Interim Transitional Cluster Study

Cluster Area 4 Study Report

July 19, 2024

Report v1.0

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1. Study Overview

1.1 Introduction

Transitional Cluster Area 4 (CA4) is generally described as the Greater Treasure Valley area and includes the following Interconnection Requests: GI #704, GI #708, GI #710, GI #716, GI #723, GI #724, and GI #731. Interconnection Requests within CA4 have proposed a total of 1,180 megawatts (MW) of new generation.

In accordance with Section 7.3 of Transmission Provider's (hereinafter referred to as Idaho Power) Large Generator Interconnection Procedures (LGIP), this Cluster Study evaluated the impact of the proposed generation interconnections on the reliability of Idaho Power's Transmission System. The Cluster Study considered the Base Case as well as all generating facilities (and with respect to (iii) below, any identified Network Upgrades associated with such higher queued interconnection) that, on the date the Cluster Study is commenced:

(i) are directly interconnected to the Transmission System;
(ii) are interconnected to Affected Systems and may have an impact on the Interconnection Request;
(iii) have a pending higher queued Interconnection Request to interconnect to the Transmission System; and
(iv) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

1.2 Study Assumptions

- Generation Interconnection Requests GI #530, GI #551, GI #557, GI #567, GI #588, GI #590, GI #604, GI #605, GI #629, GI #632, GI #634, GI #636, GI #638, GI #639, GI #640, GI #657, GI #665, GI #666, GI #667, GI #669, and GI #696 are senior-queued projects in the affected area of Idaho Power's transmission system. Idaho Power studied this Cluster Area 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 of this Cluster Area, and the results and conclusions could significantly change.

- Generation Interconnection Requests GI #704, GI #708, GI #710, GI #716, GI #718, GI #719, GI #723, GI #724, GI #725, GI #730, GI #731, GI #732, GI #734, and GI #737 are similarly queued projects in Idaho Power's Transitional Cluster Study. Changes to similarly queued projects within the Transitional Cluster Study, including in-service date and withdrawal from the queue, may trigger a restudy of this Cluster Area, and the results and conclusions could significantly change.

- Network Resource Interconnection Service (NRIS) does not convey transmission service.

- 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 Idaho Power'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 these Interconnection Requests. Based on the volume of senior-queued Interconnection Requests and in order to assess the impact of interconnecting this generation, 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. This includes, but is not limited to, single contingencies in the Interconnection Customer's Interconnection Facilities.

- Idaho Power will not mitigate thermal or voltage violations with remedial action schemes (RAS) in the generation interconnection process.

- Projects interconnecting at new greenfield stations (Transmission Provider Interconnection Facilities) will require primary and/or secondary local distribution service be constructed to feed the station. The scope and cost of these potential distribution facilities are not contemplated in this study and will be analyzed in the final Transitional Cluster Study, as applicable.

- Telecommunication requirements are not fully contemplated in this study and could require significant upgrades up to and including line rebuilds to accommodate OPGW, for example. Telecommunication requirements identified during the final Transitional Cluster Study could impact the estimated cost of the project included in this report.

- The following Idaho Power planned system improvements were assumed in service. Any facility that has been determined to be contingent will be listed in Section 5 of this report.
    - Boardman to Hemingway (B2H) 500kV transmission line (Q2 2027)
    - 50% series capacitance compensation on the Kinport to Midpoint 345kV transmission line (Q2 2026)
    - Midpoint Substation T502 500:345kV transformer (Q2 2026)
    - Hemingway to Bowmont 230kV transmission line (Q4 2025)
    - Bowmont to Hubbard 230kV transmission line (Q3 2026)
    - Midpoint to Hemingway #2 500kV transmission line (2028)

1.3 Power Flow Case Description

The WECC 2025 Light Spring and 2024 Heavy Summer Operating cases serve as the Base Cases for the power flow and transient stability analysis for this Transitional Cluster Study. The Base Cases have been modified to:

- increase power flow across the Transmission System to stress relevant transmission paths,
- include future Idaho Power transmission projects identified in Section 1.2 of this report,
- include senior-queued generation Interconnection Requests, their Interconnection Facilities, and their Network Upgrades in accordance with Section 7.3 of Idaho Power's LGIP, and
- Generating Facilities interconnected to Affected Systems that may have an impact on the Interconnection Requests in this Cluster Area.

The WECC 2024 Heavy Summer Operating base case was modified to represent a summer month with high west-to-east (eastbound) transfers across the Idaho-to-Northwest (Path 14) WECC path and Midpoint West internal path. The WECC 2024 Heavy Summer Operating base case was also modified to represent a summer month with high load and high generation.

The WECC 2025 Light Spring Operating base case was modified to represent a shoulder month condition with high east-to-west (westbound) transfers across the Idaho-to-Northwest (Path 14) WECC path and Midpoint West internal path.

2. Cluster Area

Idaho Power performed the Transitional Cluster Study based on geographically and/or electrically relevant areas on Idaho Power's Transmission System known as Cluster Areas. Idaho Power has determined that the Interconnection Requests described below are in a geographically and/or electrically relevant area on Idaho Power's Transmission System, and thus were assigned Cluster Area 4 in this Cluster Study.

Cluster Area 4 is generally described as Idaho Power's Transmission System in the Greater Treasure Valley. This Cluster Area consists of the Interconnection Requests described below.

2.1 GI #704 Description

Interconnection Customer has proposed to interconnect 330 MW of solar generation to Idaho Power's Midpoint to Hemingway 500kV transmission line located in Twin Falls County, Idaho. The requested Commercial Operation Date (COD) is June 1, 2027.

Interconnection Customer will NOT operate this generator as a Qualified Facility as defined by the Public Utility Regulatory Policies Act of 1978 (PURPA).

The Interconnection Request will be studied for NRIS.

2.2 GI #708 Description

Interconnection Customer has proposed to interconnect 150 MW of hybrid solar and battery storage generation to Idaho Power's Danskin to Hubbard 230kV transmission line located in Ada County, Idaho.

Interconnection Customer will NOT operate this generator as a Qualified Facility as defined by PURPA. The requested COD is December 31, 2028.

The Interconnection Request will be studied for NRIS.

2.3 GI #710 Description

Interconnection Customer has proposed to interconnect 200 MW of hybrid solar and battery storage generation to Idaho Power's DRAM to Rattlesnake 230kV transmission line located in Ada County, Idaho. The requested COD is June 30, 2026.

Interconnection Customer will NOT operate this generator as a Qualified Facility as defined by PURPA.

The Interconnection Request will be studied for NRIS.

2.4 GI #716 Description

Interconnection Customer has proposed to interconnect 150 MW of hybrid solar and battery storage generation to Idaho Power's Cole 230kV substation located in Ada County, Idaho. The requested COD is December 31, 2028.

Interconnection Customer will NOT operate this generator as a Qualified Facility as defined by PURPA.

The Interconnection Request will be studied for NRIS.

2.5 GI #723 Description

Interconnection Customer has proposed to interconnect 100 MW of battery storage generation to Idaho Power's Bowmont 230kV substation located in Canyon County, Idaho. The requested COD is December 31, 2027.

Interconnection Customer will NOT operate this generator as a Qualified Facility as defined by PURPA.

The Interconnection Request will be studied for NRIS.

2.6 GI #724 Description

Interconnection Customer has proposed to interconnect 100 MW of battery storage generation to Idaho Power's Bowmont 230kV substation located in Canyon County, Idaho. The requested COD is December 31, 2027.

Interconnection Customer will NOT operate this generator as a Qualified Facility as defined by PURPA.

The Interconnection Request will be studied for NRIS.

2.7 GI #731 Description

Interconnection Customer has proposed to interconnect 150 MW of battery storage generation to Idaho Power's Kuna 138kV substation located in Ada County, Idaho. The requested COD is June 1, 2026.

Interconnection Customer will NOT operate this generator as a Qualified Facility as defined by PURPA.

The Interconnection Request will be studied for NRIS.

3. NRIS Requirements

3.1 Transmission Provider's Interconnection Facilities

Transmission Provider's Interconnection Facilities (hereinafter referred to as Idaho Power's Interconnection Facilities) are defined in Section 1 of Idaho Power's LGIP as all facilities and equipment owned, controlled, or operated by Idaho Power from the Point of Change of Ownership to the POI, including any modifications, additions or upgrades to such facilities or equipment. In accordance with Section 4.2.1 of Idaho Power's LGIP, costs for Idaho Power's Interconnection Facilities are directly assigned to Interconnection Customer.

Listed below are Idaho Power's Interconnection Facilities required to interconnect the generation Interconnection Requests at their respective requested POIs.

3.1.1 GI #704 Interconnection Facilities

- One (1) 500kV disconnect switch
- Meter, dead-end structure, 3-phase potential transformers (PTs), 3-phase current transformers (CTs), foundations, and cabling

3.1.2 GI #708 Interconnection Facilities

- One (1) 230kV disconnect switch
- Meter, dead-end structure, 3-phase PTs, 3-phase CTs, foundations, and cabling

3.1.3 GI #710 Interconnection Facilities

- One (1) 230kV disconnect switch
- Meter, dead-end structure, 3-phase PTs, 3-phase CTs, foundations, and cabling

3.1.4 GI #716 Interconnection Facilities

- One (1) 230kV disconnect switch
- Meter, dead-end structure, 3-phase PTs, 3-phase CTs, foundations, and cabling

3.1.5 GI #723 and GI #724 Interconnection Facilities

- One (1) 230kV disconnect switch
- Meter, dead-end structure, 3-phase PTs, 3-phase CTs, foundations, and cabling

3.1.6 GI #731 Interconnection Facilities

- Contingent on GI #657 Terminal Addition at Kuna 138kV Station

3.2 Substation Network Upgrades

Substation Network Upgrades are defined in Section 1 of Idaho Power's LGIP as Network Upgrades that are required at the substation located at the POI; this includes all switching stations. In accordance with Section 4.2.1(a) of Idaho Power's LGIP, costs for Substation Network Upgrades are allocated per capita to each Generating Facility interconnecting at the same substation.

Listed below are the required Substation Network Upgrades required to interconnect the Projects at their respective POIs.

3.2.1 GI #704 Substation Network Upgrades

[redacted]

Figure 1 GI #704 Point of Interconnection

- **New GI #704 POI Substation**
  A generation interconnection and protection package at the new 500kV POI substation with three (3) 500kV power circuit breakers and line terminals, six (6) disconnect switches, protective relays, 3-phase PTs, 3-phase CTs, and SCADA and remote connectivity.
- **Series Capacitor at GI #704 POI**
  Install a new 14 Ohm series capacitor at the new 500kV POI substation on the GI #704–Rattle Cat (towards Hemingway) 500kV transmission line.

3.2.2 GI #708 Substation Network Upgrades

[redacted]

Figure 2 GI #708 Point of Interconnection

- **New GI #708 POI Substation**
  A generation interconnection and protection package at the new 230kV POI substation with three (3) 230kV power circuit breakers and line terminals, six (6) disconnect switches, protective relays, 3-phase PTs, 3-phase CTs, and SCADA and remote connectivity.

3.2.3 GI #710 Substation Network Upgrades

[redacted]

Figure 3 GI #710 Point of Interconnection

- **New GI #710 POI Substation**
  A generation interconnection and protection package at the new 230kV POI substation with three (3) 230kV power circuit breakers and line terminals, six (6) disconnect switches, protective relays, 3-phase PTs, 3-phase CTs, and SCADA and remote connectivity.

3.2.4 GI #716 Substation Network Upgrades

[redacted]

Figure 4 GI #716 Point of Interconnection

- **New Terminal at Cole Substation**
  A generation interconnection and protection package at the Cole 230kV substation with one (1) 230kV power circuit breaker and line terminal, two (2) disconnect switches, protective relays, 3-phase PTs, 3-phase CTs, and SCADA and remote connectivity.

3.2.5 GI #723 and GI #724 Substation Network Upgrades

[redacted]

Figure 5 GI #723 and GI #724 Point of Interconnection

- **New Terminal at Bowmont Substation**
  A generation interconnection and protection package at the Bowmont 230kV substation with one (1) 230kV power circuit breaker and line terminal, two (2) disconnect switches, protective relays, 3-phase PTs, 3-phase CTs, and SCADA and remote connectivity.

3.2.6 GI #731 Substation Network Upgrades

[redacted]

Figure 6 GI #731 Point of Interconnection

- **Contingent on GI #657 Terminal Addition at Kuna 138kV Station**

3.3 NRIS System Network Upgrades

System Network Upgrades are defined in Section 1 of Idaho Power's LGIP as Network Upgrades that are required beyond the substation located at the POI. In accordance with Section 4.2.1(b) of Idaho Power's LGIP, costs for each specific System Network Upgrades are allocated based on proportional impact of each individual Generating Facility in the Cluster Study.

Listed below are the required System Network Upgrades required for NRIS.

- **[redacted] 500kV Series Capacitor**
  Replace the existing series capacitor at [redacted] on the [redacted]-[redacted] (now [redacted]-[redacted]) 500kV transmission line with a [redacted] Ohm bank.
- **[redacted] [redacted] RAS**
  Modify the [redacted] [redacted] RAS to accommodate the new GI #704 POI substation.
- **New [redacted]-[redacted] 138kV Line**
  Build a new [redacted]-mile 138kV transmission line from [redacted] to [redacted] with [redacted] conductor. Install one new breaker and line terminal at [redacted] station and two new breakers and line terminals at [redacted] station, with associated disconnect switches, protective relays, 3-phase PTs, 3-phase CTs, and SCADA and remote connectivity.
- **New [redacted]-[redacted] 230kV Line**
  Build new [redacted]-mile 230kV line with [redacted] and steel poles with OPGW.
- **Rebuild [redacted]-[redacted] 138kV Line**
  Removal of existing line conductor and structures. Build new [redacted]-mile 138kV line with [redacted] and steel poles with OPGW.
- **Rebuild [redacted]-[redacted] 138kV Line**
  Removal of existing line conductor and structures. Build new [redacted]-mile 138kV line section with [redacted] and steel poles with OPGW.

Table 1 NRIS System Network Upgrades

Facility Description	Outage	Cost Allocation	Cost Estimate
[redacted] 500kV Series Capacitor	[redacted]	GI704 – 100%	$14,748,750
[redacted] [redacted] RAS	[redacted]	GI704 – 100%	$1,552,500
Build new 138kV [redacted]-[redacted]	[redacted]	GI723 – 11.9% GI724 – 11.9% GI731 – 76.2%	$21,269,250
Build new 230kV [redacted]-[redacted]	[redacted]	GI704 – 16.8% GI708 – 39.9% GI710 – 43.3%	$59,305,500
Rebuild 138kV [redacted]-[redacted]	[redacted]	GI731 – 100%	$6,986,250
Rebuild 138kV [redacted]-[redacted]	[redacted]	GI704 – 8.1% GI710 – 8.3% GI731 – 83.6%	$3,105,000

3.4 Battery Charging

The energy storage system (ESS) component of each project is studied charging from the grid in an unstressed case and limited local area N-1 contingency analysis. There may be times during the year where system load in the local area will prevent charging of the ESS from the grid at full capacity; for example, a forced outage that would require Idaho Power to curtail grid charging. Should the Project require non-curtailable grid charging, a firm Point-to-Point transmission service from the energy market/source to the battery would be required.

If Interconnection Customer does not intend to charge the ESS portion of the project from the grid, Interconnection Customer must notify Idaho Power of this election in writing prior to the closure of the thirty (30) Calendar Day comment period on the interim Transitional Cluster Study Report, if not previously requested, and the results of the charging study will not be included in the scope of the final Transitional Cluster Study. Interconnection Customer will be required to demonstrate operating procedures and control measures that prevent the ESS from grid charging. Additionally, Idaho Power shall enable an additional relay setting at the POI to trip the Project if grid-charging is detected.

No additional upgrades are required to support charging the ESS from the grid for any Projects.

3.5 NRIS Cost Estimates

GI #704

Interconnection Facilities	$1,514,496
Substation Network Upgrades	$33,535,087
System Network Upgrades	$26,544,270
	Total NRIS: $61,593,853

GI #708

Interconnection Facilities	$910,239
Substation Network Upgrades	$8,997,584
System Network Upgrades	$23,636,083
	Total NRIS: $33,543,906

GI #710

Interconnection Facilities	$910,239
Substation Network Upgrades	$8,997,584
System Network Upgrades	$25,934,088
	Total NRIS: $35,841,911

GI #716

Interconnection Facilities	$910,239
Substation Network Upgrades	$2,949,750
System Network Upgrades	$0
	Total NRIS: $3,859,989

GI #723

Interconnection Facilities	$455,120
Substation Network Upgrades	$1,474,875
System Network Upgrades	$2,528,124
	Total NRIS: $4,458,119

GI #724

Interconnection Facilities	$455,120
Substation Network Upgrades	$1,474,875
System Network Upgrades	$2,528,124
	Total NRIS: $4,458,119

GI #731

Interconnection Facilities	$0
Substation Network Upgrades	$0
System Network Upgrades	$25,796,562
	Total NRIS: $25,796,562

3.6 Estimated Time to Construct

Based on the identified scope of work for this Cluster Area, Idaho Power's non-binding, good-faith estimate of time to construct is a minimum of 4–5 years from LGIA execution, funding, and notice to proceed (Project Initiation). A detailed and refined timeline will be provided for each project in the final Transitional Cluster Study Report.

4. Contingent Facilities and Affected Systems

Contingent Facilities are defined in Section 1 of Idaho Power's LGIP as those unbuilt Interconnection Facilities and Network Upgrades upon which the Interconnection Request's costs, timing, and study findings are dependent, and if delayed or not built, could cause a need for restudies of the Interconnection Request or a reassessment of the Interconnection Facilities and/or Network Upgrades and/or costs and timing.

Table 2 Contingent Facilities

Service	Assigned To	Facility Description	Outage	Planned ISD
NRIS	GI #657	Build new terminal at Kuna 138kV Station for GI #657	[redacted]	Q3 2025
NRIS	GI #530	Remove [redacted] series capacitor and reactor	[redacted]	2026
NRIS	GI #530	Install series capacitor at [redacted]	[redacted]	2026
NRIS	GI #530	Install redundant communications at [redacted]	[redacted]	2026
NRIS	Idaho Power	Rebuild 138kV Bowmont–Mora	[redacted]	Q3 2026
NRIS	Idaho Power	Build new 230kV Cole Station	[redacted]	Q4 2024
NRIS	Idaho Power	Expand 230kV Bowmont Station	[redacted]	Q3 2026
NRIS	Idaho Power	Build new 230kV Mayfield–Pleasant Valley Solar	[redacted]	2028
NRIS	Idaho Power	Build new 230kV Chip Station	[redacted]	Q4 2024
NRIS	Idaho Power	Rebuild 230kV Chip–Rattlesnake	[redacted]	Q4 2024
NRIS	Idaho Power	Build new 230kV Bowmont–Hemingway #2	[redacted]	Q4 2025

Service	Assigned To	Facility Description	Outage	Planned ISD
NRIS	Idaho Power	Install Midpoint T502 500/345kV transformer	[redacted] or [redacted]	Q2 2026
NRIS	Idaho Power	Build new 230kV Bowmont–Hubbard	[redacted]	Q3 2026
NRIS	Idaho Power	Rebuild 230kV Mountain Air Wind Park–Rattlesnake	[redacted]	2026
NRIS	Idaho Power	Build B2H Project	[redacted] or [redacted]	2027
NRIS	Idaho Power	Build new 500/230kV Mayfield Station	[redacted] & [redacted]	2028
NRIS	Idaho Power	Build new 500kV Hemingway–Mayfield	[redacted] & [redacted]	2028
NRIS	Idaho Power	Build new 500kV Midpoint–Mayfield	[redacted] & [redacted]	2028

PacifiCorp has been identified as an Affected System for GI #704 and may conduct their own study which may have an impact on the Interconnection Customer's cost and timing to interconnect the project to Idaho Power's Transmission System.

5. Transient Stability Analysis

The WECC 2025 Light Spring operating case and PowerWorld Simulator version 23 Transient Stability analysis tool were used to perform the transient stability analysis.

The results showed no transient stability violations. Per NERC Standards, the Generator Owner is responsible 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.

6. Voltage Stability Analysis

A Voltage Stability analysis was performed using the WECC 2024 Heavy Summer case with Midpoint West and Idaho-to-Northwest West-to-East flows at 105% of their path ratings and the WECC 2025 Light Spring case with Midpoint West and Idaho-to-Northwest East-to-West flows at 105% of their path ratings. All contingencies solved successfully; there were no voltage stability issues found for the Project.

The Projects will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power's Load Serving Operations. Interconnection Customers will be required to manage the real power output of their Generating Facilities at the POI.

7. Protection and Control

7.1 GI #704 Protection and Control

For 500kV line protection, Idaho Power'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 gen-tie lines and fiber communication between co-located facilities. Interconnection Customer is responsible to provide communication infrastructure between Interconnection's Customer's 500kV collector substation and Idaho Power.

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider's existing 500kV breakers after this Project is interconnected.

The proposed 500kV Wye-Grounded/Wye-Grounded with a Delta tertiary transformer specified in the Interconnection Request should provide an adequate ground return path for transmission line protection/relaying.

7.2 GI #708 Protection and Control

For 230kV line protection, Idaho Power'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 gen-tie lines and fiber communication between co-located facilities. Interconnection Customer is responsible to provide communication infrastructure between Interconnection's Customer's 230kV collector substation and Idaho Power.

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

The proposed 230kV Wye-Grounded/Wye-Grounded with a Delta tertiary transformer specified in the Project should provide an adequate ground return path for transmission line protection/relaying.

7.3 GI #710 Protection and Control

For 230kV line protection, Idaho Power'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 gen-tie lines and fiber communication between co-located facilities. Interconnection Customer is responsible to provide communication infrastructure between Interconnection's Customer's 230kV collector substation and Idaho Power.

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

The proposed 230kV Wye-Grounded/Wye-Grounded with a Delta tertiary transformer specified in the Project should provide an adequate ground return path for transmission line protection/relaying.

7.4 GI #716 Protection and Control

For 230kV line protection, Idaho Power'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 gen-tie lines and fiber communication between co-located facilities. Interconnection Customer is responsible to provide communication infrastructure between Interconnection's Customer's 230kV collector substation and Idaho Power.

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

The proposed 230kV Wye-Grounded/Wye-Grounded with a Delta tertiary transformer specified in the Project should provide an adequate ground return path for transmission line protection/relaying.

7.5 GI #723 Protection and Control

For 230kV line protection, Idaho Power'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 gen-tie lines and fiber communication between co-located facilities. Interconnection Customer is responsible to provide communication infrastructure between Interconnection's Customer's 230kV collector substation and Idaho Power.

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

The proposed 230kV Wye-Grounded/Wye-Grounded with a Delta tertiary transformer specified in the Project should provide an adequate ground return path for transmission line protection/relaying.

7.6 GI #724 Protection and Control

For 230kV line protection, Idaho Power'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 gen-tie lines and fiber communication between co-located facilities. Interconnection Customer is responsible to provide communication infrastructure between Interconnection's Customer's 230kV collector substation and Idaho Power.

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

The proposed 230kV Wye-Grounded/Wye-Grounded with a Delta tertiary transformer specified in the Project should provide an adequate ground return path for transmission line protection/relaying.

7.7 GI #731 Protection and Control

For 138kV line protection, Idaho Power'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 gen-tie lines and fiber communication between co-located facilities. Interconnection Customer is responsible to provide communication infrastructure between Interconnection's Customer's 138kV collector substation and Idaho Power.

Studies indicate that there is adequate load and short circuit interrupting capability on the Transmission Provider's existing 138kV breakers after this Project is interconnected.

The proposed 138kV Wye-Grounded/Wye-Grounded with a Delta tertiary transformer specified in the Project should provide an adequate ground return path for transmission line protection/relaying.

8. Description of Operating Requirements

Generation Interconnection projects will be required to control voltage in accordance with a voltage schedule as provided by Idaho Power's Load Serving Operations. Interconnection Customers will be required to manage the real power output of their Generating Facilities at the POI. Projects will be required to provide reactive power versus real power capability measured at the high side of the main power transformer that complies with IEEE 2800.

Projects are required to comply with the applicable Voltage and Current Distortion Limits found in IEEE Standard 519-2014 *IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems* or any subsequent standards as they may be updated from time to time.

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 Projects. The specific costs associated with the Idaho Power requirements for Interconnection Customers with aggregate facilities larger than 20 MW to provide PMU data to Idaho Power will be identified in the final Transitional Cluster Study should Interconnection Customer choose to proceed to that phase of the interconnection process. Also, it may be beneficial for Interconnection Customers, for their own modeling compliance requirements, to install additional PMU devices at their facilities to monitor the generations sources separately.

9. Total Cost Summary

The cost estimates below are allocated in accordance with Section 4.2.1 of Idaho Power's LGIP. The total NRIS cost estimate includes the costs associated with Idaho Power's Interconnection Facilities, Substation Network Upgrades, and System Network Upgrades required for Network Resource Interconnection Service, including those facilities identified as necessary for grid-charging any energy storage components.

<u>GI #704</u>
Total NRIS $61,593,853

<u>GI #708</u>
Total NRIS $33,543,906

<u>GI #710</u>
Total NRIS $35,841,911

<u>GI #716</u>
Total NRIS $3,859,989

<u>GI #723</u>
Total NRIS $4,458,119

<u>GI #724</u>
Total NRIS $4,458,119

<u>GI #731</u>
Total NRIS $25,796,562

Appendices

A-1 Method of Study

The power flow case for the Cluster 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 Requests identified in Section 1.2 and their respective Network Upgrades and Interconnection Facilities. The Interconnection Requests being studied are then added to the cases with the model provided by the Interconnection Customers at the requested MW injection at the agreed-upon 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 (Idaho Power) Transmission System. The power flow model is then analyzed using P1, P2, and P7 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 are mitigated with Network Upgrades or Contingent Facilities.

A-2 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 (P-0) 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 while starting or stopping the generator is limited to 5% as measured at the POI, 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, or Path ratings used will be those that are in use at the time of the study or that are represented by Idaho Power 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 Grounding Guidance

Idaho Power requires interconnected transformers on the distribution system to limit their ground fault current to 20 amps at the POI.

A-4 Electrical System Protection Guidance

Idaho Power requires electrical system protection per Facility Connection Requirements found on the Idaho Power website,

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

A-5 WECC Coordinated Off-Nominal Frequency Load Shedding and Restoration Requirements

Idaho Power 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, which are available upon request.

A-6 Grid Enhancing Technology

The following technologies are considered when addressing voltage instability: static synchronous compensator, static VAR compensator, and synchronous condensers. Voltage instability was not found in the study.

The Transmission System interconnects all major generating stations and main load centers in the system. For reliable service, a bulk electric system must remain intact and be capable of withstanding a wide variety of disturbances. The integrated electric system is designed and operated such that the more probable contingencies can be endured with no loss of load and the more adverse contingencies do not result in uncontrolled and widespread power outages. The need to modify the electric configuration of the system or apply transmission switching was not found in the study.

Voltage source converters are used to connect HVAC and HVDC systems. Idaho Power does not act as a Transmission Provider for HVDC systems.

Advanced conductors have a higher cost when compared to more traditional conductors. However, reconductoring with advanced conductors may be less expensive than building new transmission lines. The need to modify the conductors used in an existing line, or rebuild a line, was found in the study. The use of advanced conductors would mitigate violations identified in this study. Existing structures are wood poles and steel poles. Due to fire risk and age of existing wood pole transmission lines, advanced conductors are not an option. The existing steel pole structures may be capable of supporting a reconductor with advanced conductor, however, an advanced conductor solution is not more cost effective than new transmission lines.

Power flow control devices are considered when a transmission element is overloaded and would benefit from a redistribution of flow. This can be accomplished through series reactors, series capacitors, or an equivalent technology. Power flow control devices were evaluated in this study. They did not mitigate violations, rather they pushed violations to other locations. Therefore, power flow control devices were not identified as upgrades in this study.

Raising lattice tower heights to provide more clearance may facilitate reconductoring a transmission line instead of rebuilding the transmission line. Tower lifting was not identified as a potential reconductor solution in this study because there are no lattice towers on existing transmission lines identified as needing to be rebuilt.

Revision History

Date	Author	Revisions
07/19/2024	Stephen Longmuir	Interim Transitional Cluster Study Area 4 Report version 1.0 issued.