GENERATOR INTERCONNECTION
SYSTEM IMPACT STUDY REPORT

for integration of the proposed

20 MW [redacted]

(GI PROJECT #610)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

PAYETTE COUNTY, IDAHO

for

IDAHO POWER COMPANY

Report v.1

January 12, 2021

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1.0 Introduction

[redacted] signed a study agreement with Idaho Power Company – Delivery to perform a Generator Interconnection System Impact Study (SIS) for the integration of the proposed 20 MW [redacted] (the Project). The output is in addition to the current 345 MW of the [redacted] power plant bringing the maximum output of the plant to 365 MW. The project is located in Idaho Power's Western service territory in Payette County, Idaho. Reference number GI #610 has been assigned to the Project in the Idaho Power GI queue.

The Project has chosen in the System Impact Study to be studied for Network Resource Interconnection Service (NRIS).

- 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 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 Project has applied to connect to Idaho Power's transmission system for an injection of an additional 20 MW at a single Point of Interconnection (POI) at 230kV. The POI is IPC's [redacted] 230kV bus.

This report documents the basis for and the results of this System Impact Study for the GI #610 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 impact to the Idaho Power transmission system of interconnecting the Project to the [redacted] 230kV bus was evaluated.

GI #610 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. GI #610 will be required to manage the real power output of their generation project at the POI.

The total "Network Resource Interconnection Service" generation interconnection preliminary cost estimate to interconnect the project is as follows:

- Network Resource Interconnection Service - **$0**
    - Appendix B contains a list of contingent transmission facility upgrades associated with senior queued projects and their estimated costs.

See Section 6.3 Network Resource Interconnection Service Cost Estimate for the required facilities and cost breakdowns.

The cost estimates include 20% contingency and 7.25% 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 were considered in this study. A current list of these projects can be found in the Generation Interconnection folder located on the Idaho Power web site at the link shown below:

http://www.oatioasis.com/ipco/index.html.

4.0 Contingent Facilities

IPC project GI #562 is a senior queued project in the affected area of IPC's transmission system. Idaho Power studied GI #610 with all Network Upgrades identified for senior queued projects as in-service. Changes to senior queued projects including in-service date and withdrawal from the queue, may trigger a restudy associated with GI #610.

GI #610 Network Resource Interconnection Service, NRIS, at the [redacted] 230kV bus POI is contingent upon upgrades associated with senior queued project GI #562. Refer to Appendix B for a list of contingent transmission facility upgrades and their estimated costs.

5.0 Description of Proposed Generating Project

[redacted], GI #610, proposes to increase the power output of the existing [redacted] power plant. The total injection of the power plant with the addition of the expansion in GI #610 is 365 MW (maximum project output). The POI is the existing [redacted]. This project's requested in-service date is June 2022.

Assumptions

Utilizing the temperature-power output curve provided, the plant was studied with a summer rating of 312 MW and a winter rating of 365 MW.

5.1 Description of Distribution Facilities

No distribution facilities are directly impacted by this Project.

5.2 Short Circuit Study Results

The short circuit/fault duty at approximate GI #610 POI 230kV bus location (with/without GI #610 modeled) is as follows:

Fault Study (w/ GI #610 [redacted])			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
[redacted] 230kV Bus	13765.6	10781.3	12519.2

Fault Study (w/o GI #610 [redacted])			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
[redacted] 230kV Bus	13765.6	10781.3	12519.2

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider's existing 230kV breakers after this Project is interconnected.

5.3 Electric System Protection Results and Grounding Requirements

The existing transformers at [redacted] should provide an adequate ground source for transmission line protection/relaying.

Grounding requirements and acceptability criteria are found in Appendix A.

6.0 Network Resource Interconnection Service (NRIS)

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.

6.1 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 transmission flows to determine the required Network Transmission Upgrades.

The WECC 2022 Heavy Summer case was chosen as a power flow base case for the study. The case was modified to represent high imports in Path 14 simultaneously with high Brownlee-East flows.

For the second case, a WECC 2022 Light Winter case was modified to represent a shoulder month condition.

6.2 Network Resource Interconnection Service Transmission Upgrades

No Network Transmission upgrades were identified for the integration of GI #610.

IPC project queue GI #562 is a senior queued project in the affected area of IPC's transmission system. Idaho Power studied GI #610 with all Network Upgrades identified for senior queued projects as in-service. Appendix B contains a list of contingent transmission facility upgrades associated with senior queued projects and their estimated costs. Changes to senior queued projects including in-service date and withdrawal from the queue, may trigger a restudy associated with GI #610 Network Resource, NR, service.

6.3 Network Resource Interconnection Service Cost Estimate

Table 3 below is a summary of the Network Transmission generation interconnection

facilities and conceptual costs required to interconnect the GI #610 Project to the Transmission Provider's transmission system for Network Resource Interconnection Service.

GI #610 [redacted] Project **Network Resource Interconnection Service Facilities**	
NRIS Transmission Upgrades:	**Cost**
NA	$0
Network Upgrades:	
NA	$0
Subtotal	**$0**
Contingencies (~20.0%) (1)	$0
Subtotal	**$0**
Overheads (~7.25%) (2)	$0
Total Estimated Cost (3)	**$0**

Table 3. Estimated GI #610 Network 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, 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.

7.0 Voltage Stability Analysis

A Voltage Stability study was performed using the WECC 2022 Heavy Summer case with Idaho-Northwest flows stressed up to 1260 MW (105% of the Path Rating) and the Brownlee-East flows stressed up to 1990 MW (104% of the Path Rating). All contingencies solved successfully so there were no Voltage Stability issues found for the Project.

8.0 Transient Stability Analysis

The WECC 2022 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. It is the responsibility (per NERC Standards) of the Generator Owner to ensure the modeling data utilized accurately reflects the plant 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 summer output of 312 MW, the Project would need to be able to provide approximately +/- 102.5 MVAr reactive support at the POI. At full winter output of 365 MW, the Project would need to be able to provide approximately +/- 120 MVAR reactive support at the POI.

The capability curves provided show the reactive requirements are met.

GI #610 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations, and GI #610 will be required to manage the real power output of their stated generation at the Project's POI.

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.*

10.0 Conclusion

GI #610 can be interconnected to the Idaho Power transmission system.

No Network upgrades were identified for the integration of the Project for Network Resource Interconnection Service. The Network Resource Interconnection Service is reliant on facilities

identified in senior queued generation interconnections detailed in Appendix B.

Energy Resource Interconnection Service or Network 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.

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.

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.

APPENDIX B

Table B1 is a summary of the GI #562 Network Transmission facility upgrades required by GI #610 and their conceptual costs.

GI #562 Project	
NRIS Transmission Upgrades:	**Cost**
[redacted] **RECONDUCTOR** Rebuild 4.3 miles 69 kV Line with 397 MCM ACSR Conductor	$1,365,000
Subtotal	**$1,365,000**
Contingencies (~20%)	$273,000
Subtotal	**$1,638,000**
Overheads (~7.25%)	$119,000
Network Transmission – Total Estimated Cost	**$1,757,000**

Table B1: GI #562 Transmission Upgrades Required by GI #610

Revision History

Date	Revision	Initials	Summary of Changes
1/12/2022	1	AVD	Initial Report