GENERATOR INTERCONNECTION

SYSTEM IMPACT STUDY REPORT

for integration of the proposed

1000 MW [redacted]

(GI PROJECT #662)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

POWER COUNTY, ID

for

[redacted]

Report v.1

February 16th, 2023

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1.0 Introduction

[redacted] has contracted with Idaho Power Company ("Transmission Provider") to perform a Generator Interconnection System Impact Study (SIS) for the integration of the proposed 1000 MW [redacted] (the Project). The Project location is in Power County, ID at approximately [redacted] °, [redacted] °. The project is Generation Interconnect (GI) queue number 662 (GI #662). The Project has chosen in the System Impact Study to be studied for Energy Resource Interconnection Service (ERIS).

This report documents the basis for and the results of this System Impact Study for the GI #662 Generation Interconnection Customer. The report describes the proposed Project, the determination of the Project interconnection requirements, and estimated costs for integration of the Project to the Transmission Provider transmission system. This report satisfies the SIS requirements of the Idaho Power Tariff.

2.0 Summary

The Project has applied to connect to Idaho Power's transmission system for an injection of 1000 MW at a single Point of Interconnection (POI) at 345 kV. The POI is located at Idaho Power's Borah 345 kV substation (BORA 345 kV).

This Project has chosen in the System Impact Study to be studied for Energy Resource Interconnection Service (ERIS) only. As an Energy Resource Interconnection, it was not contemplated that Idaho Power would be an off-taker of GI #662 in the System Impact Study. This project exceeds Idaho Power's Most Severe Single Contingency, (MSSC) where the MSSC is the balancing contingency event, due to a single contingency, that results in the greatest loss (measured in MW) of resource output used by the Balancing Authority at the time of the event to meet firm system load and export obligation. Idaho Power's MSSC is 330 MW. As an ERIS only study, mitigation of a loss of more than 330 MW was not included in this study.

Energy Resource Interconnection Service in and of itself does not convey transmission 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 the Transmission Provider's Transmission System at such time as a transmission service request is made that would accommodate such delivery. A transmission service request study may identify the need for additional Network Upgrades.

The Project will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. The Project will be required to manage the real power output of their generation project at the POI. Also, it may be beneficial [redacted], for their own modeling compliance requirements, to install additional PMU devices at their facilities to monitor the generation source.

The total Energy Resource Interconnection Service generation interconnection preliminary cost estimate to interconnect the Project at the POI is $2,237,048. See Section 6.5 Energy Resource Interconnection Service Cost Estimate for the required facilities and cost breakdowns.

The cost estimates include 30% contingency and 8.25% overhead. 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.

The schedule for designing, procuring, and constructing facilities 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

The Interconnection System Impact Study was done and prepared in accordance with the Transmission Provider's Standard Generator Interconnection Procedures to provide an evaluation of the system impact of the interconnection of the proposed generating project to the Idaho Power system. As listed in the Interconnection System Impact Study Agreement, the Interconnection System Impact Study report provides the following information:

- identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection;
- identification of any thermal overload or voltage limit violations resulting from the interconnection;
- identification of any instability or inadequately damped response to system disturbances resulting from the interconnection and
- description and non-binding, good faith estimated cost of facilities required to interconnect the Large Generating Facility to the Transmission System and to address the identified short circuit, instability, and power flow issues.

All other proposed Generation projects prior to this Project in the Generator Interconnect queue of the electrically relevant area were considered in this study.

4.0 Contingent Facilities

Idaho Power generation interconnection projects GI #573, GI #580, GI #623, GI #607, GI #608, GI #609, GI #633, GI #641, GI #647, GI #648, GI #654, GI #658 and GI #661 are senior queued projects in the affected area of Idaho Power's transmission system. Idaho Power studied GI #662 with all Network Upgrades identified for senior queued projects as in-service. Changes to senior queued projects including withdrawal from the queue, may trigger a restudy associated with GI #662.

GI #662 Energy Resource Interconnection Service, ERIS, at the Borah Station was found to be contingent upon the GI #648 bay position. Changes to senior queued projects including in-service date and withdrawal from the queue, may trigger a restudy associated with GI #662. Refer to Appendix B for a list of contingent transmission facility upgrades.

5.0 Description of Proposed Generating Project

Assumptions

The primary point of interconnection for GI #662 is the Borah Substation 345 kV bus. Assumed GI #662 Project's maximum generation is 1000 MW to the POI. The Project's Commercial Operation Date (COD) is December 31, 2025.

GI #662:

- 1000 MW Max export at POI
- 1107.04 MVA PV capacity
- 1107.04 MW (4 hr.) battery energy storage
- 345/34.5 kV main power transformer, 186/247/309 MVA capacity, 12.5% Z, 54.3 X/R
- (296) – [redacted] PV inverters
- (296) – [redacted] BESS inverters

6.0 Description of Substation/Transmission Facilities

As an ERIS, a Transmission Service Request will be required to determine the specific Network Upgrades required to deliver the Project output to a designated point of delivery. A new 345 kV line terminal with (1) 345 kV circuit breaker with associated switches and relays will be required to interconnect the Project at the POI. Listed below are the required transmission facilities to interconnect the Project for ERIS:

- A generation interconnection and protection package at the POI with 1 new 345 kV power circuit breaker and line terminal at the Borah Substation, associated switches, protective relays, 3-phase potential transformers (PTs) and 3-phase current transformers (CTs), SCADA and remote connectivity

The actual station layout 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.

7.0 Protection and Control

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider's existing 345 kV breakers after this Project is interconnected.

Fault Study (w/o GI #662)			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
[redacted] 345kV Bus	[redacted]	[redacted]	[redacted]

Table 1. Fault Study Results without GI #662

Fault Study (w/ GI #662)			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
[redacted] 345kV Bus	[redacted]	[redacted]	[redacted]

Table 1. Fault Study Results with GI #662

For 345 kV line protection, the Transmission Provider's System Protection Department utilizes permissive and line differential protection schemes integrated with digital communication infrastructure. Communication infrastructure between the interconnection's customer's 345kV collector substation and Idaho Power will be the responsibility of said interconnection customer. Grounding requirements and acceptability criteria are found in Appendix A.

8.0 Energy Resource Interconnection Service Cost Estimate

In Table 2 below, a summary is provided of the facilities and conceptual costs required to interconnect the GI #662 Project to the Transmission Provider's transmission system.

GI #662 Olney Generation Project - Energy Resource Interconnection Service Facilities	
ERIS Transmission Upgrades	**Cost**
System protection, additional 345 kV breaker	$2,929,318
Contingency (30%)	$878,795
Overheads (~8.25%) (2)	$314,169
ERIS – Total Estimated Cost (3)	$4,122,283

Table 2. Estimated GI #662 Project's Energy Resource Generation Interconnection Costs

(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, and overheads as shown.

- Note that these estimates do not include the cost of the customer's equipment/facilities or required communication circuits for SCADA, PMU, Protection, and metering.
- Note that the overhead rates are subject to change during the year.
- Note that these costs assume the use of in-house resources.
- These are estimated costs only and final charges to the customer will be based on the actual construction costs incurred.
- These are non-binding conceptual level cost estimates that will be further refined upon the request and completion of the Facility Study.

The schedule for designing, procuring, and constructing facilities 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.

9.0 Grid Charging

The battery energy storage system component of the project was studied from charging from the grid. The charging of the BESS was assumed to be interruptible. There may be times during the year where system load in the local area will prevent charging of the BESS at full capacity. No additional network upgrades were identified to support charging of the BESS.

10.0 Voltage Stability Analysis

A Voltage Stability study was performed using the WECC 2025 Heavy Summer case with local generating facilities all outputting their rated capacities, and the Transmission Provider's network load scaled up to 105%. All contingencies solved successfully, indicating there were no Voltage Stability issues found for the Project.

11.0 Transient Stability Analysis

The WECC 2025 Heavy Summer operating case and PowerWorld Simulator version 22 analysis tool were used to perform the transient stability analysis.

The results showed no transient stability violations on Idaho Power's system. 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.

12.0 Description of Operating Requirements

GI #662 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. The Project will be required to manage the real power output of their generation project at the POI. The Project will be required to operate at .95 leading/lagging measured at the high side of the main power transformer to maintain voltage within limits at the POI over the range of real power output. The models provided by [redacted] for this Project do satisfy the .95 power factor requirement.

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 phasor measurement unit 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 the Project. The specific costs associated with the IPC requirements for interconnection customers with aggregate facilities larger than 20 MW to provide PMU data to IPC will be identified in the Facility Study should the generation interconnection customer choose to proceed to that phase of the interconnection process. Also, it may be beneficial for [redacted], for their own modeling compliance requirements, to install additional PMU devices at their facilities to monitor the generations sources separately.

13.0 Conclusion

GI #662 can be interconnected to the Idaho Power transmission system.

Interconnection requirements detailed in Section 6.5 totaling $4,122,283 are required to interconnect the Project for Energy Resource Interconnection Service at the proposed POI.

Energy Resource Interconnection Service does not in any way convey any right to deliver electricity to any specific customer or point of delivery. A Transmission Service Request will be required to study the Transmission System Impacts.

The Energy Resource Interconnection Service System Impact Study did not evaluate the 1,000 MW of energy being delivered beyond the Point of Interconnection. It is anticipated that additional, possibly substantial, Network Upgrades will be needed to move the energy beyond the Point of Interconnection.

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 Electricity Coordinating Council (WECC) power flow case and then, using Power World Simulator or GE's Positive Sequence Load Flow (PSLF) analysis tool, examines the impacts of the new resource on Idaho Power's transmission system (lines, transformers, etc.) within the study area under various operating and outage scenarios. The WECC and Idaho Power reliability criteria and Idaho Power operating procedures were used to determine the acceptability of the configurations considered. The WECC case is a recent case modified to simulate stressed but reasonable pre-contingency energy transfers utilizing the IPC system. For distribution feeder analysis, Idaho Power utilizes DNV·GL's Synergi Electric software and EPRI's OpenDSS software.

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's 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 or VArs) 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 IPC upgrade projects that are either currently under construction or whose budgets have been approved for construction in the near future. 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 Grounding Guidance

IPC requires interconnected transformers on the distribution system to limit their ground fault current to 20 amps at the Point of Interconnection.

A-4.0 Electrical System Protection Guidance

IPC requires electrical system protection per Facility Connection Requirements found on the Idaho Power Web site,

https://docs.idahopower.com/pdfs/BusinessToBusiness/FacConnReq.pdf

A-5.0 WECC Coordinated Off-Nominal Frequency Load Shedding and Restoration Requirements

IPC requires frequency operational limits to adhere to WECC Under-frequency and Over-frequency Limits per the WECC Coordinated Off-Nominal Frequency Load Shedding and Restoration Requirements available upon request.

A-6.0 Grid Charging

The energy storage system (ESS) component of the Project was studied charging from the grid in steady state under N-0 (no contingencies) conditions. The charging of the ESS was assumed to be interruptible. No network upgrades were identified to support charging the ESS. There may be times during the year where system load in the local area will prevent charging of the ESS at full capacity; for example, a forced outage that would require Idaho Power to curtail charging. Should the Project require non-curtailable charging from their energy source then Point-to-Point firm transmission service from the energy market to the battery and from the Project to the point of delivery would be needed.

APPENDIX B

Table B1 is a summary of the ERIS upgrades assigned to GI 648 required by GI #662

GI #648 ERIS Upgrades	Cost
Substation Expansion, 345kV bus work, breakers, and protection	$8,015,133

Table B2: Senior GI Network Upgrades Required by GI #662

Revision History

Date	Revision	Initials	Summary of Changes
02/16/2023	1	LMG	Initial Report