Rocky Mountain Power
Exhibit RMP___(RAV-4SS)
Docket No. 17-035-40
Witness: Rick A. Vail

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

Exhibit Accompanying Second Supplemental Direct Testimony of Rick A. Vail

Q0712 SIS Report

February 2018

PACIFICORP

Large Generator Interconnection
System Impact Restudy Report

Completed for
Orion Wind Resources, LLC
("Interconnection Customer")
Q0712
Cedar Springs 1

Proposed Point of Interconnection
Windstar substation at 230 kV

February 8, 2018

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1.0 DESCRIPTION OF THE GENERATING FACILITY

Orion Wind Resources, LLC ("Interconnection Customer") proposed interconnecting 520 MW of new generation to PacifiCorp's ("Transmission Provider") Windstar substation at 230 kV located in Converse County, Wyoming. The Cedar Springs 1 project ("Project") will consist of two hundred eight (208) GE 127 2.5 MW wind turbines for a total output of 520 MW. The requested commercial operation date is December 31, 2020.

The restudy of this Project is performed due to the staging of the Energy Gateway West project. Specifically, while the entire Gateway West project has a longer development timeline, the Aeolus-Bridger/Anticline D.2 segment of the project (500 kV segment from the planned Aeolus substation to the planned Anticline substation) now has an expected 2020 in-service date. The earlier availability of the D.2 segment materially changes certain modeling assumptions that could impact the cost or timing of the interconnection of certain projects whose previous studies depended on Gateway West in its entirety.

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

Transmission Provider has assigned the Project "Q0712."

2.0 SCOPE OF THE STUDY

The interconnection system impact study shall evaluate the impact of the proposed interconnection on the reliability of the transmission system. The interconnection system impact study will consider Base Case as well as all generating facilities (and with respect to (iii) below, any identified network upgrades associated with such higher queued interconnections) that, on the date the interconnection system impact study is commenced:

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

This interconnection system impact restudy will consist of a short circuit analysis, a stability analysis, and a power flow analysis. The study will state the assumptions upon which it is based; state the results of the analyses; and provide the requirements or potential impediments to providing the requested interconnection service, including preliminary indication of the cost and length of time that would be necessary to correct any problems identified in those analyses and implement the interconnection. The study will also provide a list of facilities that are required as a result of the Interconnection Request and a non-binding good faith estimate of the cost responsibility and a non-binding good faith estimated time to construct.

Based on the engineering judgement, the stability results for this project are not expected to change and hence the restudy of stability analysis was not performed.

3.0 TYPE OF INTERCONNECTION SERVICE

Interconnection Customer has elected to have the interconnection studied as an *Energy Resource (ER)*.

4.0 DESCRIPTION OF PROPOSED INTERCONNECTION

Interconnection Customer's proposed Generating Facility is to be interconnected through two new bay positions on the southeast corner of the existing Windstar substation. Figure 1 below, is a one-line diagram that illustrates the interconnection of the proposed Generating Facility to Transmission Provider's system.

Interconnection Customer will be responsible for the installation of two (2) new 230 kV circuit breakers and associated switches at the Windstar 230 kV substation to interconnect the Generating Facility. Based on the data provided by Interconnection Customer, the Project consists of two different phases, Phase A and Phase B. The Project's Phase A will interconnect to Windstar substation through one of the 20-mile 230 kV double circuit line. Phase B of the Project will connect to Windstar substation through the second 230 kV line on the double circuit tie-line. Phase B of the Project is four additional miles farther than Phase A, making that 230 kV line 24 miles long. Each 230 kV circuit will be constructed using 954 kcmil ACSR (aluminum conductor steel reinforced) conductor.

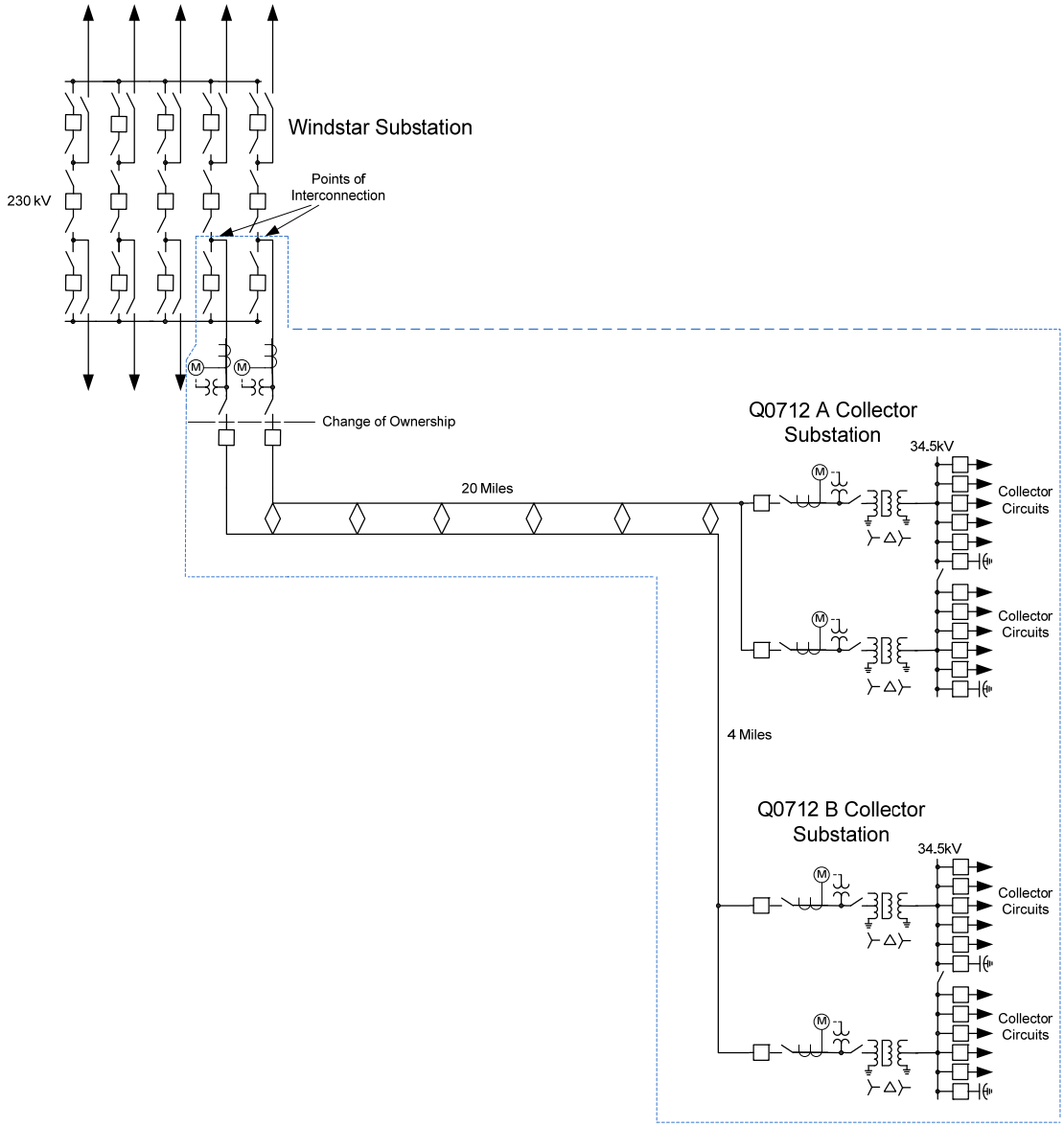

Figure 1: Simplified System One Line Diagram

4.1 Other Options Considered

The following alternative options were considered as potential Points of Interconnection for this Project: None per Interconnection Customer.

5.0 STUDY ASSUMPTIONS

- All active higher priority transmission service and/or generator interconnection requests with an in-service date of December 2020 or earlier will be considered in this study and are listed in Appendix 1. If any of these requests are materially modified or withdrawn, Transmission Provider reserves the right to restudy this request, and the results and conclusions could significantly change.

- Transmission Provider reserves the right to restudy this Project should Interconnection Customer request a change in status to a Qualifying Facility, there is a change in system topology, or assumed facility improvements are not in-service.
- For study purposes there are two separate queues:
  - Transmission Service Queue: to the extent practical, all network upgrades that are required to accommodate active transmission service requests will be modeled in this study.
  - Generation Interconnection Queue: Interconnection Facilities associated with higher queued interconnection requests with an in-service date of December 2020 or earlier will be modeled in this study.
    - Interconnection Customer's request for energy or network resource interconnection service in and of itself does not convey transmission service. Only a Network Customer may make a request to designate a generating resource as a Network Resource. The provision of transmission service may require additional studies and the construction of additional upgrades.
- Under normal conditions, Transmission Provider does not dispatch or otherwise directly control or regulate the output of generating facilities. Therefore, the need for transmission modifications, if any, which are required to provide Network Resource Interconnection Service will be evaluated on the basis of 100 percent deliverability (i.e., no displacement of other resources in the same area).
- This study assumes the Project will be integrated into Transmission Provider's system at the Windstar substation (Point of Interconnection, or "POI").
- Interconnection Customer will construct and own any facilities required between the Point of Change of Ownership and the Project unless specifically identified by Transmission Provider.
- Generator tripping will 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 Transmission Provider's performance and design standards (Policy 139).
- The Energy Gateway West, Aeolus-Bridger/Anticline D.2 500 kV line from the proposed Aeolus substation to the proposed Anticline substation and ancillary projects are assumed in service in 2020
  - All existing and proposed Remedial Action Schemes ("RAS") associated with prior queue generation facilities are assumed to be in service for this study.
- A RAS that will arm approximately 640 MW of generation for the Energy Gateway D.2 outages was assumed to be in-service.
- It is assumed that a new 230 kV line from Shirley Basin – Aeolus constructed with 2-1557 Potomac ACSR/TW as identified as mitigation for the Q0707 Project is in-service.
- This report is based on information available at the time of the study. It is Interconnection Customer's responsibility to check Transmission Provider's web site regularly for Transmission System updates at http://www.pacificorp.com/tran.html

6.0 ENERGY RESOURCE (ER) INTERCONNECTION SERVICE

Energy Resource Interconnection Service allows Interconnection Customer to connect its Generating Facility to Transmission Provider's Transmission System and to be eligible to deliver electric output using firm or non-firm transmission capacity on an as available basis. Energy resource interconnection service in and of itself does not convey transmission service.

6.1 Requirements

6.1.1 Generating Facility Modifications

All interconnecting synchronous and non-synchronous generators are required to design their generating facilities with reactive power capabilities necessary to operate within the full power factor range of 0.95 leading to 0.95 lagging. This power factor range shall be dynamic and can be met using a combination of the inherent dynamic reactive power capability of the generator or inverter, dynamic reactive power devices and static reactive power devices to make up for losses. For synchronous generators, the power factor requirement is to be measured at the POI. For asynchronous generators, the power factor requirement is to be measured at the high-side of the generator substation.

The Generating Facility must provide dynamic reactive power to the system in support of both voltage scheduling and contingency events that require transient voltage support, and must be able to provide reactive capability over the full range of real power output. If the Generating Facility is not capable of providing positive reactive support (i.e., supplying reactive power to the system) immediately following the removal of a fault or other transient low voltage perturbations, the Generating Facility must be required to add dynamic voltage support equipment. These additional dynamic reactive devices shall have correct protection settings such that the devices will remain on line and active during and immediately following a fault event. Generators shall be equipped with automatic voltage-control equipment and normally operated with the voltage regulation control mode enabled unless written authorization from the Grid Operator is given to operate in other control mode (e.g. constant power factor control). The control mode of the generating units shall be accurately represented in operating studies. The generators shall be capable of operating continuously at their maximum power output at its rated field current within +/- 5% of its rated terminal voltage.

As required by NERC standard VAR-001-1a, Transmission Provider will provide a voltage schedule for the POI. In general, Generating Facilities should be operated so as to maintain the voltage at the POI, or other designated point as deemed appropriated by Transmission Provider, between 1.00 per unit to 1.04 per unit. Transmission Provider may also specify a voltage and/or reactive power bandwidth as needed to coordinate with upstream voltage control devices such as on-load tap changers. At Transmission Provider's discretion, these values might be adjusted depending on operating conditions. Generating Facilities capable of operating with a voltage droop are required to do so. Voltage droop control enables proportionate reactive power sharing among generating facilities. Studies will be required to coordinate voltage droop settings if there are other facilities in the area. It will be Interconnection Customer's responsibility to ensure that a voltage coordination study is performed, in coordination with Transmission Provider, and implemented with appropriate coordination settings prior to unit testing.

For areas with multiple generating facilities additional studies may be required to determine whether or not critical interactions, including but not limited to control systems, exist. These studies, to be coordinated with Transmission Provider, will be the responsibility of Interconnection Customer. If the need for a master controller is identified, the cost and all related installation requirements will be the responsibility of

Interconnection Customer. Participation by the Generating Facility in subsequent interaction/coordination studies will be required pre- and post-commercial operation in order ensure system reliability.

To facilitate collection and validation of accurate modeling data to meet NERC modeling standards, PacifiCorp, as the Planning Coordinator, requires Phasor Measurement Units (PMUs) at all new Generating Facilities with an individual or aggregate nameplate capacity of 75 MVA or greater. In addition to owning and maintaining the PMU, the Generating Facility will be responsible for collecting, storing and retrieving data as requested by the Planning Coordinator. Data must be collected and be able to stream to Planning Coordinator for each of the Generator Facility's step-up transformers measured on the low side of the GSU at a sample rate of at least 30 samples per second and synchronized within +/- 2 milliseconds of the Coordinated Universal Time (UTC). Initially, the following data must be collected:

- Three phase voltage and voltage angle (analog)
- Three phase current (analog)

Data requirements are subject to change as deemed necessary to comply with local and federal regulations.

All generators must meet the Federal Energy Regulatory Committee ("FERC") and WECC low voltage ride-through requirements as specified in the interconnection agreement. As Transmission Provider cannot submit a user written model to WECC for inclusion in base cases, a standard model from the WECC Approved Dynamic Model Library is required 180 days prior to trial operation. The list of approved generator models is continually updated and is available on the http://www.WECC.biz website.

Based on the data provided by Interconnection Customer, the wind turbines do not have the capability to deliver 100% of the power to the POI within the range of +/- 0.95 power factor. The data provided indicates that the wind turbines have the power factor capability of 0.98 capacitive and 0.96 inductive at rated power. The study showed that the collector system injects approximately 31.8 MVAr (see Figure 2 in Appendix 3) when it is connected to the transmission system without the wind turbines being online. Interconnection Customer will be required to ensure that there is minimum reactive interchange under these conditions and that the collector system of the Project is not contributing excessive MVArs into the system increasing voltage under light load conditions. Failure of the Project to minimize the reactive interchange under these conditions may result in the opening of the POI breakers for the Project by Transmission Provider.

At low or zero output levels, the Project must not have reactive power interchange outside of the +/- 0.95 power factor requirement at the POI. Transmission Provider has experienced high voltages in this area of its system when the transmission system is lightly loaded with low wind conditions. With low wind conditions the wind farms tend to supply reactive power into the transmission system increasing the voltage.

The Interconnection Customer is responsible for the protection of the transmission line between the Generating Facility and the POI substation. In order to provide this protection the Interconnection Customer shall construct and own a tie-line substation to be located at the change of ownership (separate fenced facility adjacent to the Transmission Provider's POI substation) and include an Interconnection Customer owned protective device and associated transmission line relaying/communications. The ground grids of the Transmission Provider's POI substation and the Interconnection Customer's tie-line substation will be connected to support the use of a bus differential protection scheme which will protect the overhead bus connection between the two facilities.

6.1.2 Transmission System Modifications

The following transmission system modifications are required:

- Rebuild the Standpipe-Freezeout-Aeolus 230 kV line with bundled 2-1272 ACSR conductor, approximately 15 miles.
- Two (2) 230 kV 3000 ampere breakers and line positions with associated switches at Windstar substation.
- Rebuild the existing Aeolus-Shirley Basin #1 line with 2-1557 ACSR, approximately 16 miles.

6.1.3 Transmission/Distribution Line Modifications

Rebuild the existing 230 kV transmission line from Aeolis to Shirley Basin using double bundled 1557 ACSR conductor. The line will be approximately 16.23 miles long. Of this mileage, 1.88 miles (Loop-in to Shirley Basin) is existing double bundled 1272 ACSR Conductor which will be re-conducted with 1557.4 ACSS/TW Conductor.

Rebuild the approximately 15 miles of 230 kV transmission line between Standpipe, Freezeout and proposed Aeolus substation with bundled 2-1272 ACSR conductor.

The Interconnection Customer shall construct the tie line from the collector substations to the tie-line substations.

The Interconnection Customer is required to build tie-line substations adjacent to the Windstar substation which will house the tie-line breakers. The Transmission Provider shall review the design of the tie-line spans between the tie-line substation deadend towers and the Windstar substation deadend towers. The Interconnection Customer shall coil conductor, OPGW, shield wire, and line hardware with sufficient quantities to span between the tie-line substation towers and the Windstar substation towers.

The Transmission Provider will construct the span between the tie-line substation towers and the Windstar substation towers.

If any Transmission Provider lines are crossed by Interconnection Customer tie-line, the Interconnection Customer line will cross under Transmission Provider's line with at least NESC plus 3 foot clearance under all sag conditions of both lines.

6.1.4 Existing Circuit Breaker Upgrades – Short Circuit

The increase in the fault duty on the system as a result of the addition of the Generating Facility with 208 GE 127 2.5 MW wind turbine generators fed through 208 – 2600 kVA 34.5 kV – 690 V transformers with 9.0% impedance then fed through four 230 – 34.5kV 90/120/150 MVA step up transformers with 8.0% impedance will not push the fault duty above the interrupting rating of any of the existing fault interrupting equipment.

6.1.5 Protection Requirements

The ground mats of the tie-line substations and Windstar substation must be tied together so that metallic control cables can be used between the two facilities. Bus differential relays will be applied to detect faults on these connections. With this arrangement the Interconnection Customer must install line relays systems that will detect and clear all faults on the tie lines in 5 cycles or less. Sets of non-pilot step distance line relays that will detect faults on the tie lines will also be applied at Windstar substation. Should the Interconnection Customer desire a potential alternative to the tie-line substations in order to provide adequate protection to its tie lines, the Interconnection Customer may petition the Transmission Provider for an exemption to this arrangement. The Transmission Provider must review and approve the Interconnection Customer's proposed alternative. Without approval of the proposed alternative the tie-line substation configuration will be required. The Interconnection Customer will need to supply and maintain sets of line relays to be installed at Q0712 collector substations that will detect faults on the 230 kV line back to Windstar substation. These line relays can be time coordinated with the relays detecting faults on the transmission network and will not communicate with the line relays to be installed at Windstar substation for the tie line.

Protective relay elements in the line relays at Windstar substation will monitor voltage and frequency. If the voltage, magnitude, or frequency is outside of the normal operation range, this relay will trip the 230 kV breakers at the tie line substations.

New line relay settings will need to be developed for the Standpipe – Freezeout 230 kV line to adjust for the new phase conductor.

6.1.6 Data (RTU) Requirements

Data for the operation of the power system will be needed from the Generating Facility. This data can be acquired by installing an Interconnection Customer owned data concentrator at the collector substations. The data will be transferred to the RTU in Windstar substation via Interconnection Customer owned fiber on the tie from the collector substations.

In addition to the control and indication of the new 230 kV breaker in Windstar substation, the following data will be acquired through the substation RTU. Also listed is the data that will be acquired from the collector substations and tie line substations.

From Windstar substation:
<u>Analogs:</u>

- Q0712 A Net Generation MW
- Q0712 A Net Generator MVAr
- Q0712 A Energy Register
- Q0712 B Net Generation MW
- Q0712 B Net Generator MVAr
- Q0712 B Energy Register

From the Q0712 A collector substation:
Analogs:

- Transformer 1 Real power
- Transformer 1 Reactive power
- Transformer 2 Real power
- Transformer 2 Reactive power
- 34.5 kV Real power 52 AA1 & AA2 & AB1
- 34.5 kV Reactive power 52 AA1 & AA2 & AB1
- 34.5 kV Real power 52 AE
- 34.5 kV Reactive power 52 AE
- 34.5 kV Real power 52 AF
- 34.5 kV Reactive power 52 AF
- 34.5 kV Real power 52 AG
- 34.5 kV Reactive power 52 AG
- 34.5 kV Real power 52 AI
- 34.5 kV Reactive power 52 AI
- 34.5 kV Real power 52 AJ
- 34.5 kV Reactive power 52 AJ
- 34.5 kV Real power 52 AK
- 34.5 kV Reactive power 52 AK
- 34.5 kV Real power 52 AL
- 34.5 kV Reactive power 52 AL
- 34.5 kV Real power 52 AM
- 34.5 kV Reactive power 52 AM
- 34.5 kV Real power 52 AN2 &AB2
- 34.5 kV Reactive power 52 AN2 & AB2
- 34.5 kV Reactive power 52 CAP 1
- 34.5 kV Reactive power 52 CAP 2
- A phase 230 kV transmission voltage
- B phase 230 kV transmission voltage
- C phase 230 kV transmission voltage
- Average Wind speed
- Average Plant Atmospheric Pressure (Bar)
- Average Plant Temperature (Celsius)

Status:

- 230 kV Transformer Breaker 1
- 230 kV Transformer Breaker 2
- 34.5 kV breaker 52 AA1 & AA2 & AB1

- 34.5 kV breaker 52 AE
- 34.5 kV breaker 52 AF
- 34.5 kV breaker 52 AG
- 34.5 kV breaker 52 AI
- 34.5 kV breaker 52 AJ
- 34.5 kV breaker 52 AK
- 34.5 kV breaker 52 AL
- 34.5 kV breaker 52 AM
- 34.5 kV breaker 52 AN2 & AB2
- 34.5 kV breaker 52 CAP 1
- 34.5 kV breaker 52 CAP 2
- 34.5 kV breaker Bus Tie

From the Q0712 B collector substation:
Analogs:

- Transformer 1 Real power
- Transformer 1 Reactive power
- Transformer 2 Real power
- Transformer 2 Reactive power
- 34.5 kV Real power 52 AA1 & AA2 & AB1
- 34.5 kV Reactive power 52 AA1 & AA2 & AB1
- 34.5 kV Real power 52 AE
- 34.5 kV Reactive power 52 AE
- 34.5 kV Real power 52 AF
- 34.5 kV Reactive power 52 AF
- 34.5 kV Real power 52 AG
- 34.5 kV Reactive power 52 AG
- 34.5 kV Real power 52 AI
- 34.5 kV Reactive power 52 AI
- 34.5 kV Real power 52 AJ
- 34.5 kV Reactive power 52 AJ
- 34.5 kV Real power 52 AK
- 34.5 kV Reactive power 52 AK
- 34.5 kV Real power 52 AL
- 34.5 kV Reactive power 52 AL
- 34.5 kV Real power 52 AM
- 34.5 kV Reactive power 52 AM
- 34.5 kV Real power 52 AN2 &AB2
- 34.5 kV Reactive power 52 AN2 & AB2
- 34.5 kV Reactive power 52 CAP 1
- 34.5 kV Reactive power 52 CAP 2
- A phase 230 kV transmission voltage
- B phase 230 kV transmission voltage
- C phase 230 kV transmission voltage
- Average Wind speed
- Average Plant Atmospheric Pressure (Bar)

- Average Plant Temperature (Celsius)

Status:
- 230 kV Transformer Breaker 1
- 230 kV Transformer Breaker 2
- 34.5 kV breaker 52 AA1 & AA2 & AB1
- 34.5 kV breaker 52 AE
- 34.5 kV breaker 52 AF
- 34.5 kV breaker 52 AG
- 34.5 kV breaker 52 AI
- 34.5 kV breaker 52 AJ
- 34.5 kV breaker 52 AK
- 34.5 kV breaker 52 AL
- 34.5 kV breaker 52 AM
- 34.5 kV breaker 52 AN2 & AB2
- 34.5 kV breaker 52 CAP 1
- 34.5 kV breaker 52 CAP 2
- 34.5 kV breaker Bus Tie

Tie Line Substations
Status:
- 230 kV Breaker 1
- 230 kV Breaker 2

6.1.7 Substation Requirements

Q0712 Collector Station A

Interconnection Customer will provide a separate graded, grounded and fenced area along the perimeter of Interconnection Customer's Generating Facility for Transmission Provider to install a control house for any required metering, protection or communication equipment. This area will share a fence and ground grid with the Generating Facility and have separate, unencumbered access for Transmission Provider. DC power for the control house will be supplied by Transmission Provider. AC station service power for the control house will be provided by Interconnection Customer. A CDEGS grounding analysis is required by Interconnection Customer. Six 230 kV CT/VT combined metering units and four 230 kV group operated switches will be installed.

Q0712 Collector Station B

Interconnection Customer will provide a separate graded, grounded and fenced area along the perimeter of Interconnection Customer's Generating Facility for Transmission Provider to install a control house for any required metering, protection or communication equipment. This area will share a fence and ground grid with the Generating Facility and have separate, unencumbered access for Transmission Provider. DC power for the control house will be supplied by Transmission Provider. AC station service power for the control house will be provided by Interconnection Customer. A CDEGS grounding analysis is required by Interconnection Customer. Six 230 kV CT/VT combined metering units and four 230 kV group operated switches will be installed.

Windstar substation

The substation yard and fence will need to be expanded to allow for an additional 230 kV bay to be constructed. New ground grid and conduit will be installed. The ground grid at Windstar will be connected to the ground grids at the Interconnection Customer owned tie line substations. A CDEGS grounding analysis will be required. New relay panels will be installed in the control house. The following station equipment will be installed:

- (2) – 230 kV circuit breaker
- (6) – 230 kV combined CT/VT metering unit
- (2) – 230 kV group operated switch, breaker disconnect
- (2) – 230 kV group operated switch, line disconnect, with motor operator, with ground blade
- (2) – 230 kV group operated switch, meter disconnect
- (6) – 144 kV MCOV surge arrester

6.1.8 Communication Requirements

6.1.8.1 Interconnection of Q0712 (A-B) substations

Interconnection Customer is to install OPGW fiber on the new 20 mile line from the tie line substation near Windstar to the Q0712A and Q0715B collector substations. ADSS fiber is to be installed from the tie line substation into Windstar substation's building. Interconnection Customer is to supply 2 SCADA circuits with the required points using DNP3 protocol over the fiber to the Windstar substation control building where it will be routed over the Transmission Provider's existing network to the control centers.

6.1.9 Metering Requirements

6.1.9.1 Interchange Metering

The POI will be at Transmission Provider's Windstar substation: Revenue metering will be located at Windstar substation on each of the two transmission lines between Windstar and the Q0712 tie line substations. Metering will be designed bidirectional and rated for the total net generation of the Project. The bidirectional metering will also include the retail load (per tariff) delivered to Interconnection Customer. Transmission Provider will specify and order all interconnection revenue metering, including the instrument transformers, metering panels, junction box and secondary metering wire. The primary metering transformers shall be combination 2000:5 CT/VT extended range for high accuracy metering.

The metering design package will include two revenue quality meters, test switch, with DNP real time digital data terminated at a metering interposition block. One meter will be designated a primary SCADA meter and a second meter will be used designated as backup with metering DNP data delivered to the alternate control center. The metering data will include bidirectional KWH KVARH, revenue quantities including instantaneous PF, MW, MVAR, MVA, including per phase voltage and amps data.

An Ethernet connection is required for retail sales and generation accounting via the MV-90 translation system.

6.1.9.2 Q0712 Substation A metering:

Revenue metering is required for each of the two customer power transformers and will be located on the high side of each of the step-up transformers. The primary metering transformers shall be combination 230kV, 1000:5 CT/VT extended range for high accuracy metering.

Transmission Provider will design and procure the collector revenue metering panels. The panels shall be located inside the collector control house. The collector substation metering panel shall include two revenue quality meters, test switches, and all SCADA metering data terminated at a metering interposition block.

A second, independent communication path from that used for the Q0712 substation A is required for retail sales and generation accounting via the MV-90 translation system.

6.1.9.3 Q0712 Substation B metering:

Revenue metering is required for each of the two customer power transformers and will be located on the high side of each of the step-up transformers. The primary metering transformers shall be combination 230kV, 1000:5 current ratio, CT/VT extended range for high accuracy metering.

Transmission Provider will design and procure the collector revenue metering panels. The panels shall be located inside the collector control house. The collector substation metering panel shall include two revenue quality meters, test switches, and all SCADA metering data terminated at a metering interposition block.

An Ethernet phone line is required for retail sales and generation accounting via the MV-90 translation system.

6.1.9.4 Station Service/Construction Power

The Project is within the Transmission Provider's service territory. Please note that prior to back feed, Interconnection Customer must arrange transmission retail meter service for electricity consumed by the Project and arrange back-up station service for power that will be drawn from the transmission or distribution line when the Project is not generating. Interconnection Customer must call the PCCC Solution Center 1-800-625-6078 to arrange this service. Approval for back feed is contingent upon obtaining station service.

7.0 COST ESTIMATE (ER)

The following estimate represents only scopes of work that will be performed by Transmission Provider. Costs for any work being performed by Interconnection Customer are not included.

Direct Assigned

Q0712 Collector substation A *Add metering and control house*		$1,012,000
Q0712 Collector substation B *Add metering and control house*		$1,085,000
Windstar substation *Project Line Termination & Metering*		$840,000
Tie line substations *Add communications*		$124,000
	Total Direct Assigned	**$3,061,000**

Network Upgrades

Windstar substation *Expand yard, add line positions and breakers*		$4,193,000
Shirley Basin substation *Update protection & control and communications*		$250,000
Aeolus substation *Update protection & control and communications*		$250,000
Aeolus Shirley Basin #1 Transmission Line *Reconductor 16 miles of 230 kV line*		$19,501,000
Standpipe-Freezeout-Aeolus Transmission Line *Rebuild 16 miles of 230 kV line*		$19,788,000
Freezeout Substation *Rebuild substation*		$4,758,000
	Total Network Upgrade	**$48,740,000**
	Grand Total	**$51,801,000**

*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 Transmission Provider must develop the Project schedule using conservative assumptions. Interconnection Customer may request that Transmission Provider perform this field analysis, at Interconnection Customer'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 Interconnection Customer 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 Transmission Provider to interconnect this Generating Facility to Transmission Provider's electrical distribution or transmission system. A more detailed estimate will be calculated during the Facilities Study. Interconnection Customer will be responsible for all actual costs, regardless of the estimated costs communicated to or approved by Interconnection Customer.

8.0 SCHEDULE

Transmission Provider estimates it will require approximately 24-36 months to design, procure and construct the facilities described in the Energy Resource sections of 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 as well as the contingent requirements for higher queued projects results in a timeframe that may support Interconnection Customer's requested Commercial Operation date of December 31, 2020.

8.1.1 Maximum Amount of Power that can be delivered into Network Load, with No Transmission Modifications (for informational purposes only)

Zero (0) MW can be delivered on a firm basis to the Transmission Provider's network loads with additional transmission modifications.

8.1.2 Additional Transmission Modifications Required to Deliver 100% of the Power into Network Load (for informational purposes only)

In order to deliver 100% of the power into Network Load, in addition to the mitigation identified in section 6.1.2, the completion of additional Transmission Provider Energy Gateway projects and other system improvements would also be required.

9.0 PARTICIPATION BY AFFECTED SYSTEMS

Transmission Provider has identified the following affected systems: WAPA, Black Hills, Tri-state, Basin Electric

A copy of this report will be shared the each Affected System.

10.0 APPENDICES

Appendix 1: Higher Priority Requests
Appendix 2: Property Requirements
Appendix 3: Study Results

10.1 Appendix 1: Higher Priority Requests

All active higher priority transmission service and/or generator interconnection requests with an in-service date of December 2020 or earlier were considered in this study and are identified below. If any of these requests are materially modified, Transmission Provider reserves the right to restudy this request, as the results and conclusions contained within this study could significantly change.

Transmission/Generation Interconnection Queue Requests considered:

Q0720 (80 MW TSR –Q2060)
Q0542 (240 MW)
Q0706 (250 MW)
Q0707 (250 MW)
Q0708 (250 MW)

10.2 Appendix 2: Property Requirements

Property Requirements for Point of Interconnection Substation

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

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

Interconnection Customer 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.

Interconnection Customer 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 Transmission Provider. The real property shall be a permitted or able to be permitted use in all zoning districts. Interconnection Customer shall provide Transmission Provider with a title report and shall transfer property without any material defects of title or other encumbrances that are not acceptable to Transmission Provider. 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:

1. 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 Transmission Provider unless waived by Transmission Provider.

2. 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. Transmission Provider may require Interconnection Customer to procure various studies and surveys as determined necessary by Transmission Provider.

Operational: inadequate access for Transmission Provider'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 Transmission Provider.

10.3 Appendix 3: Study Results

A Western Electricity Coordinating Council (WECC) approved 2021-22 Heavy Winter case was used to perform the power flow studies using PSS/E version 33.7. The study was performed assuming the Energy Gateway, D.2 500 kV segment from the planned Aeolus substation to the planned Anticline substation was in-service. The local 500 kV, 345 kV, 230 kV, and 115 kV transmission system outages were considered during the study.

N-0 Results: Assuming the Energy Gateway, Segment D.2 projects are in service, along with the mitigation required by Q0707 and Q0708, the study did not indicate any thermal overload or voltage issues.

The data provided by Interconnection Customer indicated that the generator does not have adequate reactive capability to deliver 100% of its power output at +/- 0.95 power factor. Hence, external shunt compensation which is dynamic in nature will be required in order to control the voltage and provide adequate reactive capability to maintain the voltage at the POI with a +/- 0.95 power factor on the high side of the step-up transformer.

As shown in Figure 2, the study indicated that if the collector system is connected to the transmission system without the generator being online, the collector system contributes approximately 31.8 MVAr to the transmission system. The addition of 31.8 MVAr on the transmission system under light load conditions could cause high voltages. The Interconnection Customer will have to minimize the reactive interchange under these conditions.

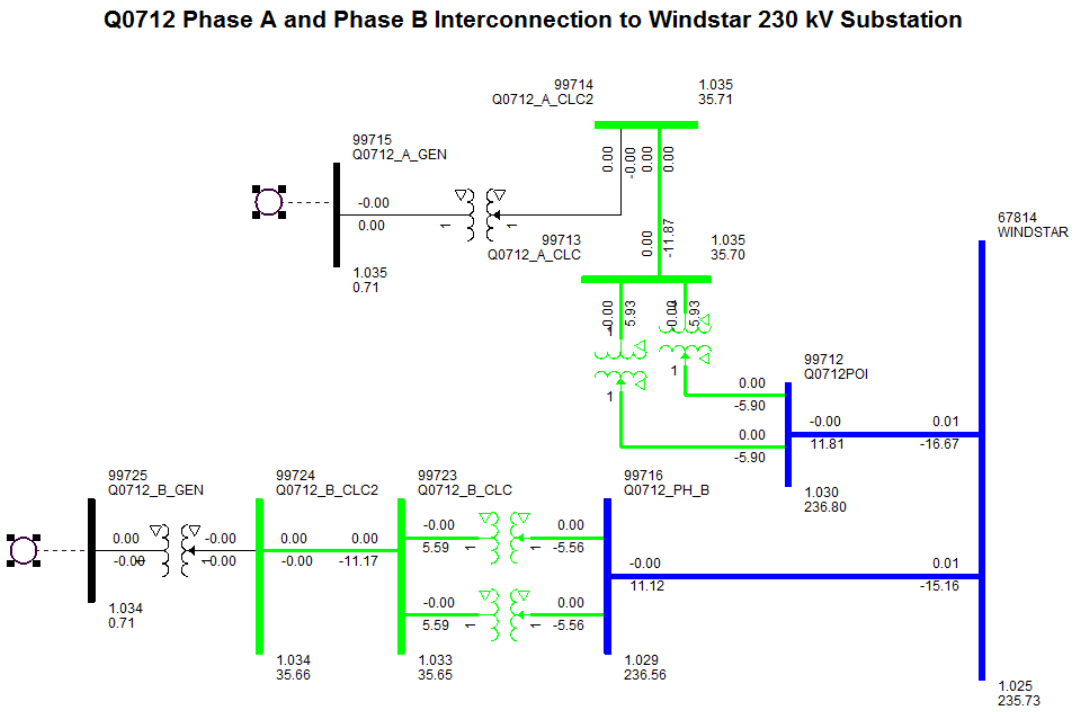

Figure 2: Charging from Q0712 Collector System

N-1 Results:

Assuming the Energy Gateway D.2 projects are in service, along with the mitigation identified for senior queue projects, an outage of the Aeolus – Shirley Basin #2 230 kV line resulted in an overload on the Aeolus – Shirley Basin 230 kV #1 line of 152%. The mitigation for this issue is to rebuild the existing Shirley Basin #1 230 kV line, approximately 16 miles, with 2-1272 ACSR.

An outage of the Aeolus – Anticline 500 kV line, Aeolus 230/500 kV transformer or Anticline 345/500 kV transformer results in an overload on the Standpipe-Freezeout 230 kV line (109%), the Freezeout -Aeolus 230 kV line (102%) 230 kV and the Standpipe-Platte 230 kV line (106%). The mitigation for this overload is to rebuild the existing lines, approximately 15 miles, from Standpipe to Freezeout to Aeolus with bundled 2x1272 ACSR.

N-1-1 Results:

Based on operating conditions in real time, generation curtailment may be required for certain N-1-1 conditions that may limit the transmission capacity in the Wyoming area. No mitigation is identified for N-1-1 outages as manual curtailment of the Project would be performed post first contingency such that no thermal overload would occur for the second contingency.

N-2 Results:

Assuming Energy Gateway, Segment D.2 and mitigation required by Q0707 and Q0708 Projects are in service, no N-2 thermal overloads or voltage issues were observed in the study.