# Generator Interconnection Facility Study Report

for the

[redacted] **Project #573**

for

[redacted]

in

**Power County, Idaho**

**08/06/2021**

# FACILITY STUDY REPORT (FSR)

[redacted]

**GI Project #573**

**08/06/2021**

## 1. General Facility Description

[redacted] (Interconnection Customer) has stated that the proposed project will consist of a 300 MW photovoltaic plus storage project located in IPCO's Eastern Region in Power County, Idaho ([redacted]) and connect to the 345 kV system at Idaho Power Company (IPC)'s [redacted] substation. The total project output as studied is 300 MW. The Interconnection Customer has stated that the storage devices will be self-charging and as such this FSR has not studied the impact of charging from IPC's transmission system. All capitalized terms in this report, if not defined herein, are defined in IPC's Open Access Transmission Tariff (OATT).

Contact Information for Interconnection Customer is as follows:

[redacted]

A Large Generator Interconnection Agreement (the "LGIA") under IPC's Open Access Transmission Tariff (OATT) between Interconnection Customer and IPC (Transmission Provider) for the [redacted] Project, specifically Generator Interconnection Project # 573 ("Project"), will be prepared for this project. The LGIA will be a definitive agreement that contains terms and conditions that supersedes this FSR.

### 1.1 Point of Interconnection

The Point of Interconnection ("POI") for the Project will electrically be the node on the bus between disconnect switches [redacted] and [redacted] and physically on the bus between air-break switches [redacted] and [redacted]. Drawings identifying the POI are attached as Exhibits 1 and 2.

### 1.2 Point of Change of Ownership

The Point of Change of Ownership for the Project will be on the Interconnection Customer's side of air-break switch [redacted], as shown on exhibit 1 and 2.

### 1.3 Interconnection Customer's Facilities

#### *1.3.1 Interconnection Customer's Interconnection Facilities*

The Interconnection Customer's Interconnection Facilities are located an unspecified distance from IPC's Interconnection Facilities. The Interconnection Customer will install, at its expense, 345kV transmission line, breaker, air-break switches, steel structures, foundations, OPGW fiber

optics, transformers (including a main step up transformer), CTs, appropriate grounding measures, and associated auxiliary equipment. The step-up transformer will be a 102/136/170 MVA, 3 phase, 345/34.5 kV unit (Z=8.5% at Base MVA) with a Wye-Grounded/Wye-Grounded with Delta Tertiary configuration. Interconnection Customer will build facilities to the Point of Change of Ownership entering the substation from the south of [redacted] Substation.

### 1.3.2 Interconnection Customer's Generating Facilities

The Interconnection Customer's photovoltaic system will be constructed as follows:

a. The inverter system will comprise of ninety-four [redacted] Inverters, with each inverter having an apparent power rating of 3450 KVA.

b. A plant controller will be used to control the inverter system and to implement smart inverter functionality for operating the project within a voltage range and power factor specified by IPC at the point of interconnection.

c. Battery storage system.

The above referenced inverters, or equivalent inverters that have the same specifications and functionality as stated above must be utilized. If a different inverter is utilized that has different specifications and functionality than that which was studied, then additional study and/or equipment may be necessary.

## 1.4 Other Facilities Provided by Interconnection Customer

### 1.4.1 Telecommunications

Interconnection Customer will supply and install single mode OPGW fiber between IPC's Interconnection Facilities and the Project for GOLC.

### 1.4.2 Ground Fault Equipment

The Interconnection Customer will install transformer configurations that will provide a ground source to the transmission system.

### 1.4.3 Generator Output Limit Control

The Interconnection Customer will install equipment to receive signals from IPC Grid Operations for Generation Output Limit Control ("GOLC") - see Section 5 Operating Requirements and Appendix A. Interconnection Customer will supply and install single mode OPGW fiber between IPC's Interconnection Facilities and the Project for GOLC.

### 1.4.4 Local Service

The Interconnection Customer is responsible to arrange for local service to their site, as necessary.

### 1.4.5 Property

#### 1.4.5.1 Land Transaction Documents

Land transaction documents ("Land Transaction Documents") in a form approved by IPC that may include, but are not limited to, the following:

- Right of Entry Agreement;
- Access Easement;
- Easements for distribution service lines, major distribution power lines, and transmission power lines and related ancillary facilities as determined necessary

by IPC at IPC's sole discretion, to support the interconnection facility and Interconnection Customer's development;
- Completed Applications with respective fees for Release of Easements and/or Crossing Agreements that may be required for the Project;
- Crossing Agreements; and
- Any other Project specific documents deemed necessary by IPC.

#### 1.4.5.2 Project Map/Site Plan

A 90% complete informational map or site plan of the Project Property with locations of all easements to be released, new easements proposed for both Interconnection Customer and IPC, existing IPC lines to be crossed by Interconnection Customer's facilities, Interconnection Customer's lease and easement areas (if any), access roads, and any other features or elements requested to be included by IPC to facilitate review and processing of the project documents.

#### 1.4.5.3 Surveyed Legal Descriptions and Maps

Written legal description and map for each Land Transaction Document, stamped and signed by a licensed surveyor. Each legal description and map is to be submitted to and approved by IPC's surveyor. See IPC survey requirements in Appendix B, attached hereto and made a part hereof.

### 1.4.6 Site Work

**N/A**

### 1.4.7 Monitoring Information

If the Interconnection Customer requires the ability to monitor information related to the IPC breaker/relay (i.e. Mirrored Bits) in the interconnection station, they are required to supply their own communications circuit to the interface area of the interconnection yard. The fiber communication circuit used for GOLC is acceptable.

### 1.4.8 Meteorological Data

In order to integrate the solar energy into the IPC system and operate IPC's solar forecasting tool, the Interconnection Customer must provide solar irradiation and weather data from the Facility's physical location to IPC via real time telemetry in a form acceptable to IPC. The associated cost for obtaining this data is the Interconnection Customer's responsibility.

The data must be provided at 10 second intervals and consist of:

1. Global Horizontal Irradiance
2. Plane of Array Irradiance
3. Ambient Temperature
4. Wind Speed and Wind Direction
5. Relative Humidity

The installed instruments must equal or exceed the specifications of the following instruments:
*Temperature and Relative Humidity*: R.M Young Relative Humidity and Temperature Probe Sensors Model 41382

*Wind*: R.M Young Wind Monitor Model 05103
*Pryanometer:* Apogee Instruments Model SP-230

### *1.4.9 Generator Technical Information & Drawings*

Interconnection Customer shall provide draft design prints during FSR development containing technical information, like impedances, and equipment brand and models. After construction, the Interconnection Customer shall submit to IPC all the as-built information, including prints with the latest approved technical information and commissioning test results.

## 1.5 Transmission Provider's Interconnection Facilities

Transmission Provider's Interconnection Facilities are referred to hereafter as "IPC's Interconnection Facilities." IPC's Interconnection Facilities are located in IPC's [redacted] Substation yard. IPC will install three 345kV dead-end structures, a 345kV air-break switch, three 345kV line/metering CTs and associated communication, control and metering equipment. Revenue metering will be accomplished on the high side of the transformer.

To meet North American Electric Reliability Corporation's (NERC's) MOD-11 and 13-WECC-CRT-1, R1.2 requirements, IPC will install equipment to collect and transmit Phasor Measurement Unit (PMU) data to IPC. The data can be made available to the Interconnection Customer on request.

The minimum acceptable PMU message rate is 30 samples per second. The minimum set of PMU measurement channels recorded at the POI is shown below. Additional or substitute channels may be required[1] on a per case basis depending on the interconnection configuration and facility design details.

- Frequency
- Frequency Delta (dF/dt)
- Positive Sequence Voltage Magnitude
- Positive Sequence Voltage Angle
- Positive Sequence Current Magnitude
- Positive Sequence Current Angle

# 2. Distribution and Network Upgrades

[1] Consult with System Planning to determine acceptability.

### 2.1 Distribution Upgrades

None

### 2.2 Network Upgrades to Substations

IPC will install the following at [redacted] Substation:

- 345kV circuit breaker and foundation ([redacted])
- Two 345kV air-break switches with structures and foundations ([redacted] & [redacted])
- Three 345kV bus PTs with structures and foundations
- [redacted] control & [redacted] Protection panel
- Additional DC load center
- Modifications to multiple existing control panels
- Cabling and bussing associated with installation of the new equipment

### 2.3 Network Upgrades to the Transmission System

None

## 3. Estimated Costs

The following good faith estimates are provided in 2021 dollars and are based on a number of assumptions and conditions. IPC does not warrant or guarantee the estimated costs in the table below, which are estimates only and are subject to change. Interconnection Customer will be responsible for all actual costs incurred in connection with the work to be performed by IPC and its agents, under the terms and subject to the conditions included in any LGIA executed by IPC and Interconnection Customer.

The estimated cost below is required to be paid in full by the Interconnection Customer, or other arrangements acceptable to IPC are made with IPC's Credit Department, prior to IPC commencing construction on the project.

**Estimated Cost:**

| Description | Ownership | Cost Estimate |
|---|---|---|
| ***IPC Interconnection Facilities:*** | | |
| Install Interconnection Facilities as described in Section 1.5 | IPC | $1,855,000 |
| | | |
| ***Network Upgrades to IPC Substation:*** | | |
| Install Network Upgrades as described in Section 2.2 | IPC | $1,105,000 |
| | | |
| ***GRAND TOTAL*** | | **$2,960,000** |
| | | |

## 4. Estimated Milestones

These milestones will begin, and the construction schedule referenced below will only be valid, upon receipt of funding from Interconnection Customer or its authorized third party no later than the date set forth below for such payment. IPC will not commit any resources toward project construction that have not been funded by Interconnection Customer. Additionally, failure by Interconnection Customer to make the required payments as set forth in this Study by the date(s) specified below may result in the loss of milestone dates and construction schedules set forth below. In the event that the Interconnection Customer is unable to meet dates as outlined below, Interconnection Customer may request an extension of the Operation Date of up to three (3) years. Interconnection Customer's request will be evaluated by IPC to ensure Interconnection Customer's request does not negatively impact other projects in IPC's Generator Interconnection Queue. Such extension will be allowed only if IPC determines, in its sole discretion, that the extension will not negatively impact other projects in IPC's Generator Interconnection Queue. Estimated milestones, which will be updated and revised for inclusion in the LGIA in light of subsequent developments and conditions, are as follows:

| Estimated Date | Responsible Party | Estimated Milestones |
|---|---|---|
| TBD | *Interconnection Customer* | *IPC receives Notice to Proceed and construction funding or arrangements acceptable to IPC are made with IPC's Credit Department* |
| 12 months after construction funds received | *IPC* | *IPC Engineering and Design Complete* |
| 12 months after construction funds received | *IPC* | *IPC Long Lead Material Procured/Received* |
| 8 months prior to IPC Commissioning | *IPC* | *New generation must be modeled and submitted to the Western Energy Imbalance Market a minimum of 6 months prior to coming online, failure to submit by given lead time will results in project delay.* |
| 22 months after construction funds received | *IPC* | *IPC Construction Complete* |
| 24 months after construction funds received | *IPC* | *IPC Commissioning Complete* |
| 5 days after switching request made to IPC Dispatch | *Interconnection Customer* | *Switch at the Point of Interconnection can be closed* |
| TBD | *IPC* | *Notification from IPC's Energy Contracting Coordinator confirming First Energy of Non-Firm Output* |

| | | |
|---|---|---|
| TBD | *Interconnection Customer* | *Interconnection Customer testing begins* |
| TBD | *IPC* | *Notification from IPC's Energy Contracting Coordinator confirming Operation Date (pending all requirements are met) of Firm Network Resource Output* |

IPC does not warrant or guarantee the foregoing estimated milestone dates, which are estimates only. These milestone dates assume, among other things, that materials can be timely procured, labor resources are available, and that outages to the existing transmission system are available to be scheduled. Additionally, there are several matters, such as permitting issues and the performance of subcontractors that are outside the control of IPC that could delay the estimated Operation Date. For purposes of example only, federal, state, or local permitting, land division approval, identification of Interconnection Facilities location, access to proposed Interconnection Facilities location for survey and geotechnical investigation, coordination of design and construction with the Interconnection Customer, failure of IPC's vendors to timely perform services or deliver goods, and delays in payment from Interconnection Customer, may result in delays of any estimated milestone and the Operation Date of the project. To the extent any of the foregoing are outside of the reasonable control of IPC, they shall be deemed Force Majeure events.

## 5. Operating Requirements

The Project is 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.

The Project will be subject to reductions directed by IPC Grid Operations during transmission system contingencies and other reliability events. When these conditions occur, the Project will be subject to Generator Output Limit Control ("GOLC") and will have equipment capable of receiving an analog setpoint via DNP 3.0 from IPC for GOLC. Generator Output Limit Control will be accomplished with a setpoint and discrete output control from IPC to the Project indicating maximum output allowed. For more detail see Appendix A.

**Frequency & Voltage Ride Through:** The Project must be capable of riding through faults on adjacent sections of the power system without tripping due to frequency or voltage deviations. The interconnection project must meet or exceed the Frequency and Voltage Ride-Through requirements as set forth in NERC Standard PRC-024.

**Frequency Response Requirements:** Generation resources must be capable of providing Fast Frequency Response for both positive and negative frequency deviations from 60Hz with a dead band not to exceed ± 0.036 Hz for Bulk Electric System frequency excursion events. The required frequency response must have an adjustable droop characteristic with a default droop value not to exceed 5%. The required frequency response shall be 0% to 3% of generation capacity, with a maximum required response of 3% of generator's full capacity for as long as the generator is able to provide frequency support. Where applicable, enabling and disabling of the frequency response function shall be made available via a SCADA control point.

**Momentary Cessation Requirements:** Momentary cessation should not be used within the voltage and frequency ride-through curves specified in PRC-024. Use of momentary cessation is not considered "ride through" within the "No Trip" zone curves of PRC-024. The use of momentary

cessation should be eliminated to the extent possible consistent with NERC's *Reliability Guideline for BPS-Connected Inverter-Based Resource Performance.*

In digital equipment, frequency should be calculated over a period-of-time (e.g. three to six cycles) and filtered to take control action on the fundamental frequency component of the calculated signal. Calculated frequency must not be susceptible to spikes caused by phase jumps on the Bulk Electric System.

Applicable generation resources should follow NERC's *Reliability Guideline for BPS-Connected Inverter-Based Resource Performance* with respect to Reaction Time, Rise Time, Settling Time, Overshoot, and Settling Band.

Interconnection Customer will be able to modify power plant facilities on the Interconnection Customer side of the Interconnection Point with no impact upon the operation of the transmission or distribution system whenever the generation facilities are electrically isolated from the system via the [redacted] switch and a terminal clearance is issued by IPC's Grid Operator.

## 6. Reactive Power

The Project must be capable of +/- 0.95 power factor operation, as measured at the Interconnection Point, for all MW production levels. The Project must have equipment capable of receiving an analog setpoint, via DNP 3.0 from IPC for Voltage Control. The setpoint will be the desired voltage level as measured at the interconnect bus. The range of setpoint will be 310.5 kV to 379.5 kV. For more detail see Appendix A.

## Note Regarding Transmission Service:

This FSR is a study of a request for Network Resource Interconnection Service. This FSR identifies the facilities necessary to provide such service. Network Resource Interconnection Service in and of itself does not convey any right to transmission service or to deliver electricity to any specific customer or Point of Delivery.

## Note Regarding LGIA:

This FSR is a study and preliminary evaluation only and does not constitute, or form the basis of, a definitive agreement related to the matters described in this FSR. Unless and until a LGIA is executed by IPC and Interconnection Customer, no party will have any legal rights or obligations, express or implied, related to the subject matter of this FSR.

# Appendix A

## Generation Interconnection Control Requirements

## A.1 Generator Output Limit Control (GOLC)

**A.1.1** IPC requires Interconnected Power Producers to accept GOLC signals from IPC's energy management system ("EMS").

**A.1.2** The GOLC signals will consist of four points shared between the IPC EMS (via the IPC RTU) and the Interconnection Customer's Generator Controller ("SGC"). The IPC RTU will be the master and the SGC will be the slave.

**A.1.2.1** GOLC Setpoint: An analog output that contains the MW value the Interconnection Customer should curtail to, should a GOLC request be made via the GOLC On/Off discrete output Control point.

**A.1.2.1.1** An Analog Input feedback point must be updated (to reflect the GOLC setpoint value) by the SGC upon the SGC's receipt of the GOLC setpoint change, with no intentional delay.

**A.1.2.2** GOLC On/Off: A discrete output (DO) control point with pulsing Trip/Close controls. Following a "GOLC On" control (DNP Control Code "Close/Pulse On"), the SGC will run power output back to the MW value specified in the GOLC Setpoint. Following a "GOLC Off" control (DNP Control Code "Trip/Pulse On"), the Interconnection Customer is free to run to maximum possible output.

**A.1.2.2.1** A Discrete Input (DI) feedback point must be updated (to reflect the last GOLC DO Control Code received) by the SGC upon the SGC's receipt of the GOLC DO control, with no intentional delay. The feedback DI should latch to an OFF state following the receipt of a "GOLC OFF" control and it should latch to an ON state following the receipt of an "GOLC ON" control.

**A.1.3** If a GOLC control is issued, it is expected to see MW reductions start within 1 minute and plant output to be below the GOLC Setpoint value within 10 minutes.

## A.2 Voltage Control

**A.2.1** IPC requires Transmission-Interconnected Power Producers to accept voltage control signals from IPC's EMS when they are connected to IPC's transmission system.

**A.2.2** The voltage control will consist of one setpoint and one feedback point shared between the IPC EMS and the SGC.

**A.2.3** The setpoint will contain the desired target voltage for plant operation. This setpoint will have a valid control range between 0.95 and 1.05 per unit ("p.u.") of nominal system voltage.

**A.2.4** The control will always be active, there is no digital supervisory point like the Curtail On/Off control above.

**A.2.4.1** When a setpoint change is issued an Analog Input feedback point must be updated (to reflect the voltage control setpoint value) by the SGC upon the SGC's receipt of the voltage control setpoint change, with no intentional delay.

**A.2.4.2** When a setpoint change is received by the SGC, the voltage control system should react with no intentional delay.

**A.2.4.3** The voltage control system should operate at the voltage indicated by the setpoint with an accuracy of +/- 0.5% of the nominal system voltage.

**A.2.5** The Interconnection Customer should supervise this control by setting up "reasonability limits", i.e. configure a reasonable range of values for this control to be valid. As an example, they will accept anything in the valid control range (between 0.95 and 1.05 p.u.) but reject values outside this range. If they were fed an erroneous value outside the valid range, their control system would default to the last known, good value.

## A.3 Generation Interconnection Data Points Requirements

| Digital Inputs to IPC (DNP Obj. 01, Var. 2) | | | |
|---|---|---|---|
| Index | Description | State (0/1) | Comments: |
| 0 | GOLC Off/On (Control Feedback) | Off/On | Feedback provided by Interconnection Customer |
| 1 | FREQUENCY RESPONSE OFF/ON (Control Feedback) | Off/On | Feedback provided by Interconnection Customer |
| 2 | 52A Interconnection Customer Main Breaker (if present) | Open/Closed | Sourced at substation |
| 3 | 52A Interconnection Customer Capacitor Breaker (if present) | Open/Closed | Sourced at substation |

| Digital Outputs to Interconnection Customer (DNP Obj. 12, Var. 1) | | |
|---|---|---|
| Index | Description | Comments: |
| 0 | GOLC Off/On | Control issued by IPC |
| 1 | Frequency Response Off/On | Control issued by IPC |

| Analog Inputs to IPC (DNP Obj. 30, Var. 2) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Index | Description | Raw High | Raw Low | EU High | EU Low | EU Units | Comments: |
| 0 | GOLC Setpoint Value Received (Feedback) | 32767 | -32768 | TBD | TBD | MW | Provided by Interconnection Customer |
| 1 | Voltage Control Setpoint Value Rec'd (Feedback) | 32767 | -32768 | TBD | TBD | kV | Provided by Interconnection Customer |
| 2 | Maximum Park Generating Capacity | 32767 | -32768 | TBD | TBD | MW | Provided by Interconnection Customer |
| 3 | Ambient Temperature | 32767 | -32768 | 327.67 | -327.68 | DEG C | Provided by Interconnection Customer |
| 4 | Wind Direction | 32767 | -32768 | 327.67 | -327.68 | Deg from North | Provided by Interconnection Customer |
| 5 | Wind Speed | 32767 | -32768 | 327.67 | -327.68 | M/S | Provided by Interconnection Customer |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | Relative Humidity | 32767 | -32768 | TBD | TBD | % | Provided by Interconnection Customer |
| 7 | Global Horizontal Irradiance | 32767 | -32768 | TBD | TBD | W/M^2 | Provided by Interconnection Customer |
| 8 | Plane of Array Irradiance | 32767 | -32768 | TBD | TBD | W/M^2 | Provided by Interconnection Customer |
| 9 | SPARE | | | | | | |
| 10 | SPARE | | | | | | |
| 11 | SPARE | | | | | | |
| 12 | SPARE | | | | | | |
| 13 | SPARE | | | | | | |
| 14 | SPARE | | | | | | |
| 15 | SPARE | | | | | | |
| 16 | SPARE | | | | | | |
| 17 | SPARE | | | | | | |

| **Analog Outputs to Interconnection Customer (DNP Obj. 41, Var. 2)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Index | Description | Raw High | Raw Low | EU High | EU Low | EU Units | Comments: |
| 0 | GOLC Setpoint | 32767 | -32768 | TBD | TBD | MW | Control issued by IPC |
| 1 | Voltage Control Setpoint | 32767 | -32768 | TBD | TBD | kV | Control issued by IPC |
| 2 | SPARE | | | | | | |
| 3 | SPARE | | | | | | |
| 4 | SPARE | | | | | | |
| 5 | SPARE | | | | | | |
| 6 | SPARE | | | | | | |
| 7 | SPARE | | | | | | |
| 8 | SPARE | | | | | | |
| 9 | SPARE | | | | | | |

# Appendix B

## IPC Survey Requirements

- ❑ Is the Grantor's Deed Instrument No. noted in the Exhibit 'A' Legal Description or Exhibit 'B' Survey Map?
- ❑ Are the Section, Township, Range, and County information clearly stated on the Exhibits?
- ❑ Is the Basis of Bearings between found monuments called out and noted on the Exhibits?
- ❑ Are the Point of Commencement, Point of Beginning and or Point of Terminus shown on the Exhibits?
- ❑ Do all lines have a bearing and distance associated with them on the Exhibits?
- ❑ All lines need bounding calls to Grantor's ownership lines, Rights-of-Way, etc. in Exhibit A.
- ❑ Are the Subdivision names, lot & block, and streets labeled on the Exhibit B?
- ❑ Are any existing Utility Easements adjoining this Easement called out and shown on the Exhibits?
- ❑ Is the map scale noted and is there a North arrow shown on the Exhibit B?
- ❑ On a strip easement is the width given and does it call to form a closed figure in the Exhibit A?
- ❑ Does the Parcel description close?
- ❑ Are the reference surveys of record or CP&Fs used to prepare the easement called out and shown on the Exhibits?
- ❑ A Professional Land Surveyor or Engineer in responsible charge must stamp, sign and date the exhibits for submission.
- ❑ A copy of the current Deed of Record for the Grantor is needed for submission.