EPE Maximizes Battery Energy Storage System (BESS) Potential Through Transmission Analysis

Background

When a leading energy company sought to integrate a large battery energy storage system (BESS) into the grid through a 60 kV substation within the California Independent System Operator (CAISO) service territory, they turned to EPE for guidance, they turned to EPE for guidance. The goal was to determine the viability of connecting the BESS to the grid and assess its capacity at the Point of Interconnection (POI) to ensure smooth integration and effective operation.

With extensive experience in interconnection planning and operations, EPE was well-prepared to lead the project. The engineering team's deep understanding of CAISO's reliability rules and infrastructure ensured smooth integration, addressing grid capacity and avoiding potential thermal violations.

Challenge

It's increasingly difficult for developers to ensure reliable and efficient grid integration for large energy storage systems. As energy storage and renewable energy projects proliferate, the ability to seamlessly connect these assets to the grid without triggering thermal overloads or compromising grid stability has become a significant concern across the energy industry.

For this project, EPE needed to determine the available export/import capacity from the 60 kV substation under normal (N-0) and contingency (N-1) conditions. However, aging transmission infrastructure often struggles to accommodate new, decentralized energy sources. The risk of encountering thermal violations, voltage instability, or curtailment is anything but uncommon, particularly when operating within a complex grid environment like CAISO.

Understanding these potential bottlenecks early in the project lifecycle is critical to avoiding costly upgrades or operational delays, and EPE was equipped to tackle this challenge head-on.

EPE MAXIMIZES BATTERY ENERGY STORAGE SYSTEM (BESS) POTENTIAL THROUGH TRANSMISSION ANALYSIS

Approach

To begin, EPE retrieved the most relevant CAISO base cases, focusing on simulating various grid conditions at the 60 kV substation where the BESS would connect. With the necessary data, the team proceeded with a comprehensive transmission analysis for discharging and charging scenarios.

Steady State Injection Study: EPE performed a steady state analysis by running load flow calculations to identify thermal limitations of the power export/import potential at the POI. The analysis included system-intact and single-contingency conditions to assess the grid's ability to handle the additional generation (discharging) and load (charging) from the BESS.

N-0 and N-1 Constraints Analysis: The team calculated the available export/import capacity under N-0 and N-1 conditions and identified thermal violations. EPE provided detailed findings on the monitored facilities, noting any overloaded transmission elements that could trigger curtailment risks or the need for system upgrades.

Outcome

EPE provided a comprehensive report summarizing the assumptions, export/import capacities and identified thermal limitations. The report also recommended further analysis to address potential risks and ensure the project's smooth integration. Some of the key outcomes included:

Export/Import Capacity Findings: EPE identified the maximum export/import capacity from the 60 kV substation under both system-intact and contingency conditions, guiding the client on project feasibility.

Identification of Thermal Violations: The analysis pinpointed potential thermal violations, helping the client plan for grid upgrades and avoid curtailment risks.

Risk Mitigation and Future Planning: With a clear understanding of the grid's limitations, the client can proceed with a more detailed transmission study, ensuring optimal project size and successful integration.

Through EPE's transmission analysis, the client gained valuable insights into the project's integration challenges, empowering them to make more informed and strategic decisions at the right time to mitigate risks and optimize grid interconnection.

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