Brandon Shores Retirement: Alternative Portfolio Development & Analysis

Response to PJM's BESS Technical Viability Report | May 29, 2024

Introduction

GridLab has requested Telos Energy to review the report by PJM Transmission and Operations Planning, titled "BESS Technical Viability - Wagner and Brandon Shores Retirements," released May 3, 2024 and provide an evaluation of the report's findings. The report was issued as a response to an analysis Telos conducted for GridLab of the retirement of the Brandon Shores power plant near Baltimore, MD and the opportunity to replace a reliability-must-run (RMR) agreement with an Alternative Portfolio including a combination of energy storage and transmission reinforcements. We provide a brief overview of the analyses conducted and relevant context, followed by specific responses to the PJM BESS Technical Viability report.

Background

After the announcement of the deactivation of Brandon Shores in June 2023 and subsequent RMR request issued by PJM, GridLab retained Telos Energy to perform an analysis to explore options for shutting down the Brandon Shores plant as near to the targeted date as possible, thereby reducing the RMR payments while maintaining the standard of reliability in accordance with PJM's criteria. GridLab also coordinated with Sierra Club, which had already been engaged regarding Brandon Shores' operation since the 2010s.

For this analysis, GridLab and Telos Energy worked with PJM staff to acquire the 2025 Regional Transmission Expansion Plan (RTEP) power flow models that they used to conduct their deactivation analysis. We discussed the scope of our analysis with the PJM Transmission Planning group during meetings in September, November, and December 2023, in which the PJM Special Studies team provided useful clarifications and guidance. Because these models are highly complex, we started by replicating PJM staff's 2025 analysis to benchmark our work against theirs.

Then we extended PJM's analysis to explore alternatives to the proposed Brandon Shores RMR. The alternative portfolio that we studied consists of a combination of:

1. Transmissions reinforcements – the same that PJM had approved but with a prioritization of shorter-timeframe voltage-supporting projects,
2. Reconductoring of a few 115kV and 138kV circuits with higher rated conductor,
3. Battery energy storage system (BESS) sited at the Brandon Shores point of interconnection, and
4. Retaining Wagner Units 3 and 4 through an RMR after PJM announced its deactivation analysis of Wagner.

The Alternative Portfolio analysis found that not only is the alternative portfolio feasible, but it presents a net economic benefit if it can reduce the RMR payments for Brandon Shores by at least one year. These savings grow substantially if the major transmission construction projects don't meet their anticipated schedule. Our analysis shows that alternative portfolios like the ones we studied warrant further consideration.

In late January and February 2024, GridLab and Telos began presenting the results to Maryland stakeholders as well as sharing directly with PJM staff. In March 2024, PJM reconnected with GridLab, Telos, and Sierra Club to clarify assumptions on the BESS component of the alternative portfolio. PJM staff also stated that they would begin their analysis of the alternative using the 2028 study year, which was the first time PJM raised using a study year other than the 2025 study year that it had previously used to assess reliability needs for the retirement of the Brandon Shores plant.

On May 3, PJM published its "BESS Technical Viability - Wagner and Brandon Shores Retirements" report, with appendices redacted. Following requests by GridLab and Telos for the appendices, PJM provided these on May 22, and updated versions on May 23. The appendices provided are marked as Critical Energy Infrastructure Information, which restricts Telos' ability to fully discuss their contents in this response. PJM also provided Telos with the modeling files for their 2028 case on May 16, 2024.

Response to PJM's "BESS Technical Viability - Wagner and Brandon Shores Retirements" Report

PJM's report provides examples for two scenarios under which it purported to have studied the Alternative Portfolio: a 2028 scenario with Wagner Units 3 and 4 offline (Scenario 1), and a 2028 scenario with Wagner Units 3 and 4 online (Scenario 2). In addition to providing general comments on the reliability results of these scenarios, PJM's report comments on the comprehensiveness, constructability, and economics of the Alternative Portfolio more broadly.

The report prepared by PJM contains several deficiencies that should be addressed. Each of these points is detailed below.

1. PJM applied a different set of critical assumptions to the Alternative Portfolio that were not applied to its analysis of the effects of Brandon Shores' deactivation.
2. The PJM mischaracterizes the proposed Alternative Portfolio as described by Telos in its updated report from February 2024.
3. PJM states that the Alternative Portfolio analysis omits considerations that were in fact examined.
4. PJM faults the Alternative Portfolio analysis for not performing analyses that PJM is solely responsible and capable of performing as part of comprehensive system reliability assessment.

5. The shifting assumptions of study year, load, and generation commitment raise new questions about the ability of the approved transmission upgrades to enable Brandon Shores and Wagner to actually retire in 2028.

1. PJM Applied a Different Set of Critical Assumptions to the Alternative Portfolio that were not Applied to Brandon Shores

Beginning on page 14, PJM's "2028 Year Scenario 1 (800 MW BESS, Brandon Shores and Wagner Retired)" describes an analysis that PJM performed that produced reliability violations.

Response:

PJM's analysis shifted assumptions in two major ways:

1. PJM shifted the study year from 2025 to 2028, and
2. PJM's 2028 reliability models have many BGE generating units offline that were online and dispatched in the 2025 model.

A Changed Study Year, from 2025 to 2028

On page 8, PJM states:

> "Accordingly, the retirement of the Brandon Shores and Wagner facilities introduces reliability concerns that are present even at today's load levels, let alone in 2025 or even 2028 when the system overall load is expected to grow by an additional 7,500 MW within the greater area of concern surrounding and including the BGE system."

Response:

Telos used the 2025 study year in its analysis because this was the same study year used by PJM for its Brandon Shores deactivation analysis. PJM staff provided the 2025 model that was used to evaluate the need for Brandon Shores, and Telos used this same model to maintain consistency with PJM's deactivation analysis.

PJM now states that load is expected to grow in the greater area of concern by 7,500 MW between 2025 and 2028, a substantial increase – even more than the peak load of BGE's entire territory.

Telos acknowledges that changes in load expected in 2028, particularly of the magnitude described by PJM, are extremely significant and any studies should consider this. However, comparison of the 2025 and 2028 cases shows that PJM is forecasting little load growth or slight summer peak load reduction in BGE. Because this load change would not have affected the viability of the Alternative Portfolio

compared to Telos' 2025 analysis, Telos looked more closely at the modeling files shared by PJM to identify other important changes versus the 2025 scenario.

PJM's 2028 reliability models have many BGE generating units offline that were online and dispatched in the 2025 model

Response:

While not described in PJM's report, close inspection of the 2028 models PJM developed for their analysis showed many generating units in BGE were set to be offline in the 2028 model but were online in the 2025 model, as shown in Table 1. The ratings and dispatch levels by unit have been redacted.

Table 1: Summary of BGE Generation Differences in 2025 and 2028 PJM Cases

Unit	Rating	2025 SUM	2028 SUM	2028 WIN	2028 LL
Wagner 3					
Wagner 4					
Perryman G12					
Perryman G34					
Perryman G51					
Perryman U6					
Phil Rd. G12					
Phil Rd. G34					
Total MW	**1173**	**978**	**107**	**0**	**0**
Total MVAr Capability (+)	**573**	**573**	**60**	**0**	**0**

This massive difference of assumed generation (871 MW dispatched, 513 MVAr capability) inside the import-constrained BGE territory constitutes a huge change in assumptions of the models – enough to swing the results of the reliability analysis. Such a change in assumptions means that PJM's analysis of the alternative is not an apples-to-apples comparison and requires further discussion and explanation by PJM.

2. PJM Mischaracterizes the Proposed Alternative Portfolio

On page 4, PJM states:

> "While the proposed battery concept would help offer some local supply within the BGE system, it will not eliminate the need for the proposed major transmission reinforcements required to maintain system reliability."

Further, on pages 10-11, PJM states:

> "However, most importantly, our analysis revealed that this battery storage concept is not technically viable, on its own, at this time." and "Telos' BESS solution [sic] not sufficient on its own."

Response:
The PJM report characterizes the Alternative Portfolio as a battery solution for retiring 2,100 MW of generation (all Brandon Shores and Wagner units). This is a misrepresentation of the Alternative Portfolio.

In the Appendices to PJM's report, they reference a presentation by Telos from December 19, 2023, which was a mid-project update shared with PJM. It seems PJM did not consider the presentation on the completed analysis that GridLab and Telos shared with PJM on February 23, 2024. The completed analysis provides more detail regarding the Alternative Portfolio as well as more developed cost analysis.

To reiterate, the Alternative Portfolio proposed is a combination of all of the following:

- An 800MW 4-hour battery energy storage plant interconnected at the Brandon Shores point of interconnection;
- Transmission upgrades, including prioritization of transmission investments already approved, particularly the reinforcements for voltage support, approximately 2,000MVAr of additional installations in the region; and
- Additional 115kV and 138kV transmission upgrades (conventional reconductoring was assumed, while it is acknowledged that other options like grid-enhancing technologies (GETs) could be considered).
- Retaining Wagner Units 3 and 4 under RMR, which is important for covering the most severe (and rare) operating conditions.

On page 10, PJM states:

> "[Telos] accordingly proposed alternate "conceptual solutions" that hinge on utilizing grid-enhancing technologies (GETs) like BESS, dynamic line ratings and automatic power-flow controllers (APFCs), Appendix 2."

Response:
This is a mischaracterization of the Alternative Portfolio. The Alternative Portfolio calls for relatively minor upgrades of a few <200kV transmission lines, of which there are many options, ranging from conventional reconductoring (which was assumed in the cost estimations) to the potential application of GETs. The Alternative Portfolio does not "hinge" on GETs.

On page 12, PJM states:

> "To simplify the analysis and focus on the feasibility of replacing the 2,100 MW of capacity currently offered by Wagner and Brandon Shores supporting the reliability needs of the BGE system, PJM conducted its analysis (that is summarized later in this report) assuming 100% availability of the full 600 MW and 800 MW battery sizes proposed by Telos."

Response:

This statement does not reflect the proposed Alternative Portfolio; the Alternative Portfolio has always considered the availability of Wagner units 3 and 4 until all approved transmission projects have been completed to meet the most severe grid operating conditions. Including Wagner units 3 and 4 in the Alternative Portfolio was a direct outcome of Telos' in-depth analysis of the extreme (and rare) conditions about which PJM expresses concern, namely during extended periods of high load and periods where the BESS cannot be charged. The Alternative Portfolio has focused specifically on accelerating the retirement of Brandon Shores through a combination of prioritized transmission investments and battery storage while retaining the Wagner 3 and 4 RMR until all of the transmission projects are completed, as described in PJM's deactivation analysis.

On page 13, PJM states:

> "The RMR analysis conducted by PJM confirmed the need for both Brandon Shores units plus Wagner Units 3 and 4 to maintain reliability. A single Brandon Shores unit (even with its increased dispatchability/flexibility compared to BESS) was found insufficient to maintain reliability."

Response:

Telos disagrees with the parenthetical comparison of flexibility between BESS and a 40-year-old coal-fired plant. It is noted in the RMR arrangement filed with FERC that Brandon Shores has a 24-hour response time.[1] While a battery has a finite energy capacity, its ability to immediately start, ramp, and provide 24/7 voltage support make it a far more capable asset class than coal-fired steam turbines, particularly where reliability needs can arise on short notice.

3. PJM Mistakenly Faults Telos for Omitting Considerations that Telos Included in its Analysis

A. BESS Duration and 8,760-hour Analysis

On page 11, PJM states:

> "Telos did not specify nor evaluate their proposed BESS duration. They assumed it to offer similar reliability services that a single Brandon Shores unit can offer.
>
> (1) This is a major flaw in assumption as the BESS being assumed infinitely available (or at the same rate as a thermal unit) is erroneous.

[1] See Docket No ER24-1790, *Brandon Shores LLC, RMR Arrangement – Continuing Operations Rate Schedule*, Attachment A at Section 3.4.

> (2) A feasible BESS solution will need to demonstrate that it could be charged and made available to provide reliability services for the longest possible duration that the replacement thermal unit can provide. This demonstration was not conducted by Telos. In December 2023, PJM requested that Telos provide this analysis to confirm the size (megawatts) and duration (megawatt-hours) of the battery necessary to meet the reliability needs, and enable PJM to evaluate the capital and operating costs."

Response:

Telos specified the BESS duration to be 4 hours and never considered it infinitely available. Telos's analysis captured a "first-pass, fatal flaw" level of analysis, in which summer peak, winter peak, and proxy cases considering winter midday conditions with the battery at full charge, and a protracted winter storm event, like Winter Storm Elliot, to assess the potential for reliability issues.[2] The analysis found that for a protracted event like a winter storm that occurs simultaneously with the loss of 2 major elements of the grid (N-1-1 contingency), the battery energy could be completely discharged before load abated from very high levels, and that in such a condition, Wagner units would be critical for maintaining reliability.

Telos agrees that the duration of the battery is a major consideration that deserves careful analysis and scrutiny, and in more detail that has been studied so far. However, PJM's report is incorrect in saying that Telos did not consider the duration of the battery.

On page 11, PJM states:

> "Telos' assessment did not consider operating throughout the 8,760 hours of the year… A full 8,760 analysis needs to be performed by Telos to prove feasibility of the BESS solution."

Response:

Telos did perform an 8,760 analysis of BESS operations against BGE's actual 2022 and 2023 load to identify periods of challenging grid operations, evaluate how the battery could be expected to perform under these challenging conditions, and evaluate the potential revenue generation from BESS operations[3]. This historical-based 8,760 analysis assumes that the resulting charge/discharge profile is representative of future years. The battery was scheduled over discrete 24-hour windows, assuming perfect foresight of load within a 24-hour period, but no foresight into future days. The ending state of charge of the battery was carried forward into the beginning of the subsequent day. Telos assumed the battery would have a 90% round-trip efficiency. An example of the resulting schedule (as an average day

[2] See the slide section beginning on slide 34, "Seasonal Considerations" https://gridlab.org/wp-content/uploads/2024/03/2024-02-20-Brandon-Shores-Presentation.pdf
[3] See the slide section beginning on slide 61, "Replacement Portfolio Financial Analysis" https://gridlab.org/wp-content/uploads/2024/03/2024-02-20-Brandon-Shores-Presentation.pdf

per month) is shown in Figure 1.[4] It is important to note that the battery was scheduled against load and not against pricing to prioritize its reliability services over the economic benefit, though in most cases, high load is coincident with high prices and so the economic and reliability incentives are generally aligned.

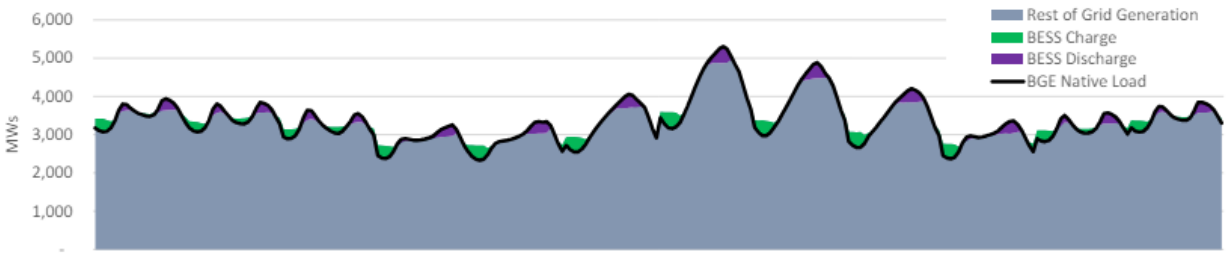


Figure 1: Example of BESS Scheduling, Average Day per Month Battery Operating Profile for 2023

To evaluate the performance of the battery during extreme grid conditions where reliability is challenged, Telos reviewed the scheduling of the battery for Winter Storm Elliot, which occurred in the last week of 2022. The hourly battery operating analysis for Winter Storm Elliot is shown in Figure 2.

During Winter Storm Elliot, the native load increased substantially at the end of December 23rd to a peak of nearly 5,900 MW. In the first several hours of the event, the battery discharged, supporting the system and keeping net load down to 5,300 MW - 5,500 MW. However, native load remained high, which prevented the battery from recharging fully during the early hours of December 24th. By mid-morning on December 24th, native load increased again and while the battery was assumed to discharge, it was soon depleted such that the rest of the grid would have to supply the native winter peak load for a few hours, shown by the brief gray peak rising to nearly 5,900 MW on December 24th.

[4] See the slide 17, https://gridlab.org/wp-content/uploads/2024/03/2024-02-20-Brandon-Shores-Presentation.pdf

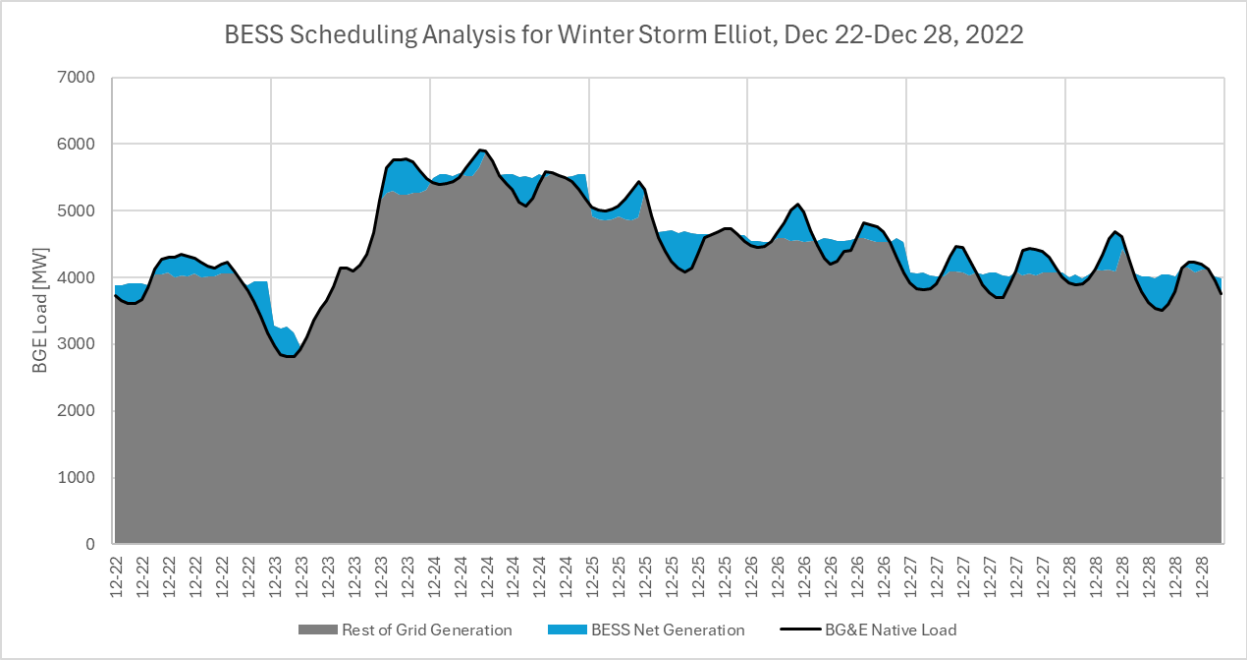


Figure 2: BESS Operations Considered for Winter Storm Elliot

To evaluate this extreme grid condition for reliability, Telos analyzed a winter peak case shown in Figure 3 and considered that the BESS was depleted, as our battery scheduling analysis indicated, and was providing 0 MW but was still online providing its full MVAr capability (voltage support), effectively acting as a STATCOM, which is a common operational condition for BESS.[5] Telos found that this level of stress was similar to that of the summer peak case, which had a similar net load considering the native load in summer is higher, but the battery can be expected to be discharging during summer peaks because the summertime peaks tend to not be prolonged. In sum, the Alternative Portfolio, including Wagner 3 and 4, was shown to be sufficient to meet reliability criteria under this extreme winter grid condition because the net BGE load (BGE native load minus expected battery operating power) was found to be similar to that of the summer peak case, which was found to be reliable with the Alternative Portfolio.

Additionally, Telos evaluated a case intended to represent a mid-day wintertime condition in which the battery is charging at its full rating, shown in Figure 3 in green. In such a condition, the net load still falls below that of the summer peak and winter peak conditions and therefore was not found to be more severe than the summer peak or winter peak conditions.

In conclusion, PJM's assertion that Telos did not evaluate the proposed BESS duration or undertake an analysis across the 8,760 hours of the year is inaccurate and overlooks many components of Telos'

[5] See the slide section beginning on slide 34, "Seasonal Considerations" https://gridlab.org/wp-content/uploads/2024/03/2024-02-20-Brandon-Shores-Presentation.pdf

analysis and results. Telos acknowledges that planning for extreme grid events is complex and believes that additional analysis on grid operations is valuable and warranted.

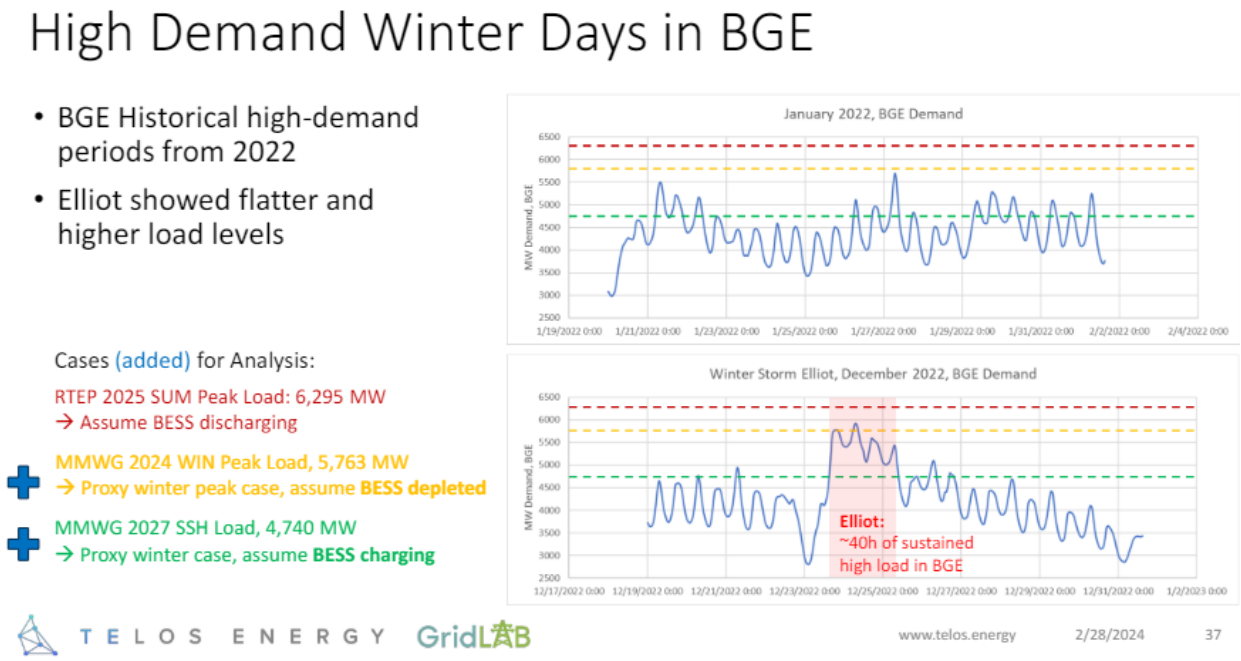


Figure 3: Reliability Analysis for Extreme Grid Conditions in BGE - Winter Storm Elliott

B. Analysis of Costs for Upgrades

On page 12, PJM states:

> "Telos' analysis captured the need for "additional VARs" on top of and beyond the BESS, thermal upgrades and RMR of Wagner." PJM continues: "No analysis was done to identify the needed upgrades nor their cost."

Response:

The Alternative Portfolio analysis clearly identified the transmission upgrades and estimated the costs of each portion of the upgrade, which is shown on slide 16 of the posted Alternative Portfolio analysis, copied below for convenience. Of the $325MM in transmission upgrades, $294MM has already been approved in FERC Docket No. ER24-163-000. Telos recommended prioritization of these projects, which are focused on providing additional voltage support (approximately 2,000 MVAr in the region). The remaining $31MM of upgrades are relatively small upgrades to existing 115kV and 138kV transmission lines, in which costs were estimated assuming a conventional reconductoring.

Transmission

Prioritized Transmission Upgrades	Approved by PJM?	Estimated Cost ($MM)
BGE - Five Forks – Rock Ridge 1 115kV (GD + N-1-1)	No	$8.6
BGE - Five Forks – Rock Ridge 2 115kV (GD + N-1-1)	No	$8.6
BGE - Chestnut Hill 7 – Frederick Road 7 115kV (GD + N-1-1)	No	$4.0
BGE - Chestnut Hill 8 – Frederick Road 8 115kV (GD + N-1-1)	No	$4.0
APS - Bethel – Riverton 138kV (GD + N-1-1)	No	$5.6
APS - Line drops to Doubs Transformer 3 (GD + N-1-1)	Yes	$0.8
PECO - New Conastone Capacitor (N-1-1 Voltage)	Yes	$15.0
PEPCO - Brighton Statcom + Capacitor (N-1-1 Voltage)	Yes	$63.0
PEPCO - Burchess Hill Cap (N-1-1 Voltage)	Yes	$15.0
BGE - Build Solley Road Substation + Statcom (N-1-1 Voltage)	Yes	$109.0
BGE - Build Granite Substation + Statcom (N-1-1 Voltage)	Yes	$91.0

$31MM "New" / Incremental Upgrades

$294MM Short Lead-Time Upgrades already approved by PJM

On page 13, PJM states:

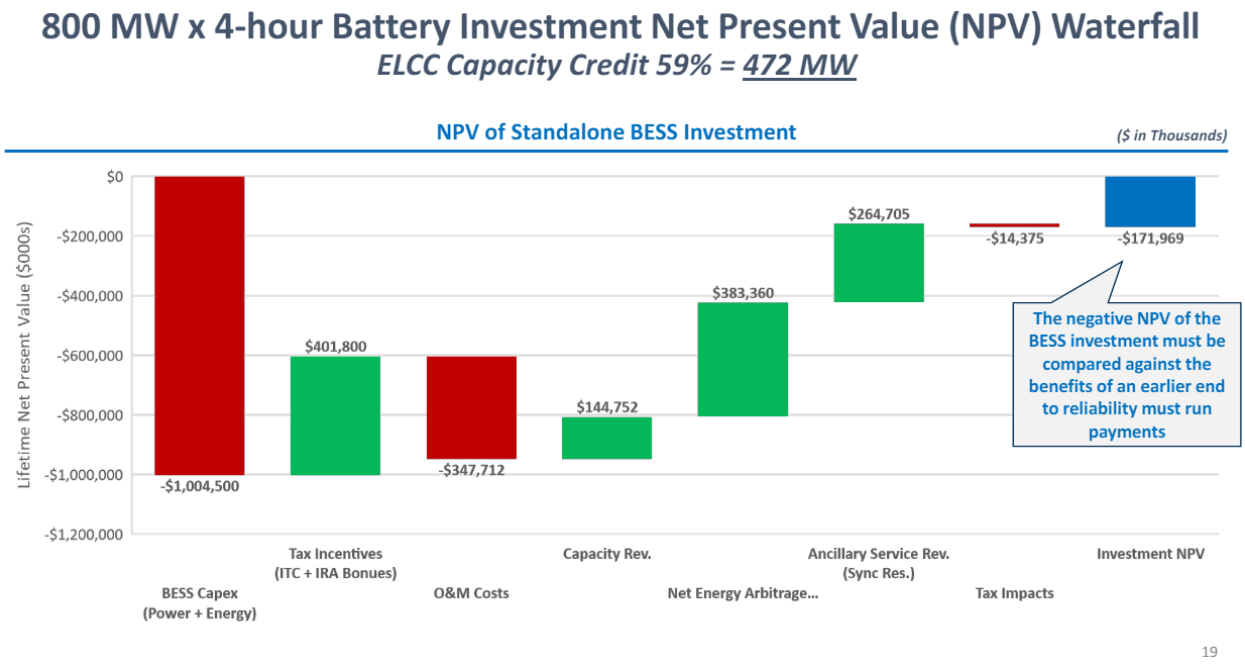
> "PJM estimated the 2024 cost to build a 600 MW four-hour and six-hour duration battery; the capital cost alone is ~$1 billion and ~$1.4 billion respectively in 2022 dollars, based on the overnight capital cost from NREL's Annual Technology Baseline."

Response:

It is not clear what specific assumptions PJM used in its estimates or whether PJM considered the large investment tax credit subsidy that would be available for a battery project at the Brandon Shores location. It is also not clear why the cost was estimated for a six-hour battery, which was not proposed. Telos performed a cost analysis that is detailed in its public slide deck, for which the reference was the NREL 2023 Advanced Technology Baseline (ATB), computed in 2021 dollars for a 2027 installation, using the NREL "Moderate" ATB estimates, which is a middle range between "Conservative" and "Advanced" (optimistic) future cost assumptions.[6] For comparison, Telos estimates that the capital expenditure for a 600MW 4-hour battery to be $450MM, $750MM before subsidy minus $300MM subsidy (30% ITC + 10% IRA bonus) and that for an 800MW 4-hour battery to be $600MM, $1B before subsidy minus $400MM subsidy (30% ITC + 10% IRA bonus).

Furthermore, PJM did not consider the revenue-generating potential of the battery from the capacity, energy, and ancillary services markets. Over the battery's 20-year life, Telos' analysis estimated that market revenue could offset the majority of capital costs and operating and maintenance costs, resulting a net present value cost of $172MM, as shown on slide 19 (repeated below for convenience) and further detailed in slides 61-73 of the Alternative Portfolio analysis.

[6] See the slide section beginning on slide 61, "Replacement Portfolio Financial Analysis" https://gridlab.org/wp-content/uploads/2024/03/2024-02-20-Brandon-Shores-Presentation.pdf



C. BESS Operating Reliability and Cycling

On page 14, PJM states:

> "With the proposed size and application of the BESS solution, it would be relied on daily to meet reliability needs. It is accordingly expected that the BESS solution will be subject to excessive cycling, which will negatively impact the lifespan of the BESS. This will increase its operating and maintenance costs and will expose the system to periodic risks where the battery capacity is reduced."

Response:

Telos' analysis accounted for the impact of daily cycling on the BESS. In our analysis, Telos assumed one complete cycle for every day of operation of the BESS for its entire life of 20 years. The Operating Expenses include 30% of energy augmentation (MWh) over this lifetime in addition to fixed O&M costs per the NREL ATB. These assumptions are consistent with typical BESS projects moving forward today that have 20-year project lifetimes that anticipate augmentation of battery cells at periodic intervals in the project lifetime to sustain the total energy of the plant, when accounting for the expected degradation of the cells for daily peak-shaving operations[7].

[7] See the slide section beginning on slide 61, "Replacement Portfolio Financial Analysis" https://gridlab.org/wp-content/uploads/2024/03/2024-02-20-Brandon-Shores-Presentation.pdf

D. Wagner RMR

On page 18, PJM states:

> "The analysis of this scenario did not extend to evaluate the charging of the BESS under light load conditions since there were violations already observed when the battery is charged without the Wagner units under RMR (see Table 3). Running the Wagner units during the charging period of the BESS to alleviate the identified violations is counter intuitive to the purpose of considering the BESS itself as it will rely on an oil-fired unit to charge a BESS that was essentially proposed by Telos to offset and avoid emissions."

Response:

While Telos expects the Alternative Portfolio to have a net reduction in emissions, emissions reduction is not an objective of this analysis and has not been evaluated. We expect that even with Wagner remaining available for the most severe operating conditions, Wagner would run significantly less with the Alternative Portfolio because the battery would be able to respond and provide MW and MVAr support very quickly, thereby reducing the number of times the Wagner units are called to start and the average duration for which they would run. This would reduce emissions on an annual basis while still ensuring that Wager is available to meet the most demanding operating conditions.

4. PJM faults the Alternative Portfolio analysis for not performing analyses that PJM is solely responsible and capable of performing as part of comprehensive system reliability assessment

On page 13, PJM states:

> "Telos did not conduct the load deliverability analysis and test its solution performance to ensure load deliverability; Telos made the assumption that CETL will remain the same as it is today (both Brandon Shores resources remain operational). PJM analysis indicated load deliverability issues, and therefore PJM tested its recommended transmission solution to ensure it adheres to load deliverability criteria. Assuming CETL will remain the same is flawed. For the analysis to be accurate, CETL should be recalculated, and the solution should be tested to ensure load deliverability is met."

Response:
The PJM-specific Load Deliverability analysis utilizes special, detailed assumptions as inputs to the model, which were not made available for this analysis of the Alternative Portfolio. It would be extremely difficult, if not impossible, for an entity external to PJM to conduct a load deliverability analysis. Therefore, simplifying assumptions were made transparently in this analysis to attempt to identify issues with load deliverability (see slide 40 of the February 2024 analysis).

Telos did not intend to replace the entire evaluation necessary to select a post-Brandon Shores retirement solution, which PJM alone can complete. Our intention was to present a cost-effective alternative that prompts more detailed evaluation by PJM and other decision-makers.

5. The shifting assumptions of study year, load, and generation commitment raise new questions about the ability of the approved transmission upgrades to enable Brandon Shores and Wagner to actually retire in 2028

On page 18, PJM very briefly describes its analysis for "2028 Year Scenario 2 (800 MW BESS, Brandon Shores Retired, Wagner RMR)":

> "PJM further extended its analysis to evaluate the efficacy of the BESS proposal assuming that the Wagner units will be retained as RMR (fully dispatched) together with the 800 MW BESS and the additional 2,100 MVAR of proposed reactive reinforcements in the BGE system by 2027/2028."
>
> and
>
> "even with the 705 MW by Wagner and the 800 MW offered by the BESS, the system experiences a large number of thermal and voltage violations."

Response:

The section of the report that comes closest to reflecting the Alternative Portfolio proposed was titled "2028 Year Scenario 2 (800 MW BESS, Brandon Shores Retired, Wagner RMR)." Although PJM shifted the study year from 2025, which had been used in the Brandon Shores deactivation analysis, to 2028, this scenario is most useful for assessing the viability/benefit of the Alternative Portfolio.

This raises the following questions:

- Why is this scenario showing 500kV thermal violations that were not previously identified in the 2025 deactivation analysis for Brandon Shores? This result may point to the impact of the large reduction in generation commitment and dispatch (Perryman and Philadelphia Road plants) in BGE in the 2028 cases.
- Are the approved Transmission investments identified in the Brandon Shores deactivation analysis, which PJM performed in 2023 using the RTEP 2025 model, sufficient to allow the RMRs for Brandon Shores and Wagner 3 & 4 units to terminate? Or do the anticipated changes in 2028 mean that the Brandon Shores RMR will have to be extended even beyond completion of the already approved transmission investments?
- Has PJM refreshed its Brandon Shores and Wagner deactivation analysis for the 2028 study year to confirm its findings from the 2025 study year?

Conclusions and Recommendations

The results of the Brandon Shores Deactivation Analysis, Wagner 3 & 4 Deactivation Analysis, our Brandon Shores Alternative Portfolio Analysis show agreement on many important points, including:

- Retirement of Brandon Shores without replacement of at least some of the capacity and voltage support provided by this plant could introduce reliability concerns until the proposed transmission upgrades are completed. (Note: Telos did not independently evaluate whether the full transmission package in fact does replace the need for Brandon Shores and Wagner 3&4 RMR).
- The already-approved voltage support projects should be pursued as quickly as possible to begin to address the voltage support deficiencies identified in the retirement analyses.
- Wagner 3 & 4 RMR is likely needed to address extreme periods of extended high load conditions in the BGE area.

Despite these areas of agreement, the analyses of PJM and GridLab/Telos differ in an important way. GridLab and Telos find that the Alternative Portfolio, consisting of a combination of transmission reinforcements, battery energy storage technology, and dispatchable generation is one specific example of a portfolio capable of replacing the Brandon Shore plant when evaluated on equal footing, and battery energy storage offers compelling attributes like extremely fast start-times, ramping, and 24/7 reactive power capability (regardless of the state of charge of the battery cells), that make it an attractive component of a larger system of grid resources. As such, the Alternative Portfolio deserves serious consideration.

We recommend that PJM perform an analysis:

- of the Alternative Portfolio as it has been proposed with the inclusion of Wagner 3 and 4 online and dispatched to their maximum in accordance with PJM's planning manuals and consistent with air permits,
- including the commitment and dispatch of available generating units in the BGE territory, unless PJM can provide an explanation as to why certain units such as Perryman and Philadelphia Road should be offline in the 2028 models
- using the 2028 study year for this analysis, provided it represents the most realistic conditions.