SMALL GENERATOR INTERCONNECTION
SYSTEM IMPACT STUDY REPORT

for integration of the proposed

20,000 kW [redacted]
IPC PROJECT QUEUE #751

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

for

[redacted]

REPORT v.0

January 8, 2025

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1.0 Introduction

[redacted] has contracted with Idaho Power Company (IPC) to perform a Generator Interconnection System Impact Study for the integration of the proposed 20,000 kW [redacted] project (the Project). The Project is located in IPC's Capital Region [redacted] in [redacted] in Elmore County, Idaho (See Figure 4: POI of [redacted] – GI # 751)

The Project has applied to connect to the IPC distribution system for an injection of 20,000 kW at a single Point of Interconnection (POI) at a 34.5 kV distribution voltage level. The POI is located at the [redacted] substation at [redacted].

This report documents the basis for and the results of this system impact study for the GI #751 Generation Interconnection Customer. The report describes the proposed project, the determination of project interconnection feasibility and estimated costs for integration of the Project to the Idaho Power System. This report satisfies the system impact study requirements of the Idaho Power Tariff.

2.0 Summary

The feasibility of interconnecting the 20,000 kW [redacted] project to IPC's [redacted] was evaluated.

The proposed POI provided is on the [redacted] 34.5 kV substation bus.

The preliminary power flow analysis indicated that interconnecting the Project to the [redacted] 34.5 kV substation bus is feasible. Additionally, Operating Requirements will require the generator to provide leading and lagging reactive power as detailed in section 12.0 of this report.

The Project will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations.

Generator interconnection service, either as an Energy Resource or a Network Resource, does not in any way convey any right to deliver electricity to any specific customer or point of delivery.

The total preliminary cost estimate to interconnect the Project to the POI at [redacted] is $956,092 and includes the following tasks:

- Substation yard expansion at [redacted].
- Install a new distribution feeder breaker serving the POI.
- Install a 34.5 kV generation interconnection package at the POI.
    - This includes an SEL-421 protective relay, which requires 3-phase PTs, 3-phase CTs, and remote connectivity.

The cost estimate includes direct equipment and installation labor costs, indirect labor costs and general overheads, and a 20% 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

The heavy and light load cases were used to study the impact to the local transmission system. The limits used for this analysis are as follows:

1. Voltage magnitude during normal operating steady-state must remain between 0.93 per unit and 1.05 per unit. If the post-transient voltage deviates from this range during N-1 conditions and an operating procedure can be taken to return the voltage to the required range without creating a four-terminal line, then network upgrades are not required.

2. Line loading must be less than 100% of line rating during normal steady-state operation. Steady-state line loading above 100% requires network upgrades.

3. Post-transient line overloading that does not exceed the emergency line rating resulting from an N-1 contingency is acceptable if an operating procedure can be taken to reduce the line loading below 100% without creating a four-terminal line.

4. Post-transient line loading above the emergency line rating resulting from an N-1 contingency requires network upgrades.

7.0 Power Flow Analysis Study Results

The distribution modeling studies showed that voltage requirements should be met at the POI, even during periods of light load and peak Project output.

The impact of the proposed Project on the IPC transmission system was analyzed. Results from the studies performed indicate the addition of the Project, GI #751, will not result in N-1 contingency violations impacting either transmission path or any local transmission system elements.

8.0 Description of Substation Facilities

Idaho Power's [redacted] station is located in [redacted], Idaho. [redacted] station is fed by a 138 kV transmission line and [redacted] 69 kV transmission line. The substation transformer feeding the 34.5 kV [redacted] substation bus, [redacted], is a three-phase 138-36.2/20.9 kV delta wye-grounded transformer rated for [redacted] currently serves [redacted] 34.5 kV distribution feeders: [redacted].

9.0 Description of Distribution Facilities

The Project was studied with a 34.5 kV connection to a new distribution circuit breaker on the 34.5 kV [redacted] substation bus. This is a grounded-wye bus operating at 34.5 kV. The Project must have a grounded-wye transformer connection on the IPC side, as well as a wye connection on the Project side of the transformer.

Refer to Appendix A, Section 3, for additional grounding requirements.

Table 1 Conceptual-level POI Cost Estimate for GI #751

Item of Work	Estimate
Generation interconnection and protection package	$ 290,000
Substation upgrades	$ 479,800
Distribution upgrades	$ 0
Transmission upgrades	$ 0
Unloaded costs	$ 769,800
20% Contingency (1)	$ 153,960
Total unloaded costs	$ 923,760
Overheads (2)	$ 32,332
Total Conceptual-level Cost Estimate in 2024 dollars (3)	**$ 956,092**

(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.

- Note that these estimates do not include the cost of the customer's equipment/facilities.
- Note that the overhead rates are subject to change during the year.
- 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 Transmission and Distribution Facility Studies.

12.0 Description of Operating Requirements

The Project shall be capable of operating in all four quadrants of the PQ plane. Figure 1 illustrates operating in the PQ plan with varying source voltage with Q(V) and P(V) functions enabled. The project shall be capable then of injecting reactive power (over-excited) equal to 8800 kVAr and absorbing reactive power (under-excited) equal to 8800 kVAr at all active power between +/-100% of nameplate active power rating (whether charging or generating).

The Project will be required to control voltage in accordance with a voltage schedule and control charging in accordance with a load schedule as provided by Idaho Power Grid Operations.

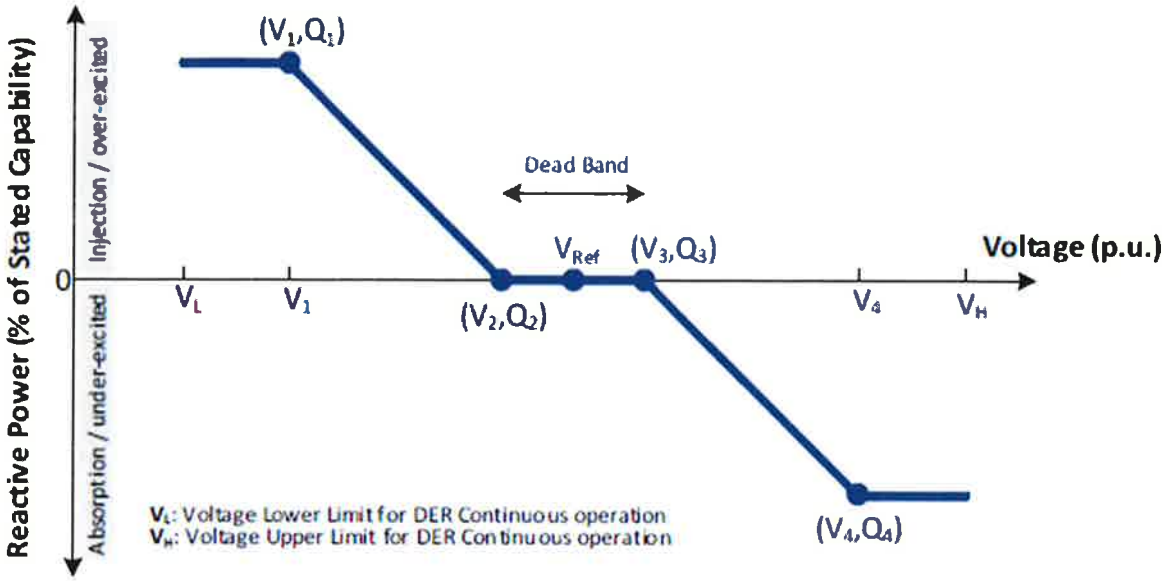

Figure 2: Voltage-Reactive Power Settings (IEEE 1547-2018)

The Project will be required to follow a voltage-reactive power characteristic curve as shown in Figure 2. Also, the Project will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations in Figure 3.

Set Point	V (pu)	Set Point	Q (pu)
V1	0.940	Q1	44%, injecting
V2	0.980	Q2	0
V3	1.020	Q3	0
V4	1.060	Q4	44%, absorption

Figure 3: Voltage Schedule Requirements

The Project is required to comply with the applicable Voltage and Current Distortion Limits found in IEEE Standard 519-2014 *IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.*

The Project shall be capable of anti-islanding and is the responsibility of [redacted] to ensure this capability is maintained.

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 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. This states, in part, that distribution voltages, under normal operating conditions, are to be maintained within plus or minus 5% (0.05 per unit) of nominal at each meter or POI 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 the starting or stopping of the generator will be limited to less than 5% as measured at the POI. Allowable voltage flicker limit is further reduced during operation due to multiple voltage fluctuations per hour or minute, 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, IEEE1453, IEEE1547, and ANSI C84.1 Standards.

APPENDIX B

B-1.0 [redacted] GI Project #751 Site Location

Figure 4: POI of [redacted] - GI #751