

**GENERATOR INTERCONNECTION
SYSTEM IMPACT RE-STUDY REPORT**

for integration of the proposed

**[REDACTED] PROJECT
(IDAHO POWER QUEUE #549)**

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

TWIN FALLS COUNTY, IDAHO

for

**[REDACTED]
REPORT v.0**

June 7, 2021

**[REDACTED] Project #549
System Impact Re-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.

Revision History

Date	Revision	Initials	Summary of Changes
6/7/2021	0	■	Initial version

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.

Table of Contents

1.0	Introduction.....	1
2.0	Summary	1
3.0	Scope of Interconnection SIS.....	2
4.0	Contingent Facilities	2
5.0	Description of proposed generating project.....	2
6.0	Description of power flow cases.....	4
7.0	Study Results	4
8.1	Power Flow Results (Thermal and Voltage Analysis).....	4
7.2	Reactive Power Requirements	5
7.3	Transient Stability Results	5
7.4	Post-Transient Voltage Stability (Reactive Margin) Results	6
7.5	Short Circuit Results	6
7.6	Other Operating Requirements.....	6
8.0	Cost estimate of required facilities	7
9.0	Conclusions.....	8
APPENDIX A.....		9
A-1.0	Method of Study	9
A-2.0	Acceptability Criteria.....	9
A-3.0	Electrical System Protection Guidance	10
A-4.0	WECC Coordinated Off-Nominal Frequency Load Shedding and Restoration Requirements	10

List of Tables

Table 1: Project Specifications	3
Table 2. Estimated GI #549 Project's Required Facilities Costs.....	7

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.

1.0 INTRODUCTION

██████████ has contracted with Idaho Power Company (“Transmission Provider”) to perform a Generator Interconnection System Impact Re-Study (SIS) for the integration of the proposed ██████████ project (the Project). The Project location (~ coordinates ██████████) is in Idaho Power Company’s (IPC’s) Southern Region in Twin Falls County, Idaho. The Project is Generation Interconnect (GI) queue number 549 (GI #549). The specific point of interconnection (POI) studied is the 345 kV ██████████

The Project has chosen to be studied for Network Resource (NR) Interconnection Service in the SIS.

IPC GI queue #502, #503, #513, #514, #517, and #523 are senior queued projects, and the facilities and subsequent cost to integrate the ██████████ Project #549 is contingent on facilities required to integrate these senior projects as identified in Transmission Service Request (TSR) OASIS #88754178.

This report documents the basis for and the results of this Re-Study SIS for the GI #549 Generation Interconnection Customer. The report describes the proposed project, the determination of project interconnection system impact and estimated costs for integration of the Project to the Transmission Provider’s transmission system. This report satisfies the SIS requirements of the Idaho Power Tariff.

2.0 SUMMARY

The **total preliminary cost estimate** to interconnect the Project to the Transmission Provider’s system is **\$2,019,000**. This cost estimate assumes that the necessary facilities were installed to integrate senior projects GI #502, #503, #513, #514, #517, and #523 as identified in TSR OASIS #88754178.

Integrating GI #549 to the Transmission Provider’s transmission system will require addition of a new 345kV ring bus bay and associated protection and metering to connect GI #549 to the 345kV ring bus substation required for GI #502, #503, #513, #514, #517, and #523, as identified in TSR OASIS #88754178.

The Project will not meet the reactive power requirements required by the Transmission Provider based on the data provided by the customer. Meeting this requirement is the responsibility of the Interconnection Customer. This is discussed further in Section 7.2. GI #549 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations and will be required to manage the real power at the POI. Also, it may be beneficial for the Interconnection Customer, for their own NERC Reliability Standard modeling

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.

compliance requirements, to install additional PMU devices at their facilities to monitor the generation source(s).

The System Impact Study determined what facilities are required to integrate this project into the IPCo transmission system and evaluated full system impacts (thermal, voltage, transient stability, 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. A Transmission Service Request (TSR) will be required to study the Transmission System Impacts.

3.0 SCOPE OF INTERCONNECTION SIS

The Interconnection SIS was conducted and prepared in accordance with the Transmission Provider's Standard Generator Interconnection Procedures to provide an evaluation of the system impact of the interconnection of the proposed generating project to the Transmission Provider's system. The scope of the Interconnection System Impact Study is detailed in the System Impact Study Agreement.

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 web site at the link shown below:

<http://www.oatioasis.com/ipco/index.html>

4.0 CONTINGENT FACILITIES

IPC GI queue projects #502, #503, #513, #514, #517, #523, and #530 are senior queued projects in the affected area of IPC's transmission system.

The 345kV ring bus substation facilities required for GI #502, #503, #513, #514, #517, and #523, as identified in TSR OASIS #88754178, are contingent facilities. These facilities are necessary to integrate GI #549 to the Transmission Provider's system. Changes to GI #502, #503, #513, #514, #517, and #523, including in-service date or withdrawal from the queue, will trigger a restudy associated with GI #549 to determine the extent of the upgrades required.

5.0 DESCRIPTION OF PROPOSED GENERATING PROJECT

██████████ GI #549, proposes to interconnect to the 345 kV Idaho Power transmission system with a total injection of 100 MW (maximum project output) using Sungrow SG3150U inverters. The interconnection point is IPC's 345 kV ██████████
This project's projected in-service date is December 1, 2023.

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.

Table 1: Project Specifications

Project Location	[REDACTED]
Number and Type of Generators	Solar Photovoltaic, Sungrow SG3150U Inverters Quantity = 34
Individual Generator Nameplate Rating	3,150 kVA
Total Output Power Rating	107,100 kVA 101,660 kW (at +/- .95 power factor)
Rated Power Factor	0.8 Leading / 0.8 Lagging
New Step-Up Transformer	(34) 3,150 kVA, 3-phase, 0.630kV(Wye-Gnd)/ 34.5kV(Delta), Z = 5.75% on 3,150 kVA base
New Step-Up Transformer	(1) 115 MVA, 3-phase, 34.5kV(Wye- Gnd)/345kV(Wye-Gnd)/13.8kV(Delta), Z = 9.82% on 69 MVA base
Interconnection Voltage	345 kV

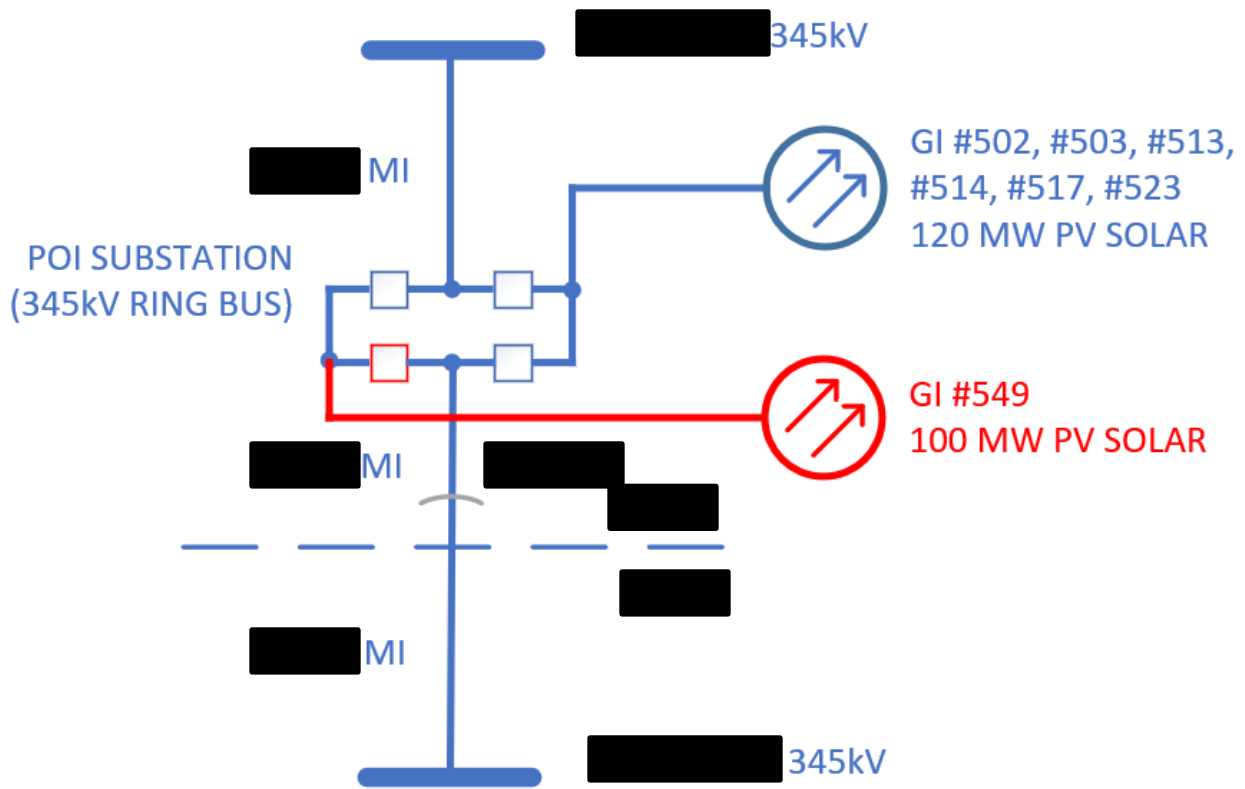


Figure 1 GI#549 Connection to [REDACTED] 345kV Line

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.

6.0 DESCRIPTION OF POWER FLOW CASES

The Western Electricity Coordination Council (WECC) 2021 Heavy Summer 3 Operating Base Case was chosen as the initial power flow case for this System Impact Study. This initial power flow case was modified to include the proposed GI #502, #503, #513, #514, #517, and #523 PV generation projects (120 MW total) as well as the proposed GI # 549 PV generation project.

The customer-provided power flow data was used to model GI #549.

The case was modified to develop scenarios with flows on [REDACTED] stressed to the path rating (as defined in the 2021 WECC Path Catalog) in both directions: [REDACTED]

Each scenario case was benchmarked using a pre-Project case (Project offline) and compared to a post-Project case (Project online at full output) to determine the system impact of the proposed GI #549 Project on the surrounding transmission system.

7.0 STUDY RESULTS

8.1 Power Flow Results (Thermal and Voltage Analysis)

Power flow analysis was performed on both the pre- and post-Project cases described above to simulate the impact of the proposed GI #549 Project.

The contingencies simulated included several N-1 and N-2 outages in the Idaho Power system and several N-1 outages in the [REDACTED] transmission system. Remedial action schemes (RAS) in [REDACTED] were also simulated.

The study area included WECC base case areas IDAHO and [REDACTED]. The study area was monitored for thermal and voltage violations pre- and post- contingency by evaluating the following limits for Bulk Electric System (BES) facilities:

- Pre-contingency flows within continuous MVA ratings
- Post-contingency flows within summer emergency MVA ratings
- Pre-contingency bus voltages between 0.95 per unit and 1.05 per unit.
- Post-contingency voltages between 0.90 per unit and 1.10 per unit.
- Post-contingency voltage deviation at load buses must be less than 8%.

Power flow solution was achieved for all the contingencies simulated. Key findings from the power flow analysis are as follows:

- Overloading. There were no significant overloads that resulted from adding the Project to the system.
- Voltage Deviation. There were no significant voltage deviations in the power flow analysis at load buses that resulted from adding the Project to the system.
- Voltage Violations. There were no significant voltage violations in the power flow analysis that resulted from adding the Project to the system.

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.

- [REDACTED] Ratings. It is expected that the Project can be interconnected without adversely impacting the [REDACTED] ratings as documented in the 2021 WECC Path Rating Catalog

7.2 Reactive Power Requirements

The installed reactive power capability of the project must have 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 (up to maximum output of 100 MW).

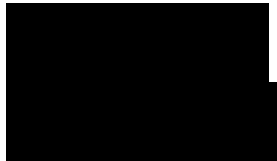
Power flow analysis indicates that the reactive compensation range of the proposed GI #549 does **not** have sufficient capacity to provide a 0.95 leading power factor at the POI at full output of 100 MW based on the data provided. Given a maximum output of 100 MW at the POI, 32.9 MVAR is required at the POI to achieve a power factor of 0.95. A simulation of the inverters supplying a maximum output of 100 MW of real power and a maximum output of 33.44 MVAR (according to power flow data provided by customer) of reactive power from the inverters, results in 16.4 MVAR being supplied at the POI with a POI voltage of 1.0 per unit. This is lower than the required 32.9 MVAR to achieve 0.95 power factor. The difference between the amount of reactive power supplied by the inverters and the reactive power measured at the POI is due to reactive losses in the GSU transformer, collector system, and inverter step-up transformers. These reactive losses are based on the power flow data provided by the customer to represent these facilities. Meeting this requirement is the responsibility of the Interconnection Customer.

The Project does have sufficient capacity to provide a 0.95 lagging power factor at the POI at minimum output of 0 MW based on the data provided by the customer.

7.3 Transient Stability Results

Transient stability runs were simulated for 10 seconds to ensure the system is stable and positively damped. All faults were simulated as three-phase faults with zero fault impedance.

The following buses were monitored and plotted during the Transient Stability simulation runs:



- POI 345kV

The following transient stability simulations were performed:

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.

- 3PH fault on [REDACTED] 345kV line, 90% from [REDACTED], 4 cycle clearing time
- 3PH fault on [REDACTED] 345kV line, 90% from [REDACTED], 4 cycle clearing time
- 3PH fault at the POI 345kV bus with 4 cycle clearing time
- 3PH fault on [REDACTED] 345kV line, 90% from [REDACTED], POI substation breaker failure, 11 cycle clearing time

These simulations were performed on cases with [REDACTED] at [REDACTED] and on cases with [REDACTED] at [REDACTED].

Transient stability simulations were monitored for violations of the transient stability performance criteria listed in WECC regional criteria TPL-001-WECC-CRT-3.2. The results showed no transient stability violations.

7.4 Post-Transient Voltage Stability (Reactive Margin) Results

Post-transient voltage stability analyses were performed for the scenario cases with the Project modeled. Post-transient voltage stability was demonstrated due to all simulated contingencies reaching a valid power flow solution with 105% of rated [REDACTED] flow in the north-to-south and south-to-north directions.

7.5 Short Circuit Results

Studies indicate that there is adequate short circuit interrupting capability on breakers in the area for the addition of this generation project.

7.6 Other Operating Requirements

GI #549 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. And GI #549 will be required to install a plant controller for managing the real power output at the project POI.

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*.

The Project will be required to reduce output to levels directed by IPC Grid Operations during transmission system contingencies and other reliability events. This will be accomplished with a Generator Output Limit Control (GOLC) setpoint sent from IPC to the Project.

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.

8.0 COST ESTIMATE OF REQUIRED FACILITIES

In Table 2 below is a conceptual-level cost estimate to interconnect the GI #549 [REDACTED] project to Idaho Power’s system. This cost estimate assumes that the necessary facilities were installed to integrate senior projects GI #502, #503, #513, #514, #517, and #523 as identified in TSR OASIS #88754178. Should these projects drop out of the queue then this project will be responsible for the facilities.

GI #549 [REDACTED] Project	
Network Resource Interconnection Facilities and Network Upgrades¹	Cost
Integrate GI#549 to POI 345kV Station¹ Add a new 345kV ring bus bay and associated protection and metering	\$1,565,000
Subtotal	\$1,565,000
Contingencies (~20%)	\$313,000
Subtotal	\$1,878,000
Overheads (~7.5%)	\$141,000
Total Estimated Cost	\$2,019,000

Table 2. Estimated GI #549 Project’s Required Facilities Costs

(1) Project GI#549 will utilize the facilities constructed for GI #502, #503, #513, #514, #517, and #523

- The above estimate includes Interconnection Facilities and Network Upgrades. A breakdown of costs of Interconnection Facilities and Network Upgrades will be provided in the Facilities Study.
- Note that these estimates do not include the cost of the customer’s equipment/facilities
- 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 in the Facilities Study phase of the interconnection process.

The cost estimate includes direct equipment and installation labor costs, indirect labor costs, general overheads, and a contingency allowance. These are only cost estimates and final charges to the customer will be based on the actual construction costs incurred. It should be noted that the

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.

preliminary cost estimate of \$2,019,000 does not include the cost of the customer's owned equipment to construct the solar generation site.

9.0 CONCLUSIONS

GI #549 can be interconnected to the Idaho Power 345kV transmission system.

Interconnection requirements, detailed in Section 8.0 totaling \$2,019,000 are required to interconnect the Project. This cost estimate assumes that the necessary facilities were installed to integrate senior projects GI #502, #503, #513, #514, #517, and #523 as identified in TSR OASIS #88754178.

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. A Transmission Service Request (TSR) will be required to study the Transmission System Impacts.

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.

APPENDIX A

A-1.0 Method of Study

The SIS plan inserts the Project up to the maximum requested injection into the selected Western Electric Coordinating Council (WECC) power flow case and then, using Power World Simulator or GE's Positive Sequence Load Flow (PSLF) analysis tool, the impacts of the new resource on Idaho Power's transmission system (lines, transformers, etc.) within the study area are analyzed. The WECC and Idaho Power reliability criteria and Idaho Power operating procedures were used to determine the acceptability of the configurations considered. For distribution feeder analysis, Idaho Power utilizes Advantica's 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 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 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) 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.

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.

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 Electrical System Protection Guidance

IPCo requires electrical system protection per the Facility Connection Requirements document found on the Idaho Power Web site,

<https://docs.idahopower.com/pdfs/BusinessToBusiness/FacConnReq.pdf>

A-4.0 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.

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.