Community Solar Project Interconnection

Community Solar Project System Impact Study Report

Completed for

("Applicant")
OCS004

Proposed Point of Interconnection
Circuit 5L36 out of Modoc substation at 12.0kV
(at approximately 42.500500°N, 121.886800°W)

June 29, 2020

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1.0 Description of the Community Solar Project

(“Applicant”) proposed interconnecting 0.8 MW of new generation to PacifiCorp’s (“Public Utility”) circuit 5L36 out of Modoc substation located in Klamath County, Oregon. The project (“Project”) will consist of seven Sungrow SG125HV, 125 kW inverters factory derated to 112.5

kW for a total requested output of 0.8 MW. The requested commercial operation date is September 28, 2021.

The Public Utility has assigned the Project "OCS004."

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 5L36 out of Modoc substation via a 12.0 kV primary meter. The proposed Point of Interconnection will be at approximately 42.500500°N, 121.886800°W located in Klamath County, Oregon. Figures 1 and 2 below are one line diagrams that that illustrate the interconnection of the proposed generating facility to the Public Utility's system.

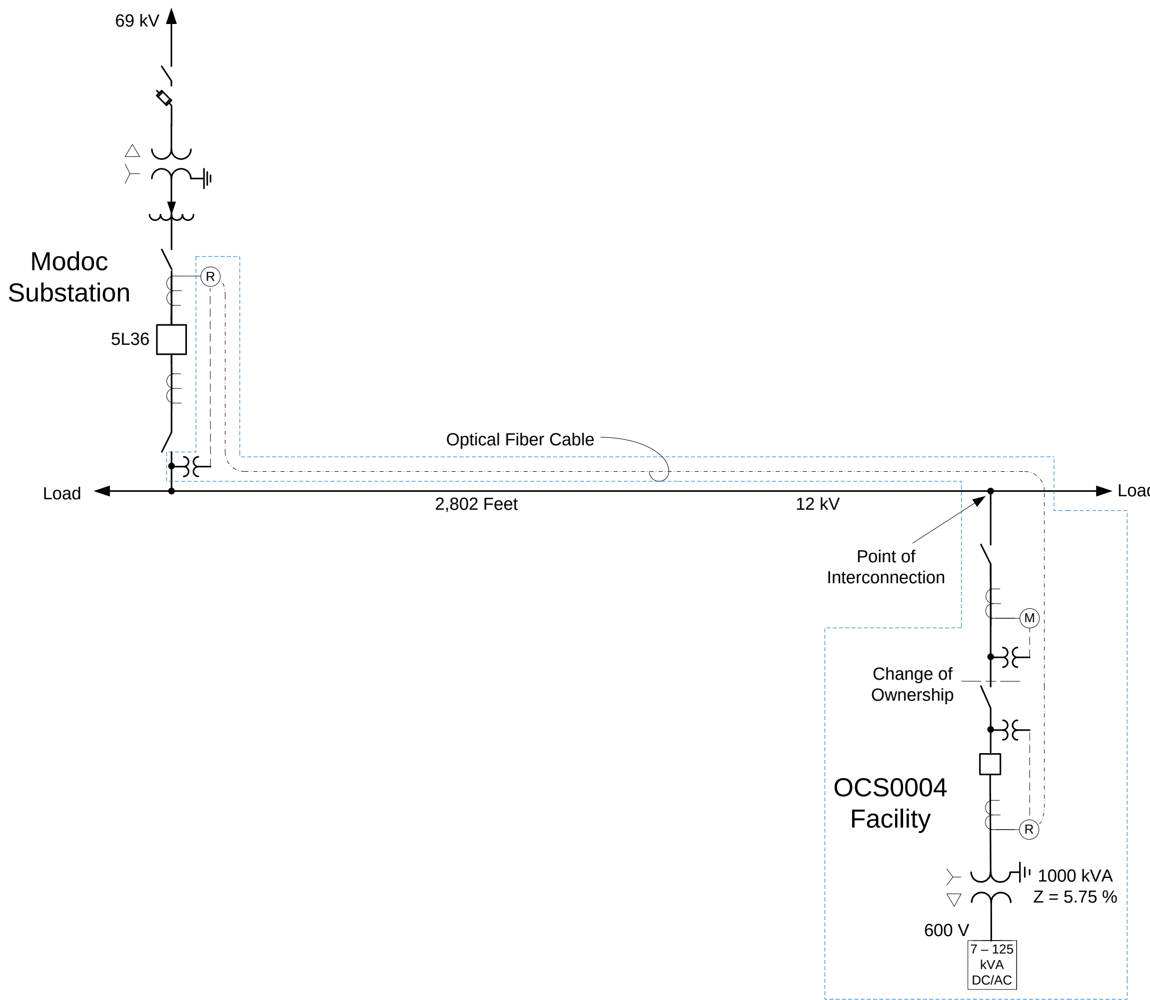

Figure 1: System One Line Diagram

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 Point of Interconnection 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.
- The closest existing Public Utility pole to the proposed POI is facility point 01435007.0-284001.
- Distribution load flow were performed at peak and light load and full and no generation with summer and winter loading conditions.
- Contingency transmission configuration for the Public Utility's system is defined as any configuration other than the normal transmission configuration.
- Six case studies were assembled and studied in power flow simulation at the transmission level. Each case was studied under peak loading and light loading conditions. Certain cases were studied for influence by variations in flow on 230/345 kV WECC Path 76 extending from Alturas, California, to Reno, Nevada, which affects flow on 115 kV Lines 61 and 36 near the proposed OCS004 Point of Interconnection when the 115 kV path is closed:
    1. Normal transmission configuration case no. 1: The distribution system supplied from Modoc Substation at Chiloquin, Oregon supplies OCS004; Modoc Substation is supplied by 69 kV Line 60 (K11) from Chiloquin Substation; 115 kV from Line 61 (K2) and Line 36 (K3) operate as a closed path from Chiloquin Substation to BPA Warner Substation in Alturas, California; the Chiloquin Substation 230-115 kV transformer is connected to the energized 230 kV transmission grid and supplies power to 115 kV Line 61 (K2); the BPA Warner Substation 230-115 kV transformer is connected to the energized 230 kV transmission grid and supplies power to 115 kV Line 36 (K3); all 69 kV loads near Alturas are supplied from Malin Substation near Malin, Oregon.
    2. Contingency transmission configuration case no. 2: Same as normal transmission configuration except that the Chiloquin Substation 230-115 kV transformer is open. In power flow simulation, the transmission system was tested for its response to the interruption of the requested OCS004 power flow.
    3. Contingency transmission configuration case no. 3: Same as normal transmission configuration except that the BPA Warner Substation 230-115 kV transformer is open. In power flow simulation, the transmission system was tested for its response to the interruption of the requested OCS004 power flow.
    4. Contingency transmission configuration case no. 4: Begins in the normal transmission configuration with OCS004 in normal operation at full power flow; 115 kV Line 61 (K2) then opens between Mile Hi and Chiloquin substations, simulating a protective relay trip while OCS004 continues normal operation at full power flow. The test does not interrupt service to OCS004 but it does cause a sudden redirection of power flow from OCS004 resulting in step voltage changes in the transmission system.
    5. Contingency transmission configuration case no. 5: Begins in the normal transmission configuration with OCS004 in normal operation at full power flow;

the Chiloquin Substation 230-115 kV transformer then opens, simulating a protective relay trip while OCS004 continues normal operation at full power flow. The test does not interrupt service to OCS004 but it does cause a sudden redirection of power flow from OCS004 resulting in step voltage changes in the transmission system.

6. Contingency transmission configuration case no. 6: Begins in the normal transmission configuration with OCS004 in normal operation at full power flow; the BPA Warner Substation 230-115 kV transformer then opens, simulating a protective relay trip while OCS004 continues normal operation at full power flow. The test does not interrupt service to OCS004 but it does cause a sudden redirection of power flow from OCS004 resulting in step voltage changes in the transmission system.

- Summer peak load is defined as the highest load demand that occurs on the Public Utility's power system during the summer season.
- Winter peak load is defined as the highest load demand that occurs on the Public Utility's power system during the winter season.
- Light load is defined as the minimum daytime load demand that occurs on the Public Utility's power system at any time during the year.
- Steady state voltage is defined as the voltage after all voltage regulating devices, both electronic and mechanical, have reached a quiescent state for the power flow and voltage conditions at a specific time.
- Post transient voltage is defined as the voltage measured after high speed switching transients and the effects of generator exciter controls have settled out and before any mechanically operated load tap changing and voltage regulating devices have started to adjust to new system conditions.
- Post transient voltage step is defined as the difference between the voltage before an event and the post transient voltage after the event. The Western Electricity Coordinating Council (WECC) limits the post transient voltage step to a maximum of 8.0 percent for infrequent switching events such as the separation of a generation facility from the transmission system. Any post transient voltage step occurring on the transmission system is imposed directly on customers in the region.
- Remedial Action Scheme (RAS) and Special Protection System (SPS) is defined by the North American Reliability Corporation (NERC) as an automatic protection system designed to detect abnormal or predetermined system conditions, and take corrective actions other than and/or in addition to the isolation of faulted components to maintain system reliability. Such action may include changes in demand, generation (MW and MVAR), or system configuration to maintain system stability, acceptable voltage, or power flows.
- 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 control with the power factor sensed electrically at the Point of Interconnection. The required power factor is 1.00 per unit at the Point of Interconnection. In general, the Community Solar Project and Interconnection Equipment should be operated so as to maintain the voltage at the Point of Interconnection between 1.01 pu to 1.04 pu. At the Public Utility's discretion, these values might be adjusted depending on the operating conditions.

The minimum power quality requirements are in PacifiCorp's Engineering Handbook section 1C and are available at https://www.pacificpower.net/about/power-quality-standards.html. Requirements in the System Impact Study that exceed requirements in the Engineering Handbook section 1C power quality standards shall apply. 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 Point of interconnection. Under normal conditions, the Public Utility's system should not supply reactive power to the Community Solar Project.

6.2 Transmission System Modifications

None.

6.3 Distribution Line Modifications

Extend the distribution line from Day School Road to the point of change of ownership. The line will be constructed with #2 AAAC phase and neutral conductor. The line extension will include a pole for primary metering and a pole with a 600 amp group operated switch.

6.4 Existing Breaker Modifications – Short-Circuit

The increase in the fault duty on the system as the result of the addition of the generation facility with photovoltaic arrays fed through 7 – 125 kW inverters connected to 1 – 1.0 MVA 12 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 OCS004 generation facility will need to disconnect from the network in a high speed manner for faults on the 12 kV line on circuit 5L36 out of Modoc substation. The minimum daytime load on circuit 5L36 is 342 kW which is below the maximum potential power output of the proposed OCS004 generating facility. For this reason the imbalance condition of the load and generation cannot be relied upon to cause the high speed disconnection of the generating facility for faults on the distribution system. A transfer trip circuit will need to be installed between Modoc substation to the OCS004 generation facility. 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 circuit breaker 5L36 at Modoc substation is equipped with automatic reclosing. When circuit breaker 5L36 opens the transfer trip signal will be sent to the circuit recloser at the generation facility. An optical fiber cable will need to be installed between Modoc substation and the circuit recloser. The transfer trip signal will be sent over the optical fiber cable.

To insure that the automatic reclosing of circuit breaker 5L36 does not take place before the generating facility disconnects, a dead line checking control circuit will be installed. The dead line checking control circuit will delay the reclosing until the line is no longer energized to insure that no damage is done to any of the existing customers' equipment. The enabling of this type of control will require the addition of a voltage instrument transformer on the line side of circuit breaker 5L36. To accommodate both the transfer trip and the dead line checking a new relay will need to be installed at Modoc substation.

The 12 kV circuit recloser planned to be installed at the OCS004 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 12 kV equipment at the solar-electric generation facility
2. Detect faults on the 12 kV line to Modoc substation
3. Monitor the voltage and react to under or over frequency, and /or magnitude of the voltage
4. Receive transfer trip from Modoc substation.

6.6 DATA REQUIREMENTS (RTU)

Due to the size of the generating facility no real time monitoring will be required by the Public Utility for the operation of the transmission network so no RTU will be required.

6.7 COMMUNICATION REQUIREMENTS

Approximately 0.5 miles of 48-fiber, single-mode, ADSS cable will be installed on the distribution line between the OCS004 POI recloser and Modoc substation. The fiber will be terminated in patch panels in enclosures. Fiber-optic jumper cables from the patch panels to the relays' fiber optic transceivers will be installed.

6.8 SUBSTATION REQUIREMENTS

A distribution voltage transformer will be installed on the existing structure at Modoc substation.

6.9 METERING REQUIREMENTS

<u>Interchange Metering</u>

The metering will be located on the high side of the customer generator step up transformer at the Point of Interconnection. The metering will be installed overhead on a pole per distribution DM construction standards. 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-up 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.

Station Service/Construction Power
The Interconnection Customer 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.

OCS004 Collector Station *Line extension, metering, communications equipment, relay settings*	$68,000
Distribution Line *Install fiber*	$33,000
Modoc Substation *Voltage transformer, relay and communications equipment*	$147,000
Total	**$248,000**

*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 appears to result in a timeframe that may not support the Applicant's requested commercial operation date of September 28, 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: Distribution Study Results
Appendix 5: Transmission 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:

Queue #	Size (MW)
660	10
721	55
741	40
849	100
905	50
971	2.7
1029	400
1031	80
1032	80
1033	80
1034	60
1055	4.2
1062	240
1087	50
1104	3
1120	3
1126	8
1133	80
1134	120
1135	80
1147	2.999
1158	1.8
1160	70
1192	238.5
OCS003	0.8

BPA GI Queue	MW	BPA GI Queue	MW
501	1100.00	570	20.00
521	20.00	571	20.00
526	20.00	572	20.00
527	200.00		

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.

There are currently a significant number of higher-queued requests seeking interconnection in the southern Oregon area where the CSP generator proposes to interconnect. These interconnection studies must be completed before the transmission provider can determine what upgrades and associated cost estimates may 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 point of interconnection 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: Distribution Study Results

- The modeled power flow on Modoc circuit breaker 5L36 and the Modoc substation transformer bank is 457 kW reverse power flow during light load and full generation.

10.5 APPENDIX 5: TRANSMISSION STUDY RESULTS

10.5.1 SUMMARY OF POWER FLOW SIMULATION

A power flow simulation of addition of OCS004 power flow (operating at 0.8 MW maximum) to the Public Utility's system predicted the following:

- 100 MVA rated Chiloquin 230-115 kV transformer is overloaded to 176.3 MVA by higher priority generation interconnection and transmission service requests and would be further overloaded to 176.8 MVA by the addition of OCS004 in normal transmission configuration no. 1. The additional overload caused by the OCS004 alone is not considered significant enough to require an increase in transformer capacity.
- 115 kV Line 61 (K2) is overloaded by higher priority generation interconnection and transmission service requests but would not affected by the addition of OCS004 in normal transmission configuration no. 1.
- Excessive power flow from higher priority generation interconnection and transmission service requests would cause voltage collapse unless specific generation facilities are restricted from operating in contingency transmission configuration no. 2, but because operation of OCS004 would not make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation.
- Excessive power flow from higher priority generation interconnection and transmission service requests would cause voltage collapse unless specific generation facilities are restricted from operating in contingency transmission configuration no. 3, but because operation of OCS004 would not make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation.
- 100 MVA rated Chiloquin 230-115 kV transformer would be overloaded to 138.3 MVA by higher priority transmission service requests and insignificant flow contribution from OCS004 before contingency transmission configuration no. 4 but has adequate capacity to carry power flow from OCS004 afterward. OCS004 is not required to be automatically separated from the transmission system by a Remedial Action Scheme required for certain higher priority generation interconnection and transmission service requests during contingency transmission configuration no. 4
- When the Chiloquin 230-115 kV transformer trips open in contingency transmission configuration no. 5, unless specific higher priority generation interconnection requests are automatically separated from the transmission system, the power flow from generation facilities would exceed the thermal rating of the transmission system and cause regional voltage collapse. However, because operation of OCS004 would not make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation in contingency transmission configuration no. 5
- When the BPA Warner 230-115 kV transformer trips open in contingency transmission configuration no. 6, unless specific higher priority generation interconnection requests are automatically separated from the transmission system, the power flow from generation facilities would exceed the thermal rating of the transmission system and cause regional voltage collapse. However, because operation of OCS004 would not

make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation in contingency transmission configuration no. 6

- After the addition of OCS004, voltages are predicted to be acceptable in normal transmission configuration no. 1.
- Power could be accepted in normal transmission configuration no. 1.

10.5.2 Normal Transmission Configuration No. 1

In normal transmission configuration no. 1, fully defined in Study Assumptions, the Chiloquin transmission substation 115 kV Line 61 and 36 path to BPA Warner Substation is closed, and Chiloquin supplies 69 kV Line 60 to Modoc distribution substation and the OCS004 Point of Interconnection. In power flow simulation, OCS004 flow was then interrupted.

Transmission Line Loading

Table 10.5.2.a. Power flow in normal transmission configuration no. 1 (Chiloquin-BPA Warner network path closed; Modoc supplying OCS004 Point of Interconnection).

Season	OCS004 POI, MW	OCS004 POI, MVAR	Power flow on Chiloquin Sub 230-115 kV Transformer, MVA	Limiting Rating on Chiloquin Sub 230-115 kV Transformer, MVA	Power flow on 115 kV Line 61 (K2) at Chiloquin Sub, MVA	Limiting Rating on 115 kV Line 61 (K2) at Chiloquin Sub, MVA
Summer Peak Load†	0	0	**125.1**	100	**122.7**	110
Summer Peak Load†	0.8	0	**125.7**	100	**122.6**	110
Summer Peak Load**	0	0	**161.5**	100	**158.7**	110
Summer Peak Load**	0.8	0	**162.1**	100	**158.6**	110
Winter Peak Load†	0	0	**125.7**	120	**126.1**	148
Winter Peak Load†	0.8	0	**126.2**	120	**126.1**	148
Light Load†	0	0	**136.4**	100	**129.6**	110
Light Load†	0.8	0	**137.1**	100	**129.5**	110
Light Load**	0	0	**176.3**	100	**169.5**	110
Light Load**	0.8	0	**176.8**	100	**169.5**	110

* During 300 MW maximum southbound flow on WECC Path 76 Alturas-Reno.
**During 300 MW maximum northbound flow on WECC Path 76 Alturas-Reno.
† During 80 MW typical southbound flow on WECC Path 76 Alturas-Reno.

Table 10.5.2.a shows that 100 MVA rated Chiloquin 230-115 kV transformer is overloaded to 176.3 MVA by higher priority generation interconnection and transmission service requests and would be further overloaded to 176.8 MVA by the addition of OCS004 in normal transmission configuration no. 1; 115 kV Line 61 (K2) is overloaded by higher priority generation interconnection and transmission service requests but would

not affected by the addition of OCS004.

Table 10.5.2.b. Power flow in normal transmission configuration no. 1 (Chiloquin-BPA Warner network path closed; Modoc supplying OCS004 Point of Interconnection).

Season	OCS004 POI, MW	OCS004 POI, MVAR	Power flow on Modoc Sub Transformer, MVA	Limiting Rating on Modoc Sub Transformer, MVA	Power flow on 69 kV Line 60 (K11) at Chiloquin Sub, MVA	Limiting Rating on 69 kV Line 60 (K11) at Chiloquin Sub, MVA
Summer Peak Load	0	0	4.2	5.8	6.5	60
Summer Peak Load	0.8	0	3.4	5.8	5.8	60
Winter Peak Load	0	0	5.0	7.2	8.7	90
Winter Peak Load	0.8	0	4.4	7.2	8.0	90
Light Load	0	0	1.7	5.8	2.6	60
Light Load	0.8	0	1.0	5.8	1.8	60

Table 10.5.2.b shows that the Modoc Substation transformer and 69 kV Line 60 (K11) have adequate thermal capacity to carry power flow from OCS004 in normal transmission configuration no. 1.

Transmission System Voltages

Voltages and post transient voltage steps are projected in power flow simulation to remain within permissible limits during the interruption of the OCS004 power flow in the Public Utility's normal transmission configuration no.1. Table 10.5.2.c shows the most significant predicted post transient voltage steps on the distribution system at Modoc Substation caused by the addition of OCS004.

Table 10.5.2.c. Power system voltages when OCS004 power flow interrupted during normal transmission configuration no. 1 (Chiloquin-BPA Warner network path closed; Modoc supplying OCS004 Point of Interconnection).

Season	Location	OCS004 POI, MW	OCS004 POI, MVAR	Steady State Voltage, per unit	Post Transient Voltage After OCS004 Interruption, per unit	Post Transient Voltage Step, percent
Summer Peak Load	Modoc Sub 12 kV bus	0.8	0	1.015	1.012	0.3%
Winter Peak Load	Modoc Sub 12 kV bus	0.8	0	1.029	1.027	0.2 %
Light Load	Modoc Sub 12 kV bus	0.8	0	0.993	0.990	0.3%

10.5.3 Contingency Transmission Configuration No. 2

In contingency transmission configuration no. 2, fully defined in Study Assumptions, the Chiloquin transmission substation 230-115 kV transformer is open. The power flow simulation test began with OCS004 generating, then generation was interrupted.

Transmission Line Loading

Excessive power flow from higher priority generation interconnection and transmission service requests would cause voltage collapse unless specific generation facilities are restricted from operating in contingency transmission configuration no. 2, but because operation of OCS004 would not make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation.

Transmission System Voltages

See discussion of voltage instability under Transmission Line Loading above.

10.5.4 Contingency Transmission Configuration No. 3

In contingency transmission configuration no. 3, fully defined in Study Assumptions, the BPA Warner substation 230-115 kV transformer is open. The power flow simulation test began with OCS004 generating, then generation was interrupted.

Transmission Line Loading

Excessive power flow from higher priority generation interconnection and transmission service requests would cause voltage collapse unless specific generation facilities are restricted from operating in contingency transmission configuration no. 3, but because operation of OCS004 would not make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation.

Transmission System Voltages

See discussion of voltage instability under Transmission Line Loading above.

10.5.5 Contingency Transmission Configuration No. 4

In contingency transmission configuration no. 4, fully defined in Study Assumptions, the transmission system begins in the normal configuration with OCS004 operating at full power flow, after which 115 kV Line 61 (K2) trips open between the Q964 POI substation and Chiloquin substation as OCS004 continues to operate normally. Certain higher priority generation interconnection requests will be automatically separated from the transmission system by a Remedial Action Scheme (RAS) to prevent voltage collapse, and the contingency configuration no. 4 test will determine if OCS004 must also participate in the RAS for this configuration.

Transmission Line Loading

Table 10.5.5.a. Power flow in contingency transmission configuration no. 4 (Normal configuration followed by opening of Line 61 from Chiloquin to Mile Hi).

Season	**OCS004 POI, MW**	**OCS004 POI, MVAR**	**Before Config No. 4: Power flow on Chiloquin Sub 230-115 kV Transformer, MVA**	**After Config No. 4: Power flow on Chiloquin Sub 230-115 kV Transformer, MVA**	**Limiting Rating on Chiloquin Sub 230-115 kV Transformer, MVA**
Light Load	0	0	**138.3**	6.3	100
Light Load	0.8	0	**126.3**	0.8	100

Table 10.5.5.a shows that the 100 MVA rated Chiloquin 230-115 kV transformer would be overloaded to 138.3 MVA by higher priority transmission service requests and OCS004 before contingency transmission configuration no. 4 but has adequate capacity to carry power flow from OCS004 afterward. OCS004 is not required to be automatically separated from the transmission system by a Remedial Action Scheme during contingency transmission configuration no. 4.

Transmission System Voltages

Table 10.5.5.b. Power system voltages when OCS004 power flow is interrupted during contingency transmission configuration no. 4 (Normal configuration followed by opening of Line 61 from Chiloquin to Mile Hi).

Season	Location	OCS004 POI, MW	OCS004 POI, MVAR	Steady State Voltage, per unit	Post Transient Voltage After OCS004 Interruption, per unit	Post Transient Voltage Step, percent
Summer Peak Load	Modoc Sub 12 kV bus	0.8	0	1.017	1.093	7.6%
Light Load	Modoc Sub 12 kV bus	0.8	0	0.991	0.988	0.3%

Table 10.5.5 b. shows that voltages are acceptable in contingency transmission configuration no. 4.

10.5.6 Contingency Transmission Configuration No. 5

In contingency transmission configuration no. 5, fully defined in Study Assumptions, the transmission system begins in the normal configuration with OCS004 operating at full power flow, after which the Chiloquin Substation 230-115 kV transformer opens as OCS004 continues to operate normally. Contingency transmission configuration no. 5 simulates a protective relay trip the Chiloquin transformer. Although service to OCS004 is not interrupted, the test does impose a sudden redirection of power flow on the transmission system, resulting in sudden changes in voltage. Certain higher priority generation interconnection requests will be automatically separated from the transmission system by a Remedial Action Scheme (RAS) to prevent voltage collapse, and the contingency configuration no. 5 test will determine if OCS004 must also participate in the RAS.

Transmission Line Loading

When the Chiloquin 230-115 kV transformer trips open in contingency transmission configuration no. 5, unless specific higher priority generation interconnection requests are automatically separated from the transmission system, the power flow from generation facilities would exceed the thermal rating of the transmission system and cause regional voltage collapse. However, because operation of OCS004 would not make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation in contingency transmission configuration no. 5.

Transmission System Voltages

See discussion of voltage instability under Transmission Line Loading above.

10.5.7 Contingency Transmission Configuration No. 6

In contingency transmission configuration no. 6, fully defined in Study Assumptions, the transmission system begins in the normal configuration with OCS004 operating at full power flow, after which the BPA Warner Substation 230-115 kV transformer opens as OCS004 continues to operate normally. Contingency transmission configuration no. 6 simulates a protective relay trip the BPA Warner transformer. Although service to OCS004 is not interrupted, the test does impose a sudden redirection of power flow on the transmission system, resulting in sudden changes in voltage. Certain higher priority generation interconnection requests will be automatically separated from the transmission system by a Remedial Action Scheme (RAS) to prevent voltage collapse, and the contingency configuration no. 6 test will determine if OCS004 must also participate in the RAS.

Transmission Line Loading

When the BPA Warner 230-115 kV transformer trips open in contingency transmission configuration no. 6, unless specific higher priority generation interconnection requests are automatically separated from the transmission system, the power flow from generation facilities would exceed the thermal rating of the transmission system and cause regional voltage collapse. However, because operation of OCS004 would not make a significant contribution to power flow at the 115 kV transmission level, it would not be required to suspend operation in contingency transmission configuration no. 6.

Transmission System Voltages

See discussion of voltage instability under Transmission Line Loading above.