Community Solar Project Interconnection

Community Solar Project System Impact Study Report

Completed for

("Applicant")

CSPQ056

Proposed Point of Interconnection

Circuit 4M22 out of Independence substation

February 15, 2021

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1.0 DESCRIPTION OF THE COMMUNITY SOLAR PROJECT

("Applicant") proposed interconnecting 2.9 MW of new generation to PacifiCorp's ("Public Utility") circuit 4M22 out of Independence substation at 20.8 kV located in Polk County, Oregon. The project ("Project") will consist of twenty-four (24) SCA125KTL-DO/US-600-UL for a total requested nameplate output of 2.9 MW (factory nameplate limited). The requested commercial operation date is April 2, 2021.

The Public Utility has assigned the Project "OCSQ056."

2.0 APPROVAL CRITERIA FOR TIER 4 INTERCONNECTION REVIEW

Pursuant to the Section I(1) of the Public Utility's CSP Interconnection Procedures, a Public Utility must use the Tier 4 review procedures for an application to interconnect a Community Solar Project that meets the following requirements:

(a) The Community Solar Project does not qualify for or failed to meet Tier 2 review requirements; and

(b) The Community Solar Project must have a nameplate capacity of three (3) megawatts or less.

3.0 SCOPE OF THE STUDY

Pursuant to Section I(6)(g) of the CPS Interconnection Procedures, the System Impact Study Report shall consist of: (1) the underlying assumptions of the study; (2) a short circuit analysis; (2) a stability analysis; (3) a power flow analysis; (4) voltage drop and flicker studies; (5) protection and set point coordination studies; (6) grounding reviews; (7) the results of the analyses; and (8) any potential impediments to providing the requested Interconnection Service, including a non-binding informational NRIS portion that addresses the additions, modifications, and upgrades to the Public Utility's Transmission System that would be required at or beyond the point at which the Interconnection Facilities connect to the Public Utility's Transmission System to accommodate the interconnection of the CSP Project In addition, the System Impact Study shall provide a list of facilities that are required as a result of the Community Solar Project request and non-binding good faith estimates of cost responsibility and time to construct.

4.0 PROPOSED POINT OF INTERCONNECTION

The Applicant's proposed Community Solar Project is to be interconnected to the Public Utility's distribution circuit 4M22 out of Independence substation (Figure 1) via a 20.8 kV primary meter. The proposed Point of Interconnection will be located at approximately 44.894288°N, 123.178132°W located in Polk County, Oregon. Figures 1 and 2 below are a map and a one-line diagram that illustrate the interconnection of the proposed generating facility to the Public Utility's system.

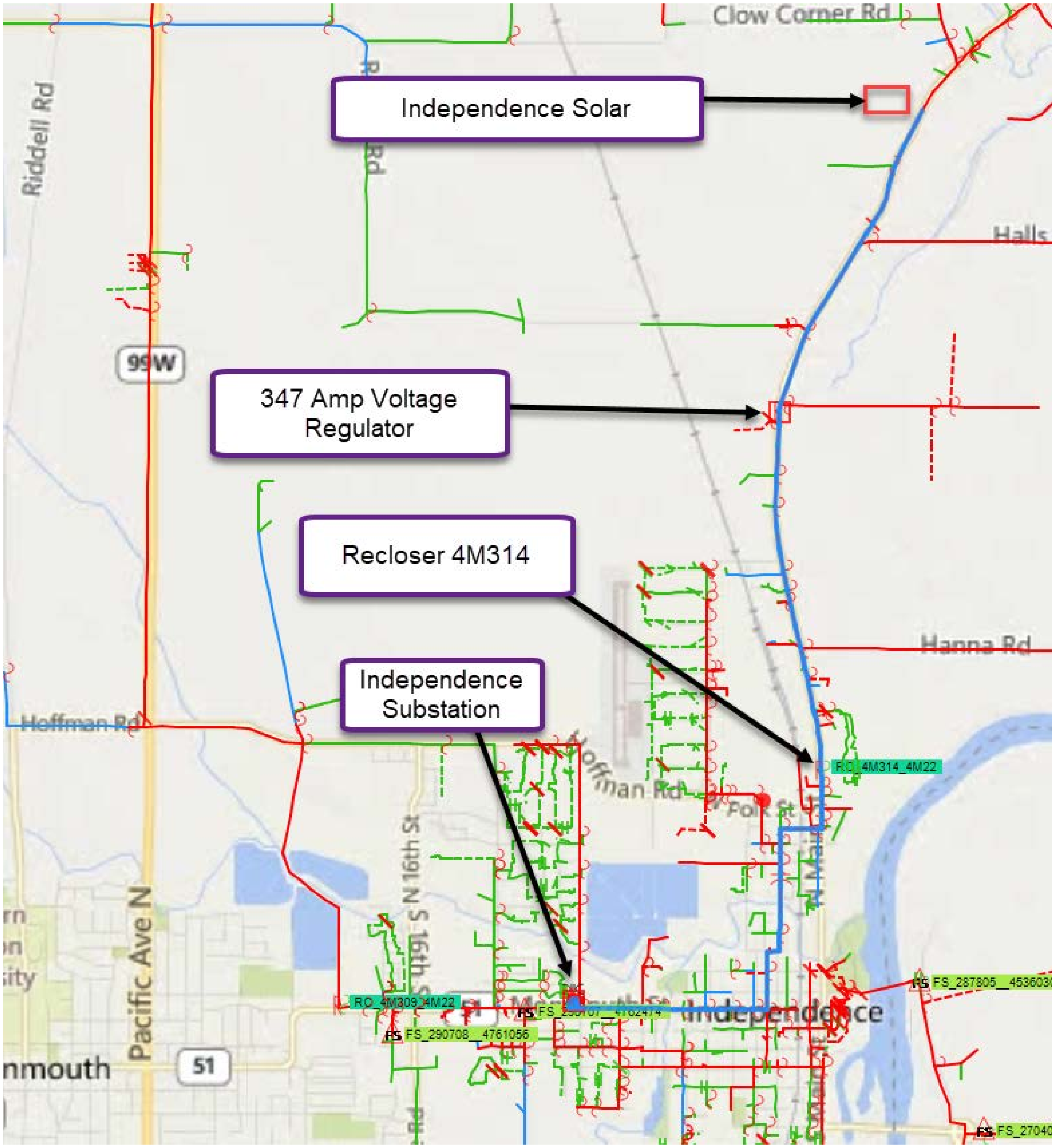

Figure 1: System Map

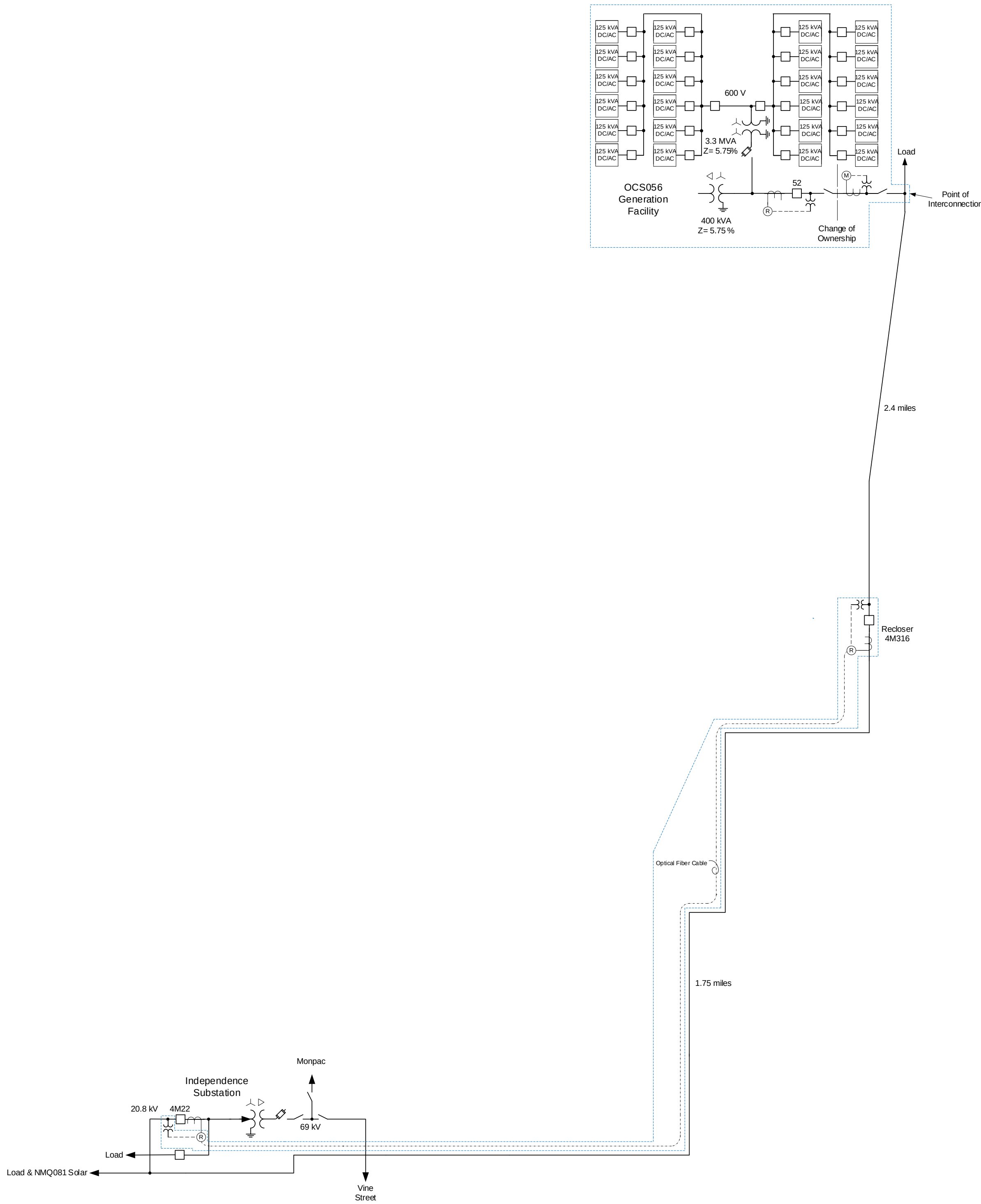

Figure 2: System One Line Diagram

5.0 STUDY ASSUMPTIONS

- All active higher-priority requests for transmission service and/or generator interconnection service (including requests in the traditional interconnection queue and other requests in the

Community Solar queue) in the local area of the requested POI will be considered in this study and are listed in Appendix 1. If any of these requests are withdrawn, the Public Utility reserves the right to restudy this request, as the results and conclusions contained within this study could significantly change.

- The Applicant's request for interconnection service in and of itself does not convey transmission service.
- This study assumes the Project will be integrated into Public Utility's system at the agreed upon and/or proposed Point of Interconnection ("POI").
- The Applicant will construct and own any facilities required between the POI and the Project unless specifically identified by the Public Utility.
- Line reconductor or fiber underbuild required on existing poles will be assumed to follow the most direct path on the Public Utility's system. If during detailed design the path must be modified it may result in additional cost and timing delays for the Applicant's Project.
- Generator tripping may be required for certain outages.
- All facilities will meet or exceed the minimum Western Electricity Coordinating Council ("WECC"), North American Electric Reliability Corporation ("NERC"), and Public Utility performance and design standards.
- This report is based on information available at the time of the study. It is the Applicant's responsibility to check the Public Utility's web site regularly for transmission system updates (https://www.oasis.oati.com/ppw)

6.0 REQUIREMENTS

6.1 COMMUNITY SOLAR PROJECT REQUIREMENTS

The Community Solar Project and Interconnection Equipment owned by the Applicant are required to operate under automatic power factor with the power factor electrically at the POI. The Community Solar Project should have sufficient reactive capacity to enable the delivery of 100 percent of the plant output to the POI at unity power factor measured at 1.0 per unit voltage under steady state conditions.

In general, the Community Solar Project and Interconnection Equipment should be operated so as to maintain the voltage at the POI between 1.01 pu to 1.04 pu. At the Public Utility's discretion, these values might be adjusted depending on the operating conditions. Within this voltage range, the Community Solar Project should operate so as to minimize the reactive interchange between the Community Solar Project and the Public Utility's system (delivery of power at the POI at approximately unity power factor). The voltage control settings of the Community Solar Project must be coordinated with the Public Utility prior to energization (or interconnection). The reactive compensation must be designed such that the discreet switching of the reactive device (if required by the Applicant) does not cause step voltage changes greater than +/-3% on the Public Utility's system.

All generators must meet applicable WECC low voltage ride-through requirements as specified in the interconnection agreement.

As per NERC standard VAR-001-1, the Public Utility is required to specify voltage or reactive power schedule at the POI. Under normal conditions, the Public Utility's system should not supply reactive power to the Community Solar Project.

The Generation Interconnection Customer will be required to install a transformer that will hold the phase to neutral voltages within limits when the generation facility is isolated with the Transmission Provider's local system until the generation disconnects. The proposed wye – wye step-up transformer will not accomplish the stabilization of the phase to neutral voltages on the 20.8 kV system. The circuit that the Project is connecting to is a four wire multi-grounded circuit with line to neutral connected load. Figure 2 shows the addition of a wye – delta grounding transformer of adequate power size and impedance that will meet the requirement. The grounding transformer will need to be a 350 kVA transformer with 5.75 % impedance.

6.2 Transmission System Modifications

No transmission system modifications are required to accommodate the proposed Interconnection Customer's facility.

6.3 Distribution/Transmission Line Modifications

Distribution system feeder 4M22 minimum daytime load (MDL) is 4.9 MW. There is also another net metering 1.12 MW of generation not captured as a study is under way. This will put the net existing generation on the circuit at 1.675 MW changing maximum available generation from application to .225 MW. The Applicant's proposed generating facility is located beyond one recloser and one voltage regulator bank. The MDL beyond recloser 4M314 is 1,980 kW. The MDL beyond the voltage regulator bank is 1,498 kW. Because the MDL beyond the recloser and voltage regulator is less than the proposed generation this will trigger additional protection/regulation requirements. Recloser 4M314 will need to be replaced to accommodate updated protection. Voltage regulator may need to be replaced to accommodate reverse power flow.

The following distribution modifications will be required. Note that locations and distances are estimated and could change depending on final design.

- Reprogram regulators at FP 01308004.0163706 for reverse power flow, if able.
- Replace recloser 4M314 with a new SEL-651R2 triple-single recloser with 6 internal PT's at facility point (FP) 01308004.0214513
- Interest new pole near FP 01308004.0098700–frame location for 3 phase tap and fuse with 100T's. Extend approximately 80' of 3 phase 1/0 ACSR west to new pole.
- FP New – Install new pole and 3 phase unitized load break switch west of new tap for generation. Extend 1/0 ACSR from this location approximately 50' west to primary metering pole and POI.
- FP New – Install new pole to for primary metering to act as POI.

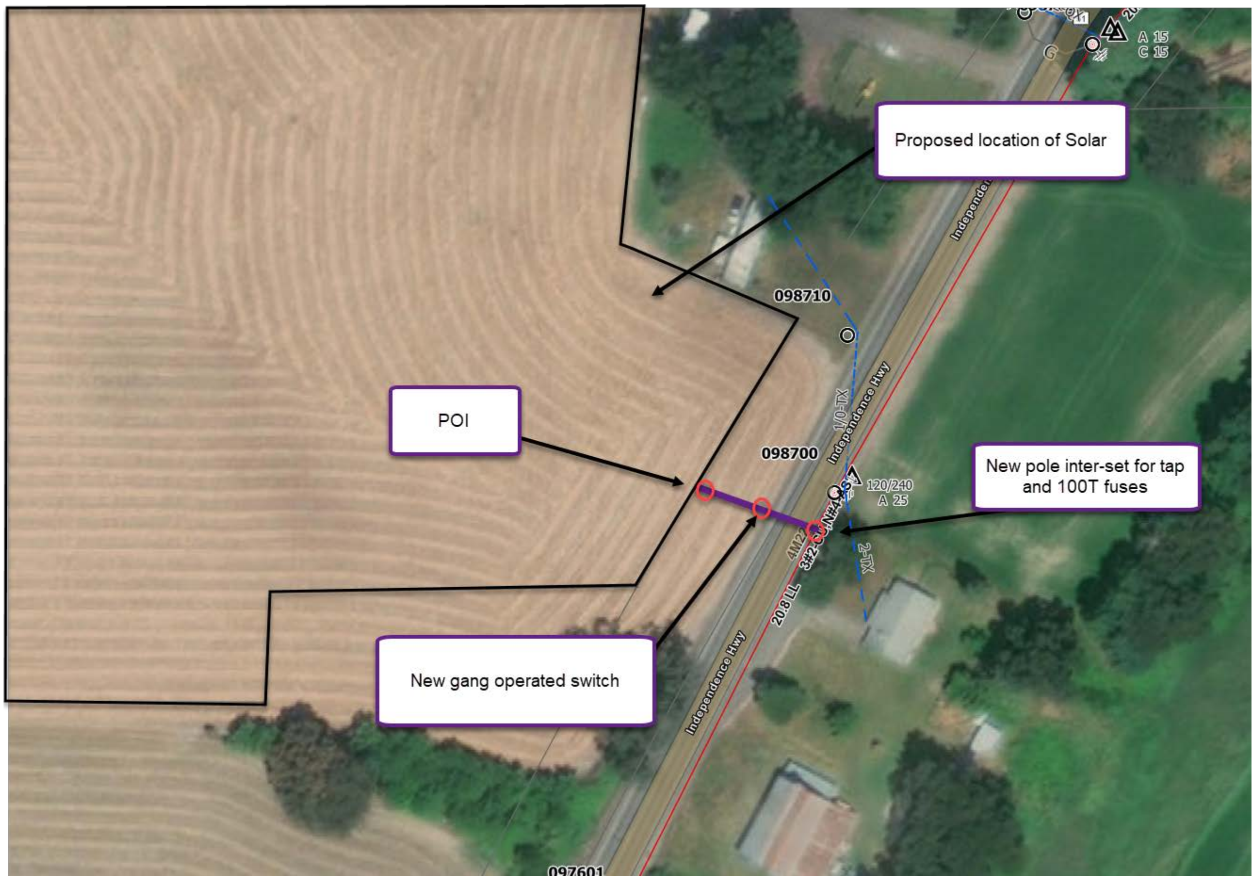

Figure 3: POI Map

6.4 Existing Breaker Modifications – Short-Circuit

The increase in the fault duty on the system as the result of the addition of the Community Solar Project with photovoltaic arrays fed through 24 – 125 kW inverters connected to 1 – 3.3 MVA 20.8 kV – 600 V transformer with 5.75 % impedance will not push the fault duty above the interrupting rating of any of the existing fault interrupting equipment.

6.5 Protection Requirements

The OCS056 Community Solar Project will need to disconnect in a high-speed manner for any fault on the 20.8 kV circuit 4M22 out of Independence substation. The minimum daytime load on circuit 4M22 with the addition of the NMQ081 project does not provide adequate margin above the potential power output of the proposed OCS056 Community Solar Project to rely on the imbalance condition of the load and generation that the Community Solar Project could be isolated with following the opening of 4M22 to result in high-speed disconnection of the Community Solar Project for faults on the distribution system. A transfer trip circuit will need to be installed between Independence substation and the OCS056 recloser at the POI. Since most faults on overhead lines are temporary and the circuit can be restored as soon as all the sources of power to the fault have been disconnected the breaker 4M22 is equipped with automatic reclosing. When breaker 4M22 opens a transfer trip signal will be sent to the recloser at the POI for the generation facility.

To ensure that the automatic reclosing of breaker 4M22 does not take place before the Community Solar Project has disconnected, a deadline checking control circuit will be installed. The deadline checking control circuit will delay the reclosing until the line is no longer energized to ensure that no damage is done to any of the existing customers' equipment. The enabling of this type of controls will require the addition of a voltage instrument transformer (VT) on the line side of breaker 4M22. The existing feeder relay and control system will need to be replaced with a relay that can accommodate both the transfer trip and the deadline checking circuit.

The OCS056 Community Solar Project will be connected beyond a line recloser. Line recloser 4M316 is located on Main Street. The Community Solar Project will need to disconnect in a high-speed manner for the operation of the line recloser. The minimum daytime load beyond the line recloser is below the maximum potential power output of the proposed project. Because the unbalance between the islanded load and generation cannot be relied upon to cause high speed disconnection of the Community Solar Project, transfer trip circuits will need to be installed between 4M316 and the POI recloser for the OCS056 Community Solar Project. A communication system will be required to carry the transfer trip circuits.

Deadline checking control circuit will be needed at the line recloser to delay the automatic reclose if the generation at the Community Solar Project is not disconnected due to a failure of the relay or communication circuitry, or a failure of the recloser at the POI. The line recloser at 4M316 has neither of these capabilities for the deadline checking or transfer trip. For this reason, the line recloser will need to be replaced as part of this generation interconnect project.

The 20.8 kV circuit recloser planned to be installed at the OCS056 Project will need to equipped Schweitzer Engineering Laboratories (SEL) 651R relay/controller and voltage instrument transformers mounted on the utility side of the circuit recloser. The 651R will perform the following protection functions:

1. Detect faults on the 20.8 kV equipment at the Community Solar Project
2. Detect faults on the 20.8 kV line to Independence substation
3. Monitor the unbalance current flowing through the grounding transformer and protect the transformer from damage due to phase unbalances on the 20.8 kV circuit
4. Monitor the voltage and react to under or over frequency, and /or magnitude of the voltage
5. Receive transfer trip from Independence substation and the line recloser 4M316

6.6 DATA REQUIREMENTS (RTU)

Due to the power size of the solar-electric generation facility no real time monitoring will be required by the Transmission Provider for the operation of the transmission network so no RTU will be required.

6.7 COMMUNICATION REQUIREMENTS

A fiber link will be installed between Independence substation and recloser 4M316 and a radio link between 4M316 and the customer recloser for transfer trip communication between the three sites. A 48-fiber, single-mode, ADSS cable will be installed along the distribution line between the line recloser 4M316 and Independence substation. The fiber will terminate in patch panels at both ends. Jumpers will be installed to the relays' fiber optic transceivers, and at 4M316, the radios' fiber optic transceivers. This equipment will be placed in a pole-mounted enclosure at the recloser and in a rack at Independence substation. An SEL-3031 radio link will be installed between recloser 4M316 and the OCS056 recloser. Radios, SEL-2812 transceivers, DC power supplies, and batteries will be installed in enclosures at both sites. Wood poles will be installed for the antennas.

6.8 SUBSTATION REQUIREMENTS

New equipment will be required at Independence substation to facilitate high speed disconnection of the solar generation facility from the 20.8kV distribution system. The following equipment has been identified as being required and may change during detailed design:

(1) 20.8kV VT

6.9 METERING REQUIREMENTS

<u>Interchange Metering</u>

The metering will be located on the high side of the Community Solar Project step up transformer at the POI. The metering transformers will be installed overhead on a pole per distribution DM construction standards. The meter itself will be installed at the base of the pole. The Public Utility will procure, install, test, and own all revenue metering equipment. The metering will be bi-directional to measure KWH and KVARH quantities for both generation received and back feed retail load delivered. There will be no additional station service metering for supplying generation load. The metering generation and billing data will be remotely interrogated via the Public Utility's MV90 data acquisition system.

<u>Station Service/Construction Power</u>

The Applicant must arrange distribution voltage retail meter service for electricity consumed by the project when not generating. Temporary construction power metering shall conform to the Six State Electric Service Requirements manual. Applicant must call the PCCC Solution Center 1-800-640-2212 to arrange this service. Approval for back feed is contingent upon obtaining station service.

7.0 Cost Estimate

The following estimate represents only scopes of work that will be performed by the Public Utility. Costs for any work being performed by the Applicant are not included.

Project Administration *Project management, administrative support*	$17,000
Protection & Control *P&C Engineer and Relay Technician*	$11,000
Metering *Metering equipment*	$19,000
Distribution *Load side VT's, poles, conductor, jumper, disconnect switch*	$55,000
Communications *Install 1.8 miles of fiber, communications equipment at recloser, Independence substation, and generating facility*	$176,000
Substation *Installation of instrument transformer*	$77,000
Other Costs *Capital surcharge and contingency*	$62,000
Total Project Cost	**$417,000**

*Any distribution line modifications identified in this report will require a field visit analysis in order to obtain a more thorough understanding of the specific requirements. The estimate provided above for this work could change substantially based on the results of this analysis. Until this field analysis is performed the Public Utility must develop the Project schedule using conservative assumptions. The Applicant may request that the Public Utility perform this field analysis, at the Applicant's expense, prior to the execution of an Interconnection Agreement in order to obtain more cost and schedule certainty.

Note: Costs for any excavation, duct installation and easements shall be borne by the Applicant and are not included in this estimate. This estimate is as accurate as possibly given the level of detailed study that has been completed to date and approximates the costs incurred by Public Utility to interconnect this Community Solar Project to Public Utility's electrical distribution or transmission system. An estimate, based on finer detail, will be calculated during the Facilities Study. The Applicant will be responsible for all actual costs, regardless of the estimated costs communicated to or approved by the Applicant.

8.0 SCHEDULE

The Public Utility estimates it will require approximately 12-15 months to design, procure and construct the facilities described in this report following the execution of an Interconnection Agreement. The schedule will be further developed and optimized during the Facilities Study.

Please note, the time required to perform the scope of work identified in this report does not support the Applicant's requested commercial operation date of April 2, 2021.

9.0 PARTICIPATION BY AFFECTED SYSTEMS

Public Utility has identified the following Affected Systems: None

Copies of this report will be shared with each Affected System.

10.0 APPENDICES

Appendix 1: Higher Priority Requests
Appendix 2: Informational Network Resource Interconnection Service Assessment
Appendix 3: Property Requirements
Appendix 4: Transmission/Distribution system study results

10.1 Appendix 1: Higher Priority Requests

All active higher priority transmission service and/or generator interconnection and Community Solar Project requests will be considered in this study and are identified below. If any of these requests are withdrawn, the Public Utility reserves the right to restudy this request, as the results and conclusions contained within this study could significantly change.

Transmission/Generation Interconnection/Community Solar Queue Requests considered:

1120 kW Net Metering Solar Project WO# 45048885

Q#	**Size (MW)**
1149	0.108
1150	0.504
1151	0.285
OCS008	2.16
OCS026	1.5
OCS035	2.25
OCS038	.981
OCS041	1.875

10.2 APPENDIX 2: INFORMATIONAL NETWORK RESOURCE INTERCONNECTION SERVICE ASSESSMENT

The study results described above reflect an energy resource interconnection service ("ERIS") evaluation, modified in the CSP program rules to examine only generation and load conditions local to the requested CSP project's interconnection point (sometimes referred to as the "zoomed in view"). The "zoomed in view" functions to: (1) study the project's proposed interconnection without considering certain existing or higher-queued requests outside of the local area; and (2) to inform whether the CSP facility must cap its project to mitigate, although not eliminate, the risk of potential deliverability-related network upgrades to accommodate the proposed CSP generator.

By contrast, the following informational section provides a network resource interconnection service ("NRIS") evaluation performed with traditional assumptions, i.e., not modified to examine only local generation and load conditions, but rather one that assumes that all existing interconnections, higher-queued requests for interconnection service (in both the traditional and CSP queue), and generators with executed contracts beyond the local area are in-service. Depending on the severity of the conditions created when absorbing additional generation (capped or not capped) in that broader, "zoomed out" area, the local area-focused generator size cap developed in the "zoomed in" examination may not be sufficient to mitigate the need for deliverability-related network upgrades. Regardless of this report's informational NRIS results, the deliverability-related network upgrades ultimately necessary to accommodate the proposed CSP generator will depend on conditions present when the future transmission service study is performed, as well as whether network upgrade alternatives are available at that time.

Considering existing generation and higher-queued requests to interconnect in the Willamette Valley area where the CSP generator proposes to interconnect, 2.9 MW of additional generation can be absorbed. As a result, the transmission provider determines that no additional network upgrades would be required for the aggregate of generation in the local area to be delivered to the aggregate of load on the transmission provider's transmission system (the NRIS study scope).

10.3 APPENDIX 3: PROPERTY REQUIREMENTS

Requirements for rights of way easements
Rights of way easements will be acquired by the Applicant in the Public Utility's name for the construction, reconstruction, operation, maintenance, repair, replacement and removal of Public Utility's Interconnection Facilities that will be owned and operated by PacifiCorp. Applicant will acquire all necessary permits for the project and will obtain rights of way easements for the project on Public Utility's easement form.

Real Property Requirements for Point of Interconnection Substation
Real property for a POI substation will be acquired by an Applicant to accommodate the Applicant's project. The real property must be acceptable to Public Utility. Applicant will acquire fee ownership for interconnection substation unless Public Utility determines that other than fee ownership is acceptable; however, the form and instrument of such rights will be at Public Utility's sole discretion. Any land rights that Applicant is planning to retain as part of a fee property conveyance will be identified in advance to Public Utility and are subject to the Public Utility's approval.

The Applicant must obtain all permits required by all relevant jurisdictions for the planned use including but not limited to conditional use permits, Certificates of Public Convenience and Necessity, California Environmental Quality Act, as well as all construction permits for the project.

Applicant will not be reimbursed through network upgrades for more than the market value of the property.

As a minimum, real property must be environmentally, physically, and operationally acceptable to Public Utility. The real property shall be a permitted or able to be permitted use in all zoning districts. The Applicant shall provide Public Utility with a title report and shall transfer property without any material defects of title or other encumbrances that are not acceptable to Public Utility. Property lines shall be surveyed and show all encumbrances, encroachments, and roads.

Examples of potentially unacceptable environmental, physical, or operational conditions could include but are not limited to:

- Environmental: known contamination of site; evidence of environmental contamination by any dangerous, hazardous or toxic materials as defined by any governmental agency; violation of building, health, safety, environmental, fire, land use, zoning or other such regulation; violation of ordinances or statutes of any governmental entities having jurisdiction over the property; underground or above ground storage tanks in area; known remediation sites on property; ongoing mitigation activities or monitoring activities; asbestos; lead-based paint, etc. A phase I environmental study is required for land being acquired in fee by the Public Utility unless waived by Public Utility.

- Physical: inadequate site drainage; proximity to flood zone; erosion issues; wetland overlays; threatened and endangered species; archeological or culturally sensitive areas; inadequate sub-surface elements, etc. Public Utility may require Applicant to procure various studies and surveys as determined necessary by Public Utility.

- Operational: inadequate access for Public Utility's equipment and vehicles; existing structures on land that require removal prior to building of substation; ongoing maintenance for landscaping or extensive landscape requirements; ongoing homeowner's or other requirements or restrictions (e.g., Covenants, Codes and Restrictions, deed restrictions, etc.) on property which are not acceptable to the Public Utility.

10.4 APPENDIX 4: TRANSMISSION/DISTRIBUTION STUDY RESULTS

Transmission:

Three base cases were developed to represent heavy summer, heavy winter and light spring load conditions. A Power flow analysis was performed on each case for three system configurations described below.

1. Normal transmission configuration: Independence normally fed radial out of Monpac substation at 69kV. Normally open section along the 69kV line between Independence to Vine St. substation.
2. Contingency transmission configuration: Loss of Monpac 115-69 kV transformer. Transfer to Independence to Hazelwood source via Vine St. substation.

Each Power flow analysis was conducted pre and post OCS056. The study focused on the 69 kV system out of Monpac and Hazelwood substations and distribution substations in the area. Voltage and thermal limitation of surrounding substation buses and lines were monitored.

The results for the transmission study concluded that steady state and post transient voltages are within acceptable limits. No thermal violations were identified. The proposed OCS056 project does not result in additional deficiencies to the Transmission Provider’s transmission system.

There are no contingent facilities identified for this interconnection request