[redacted] System Assessment

Interconnection System Impact Study Report

WDT1371ISP [redacted]

SOUTHERN CALIFORNIA
EDISON
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Southern California Edison Company

Nicole Cadreau
Generation Interconnection Planning

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Contents

1. Purpose

The [redacted] is an interconnection request to allow for the export of an existing wind generating facility currently operating as non-export. The project is comprised of a gross total of 24 MW of wind generation connecting to the existing Cal Cement 66/4.160 kV Substation on the 4.160 kV side. The point of interconnection for the Project is the Cal Cement 66 kV Substation.

The purpose of this study is to determine the adequacy of SCE's electrical distribution system to accommodate the export of the [redacted]-[redacted] Project and to identify system limitations that would require Distribution Upgrades on the subtransmission system to mitigate any identified impacts corresponding to project export. The study included all existing and queued ahead generation projects in the Windhub 66 kV Subtransmission System, regardless of the in-service dates of such prior queued generation projects. The assessment considered minimum and maximum load levels in order to stress the Windhub subtransmission system.

2. [redacted] Project Interconnection Information

The most current interconnection information provided for the existing 24 MW [redacted] Wind [redacted] Project is listed below. Table A.1 lists the essential data obtained from the interconnection request and the project's most recent one line diagram.

Table A.1: Project General Information

Project Location	[redacted]
Participating TO's Planning Area	SCE Northern Area
Point of Interconnection	Cal Cement 66 kV Substation
Number and Types of Generators	Eight (8) [redacted]
Maximum Generator Output	24 MW
Generator Auxiliary Load	0.4 MW
Maximum Net Output at Generation Facility	[redacted]
Large Customer Load Demand	30 MW*
Estimated Generation Tie-Line Losses	Not Applicable
Estimated Maximum Net Output at POI	[redacted]
Power Factor Range	[redacted]
Feeder Transformer(s)	[redacted]
IC Requested COD	August 31, 2016

*Note: This assessment will model existing large customer load at zero to maximize project export.

3. System Assumptions

3.1 Planning Criteria

The generator interconnection studies were conducted utilizing SCE's Reliability Planning Criteria. More specifically, the main criteria applicable are as follows:

Power Flow Analysis

The following contingencies are considered for subtransmission lines and 220/66 kV transformer banks ("A-banks"):

- Single Contingencies (N-1) – Loss of one line or one A-bank
- Double Contingencies (N-2) – Loss of two lines

The following reliability criteria are used:

Subtransmission Lines	Base-Case	Limiting Component Normal Rating
	N-1 and N-2	Limiting Component Emergency Rating
220/66 kV Transformer Banks* (A-banks)	Base-Case	Normal Loading Rating
	N-1 and N-2	As defined by SCE Operating Bulletin

* Please note that Normal Rating has been reduced to reflect 95% of rating for charging cases.

3.1.1. Normal Overloads

Normal overloads are those that exceed 100 percent of normal facility rating with all facilities in-service (base case). Mitigation will be required to address any identified normal overload triggered by the inclusion of the project export.

3.1.2. Contingency Overloads

Contingency overloads are those that exceed 100 percent of emergency ratings under outage conditions. Mitigation will be required to address any identified contingency overload triggered by the inclusion of the project export.

3.1.3. Voltage Criteria

Voltage performance under single and double outage conditions will be limited to 5 percent and 10 percent deviation respectively.

3.1.4. Power Factor Criteria

All projects will need to comply with SCE's Interconnection Handbook requirements.

3.2 Load Assumptions

The load assumptions for the local subtransmission system utilized a combination of historical load as well as a 2020 load forecast in order to provide a projected representation of the load for the year 2020. The 2020 load forecast was derived using SCE's Distribution Engineering

A-Bank Planning load forecast. The resulting load values that were used for the peak and off-peak conditions are shown below in Table 3.2 and were used as the basis for evaluating subtransmission system performance for inclusion of this project export.

Table 3.2
Local Subtransmission System Load Assumptions

Year	Peak Load (MW)	Off-Peak Load (MW)
2014	[redacted]	[redacted]
2020	[redacted]	[redacted]

3.3 Generation Assumptions

Generation dispatch of local subtransmission system generation (existing and queued) was done in a manner that would provide for a stressed export of generation in the system. In order to assess the subtransmission system and stress it to its maximum capacity, all local generation resources within the Windhub 66 kV Subtransmission System were dispatched as listed in Table 3.3 below. Note that the Tehachapi wind production from wind turbines installed during the QF era have been modeled to reflect a collective 295 MW output resulting in a total MW output of 651 MW[1] modeled in the studies. The total MW output with the inclusion of the export of the [redacted] increased to 675 MW.

Table 3.3
Existing and Queued Ahead Local Generation

Generation	Resource	Size (MW)	Status
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

[1] The 335.3 MW of [redacted] installed during QF era was dispatched to 295 MW and the [redacted] load was rolled to the Vestal System

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

[redacted] can be rolled to Vestal System to provide 10 MW of additional capacity
** Tehachapi wind production from wind turbines installed during the QF era have been modeled to reflect a collective 295 MW output

3.4 Subtransmission System Assumptions

This assessment modeled the existing Windhub subtransmission system without any additional upgrades.

3.5 Study Methodology

3.5.1. Power Flow Study

The base cases were developed to represent stressed loading and generation conditions for the Windhub subtransmission system based on the load and generation data provided in Tables 3.2 and 3.3. The pre-cases included all existing and queued ahead projects, and the post-cases modeled the existing 24 MW [redacted] as an export with zero customer load demand to identify the incremental impacts of the project's export. The critical outage conditions evaluated that were evaluated are provided below in Table 3.5.1.

Table 3.5.1
List of Contingencies Evaluated

#	Contingency Type	Contingency Description
1	Base Case	No Outage
5	N-1	Loss of Windhub No.2 220/66 kV Transformer Bank
6	N-1	Loss of Windhub No.3 220/66 kV Transformer Bank

Note: Though other relevant contingencies were also evaluated, only those listed above were the most critical and seen to create overloads that could be attributed to the addition of the [redacted]

3.5.2. Post Transient Voltage Study

The power flow study voltage results were used in the system impact study as a screen to identify those contingencies that may have required additional post-transient voltage studies. Contingencies identified in the power flow to have a voltage drop in excess of 5% were selected for post-transient voltage analysis. The Post-transient voltage studies compare voltage deviations to the reliability requirements for contingency outages on the subtransmission system. Mitigation measures will be recommended for any criteria violation that may have been identified to be triggered with the inclusion of this project.

4. Power Flow Results

4.1 Maximum Generation Coupled with Minimum Load Conditions

4.1.1 Base Case Conditions

As shown in Table 4.1.1, the study identified a base case overload on the No.2 and No.3 220/66 kV Windhub transformers (A-Banks).

Table 4.1.1
Base Case Power Flow Results

Overloaded Component	Rating (MVA)	Non-export Loading (Amps or MVA)	Non-export Loading % Rating	Export Loading (Amps or MVA)	Export Loading % Rating	% Change from Pre-Project Loading
No. 2 A-Bank	280	279.0	99.6%	295.6	105.6%	6%
No. 3 A-Bank	280	279.8	99.9%	296.4	105.9%	6%

4.1.2 Outage Conditions

The project cannot export without the appropriate mitigation in place to address the base case overload discussed above, therefore, outage conditions with base case overloads were not evaluated. See section 4.4 for mitigation details.

4.2 Maximum Generation Coupled with Maximum Load Conditions

4.2.1 Base Case Conditions

The study did not identify any base case conditions where the inclusion of the project resulted in overloading any of the facilities.

4.2.2 Outage Conditions

There is an existing Loss of A-Bank Scheme in place at [redacted] to trip generation under loss of either A-Bank to prevent thermal overloading in excess of the emergency rating of the transformers. The study did not identify any additional overloads during outage conditions.

4.3 Power Flow Study Observations and Notes

(a) Northern Bulk Area Export Limits

The Project does not contribute to thermal overload issues on the Northern Bulk system that are not already being addressed, will be addressed by pending upgrades, or addressed via CAISO congestion protocols.

(b) N-1-1 Outages

There is an operational risk associated with non-common corridor N-2 outages. Loss of two lines under a non-common mode failure is considered an N-1-1 contingency event which allows for manual system adjustments between contingencies if an overload is anticipated for the next contingency that follows the first contingency. It is important to note that under such potential conditions, curtailment of generation output will be implemented under real-time operation of the system, if required, in advance of the second outage to ensure a potential overload is properly mitigated. Because all interconnection agreement contain provision to enable such generation curtailment, no additional physical upgrades were identified to be required under any such N-1-1 outage conditions.

4.4 Subtransmission Assessment Mitigations

(a) Maximum Generation Coupled with Minimum Load Conditions

<u>Mitigation for A-Bank Overload</u>

All previous studies in the [redacted] [redacted] System have been performed under the assumption that the existing non-export generation at Cal Cement is generating behind the meter while the cement plant is operating. The most recent independent study has identified that the [redacted] System cannot accommodate any additional projects, regardless of size, without the installation of a third [redacted] This base case overload mitigation will be allocated to this project with full cost responsibility. The cost estimate summary can be found in Appendix 1 of this report. No additional overloads were identified with the mitigation in place.

(b) Maximum Generation Coupled with Maximum Load Conditions

No overloads were identified in this scenario and therefore no mitigation is needed.

5. Post Transient Voltage Stability Assessment Results

Review of study power flow results identified that no voltage deviations exceeded the criteria discussed above. As a result, no further post-transient analysis on the subtransmission system was performed.

6. Short Circuit Duty Assessment Results

Since the project is existing and connected to the system, no additional short circuit duty impacts are associated with the project exporting.

7. Schedule

SCE will require an estimated 43 months, from the time an interconnection agreement is signed, to engineer, procure, construct, and put In-service, the required upgrades

8. Conclusion

The [redacted] System cannot accommodate any additional generation exported to the system without the installation of a third [redacted] As a result, the third [redacted] A-Bank would be required in order for the [redacted] to export any existing generation. Additionally, there were no voltage or short circuit duty issues identified in this study.

Appendix 1

Distribution Upgrades and Network Upgrades Cost Estimated Summary

Cost Estimate Summary (2016 Dollars)

Scope: [redacted]nd 220kV bank position

[redacted]

* Pursuant to FERC Order 2003A, ITCC is not collected on Reliability Upgrades and One Time Costs.
** ITCC cost may be satisfied with a letter of credit in accordance with the tax provisions of the LGIA.
*** The ITCC included in this cost estimate was computed using a 35% rate
Cost estimate is only an estimate based on 2016 constant dollars and actual cost is subject to change depending on project construction date, and inflation