Southern California Edison
A.09-09-022 – Alberhill PTC & CPCN

DATA REQUEST SET E D - A l b e r h i l l - S C E - J W S - 2

To: CPUC
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Response Date: 4/5/2019

Question 01h: Provide additional analysis as required by Decision D. 18-08-026, Ordering Paragraph 4, items 4b, 4d, 4e, and 4h, replicated below:

h) Identify capital investments or operational changes effectuated to address reliability issues in the absence of construction of Alberhill Substation and associated costs for such actions

Response to Question 01h:

Based on discussions with the California Public Utilities Commission Energy Division, SCE interprets this question as inquiring about what interim solutions (*i.e.*, capital investments or operational changes) could potentially be utilized to address the capacity shortfalls and associated reliability[1] issues of the Valley South System prior to the planned operating date of the Alberhill System Project (ASP). The response to this item does *not* discuss long-term solutions to address reliability issues associated with the anticipated capacity shortfalls should the ASP not be constructed. Any additional long-term solutions to address reliability issues associated with capacity shortfalls will be provided (and evaluated along with the ASP) in a subsequent data submittal.

Timeframe for Interim Solution

An interim solution to address the reliability issues associated with capacity shortfalls of the Valley South System would be implemented from the time at which the operating limit of the Valley South System's transformer capacity is exceeded (*i.e.*, the project need date), up until the proposed ASP would become operational. According to SCE's 2017 ten-year load forecast (covering the years 2018-2027) for the Valley South System, the projected need date for a solution is 2022. SCE is currently in the process of finalizing its 2018 ten-year load forecast (covering the years 2019-2028) and schedule for implementing the ASP, which will further refine the timeframe for which an interim solution is required.

Interim Solution

As described in SCE's previous testimony and oral arguments associated with the ASP Certificate of Public Convenience and Necessity (CPCN) proceeding, the interim solution SCE intends to use to

[1] Reliability refers to a utility's ability to meet service requirements under normal and N-1 contingency conditions, both on a short-term and long-term basis. At the subtransmission level, reliability is associated with having both sufficient transformation and subtransmission line capacity (including system tie-lines) to serve the system load.

address the reliability needs of the Valley South System associated with a capacity shortfall is to utilize the spare Valley Substation transformer for the Valley South System whenever peak demand is expected to exceed the operating limits of the two 560 MVA Valley South transformers.[2]

Valley Substation is a transmission substation[3] that transforms voltage from 500 kV to 115 kV which then directly serves 115/12 kV distribution substation load *via* a network of 115 kV subtransmission lines. It is considered a load serving A-bank substation; however, because it is provided power by the 500 kV transmission system it differs from all other SCE load serving A-bank substations. All of the other substations operating with 500 kV are considered AA-bank substations, transforming voltage from 500 kV to 220 kV, and do not directly serve distribution substation load *via* a network of subtransmission lines. Because of this, Valley Substation is planned for as an A-bank substation while using AA-bank substation transformer ratings for its transformers. As such, SCE has established the following ratings for the Valley Substation transformers under specific system conditions:[4]

- Normal condition - 100% of manufacturer nameplate rating
- Long-term Emergency Loading Limit (LTELL) – 120% of nameplate (24 hours)[5]
- Short-term Emergency Loading Limit (STELL) – 160% of nameplate (1 hour)

Valley Substation's transformers each have a nameplate rating of 560 MVA, an LTELL rating of 672 MVA, and an STELL rating of 896 MVA. It is not permissible to operate the two Valley South System transformers with load over 896 MVA because the instantaneous loading that would be placed upon one transformer during an unplanned outage of the other would be beyond the STELL rating, exposing the transformer to potential damage and the potential for catastrophic failure. This limitation is why SCE has developed mitigation through a temporary operating procedure which places the spare transformer in-service with the two load-serving transformers any time the Valley South System load approaches 896 MVA.

This configuration, with three transformers operating together, increases the amount of energy (known as short-circuit duty) that would pass through the transformers should an electrical fault occur in the system. The increase in short-circuit duty approaches the rated limits of the substation equipment, which creates increased risk to equipment failure and personnel safety. Similarly, if the spare transformer is already in service at the time of an emergency (such as being used for a planned outage, unplanned outage, or maintenance), then it would not be available to fulfill the interim solution, which then would lead to involuntary load reductions.

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[2] This interim solution is consistent with testimony, oral arguments, and comments provided by SCE on the use of the Valley Substation spare transformer as a temporary overload mitigation plan.

[3] Transmission substations are those with either 220 kV or 500 kV voltages from the transmission system on the high-voltage side of the transformers. SCE terms the 220 kV substations as "A-bank" substations and those with 500 kV as "AA-bank" substations. Valley Substation is designed and planned for as an A-bank substation (however using AA-bank transformer ratings) having a ultimate design limit of four transformer banks. A maximum of four transformer banks per A-bank or AA-bank substation is consistent with both SCE's design standards and criteria and with SCE's other A-bank or AA-bank substations.

[4] The service life of a transformer is directly related to its operating temperature. The normal condition and LTELL and STELL ratings are used by SCE grid operators to ensure that transformer temperature ratings are not exceeded during normal and temporary overload conditions.

[5] AA-bank transformer emergency loading limits (both long-term and short-term) for are calculated values based on many input data including loading profiles, peak loading values, transformer specifications, maintenance and inspection data, etc. and may be lower, but not higher than the specified 120% of nameplate for LTELL and 160% for STELL.

In 2017, the utilization of the Valley South System transformer capacity was approximately 97%[6] (an operating margin of approximately 3%). As load growth continues, the operating margin of the Valley South System transformers will diminish, and the spare transformer will be used more often (and for longer durations) as an asset for mitigation rather than be used for its installed purpose. The lack of an available spare will further degrade the reliability and resiliency[7] of the area served by Valley Substation. For the short-term, SCE has accepted the risks associated with this interim solution, expecting that it would initially be relied on for a limited number of hours on a few days per year, until a long-term solution is implemented.

The use of the spare transformer as base case overload mitigation is not within the typical planning and operating criteria, and it not a substitute for a long-term solution. As the spare transformer is put into service on a more consistent basis and for longer durations to mitigate anticipated overloads, the likelihood of a coincident event that would result in service interruptions increases (since the spare transformer would already be in-service and could not be immediately be used as part of a larger recovery plan). As such, the operational and maintenance costs, and assumed risk to provide reliable service increases until a long-term solution is implemented.

Although utilizing the spare Valley Substation transformer does not require any capital investment, it does come at a cost from an operations and maintenance perspective. Putting the spare transformer in and out of service on a more consistent basis reduces the service life of the transformer circuit breakers and could ultimately lead to an accelerated replacement of the circuit breakers. Another non-obvious cost of using the spare transformer is the additional burden that it places on SCE grid operators from an operations standpoint. Relying on the spare transformer as part of the overload mitigation plan on peak demand days (days which typically already result in above-average grid operator involvement and above-average procedural operations), increases the complexity of operating the system. This potentially subjects the system to an increase in potential for human errors, which can be a significant root cause of system outage events.

[6] This value is equal to 2017 peak demand of 1,083 MVA of the Valley South System (adjusted for 1-in-5 hear storm weather conditions) divided by the maximum planned design capacity of the Valley South System (1,119 MVA).

[7] Resiliency is focused on how well a utility anticipates, prepares for, mitigates, and recovers from effects of extraordinary events (such as wildfires, earthquakes, cyberattacks, and other potential high impact, low probability (HILP) events). This is consistent with IEEE PES-TR65, "The Definition and Quantification of Resilience", April 2018.