GENERATOR INTERCONNECTION

SYSTEM IMPACT STUDY REPORT

for integration of the proposed

200 MW [redacted]

(GI PROJECT #567)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

ADA COUNTY, IDAHO

for

[redacted]

REPORT v.4

January 5, 2022

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1.0 Introduction

[redacted] (Customer) has contracted with Idaho Power Company (Idaho Power) to perform a Generator Interconnection System Impact Study (SIS) for the integration of a proposed 200 MW [redacted] (Project) located in the Idaho Power Capital Region in ADA County, Idaho [redacted]. The Project has been assigned an Idaho Power Generation Interconnect (GI) queue number 567 (GI #567). In the SIS Agreement, the Project has chosen to have studies performed for both Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). This is report is the result of a re-study that incorporates a change in location.

Energy Resource Interconnection Service and/or Network Resource Interconnection Service in and of themselves do not convey transmission service. In addition to Network Upgrades identified in the Interconnection System Impact Study:

- For Energy Resource Interconnection Service, the Interconnection Customer's ability to inject its Large Generating Facility output beyond the Point of Interconnection will depend on the existing capacity of Transmission Provider's Transmission System at such time as a transmission service request is made that would accommodate such delivery. The provision of firm Point-to-Point Transmission Service or Network Integration Transmission Service may require the construction of additional Network Upgrades.

- For Network Resource Interconnection Service, additional studies to reduce or eliminate congestion may be required and these studies may identify the need for additional upgrades. To the extent Interconnection Customer enters into an arrangement for long term transmission service for deliveries from the Large Generating Facility outside Transmission Provider's Transmission System, such request may require additional studies and upgrades in order for Transmission Provider to grant such request.

The specific point of interconnection studied is a line connection southeast of Boise to the existing Idaho Power owned Danskin-Hubbard 230 kV line [redacted].

This report documents the basis for and the results of the SIS for the GI #567 Generation Interconnection. The report describes the proposed project, the determination of interconnection requirements and estimated costs for integration into the Idaho Power transmission system. This report satisfies the SIS requirements of the Idaho Power Tariff.

2.0 Summary

The impact to the Idaho Power transmission system of interconnecting the Project to the Danskin-Hubbard 230 kV line was evaluated.

The Project will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. GI #567 will be required to manage the real power output of their generation project at the POI.

The total Energy Resource Interconnection Service preliminary cost estimate to interconnect the Project is:

- Energy Resource Interconnection: $4,306,110

  See Section 6.5, Energy Resource Interconnection Service cost estimate, for the required facilities and cost breakdowns.

The Network Resource Interconnection Service preliminary cost estimate is the same as the Energy Resource Interconnection Service cost estimate, however, it is contingent on transmission facility upgrades associated with senior queue Generator Interconnection projects.

Appendix B contains a list of contingent transmission facility upgrades associated with senior queue projects and their estimated costs.

The estimate includes 20% contingency and 7.25% overhead costs. These are cost estimates only and final charges to the customer will be based on the actual construction costs incurred. It should be noted that the preliminary cost estimates do not include the cost of the customer's owned equipment.

Idaho Power estimates it will require approximately 36 months to design, procure, and construct the facilities described in this report following the execution of a Generation Interconnection Agreement. A more specific schedule will be developed and optimized during the Facility Study should the generation interconnection customer choose to move to that study phase of the interconnection process.

3.0 Scope of Interconnection System Impact Study

This SIS was performed in accordance with Idaho Power Standard Generator Interconnection Procedures, evaluating the impact of interconnecting the Project to the transmission system. The scope of the SIS is detailed in the System Impact Study Agreement.

4.0 Contingent Facilities

The Project's Network Resource Interconnection Service is contingent on transmission facility upgrades associated with senior queued projects. Refer to Appendix B for a list of possible contingent facilities.

5.0 Description of Proposed Generating Project

[redacted], GI #567, proposes to interconnect to the Idaho Power transmission system at 230 kV with a total injection of 200 MW (maximum project output). The POI is assumed to be on the Danskin-Hubbard 230 kV line.

The proposed facility is a 200 MW_{ac} (219.6 MVA) nameplate solar photovoltaic generator with an AC-coupled, solar-charged battery energy storage system up to 150 MW (176.4 MVA) capacity, with a POI limit not to exceed 200 MW. Solar modules will feed into 61 3.6MVAinverter/transformer stations which step up the voltage to 34.5kV. The battery energy storage system will consist of 49 of the same 3.6MVA inverter/transformer modules. These stations feed a 34.5kV/230kV Wye-Delta-Wye main power transformer. This transformer will be connected to the 230kV system at a newly proposed 4-breaker substation (POI substation) adjacent to the existing Danskin-Hubbard 230kV transmission line.

Table 1: Project Specifications

Project Location	[redacted]
Number and Type of Generators Solar:	[redacted] Quantity = 61
Individual Generator Nameplate Rating	3600 KVA
Total Output Rating	219.6 MVA
New Step-Up Transformer	133.3/177.8/222.2 MVA ONAN/ONAF/ONAF @ 65°C 230Y / 34.5 - 13.8 Delta kV Z=10% @ BASE MVA
Number and Type of Generators Battery:	[redacted] Quantity = 49
Individual Generator Nameplate Rating	3600 KVA
Total Output Rating	176.4 MVA
Interconnection Voltage	230 kV

6.0 Energy Resource Interconnection Service (ERIS)

Energy Resource Interconnection Service allows the Interconnection Customer to connect its Generating Facility to a Transmission Provider's transmission system and to be eligible to deliver electric output using firm or non-firm transmission capacity on an as available basis.

Power flow analysis indicated that the Project's full output of 200 MW can be interconnected at the POI.

6.1 Substation Facilities

The proposed interconnection will require a new 230 kV substation with a four-position ring bus to connect to the Danskin-Hubbard 230 kV line. The four-position ring bus is specified to accommodate GI #588 as well as GI 567. If a three-position ring bus is constructed in lieu of the four-position ring bus, the estimated cost will decrease by $930,309.

The actual station layouts and detailed equipment requirements will be determined in the Facility Study should the interconnection customer choose to move to that study phase of the interconnection process.

6.2 Grounding Requirements

The proposed 230/34.5 kV Wye-Grounded/Wye-Grounded with Delta Tertiary station transformer specified in the Idaho Large Generator Interconnection Request for [redacted] GI #567, should provide an adequate ground source for transmission line protection/relaying.

Grounding requirements and acceptability criteria are found in Appendix A.

6.3 System Protection Assessment

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider's existing breakers.

The short circuit analysis results are:

Fault Study (system as-is)			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
At POI	-	-	-
[redacted]			
[redacted]			

Fault Study (with GI#567)			
Location	**SLG (A)**	**L-L (A)**	**3PH (A)**
At POI	[redacted]		
[redacted]			
[redacted]			

6.4 Electric System Protection Results

For 230 kV line protection, the Transmission Provider's System Protection Department utilizes permissive and line differential protection schemes integrated with our existing digital communication infrastructure. Digital communication infrastructure for the interconnection customer's 230 kV line will be the customer's responsibility.

6.5 Energy Resource Interconnection Service Cost Estimate

In Table 2 below summarizes the Idaho Power Interconnection Facilities and Network Upgrades and conceptual costs required to interconnect the GI #567 solar project to the Transmission Provider's transmission system.

Table 2: Energy Resource Interconnection Service Cost Estimate

Item of Work	Estimate
New 230 kV Ring bus substation Air break switches, metering, relaying, etc	$3,245,851
230 kV Line Work	$100,000
Contingency 20% (1)	$669,170
Overheads (2)	$291,089
Total loaded costs (3)	**$4,306,110**

(1) Contingency is added to cover the unforeseen costs in the estimate. These costs can include unidentified design components, material cost increases, labor estimate shortfalls, etc.
(2) Overhead costs cover the indirect costs associated with the Project.
(3) This cost estimate includes direct equipment, material, labor, overheads, and contingency as shown.

The cost estimates include Idaho Power Interconnection Facilities which are sole use facilities to integrate GI #567, as well as, Network Upgrades and installation labor costs, indirect labor costs and general overheads, and a contingency allowance. These are cost estimates only and final charges to the customer will be based on the actual construction costs incurred. It should be noted that the preliminary cost estimates do not include the cost of the customer's owned equipment.

7.0 Network Resource Interconnection Service

Network Resource Interconnection Service allows the Interconnection Customer to integrate its generating facility with the Transmission Provider's Transmission System in a manner comparable to that in which the Transmission Provider integrated its generating facilities to serve native load customers. The transmission system is studied under a variety of conditions to determine the transmission improvements/upgrades which are necessary. Network Resource Interconnection Service in and of itself does not convey Transmission Service.

7.1 Description of Power Flow Cases

For the Network Resource Interconnection Service study, two power flow cases were used to study the Transmission Provider's transmission system with westbound and eastbound flows to determine the required Network Transmission Upgrades.

A WECC 2023 Heavy Summer case was modified to represent a summer month with high imports from the west on Path 14, Idaho-Northwest.

A WECC 2022 Light Winter case was modified to represent a light load condition with high east to west (westbound) transfers across the Midpoint West path.

7.3 Network Resource Interconnection Service Transmission Upgrades

From the power flow/contingency analysis, no additional Network Upgrades were identified for the integration of GI #567 beyond that identified for the Energy Resource generation interconnection; however, the studies were performed with all senior queue Generation Interconnection project and their upgrades in service. Contingent Facilities for GI #567 and their costs are outlined in Appendix B.

7.4 Network Resource Interconnection Service Cost Estimate

For Network Resource Interconnection Service, all cost attributed to the Energy Resource Interconnection Service will be required; also, additional transmission upgrades associated with senior queue GI projects are required. Appendix B contains a list of senior queue transmission facility upgrades that are contingent facilities and their estimated costs.

8.0 Transient Stability Analysis

The WECC 2023 Heavy Summer operating case and PowerWorld Simulator version 22 analysis tool were used to perform the transient stability analysis.

When studied the plant controllers were set to control to the 230 kV POI. The results showed no transient stability violations. It is the responsibility (per NERC Standards) of the Generator Owner to ensure the modeling data utilized accurately reflects inverter operations, and to provide updates to Idaho Power if testing or real-time observations indicate a need.

9.0 Description of Operating Requirements

It is the Project's responsibility to provide the reactive power capability to provide at a minimum a power factor operating range of 0.95 leading (supplying) to 0.95 lagging (absorbing) at the POI over the range of real power output. At full output of 200 MW, the Project would need to be able to provide approximately +/- 66 MVAr reactive support at the POI. Based on the information provided, the Project's PV inverters can supply 90.69 MVAr and the Project's BESS inverters can supply 92.83 MVAr. The supplied epc file shows two shunt capacitors with one sized at 10 MVAr.

GI #567 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations.

The Project is required to comply with the applicable Voltage and Current Distortion Limits found in IEEE Standard 519-1992 *IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*.

Installation of PMU devices at the POI and maintenance costs associated with communication circuits needed to stream PMU data will also be required to be provided to interconnect GI #567. The specific costs associated with Idaho Power requirements for interconnection customers with aggregate facilities larger than 20 MW to provide PMU data to Idaho Power will be identified in the Facility Study should the generation interconnection customer choose to proceed to that phase of the interconnection process.

10.0 Conclusion

The requested interconnection of the [redacted], GI #567, to Idaho Power's system was studied.

For Energy Resource Interconnection Service Idaho Power Interconnection Facilities and Network Upgrades totaling $4,306,110 are required, see Section 6.5. For Network Interconnection Service the cost to integrate the project is the same plus the cost of any contingent facility upgrades not provided by senior queue projects, See Appendix B.

The results of this study work confirm that GI #567 can be interconnected to the Idaho Power 230 kV transmission system at the proposed POI.

APPENDIX A

A-1.0 Method of Study

The System Impact Study plan inserts the Project up to the maximum requested injection into the selected Western Electric Coordinating Council (WECC) power flow case(s) and then, using PowerWorld Simulator analysis tool, the impacts of the new resource on the Idaho Power transmission system (lines, transformers, etc.) within the study area are analyzed. The WECC and Idaho Power reliability criteria and operating procedures were used to determine the acceptability of the configurations considered.

A-2.0 Acceptability Criteria

The following acceptability criteria were used in the power flow analysis to determine under which system configuration modifications may be required:

The continuous rating of equipment is assumed to be the normal thermal rating of the equipment. This rating will be as determined by the manufacturer of the equipment or as determined by Idaho Power. Less than or equal to 100% of continuous rating is acceptable.

Idaho Power Voltage Operating Guidelines were used to determine voltage requirements on the system. These state, in part, that distribution voltages, under normal operating conditions, are to be maintained within plus or minus 5% (0.05 per unit) of nominal everywhere on the feeder. Therefore, voltages greater than or equal to 0.95 pu voltage and less than or equal to 1.05 pu voltage are acceptable.

Voltage flicker during starting or stopping the generator is limited to 5% as measured at the point of interconnection, per Idaho Power's T&D Advisory Information Manual.

Idaho Power's Reliability Criteria for System Planning was used to determine proper transmission system operation.

All customer generation must meet IEEE 519 and ANSI C84.1 Standards.

All other applicable national and Idaho Power standards and prudent utility practices were used to determine the acceptability of the configurations considered.

The stable operation of the system requires an adequate supply of Volt-Amperes reactive (VAr) to maintain a stable voltage profile under both steady-state and

dynamic system conditions. An inadequate supply of VArs will result in voltage decay or even collapse under the worst conditions.

Equipment/line/path ratings used will be those that are in use at the time of the study or that are represented by Idaho Power upgrade projects that are either currently under construction or whose budgets have been approved for construction soon. All other potential future ratings are outside the scope of this study. Future transmission changes may, however, affect current facility ratings used in the study.

A-3.0 Electrical System Protection Guidance

Idaho Power requires electrical system protection per Requirements for Generation Interconnections found on the Idaho Power Web site,

http://www.idahopower.com/pdfs/BusinessToBusiness/facilityRequirements.pdf

APPENDIX B

Table B1 is a summary of the Network Transmission facility upgrades required by senior queue projects and their conceptual costs

GI #530 Project	
Network Resource Transmission Upgrades:	**Cost**
[redacted] **Line Loop in-and-out of** [redacted] **Station** Build [redacted]	$1,040,000
[redacted] **230kV Station** Add two 230kV Line Terminals	$1,775,000
Subtotal	**$2,815,000**
Contingencies (~20%)	$563,000
Subtotal	**$3,378,000**
Overheads (~7.25%)	$244,905
Network Transmission – Total Estimated Cost	**$3,622,905**

Table B1 Senior Queue Network Upgrades

Revision History

Date	Revision	Initials	Summary of Changes
06/29/2020	0	GMT	Original
6/30/2020	1	GMT	Incorporated comments from Peer review
10/06/2021	2	PMA	Restudy
10/08/2021	3	PMA	Incorporated comments from internal review
01/05/2022	4	PMA	Revised Appendix B removing the [redacted] line rebuild as a contingent facility