

**GENERATOR INTERCONNECTION  
SYSTEM IMPACT STUDY REPORT**

for integration of the proposed

**300 MW [REDACTED] PROJECT  
(GI PROJECT #607)**

to the

**IDAHO POWER ELECTRICAL SYSTEM**

in

**SWEETWATER COUNTY, WYOMING**

for

[REDACTED]

**REPORT v1.0**

**January 14, 2022**

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## Table of Contents

<b>1.0</b>	<b>Introduction.....</b>	<b>3</b>
<b>2.0</b>	<b>Summary.....</b>	<b>4</b>
<b>3.0</b>	<b>Scope of Interconnection System Impact Study.....</b>	<b>6</b>
<b>4.0</b>	<b>Contingent Facilities .....</b>	<b>6</b>
<b>5.0</b>	<b>Description of Proposed Generating Project.....</b>	<b>6</b>
<b>6.0</b>	<b>Energy Resource Interconnection Service (ERIS).....</b>	<b>7</b>
<b>6.1</b>	<b>Transmission Line Facilities.....</b>	<b>7</b>
<b>6.2</b>	<b>Substation Facilities .....</b>	<b>7</b>
<b>6.3</b>	<b>Grounding Requirements .....</b>	<b>7</b>
<b>6.4</b>	<b>System Protection Assessment .....</b>	<b>8</b>
<b>6.5</b>	<b>Energy Resource Interconnection Service Cost Estimate .....</b>	<b>8</b>
<b>7.0</b>	<b>Network Resource Interconnection Service (NRIS).....</b>	<b>9</b>
<b>7.1</b>	<b>Description of Power Flow Cases.....</b>	<b>9</b>
<b>7.2</b>	<b>Network Resource Transmission Upgrades.....</b>	<b>9</b>
<b>7.3</b>	<b>Network Resource Interconnection Service Cost Estimate.....</b>	<b>10</b>
<b>8.0</b>	<b>Transient Stability Analysis.....</b>	<b>10</b>
<b>9.0</b>	<b>Description of Operating Requirements.....</b>	<b>10</b>
<b>10.0</b>	<b>Conclusion .....</b>	<b>11</b>
	<b>APPENDIX A.....</b>	<b>12</b>
<b>A-1.0</b>	<b>Method of Study.....</b>	<b>12</b>
<b>A-2.0</b>	<b>Acceptability Criteria .....</b>	<b>12</b>
<b>A-3.0</b>	<b>Electrical System Protection Guidance.....</b>	<b>13</b>

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## 1.0 Introduction

██████████ (Customer) has contracted with Idaho Power Company (IPCO) to perform a Generator Interconnection System Impact Study (SIS) for the integration of a proposed 300 MW ██████████ Project (Project) located in PacifiCorp's Southern Wyoming Region in Sweetwater County, Wyoming (~ coordinates ██████████° N, ██████████° W).

The Project has been assigned an IPCO Generation Interconnect queue number 607 (GI #607). In the SIS Agreement, the Project has chosen to have studies performed for both Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS).

The requested Point of Interconnection (POI) for this study is the Jim Bridger 345 kV bus, 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 GI #607 Generation Interconnection. The report describes the proposed Project and identifies interconnection requirements with associated cost estimates for integration into the Idaho Power and PacifiCorp transmission system. This report satisfies the SIS requirements of the Idaho Power Tariff.

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## 2.0 Summary

The impact to the transmission system of interconnecting the Project to the Jim Bridger 345 kV bus was evaluated and the results of this study work confirm that GI #607 can be interconnected at the proposed POI with the specified network upgrades.

ERIS and/or NRIS in and of themselves do not convey transmission service. In addition to Network Upgrades identified in the Interconnection System Impact Study:

- For ERIS, the Interconnection Customer's ability to inject its Large Generating Facility output beyond the Point of Interconnection will depend on the existing capacity of Transmission Provider's Transmission System at such time as a transmission service request is made that would accommodate such delivery. The provision of firm Point-to-Point Transmission Service or Network Integration Transmission Service may require the construction of additional Network Upgrades.
- For NRIS, additional studies to reduce or eliminate congestion may be required and these studies may identify the need for additional upgrades. To the extent Interconnection Customer enters into an arrangement for long term transmission service for deliveries from the Large Generating Facility outside Transmission Provider's Transmission System, such request may require additional studies and upgrades in order for Transmission Provider to grant such request.

As the operator of Jim Bridger, PacifiCorp will be responsible for the design and construction of all ERIS facilities. The following Idaho Power estimate is subject to change.

The total ERIS preliminary cost estimate to interconnect the Project is: **\$6,447,951**

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

Analysis of NRIS for this SIS is provided for the following two Operational Conditions yet to be negotiated in the Generation Interconnection Agreement (GIA):

**Operational Condition 1:** If IPCO agrees to regulate its share of existing Jim Bridger generation such that the combination of IPCO Jim Bridger generation plus the Project output does not exceed IPCO's existing transmission capacity. NRIS could be granted without additional network upgrades beyond those specified for ERIS.

**Operational Condition 2:** If IPCO does not agree to regulate its share of existing Jim Bridger generation the sum of IPCO Jim Bridger generation plus the Project output overloads the Jim Bridger-Populus #1 & #2 345 kV lines pre-contingency and exceeds IPCO's existing transmission capacity. Additional transmission capacity would need to be constructed by becoming a partner of 500 kV of the [REDACTED] projects Segment D.3 from Anticline to Populous and Segment E from Populous to Hemingway and accelerate their construction schedule. Total cost estimates for these [REDACTED] segments are expected to be in range of **\$2.5 billion**.

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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 generally estimates approximately 36 months, following the execution of a GIA, will be needed to design, procure, and construct the interconnection facilities specified; however, the magnitude of upgrades required under NRIS Operational Condition 2 may take considerably longer. A more detailed 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.

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### 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 is not contingent upon the Network Upgrades of any senior queue projects.

### 5.0 Description of Proposed Generating Project

██████████, GI #607, proposes to interconnect to the PacifiCorp transmission system at 345 kV with a total injection of 300 MW (maximum Project output). The POI is assumed to be on the Jim Bridger 345 kV bus.

**Table 1: Project Specifications**

<b>POI Location</b>	<b>Lat:</b> ██████████ <b>Long:</b> ██████████
<b>Number and Type of Generators</b>	(130) ██████████ - Wind (96) ██████████ - Solar (96) ██████████ - Battery
<b>Individual Generator Nameplate Rating</b>	Wind 2.4 MW Solar 3.26 MW Battery 3.26 MW
<b>Total Output Power Rating</b>	312.0 MW Wind 312.96 MW Solar 312.96 MW Battery
<b>Rated Power Factor</b>	Unspecified
<b>New Step-Up Transformer</b>	#1: 170 MVA, 3-phase, 34.5/345/13.8 kV, Z = 8.5%, X/R = 40 #2: 170 MVA, 3-phase, 34.5/345/13.8 kV, Z = 8.5%, X/R = 40
<b>Interconnection Voltage</b>	345 kV

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## **6.0 Energy Resource Interconnection Service (ERIS)**

ERIS 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.

The ERIS study was performed using PowerWorld Simulator v22 with two WECC base cases; 2026 Heavy Winter case was modified with the addition of the Project and increasing WECC Path 19 & Path 17 flows to their limits. 2024 Light Spring case was modified with the addition of the Project and increasing WECC Path 19 flows to its limit. This represents peak loading of the transmission system using both winter and summer ratings.

Contingency Analysis shows no thermal or voltage violations resulting from the addition of the project.

### **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 those required to interconnect the Project in Section 6.5.

### **6.2 Substation Facilities**

The Jim Bridger substation yard will need to be expanded and the existing 345 kV bus work extended to make room for a new line bay with two new power circuit breakers, associated switches, protective relaying systems, SCADA, communications, and a Generation Interconnection metering package in a configuration similar to Figure 1. The POI will be the two circuit breakers for the customer's line.

REDACTED

**Figure 1 – Jim Bridger 345 kV Bus w/ GI 607**

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 345 kV Wye-Grounded/Wye-Grounded with Delta Tertiary transformers specified in the Idaho Large Generator Interconnection Request for [REDACTED], GI #607, should provide an adequate ground return for transmission line protection/relaying.

Grounding requirements and acceptability criteria are found in Appendix A.

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## 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.

<i>Fault Study (Baseline w/o additional gen)</i>			
Location	SLG (A)	LTL (A)	3PH (A)
<b>JBGR 345kV Bus</b>	30962	24443	28239

<i>Fault Study (with GI#607)</i>			
Location	SLG (A)	LTL (A)	3PH (A)
<b>JBGR 345kV Bus</b>	31595	24737	28364

## 6.5 Energy Resource Interconnection Service Cost Estimate

The following upgrades will be required to facilitate the interconnection of [REDACTED], GI #607:

- Expand the substation yard and extend the 345 kV bus work to make room for a new line bay consisting of two power circuit breakers, SEL-421 protective relay, which requires 3-phase potential transformers (PTs) and 3-phase current transformers (CTs), Generation Interconnection Metering package, SCADA, and remote connectivity.
- Construct transmission structure to terminate customer's line from the generating facility.
- 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	\$4,884,812
Contingency 20% (1)	\$976,962
Total unloaded costs	\$5,861,774
Overheads (2)	\$586,177
<b>Total Conceptual-level Cost Estimate in 2020 dollars (3)</b>	<b>\$6,447,951</b>

(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.

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(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 Transmission and Distribution System Impact Studies.

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 Interconnection Service (NRIS)**

NRIS 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. NRIS in and of itself does not convey Transmission Service.

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

The same cases that were used for the ER Interconnection Service were used to study the NR Interconnection Service with the exception that the WECC Path flows were increased to their limits prior to the addition of the Project.

### **7.2 Network Resource Transmission Upgrades**

Network upgrades required to grant NR Interconnection service from the POI to Idaho Power load are dependent on the Operational Conditions negotiated in the GIA.

**Operational Condition 1:** If IPCO agrees to regulate its share of existing Jim Bridger generation such that the combination of IPCO Jim Bridger generation plus the Project output does not exceed IPCO's existing transmission capacity. NRIS could be granted without additional network upgrades beyond those specified for ERIS.

**Operational Condition 2:** If IPCO does not agree to regulate its share of existing Jim Bridger generation. The sum of IPCO Jim Bridger generation plus the Project output overloads the [REDACTED] & [REDACTED] 345 kV lines pre-contingency and exceeds IPCO's existing transmission capacity. Additional transmission capacity would need to be constructed. The following three options for providing additional capacity were considered:

- 1) Rebuild all three existing 345 kV lines from [REDACTED] with three conductor bundles which in total is approximately 800+ miles of 345 kV lines.
- 2) Construct a new 345 kV line from [REDACTED] substations. Establish line routing, permit, and construct approximately 250+ miles of 345 kV line.
- 3) Become a partner with adequate capacity share in the planned 500 kV [REDACTED] segment [REDACTED] and segment [REDACTED] substations and accelerate their

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construction.

Options 1 & 2 also require additional upgrades to IPCO's internal system on Path 17 and Midpoint West. At a minimum, add series compensation to the [REDACTED] 345 kV line and add new 500/345 kV transformer at [REDACTED] and build a new [REDACTED] 500 kV line. For cost and time constraints, Option 1 & 2 were not considered viable.

Option 3, the [REDACTED] segments are well underway in the permitting process and was been deemed more likely to be built in the time frame of the Project.

### **7.3 Network Resource Interconnection Service Cost Estimate**

A detailed estimate for Option 3 was not possible for this report; however, total [REDACTED] estimates for these segments are be expected to be in the range of **\$2.5 billion**.

### **8.0 Transient Stability Analysis**

PowerWorld Simulator v22 was used to perform the transient stability analysis on the 2024 Light Spring WECC base case modified to increase WECC Path 19 to its limit.

When studied the plant controllers were set to control the 345 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 300 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 300 MW, the Project would need to be able to provide approximately +/- 99 MVAR reactive support at the POI. Based on the information provided, the combined generation resources proposed by Project should be able to provide the necessary 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 GI #607. The specific costs associated with this requirement will be identified in the Facility Study phase of the interconnection process.

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## **10.0 Conclusion**

The requested interconnection of the [REDACTED] Project, GI #607, to the Jim Bridger 345 kV bus in PacifiCorp's transmission system was studied.

The results of this study work confirm that GI #607 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 for ERIS. Interconnection requirements for NRIS are dependent on the Operational Conditions negotiated in the GIA as described in Section 7.2.

Generator interconnection service does not in any way convey any right to deliver electricity to a specific customer or point of delivery.

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## **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 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 POI, 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 VAr 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.

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### **A-3.0 Electrical System Protection Guidance**

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

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

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## Revision History

<b>Date</b>	<b>Revision</b>	<b>Initials</b>	<b>Summary of Changes</b>
12/28/2021	0.1	GMT	Draft Original
1/14/2022	1.0	GMT	Submitted Version

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