AMENDED GENERATOR INTERCONNECTION
SYSTEM IMPACT STUDY REPORT

for integration of the proposed

263 MW XXXXXX PROJECT
(GI PROJECT #580)

to the

PACIFICORP ELECTRICAL SYSTEM

in

BONNEVILLE COUNTY, IDAHO

for

XXXXXX, LLC

REPORT v.4

June 23, 2021

Table of Contents

1.0 Introduction

XXXXXX, LLC (Customer) has contracted with Idaho Power Company (IPCO) to perform a Generator Interconnection System Impact Study (SIS) for the integration of a proposed 263 MW XXXXXX Project (Project) located in PacifiCorp's Eastern Idaho Region in Bonneville County, Idaho (~ coordinates XXXXXX° N, XXXXXX° W).

The Project has been assigned an IPCO Generation Interconnect (GI) queue number 580 (GI580). In the SIS Agreement, the Project has chosen to have studies performed for both Energy Resource (ER) Interconnection Service and Network Resource (NR) Interconnection Service.

The requested point of interconnection for this study is the XXXXXX 161 kV line, a line jointly owned by Idaho Power and PacifiCorp and operated by PacifiCorp.

This report documents the basis for and the results of the SIS for the GI580 Generation Interconnection. The report describes the proposed Project and identifies interconnection requirements with associated cost estimates for integration into the PacifiCorp transmission system. This report satisfies the SIS requirements of the Idaho Power Tariff.

Restudy Note:

The customer has inquired about changing their facilities to include solar and/or batteries. If the power delivered to the POI is unchanged, the change would not be considered a Material Modification, however, it would require a restudy to validate modeling parameters. The proposed changes to include inverter type sources would require additional dynamics data (dyd files) and the collector system models would need to be updated to evaluate reactive requirements.

2.0 Summary

The impact to the transmission system of interconnecting the Project in the XXXXXX 161 kV line was evaluated and the results of this study work confirm that GI580 can be interconnected at the proposed POI with the specified network upgrades.

The following cost estimates are for information purposes only and do not convey Transmission Service. For ER service a Transmission Service Request (TSR) will be required. The ER cost estimate provided does not include dedicated transmission capacity to deliver energy to any customer.

The total ER Interconnection Service preliminary cost estimate to interconnect the Project is:

- Energy Resource Interconnection: **$12,394,800**

  See Section 6.6, Energy Resource Cost Estimate, for the required ER facilities and cost breakdowns.

The analysis of NR service for this SIS assumed that the Project will displace other generation utilizing the existing transmission capacity. Therefore, the NR Interconnection Service preliminary cost estimate is the same as the ER interconnection. It should be noted the Project output exceeds Idaho Power's allocated capacity on the XXXXXX line.

These estimates include 20% contingency and 10% 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.

IPCO estimates it will require approximately 36 months to design, procure, and construct the facilities described in this report following the execution of a Generation Interconnection Agreement. A more specific schedule will be developed during the Facility Study phase of the interconnection process.

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

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 transmission system. The scope of the SIS is detailed in the System Impact Study Agreement.

4.0 Contingent Facilities

The Project was studied with PacifiCorp's senior queue project Q2611 in the model which includes significant transmission system upgrades; GI 580 is not contingent upon the Network Upgrades of Q2611.

Note: The Contingent Facilities listed in the previous version of this report have been removed. Since the report was originally submitted post contingency mitigating actions were discovered which remove the overloads previously observed.

5.0 Description of Proposed Generating Project

XXXXXX, GI580, proposes to interconnect to the IPCO transmission system at 161 kV with a total injection of 263 MW (maximum Project output). The POI is assumed to be on the XXXXXX 161 kV line.

Table 1: Project Specifications

Project Location	**XXXXXX° N, XXXXXX° W**
Number and Type of Generators	Siemens Gamesa 6.2 MW turbines Quantity = 44
Individual Generator Nameplate Rating	6.2 MW 6500 KVA
Total Output Rating	272.8 MW
New Step-Up Transformers	(1) 85/110/140 MVA ONAN/ONAF/ONAF @ 65°C 161Y / 34.5 - 13.8 Delta kV Z=10% @ BASE MVA, X/R=35.8 (1) 100/130/165 MVA ONAN/ONAF/ONAF @ 65°C 161Y / 34.5 - 13.8 Delta kV Z=10% @ BASE MVA, X/R=37.3
Interconnection Voltage	161 kV

6.0 Energy Resource (ER) Interconnection Service

ER Interconnection Service allows the Interconnection Customer to connect to a Transmission Provider's transmission system and be eligible to deliver electric output on firm or non-firm transmission capacity on an "as available" basis.

For the ER Interconnection Service study, PowerWorld Simulator v22 with a 2022 Heavy Winter WECC base case modified only to add the Project and senior queue projects was used. This represents a peak load case for the region where the Project is proposed.

Contingency Analysis shows for the loss of the line from XXXXXX results in the overload of the XXXXXX line section; as a mitigation, the existing 161 kV line from XXXXXX will need to be rebuilt with 795 ACSR conductor.

6.1 Transmission Line Facilities

As an ER, a TSR will be required to determine the Network Upgrades required to deliver the Project output to a designated point of delivery. At this time, no network upgrades have been identified for the Project as an ER interconnection beyond what has been listed above.

6.2 Substation Facilities

A new 161 kV substation will need to be constructed adjacent to the existing XXXXXX 161 kV line. The line will be broken adjacent to the new substation and the line sections will be terminated in the substation as two individual lines along with the customer owned line in a three-position ring bus in a manner similar to Figure 1.

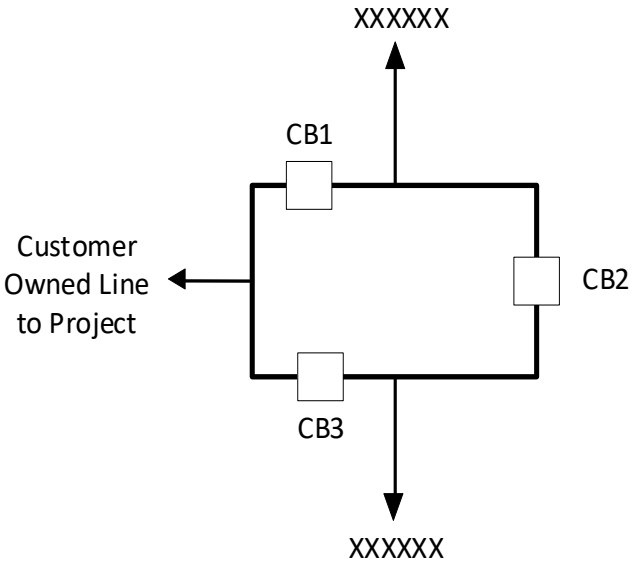

Figure 1 - Proposed interconnection station

The new substation will include protective relaying systems and SCADA for all three lines, a Generation Interconnection metering package and communications. The POI will be the circuit breakers for the customer's line.

The actual station layouts and detailed equipment requirements will be determined in the Facility Study should the customer choose to move to that phase of the interconnection process.

6.3 Grounding Requirements

The proposed 161 kV Wye-Grounded/Wye-Grounded with Delta Tertiary transformers specified in the Idaho Large Generator Interconnection Request for XXXXXX Park, GI580, 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

PacifiCorp will need to verify fault currents are within all device ratings.

Fault duty at each of the breakers with and without the generation.

Fault Study (w/ GI580_ARCO)			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
@XXXXXX BUS	22051.2	17178.7	19917.6
@XXXXXX BUS	4713.9	5109.1	5894.8
@XXXXXX POI	7046.4	6592.8	7689.0

Fault Study (w/o GI580_ARCO)			
Location	**SLG (A)**	**LTL (A)**	**3PH (A)**
@XXXXXX BUS	21385.8	16671.9	19352.3
@XXXXXX BUS	4266.3	4900.1	5653.4

6.5 Energy Resource Cost Estimate at 263 MW at POI.

The following upgrades will be required to facilitate the interconnection of XXXXXX, GI580:

- Construct a new 161 kV three-position ring bus substation.
- Install generation interconnection package at the POI. This includes two 161 kV power circuit breaker, SEL-421 protective relay, which requires 3-phase potential transformers (PTs), 3-phase current transformers (CTs) for each circuit breaker, SCADA and remote connectivity.
- Install a 161 kV power circuit breaker to form the remainder of the ring bus and the associated protection systems for the two lines.
- Line work to break existing 161 kV line and terminate each end at substation.
- Rebuild the existing XXXXXX 161 kV line.
- 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.

Table 2: Conceptual Cost Estimate

Item of Work	Estimate
Substation construction and Generation interconnection and protection package	$5,015,000
Transmission upgrades	$4,375,000
Unloaded costs	$9,390,000
Contingency 20% (1)	$1,878,000
Total unloaded costs	$11,268,000
Overheads (2)	$1,126,800
Total Conceptual-level Cost Estimate in 2020 dollars (3)	**$12,394,800**

(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.

These are non-binding conceptual level cost estimates that will be further refined upon the request and completion of a Facility Study.

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 Network Resource (NR) Interconnection Service

NR 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 own 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. NR Interconnection Service in and of itself does not convey Transmission Service.

7.1 Description of Power Flow Cases

For the NR Interconnection Service study, two power flow cases were studied with PowerWorld Simulator v22 to evaluate the need for Network Transmission Upgrades on Transmission Provider's system under various conditions.

A 2020 Heavy Summer WECC base case was modified to represent summer months with high imports from the west on Path 14 and high transfers from the north on Path 18.

A 2020 Light Spring WECC base case was modified to represent shoulder months with high east to west transfers on Path 17 and high transfers from the south on Path 18.

7.2 Network Resource Transmission Upgrades

PowerWorld Contingency Analysis for NR Interconnection Service show no additional Network Upgrades are required for the integration of GI580 beyond that identified for the Energy Resource Interconnection Service.
.

7.3 Network Resource Cost Estimate

The cost for NR Interconnection Service will include all cost attributed to the ER Interconnection Service and the costs to add transmission capacity to deliver the projects output to load.

8.0 Transient Stability Analysis

PowerWorld Simulator v22 was used to perform the transient stability analysis on the WECC 2020 Light Spring operating case modified to increase WECC Path 14 and Path 18 to their limits.

When studied the plant controllers were set to control the 161 kV POI. The results showed no transient stability violations. Once construction is complete the Developer should validate the dynamic modeling data. It is the responsibility (per NERC Standards) of the Generator Owner to ensure the modeling data accurately reflects generator operations, and to provide updates to PacifiCorp if testing or real-time observations indicate a need.

9.0 Description of Operating Requirements

The Project will be required to control voltage in accordance with a voltage schedule provided by PacifiCorp and manage the real power output at the POI to not exceed 263 MW.

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 output of 263 MW, the Project would need to be able to provide approximately +/- 86 MVAr reactive support at the POI. Based on the information provided, the Project's own facilities will consume approximately 44 MVAr. The customer's documentation indicates the combined output from the turbines plus the two 12 MVAr shunt cap banks shown on the provided single line diagram will not supply the combined need. The Project will foreseeably be required to install additional reactive support.

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*.

IPCO requires that interconnection customers with aggregate facilities larger than 20 MW provide PMU data. Installation of PMU devices and maintenance costs associated with communication circuits needed to stream PMU data will be required to interconnect GI580. The specific costs associated with this requirement will be identified in the Facility Study phase of the interconnection process.

10.0 Conclusion

The requested interconnection of the XXXXXX Project, GI580, to the XXXXXX161 kV line in PacifiCorp's transmission system was studied.

The results of this study work confirm that GI580 can be interconnected at the proposed POI with the specified network upgrades.

Interconnection requirements, detailed in Section 6.6, are required to interconnect the Project as an Energy Resource or Network Resource.

Generator interconnection service (either as an Energy Resource or a Network Resource) does not in any way convey any right to deliver electricity to a 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 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 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 IPCO's T&D Advisory Information Manual.

IPCO'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
05/18/2021	0	GMT	Draft Original
5/20/2021	1	GMT	Revised with feedback from Mark
5/21/2021	2	GMT	Revised with feedback from Erik
5/25/2021	3	GMT	Included note about Restudy if equipment is changed
6/23/2021	4	GMT	Removed Contingent Facility requirements.