GENERATOR INTERCONNECTION
SYSTEM IMPACT STUDY REPORT

for integration of the proposed

[redacted]

(GI PROJECT #562)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

MALHEUR, OREGON

for

[redacted]

REPORT v.0

September, 2020

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1.0 Introduction

[redacted] has contracted with Idaho Power Company (IPCO) to perform a Generator Interconnection System Impact Study (SIS) for the integration of the proposed 42 MW [redacted] The Project location (~ coordinates [redacted]) is in the IPCO Western Region in Malheur County, Oregon. The Project has been assigned an IPCO Generation Interconnect (GI) queue number 562 (GI #562).

The specific Point of Interconnection (POI) studied is on IPC's [redacted] section of the [redacted] 138kV line approximately 8.76 miles from IPC's [redacted] station and approximately

This report documents the basis for and the results of this SIS for the GI #562 Generation Interconnection Customer. The report describes the proposed project, the determination of interconnection requirements and estimated costs for integration in to the IPCO transmission system. This report satisfies the SIS requirements of the Idaho Power Tariff.

2.0 Summary

The impact to the IPCO transmission system of interconnecting the 42 MW [redacted], GI #562, to [redacted] 138kV line was evaluated.

The following is for information purposes only and does not convey Transmission Service.

The total preliminary cost estimate to interconnect [redacted], GI #562, to Idaho Power's 138 kV system between [redacted] substations is **$8,963,749**.

The estimate includes 20% contingency and 8.5% 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.

A 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 IPCO Standard Generator Interconnection Procedures, evaluating the impact of interconnecting the Project to the IPCO transmission system. The scope of the SIS is detailed in the System Impact Study Agreement.

4.0 Contingent Facilities

The Project's NR or ER service is not contingent on upgrades associated with senior queued projects.

5.0 Description of Proposed Generating Project

[redacted] GI #562, proposes to interconnect to the Idaho Power transmission system at 138 kV with a total injection of 42 MW (maximum project output). The POI is assumed to be a new 138 kV class substation inserted in the IPCO 138 kV [redacted] Transmission line.

Table 1: Project Specifications

Project Location	[redacted]
Number and Type of Generators	Solar Photovoltaic, Type Sungrow SG3150U, Quantity = 15
Individual Generator Nameplate Rating	3150 kW
Total Output Power Rating	42,000 kWac
Rated Power Factor	0.95 Leading / 0.95 Lagging
New Step-Up Transformer	30/40/50 MVA, 3-phase, 138/34.5/13.8 kV, Z = 9% on 30 MVA base
Interconnection Voltage	138 kV

6.0 Description of Substation/Transmission Facilities

The [redacted], GI #562, interconnection to the [redacted] 138 kV line was studied in this SIS. The Project is located adjacent to the proposed POI.

Power flow analysis indicated that the Project's full output of 42 MW can be interconnected at the POI with the following network upgrades identified.

- New GI #562 138 kV Generation Interconnection Station
- Rebuild of the approximately 4.3-mile [redacted] 69 kV line
- Move approximately 2 miles of the [redacted] 138 kV line from the shared [redacted] 230 kV structures near Caldwell.
- Implement a transfer trip from [redacted] Substation to [redacted]

6.1 Transmission Line Facilities

The Project will be inserted in the [redacted] section of the [redacted] 138-kV line. The POI will be the 138-kV breaker on the high side of the Project 138/34.5 kV transformer.

6.2 Substation Facilities

A new 138/34.5 kV substation will need to be constructed adjacent to the existing [redacted] 138 kV line section. It is Idaho Power's policy to not allow another tap on this line and create a four-terminal line due to technical protective relaying issues. From a transmission system perspective, it was determined the best location, for this additional

138kV sectionalizing breaker, would be to install it on the north side of [redacted] looking toward [redacted]. Thus, breaking the existing [redacted] 138kV line into a [redacted] 138kV line and a [redacted] 138kV line

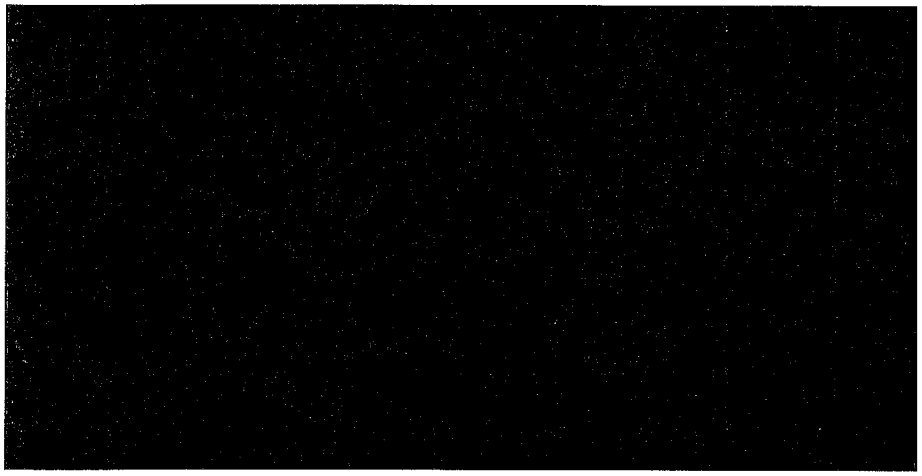

Figure 1 - Proposed interconnection station

The new substation will consist of two 138 kV breakers with associated protective relaying systems and a customer owned 138/34.5 kV transformer. The POI will be the 138 kV breaker on the high side of the 138/34.5 kV transformer.

6.3 Grounding Requirements

The proposed 138/34.5 kV Wye-Grounded/Wye-Grounded with Delta Tertiary station transformer specified in the latest Single Line Diagram (SLD) provided by [redacted] should provide an adequate ground source for transmission line protection/relaying.

Grounding requirements and acceptability criteria are found in Appendix A.

6.4 System Protection Assessment

Fault study at the different breakers are shown below:

Fault Study (w/ [redacted])			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
@[redacted] Breaker	4252.8	3763.9	4406.8
@[redacted] Breaker	3667.4	2155.0	1307.0
@[redacted] POI	1389.0	1693.5	1681.5

Fault Study (w/[redacted])			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
@[redacted] Breaker	3331.0	3780.3	4426.6
@[redacted] Breaker	1199.1	1566.6	1794.1

The fault duty for each of the buses with and without the solar generation are shown below

Fault Study (w/ [redacted])			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
@[redacted] Bus	6272.6	5462.8	6600.9
@[redacted] Bus	17143.0	12928.3	12253.5
@[redacted] POI	8041.7	8438.1	6345.6

Fault Study (w/o [redacted])			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
@[redacted] Bus	6201.1	5715.1	6620.0
@[redacted] Bus	14143.9	11387.5	12832.7

6.5 Description of Distribution Facilities

No distribution facilities are directly impacted by this project.

6.6 Network Resource and Energy Resource Cost Estimate

The following upgrades will be required to facilitate the interconnection of [redacted], GI #562:

- Install generation interconnection package at the POI. This includes one 138 kV power circuit breaker, an SEL-421 protective relay, which requires 3-phase potential transformers (PTs), 3-phase current transformers (CTs), SCADA and remote connectivity.
- New GI #562 138kV Generation Interconnection Station.
- Rebuild of the approximately 4.3-mile [redacted] 69 kV line using [redacted] ACSR (or equivalent) conductor.
- Move approximately 2 miles of the [redacted] 138kV line from the shared [redacted] 230kV structures near Caldwell. Utilize the old [redacted] 69kV right of way for the re-located line
- [redacted] Open-Breaker Transfer Trip Scheme.
- Note that this cost estimate does not include the cost of the customer's equipment/facilities or required communication circuits.
- These are estimated costs only and final charges to the customer will be based on the actual construction costs incurred.

See the conceptual-level cost estimate in Table 1.

Table 2 Conceptual-Level Cost Estimate for GI #562

Item of Work	Estimate
Generation interconnection and protection package	$2,726,000
Substation upgrades	$0
Distribution upgrades	$435,000
Transmission upgrades (1)	$3,723,600
Unloaded costs	$6,884,600
Contingency 20% (2)	$1,376,920
Total unloaded costs	$8,261,520
Overheads (3)	$702,229
Total Conceptual-level Cost Estimate in 2020 dollars (4)	$8,963,749

- (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.

The cost estimates include direct equipment 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 Transient Stability Analysis

The WECC 2019 Heavy Summer operating case modified to increase WECC Path 14 to its East to West limit. PowerWorld Simulator version 21 analysis tool were used to perform the transient stability analysis.

When studied the plant controllers were set to control to the low side of the GSU (34.5 kV) The results showed no transient stability violations. The developer should validate their dynamic modeling data. 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 IPCO if testing or real-time observations indicate a need.

The provided dynamic data used the **REEC_B** model, this model has been retired by WECC and is no longer accepted. An updated model shall be submitted during the Facility study.

8.0 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 (absorbing) to 0.95 lagging (supplying) at the POI over the range of real power output. At full output of 42 MW, the Project would need to be able to provide approximately +/- 13.8 MVAr reactive support at the POI. The 10- MVAr 34.5kV shunt capacitor indicated on the Project's supplied single line drawing is sufficient to make-up the reactive power deficiency.

GI #562 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 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 #562. The specific costs associated with IPCO requirements for interconnection customers with aggregate facilities larger than 20 MW to provide PMU data to IPCO will be identified in the Facility Study should the generation interconnection customer choose to proceed to that phase of the interconnection process.

9.0 Conclusion

Interconnection requirements, detailed in Section 6.6, are required to interconnect the Project as either a NR or ER Interconnection Service.

The requested interconnection of the [redacted], GI #562, to Idaho Power's system was studied.

The results of this study work confirm that GI #562 can be interconnected to the existing IPCO transmission system with the required upgrades.

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.

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 or GE Positive Sequence Load Flow (PSLF) analysis tool, the impacts of the new resource on the IPCO transmission system (lines, transformers, etc.) within the study area are analyzed. The WECC and IPCO reliability criteria and IPCO operating procedures were used to determine the acceptability of the configurations considered. For distribution feeder analysis, IPCO utilizes Advantica SynerGEE 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 IPCO. Less than or equal to 100% of continuous rating is acceptable.

IPCO 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 IPCO 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 IPCO 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

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

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

Revision History

Date	Revision	Initials	Summary of Changes
09/23/2020	0	AV	Original