GENERATOR INTERCONNECTION

FEASIBILITY STUDY REPORT

for integration of the proposed

[redacted]

IPC PROJECT QUEUE #430

to the

IDAHO POWER COMPANY ELECTRICAL SYSTEM

For

[redacted]

FINAL REPORT v.0

October 16, 2014

RK

Revision History

Date	Revision	Initials	Summary of Changes
10/16/2014	0	RK	FeSR GI #430 – Issued for Interconnection Customer review and comment

1.0 Introduction

The [redacted] has contracted with Idaho Power Company (IPC) to perform a Generator Interconnection Feasibility Study for the integration of the 550 kW [redacted] hydro generation project ("the Project"). The Project is located in IPC's Southern Region approximately [redacted] at Township [redacted] Range [redacted], Section [redacted] in Twin Falls County, Idaho (See Figure 1: Location of [redacted] – GI #430 in Appendix B). The Project is Generation Interconnect (GI) queue number 430.

The Project has applied to connect to the Idaho Power distribution system for an injection of 550 kW, at a single Point of Interconnection (POI) at the 34.5 kilovolt (kV) distribution voltage level on the [redacted] distribution feeder located approximately [redacted] of the [redacted] substation.

This report documents the basis for and the results of this Feasibility Study. It describes the required generation interconnection requirements, the study cases used, outage scenarios assumed, and the results of all work in the areas of concern. This report satisfies the feasibility study requirements of the Idaho Power Tariff.

2.0 Summary

The Project, GI #430, is rated at 550 kW at the POI. The distribution POI is at the 34.5 kV voltage level on the [redacted] distribution feeder, and is located approximately [redacted] of the [redacted] substation.
The following upgrades will be required to IPC owned facilities to facilitate the distribution interconnection of GI #430:

- Install a four-pole 34.5 kV generation interconnect package at the POI
- Rebuild 1.2 miles of existing 19.9 kV 1-phase line to a 34.5 kV 3-phase line
- Move the [redacted] R46 1-phase recloser due to the 3-phase line rebuild
- Build 2.0 miles of new 34.5 kV 3-phase line from the end of the existing Idaho Power system to the POI

The estimated cost for all required upgrades of IPC owned facilities to serve the Project with the distribution alternative is **$1,015,000** (see Table 1 in Section 9.0).

During the Feasibility Study pre-scoping meeting, J-U-B Engineering asked for an additional cost estimate to connect to the 138 kV line located approximately [redacted] miles [redacted] of the Project location. The estimated cost for all required upgrades of IPC owned facilities to serve the Project with the transmission alternative is **$2,885,000** (see Table 2 in Section 9.0). This alternative was not pursued as it was considered cost prohibitive.

Power factor requirements for the Project will be determined after the applicant provides the generator power factor specifications prior to a Facility Study. Additional reactive support may be required to be installed on the [redacted] feeder at the Project's expense, based on the generator power factor.

3.0 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;
- Description and non-binding estimated cost of facilities required to interconnect the Small Generating Facility to the Distribution 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 on the Idaho Power web site as follows:

http://www.oatioasis.com/IPCso/index.html.

4.0 Description of Proposed Generating Project

The Project consists of a single 550 kW [redacted] generator which will be interconnected to Idaho Power's [redacted] distribution system. The POI for this project is at the 34.5 kV distribution voltage level, and is located approximately [redacted] of the [redacted] substation.

No additional description or technical literature, such as generator type, output voltage, power factor, or single-line drawings were provided by [redacted] for the Project. A wye-grounded to wye-grounded connected transformer must be used at the POI.

The proposed in-service date for the Project is December 31, 2016.

5.0 Description of Existing Sub-transmission Facilities

The [redacted] substation is served from the [redacted] 138 kV line.

5.1 Sub-transmission Study Assumptions

This Feasibility Study evaluated the performance of the IPC sub-transmission system with the full 550 kW output of the Project. The increase in generation will be scheduled to Area 60 (Idaho) with a reduction in generation at the area 60 swing bus (Brownlee 5).

Following a single contingency (N-1) on the transmission system, this study assumes no system element should be overloaded above its 30 minute thermal capability. Any assumption of "redispatchability" allows the generator outputs to be lowered to relieve any overloads and lower loadings to 100% or below nominal thermal capabilities. Any planned or combination of planned and unplanned outages that result in a facility overload less than or equal to its 30 minute thermal capability may result in generator outputs being lowered (redispatched) to alleviate the overload.

This Feasibility Study modeled all proposed pre-queue generation interconnection projects that were ahead of this new project in the Generator Interconnection Queue and included all transmission system upgrades that were associated with those pre-queue projects.

This Feasibility Study is for Network Resource Interconnection Service at 34.5 kV for a 550 kW induction generator connected to [redacted] feeder.

6.0 Sub-transmission Study Results

There were no single contingencies (N-1) identified in the local 138 kV system that resulted in overloading any system element above its 30 minute thermal capability.

7.0 Description of Existing Substation Facilities

Idaho Power's [redacted] substation is located in Twin Falls County, Idaho. The existing substation transformer, [redacted] T-131, is a 138/12.5 kV transformer rated for 10.5 megavolt-amperes (MVA). An additional 12.5/34.5 kV transformer, [redacted] T-042, steps the [redacted] feeder voltage up to 34.5kV within the substation. With consideration of the size of the proposed project and other projects ahead of GI #430 in the generation interconnection queue, the substation has sufficient capacity to serve the Project.

8.0 Description of Existing Distribution Facilities

The requested POI for the Project is on the [redacted] distribution feeder. This is a grounded-wye feeder operating at 34.5 kV at the POI. The nearest distribution line to the Project is a 1-phase line approximately [redacted]. The nearest 3-phase distribution line is approximately [redacted] of the Project.

A generation interconnection and protection package will be required at the POI.

Refer to Appendix A, Section 3, for additional grounding requirements.

9.0 Description of Required Facility Upgrades and Cost Estimate

Study results indicate that it is feasible to connect the Project to the [redacted] feeder. The following upgrades will be required to IPC owned facilities to facilitate the interconnection of GI #430:

- Install a four-pole 34.5 kV generation interconnect package at the POI
- Rebuild 1.2 miles of existing 19.9 kV 1-phase line to a 34.5 kV 3-phase line
- Move the [redacted] R46 1-phase recloser due to the 3-phase line rebuild
- Build 2.0 miles of new 34.5 kV 3-phase line from the end of the existing Idaho Power system to the POI

No additional upgrades will be required to the [redacted] substation of the transmission system.

See the conceptual-level cost estimate in Table 1.

Table 1: Conceptual-level Cost Estimate for GI #430 – [redacted] Option

Item of Work	Estimate
Generation interconnection and protection package	$195,000
Distribution upgrades	$510,000
Unloaded costs	$705,000
Contingency 20% (1)	$140,000
Total unloaded costs	$845,000
Overheads (2)	$170,000
Total loaded costs	$1,015,000
Total Conceptual-level Cost Estimate in 2014 dollars (3)	**$1,015,000**

(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 this project.

(3) This cost estimate includes direct equipment, material, labor, overheads, and contingency as shown.

During the Feasibility Study pre-scoping meeting, J-U-B Engineering asked for an additional cost estimate to connect the Project to the [redacted] 138 kV line located approximately [redacted] of the Project location. The following upgrades will be required to IPC owned facilities to facilitate the interconnection of GI #430 to this transmission line:

- Build an Idaho Power owned 138/12.5 kV substation connected to the [redacted] 138 kV transmission line. Install a 138/12.5 kV transformer, protection, relaying, controls, communication, and SCADA in the new substation.
- Build a [redacted] 12.5 kV 3-phase line from the new substation to the POI.
- Install a four-pole 12.5 kV generation interconnect package at the POI

See Figure 2: Alternative Solution - Serve the Project from the [redacted] 138 kV Line in Appendix B

See the conceptual-level cost estimate in Table 2.

Table 2: Conceptual-level Cost Estimate for GI #430 – [redacted] 138 kV Option

Item of Work	Estimate
Generation interconnection and protection package	$155,000
Substation upgrades	$1,770,000
Distribution upgrades	$80,000
Unloaded costs	$2,005,000
Contingency 20% (1)	$400,000
Total unloaded costs	$2,405,000
Overheads (2)	$480,000
Total loaded costs	$2,885,000
Total Conceptual-level Cost Estimate in 2014 dollars (3)	**$2,885,000**

(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 this project.
(3) This cost estimate includes direct equipment, material, labor, overheads, and contingency as shown.

- Note that these estimates do not include the cost of the customer's equipment/facilities.
- Please 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 Transmission and Distribution Facility Studies.

10.0 Description of Operating Requirements

Power factor requirements for the Project will be determined after the applicant provides the generator power factor specifications prior to a Facility Study. Additional reactive support may be required to be installed on the [redacted] feeder at the Project's expense, based on the generator power factor.

Voltage flicker during a single startup will be limited to less than 5% as measured at the POI. The allowable voltage flicker limit is further reduced during operation due to multiple voltage fluctuations per hour or minute, per Idaho Power's T&D Advisory Information Manual.

The Project is required to comply with the applicable voltage fluctuation limits found in IEEE Standard 1453-2004 *IEEE Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power System.*

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 forHarmonic Control in Electrical Power Systems.*

11.0 Conclusions

The requested interconnection of the [redacted] 550 kW hydro generation project (GI #430) to IPC's electrical system was studied. The results of this assessment indicate that it is feasible to serve this project from the [redacted] distribution system.

Alternatively, it is feasible to serve the Project from the [redacted] 138 kV transmission line through construction of a new substation and distribution feeder. Upgrades will be required at the estimated cost to connect this project to the existing IPC system.

Power factor requirements for the Project will be determined after the applicant provides the generator power factor specifications prior to a Facility Study. Additional reactive support may be required to be installed on the [redacted] feeder at the Project's expense, based on the generator power factor.

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 Electric Coordinating Council (WECC) power flow case and then, using Power World Simulator, examines the impacts of the new resource on Idaho Power's transmission system (lines, transformers, etc.) within the study area under various operating/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 Advantica's SynerGEE 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. 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 a single startup will be limited to less than 5% as measured at the POI. Allowable voltage flicker limit is further reduced during operation due to multiple voltage fluctuations per hour or minute, 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, IEEE1453, IEEE1547, 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 Grounding Guidance

Idaho Power Company (IPC) requires interconnected transformers 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 at
http://www.idahopower.com/aboutus/BusinessToBusiness/GenerationInterconnect

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.

APPENDIX B

Figure 1: Location of [redacted] – GI #430

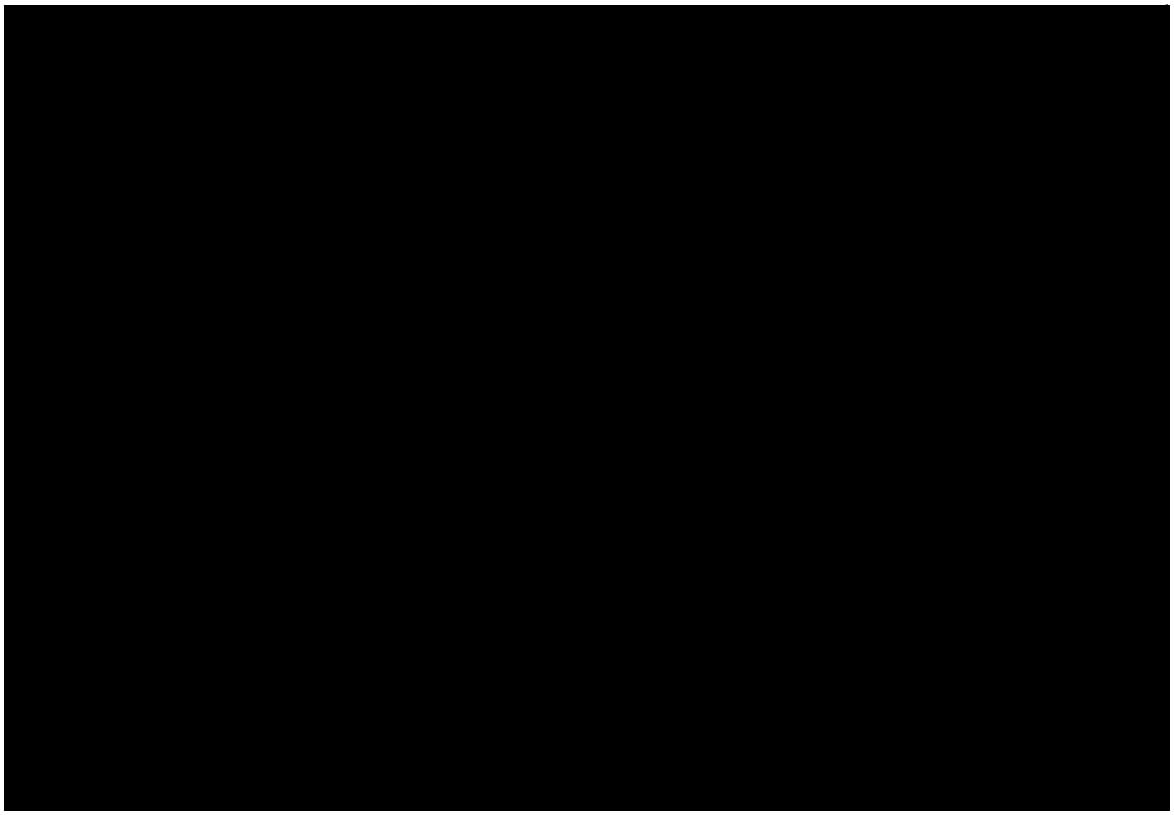

Figure 2: Alternative Solution - Serve the Project From the [redacted] 138 kV Line