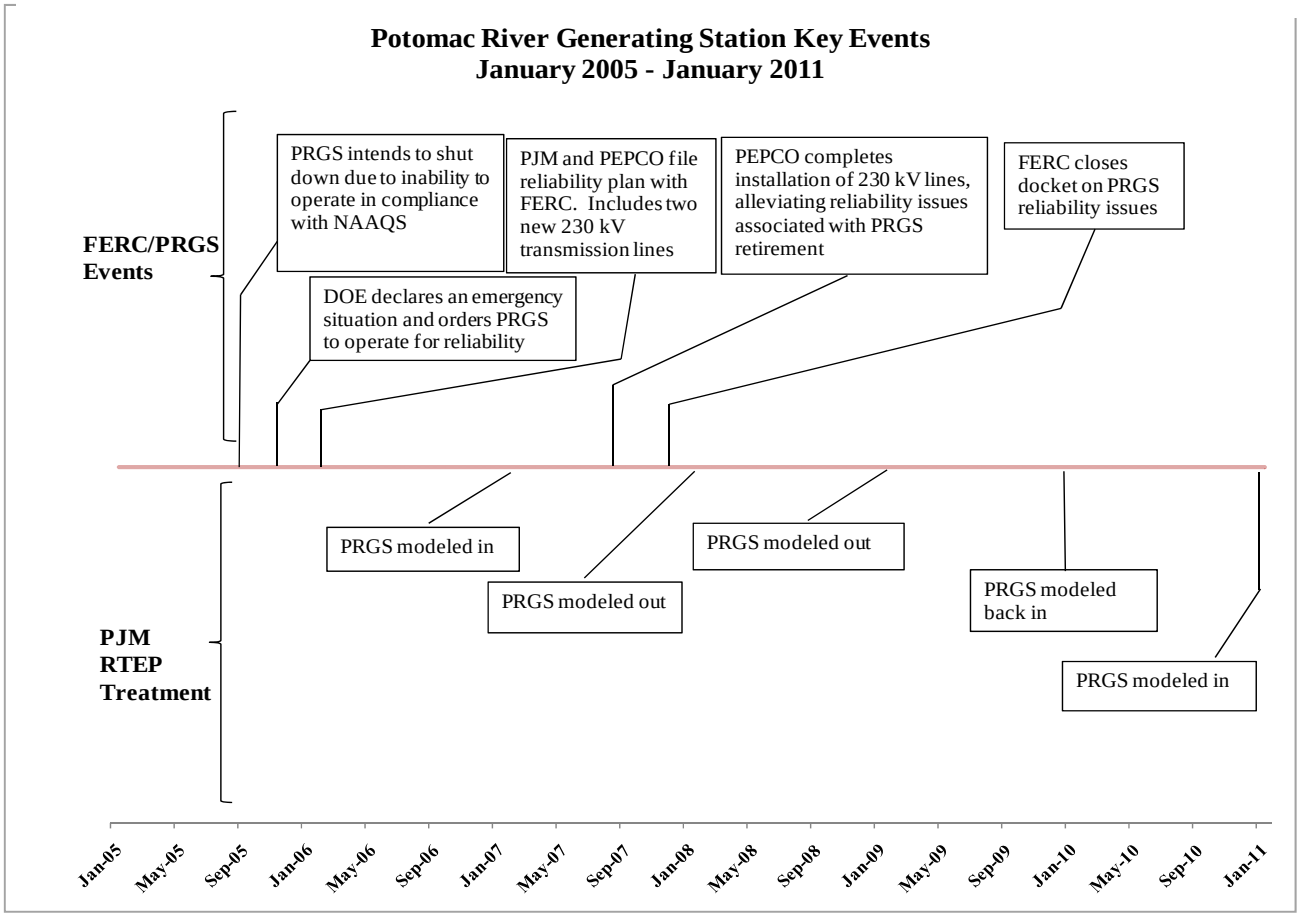
Note:
1. No information about this upgrade was available on the PJM website.

Source:
"Transmission Construction Status", PJM, http://pjm.com/planning/rtep-upgrades-status/construct-status.aspx, accessed May 17, 2011.

Observations as of 2011

These events that occurred during 2007/2008 were the culmination of a long, deliberative process of policy and analysis, and subsequent transmission system upgrade activities, involving several government agencies (FERC, the DOE, the DC PSC, and transmission system planners and operators (PJM and PEPCO). They key events and reliability modeling assumptions related to the PRGS are summarized in Figure 5.

Figure 5



The process of careful review and mitigation of local reliability issues involved the parties responsible for assuring adequate supply of electricity to consumers in the potentially affected areas. PJM, as the entity responsible for reliable operations of the bulk power system in the area, took steps to assess the original request to retire a generating unit, and to plan the transmission system in the near and long term to support reliable grid operations in all contingencies. PJM tracks changes in the system, including demand, generation unit changes, as well as the status of upgrade development, construction and activation. For

example, if the owner of a power plant located in the PJM region wishes to deactivate, or retire, the power plant, it must provide notice no later than 90 days prior to the proposed deactivation date for the unit.[33] Following a deactivation request, PJM reviews the potential impacts on power system reliability if a plant were to retire. Upon a retirement decision, PJM assumes that the unit is out of service in subsequent regional transmission planning evaluations of power system reliability.

Thus, when Mirant declared it would shut down the PRGS in August of 2005, PJM began to assume in its RTEP that PRGS was retired. As regulatory events unfolded over time with respect to the PRGS (from both an environmental and reliability point of view), PJM has variously modeled the PRGS as in or out of service. Figure 5 above depicts the treatment of the PRGS in various PJM assessments taken from annual RTEPs.

PJM currently models the PRGS as in service, and GenOn (the current owner of the plant, which was sold by Mirant) has not filed a deactivation request for the station. Should it do so, PJM will need to conduct a transmission analysis to confirm that retirement of the plant will not create reliability concerns, and the focus of that analysis is likely to center on transmission system contingencies in the Washington DC area. Based upon a review of the events of the past five years related to requirements by FERC on PJM and PEPCO, and the substantial transmission system upgrades that have been put in place as a result of these regulatory requirements and specifically to address reliability concerns associated with the potential retirement of the PRGS, we expect that it is unlikely that PJM will find the station needed for reliability if GenOn were to request deactivation.

A deactivation request is not the only path to a reliability evaluation at this point in time. As has happened in the past, any decision to retire the PRGS will likely attract a heavy degree of attention from state, district, and federal governmental authorities to ensure that plant closure – which may be warranted for economic and air quality reasons – will not lead to reliability violations within the critical Washington DC area. It would be prudent in light of the many indicators pointing towards the potential retirement of generation facilities for economic and environmental compliance reasons to initiate a retirement review for the PRGS at this time.

To the extent that the PRGS is facing difficult decisions related to plant economics and/or compliance with environmental requirements that will become effective and will likely require decisions on new capital investment for compliance in the next few years, a proactive approach to a reliability evaluation will help confirm that reliability will be preserved in the District, and that the decision by GenOn with respect to continued operation of the PRGS can be made on the basis solely of economic and financial considerations. Importantly, such an

[33] PJM OATT - Part V - Generation Deactivation, page 339.

analysis could be initiated as a reliability scenario analysis by PJM, or could be requested or required by the DC PSC, FERC, and/or US DOE.[34]

4. PRGS POLLUTION CONTROL AND EMISSION IMPACTS

The Regulatory and Economic Setting for Continued Operation

The original context for the historical interest in retiring the PRGS focused on environmental issues associated with the plant. Recall that in 2005, the Virginia DEQ cited the facility as being in violation of various air pollution standards designed to protect the health of residents in the local and regional area. Importantly, local public health impacts of power plant operation are often most important during summer peak load conditions, and this is no different for the Washington DC metropolitan area. Plant operations during hot summer conditions tend to strongly exacerbate already poor air quality conditions.

Six years later, in 2011, the environmental issues are different, but nonetheless remain challenging. Several factors could affect the continued viability of the plant going forward: the old age, relatively poor efficiency, and emission profile of the PRGS; the emergence of new environmental requirements affecting coal plants with compliance periods starting in the next few years; the continued risk of carbon control requirements occurring sometime in the future; and significant changes in fuel market conditions that affect the relative attractiveness of output at many gas-fired power plants relative to older and less efficient coal-fired power plants. Together, these factors would present difficult decisions for the owner of a facility, like the PRGS, in the coming months or years. The Station's generating units are among the oldest in the region, ranging from 54 to 61 years old. The emergence of relatively abundant, low-priced natural gas has dramatically affected energy market revenues for all generators across the region. And emerging federal environmental regulations are likely to impose significant additional capital costs for emission controls on the plant.

The PRGS has a history of challenges in meeting environmental requirements and addressing the concerns of environmental regulators. The 2005 citation issued by the Virginia DEQ caused the plant owners to take action to remedy the problem or shut down (which it almost did). In July 2008, the PRGS' then-owner, Mirant, and the City of Alexandria entered into a project schedule and agreement regarding the implementation of emissions controls at the PRGS.[35] As part of the agreement Mirant agreed to deposit $34 million in an escrow account for purposes of implementing a detailed list of pollution control technology at the PRGS. In

[34] See, for example, DOE's authority under Section 202(c) of the Federal Power Act, 16 U.S.C. 825a(c) and section 301(b) of the Department of Energy Organization Act, U.S.C. 7151(b).

[35] "Project Schedule and Agreement," Between Mirant Potomac River, LLC, and the City of Alexandria, Virginia, July 14, 2008.

July of 2010, the Virginia DEQ issued new permit limits on the Station's emission, in part to lower emissions at a time when they contribute to public health concerns during the summer ozone season. Finally, in 2011 GenOn entered into an agreement with the Virginia DEQ to pay $276,000 to settle a number of emission violations.[36]

GenOn is likely to need to install additional controls to comply with forthcoming air, coal-ash handling, and possibly water quality requirements of the U.S. Environmental Protection Agency ("EPA").[37] Compliance with these regulations and continued operation of the plant would require GenOn to take steps (and make capital investments) at the PRGS beginning within the next few years. As NAAQS requirements tighten, along with stronger controls over emissions of mercury and other hazardous air pollutants, the treatment of coal ash, and increased protection of aquatic species near power plant intake structures emerge, GenOn will need to determine whether continued operation of the plant makes economic sense given prevailing fuel prices and market dynamics, increased operation and maintenance costs for an aging facility, and the potential for new regulatory requirements related to emissions of CO_2.

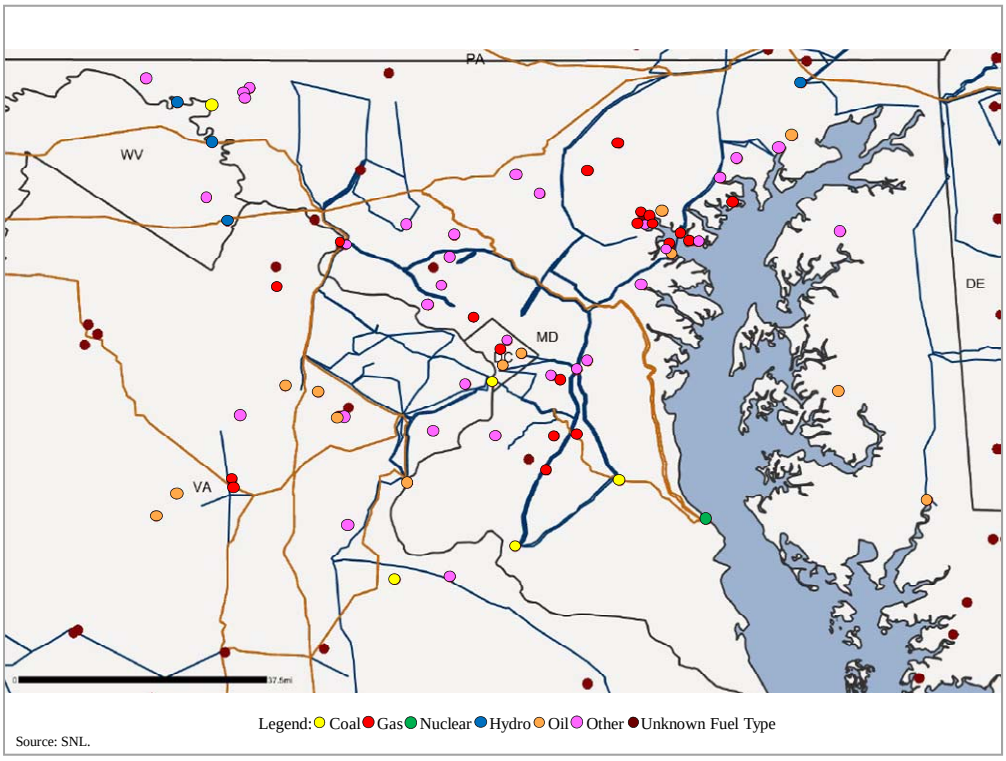
Potential Air Emission Impacts of PRGS Closure

Based on public records, it does not appear that GenOn has decided to retire the PRGS facility. Were it to close permanently, its output would likely be replaced primarily through dispatch of other power plants in the Mid-Atlantic region of PJM in which it sits. Since surrounding generation sources include a mix of fuel and technology types (as shown in Figure 6), it cannot be assumed *a priori* that retirement of the facility would lead to a net decrease or a net increase in regional emissions.

Consequently, we analyzed various generation dispatch and emissions scenarios to determine potential impacts from the point of view of impacts on the emission of air pollutants in the region.

[36] GenOn Energy, Inc. 10-Q Report for Q1 2011, filed May 9, 2011.
[37] These regulations relate to the EPA's implementation of the Clean Air Act (the updated NAAQS, the Clean Air Transport Rule and the Mercury/Air Toxics Rule affecting coal and oil plants), the Clean Water Act (the so-called 316(b) requirements relating to use of water cooling systems for thermal power plants), and the coal-ash handling rules, proposed under the Resource Conservation and Recovery Act.

Figure 6 – Power plants in the area near PRGS



To estimate the potential air quality impacts of permanent retirement of the PRGS, we constructed a model to estimate regional emissions with and without operation of the Station, assuming full potential to produce power from each generating unit (including PRGS).[38] Specifically, we modeled total emissions of CO_2, SO_2, and NO_x for 2010 with PRGS in service to meet electrical demand, and then compared those estimates with another depicting the same level of electrical demand without the PRGS available for operation. While we looked at the results from the perspective of the immediate PJM region in which it sits (the PJM Mid-Atlantic-SW transmission zone - which is the region including PEPCO and BGE), we also expanded the analysis to include the full PJM Mid-Atlantic Transmission Area, recognizing that in many hours the absence of PRGS would increase generation from facilities outside PJM Mid-Atlantic-SW.[39]

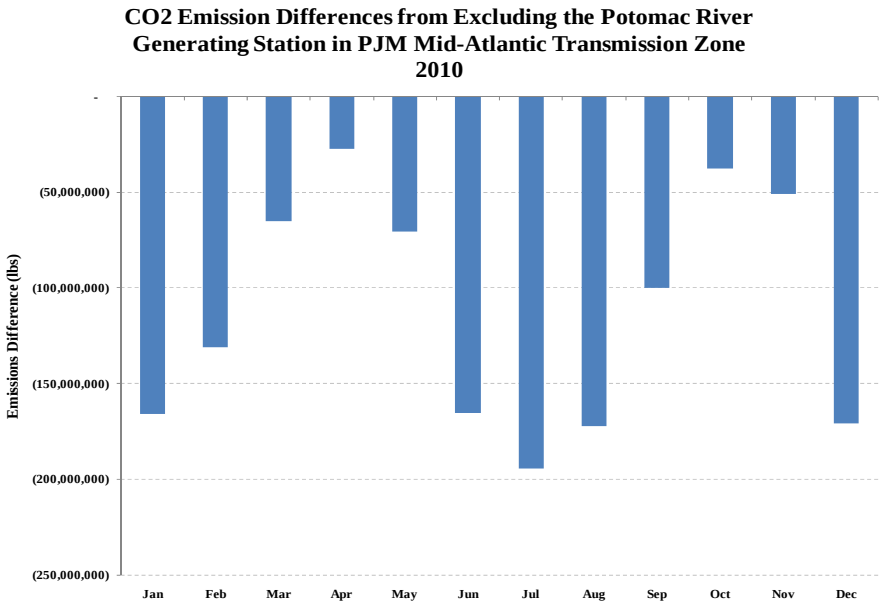
[38] Note that PRGS has operated at significantly less than full power in recent years, as shown in Figure 3 (displaying PRGS' capacity factors in recent years). Removing PRGS from service in 2010 – when the highest capacity factor of the station's units was less than 30 percent – would have required replacement of only the actual level of output, and the emissions from the replacement power would have been compared to PRGS' actual emissions. Going forward, since we did not know the level of dispatch of PRGS or any other power plant, we examined each plant's potential to generate power and potential to emit air pollution.

[39] Our analysis started with the construction of a supply curve for the region of relevance. Using data from Ventyx on unit capacities, emission rates, and marginal costs, we created in effect a dispatch order for generation in the region, ranging

Our purpose in constructing this analysis was to develop a first-order approximation of the likely direction of the impact of PRGS retirement on emissions, in order to determine whether the impact would be positive or negative given the emission profiles of other generation facilities in the region of interest. We therefore made a number of appropriate but simplifying assumptions in making these calculations.[40]

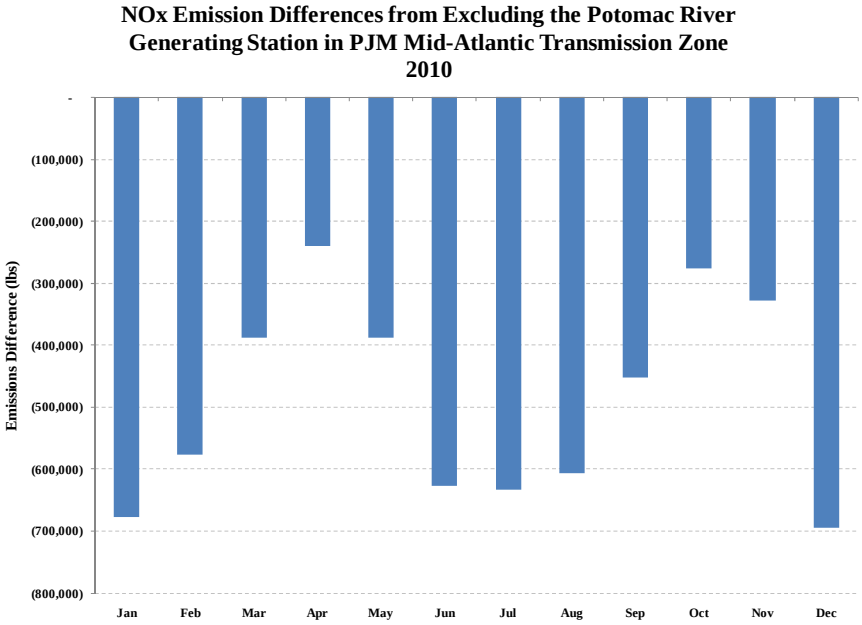
The results show that the retirement of PRGS would likely provide benefits from the perspectives of public health and climate change risks. Specifically, removal of PRGS would lead to reductions in monthly emissions of CO_2 of between approximately 10,000 and 90,000 tons. Total annual CO_2 emissions would be reduced by nearly 600,000 tons. See Figure 7.

Figure 7a and 7b



from lowest to highest marginal cost. We then gathered from PJM data on zonal-specific metered loads for every hour of every day in 2010 (8760 hours). For each hour, we simulated a "dispatch" of generation by moving up the supply curve until reaching the metered load for that hour. We calculated emissions for the hour and for each pollutant as the sum of emissions from all plants operating, based on the generation in the hour from each facility and emission rates. We repeated this process for each hour in the year, and summed emissions for each month. We performed this process again after removing the five PRGS units from the generation mix, and then calculated the differences in emissions of each pollutant across the two scenarios.

[40] To derive a precise estimate, one would want to run an actual dispatch model; one that takes into account in more systematic faction the impact of unit outages, individual transmission line limits and constraints, heat rates that vary across the operating range of the generating units (ours are a single full-load heat rate), unit operational characteristics such as minimum and maximum run time, and ramp rates, etc. However, such a modeling was not necessary here, in light of our goal of characterizing the relative impact of retiring the PRGS unit on overall emissions in the region.



Removal of PRGS would also reduce monthly emissions of NO_x by between approximately 250,000 and 700,000 lbs. Total annual NO_x emissions would be reduced by nearly six million pounds, as shown in Figure 7. Reductions of NO_x are particularly strong in summer months, when local and regional air quality concerns associated with ground-level ozone and particulates are most acute.[41]

5. CONCLUSIONS

Our review of regulatory, planning, generation output, and other documents in the public domain suggests that the substantial transmission system upgrades that have been put in place in and around the PRGS facility render the plant no longer needed from a reliability point of view. Such a conclusion would need to be confirmed by PJM and PEPCO, in the event that the plant's owner filed a request to deactivate the unit, or regulatory authorities considered it in the public interest to request or require a reliability analysis done in anticipation of plant closure.

Were the PRGS power plant to retire, it would likely lead to overall reductions of pollutants contributing to local/regional air quality and climate change risks, in light of other more efficient and less-polluting plants replacing the power that PRGS would have generated.

[41] Significant reductions of SO2 during summer months are also likely. Specifically, our modeling reveals a reduction in regional SO2 emissions of 325,000 lbs total for the months of June, July, and August.