



Interconnection Facilities Study Report GEN-2023-153

Interconnection Request No. GEN-2023-153
120 MW Solar & BESS Generating Facility
Perkins County, NE

Rev. 0 – January 30, 2026

Prepared by Kayla Voller, PE
Burns & McDonnell Engineering Company, Inc.

Review Coordinated by
Tri-State Transmission Engineering

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

THIS DOCUMENT WAS PREPARED BY TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC., IN ITS CAPACITY AS TRANSMISSION OWNER (TO), IN RESPONSE TO A LARGE GENERATOR INTERCONNECTION REQUEST. NEITHER TO, NOR ANY PERSON ACTING ON BEHALF OF TO: (A) MAKES ANY REPRESENTATION OR WARRANTY EXPRESS OR IMPLIED, WITH RESPECT TO THE USE OF ANY INFORMATION, METHOD, PROCESS, CONCLUSION, OR RESULT, INCLUDING FITNESS FOR A PARTICULAR PURPOSE; OR (B) ASSUMES RESPONSIBILITY FOR ANY DAMAGES OR OTHER LIABILITY, INCLUDING ANY CONSEQUENTIAL DAMAGES, RESULTING FROM USE OF OR RELIANCE UPON THIS DOCUMENT OR ANY INFORMATION CONTAINED HEREIN.

Contents

Executive Summary.....	3
Interconnection of the Generating Facility.....	4
Scope of Work.....	4
Cost Estimates and Assumptions.....	4
Interconnection Customer’s Generation Facility (costs are not included in the estimates identified in this FacS Report)	5
Transmission Owner’s Interconnection Facilities	6
Transmission Owner Network Upgrades	7
Schedule.....	8
Contingent Facilities.....	8
Appendices.....	9

Executive Summary

This Interconnection Facilities Study (“FacS”) report sets forth the scope of work, non-binding good faith cost estimate, and schedule for the Transmission Owner (“TO” or “Tri-State”) and the Interconnection Customer (“IC”) to interconnect a proposed 120 MW Solar & Battery Energy Storage System (“BESS”) Generating Facility (“GF”) utilizing Network Resource Interconnection Service (“NRIS”) per Interconnection Request (“IR”) GEN-2023-153 via a 115 kV generator tie line routed from the GF to a new 115 kV line position at Tri-State’s existing Grant 115 kV Substation, (collectively referred to as the “Project”). The IR was submitted to Southwest Power Pool (“SPP”) as the Transmission Provider (“TP”) pursuant to the TP’s Generator Interconnection Procedures (“GIP”) that are part of TP’s Open Access Transmission Tariff (“OATT”).

Based on the GEN-2023-153 report dated September 29, 2023, the IC will construct a GF that consists of thirty-two (32) Freesun Gen3 4200M PV inverters equivalent to one (1) 120 MW equivalent solar generator and thirty-two (32) Tesla Megapack 2 XL inverters equivalent to one (1) 120 MW equivalent BESS generator. The IC will also install one (1) 34.5-115 kV transformer and a 0.6-mile 115 kV generator tie line that will interconnect to TO’s existing Grant 115 kV Substation. In its application, the IC proposed an in-service date (“ISD”) of June, 2028, and commercial operation date of August 1, 2028, for the Project with a Point of Interconnection (“POI”) located at Grant 115 kV Substation. **The estimated project in-service date does not meet the IC’s requested in-service date.**

To accommodate the addition of the 115kV generator tie line, the existing 115 kV 5-breaker, 5-position ring bus at Grant substation will be expanded to a 10-breaker, 6-position breaker-and-a-half bus configuration. The new 115 kV generator tie line for GEN-2023-153 will be connected to the new northeast position in the breaker-and-a-half configuration. Additional upgrades associated with this project include relocation and replacement of the three (3) 115 kV Ogallala Line 1 single phase CCVTs, addition of one (1) single phase 115 kV CCVT for the north bus, addition of one (1) single phase 115 kV CCVT for the south bus, addition of one (1) DFR, addition of one (1) bus differential relay panel, additions to the existing breaker failure/control panels, and addition of one (1) transmission line protection panel. This expansion does not require civil or site work because the substation site footprint can accommodate this addition without additional site expansion.

The total cost of the Project is estimated at **\$8 million** comprised of: 1) TO’s Interconnection Facilities (“TOIF”) estimated to be **\$1.6 million**; and 2) TO’s Network Upgrades (“TONU”) estimated to be **\$6.4 million**. The total of which is to be funded by the IC pursuant to the Generator Interconnection Agreement (“GIA”). The estimated time for design, permitting, procurement, and construction of the Grant Substation addition is approximately **43 months** to complete the work. This is from the date the TO obtains written authorization to proceed under an GIA or Engineering and Procurement (“E&P”) Agreement. All schedule and cost estimates are subject to increasing uncertainty due to on-going supply chain impacts and the rapidly changing conditions that are present during the writing of this report. This estimate assumes no land acquisition or permitting is required.

Interconnection of the Generating Facility

Scope of Work

The documents in support of this FacS include general arrangement drawings, substation elevation drawings, electrical metering and relaying AC one-line diagram, and switching one-line diagram. These are located in Appendices A and B of this FacS, which are supplied to the IC only upon request (not to be posted on the TP's OASIS site for public use).

The proposed GF must include 115 kV generation tie line protection, a Supervisory Control and Data Acquisition ("SCADA") system, and a remote terminal unit ("RTU"). Primary protection (relaying and the interrupting device) for the IC's 34.5-115 kV transformer will be provided by the IC in the GF's yard. Equipment in the Grant Substation will only provide backup protection for the IC's 34.5-115 kV transformer in the event of equipment failure or malfunction at the GF. TO requires relaying communications channels on both primary and secondary generation tie line relaying and will coordinate with the GF to provide line protection for the tie line. To facilitate protective relaying, SCADA, and metering between the Grant substation and the GF, an optical ground wire ("OPGW") with 48-strand single-mode fiber is required, routed from the GF to the Grant Substation via 115kV generation tie line. The IC must also provide access to analog, indicating, control, and data circuits as required to integrate the Project into the design and operation of the TO's control system.

The Point of Interconnection ("POI") will be the node on the 115kV bus where the generation tie line splits between new 115 kV breakers 862 and 1062. The Point of Change of Ownership ("PCO") will be the IC generation tie line termination on the new vertically configured full tension monopole dead-end. All transmission structures including transmission monopole dead-end at PCO outside substation fence to be included in GF and excluded from scope of this FacS and these costs associated with GF are not included in this FacS. The cost estimate includes all necessary substation equipment including, but not limited to, grounding, conduit, cable, insulators, foundations, support steel, bus work, yard work, and fencing inside the existing Grant 115 kV Substation yard. See **Figure 1** below for ownership classification; clouded region in figure denotes FacS related scope.

To accommodate the IC 115 kV generation tie line, the interconnection facilities and network upgrades for the Project are located on the TO's side of the PCO at the existing Grant Substation and involve updating the existing substation from a 5-breaker ring bus to a 10-breaker breaker-and-a-half configuration. For more details on 115 kV Grant Substation expansion scope of work reference other sections within this FacS.

Cost Estimates and Assumptions

The layout of the proposed modifications and additions to the existing Grant 115 kV Substation are shown on the attached One-Line Diagrams (Appendix B) and General Arrangements (Appendix A).

GEN-2023-153
APPENDIX B-2

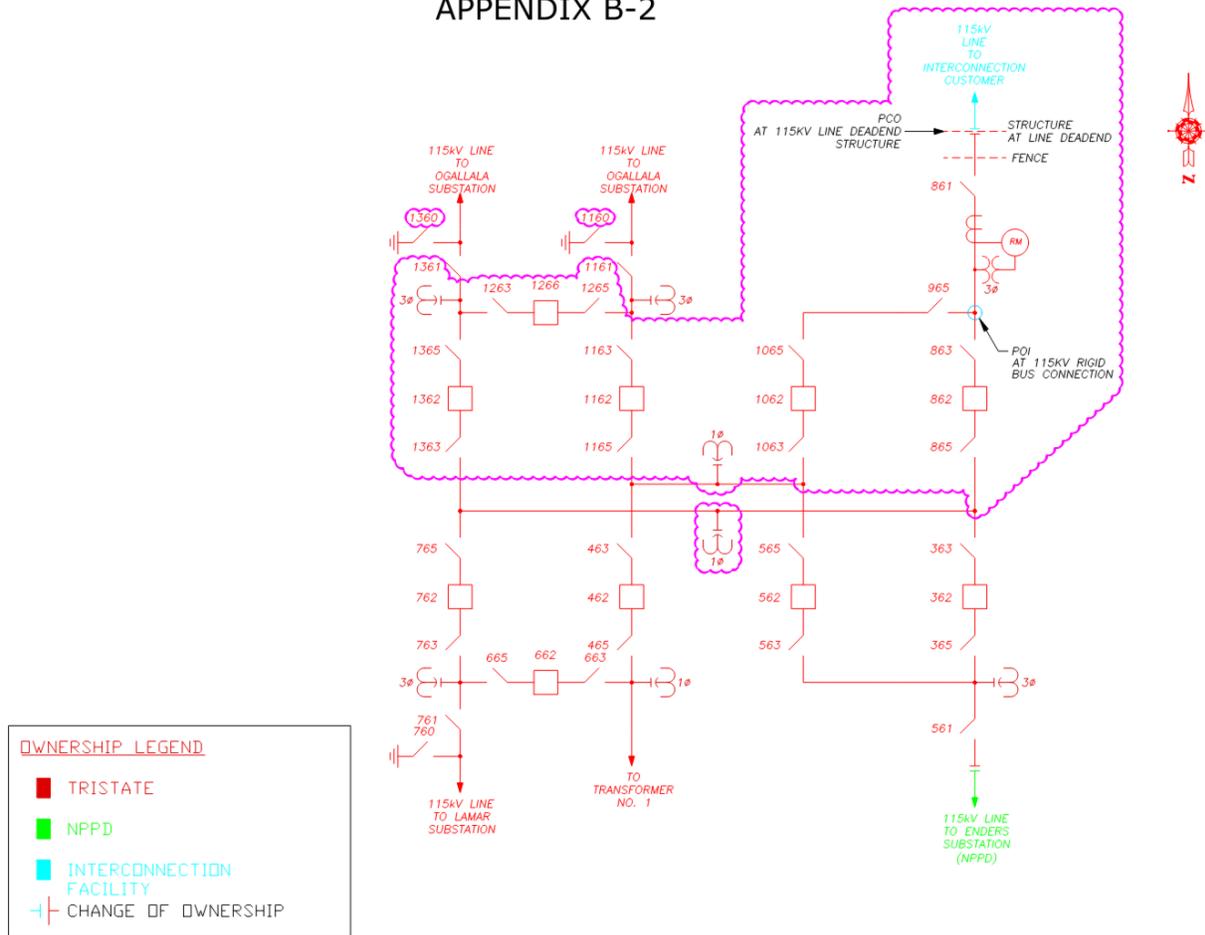


Figure 1. Switching One Line Diagram with PCO and POI (Appendix B)

Interconnection Customer’s Generation Facility (costs are not included in the estimates identified in this FacS Report)

- One (1) 34.5-115 kV step up transformer.
 - Relaying and control for 115 kV step up transformer.
 - IC to provide design specifications, relay settings, RTU configuration, and test reports for the 115 kV step up transformer to TO.
- One (1) 115 kV fault interrupting device (transformer 115 kV breaker).
- One (1) 115 kV disconnect switch (for line entrance and transformer breaker).
- 115 kV transmission line with optical ground wire (“OPGW”) to IC’s monopole dead-end structure with provisions to ensure appropriate electrical phasing as needed.
 - Relaying and control for the 115 kV transmission line to Transmission Owner’s Grant substation including one (1) SEL-411L primary and one (1) SEL-311L secondary relay (with appropriate current and potential contributions as needed, including provisions for TO’s communication-assisted tripping disable functionality for relay testing purpose).

- One (1) vertically configured full tension transmission monopole dead-end structure located outside of the Grant Substation fence and approximately 10 feet inside the Grant Substation property line for the IC's Generating Facility line termination.
 - The vertically configured full tension transmission monopole dead-end structure shall create zero-line angle with the TO's Dead-End Structure, unless another location is mutually agreed upon by the Parties in writing.
 - Termination of the OPGW at 15 feet above ground line on the IC's transmission monopole dead-end Structure in the TO's weatherproof canister with a 100 feet coil for future splicing.
- SCADA RTU that is suitable for Distributed Network Protocol 3 ("DNP3") for interfacing with the Transmission Owner's control and monitoring communications circuits (over OPGW).
- Metering capable of measuring the generation and parasitic load of both the Solar facility and the BESS facility independently in order to determine the station service (back-feed) load for each.
- Land, access roads, and any costs associated with obtaining state or local permits for the GF and ICIF.
Facilities and equipment to provide access to analog, indicating, control and data circuits, as required to integrate into the design and operation of the TO's control system.

These costs are not included in this Facilities Study Report.

Transmission Owner's Interconnection Facilities

- 115 kV Grant Substation
 - One (1) 115 kV substation dead-end structure.
 - One (1) 115 kV line disconnect switch
 - Three (3) 115 kV high-accuracy, extended-range metering class current transformers
 - Three (3) 115 kV metering class voltage transformers
 - Three (3) 115 kV arresters
 - One (1) 115 kV transmission line relaying panel, including two (2) SEL-411L primary and secondary relays, one (1) SEL-735 REV/PQ meter (with appropriate current and potential contributions as needed as well as provisions for communication assisted tripping disable functionality for relay testing purposes).
 - Line termination SCADA and telemetry communication equipment connections to RTU, Phasor Measurement Unit ("PMU") and digital fault recorder ("DFR").
 - All other necessary switching station equipment including but not limited to grounding, conduit, cable, insulators, foundations, support steel, tubular and cable bus, trench, site preparation, yard work, and fencing to accommodate installation of equipment described in this section.
- Transmission
 - One (1) 115 kV slack span line from the IC's transmission monopole dead-end structure to TO's substation dead-end structure, all jumpers and splices for the OPGW.

- TO shall string the last span from the IC's transmission monopole dead-end structure to TO's substation dead-end structure and install all jumpers. The TO will run underground conduit and fiber optic cable from the TO control building to the base of the IC's transmission monopole dead-end structure and splice the OPGW at TO's provided weatherproof canister that TO mounts on the IC's transmission monopole dead-end structure.
- Associated line hardware including dead end conductor and shield wire assemblies, dampers, OPGW, insulators, etc.

The estimated cost for the **Transmission Owner's Interconnection Facilities ("TOIF") is \$1.6 million**. This is over 20% higher than the provided DISIS cost estimate for TOIF of \$1.25 million, the increase in estimated TOIF costs in this FacS are attributed to a year-over-year increase in labor and equipment costs. Estimated cost for labor increased 30% to \$1.1 million.

Transmission Owner Network Upgrades

- 115 kV Grant Substation
 - Five (5) 115 kV circuit breakers.
 - Eleven (11) 115 kV disconnect switches.
 - One (1) SEL-351S relay to existing panel 10F.
 - One (1) SEL-351S relay to existing panel 11F.
 - Two (2) SEL-351S relays to existing panel 12F.
 - One (1) SEL-351S relay to existing panel 13F.
 - Five (5) 115 kV coupling capacitor voltage transformers.
 - One (1) DFR
 - One (1) 115 kV bus differential panel, including bus differential relays.
 - Line termination SCADA and telemetry communication equipment connections to RTU and DFR
 - Update relay settings for new bus configuration at Grant 115 kV Substation.
 - All other necessary substation equipment including but not limited to grounding, conduit, cable, insulators, foundations, support steel, tubular and cable bus, trench, access, grading, drainage, yard surfacing, and fencing to accommodate installation of equipment described in this section.

The estimated total cost of the **Transmission Owner's Network Upgrades ("TONU") is \$6.4 million**. This is over 20% higher than the provided DISIS cost estimate for TONU of \$5.25 million. The increase in estimated TONU costs in this FacS are attributed to a year-over-year increase in labor and equipment costs. Estimated cost for each 115kV circuit breaker increased 106% to \$165 thousand.

Total Project Cost (including TOIF and TONU to interconnect IC's GF) is \$8 million.

NOTE: The additional costs that the IC will be responsible for include TO labor associated with witnessing the testing and commissioning activities that will be required at the IC's GF prior to the ISD (relaying and synchronizing equipment), and labor associated with synchronizing and

verification of GF’s compliance with the TP’s voltage control and reactive power capability criteria, final POI metering checks, etc.

Schedule

Activity	Duration	Start	Finish
Engineering Design and Procurement	35 months	JUL-2026	JUL-2029
Construction and Commissioning	9 months	APR-2029	JAN-2030
Total Schedule	43 months	JUN-2026	JAN-2030

The project schedule starts with the receipt of authorization to proceed with design and procurement of materials as set forth in the GIA, or Engineering & Procurement (“E&P”) Agreement if applicable. **The estimated project in-service date does not meet the IC’s requested in-service date of June, 2028. The estimated duration from the receipt of authorization to proceed for design and procurement of materials to the back-feed ISD is approximately 43 months** and may be subject to modification based upon resource availability.

The desired final Commercial Operation Date (“COD”) request in Attachment C of Appendix 3 of the GIP is August 1, 2028. The COD for this GIR project will depend upon the commissioning time required by the IC for its generation facilities; it has been assumed for the purposes of this FacS report and schedule that this will take approximately 1 to 2 months, and that there will be some time required for the TO to witness portions of the commissioning activities as it pertains to the POI interconnection at IC’s facility. Note that durations in the attached schedule are in business days, and that project closeout will take place after completion of the Project.

Contingent Facilities

Contingent Facilities are defined as those unbuilt Interconnection Facilities and Network Upgrades, and/or planned upgrades not yet in service upon which the Interconnection Request’s costs, timing, and study findings are dependent, and if delayed or not built, could cause a need for re-study of the IR or a reassessment of the Interconnection Facilities and/or Network Upgrades and/or costs and timing.

The following are identified as Contingent Facilities in the DISIS-2023-001:

- Line – Elm Creek 345 kV – Tobias 345 kV New Line
 - Build a new 345 kV transmission line (85.2 miles) from Tobias to Elm Creek Substations to a standard rating of 1792 MVA
- Multi – Tande – Finstad – Leland Olds 345kV
 - Build a new 345 kV transmission line 48 miles from Finstad to Tande.

- Build a new 345 kV Substation including 345 kV terminals for transmission line from 345 kV Leland Olds Substation, transmission line from 345kV Tande Substation, and high side terminal equipment for 345/115 kV Finstad Substation Ckt 1 transformer and Finstad 345/115 kV Ckt 2 transformer
- Install a switched shunt reactor at Finstad Substation
- Build a new 345 kV Substation with terminal equipment to support a new 345 kV transmission line from Finstad 345 kV Substation.
- Install new terminal equipment at 345kV Tande Substation to support a new 345 kV transmission line from Finstad Substation.
- Install a series compensation device at Finstad or Tande Substation.
- Build a new 345 kV transmission line (123 miles) from Leland Olds to Finstad Substations.

Appendices

Appendix A-1: General Arrangement Drawings

Appendix A-2: Elevation Drawings

Appendix B-1: One Line Drawings

Appendix B-2: Switching Diagram