

**GENERATOR INTERCONNECTION
FEASIBILITY STUDY REPORT**

for integration of the proposed

**10.0 MW [REDACTED]
IPC PROJECT QUEUE #554**

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

for

[REDACTED]

REPORT v.0

July 26, 2019

OFFICIAL USE ONLY

This report contains Idaho Power Company Critical Energy Infrastructure Information (CEII). Distribution of this report must be limited to parties that have entered into a non-disclosure agreement with Idaho Power Company and have a need to know.

Revision History

Date	Revision	Initials	Summary of Changes
7/26/19	0	PMA	FeSR GI #554 – Original issue.

Table of Contents

1.0	Introduction.....	1
2.0	Summary	1
3.0	Scope of Interconnection Feasibility Study	2
4.0	Description of Proposed Generating Project.....	3
5.0	Description of Transmission Facilities	3
6.0	Description of Substation Facilities	3
7.0	Description of Distribution Facilities.....	3
8.0	Short Circuit Study Results.....	3
9.0	Description of Required Facility Upgrades	4
10.0	Description of Operating Requirements	5
11.0	Conclusion	6
	APPENDIX A.....	7
	A-1.0 Method of Study	7
	A-2.0 Acceptability Criteria	7
	A-3.0 Grounding Guidance.....	8
	A-4.0 Electrical System Protection Guidance	8
	A-5.0 WECC Coordinated Off-Nominal Frequency Load Shedding and Restoration Requirements	8
	APPENDIX B	9
	B-1.0 [REDACTED] GI Project #554 Site Location	9

List of Tables

Table 1 Conceptual-level Cost Estimate for GI #554..... 4

List of Figures

Figure 1 Operating requirements (IEEE 1547-2018)..... 5
Figure 2 Location of [REDACTED] – GI #554 9

1.0 Introduction

██████████ has contracted with Idaho Power Company (IPC) to perform a Generator Interconnection Feasibility Study for the integration of the proposed 10 MW ██████████ project (the Project). The Project is located in IPC's Capital Region at ██████████ in ██████████, ██████████ in Ada County, Idaho (See Figure 2: Location of ██████████ – GI # 554 in Appendix B). The Project is Generation Interconnect queue number 554 (GI #554).

The Project has applied to connect to the IPC distribution system for an injection of 10 MW at a single Point of Interconnection (POI) at a 34.5 kV distribution voltage level. The POI is located ██████████.

This report documents the basis for and the results of this feasibility study for the GI #554 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 feasibility study requirements of the Idaho Power Tariff.

2.0 Summary

The feasibility of interconnecting the 10 MW ██████████ project to IPC's ██████████ substation was evaluated.

The proposed POI provided is in ██████████ feeder service territories. All three feeders were reviewed for interconnection.

██████████ already has a 3 MW generating plant connected, limiting the maximum additional generation at 7 MW and would experience voltage control issues. This option was not considered.

██████████ was found to experience voltage and capacity issues when 10 MW of generation is connected. This option was not considered.

██████████ is operated at 12.47 kV at the proposed POI. At 12.47 kV at this location, ██████████ also would experience voltage and capacity issues.

Adding a parallel 34.5 kV section of ██████████ from the station side of recloser ██████████ up to the proposed POI mitigates these issues. This option was the option utilized for this this Feasibility Study Report.

This study assumed a customer built, owned and maintained line from the generating plant to the POI.

The preliminary power flow analysis indicated that interconnecting the ██████████ project to ██████████ is feasible.

The Project will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. The installation of a phasor measurement unit device (PMU) at 10 MW ██████████

the POI and the installation and maintenance costs associated with communication circuits needed to stream PMU data will be required to interconnect GI #554.

A Transmission System Impact Study is required to determine if any additional network upgrades are required to integrate the Project into the IPC transmission system and to evaluate system impacts such as thermal, voltage, transient stability, and reactive margin. 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.

Additionally, a Distribution System Impact Study will be required.

The total preliminary cost estimate to interconnect the [REDACTED] project to the [REDACTED] substation is \$665,277 and includes the following tasks:

- Install a four-pole 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
 - SCADA
 - Additionally, a single-phase PT shall be installed on the line side of the [REDACTED] feeder at the JPLN substation for deadline check
- Install a PMU device at the POI
- Build a parallel 34.5 kV [REDACTED] line section for approximately [REDACTED] from the station side of recloser [REDACTED] to the POI.

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 noted that the preliminary cost estimate of \$665,277 does not include the cost of the customer's owned equipment to construct the generation site or required communication circuits.

3.0 Scope of Interconnection Feasibility Study

The Interconnection Feasibility Study was done and prepared in accordance with Idaho Power Company 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 as a result of the interconnection;
- preliminary identification of any thermal overload or voltage limit violations resulting from the interconnection; and
- preliminary description and non-binding estimated cost of facilities required to interconnect the Small Generating Facility to the IPC system and to address the identified short circuit and power flow issues.

All other proposed generation projects prior to the 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 Description of Proposed Generating Project

██████████, GI #554, consists of a single POI with up to ██████████ synchronous generators and has requested to connect to Idaho Power's 34.5 kV distribution system. The Project will use up to five ██████████ generators. ██████████ requested that a 10 MW injection at the POI be studied. ██████████ of ██████████ conductor connecting the proposed generating plant to the POI operating at 34.5 kV was assumed for the load flow model. It is assumed that this line will be customer built, owned and maintained.

The Project's projected in-service date is ██████████.

5.0 Description of Transmission Facilities

Preliminary power flow analysis indicated that interconnection of a 10 MW injection at the POI considered in this study is feasible. A Transmission System Impact Study will be required to determine the specific network upgrades required to integrate the full project output of 10 MW.

6.0 Description of Substation Facilities

Idaho Power's ██████████ station is located in Ada County, Idaho. ██████████ station is fed by a 138-kV transmission line. The substation transformer feeding ██████████, ██████████, is a three-phase 138-36.2Y/20.9 kV delta wye-grounded transformer rated for 44.8 MVA. ██████████ currently serves two 34.5 kV distribution feeders: ██████████ and ██████████.

7.0 Description of Distribution Facilities

The Project was studied with a 34.5 kV connection to ██████████. This is a grounded-wye feeder 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.

8.0 Short Circuit Study Results

Fault Duty at ██████████ GEN POI:

SLG Fault (A) 2420.50

LL Fault (A) 2427.31

3PH Fault (A) 2732.11

The fault current contribution from the synchronous generators does not exceed any circuit breaker rating.

9.0 Description of Required Facility Upgrades

A Distribution System Impact Study will be required to evaluate distribution operational concerns, mitigation options, and costs if the Project chooses to continue to the next phase of the study process.

The following upgrades will be required to IPC-owned facilities to facilitate the interconnection of GI #554:

- Install a four-pole 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
 - SCADA
 - Additionally, a single-phase PT shall be installed on the line side of the [REDACTED] feeder at the [REDACTED] substation for deadline check
- Install a PMU device at the POI
Build a parallel 34.5 kV [REDACTED] line section for approximately [REDACTED] from the station side of recloser [REDACTED] to the POI.

See the conceptual-level cost estimate in Table 1.

Table 1 Conceptual-level Cost Estimate for GI #554

Item of Work	Estimate
Generation interconnection and protection package	\$ 156,114
Substation upgrades	\$ 10,000
Distribution upgrades	\$ 317,021
Transmission upgrades	\$ TBD
Unloaded costs	\$ 483,135
20% Contingency (1)	\$ 96,627
Total unloaded costs	\$ 579,762
Overheads (2)	\$ 85,515
Total loaded costs	\$ 665,277
Total Conceptual-level Cost Estimate in 2019 dollars (3)	\$ 665,277

(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 or required communication circuits for SCADA, PMU, and metering.
- 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.

10.0 Description of Operating Requirements

The Project shall be capable of injecting reactive power (over-excited) equal to 4.4 MVAR and absorbing reactive power (under-excited) equal to 2.5 MVAR at all active power output between 20% and 100% of nameplate active power rating as defined in IEEE 1547-2018 Category A reactive power capability and shown in Figure 1.

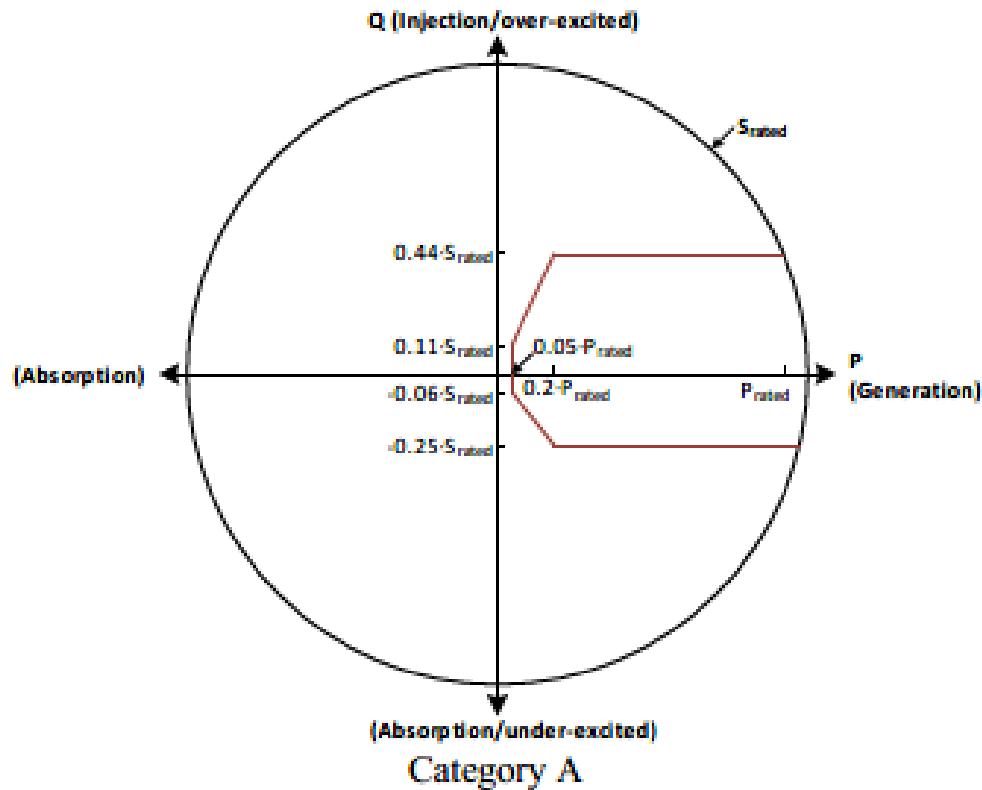


Figure 1 Operating requirements (IEEE 1547-2018)

Idaho Power has determined that the generation equipment selected by the Project does meet the reactive power capability requirements.

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

Voltage flicker at startup and during operation will be limited to less than 5% as measured at the POI. The 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.

The Project is required to comply with the applicable voltage fluctuation limits found in IEEE Standard 1453-2004 *IEEE Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems*.

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*.

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

11.0 Conclusion

The requested interconnection of the [REDACTED] project, GI #554, to Idaho Power's system was studied. The project will interconnect to [REDACTED] feeder at the 34.5 kV distribution voltage level.

The results of this study work confirm that it is feasible to interconnect the [REDACTED] project, GI #554, to the Idaho Power system with the identified upgrades. A four-pole generation interconnect package and PMU at the POI, adding [REDACTED] of 34.5 kV [REDACTED] parallel line section, and deadline check at the [REDACTED] substation are required to integrate the 10 MW project. A Transmission and Distribution System Impact Study is required to determine the specific transmission network upgrades required to integrate the project as a Network Resource and to evaluate the system impacts such as thermal overload, voltage, transient stability, and reactive margin.

All generation projects in the area ahead of the Project in the IPC generation interconnection queue and their associated transmission system improvements were modeled in a preliminary power flow analysis to evaluate the feasibility of interconnecting GI #554. The results and conclusions of this feasibility study are based on the realization of these projects in the unique queue/project order.

The estimated cost to interconnect GI #554 to the IPC system at the [REDACTED] feeder at the 34.5 kV point of interconnection considered in this study is approximately \$665,277.

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. Transmission requirements to integrate the Project will be determined during the System Impact Study phase of the generator interconnection process.

APPENDIX A

A-1.0 Method of Study

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. The guideline 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.

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 (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 to limit their ground fault current to 20 amps at the Point of Interconnection.

A-4.0 Electrical System Protection Guidance

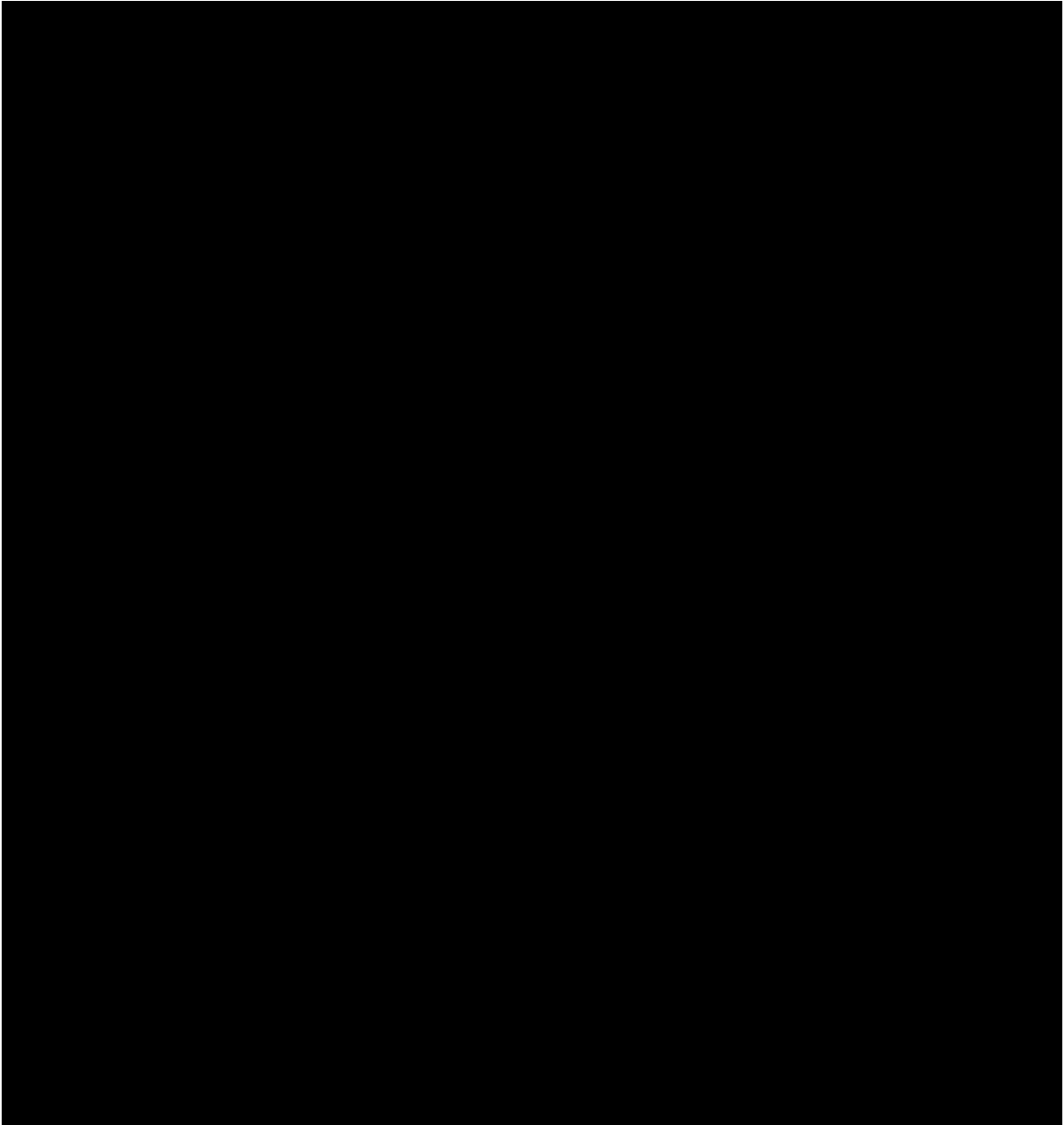
IPC requires electrical system protection per Requirements for Generation Interconnections found on the Idaho Power Web site,

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



10 MW [REDACTED]
Feasibility Study Report

OFFICIAL USE ONLY

This report contains Idaho Power Company Critical Energy Infrastructure Information (CEII). Distribution of this report must be limited to parties that have entered into a non-disclosure agreement with Idaho Power Company and have a need to know.