Impact of Brandon Shores deactivation projects on Maryland generation needs

10 March 2025

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Final

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Planned transmission system improvements should significantly increase the ability of the BGE/PEPCO area to import power.

Powerflow studies performed by DH Infrastructure (DHI) show that the import capability improvements from the transmission projects planned to allow the deactivation of the Brandon Shores power plant should allow utilities in the BGE and PEPCO areas to supply future electric load without needing added generation within Maryland.

The electric power operations of Baltimore Gas & Electric (BGE), Potomac Electric Power (PEPCO), and Southern Maryland Electric Cooperative (SMECO) are part of the PJM Interconnection (PJM). PJM is a regional transmission organization (RTO) that conducts centralized generation dispatch and coordinates generation and transmission planning across 13 states and the District of Columbia. PJM is responsible for overseeing generation capacity adequacy and the planning of transmission expansions and upgrades.

PJM's system planning process is designed to ensure that the different regions within PJM, known as Locational Deliverability Areas (LDAs), have adequate generation and import capabilities to meet their load under various conditions. PJM tests whether each LDA has enough local generation and import capability to reliably serve its future load. To that end, PJM evaluates each LDA under various future conditions, including different generator and transmission outages. There are two LDAs in eastern Maryland and the District of Columbia; one is the BGE service area and the other is the combined PEPCO/SMECO areas.

PJM's studies of the system with the Brandon Shores power plant deactivated showed reliability violations. In response, it directed the construction of several transmission projects to resolve these violations. These Brandon Shores deactivation transmission projects likely remove the existing BGE and PEPCO LDA import constraints.

DHI performed powerflow studies of the impact of approved transmission projects on the ability of the BGE/PEPCO LDAs to meet their local load entirely through imports or with limited local generation. This memo describes three different conditions regarding the peak BGE/PEPCO load and their import capability: First, the 2028 conditions assumed by PJM in its base-case powerflow (Table 1); second, conditions assuming all transmission elements are in service (Table 2); and third, anticipating that the worst transmission element could be out of service (Table 3).

While this study did not replicate the full PJM scenario analysis, it is consistent with PJM procedures and data, using the main components of PJM's methods. The results show that future load through 2029 and beyond could be supplied without added local generation due to the increased import capacity from transmission improvements approved for the deactivation of the Brandon Shores and Wagner power plants. These improvements within the BGE LDA included a new 500 kV line in Maryland from Cooper

(in southeastern Pennsylvania) to High Ridge, two new voltage control devices (STATCOMs) and capacitors, a new 230 kV double circuit line from Graceton to Batavia Rd to Riverside, and other improvements in the 230 kV network.[1]

Table 1 presents the "base case" assumptions used by PJM for the year 2028 from its 2023 Regional Transmission Expansion Plan. The forecasted load of 12,340 MW in the PJM powerflow case is the average, or "50/50" forecast, for the summer peak loads for the BGE/PEPCO LDAs.[2] The local generation is 5,440 MW, an amount that includes the Calvert Cliffs nuclear units and the Keys Energy Center and CPV Charles natural gas combined cycle plants. It excludes the deactivated generating plants at Brandon Shores and Wagner.

Table 1: 2028 powerflow base case peak load, generation, and imports

	BGE	PEPCO	SMECO	Combined
Customer load	6,190	5,410	740	12,340
Local generation:				
Nuclear	1,615	0	0	1,615
Other	465	3,310	50	3,825
Total local generation	2,080	3,310	50	5,440
Net imports	4,110	2,100	690	6,900

To analyze the benefits of the Brandon Shores deactivation transmission improvements, DHI ran multi-step powerflows.

The first step was to find the thermal limit for imported power by increasing imports and reducing local generation until reaching a transmission limit with all transmission in normal operation. The resulting powerflow cases did not find a thermal limit at the forecasted LDAs' combined peak load because the imports did not reach a thermal limit with the Brandon Shores deactivation transmission improvements. It would be possible to serve the entire BGE/PEPCO LDAs load with imported power and without the base-load Calvert Cliffs nuclear units, the Keys Energy Center, or the CPV Charles natural gas combined cycle plants.

Since no thermal limit was reached, DHI made further powerflow tests with higher local load levels. These cases showed that the Brandon Shores deactivation transmission improvements supported an additional 300 MW of load, reaching about 12,600 MW before transmission thermal limits were reached.

However, these first-step tests are unrealistic because they are based on all transmission elements being in service (N-0). The system is normally operated assuming that any one element can be lost. This is the N-1 (all transmission minus one element) criterion and is part of the reason for the second step. The second step finds the import limit under N-1 conditions. DHI powerflow cases showed that the worst N-1 event for local imports was

1. There were also several improvements in the Peach Bottom area in Pennsylvania.
2. The BGE and PEPCO LDAs are wholly or largely within Maryland.

losing the Cooper–High Ridge 500 kV line.[3] In order to maintain reliability anticipating this line out of service (N-1), at least 1,900 MW of local generation would be needed, limiting imports to 10,440 MW as shown in Table 2. Considering that the three local base-load generating plants have a combined capacity of more than 3,200 MW, and that there is an additional 3,000 MW of available local generation, it is reasonable to assume that there will be at least 1,900 MW of local generation operating, especially during peak load conditions. In fact, the PJM powerflow case assumed more than 5,400 MW of local generation.

Table 2: 2028 local peak load, generation, and N-1 imports

	Combined
Customer load	12,340
Required local generation	1,900
Net imports (N-1)	10,440

Since it is possible that all generation may not be available during peak-load conditions, DHI conservatively assumed that only 80% of the 6,100 MW of local generating capacity in the PJM powerflow case might be available. With this assumption, under the worst N-1 condition, the BGE/PEPCO LDAs could serve almost 15,000 MW of local load as shown in Table 3. The LDAs' load is not forecasted to exceed 15,000 MW until at least 2042, based on the latest PJM forecast.[4] The upgraded transmission system could support up to 2,600 MW of new load without needing additional local generation.

Table 3: Maximum LDA N-1 load

	MW
Customer load (2028)	12,340
80% of 6,100 MW local generation	4,500
Less required local generation	1,900
Maximum N-1 local load	14,940
Increased load that could be served	2,600

The deactivation projects should allow the BGE/PEPCO LDAs to operate reliably without requiring any added generation for many years.[5]

3. The N-1 contingencies DHI studied included Brighton–Doubs 500 kV, Brighton–Conastone 500 kV, and Cooper–High Ridge 500 kV. It is possible that some other contingency outside of Maryland might be more limiting.
4. The PJM 2025 load report (January 2025), forecasts the LDA load to be 14,928 in 2041, Table D-1, "90/10" extreme summer forecast. Of course, those forecasts could be higher or lower than the actual peaks, and increased demand response and energy efficiency measures could reduce the future load.
5. The preliminary results also show that the Maryland Piedmont Reliability Project (MPRP), further increases the import capability. The MPRP is a new 500 kV line that connects an area near the Conastone substation in northeast Maryland with the Doubs substation in Frederick County, Maryland.