GENERATOR INTERCONNECTION

FEASIBILITY STUDY REPORT

for integration of the proposed

85 MW [redacted]

(GI PROJECT #630)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

ELKO COUNTY, NEVADA

for

[redacted]

Report v.1

March 29, 2022

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1.0 Introduction

[redacted] has contracted with Idaho Power Company ("Transmission Provider") to perform a Generator Interconnection Feasibility Study for the integration of the proposed 85 MW [redacted] project (the Project). The Project location is in Elko County, Nevada at approximately 41.23' 58.40" N, 114.46' 57.76" W, south of the town of Wilkins in Elko County, Nevada 89835. The project is Generation Interconnect (GI) queue number 630 (GI #630). The Project has chosen in the Feasibility Study to be studied for Network Resource Interconnection Service (NRIS) and Energy Resource Interconnection Service (ERIS).

The Project has applied to connect to Idaho Power's transmission system for an injection of 85 MW at a single POI on the 138 kV [redacted].

IPC projects queue GI #530, GI #551, GI #557, GI #567, GI #570, GI #588, GI #590, GI #604, GI #605, GI #613, GI #614, GI #624, and GI #625 are senior queued projects in the affected area of IPC's transmission system and their associated Network Upgrades and/or Interconnection Facilities may be contingent facilities. Should GI #630 elect to move forward into the System Impact Study phase the facilities that are contingent will be identified.

This report documents the basis for and the results of this Feasibility Study for the Project. 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 feasibility study requirements of the Idaho Power Tariff.

2.0 Summary

The Interconnection Feasibility Study was done and prepared in accordance with the Transmission Provider's Standard Generator Interconnection Procedures to provide a preliminary evaluation of the feasibility of the interconnection of the proposed generating Project to the Idaho Power system. As listed in the Interconnection Feasibility Study agreement, the Interconnection Feasibility Study report provides the following information:

- preliminary identification of any circuit breaker short circuit capability limits exceeded because of the interconnection.
- preliminary identification of any thermal overload or voltage limit violations resulting from the interconnection.
- preliminary description and non-binding estimated cost of facilities required to interconnect the Large Generating Facility to the IPC System and to address the identified short circuit 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 Oasis web site at the link provided here: **http://www.oatioasis.com/ipco/index.html.**

An Interconnection System Impact Study (SIS) is required to determine if any additional Interconnection Facilities or Network Upgrades are required to mitigate thermal, voltage, transient stability, and/or reactive margin issues. 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.

3.0 Feasibility Cost Estimate

The total "Energy Resource Interconnection Service" generation interconnection preliminary cost estimate to interconnect the [redacted], GI #630, as requested to the 138 kV [redacted] transmission line is $7,909,859. See Section 6.2 Energy Resource Interconnection Service Cost Estimate for the required facilities and cost breakdowns.

The total "Network Resource Interconnection Service" generation interconnection preliminary cost estimate to interconnect the Project is the same as the cost for the Energy Resource Interconnection Service and is $7,909,859. See Section 7.3 Network Resource Interconnection Service Cost Estimate for the required facilities and cost breakdowns.

The cost estimate includes a 30% 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. An Interconnection System Impact Study (SIS) is required to determine if any additional Interconnection Facilities or Network Upgrades are required to mitigate adverse impacts to the electrical grid such as, but not limited to, thermal violations.

This does not include costs for any potential contingent facilities from senior queued GI #530, GI #551, GI #557, GI #567, GI #570, GI #588, GI #590, GI #604, GI #605, GI #613, GI #614, GI #624, and GI #625.

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.

4.0 Description of Proposed Generating Project

The point of interconnection (POI) for GI #630 is the 138 kV [redacted] line. The Project's maximum generation export is 85 MW at the POI. The Project's Commercial Operation Date (COD) is January 01, 2025. Equipment and specification for the Project are shown in Table 1.

POI Location	41.23' 58.40" N, 114.46' 57.76" W
Generator Nameplate Rating	100.8 MVA
Total Output Power Rating	85 MW PV
Number and Type of Inverters	[redacted]
Generator Step-Up Transformer	(1) 63/83.8/104.7 MVA, 3-phase, 138/34.5 kV, Z = 6.0% @ 63 MVA, X/R = 26.07
Inverter Step-Up Transformer	(28) 3.6 MVA, 34.5/.63 kV Z=5.75%, X/R=6.5
Rated Power Factor	0.867 Leading / 0.867 Lagging (equipment rating), modeled at .93 lagging at POI
Interconnection Voltage	138 kV

Table 1. Project Specifications

5.0 Description of Substation and Transmission Facilities

Below is a brief description of the substation and transmission facilities associated with the Project and the POI.

5.1 Transmission Line Facilities

The Project's POI is located on [redacted] 138 kV line constructed with [redacted] that originates at [redacted] and terminates radially to serve load at [redacted]. The POI is approximately 100 miles from the origin of the radial line at [redacted] and 24 miles from the end of the line at [redacted]**.** The line is tapped 10.3 miles from [redacted] to serve [redacted] Substation which has an existing 21 MW generation facility. Another tap is located 57 miles from [redacted] to serve load at [redacted] Substation. See map in the appendix.

5.3 Substation Facilities

There are no existing substation facilities at the Project's POI. The proposed interconnection will require a new interconnection and protection package and line tap to connect to the 138 kV [redacted] line at the POI.

5.2 Short Circuit Study Results

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider's existing 138kV breakers after this Project is interconnected.

5.2 Electric System Protection Results and Grounding Requirements

For 138 kV line protection, the Transmission Provider's System Protection Department utilizes a Directional Comparison Blocking protection scheme (DCB) integrated with Power Line Carrier infrastructure. Power Line Carrier infrastructure for the interconnection customer's 138 kV Interconnection Facilities will be the responsibility of said interconnection customer.

The proposed 138 kV Wye-Grounded/Delta transformer specified in the Idaho Large Generator Interconnection Request for the Project should provide an adequate ground return path for transmission line protection/relaying. Grounding requirements and acceptability criteria are found in Appendix A.

6.0 Energy Resource Interconnection Service (ERIS)

Energy Resource Interconnection Service (ERIS) allows the Interconnection Customer to connect its Generating Facility to 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.

The Project has applied to connect to Idaho Power's transmission system for an injection of 85 MW at a single POI on the 138 kV [redacted]. All generation projects in the area ahead of this Project in the IPC generation queue and their associated transmission system improvements were modeled in a preliminary power flow analysis to evaluate the feasibility of interconnecting GI #630.

6.1 Required ERIS Upgrades

The proposed interconnection will require a new interconnection and protection package and line tap to connect to the 138 kV [redacted] line at the POI. The detailed interconnection equipment requirements will be determined in the Facility Study should the interconnection customer choose to move to that study phase of the interconnection process.

From the power flow analysis, the following upgrades were identified for the integration of GI #630 for Energy Resource Interconnection Service (ERIS). A System Impact Study will ultimately be required to determine the specific network upgrades required to integrate the Project.

- Rebuild 10.3 mile 138 kV [redacted] line. This section of line supports an existing 21 MW generator at [redacted] substation. The addition of GI#630 will overload this line.
- Install ~30 MVAr capacitor bank near [redacted] substation to source the required MVAr to support voltage at the POI. The addition of GI#630 at the Project's POI ~100 miles from the origin of the line causes high voltage and requires the Project to absorb MVAr to maintain voltage within limits (see Section 8.0 for operating requirements). The actual size and location of the capacitor bank will be determined and optimized in the System Impact Study or Feasibility Study.

6.2 Energy Resource Interconnection Service Cost Estimate

In Table 3 below, a summary is provided of the facilities and conceptual costs required to interconnect the GI #625 Project to the Transmission Provider's transmission system.

Item of Work	Estimate
Generation interconnection and protection package	$1,769,000
Transmission upgrades	$3,904,200
Unloaded costs	$5,673,200
Contingency 30% (1)	$1,701,960
Total contingency costs	$7,375,160
Overheads (2)	$534,699
Total Conceptual-level Cost Estimate in 2022 dollars (3)	**$7,909,859**

Table 3. Estimated GI #630 Interconnection Service 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.

7.0 Network Resource Interconnection Service (NRIS)

Network Resource Interconnection Service (NRIS) 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.

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 transmission flows to determine the required Network Transmission Upgrades.

The WECC 2025 Heavy Summer base case was modified to represent a summer month with high west to east (eastbound) transfers across Midpoint West.

For the second case, a WECC 2022 Light Winter base case was modified to represent a shoulder month condition with high east to west (westbound) transfers across Midpoint West.

7.2 NRIS Power Flow Findings

From the power flow/contingency analysis, no additional Network Transmission upgrades were identified for the integration of GI #630 in addition to the Energy Resource generation interconnection facilities. A System Impact Study will ultimately be required to determine the specific network upgrades required to integrate the Project.

IPC Generation Interconnection projects queue GI #530, GI #551, GI #557, GI #567, GI #570, GI #588, GI #590, GI #604, GI #605, GI #613, GI #614, GI #624, and GI #625 are senior queued projects in the affected area of IPC's transmission system. Idaho Power studied GI #630 with all Network Upgrades identified for senior queued projects as in service (Potential Contingent Facilities). Changes to senior queued projects including in-service date and withdrawal from the queue, may trigger a restudy associated with GI #630 Network Resource.

The 2022 lightly loaded power flow case shows the following losses both with and without GI#630. In a lightly loaded case, the power generated from the Project flows 100 miles across [redacted] to [redacted] which incurs heavy losses.

Light Load Case Losses (MW)				
	[redacted]	[redacted]	[redacted]	**Total**
Load Serving (pre-GI#630)	0.04	0.16	0.05	**0.25**
With GI#630	7.9	7.7	2.2	**17.8**

Table 2 Lightly loaded case losses with and without GI#630.

A System Impact Study will ultimately be required to determine the specific network upgrades required to integrate the Project. Additionally, the 124-mile 138 kV line from [redacted] to [redacted] does not currently meet the NERC definition to be included as part of the Bulk Electric System (BES). With the installation of the Project, the line will meet the definition of BES and will be subject to applicable NERC requirements. An inspection of the line, built in 1960 with [redacted], will need to be conducted to ensure the line meets applicable NERC BES standards. A detailed inspection of this line may result in changes to the assumed Facility Rating of the line.

7.3 Network Resource Interconnection Service Cost Estimate

Below is a summary of the Network Transmission generation interconnection facilities and conceptual costs required to interconnect the GI #630 Project to the Transmission Provider's transmission system.

Item of Work	Estimate
Network Upgrades	$0
ERIS upgrades	$7,909,859
Total Conceptual-level Cost Estimate in 2022 dollars (3)	**$7,909,859**

Table 3. Estimated GI #630 Interconnection Service 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.

8.0 Description of Operating Requirements

GI #630 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 beyond the standard .95 leading/lagging measured at the POI to maintain voltage within limits at the POI over the range of real power output. The Project will be required to operate at approximately .90 leading/lagging measured at the POI to maintain voltage within limits.

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 GI #630. 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.

Additional operating requirements for this Project may be identified in the System Impact Study when it is performed.

The Project(s) 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*.

9.0 Conclusion

GI #630 can be interconnected to the Idaho Power transmission system.

Interconnection requirements detailed in Section 6.2 totaling $7,909,859 are required to interconnect the Project for Energy Resource Interconnection Service (ERIS) at the proposed 138 kV POI. If the Project interconnects for Network Resource Interconnection Service (NRIS), the cost is the same as the ERIS to integrate the project and is $7,909,859. Both the ERIS and NRIS may be reliant on facilities identified in senior queued generation interconnections.

If the Project moves forward with a SIS at the currently rated output, the [redacted] line that the Project would connect to will meet the definition of a bulk electric system asset and will be subject to applicable NERC standards. A detailed inspection of this line may result in changes to the assumed Facility Rating of the line.

A SIS is required to determine the specific Transmission Network Upgrades required to integrate the Project as a Network Resource and to evaluate the system impacts (thermal overload, voltage, transient stability, reactive margin).

Generator interconnection service (either as an Energy Resource Interconnection Service or a Network Resource Interconnection Service) does not in any way convey any right to deliver electricity to any specific customer or point of delivery. Transmission requirements to integrate the Project will be determined during the SIS phase of the generator interconnection process.

APPENDIX A

A-1.0 Method of Study

The Feasibility 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 POI Map

Redacted

Revision History

Date	Revision	Initials	Summary of Changes
4/06/2022	1	PTP	Initial Report