

**GENERATOR INTERCONNECTION  
OPTIONAL INTERCONNECTION STUDY REPORT**

for integration of the proposed

**240 MW [REDACTED]  
(GI PROJECT #605)**

to the

**IDAHO POWER COMPANY ELECTRICAL SYSTEM**

in

**ELMORE COUNTY, IDAHO**

for

**[REDACTED]  
Report v.1**

**April 26, 2022**

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## 1.0 Introduction

██████████ has contracted with Idaho Power Company (“Transmission Provider”) to perform a Generator Interconnection Optional Interconnection Study (OIS) for the integration of the proposed 240 MW ██████████ project (the Project) assuming the exclusion of earlier queued Interconnection Request GI #530. The Project has applied to connect to Idaho Power’s transmission system for an injection of 240 MW at a single Point of Interconnection (POI) at 230kV. The POI is IPC’s ██████████ Station 230kV bus.

The Project location is in Idaho Power Company’s (IPC’s) Capital Region in Elmore County, Idaho. The Project latitude and longitude coordinates are approximately ██████████. The project is Generation Interconnect (GI) queue number 605 (GI #605).

The Project has chosen in the Optional Interconnection Study to be studied for Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS). This is an informational only report and while terms like ERIS and NRIS are used, this sensitivity study does not convey any type of Interconnection Service.

This report documents the basis for and the results of this Optional Interconnection Study for the GI #605 Generation Interconnection Customer. The report describes the proposed Project, the determination of the Project interconnection requirements, and estimated costs for integration of the Project to the Transmission Provider transmission system. This report satisfies the OIS requirements of the Idaho Power Tariff.

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## 2.0 Summary

The impact to the Idaho Power transmission system of interconnecting the Project to the [REDACTED] Station 230kV bus, assuming the exclusion of earlier queued Interconnection Request GI #530, was evaluated.

The GI #605 Project is combined PV and BESS and it has been assumed that the BESS will be charged via the PV output. [REDACTED] will need to demonstrate the operating procedures and control measures which prevents the BESS from being charged via IPC's transmission system. However, if the intent is also to be able to charge the BESS via IPC's transmission system, [REDACTED] will need to make an IPC Large Load Service request.

GI #605 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. GI #605 will be required to manage the real power output of their generation project at the POI. Also, it may be beneficial for [REDACTED], for their own modeling compliance requirements, to install additional PMU devices at their facilities to monitor the generation source(s).

The total "Energy Resource Interconnection Service" generation interconnection preliminary cost estimate to interconnect the Project to the primary study POI is as follows:

- Energy Resource Interconnection Service at proposed 230kV POI - **\$3,479,730**

See Section 6.5 Energy Resource Interconnection Service Cost Estimate for the required facilities and cost breakdowns.

The total "Network Resource Interconnection Service" generation interconnection preliminary cost estimate to interconnect the [REDACTED] project is as follows:

- Network Resource Interconnection Service - **\$84,794,162**
  - Appendix B contains a list of contingent transmission facility upgrades associated with senior queued projects and their estimated costs.

See Section 7.3 Network Resource Interconnection Service Cost Estimate for the required facilities and cost breakdowns.

The cost estimates include 20% contingency and 6.25% overhead. 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.

The schedule for designing, procuring, and constructing facilities 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.

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### 3.0 Scope of Optional Interconnection Study

The Optional Interconnection Study was done 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 Idaho Power system. As listed in the Optional Interconnection Study Agreement, the Optional Interconnection Study report provides the following information:

- identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection;
- identification of any thermal overload or voltage limit violations resulting from the interconnection;
- identification of any instability or inadequately damped response to system disturbances resulting from the interconnection and
- description and non-binding, good faith estimated cost of facilities required to interconnect the Large Generating Facility to the Transmission System and to address the identified short circuit, instability, and power flow issues.

All other proposed Generation projects prior to this Project in the Generator Interconnect queue were considered in this study except for GI #530. 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>.

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#### 4.0 Contingent Facilities

IPC projects queue GI #551, GI #557, GI #567, GI #588, GI #590, and GI #604 are senior queued projects in the affected area of IPC’s transmission system. Idaho Power studied GI #605 with all Network Upgrades identified for these senior queued projects as in-service.

GI #605 Energy Resource Interconnection Service, ERIS, at the [REDACTED] Station 230kV bus POI is not contingent upon upgrades associated with any senior queued project.

GI #605 Network Resource Interconnection Service, NRIS, at the [REDACTED] Station 230kV bus POI is contingent upon upgrades associated with senior queued projects. Refer to Appendix B for a list of contingent transmission facility upgrades and their estimated costs.

#### 5.0 Description of Proposed Generating Project

##### Assumptions

The primary point of interconnection for GI #605 is the [REDACTED] Station 230kV bus. Assumed GI #605 Project’s maximum generation is 240 MW from the combined Photovoltaic (PV) and Battery Energy Storage System (BESS). BESS will be charged via PV output and not Idaho Power’s transmission system. The Project’s Commercial Operation Date (COD) is [REDACTED].

<b>Project Location</b>	[REDACTED]
<b>Interconnection Voltage</b>	230kV
<b>Number and Type of Generators</b> <b>Solar:</b>	[REDACTED]
<b>Individual Solar Generator Nameplate Rating</b>	[REDACTED]
<b>Total Solar Output Rating</b>	[REDACTED]
<b>Number and Type of Generators</b> <b>Battery:</b>	[REDACTED]
<b>Individual Battery Generator Nameplate Rating</b>	[REDACTED]
<b>Total Battery Output Rating</b>	[REDACTED]
<b>Substation Step-Up Transformer</b>	[REDACTED]

Table 1. GI #605 Project Specifications

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## 6.0 Energy Resource Interconnection Service (OIS ERIS)

Energy Resource Interconnection Service allows the Interconnection Customer to connect its Generating Facility to Transmission Provider's transmission system and to be eligible to deliver electric output using firm or non-firm transmission capacity on an as available basis.

The GI #605 Project has applied to connect to the Idaho Power transmission system for an injection of 240 MW with a new 230kV interconnection at the [REDACTED] Station 230kV bus. All generation projects in the area ahead of this Project in the IPC generation queue and their associated transmission system improvements, except for GI #530, were modeled in a power flow analysis to evaluate the system impact of interconnecting GI #605. Power flow analysis indicates that the Project's full output of 240 MW can be interconnected at the POI.

### 6.1 Description of Substation/Transmission Facilities

As an Energy Resource Interconnection Service, a Transmission Service Request will be required to determine the specific Network Upgrades required to deliver the Project output to a designated point of delivery. Listed below are the required transmission facilities to interconnect the Project for ERIS:

- The proposed interconnection will require two new line terminal interconnections at the [REDACTED] Station 230kV bus.
- The second line terminal is required to prevent a single contingency breaker failure from dropping more generation than IPC's Most Severe Single Contingency (MSSC).

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

### 6.2 Description of Distribution Facilities

No distribution facilities are directly impacted by this Project.

### 6.3 Short Circuit Study Results

The short circuit/fault duty at approximate GI #605 POI 230kV bus location (with/without GI #605 modeled) is as follows:

Fault Study (w/o GI #605)			
Location	SLG (A)	LTL (A)	3PH (A)
[REDACTED] 230kV Bus	[REDACTED]	[REDACTED]	[REDACTED]

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Fault Study (w/ GI #605)			
Location	SLG (A)	LTL (A)	3PH (A)
██████████ 230kV Bus	██████████	██████████	██████████

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider’s existing 230kV breakers after this Project is interconnected.

#### 6.4 Electric System Protection Results and Grounding Requirements

For 230kV line protection, the Transmission Provider’s System Protection Department utilizes permissive and line differential protection schemes integrated with our existing digital communication infrastructure. Digital communication infrastructure for the interconnection customer’s 230kV line terminal will be the responsibility of said interconnection customer.

#### 6.5 Energy Resource Interconnection Service Cost Estimate

In Table 2 below, a summary is provided of the facilities and conceptual costs required to interconnect the GI #605 Project to the Transmission Provider’s transmission system.

GI #605 ██████████ Project Energy Resource Interconnection Service Facilities	
ERIS Transmission Upgrades:	Cost
<b>Interconnection Facilities</b>	
██████████ 230kV Line Terminal for GI #605	\$1,789,600
<b>Network Upgrades</b>	
Additional ██████████ 230kV Line Terminal to avoid increase of MSSC	\$939,600
<b>Subtotal</b>	<b>\$2,729,200</b>
Contingencies (~20.0%) (1)	\$545,840
<b>Subtotal</b>	<b>\$3,275,040</b>
Overheads (~6.25%) (2)	\$204,690
<b>Energy Resource Interconnection Service – Total Estimated Cost (3)</b>	<b>\$3,479,730</b>

**Table 2.** Estimated GI #605 Project’s Energy Resource Generation Interconnection Costs

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- (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.
  - 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.
  - Note that these costs assume the use of in-house resources.
  - 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 the Facility Study.

The schedule for designing, procuring, and constructing facilities 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.

## **7.0 Network Resource Interconnection Service (OIS NRIS)**

Network Resource 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 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. Network Resource Interconnection Service in and of itself does not convey Transmission Service.

### **7.1 Description of Power Flow Cases**

For the Network Resource Interconnection Service study, three power flow cases were used to study the Transmission Provider's transmission system with westbound and eastbound transmission flows to determine the required Network Transmission Upgrades.

The WECC 2023 Heavy Summer case was chosen as a power flow base case for the study. The case was modified to represent a summer month with high west to east (eastbound) transfers across Midpoint West.

For the second case, a WECC 2022 Light Winter case was modified to represent a shoulder month condition with high east to west (westbound) transfers across Midpoint West.

For the third case, the WECC 2023 Heavy Summer case was modified to represent a summer month with medium wind, high solar, and high gas generation east of Boise with high transfers into the Boise area.

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## 7.2 Network Resource Interconnection Service Transmission Upgrades

From the power flow/contingency analysis, additional Network Transmission upgrades were identified for the integration of GI #605 in addition to the Energy Resource generation interconnection facilities. Listed below are the required transmission facilities to interconnect the Project for NRIS:

1. Reconductor [REDACTED] – [REDACTED] 230kV line (~ [REDACTED] miles) with [REDACTED] conductor
2. Reconductor [REDACTED] – [REDACTED] 230kV line (~ [REDACTED] miles) with [REDACTED] conductor
3. Reconductor [REDACTED] – [REDACTED] 230kV line (~ [REDACTED] miles) with [REDACTED] conductor
4. Reconductor [REDACTED] – [REDACTED] 138kV line (~ [REDACTED] miles) with [REDACTED] conductor

IPC projects queue GI #551, GI #557, GI #567, GI #588, GI #590, and GI #604 are senior queued projects in the affected area of IPC’s transmission system. Idaho Power studied GI #605 with all Network Upgrades identified for these senior queued projects as in-service. Appendix B contains a list of contingent transmission facility upgrades associated with senior queued projects and their estimated costs.

## 7.3 Network Resource Interconnection Service Cost Estimate

Table 3 below is a summary of the Network Transmission generation interconnection facilities and conceptual costs required to interconnect the GI #605 Project to the Transmission Provider’s transmission system for Network Resource Interconnection Service.

<b>GI #605 [REDACTED] Project Network Resource Interconnection Service Facilities</b>	
<b>NRIS Transmission Upgrades:</b>	<b>Cost</b>
<b>Network Upgrades:</b>	
Reconductor [REDACTED] – [REDACTED] 230kV line (~ [REDACTED] miles) with [REDACTED] conductor	\$27,130,000
Reconductor [REDACTED] – [REDACTED] 230kV line (~ [REDACTED] miles) with [REDACTED] conductor	\$22,600,350
Reconductor [REDACTED] – [REDACTED] 230kV line (~ [REDACTED] miles) with [REDACTED] conductor	\$2,509,076

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Reconductor [REDACTED] – [REDACTED] 138kV line (~ [REDACTED] miles) with [REDACTED] conductor	\$11,536,599
<b>Subtotal</b>	<b>\$63,776,025</b>
Contingencies (~20.0%) (1)	\$12,755,205
<b>Subtotal</b>	<b>\$76,531,230</b>
Overheads (~6.25%) (2)	\$4,783,202
<b>NRIS – Subtotal</b>	<b>\$81,314,432</b>
ERIS – Total Estimated Cost	\$3,479,730
<b>NRIS – Total Estimated Cost (3)</b>	<b>\$84,794,162</b>

**Table 3.** Estimated GI #605 Network Resource Generation Interconnection Costs

(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.

- 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.
- Note that these costs assume the use of in-house resources.
- 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 the Facility Study.

The schedule for designing, procuring, and constructing facilities 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.

## 8.0 Voltage Stability Analysis

A Voltage Stability study was performed using the WECC 2023 Heavy Summer case with Midpoint West West-to-East flows stressed up to 1743 MW (105% of the Path Rating) and the WECC 2022 Light Winter case with Midpoint West East-to-West flows stressed up to 2940 MW (105% of the Path Rating). All contingencies solved successfully so there were no Voltage Stability issues found for the Project.

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## 9.0 Transient Stability Analysis

The WECC 2022 Light Winter operating case and PowerWorld Simulator version 22 analysis tool were used to perform the transient stability analysis.

The results showed no transient stability violations. 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 Idaho Power if testing or real-time observations indicate a need.

## 10.0 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 (supplying) to 0.95 lagging (absorbing) at the POI over the range of real power output. At full output of 240 MW, the Project would need to be able to provide approximately +/- 78.9 MVAR reactive support at the POI. Based on the information provided, the Project's combined generators can only supply [REDACTED] MVAR at the POI which does not meet the required reactive power capability.

GI #605 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations, and GI #605 will be required to manage the real power output of their stated generation at the Project's 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*.

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 #605. The specific costs associated with the IPC requirements for interconnection customers with aggregate facilities larger than 20 MW to provide PMU data to IPC will be identified in the Facility Study should the generation interconnection customer choose to proceed to that phase of the interconnection process. Also, it may be beneficial for [REDACTED], for their own modeling compliance requirements, to install additional PMU devices at their facilities to monitor the generations sources separately.

## 11.0 Conclusion

An Optional Interconnection Study (OIS) was performed for the integration of the proposed 240 MW [REDACTED] project assuming the exclusion of earlier queued Interconnection Request GI #530. The Optional Interconnection Study is solely for informational purposes only. This study is a sensitivity analysis and does not convey Interconnection Service.

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Interconnection requirements detailed in Section 6.5 totaling **\$3,479,730** are required to interconnect the Project for Energy Resource Interconnection Service at the proposed [REDACTED] 230kV bus POI. Additional upgrades were identified for the integration of the Project for Network Resource Interconnection Service detailed in Section 7.3 totaling **\$84,794,162**. The Network Resource Interconnection Service is also reliant on facilities identified in senior queued generation interconnections detailed in Appendix B.

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## APPENDIX A

### A-1.0 Method of Study

The Optional Interconnection 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 Electric 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. 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 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 or 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

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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 on the distribution system 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 Facility Connection Requirements found on the Idaho Power Web site,

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

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## APPENDIX B

Table B1 is a summary of the senior queued Network Transmission facility upgrades required by GI #605 and their conceptual costs.

<b>NRIS Transmission Upgrades:</b>	<b>Cost</b>
██████████ – ██████████ <b>138kV Line</b> Rebuild ~ ██████████ miles of 138kV line with ██████████ Conductor	\$1,455,800
Contingencies (~20%)	\$291,160
<b>Subtotal</b>	<b>\$1,746,960</b>
Overheads (~6.25%)	\$109,185
<b>Network Transmission – Total Estimated Cost</b>	<b>\$1,856,145</b>

**Table B1:** Senior Queued Transmission Upgrades Required by GI #605

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