# GENERATOR INTERCONNECTION
# OPTIONAL INTERCONNECTION STUDY REPORT

for integration of the proposed

**330 MW [redacted] PROJECT**

**(GI PROJECT #590)**

to the

**IDAHO POWER COMPANY ELECTRICAL SYSTEM**

in

**ELMORE COUNTY, ID**

for

[redacted]

**Report v1.0**

**October 25, 2024**

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## Introduction

[redacted] has contracted with Idaho Power Company (Transmission Provider) to perform a Generator Interconnection Optional Interconnection Study (OIS) for the integration of the proposed 330 MW [redacted] project (the Project) at a single Point of Interconnection (POI) at 230kV on Idaho Power's [redacted] line. The Project is located in Elmore County, ID at approximately [redacted]. The project is assigned Generation Interconnect (GI) queue number 590 (GI #590).

The Project has requested the performance of an Optional Interconnection Study (OIS) under Section 10 of the LGIP. The Project would like to assess the impact of the extensive network upgrades and system expansions occurring in the immediate vicinity of the Project, on the continuing need for the Network Upgrades included in the executed, but suspended GIA. Specifically, The Project would like the OIS to model the impact of the activities listed below on the continuing need for the Project's Network Upgrades:

1. GI#530, the [redacted] project, withdraws from the queue.
2. The [redacted] Substation is completed as planned.
3. The [redacted] Substation is completed as planned.
4. The [redacted] 230kV transmission line is completed as planned.
5. The [redacted] 230kV transmission line is completed as planned.
6. The [redacted] 230kV line is wrapped in-and-out of [redacted].

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 #590 Generation Interconnection Customer. The report describes the study assumptions, 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.

## 1.0 Study Assumptions

- For ERIS, the Interconnection Customer's ability to inject its Large Generating Facility output beyond the POI 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. 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. NRIS in and of itself does not convey Transmission Service.

- Senior-queued generator interconnection requests that were considered in this study are listed in Section 5.0. If any of these requests are withdrawn, the Transmission Provider reserves the right to restudy this request, and the results and conclusions could significantly change.

- The need for transmission modifications, if any, that may be required to provide NRIS will be evaluated on the basis of 100 percent deliverability of the interconnection request under study.
- Power flow analysis requires WECC base cases to reliably balance under peak load conditions the aggregate of generation in the local area, with the Generating Facility at full output, to the aggregate of the load in the Transmission Provider's Transmission System. However, Idaho Power's balancing authority area has proposed generation in the interconnection queue that far surpasses projected load. To reliably balance the power flow case, it is necessary to assume some portions of other resources are displaced by this Project's output in order to assess the impact of interconnecting this Project's generation and that some generation is being transferred regionally through the transmission system.
- The Most Severe Single Contingency (MSSC) is the balancing contingency event, due to a single contingency, that results in the greatest loss (measured in MW) of resource output used by the Balancing Authority at the time of the event to meet firm system load and export obligation. Idaho Power's MSSC is 330 MW. An NRIS interconnection request greater than 330 MW must mitigate single contingencies that would result in the loss of more than 330 MW.
- Idaho Power will not mitigate thermal violations with remedial action schemes (RAS) in the generation interconnection process.
- The following Transmission Provider planned system improvements were assumed in service:
    - [redacted] 500 kV transmission line (2027)
    - [redacted] series capacitance compensation on the [redacted] 345 kV transmission line (2026)
    - [redacted] 500:345 kV transformer (2026)
    - [redacted] 230 kV transmission line (2026)
    - [redacted] 230 kV transmission line (2026)
    - [redacted] 500 kV transmission line (2029)

## 2.0 Description of Proposed Generating Project

The primary POI for the Project is on the [redacted] 230kV line with a maximum injection of 330 MW.

| | |
|---|---|
| **Project Location** | [redacted] |
| **Generator Nameplate Rating** | [redacted] |
| **Total Output Power Rating** | 330 MW to POI |
| **Number and Type of Inverters** | [redacted] |
| **Main Power Transformers (x2)** | [redacted] |
| **Rated Power Factor** | [redacted] |

**Table 1.** GI #590 Project Specifications

## 3.0 Protection and Control

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

For 230 kV line protection, the Transmission Provider's System Protection Department utilizes permissive and line differential protection schemes integrated with digital communication infrastructure. Idaho Power will require OPGW in the static wire position for any lead-line interconnection facility or fiber communication between co-located facilities. Communication infrastructure between the interconnection's customer's 230 kV collector substation and Idaho Power will be the responsibility of the interconnection customer.

The proposed 230 kV [redacted] transformer specified in the Project should provide an adequate ground return path for transmission line protection/relaying.

Grounding requirements and acceptability criteria are found in Appendix A.

## 4.0 Description of Power Flow Cases

For the NRIS study, two power flow cases were used to study the Transmission Provider's transmission system with heavy east to west power flow and a heavy west to east power flow conditions to determine the required Network Transmission Upgrades.

The WECC 2029 Heavy Summer base case was modified to represent a summer month with high west to east (eastbound) transfers across Idaho-to-Northwest, Midpoint West, and Borah West.

The WECC 2029 Light Spring base case was modified to represent a shoulder month condition with high east to west (westbound) transfers across Idaho-to-Northwest, Midpoint West, and Borah West.

## 5.0 Senior-Queued Interconnections

Idaho Power generation interconnection projects GI #551, GI #556, GI #558, GI #562, GI #567, GI #573, and GI #588 are senior-queued projects in the affected area of Idaho Power's transmission system. Idaho Power studied GI #590 with all Network Upgrades for the identified senior-queued projects as in-service.

Changes to senior-queued projects, including in-service date and withdrawal from the queue, may trigger a restudy associated with GI #590.

## 6.0 POI Facilities

Listed below are the required transmission facilities to interconnect the Project at the POI. In Table 2 below, a summary is provided of the facilities and conceptual costs required to interconnect the GI #590 Project to the Transmission Provider's transmission system.

| Item of Work | Estimate |
|---|---|
| A generation interconnection and protection package at the POI with 3 new 230 kV power circuit breakers and line terminals at the Substation, associated switches, protective relays, 3-phase potential transformers (PTs) and 3-phase current transformers (CTs), SCADA and remote connectivity | $3,842,507 |
| Modify existing [redacted] 230kV series capacitor to achieve required impedance | $1,231,498 |
| Facilities between the Point of Change of Ownership and Point of Interconnection | $768,501 |
| Distribution feeder line extensions | $29,215 |
| **Subtotal** | **$5,871,721** |
| Contingency 20% (1) | $1,174,344 |
| **Total unloaded costs** | **$7,046,065** |
| Overheads (2) | $246,612 |
| **Total Conceptual-level Cost Estimate (3)** | **$7,292,677** |
| (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.<br>(2) Overhead costs cover the indirect costs associated with the Project and are subject to change.<br>(3) This cost estimate includes direct equipment, material, labor, and overheads as shown. | |

**Table 2.** Estimated GI #590 Project's POI Costs

Note the following regarding Table 2:

- These estimates do not include the cost of the customer's equipment/facilities or required communication circuits for SCADA, PMU, Protection, and metering.
- These costs assume the use of Idaho Power resources.
- These are non-binding conceptual level cost estimates; final charges to the customer will be based on the actual construction costs incurred.

- These costs include both Interconnection Facilities (direct assigned) and Network Resources (reimbursable).

## 7.0 System Upgrades

Studies did not identify any overloads in either WECC base case. As such, there are no additional Network Upgrades identified.

However, the following IPC contingent facilities were identified:

| Designation | Contingent Facility | Estimate | Estimated In-Service |
|---|---|---|---|
| **NRIS** | [redacted] 500/230kV substation with [redacted] and 500kV transmission lines | TBD | 2029 |
| **NRIS** | Wrap the [redacted] 230kV line in-and-out of [redacted] substation | TBD | TBD |

**Table 3**. GI #590 Contingent Facilities

## 8.0 Voltage Stability

A Voltage Stability study was performed using the WECC 2029 Heavy Summer case with Borah West West-to-East flows at 105% of the path rating and the WECC 2029 Light Spring case with Borah West East-to-West flows at 105% of the path rating. All contingencies solved successfully, there were no voltage stability issues found for the Project.

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

## 9.0 Transient Stability Analysis

The WECC 2029 Light Spring operating case and PowerWorld Simulator version 23 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

GI #590 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Load Serving Operations. The Project will be required to manage the real power output of their generation project at the POI. The Project will be required to operate at 0.95

leading/lagging measured at the high side of the main power transformer to maintain voltage within limits at the POI over the range of real power output.

The Project is required to comply with the applicable Voltage and Current Distortion Limits found in the latest version of the IEEE Standard 519 (*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 the Project. The specific costs associated with the IPC requirements for interconnection customers with aggregate facilities larger than 20 MW to provide PMU data to IPC were not identified in this OIS. 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 [redacted] project. The Project would like to assess the impact of the extensive network upgrades and system expansions occurring in the immediate vicinity of The Project, on the continuing need for the Network Upgrades included in the executed, but suspended GIA. Specifically, The Project would like the OIS to model the impact of the activities listed below on the continuing need for The Project's Network Upgrades:

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The OIS is solely for informational purposes only. This study is a sensitivity analysis and does not convey Interconnection Service. Interconnection requirements detailed in Section 6.0 totaling $7,292,677 are required to interconnect the Project at the POI. No additional Network Upgrades were identified. Contingent facilities detailed in Section 7.0 are also required.

# APPENDIX A

## A-1.0 Method of Study

The power flow case for the Optional Interconnection Study is built using Western Electricity Coordinating Council (WECC) power flow cases as a base case in Power World Simulator. The base cases are then modified to include the senior-queued generation interconnection projects in Section 5.0 and their respective Network Upgrades and POI facilities. The generation project being studied is then added to the cases with the model provided by [redacted] at the requested 330 MW at the requested POI. The base cases are then rebalanced such that the applicable WECC transmission paths are at their WECC path rating with reasonable pre-contingency energy transfers utilizing the Idaho Power transmission system. The power flow model is then analyzed using P1 and P2 category contingencies contained in Table 1 of NERC standard TPL-001. WECC and Idaho Power reliability criteria are applied to the results of the contingency analysis and any violations listed in Table 3, are mitigated with Network Upgrades or contingent facilities, (see also Section 7.0).

## 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 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 website,

**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.

## Revision History

| Date | Revision | Initials | Summary of Changes |
|---|---|---|---|
| 10/25/2024 | 1.0 | SL | Initial OIS Report |