Interconnection Facilities Study
Final Report

Generator Interconnection Request No. TI-08-0204
150 MW Wind Energy Generating Facility
In Kit Carson County, Colorado

Prepared By:

Tri-State Generation and Transmission Association, Inc.

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Attachment A: Burlington Substation General Arrangement and Electrical Drawings

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1.0 INTRODUCTION

1.1 Objective

This report presents the findings of the Interconnection Facilities Study for Generator Interconnection Request No. TI-08-0204, a 150 MW wind energy Generating Facility to be located in Kit Carson County, Colorado. This report was prepared in accordance with Tri-State Generation and Transmission Association, Inc. Generator Interconnection Procedures.

1.2 Background

The Project consists of eighty-one (81) GE 1.715 MW wind turbines and six (6) GE 1.79 MW wind turbines and one 34.5-230 kV transformer at the main wind energy generating facility, with a primary Point of Interconnection (POI) at Tri-State's Burlington 230 kV Substation via a four mile 230 kV transmission line. A Final System Impact Study (SIS) report for the Project was published on April 22, 2014 and posted on Tri-State's OASIS web site. The SIS included steady state power flow, dynamic stability, and short circuit analysis for interconnection of the Project as a Network Resource.

1.3 Scope of Study

The Project requires adding a 230 kV circuit breaker, 230 kV switches and associated facilities to the breaker-and-a-half bus configuration planned for the Burlington Substation (see Drawing S1007-A-02-002, General Arrangement). This Interconnection Facilities Study Report includes details for the Project interconnection at the Burlington Substation and provides a cost estimate for those facilities that are the responsibility of the Interconnecting Customer. Attachment A to this Facilities Study includes:

1. General Arrangement drawing identifying Interconnection Facilities (S1007-A-02-002)
2. Trip and close electrical one-line diagram (S1007-B-01-005)
3. AC current and potential one-line diagram (S1007-B-01-001)
4. Carousel Wind 230 kV line AC current and potential 3-line schematic (S1007-B-02-014)
5. Carousel Wind line primary and secondary relaying DC schematic (S1007-B-04-018)

Note that the Interconnecting Customer will be responsible for constructing the radial 230 kV transmission line to the generating facility site and for providing the primary protection (interrupting device) for the customer's step-up transformer located in its 230-34.5 kV substation yard. Equipment at the Burlington Substation will only provide backup protection for the customer's 230-34.5 kV main transformer in the event of equipment failure or malfunction at the customer's facility.

The Interconnecting Customer is responsible for providing a communication channel, such as fiber optic cable (OPGW) on its radial 230 kV transmission line, to provide for SCADA, metering, and protective relaying. The Interconnecting Customer must also provide access to analog, indicating, control and data circuits, as required to integrate the Project into the design and operation of the Tri-State control system.

2.0 INTERCONNECTION FACILITIES

2.1 Overview

The layout of the Burlington Substation is depicted on the attached General Arrangement drawing. The Burlington Substation 230 kV yard is being modified by Tri-State to terminate its new Burlington - Wray 230 kV transmission line. That project involves adding two 230 kV breakers and associated switches to the existing two breaker arrangement to accommodate the new line termination (Tri-State Work Order No. 1518). A fifth 230 kV circuit breaker and associated switches will be added to accommodate the Interconnecting Customer's POI (Tri-State Work Order No. 4587). Reference the highlighted portion of the General Arrangement diagram.

The POI is defined as the location on the 230 kV Burlington Substation bus that terminates the radial Project line. The Point of Change of Ownership (PCO) is at the dead-end structure of the radial Project line.

The Interconnecting Customer shall be responsible for engineering, purchasing, constructing and owning all equipment associated with the generating facilities up to the Point of Change of Ownership.

2.2 List of Burlington Substation Additions for the Project (Work Order No. 4587)

<u>Network Upgrades (Reimbursable)</u>

- One (1) 230 kV line bay
- One (1) 230 kV power circuit breaker
- Two (2) 230 kV breaker disconnect switches and associated structures
- Circuit breaker station control
- SCADA and telemetry RTU communication equipment
- Associated substation equipment including structural steel, grounding conductor, conduit, cable, insulators and foundations

<u>230 kV Termination Equipment between PCO and POI (Non-Reimbursable)</u>

- One (1) 230 kV steel dead-end structure
- One (1) 230 kV slack span from dead-end
- One (1) 230 kV line disconnect switch and associated structure
- Three (3) 230 kV CT/VT combination metering units, high accuracy, extended range
- PQ metering panel including SEL-735 revenue/PQ meter, panel meters
- Relaying for the Interconnecting Customer's radial 230 kV line protection (SEL-321 primary, SEL-311C secondary, and SEL-501 breaker-failure)
- Three (3) 230 kV surge arresters
- Line termination SCADA and telemetry communications
- Associated substation equipment including but not limited to grounding conductor, conduit, cable, insulators, foundations, bus, site prep and yard work

Consistent with the SIS, the above list identifies those facilities whose costs are Reimbursable to the Interconnecting Customer and those costs that are Non-Reimbursable. The Interconnecting Customer must initially fund the total Project cost, including the cost for facilities defined as Network Upgrades. Actual costs for Network Upgrades (Reimbursable) will be determined at the time of Project close-out and will be credited back to the Interconnection Customer as Network Credits.

3.0 COST ESTIMATE

Total Project Cost is estimated at $1,822,876 and includes all overheads and a 10% contingency. Based on material cost estimates for those items identified in Section 2.2 of this report, the Reimbursable costs (Network Upgrades) are estimated to be $729,150 and the Non-Reimbursable costs are estimated to be $1,093,726. Details for the Total Project Cost are presented in Attachment B to this report. The estimate of Total Project Cost is based on the following assumptions.

1. No additional land is required at the Burlington Substation for the Project.
2. No Environmental Review will be required.
3. A minor Control Survey will be required.
4. Construction will take approximately 11 weeks and be completed by a construction contractor.
5. Costs are for Work Order No. 4587 only (the Project) and do not include additional upgrades at the Burlington Substation for termination of Tri-State's new Burlington to Wray 230 kV line.

4.0 GENERATING FACILITY PERFORMANCE

As discussed in the SIS report, the Interconnecting Customer is responsible for the installation of equipment to ensure that the generating facility can achieve the net 0.95 power factor lag and lead capability across the 0 to 150 MW net generation output rating as measured at the POI. The Interconnecting Customer must provide data that demonstrates compliance with Tri-State's reactive criteria. Verification of these capabilities as measured at the POI will be required when the facility is ready for commercial operation.

5.0 SCHEDULE

Tri-State's Burlington – Wray 230 kV Transmission Project is targeted to be operational in 2016.

Construction at the Burlington Substation is targeted to commence in March 2015.

The terminal upgrade at the Burlington Substation, including those facilities required for the Project, is scheduled to be completed by November 30, 2015.