



PATH Allegheny Transmission Company, LLC

800 Cabin Hill Drive
Greensburg, PA 15601-1689

January 15, 2009

Jan H. Gardner, President
Board of County Commissioners
Frederick County
Winchester Hall
12 East Church Street
Frederick, MD 21701

Douglas S. Kaplan, President
Sugarloaf Conservancy, Inc.
8424 Peters Road
Frederick, MD 21704

Sandra Patty
Power Plant Research Program
Maryland Department of Natural Resources
Tawes State Office Building B-3
580 Taylor Ave.
Annapolis MD 21401

Dear Ms. Gardner, Ms. Patty and Mr. Kaplan:

Over the past several weeks, the Frederick County Board of County Commissioners, the Power Plant Research Program (PPRP) and the Sugarloaf Conservancy, Inc. (Sugarloaf) have inquired of PATH Allegheny Transmission Company, LLC (PATH Allegheny) or PJM Interconnection, L.L.C. (PJM) regarding the application of high voltage direct current (HVDC) technology, including underground HVDC, to the Potomac Appalachian Transmission Highline (PATH) project. This letter provides PATH Allegheny's comprehensive response to these inquiries.

Response to Power Plant Research Program

Prior to the January 8, 2009 Technical Conference on the electrical need for PATH, PPRP provided us with a series of questions. Question 5 pertained to the application of HVDC technology and during the conference I indicated a response would be provided at a later time.

Question 5:

Has PJM considered HVDC for the Amos-Kempton line and if so, what was the result of this analysis? Could the planned substations (Midpoint and Kempton) be constructed to include AC [alternating current] to DC [direct current] conversion equipment to accommodate HVDC?



The following response which has been prepared by PJM:

Initially after PJM identified the reliability problems driving the need for the PATH project PJM did not limit the potential solutions to any particular transmission technology. HVDC technology is often utilized in applications where two asynchronous systems are being interconnected, where large pockets of isolated generation must be delivered to distant load centers, where short circuit currents need to be limited, where precise control of the flow across the line is required, or for long distance underwater crossings. The Amos – Kemptown project does not present any of these challenges. To the contrary, the Amos – Kemptown project will be one element in an interface comprised of a number of backbone transmission lines in the center of a highly integrated system. In addition, there is considerable expense associated with the HVDC conversion equipment that would be required, increasing the overall cost of the project. Also, as implied in the question, the HVDC conversion equipment would significantly increase the size of the Kemptown, Midpoint and Amos substations. Given the limited available real estate at Kemptown, HVDC conversion equipment, at a minimum, would limit the future expansion capability of the site. Use of HVDC technology for the line between Amos - Kemptown would also limit the ability to tap the line to reinforce underlying systems. Considering all of these issues, use of HVDC technology was not pursued for the Amos – Kemptown project. In addition, alternatives to resolve the reliability problems identified as part to 2007 RTEP were vetted with stakeholders at the Transmission Expansion Advisory Committee.

Response to Sugarloaf Conservancy, Inc.

On November 19, 2008, representatives of PATH Allegheny met with representatives of Sugarloaf to discuss the application of underground HVDC technology to the PATH project. During the meeting, Sugarloaf provided an extensive 180 page compilation of 22 documents consisting of technical reports, published technical papers, Internet articles, marketing materials, and conclusions drawn by Sugarloaf. During the meeting, we agreed to review the documents and provide Sugarloaf with a response. Subsequently, we advised Mr. Kaplan that PATH Allegheny would respond by January 15, 2009.

PATH Allegheny's review of Sugarloaf's documents was performed by Allegheny Energy's engineers in consultation with engineers representing American Electric Power Company (AEP), Allegheny Energy's joint venture partner in the PATH project. These professionals have many years of experience in the development of HV transmission projects and are continually engaged with other industry professionals and suppliers of equipment and services to identify, develop, test and utilize new technology when appropriate. In addition, Allegheny Energy and AEP are recognized as leaders within the industry when it comes to the consideration and use of new technology. Our thorough review of Sugarloaf's documents was premised upon the expertise of these professionals and the reputation of these companies. As a result of our review discussed in further detail below, we conclude that Sugarloaf's documents do not support further consideration, including a feasibility study, of underground HVDC as an alternative to the proposed overhead high voltage alternating current (HVAC) construction for the PATH project.



We offer the following general observations with regard to the documents provided by Sugarloaf:

- Twelve of the documents address the use of HVDC generally and are not specifically directed to the application of this technology for underground purposes.
- Four of the documents discuss and promote overhead HVDC without addressing the use of this technology for underground purposes.
- Only three of the documents specifically discuss the application of HVDC for underground purposes.
- Eleven of the documents were prepared by vendors of equipment and services with economic interests in the use of HVDC technology.
- The documents indicate the cost of underground HVDC is significantly higher than overhead HVAC.
- Many of the documents indicate the cost breakeven point for use of overhead HVDC requires projects of longer lengths and higher capacity than the entire approximately 285 mile PATH project. The length of PATH in Maryland is expected to be approximately 19 miles.
- The documents do not address the allocation of additional costs associated with underground HVDC for this project within the PJM Region where the costs of new transmission projects of 500 kV or greater are allocated to all load serving entities within the Region.

The PATH project is needed to address reliability violations in the PJM Region that are expected to occur as early as 2013. Allegheny Power and AEP have determined, and PJM has corroborated, that 765 kV AC transmission is the best option for PATH from a reliability, siting, operational, technical and economic perspective. The use of 765 kV voltage level provides the large power transfer capability needed for the project, while offering right-of-way and line loss efficiencies.

For this project, HVAC technology was found to be superior to HVDC technology for a number of reasons. HVAC transmission is easier to integrate with the existing underlying network than HVDC. It also facilitates future additions of intermediate substations to provide exit/entrance ramps to serve future load centers or to provide outlets for future generation.

HVDC lines are not conducive to establishing intermediate substations because the cost could be prohibitive and, in many cases, the intermediate HVAC connection may not be technically feasible. HVDC transmission lines are better suited for point-to-point power transfers over long distances where the need for intermediate HVAC connections to the existing power system is not expected to occur.

When compared to overhead construction, either underground HVAC or HVDC transmission lines create a greater environmental impact and present significant technological challenges and limitations as well as ongoing reliability and operational issues. Typically, underground transmission construction is used only to solve specific project design constraints or when overhead installations are just not feasible. Feasible overhead installations are available for the PATH project and there are no design constraints that would warrant the application of underground construction, especially when the higher environmental and economic costs associated with underground construction are considered.



Our analysis of the Sugarloaf documents supports the decision reached by PJM, Allegheny Energy and AEP with regard to the type of construction and technology to be used for the PATH project. Generally, the documents suggest that the cost effectiveness of HVDC has improved in some

applications, particularly when applied to very high capacity lines over very long distances. However, as noted above, most of the documents supporting this conclusion were prepared by market-motivated suppliers of HVDC equipment and services. In contrast, the PATH companies selected technologies that were the most reliable, efficient and cost effective solutions to meet the project objectives.

In support of our conclusion, PATH Allegheny notes the following:

- HVDC, either above or below ground, requires the construction of converter stations at each terminus of the DC line. These converter stations are very large and considerably more expensive than traditional AC stations and operating multi-terminal HVDC systems is complex (Tab B).¹
- The high cost of conversion equipment limits the breakeven cost for DC to AC to 31 miles for submarine cable and 375 to 500 miles for overhead cables (Tab B). The entire PATH project which is only approximately 285 miles in length is significantly shorter than even the minimum breakeven point.
- Underground lines (AC or DC) have an increased socioeconomic impact because of greater costs (Tab B).
- The primary benefit of burying transmission lines is reduced visual impact. However, many other environmental impacts are increased (Tab B).
- The Federal Energy Regulatory Commission (FERC) has approved the cost recovery mechanism for this project based on overhead HVAC construction and, in accordance with FERC orders, those costs will be recovered on a socialized basis across the entire PJM Region on basis that the entire Region benefits from enhanced reliability of PJM's backbone transmission system. However, it is not clear who would be required to pay the additional costs of underground HVDC construction required or requested by a state or local government when such construction is not required for reliability purposes and the primary benefits of reduced visual impact does not inure to the benefit of the entire Region.²

¹ Tab references pertain to tabs used in the Sugarloaf compilation.

² The significant additional costs associated with constructing PATH underground using HVDC technology at the direction of a state commission or voluntarily by PATH Allegheny without direction from PJM could be classified as a Supplemental Project under Schedule 6 of the PJM Amended and Restated Operating Agreement, Third Revised Rate Schedule FERC No. 24 ("Operating Agreement"). Supplemental Projects are defined in Section 1.42A.02 of the Operating Agreement as projects that PJM has determined are not required for compliance with the PJM planning criteria relating to system reliability, operational performance or economic efficiency. Under Section 1.5.6 (e) of Schedule 6, the cost of such projects must be borne by the requestor of the project. As a result, PATH Allegheny would be required to seek recovery of the additional costs to underground PATH with HVDC technology through the PJM tariff from load serving entities (LSEs) located within the Allegheny Power zone. If underground HVDC installation is undertaken either voluntarily by PATH Allegheny or at the direction of the Maryland Public Service Commission, some LSEs and states other than Maryland in the Allegheny Power zone may protest the allocation to the entire zone and ask FERC to direct the allocation solely to LSEs in Maryland. There is FERC precedent for the allocation of transmission upgrade costs solely to LSEs within one state as opposed to the zone or region in which the transmission system exists where the upgrade is deemed to be necessary for the benefit only of customers in that state. See, *Northeast Utilities Service Company*, 116 FERC ¶ 61,094 (2006); *Northeast Utilities Service Company*, 123 FERC ¶ 61,324 (2008).



- The Pepco Holdings, Inc. (PHI) materials provided by Sugarloaf acknowledge that the HVDC option for the Chesapeake Bay submarine crossing for the MAPP project is more costly as compared to a submarine AC crossing. However, PHI believes there are reliability and environmental benefits to its application of HVDC to this underwater crossing of the Chesapeake Bay (Tab C). These benefits are not present for the PATH project.
- HVDC should be considered where there is a need to transfer power in the range of 5,000 to 6,000 MW over 1,000 km (621 miles). In such cases, 800 kV DC overhead transmission is the appropriate choice (Tabs F, J, L, M and N). Because of the significantly shorter length and smaller transfer capacity of the PATH project, HVDC is not an applicable technology.
- Per the ABB sales brochure (Tab E), the largest HVDC underground system currently in service has a power transfer capacity of 330 MW and a 350 MW system is under construction. Based on this information, twelve 350 MW systems (24 cables) would be required to provide the same power transfer capacity of the 765 kV overhead installation proposed for the PATH project. To accommodate these cables, massive conversion stations would be required at both ends of the DC line. A right-of-way width of approximately 100 feet would need to be cleared and maintained void of trees along the entire length of the underground line to allow for permanent access.

While there may be projects for which HVDC is the appropriate technology and underground installation is reasonable, the PATH project is not one of them. The MAPP project, however, is a good example because it appears there are no viable overhead options for crossing the Chesapeake Bay and PHI has concluded that the technical benefits of submarine HVDC technology when applied to the crossing of the bay justify the increased costs associated with this type of construction. However, for the PATH project there are both technical and economic obstacles to the application of these technologies.

Response to the County Board of Commissioners

By letter dated January 7, 2009, the Commissioners noted the concerns of citizens regarding the right-of-way required for the PATH project and information they had received that the use of underground HVDC would require only a 20-foot right-of-way. The letter further expressed the view of the Commissioners that it would be in the best interest of both the community and PATH Allegheny to have an independent third party consultant evaluate and consider the feasibility and benefits of locating the Maryland portion of the PATH project underground.

While the Commission's letter does not indicate that the third party consultant evaluation should necessarily consider underground HVDC construction for the project, we assume such an evaluation would include consideration of HVDC. For the reasons stated above in response to Sugarloaf, further study and consideration of underground HVDC is not warranted. Such additional studies would likely cause a delay in obtaining authorization to construct the project which in turn would delay the enhancement of electric reliability to Maryland and the associated energy market benefits.

From an operational standpoint, prolonged outages are required to repair underground cable failures, and this could jeopardize the reliability of the transmission system. In addition, the environmental impact of undergrounding is significant – underground cables require extensive excavation that could severely impact streams, wetlands and other sensitive areas. Multiple above-ground stations would be required along the line route with permanent access required along the full length of the line for maintenance and repairs.



We have given consideration to the possibility of constructing the project as underground HVAC and have determined that such construction is not appropriate for this project. No transmission line of this length, voltage or capacity has ever been placed underground, nor has the technology been commercially developed at this voltage level. Even if the technology was available, the project cost would increase dramatically – as much as 10 times or more – and the time to complete the project would increase substantially. Moreover, with regard to the Commission’s specific concern, the right-of-way needed for underground construction, as discussed above, would be approximately 100 feet rather than 20 feet as has been suggested to the Commission by others.

Conclusion

We take our responsibility to provide technically competent and cost effective energy solutions very seriously. The PATH project as proposed represents a significant milestone in the application of state of the art technology for electric transmission. As indicated above, we believe there are projects for which HVDC and underground applications may be appropriate and reasonable. However, our conclusion is that neither is appropriate or reasonable for the PATH project.

Sincerely,

Michael J. Hosier
General Manager, Transmission
Projects

cc: Senator Alex X. Mooney
Senator David R. Brinkley
Delegate Joseph R. Bartlett
Terry Romine, Executive Secretary, Maryland Public Service Commission
Frank Bender, Chief Engineer, Maryland Public Service Commission
Paula Carmody, Maryland Office of the People’s Counsel