PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE

SAN FRANCISCO, CA 94102-3298

June 16, 2022

Tom Diaz
SCE Regulatory Affairs - Infrastructure Licensing
Southern California Edison

Via email to thomas.diaz@sce.com

RE: CPUC Supplemental Data Request 12 for the Southern California Edison Alberhill System Project, A.09-09-022

Dear Mr. Diaz,

Upon further review of Southern California Edison's supplemental data response to the additional analyses requested in Decision 18-08-026, the Energy Division requests the information contained in Attachment 1 to this letter. Responses should be submitted to the Energy Division and WSP in electronic format. We request that SCE respond to this data request by June 30, 2022. Inform us as soon as possible if you cannot provide specific responses by this date. Delays in responding to this data request may cause delays in the supplemental analysis review process.

Direct questions to Joyce Steingass at (415) 703-1810 or by e-mail (address below). Please copy the CPUC's consultant, Amy DiCarlantonio, WSP, on all communications (amy.dicarlantonio@wsp.com). Energy Division reserves the right to request additional information at any point during the proceeding and subsequently during project construction and restoration should Application (09-09-022) be approved.

Sincerely,

Joyce Steingass, P.E.
CPUC Project Manager
California Public Utilities Commission
505 Van Ness Avenue
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SAN FRANCISCO, CA 94102-3298

CC: Amy DiCarlantonio, Project Manager, WSP

Attachment 1: 2022-0616_Data Request No. 12_Table

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DG #	Resource Areas/ Topic	SCE Data Submittal Item/Page	Data Gap Question	Response
DG-MISC-83	Alternatives	N/A	Provide additional analysis on the Valley South to Valley North plus Centralized Battery Energy Storage System (VS-VN+CBESS) project alternatives as defined in the DG-MISC-83 Attachment 1 – Scope of Additional Analysis Requested Valley South to Valley North Plus Centralized Battery Energy Storage System Alternative.	

Scope of Additional Analysis Requested

Valley South to Valley North Plus Centralized Battery Energy Storage System Alternative

1.0 Methodology and Assumptions

The methodology and assumptions described herein provide the basis for scoping Valley South to Valley North plus Centralized Battery Energy Storage System (VS-VN+CBESS) project alternatives.

SCE will evaluate the system performance of the VS-VN + CBESS alternative under two scenarios to meet the minimum system performance criteria as required by SCE's planning criteria and guidelines and which is consistent with common electric utility practice. Specifically, at a minimum, the performance of the alternative must:

- Ensure all load is served during normal system conditions (i.e., all electrical facilities in-service or "N-0") and during 1-in-5-year heat storm weather conditions
- Ensure all load is served during abnormal system conditions consisting of a single electrical system component being out-of-service (i.e., "N-1") and during 1-in-5 year heat storm weather conditions

The year of study will be 2031 which is the last year of the last finalized 10-year planning horizon covering the years 2022-2031. A 10-year planning horizon is common for system studies as it is typically adequate for evaluating system performance, identifying system needs, and allowing for solutions to be implemented within the first several years of the 10-year planning horizon. However, SCE notes that for larger and more complex projects (e.g., projects that require permitting and licensing approval from the CPUC such as the Alberhill System Project) that commonly take 5-7 years (or more) to complete, it can be argued that a 10-year planning horizon is not long enough to properly evaluate the cost effectiveness of an alternative that may only be in-service for several years through the 10-year planning horizon.

Scenario 1 – with initial transfer of two substations from VS to VN

Study system performance ***with*** the permanent transfer of two substations (Newcomb and Sun City) to Valley North and with an appropriately sized CBESS located in VS (near Pechanga Substation). The CBESS will be sized to ensure that following the transfer of the two substations, the loading of two load-serving VS transformers will not exceed 896 MVA under normal system conditions (N-0) during 1-in-5 year heat storm weather conditions and will not exceed 896 MVA under abnormal system conditions (N-1) during 1-in-5 year heat storm weather conditions.[1]

Scenario 2 – without initial transfer of two substations from VS to VN

Study system performance ***without*** the permanent transfer of two substations (Newcomb and Sun City) to Valley North and with an appropriately sized CBESS located in VS (near Pechanga

[1] Scenario 1 is the VS-VN + BESS alternative identified in SCE's Planning Study which includes 115 kV subtransmission line scope that transfers two substations from VS to VN thereby reducing the loading of the VS transformers. In Scenario 1, the two substations are transferred initially as part of the normal N-0 system reconfiguration of the system. This alternative does not result in system tie-lines that allow for additional load transfers from VS during N-1 conditions (e.g., an unplanned outage of a VS load-serving transformer). As a result of these tie-lines being unable to further reduce the load of the VS transformers during N-1 contingencies, any load amount above 896 MVA (the maximum emergency loading limit of a single transformer) must be reduced through use of the BESS and the system loading at all times must be maintained at no greater than 896 MVA at all times (N-0 and N-1 system conditions).

Substation). The CBESS will be sized to ensure that the two load-serving VS transformers will not exceed 1,120 MVA under normal system conditions (N-0) during 1-in-5 year heat storm weather conditions and will not exceed 896 MVA under abnormal system conditions (N-1) during 1-in-5 year heat storm weather conditions.[2]

SCE is providing this analysis to demonstrate the BESS size that is required considering that under Scenario 1 (no N-1 tie-line transfer capacity) the maximum loading limit of VS is 896 MVA at all times (both normal and abnormal system conditions). Additionally, at the request of the Energy Division, SCE will analyze Scenario 2 and will demonstrate the size of the BESS required to maintain loading of the VS transformers to no more than 1,120 MVA and 896 MVA under normal and abnormal system conditions respectively.

2.0 System Operating Thresholds

The scope of each scenario, particularly the battery sizes, are guided by SCE's Subtransmission Planning Criteria and Guidelines (i.e., system operating thresholds) which state that, at a minimum, system performance shall serve all load under N-0 (normal conditions) and N-1 ("Likely Contingency") conditions with limited exceptions.[3] Additionally, studies shall be performed for awareness of impacts and consideration of solutions to address "Unlikely Contingencies" (i.e., N-1-1 and N-2).[4]

SCE's Subtransmission Planning Criteria and Guidelines dictate that sufficient transformer capacity or adequate subtransmission tie-line capacity will be planned to limit or reduce transformer loading (to within defined maximum emergency loading limits) in the event of a transformer outage."[5] Based on this criterion, the Valley South and Valley North system operating thresholds are as follows.

Valley North (<u>normal condition</u> operating threshold because tie-lines are present to reduce load during N-1 contingencies): 1,120 MVA

Basis: VN has existing system tie-line capacity that can reduce loading on the VN during contingency events and the full nameplate rating of 1,120 MVA of its transformers during normal conditions is its operating threshold because during an N-1 transformer contingency, load (sufficient to reduce VN loading to below the one-hour transformer emergency rating of 896 MVA) may be shed[6] and then (all or most) of the shed load could then be promptly transferred via tie-lines to the adjacent Vista 115 kV System.

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[2] Scenario 2 presents a variation of the alternative in Scenario 1, and which includes the same 115 kV subtransmission line scope as Scenario 1, but which differs in that it does <u>not</u> transfer the two substations as part of the normal N-0 system reconfiguration of the system. This variation does not reduce loading of the VS transformers under normal system conditions, but rather allows for the temporary transfer of the two substations from VS to VN under N-1 abnormal system conditions. As these tie-lines allow for load reductions of the VS transformers during contingency conditions, the maximum VS system loading is permitted to be up to 1,120 MVA under normal system conditions and up to 896 MVA under abnormal system conditions. The size of the BESS is determined by the amount of load reduction required to maintain both of these operating limits.

[3] Sections 2.3.2.1A and 1.3 of SCE's Subtransmission Planning Criteria and Guidelines

[4] Section 1.4 of SCE's Subtransmission Planning Criteria and Guidelines

[5] Section 2.2.1 of SCE's Subtransmission Planning Criteria and Guidelines

[6] VN has existing automatic load-shedding relays in place designed to drop sufficient load to ensure load remains no greater than 896 MVA during an N-1

Scope of Additional Analysis Requested

Valley South to Valley North Plus Centralized Battery Energy Storage System Alternative

Valley South—Potential Future State Post-Construction (<u>normal condition</u> operating threshold *if solution provided tie-lines with transfer capability*): 1,120 MVA

> **Basis:** Under the assumption that a project were constructed with relays to automatically shed load and which would provide VS with system tie-lines (similar to VN whereby all or most of the load that was shed could be transferred), the full normal-condition nameplate rating of 1,120 MVA of the VS transformers would be the operating threshold.

Valley South – Status Quo Current Operating State (<u>normal</u> and <u>emergency condition</u> operating threshold because VS *does not* have tie-lines and the proposed solution would not create tie-line transfer capability of load transfers *from* VS to another system): 896 MVA

> **Basis:** Valley South does not meet the criterion of having sufficient transformer capacity OR tie-line capacity during a transformer outage. In lieu of tie-lines, a temporary mitigation measure has been implemented to align the spare transformer when system load exceeds 896 MVA, as this is the maximum one-hour emergency operating limit of a single Valley Substation transformer. Placing the spare transformer in service prevents a scenario in which a single transformer outage leaves the second transformer exposed to load in excess of its maximum emergency rating, which could result in a catastrophic failure, personnel injury, and/or loss of load. The operational risk, and therefore the system operating threshold, is identical *with* or *without* an actual transformer failure since operators must always have means to protect the remaining in-service transformer (i.e., by having sufficient transformation capacity or adequate tie-line capacity). Should a transformer actually fail, there are only two remaining transformers available to serve Valley South and a subsequent transformer failure would expose the single remaining transformer to loads in excess of its maximum emergency rating and potentially lead to catastrophic failure. As such, load is limited to 896 MVA consistent with SCE's planning criteria and guidelines.

3.0 Summary of Scope

The scope of the VS-VN + CBESS alternatives (both with and without the initial transfer of two substations) include the following key components:

- New 115 kV lines between Valley South and Valley North Systems. These 115 kV lines would enable the transfer of Newcomb and Sun City Substations to the Valley North System. The operational status of the new 115 kV lines will be guided by the scenario under study. When permanently transferring load initially they would be termed "source lines" and when transferring load temporarily during contingencies they would be termed "tie-lines."
- Centralized Battery Energy Storage System in the Valley South System (VS-CBESS)
- Reactive power support through a STATCOM to reduce the reactive power flow through the Valley South System transformers

Scope of Additional Analysis Requested

Valley South to Valley North Plus Centralized Battery Energy Storage System Alternative

The VS-VN + CBESS alternative will be evaluated under two scenarios. The differences are embedded in the use of new 115 kV lines as 1) permanent initial transfer or 2) temporary transfers only during contingencies. SCE will study both scenarios with and without use of the STATCOM device.

The different system operating thresholds that govern operations are described for each of the two scenarios below. The specific role of each system component (e.g., CBESS, tie-lines, STATCOM) is described below from the perspective of different system operating thresholds (e.g., normal condition and emergency condition).

VS-VN + VS-CBESS alternative with temporary transfers during contingencies

Normal conditions: Transformer capacity margin in the Valley South and Valley North Systems is achieved in this alternative via the use of a CBESS in Valley South to reduce load below the system's operating threshold (1,120 MVA). The availability of tie-line capacity (via the new 115 kV lines that would allow for the transfer of Newcomb and Sun City Substation ~200 MVA) will enable Valley South to operate up to 1,120 MVA while Valley North will also be operated to 1,120 MVA as it has existing tie-line transfer capacity. The magnitude and duration of the load in excess of the system operating thresholds defines the power (MW) and energy (MWh) levels of the CBESS. The apparent power (MVA) flow through the Valley South System transformers will be directed to unity using the STATCOM device. As such, the CBESS power and energy sizing will be based off of the real power flow through Valley South System transformers.

Emergency conditions: (i.e., loss of Valley South transformer): As defined within SCE's planning criteria, the emergency operating threshold of 896 MVA would be applicable for the first hour of the contingency. Under this condition, automatic load shedding relays (installed with the construction of the new 115 kV lines) would drop Newcomb and Sun City Substations after which the new 115 kV lines would be closed in restoring service to Newcomb and Sun City Substations via Valley North. Additionally, the spare transformer would be switched in-service to the Valley South System. The magnitude of the load in excess of the emergency operating threshold defines the power requirement (MW) of the supplemental VS-CBESS needed to reduce loading within limits. The energy (MWh) of the VS-CBESS will only be sized for a duration of one hour which is assumed to be adequate time to place the spare transformer in service. The STATCOM device will be sized to meet the reactive power demand locally in the same fashion as identified for normal operating conditions.

VS-VN + VS-CBESS alternative with permanent transfers

Normal conditions: Transformer capacity margin in Valley South is achieved in this alternative via the use of the permanent transfer of Newcomb and Sun City Substations from Valley South to Valley North. The lack of Valley South tie-line transfer capacity will require the Valley South System to operate at the 896 MVA operating threshold (normal condition operating threshold without tie-lines), in preparation for an unplanned outage of a Valley South transformer. The magnitude and duration of any load in excess of 896 MVA (see Section 2.0 above) defines the power (MW) and energy (MWh) requirements of the VS-CBESS. The apparent power (MVA) flow through the Valley South System transformers will be directed to unity using the STATCOM device. As such, the CBESS power and energy sizing will be based off of the real power flow through Valley South System transformers.

Emergency conditions: For Valley South, the VS-CBESS would need to be sized for emergency conditions (896 MVA) due to the lack of system tie-lines. However, as described immediately above in the "normal conditions" section, the VS-CBESS would already be sized for 896 MVA in preparation of an N-1

transformer outage in VS and thus the sizing is identical for both normal and emergency conditions. The STATCOM device will be sized to meet the reactive power demand locally in the same fashion as identified for normal operating conditions.

3.1. BESS Sizing Factors

The minimum size of the CBESS will be in accordance with the system operating thresholds described in Section 2.0. The sizing of the CBESS for this analysis will not include factors impacting the sizing to account for round trip efficiency, battery degradation, BESS resource N-1, or additional margin to account for things such as forecast uncertainty. The CBESS size (real power or MW) is driven by the need to meet the Valley South System transformer capacity operating thresholds under both N-0 and N-1 to prevent real power (MW) overloads. Use of the STATCOM device will be studied to address reactive power (MVAR) needs of the Valley South System thereby minimizing the CBESS sizing to that which would be required to meet on the real power (MW) needs of the system. The analysis will size the BESS to meet the system requirements through 2031. For this analysis, it is assumed that following project approval and completion of construction (assumed operating date of 2027), the identified CBESS size required to satisfy capacity through 2031 would be installed at the initial in-servicing of the project (i.e., 2027). SCE notes that by 2031, the incremental CBESS additions for the next period of time (e.g., 2032 or through some other period of time) would also need to be installed.

- ***VS-VN + CBESS alternative with temporary transfers during contingencies***
  - Valley South
    - CBESS MW and MWh + STATCOM MVAR: CBESS sized to address real power (MW) loading above normal condition operating threshold of 1,120 MVA for Valley South (because it would have tie-lines) and STATCOM would provide required MVAR compensation to maintain unity power factor
    - CBESS MW and MWh + STATCOM MVAR: CBESS sized to address real power (MW) loading above emergency condition operating threshold of 896 MVA for Valley South (after use of tie-lines to transfer load to Valley North) and STATCOM would provide required MVAR compensation to maintain unity power factor

- ***VS-VN + CBESS alternative with permanent transfers***
  - Valley South
    - CBESS MW and MWh + STATCOM MVAR: CBESS sized to address real power (MW) loading above emergency condition operating threshold of 896 MVA for Valley South (because it would not have tie-lines) and STATCOM would provide required MVAR compensation to maintain unity power factor

1. **In-Service Date**

   The VS-VN + CBESS alternative is assumed to be in-service by 2027 (several years after deficiencies are present) and will be sized for system needs through the study year of 2031.

2. CBESS Location Considerations

In the analysis, the VS-CBESS will be sited in a location that considers *both* optimizing the size of the energy storage (i.e., results in least amount of MW & MWh to achieve zero LAR under N-0 operating thresholds) and in an area with undeveloped land reasonably expected to construct a substation on. Siting the CBESS will not consider impacts to existing subtransmission lines (i.e., Auld-Moraga #2 overload).

4.0 Study Considerations and Flex Metrics.

Based on the sizing criteria above, no LAR will need to be accrued for either alternative under transformer N-0 overload conditions.

The analysis will focus on the year 2031 (the 10th year of the current 10-year planning horizon using the IEPR forecast and covering the years 2022-2031) and will revisit the Flex-2 metrics using updated battery sizes from Section 3.0 for contingency scenarios described below:

Flex-2-1

For Flex-2-1 (complete loss of Valley Substation for two weeks), study the outage with the peak day occurring in the middle of the two weeks and in the year (2031).

In this case, LAR would be accrued throughout the two-week outage for all customers continuing to be served in the Valley South and Valley North systems after the load transfer from Valley North to Vista is made using the available Valley North tie-lines. CBESS is assumed unavailable due to a lack of charging or synchronization capability.

This would be considered a "high-impact- low-probability" event and thus an "Unlikely Contingency" under SCE's planning criteria but its impact should be considered due to the potential large number of affected customers.

This metric is unchanged from the previous study.

Flex-2-2-A- Short Duration Outage with on-site spare

Flex-2-2-A will evaluate the impact of a 6-hour outage of the Valley South transformer. The on-site spare transformer will be available by the start of hour 2 of the outage i.e., two transformers serving VS for remaining 5 hours of the outage.

The analysis will occur over the 24-hour period of the peak day of the year with the outage occurring from hours 1400-1900 (peak hour in the middle).

This is a new variation of the Flex 2-2 metric and would be considered an N-1 contingency and "Likely Contingency" under SCE's planning criteria.

Flex-2-2-B- Short Duration Outage without on-site spare

Scope of Additional Analysis Requested

Valley South to Valley North Plus Centralized Battery Energy Storage System Alternative

Flex-2-2-B will evaluate the impact of a 6-hour outage of the Valley South transformer. The on-site spare transformer would not be available during the event (i.e., only one transformer serving VS for the full-6-hour outage). In this case, LAR will be accrued in hours 2-6 for any load that would exceed the 24-hour emergency transformer loading limit of 672 MVA

The analysis will occur over the 24-hour period of the peak day of the year with the outage occurring from hours 1400-1900 (peak hour in the middle).

This is a new variation of the Flex 2-2 metric and would be considered an N-1-1 contingency of limited duration, and thus an "Unlikely Contingency" but one that would generally be considered in SCE system planning because it is not uncommon to have short duration outages due to alarms or other minor maintenance issues.

Flex-2-2-C- Long Duration Outage without on-site spare

Flex-2-2-C will evaluate the impact of a 2-week outage of the Valley South transformer. This condition is reflective of an N-1-1 event, i.e., one VS transformer failure without the spare transformer available leaving only one transformer serving VS for the full 2-week outage as the off-site spare must be mobilized.

In this case, for the first day, LAR would be accrued for load above 896 MVA for the first hour and above 672 MVA for hours 2-24. For days 2-14, LAR would accrue for any load above the nameplate rating of 560 MVA.

This scenario is identical to the Flex-2-2 scenario presented in the Planning Study and would be considered a "high-impact, low-probability" event. This would also be considered an "Unlikely Contingency" under SCE's planning criteria, but its impact should be considered due to the potential large number of affected customers.

4.1. Evaluation of BESS - Assumptions

- The BESS would be evaluated as available to offset any LAR accrual over the course of the outage event until it was fully discharged.
- Irrespective of system constraints, the BESS would be able to fully charge overnight and available for discharge when required.
- If the analysis indicates the system is unstable due to the combination of the CBESS additions and high system loading, this will be handled by including additional scope to make the solution operationally feasible. These events are generally encountered when the balance between generation addition (CBESS) and system load cannot reach a stable equilibrium point, resulting in mismatches due to voltage swings and excessive MVAR flows. These are indicative of challenges in operating the Valley System under increased loading conditions with a single transformer in service. The additional scope could include additional capacitor banks, adjusting transformer tap settings, adjusting voltage schedules at the Valley 115kV substation, or adding devices such as a STATCOM. Any operational complexities associated with the operation of this alternative will be identified and discussed.

5.0 Planning-Level Cost Estimates

SCE will provide planning-level cost estimates for each of the two VS-VN + CBESS variants consistent with the methodology (including the component cost inputs) used in the previous benefit-cost analysis (BCA) and Planning Study.

SCE notes that CBESS facilities would need to be installed and in-service by the earliest feasible operating date to meet the system needs (as the operating date is later than the need date) and both are before the study year 2031. Consistent with the analysis provided in the Planning Study, this analysis reflects the necessary CBESS sizing and costs (nominal dollars) to address system needs through 2031 with installation assumed to occur in 2025 (consistent with the Planning Study to allow an "apples-to-apples" cost comparison). Additionally, SCE will provide for awareness the size and costs for CBESS battery additions in VS expected to be installed by 2031 to meet needs through 2035; however, LAR calculations will not be made for this time period. Finally, SCE will independently provide a rough order of magnitude estimate for a STATCOM addition so that the Energy Division can assess its cost versus potential added value in reducing BESS sizing.