GENERATOR INTERCONNECTION
SYSTEM IMPACT STUDY REPORT

for integration of the proposed

1050 MW [redacted] PROJECT

(GI PROJECT #587)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

JEROME, LINCOLN, and MINIDOKA COUNTIES; IDAHO

for

[redacted]

Report v.0

March 29, 2021

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Revision History

Date	Revision	Initials	Summary of Changes
03/29/2021	0	MDH	Initial Report

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2.0 Summary

The system impact of interconnecting the GI #587 1050 MW generation project to the Transmission Provider's transmission system was evaluated. GI #587 can be interconnected to the Idaho Power transmission system. The Point of Interconnection (POI) is located at Idaho Power's [redacted] station.

The System Impact Study determined if any additional network upgrades 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.

GI #587 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. GI #587 will be required to manage the real power output of their generation project at the POI. Installation of a phasor measurement unit device at the POI will be required to interconnect GI #587. 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 [redacted] POI - **$7,096,106**

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

The total "Network Resource Interconnection Service" generation interconnection preliminary cost estimate to interconnect the Magic Valley Energy, LLC project is as follows:

- Network Resource Interconnection Service - **$12,565,350**

See Section 7.5 Network Resource Cost Estimate for the required Network Resource facilities and cost breakdowns. The cost estimates include a 20% contingency and 7.25% 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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GI #587

- One 11.7-miles [redacted] transmission line (Project to POI)
- Two [redacted] station transformers with a 383/510/637 MVA capacity each
- Five [redacted] lines with lengths ranging from 4.9 to 18.0 miles
- Five [redacted] GSU transformers from 225 to 285 MVA
- 363 GE 3.03-140 wind turbines – 3.189/3.03 MVA/MW with a Power Factor 0.95 dispersed among the five Collector Stations ([redacted])
- Total plant limited to 1050 MW at the [redacted] POI
- All generation in voltage regulation (Reactive capability used to regulate voltage – supply/absorb reactive)

6.0 Energy Resource (ER) Interconnection Service

Energy Resource (ER) 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 #587 project has applied to connect to the Idaho Power transmission system for an injection of 1050 MW with a new [redacted] line-terminal at Idaho Power's [redacted] station. All generation projects in the area ahead of this project in the IPC generation queue and their associated transmission system improvements were modeled in a preliminary power flow analysis to evaluate the system impacts of interconnecting GI #587.

6.1 Description of Substation/Transmission Facilities

As an Energy Resource, 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:

Substation/Transmission Interconnection Facilities:

The proposed generation interconnection will require a new [redacted] line terminal bay which requires two [redacted] breakers and the re-termination of the [redacted] line.

[redacted] **Station**

- New [redacted] Line Terminal for ER Interconnection Service

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.

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Direct Assigned	Cost
None	$0
Network Assigned	
[redacted] **Station** New [redacted] Line Terminal Bay (with two [redacted] breakers)	$4,249,607
Re-terminate [redacted] Line (with one [redacted] breaker)	$1,264,073
Subtotal	**$5,513,680**
Contingencies (~20.0%) (1)	$1,102,736
Subtotal	**$6,616,416**
Overheads (~7.25%) (2)	$479,690
Energy Resource – Total Estimated Cost (3)	**$7,096,106**

Table 1. Estimated GI #587 Project's Energy 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.
- 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 (NR) Interconnection Service

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

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transmission flows to determine the required Network Transmission Upgrades.

The WECC 2020 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 the Midpoint West and Borah West transfer paths.

For the second case, a WECC 2019 Light Winter operating case, was modified to represent a shoulder month condition with high east to west (westbound) transfers across Midpoint West. Eastern generation resource in Wyoming and Utah were displaced by the Project's 1050 MW generation.

7.3 Power Flow Analysis Results

Results from the high Midpoint West/Borah West westbound transfer case indicate the addition of the GI #587 project will result in a single post-contingency overload. The following list are the overloaded contingency from the westbound transfer case. No contingency violations were identified in the eastbound transfer case.

1. P1: [redacted] Line with [redacted] Series Capacitor
   a. Post-contingency loading 100.05% of the emergency rating of [redacted] Transformer.

7.4 Network Resource Transmission Upgrades

From the System Impact Study power flow/contingency analysis, the following Network Transmission upgrades were identified for the integration of GI #587 in addition to the Energy Resource generation interconnection facilities.

[redacted] Station

- Build a 2nd [redacted] Line Terminal for NR Interconnection Service

The Network Upgrades for the resulting marginal overload (< 1 MVA) on [redacted] have not been included. The installation of a new second [redacted] transformer (~$40M) to resolve this marginal overload most likely will be identified in GI #587 TSR study.

IPC projects queue GI #530, GI #551, GI #557, GI #561, GI 567, and GI #568 are senior queued project in the affected area of IPC's transmission system. Idaho Power studied GI #587 with all Network Upgrades identified for 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 #587 Network Resource, NR, service.

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optimized during the Facility Study should the generation interconnection customer choose to move to that study phase of the interconnection process.

8.0 Transient Stability Analysis

The WECC 2020 Heavy Summer case modified to represent a summer month with high solar, wind, and gas generation east of Boise was used along with PowerWorld's Transient Stability Analysis tool to perform the transient stability analysis for the Project.

Two transient stability runs were performed with the Project on the system to validate model and system performance:

1. 3.0 Cycle [redacted] Line 3-Phase fault, loss of [redacted] Line
2. 9.0 Cycle [redacted] Line 3-Phase fault, loss of [redacted] Line w/ Delayed Clearing
3. 9.0 Cycle [redacted] Line Single-Line-Ground (SLG) fault, loss of [redacted] Line w/ Delayed Clearing

The results showed no transient stability violations. Appendix B contains the transient stability plots for the [redacted] 3-Phase fault, [redacted] 3-Phase fault with Delayed Clearing, and [redacted] SLG fault with Delayed Clearing.

9.0 Description of Operating Requirements

It is the generation project's responsibility to provide reactive power capability of the project to have a power factor operating range of at least 0.95 leading (absorbing) to at least 0.95 lagging (supplying) at the POI over the range of real power output (up to maximum output of the project. With only a single [redacted] Project line to the POI, preliminary analysis indicated that approximately 367.5^{+} MVAr shunt compensation will be required to be installed to achieve the 0.95 lagging (supplying) power factor at the POI.

GI #587 will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations, and GI #587 will be required to manage the real power output of their stated generation at the project's POI.

The project(s) 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 interconnect GI #587. The specific costs associated with the IPC requirements for interconnection

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APPENDIX A

A-1.0 Method of Study

The Feasibility 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 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 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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APPENDIX B – Transient Stability Plots

REDACTED

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