GENERATOR INTERCONNECTION

FEASIBILITY STUDY

for integration of the proposed

300 MW [redacted] PROJECT

(GI PROJECT #534)

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

in

JEROME COUNTY, IDAHO

for

[redacted]

REPORT V1

August 30, 2018

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1.1 Introduction

[redacted] has contracted with Idaho Power Company ("Transmission Provider") to perform a Generator Interconnection Feasibility Study for the integration of the proposed 300MW [redacted] project (the Project). The Project location (~ coordinates [redacted]) is in Idaho Power Company's (IPC's) Southern Region in Jerome County, Idaho. The Project is Generation Interconnect (GI) queue number 534 (GI #534). The Project has chosen in the Feasibility Study to be studied as both an Energy Resource (ER) Interconnection Service and a Network Resource (NR) Interconnection Service.

The Project has applied to connect to the Transmission Provider's transmission system for an injection of 300MW with a new 345kV interconnection on the Idaho Power Company's (IPC's) [redacted] 345kV substation. The Project's Generation Point of Interconnection (POI) is assumed to be at this station.

This report documents the basis for and the results of this Feasibility Study for the GI #534 Generation Interconnection Customer. The report describes the proposed project, the determination of project interconnection feasibility and estimated costs for integration of the Project to the Transmission Provider transmission system. This report satisfies the feasibility study requirements of the Idaho Power Tariff.

1.2 Summary

The feasibility of interconnecting the 300MW generation project to the Transmission Provider's transmission system with a 345kV interconnection at the [redacted] station was evaluated. The Project's Generation Point of Interconnection (POI) is assumed to be at the station.

Power flow analysis indicated that interconnecting the Invenergy Wind Development Project is feasible.

The Project will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power Grid Operations. And, GI #534 will be required to manage the real power output of the 300MW generation project at the Project's POI. Also, the installation of phasor measurement unit devices (PMU's) at the POI and maintenance costs associated with communication circuits needed to stream PMU data will be required to be provided to interconnect GI #534. Also, it may be beneficial for [redacted] for their own modeling compliance requirements to install additional PMU devices at their facilities monitor the generation source(s).

A Transmission System Impact Study is required to determine if any additional network upgrades are required to integrate this project into the IPCo transmission system and to evaluate 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.

The total "Energy Resource Interconnection Service" and "Network Resource Interconnection Service" generation interconnection preliminary cost estimate to interconnect the [redacted] 300MW Project with an interconnection to the [redacted] 345kV substation is **$1,829,835**. The cost estimate includes the [redacted] substation infrastructure.

The cost estimate includes direct equipment and installation labor costs, indirect labor costs and general overheads. The cost estimate does not include contingency or overheads. 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 Transmission Provider estimates it will require approximately 36 months to design, procure, and construct the facilities described in both the Energy Resource and Network Resource sections of this report following the execution of a Generation Interconnection Agreement. The schedule will be further developed and optimized during the Facility Study should the generation interconnection customer choose to move to that study phase of the interconnection process.

1.3 Purpose of a Feasibility Study

The purpose of a GI Feasibility Study is to provide the following information:

- A description of the proposed project and existing facilities in the project area.
- Powerflow study results of any thermal overload or voltage limit violations resulting from the interconnection.
- Preliminary description of the facilities required to connect the interconnection project to the designated point-of-interconnection.
- A non-binding estimated cost of the facilities required to interconnect the project to the Idaho Power Transmission System.
- Determination of any circuit breaker (or other interrupting device) short circuit interrupting capability limits exceeded due to the interconnection.
- A description of initial grounding and electrical system protection requirements.
- A preliminary description of reactive power requirements.

2.0 Scope of Interconnection Feasibility Study

The Interconnection Feasibility Study was done and prepared in accordance with Idaho Power Company Standard Generator Interconnection Procedures, to provide a preliminary evaluation of the feasibility of the interconnection of the proposed generating project to the Idaho Power system. As listed in the Interconnection Feasibility Study agreement, the Interconnection Feasibility Study report provides the following information:

- Initial identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection;

- Initial identification of any thermal overload or voltage limit violations resulting from the interconnection;

  Initial review of grounding requirements and electrical system protection; and

- Description and non-binding estimated cost of facilities required to interconnect the Small Generating Facility to the IPCo System and to address the identified short circuit and power flow issues.

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.oasis.oati.com/ipco/index.html

2.1 Study Assumptions

This Feasibility Study evaluated the performance of the IPC transmission system with full output of the 300MW Generator Interconnection Project.

This Feasibility Study modeled the proposed generation project in the order they appear in the Generator Interconnection Queue.

3.0 Description of Proposed Generating Project

GI Project #534 proposes to connect to the Idaho Power transmission system at 345kV with a total injection of 300 MW (maximum project output). The proposed interconnection is via a customer owned and operated 345kV line from the project's 34.5/345kV generation station to the proposed [redacted] substation.

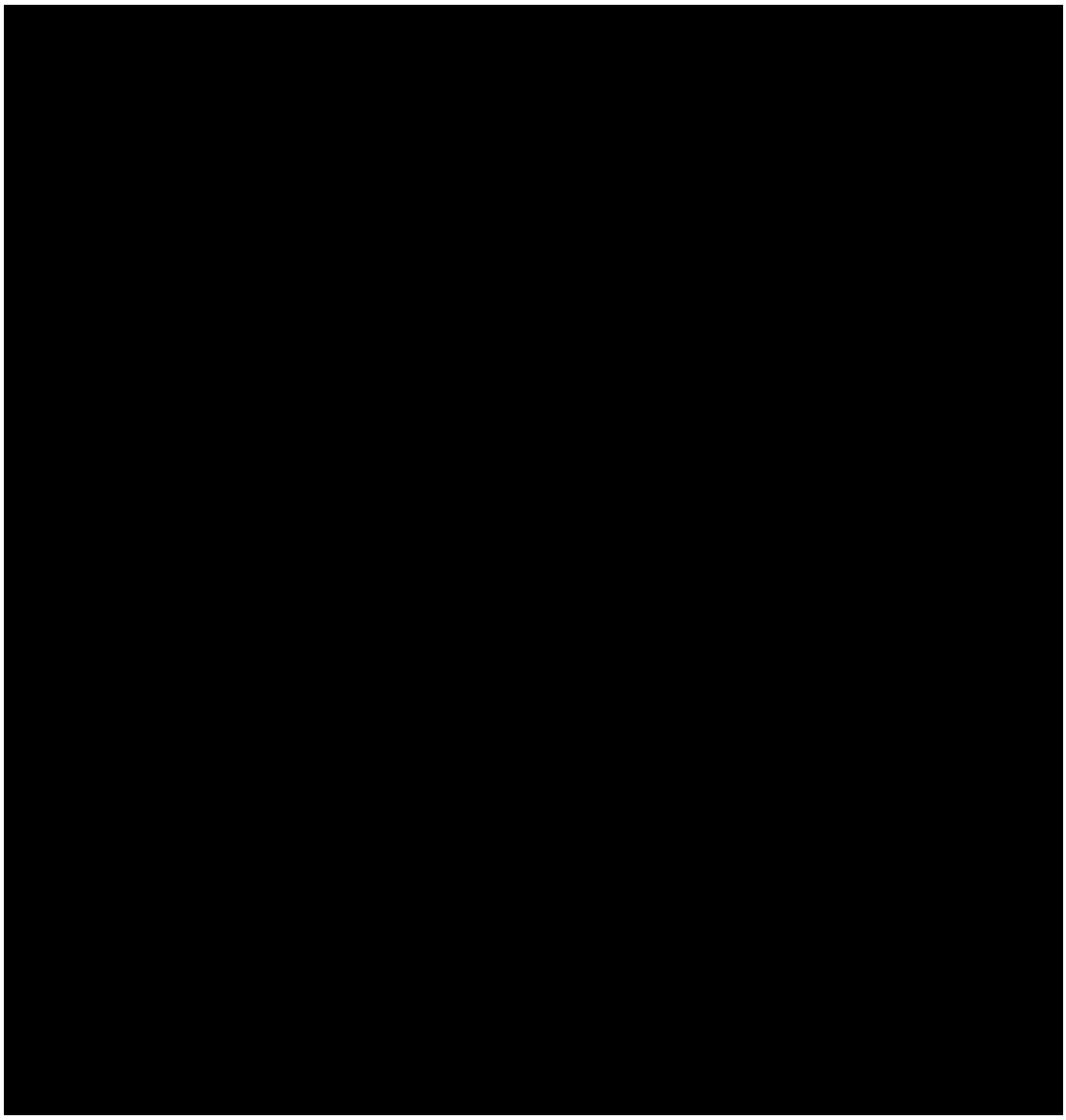

Figure 1: Project Model

4.0 Description of Existing Transmission Facilities

All generation projects in the area ahead of this project in the IPCo generation queue and their associated transmission system improvements were modeled in a preliminary power flow analysis to evaluate the feasibility of interconnecting GI Project #534.

5.0 Description of Interconnection Facilities

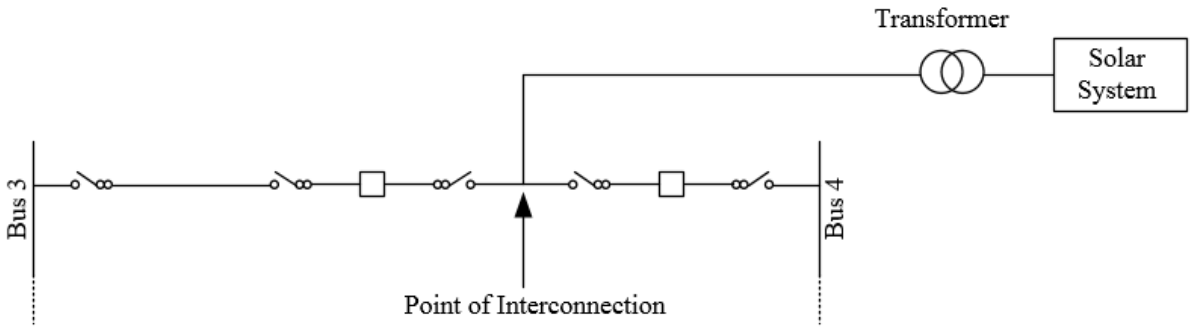

Figure 2: Substation Model

Integration of GI Project #534 will require the construction of a new rung at the 345kV [redacted] substation. This includes: Two new 345kV breakers and associated air breaks. A new transmission line relaying package using digital communications – assumes OPGW on the customer owned transmission line with customer owned and operated relaying at the collector station. Conduit runs between all yard apparatus/equipment and the control building. Revenue metering package installed. TeleComm activation fee, cable and SNC protection added for POTS line, SCADA, relay maintenance and Rev Mtg comm's. This project also requires installation of a PMU at the project POI.

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.

6.0 Short Circuit Study Results

Fault current contribution: the rated fault current contribution from GI Project #534 (as per the interconnection request) is rated at 1.00 p.u. of full load current. IPCo does not anticipate that the fault current contribution will exceed any existing circuit breaker interrupter ratings.

A more comprehensive study will be conducted during the System Impact Study should the interconnection customer choose to proceed to that study phase of the interconnection process.

7.0 Grounding Requirements and Electrical System Protection Results

The proposed customer owned wye-grounded/wye-grounded with delta tertiary substation transformer meets Idaho Power's transmission interconnection grounding requirements.

8.0 Description of Powerflow Case

The WECC 2018 Light Autumn operating case was chosen as the initial power flow base case for this feasibility study. It has been extensively modified to represent a shoulder month condition with high wind, solar, and gas generation east of Boise, and high east to west (westbound) transfers (representing Firm Transmission Service provided by the Transmission Provider) across the Transmission Provider's transmission system which generally occurs in the fall.

The second case used for the study is the WECC 2015 Heavy Summer operating case. This case was chosen as an additional power flow base case for this feasibility study to represent a heavy summer operating case. Next, the base case was modified to represent high west to east (eastbound) transfers across the Idaho transmission system during heavy load conditions.

The levels of flow represented in the study cases are intended to capture potential impact of the new project on the existing capabilities of the surrounding paths and the interconnected transmission systems.

9.0 Cost Estimate Required Facilities

The interconnection costs are **$1,829,835**. This represents the infrastructure at the [redacted] substation required to connect GINT #534. This estimate is given in 2018 dollars. This estimate will need to be revisited if the project is built at a much later date. This is a cost estimate only and final charges to the customer will be based on the actual construction costs incurred. Allowance for funds used during construction (AFUDC) has not been included in the cost estimates since it is assumed that IPC will be provided up-front funding by the Interconnect Customer. Note that this estimate does not include the cost of the customer's equipment. The cost estimate assumes that transmission network upgrades have been placed in-service from projects ahead of #534 in the Generator Interconnection Queue.

GI #534 [redacted] Project **POI – [redacted] 345kV Station** **Energy Resource Generation Interconnection Facilities**	
Direct Assigned	**Cost**
[redacted] Line Terminal Controls and Indication Line Protection and Control, Metering	$42,346
Network Upgrade	**Cost**
345kV Breakers and Associated Air Breaks and Bus Two 345kV breakers, five air breaks, and bus work	$1,787,489

9.1 Explanation of Costs

If applicable, the cost estimate includes both Direct Assigned ('DA') costs and Network Upgrade ('NU') costs (definitions of cost allocations provided below). The Interconnection Customer is responsible for all of the Direct Assigned costs. The Transmission Provider is responsible for the Network Upgrade costs, however these funds will be secured by the Interconnect Customer. If the Network Upgrades are associated with a PURPA project, then they become the sole responsibility of the Interconnection Customer. Interconnect Customers Interconnection Facilities ('ICIF') are the sole responsibility of the Interconnection Customer.

Idaho Power Company Open Access Transmission Tariff Definitions for Cost allocations:

Interconnection Customer's Interconnection Facilities ('ICIF'). Interconnection Customer shall, at its expense, design, procure, construct, own and install the ICIF, as set forth in Appendix A, Interconnection Facilities, Network Upgrades and Distribution Upgrades.

Direct Assignment Facilities ('DA'): Facilities or portions of facilities that are constructed by the Transmission Provider for the sole use/benefit of a particular Transmission Customer requesting service under the Tariff. Direct Assignment Facilities shall be specified in the Service Agreement that governs service to the Transmission Customer and shall be subject to Commission approval.

Network Upgrades ('NU'): Modifications or additions to transmission-related facilities that are integrated with and support the Transmission Provider's overall Transmission System for the general benefit of all users of such Transmission System.

11.0 Conclusions

A Generation Interconnection Feasibility Study was performed for interconnection of the [redacted] project (IPCo queue #534) to Idaho Power's [redacted] 345kV substation. The project will integrate 300 MW of [redacted] inverters.

Post-transient analysis showed acceptable system performance for all N-1 and N-2 contingencies studied.

Detailed fault studies were performed to evaluate increases in short circuit fault duties for the transmission grid. The Project's impact on fault current magnitude was minimal and no mitigation is required.

The estimated cost to interconnect the proposed projects to the IPCo system is approximately $1.8 million.

Pre-queue transmission service applicants will be charged with transmission system capacity upgrades that may not materialize if one or more of the applicants drop out of the queue. The results and conclusions of this study are based on the realization of these projects in the unique queue/project order. Consequently, this Project may have to bear additional costs for transmission system capacity upgrades if any of the pre-queue applicants drop out of the queue.

Revision History

Date	Revision	Initials	Summary of Changes
08/31/2018	0	ELS	Description

APPENDIX A – Acceptability Criteria

A-1.0 Method of Study

The Feasibility Study 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. NERC, 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 (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 Electrical System Protection Guidance

IPC requires electrical system protection per Requirements for Generation Interconnections found on the Idaho Power Web site, https://www.idahopower.com/AboutUs/BusinessToBusiness/GenerationInterconnect/default.cfm.