

Interconnection Request No. TI-08-0312

INTERCONNECTION FACILITIES STUDY REPORT



Prepared by
Tri-State Generation and Transmission Association, Inc.

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1. INTRODUCTION

1.1 Objective

This report presents the Interconnection Facilities Study results for interconnection of a proposed 30 MW solar generating facility (the Project) to Tri-State Generation and Transmission Association's (Tri-State) 115kV transmission system in north central New Mexico.

1.2 Background

The Project has selected a Point of Interconnection (POI) approximately five miles from Springer Substation on the Springer-York Canyon 115kV Transmission Line, where a new Tri-State interconnection substation called Bison Substation will be constructed. Bison Substation will be a simple 115kV tap substation with a single 115kV breaker installed for line protection. Additional equipment will be installed to accommodate a future ring-bus expansion without the need to take line or bus outages. The Bison Substation property is expected to be directly adjacent to Tri-State's existing transmission line. The Interconnection Customer's substation is expected to lie directly east of Bison Substation with connection to the solar farm substation by a tubular bus extension between the two substations.

A Final System Impact Study (SIS) report for this project dated November 19, 2009 has been issued and posted on Tri-State's OASIS web site. The study was conducted in accordance with Tri-State's Large Generator Interconnection Procedures (LGIP) and entails steady state power flow, dynamic stability, short circuit analysis and preliminary cost and schedule estimates for interconnection of the Project as a Network Resource. A conclusion of the SIS report is that the project may be added without Network Upgrades other than the construction of Bison Substation and associated telecommunication additions and modifications.

1.3 Scope

This Interconnection Facilities Study Report includes details of the configuration for the construction of the new Tri-State Bison 115kV Substation and associated Network Upgrades. Documents to summarize the construction work required include: electrical one-line diagram, general arrangement drawing, major material lists with cost estimates ($\pm 20\%$ accuracy), and project schedule. Because the Project will be connected to a radial line with multiple loads on the end of the line no outages of the line will be permitted for the proposed construction. Therefore the proposed design will facilitate tapping the line while hot.

2. INTERCONNECTION OF BISON SUBSTATION

2.1 General Discussion

Full line sectionalizing will not be required for connection to the radial transmission system. The simple tap breaker configuration will allow isolation of the Bison facility by using the motor-operated switches but not without an interruption to the Bison interconnection. The proposed installation includes high-side bi-directional metering, high-side protection, SCADA system and telecommunications. Communications to Bison Substation will be by digital microwave with one hop to Springer Substation where new terminal equipment will be installed. A component of

the protection design includes a transfer-trip scheme to disconnect the generating facility upon any opening of the Springer Substation 115kV line breaker on the Springer-York Canyon 115kV line. This scheme has been added to address an unacceptable islanding condition that occurs when the Springer 115kV breakers trips. Primary protection (relaying and the interrupting device) for the IC's step-up transformer will be provided by the IC in their substation yard. Equipment in the Bison Substation can be available to provide backup protection for the transformer protection in the event of equipment failure or malfunction in the IC's facility. To facilitate protective relaying, backup power and data acquisition, conduit will be installed between Bison and the IC Substations to contain as a minimum: CT circuits; fiber optic cables for data communication (and breaker failure relaying if requested); circuits for differential tripping; and backup station power.

2.2 Bison Substation Description

The layout of the proposed substation is depicted on the attached One-Line Diagram and General Arrangement. The physical layout will provide for a future expansion of the bus arrangement into a possible four-breaker ring bus.

2.2.1 Work to be completed and paid for by the Interconnection Customer

- Engineer, purchase, construct and own equipment associated with the generating plant and all Interconnection Facilities up to the Point of Ownership Change (POC), as indicated on the attached one-line diagram.
- Install an interrupting device, associated switch and relaying for transformer protection.
- Land costs, access roads and any costs associated with obtaining state or local permits for the Project.
- Backup 120/240V, 25kVA single phase station service for the Transmission Provider's facilities.
- Provide access to analog, indicating, control and data circuits, as required to integrate into the design and operation of the Tri-State control system.
- Coordinate with Tri-State to intertie substation ground grids (if applicable), substation fencing, duct bank/conduit between the substations, substation grading plans and the 115kV intertie.

2.2.2 Network Upgrade work at Bison Substation and communication/relay work at Springer Substation to be completed by the Transmission Provider and initially paid for by Interconnection Customer (with cost being refundable per the LGIP)

- Engineer, purchase, construct, own and operate all Interconnection Facilities and Network Upgrades starting from the Point of Ownership Change (POC).
- Install two 115kV in-line motor operated disconnect switches (one with load-break capabilities).
- Install one 115kV circuit breaker
- Install two 115kV breaker isolation switches.
- Install one 115kV power potential transformer for primary station service and sync check.

- Perform hot line work necessary to connect Bison substation to Tri-State's 115kV transmission line.
- Install power control assembly with space for switch controls, line and bus differential relaying, battery and DC system, AC system, telecommunications gear, and SCADA equipment. The control system designed for this station will also include the transfer-trip requirement identified in the SIS for a trip by the Springer breakers serving the Springer-York Canyon line.

The estimated cost of this construction is \$2,265,000; a copy of the estimate is attached.

2.2.3 Interconnection Facilities work at Bison Substation to be completed by the Transmission Provider and paid for by the Interconnection Customer (with cost being non-refundable per the LGIP)

- Install three 115kV voltage transformers and three 115kV current transformers for bi-directional metering.
- Install one 115kV metering disconnect switch.
- Install one meter panel
- Install other necessary substation equipment including but not limited to grounding conductor, cable trench, conduit, foundations, support steel, fence, yard surface, static protection and tubular and cable bus.

The estimated cost of the Interconnection Facilities construction is \$304,000; a copy of the estimate is attached.

2.2.3 Work to be completed and paid for by the Transmission Provider

- Install four 115kV disconnect switches for the future installation of a ring-bus.

2.3 Springer Substation Work Description

2.3.1 Work to be completed and paid for by the Interconnection Customer

- None

2.3.2 Work to be completed by the Transmission Provider and initially paid for by Interconnection Customer (with cost being refundable per the LGIP)

- To accommodate the required transfer-trip to Bison Substation in the event the Springer-York Canyon transmission line breaker trip, some minor protection and telecommunications work will need to be performed.

The cost for this work is included in the Network Upgrades estimate.

3. GENERATING FACILITY PERFORMANCE VERIFICATION

Results of the SIS indicate that the IC will need to install additional equipment to provide the voltage regulation and reactive support capabilities required. Verification of these capabilities as

measured at the Point of Interconnection (POI) bus will be required when the facility is ready for commercial operation. Detailed discussion on this topic is contained in the SIS Final Report.

4. SCHEDULE

A Gantt chart schedule is attached for the engineering and construction of the Bison Substation interconnection facilities. The schedule starts with the receipt of funds and execution of an E&P agreement on September 14, 2009. After the Project start, engineering and construction activities continue assuming timely execution of the LGIA and receipt of final project funding. The estimated duration from the receipt of funds is 10 months. The current estimated in-service date is June 1, 2010, but Tri-State will make all reasonable attempts to improve on this date.

5. REFERENCES

[1] Jeremy Sneath and Andrew Issacs P.E., "Updated Interconnection System Impact Study Report Final Report – November 19, 2009. Queue Interconnection Request No. TI-08-0312, 30MW Photovoltaic Facility near Springer, New Mexico" prepared for Tri-State Generation and Transmission Association, Inc., Final Review by: Ray LaPanse

6. LIST OF ATTACHMENTS

Drawings

Bison Substation:

One-Line Diagram

Preliminary General Arrangement

Cost Estimates

Bison Substation – (Network Upgrades) Estimate, dated 10/19/09

Bison Substation – (Interconnection Facilities) Estimate, dated 10/19/09

Schedule

Bison Substation MS Project Gantt Chart, dated 11/30/09