FirstEnergy

Transmission Planning and Protection Department

DETAILED LOAD STUDY REPORT

A 138 kV Transmission Delivery Point
For
City of Columbus Division of Water

Transmission Connection Request ID. No. 2023-0237

Date Issued: 2/15/2024

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1.0 Executive Summary

This report completes the Detailed Load Study ("DLS") requested by City of Columbus Division of Water ("Customer") for a new transmission connection request to serve the Customer proposed 6 MW load at 90% power factor and 7 MW of generation. The Customer substation is located at 8415 Dublin Road, Powell, OH 43065. See **Appendix A** for addition details.

To serve the Customer's load it is required to construct approximately 3.3 miles of 138 kV extension line with 795 ACSR conductor tapped from the London – Tangy 138 kV Line at/near structure 13814 on new transmission Right of Way (ROW).

See **Appendix B** for the geographic location of the connection point in relationship to the FirstEnergy ("FE") transmission system.

The Customer proposed in-service date is September 1, 2026. This is not FE's commitment to the Customer proposed in-service date.

The DLS identified no thermal or voltage criteria violations on the FE transmission system caused by the addition of the Customer's delivery point at the requested load level.

The DLS was performed by FE's Transmission Planning & Protection ("TPP") group, with assistance from Substation Design, Transmission Line Design, Metering Technical Support, Customer Support, and FERC Wholesale & Connection Support.

Please note that if the Customer should significantly change their substation configuration or increase their required load above 2 MVA after their in-service date for this interconnection, then an additional study may need to be performed by FE.

The results of this study report are subject to change. This study is based upon the current configuration of the FE transmission system and includes only those proposed Delivery Point projects with signed Delivery Point agreements. Delivery Point agreements executed subsequent to the completion of this study may impact the study results and cause the study to be performed again at the Customer's cost. FE will use best efforts to inform Customer should this occur.

Note: See **Appendix C.2** of this report for the Customer Substation one-line diagram.

2.0 Scope of Study

This study and report fulfill the DLS Agreement signed between FE and its affiliates and the Customer that was received on 9/22/2023. The results of the study are provided within this report and include a Class 4 cost estimate and engineering and construction schedule to complete the required FE transmission system modifications needed to accommodate this transmission connection request.

The scope of this study includes:

1. A summary of the study performed of the FE transmission system to accommodate 6 MW of load and 7 MW of generation by *09/01/2026* served from the London – Tangy 138 kV Line.

2. Requirements to facilitate connection of the Customer facilities to the FE transmission system. This includes the standard equipment requirements and configuration on the FE and Customer side on the connection.

3. Short circuit level at the defined Point of Interconnection ("POI").

The report provides a description of the transmission system operating and protection requirements, power quality requirements, revenue metering requirements, and transmission system scope of work.

3.0 Methodology

3.1 Case Description

The power flow models used to perform power flow analysis were developed from the North American Electric Reliability Corporation (NERC) / Multi-regional Modeling Working Group (MMWG) model. The new delivery point and load connection to the FE transmission system was modeled using the detailed FE 2023 summer peak load base case.

3.2 Analysis Performed

The power flow analysis evaluated the existing transmission system capacities for NERC Category P0, P1, P2, P4, P6 and P7 contingencies.

- NERC Category P0 contingencies evaluate the transmission system with all elements intact.
- NERC Category P1 contingencies remove a single transmission element (i.e. line section, transformer, generator, capacitor) from service.
- NERC Category P2, P4, P6 and P7 contingencies remove multiple transmission elements due to common node failures (i.e., bus/line fault, faulted/stuck breaker, two overlapping P1 contingencies, or common tower, etc.) from service.

This analysis was done with and without the proposed Customer load addition. The results of the power flow analysis were compared against the FE Transmission Planning Criteria. Any planning criteria thermal loading or voltage violations were reported.

The acceptable thermal and voltage criteria can be found in the FE Transmission Planning Criteria document which is referenced in the 'Additional Resources' section in the **Appendix E** of this report.

4.0 Results

4.1 Power Flow Study Results

A power flow analysis was performed to determine if the proposed load addition at the Customer delivery point can be adequately served without causing adverse effects on the FE transmission system. This could include problems such as: thermal overloads of equipment, under- or over-voltages at nearby facilities, and large voltage sags on the transmission system that violate FE's Transmission Planning Criteria.

The transmission system model is evaluated before and after the specified connection option(s) at projected peak loads, under normal and contingency conditions. If violations of thermal or voltage limits are identified, conceptual transmission system modifications are considered and tested for their effectiveness in alleviating the violations.

Study Year:	2023	Customer Load:	6.0	MW @	90	% PF	Customer Gen:	7.0	MW
Study Year:	N/A	Customer Load:	N/A	MVA @	N/A	% PF	Customer Gen:	N/A	MW

Voltage Violations: No voltage criteria violations were identified.

Thermal Violations: No thermal criteria violations were identified.

Motor Analysis
A motor start analysis was not performed as part of this analysis due to the profile of the Customer's load.

The Customer is required to comply with the requirements outlined in the FE "Requirements for Transmission Connected Facilities" document (see Resources Section in **Appendix E**).

5.0 Transmission System Protection

5.1 Protection Requirements

The Customer is solely responsible for protecting its own equipment in such a manner that electrical faults or other disturbances on the FE transmission system do not damage its equipment. The Customer shall design its facility to meet or exceed the protection requirements detailed in the FE "Requirements for Transmission Connected Facilities" document. The Customer must also design their system to meet all State and Local Codes and Laws applicable to this installation.

The Customer is required to have a fully rated circuit breaker at the POI. Any protective relay schemes utilized by the Customer must coordinate with the first FE upstream protective device. The Customer must submit to FE for approval, all applicable system protective devices that need to coordinate with the FE transmission system. FE shall review the settings for all Customer-owned relays to establish coordination between the Customer's protective equipment and the FE transmission system relays to ensure that faults on the load side of the Customer's main system protection do not adversely affect the FE transmission system. Additionally, the Customer's protective relaying system and interrupting device control circuits shall have a reliable source of power independent from the AC system or immune to AC system disturbances or loss (e.g., dc battery and charger) to assure proper operation of the protection scheme.

The Customer's transformer shall not contribute zero sequence current to faults on the FE transmission system. This requires the use of an ungrounded transformer high-side winding connection, either delta or ungrounded wye.

The specific recommendations and requirements for Customer protection will be made by FE based on the individual substation location, voltage, and configuration. Protection details specific to transmission line tap connections for Load Connection facilities can be found in Appendix G - Distribution Power Transformer Protection of the FE "Requirements for Transmission Connected Facilities" document. To provide adequate protection to the FE transmission system in a transmission line tap connection, FE may require that the Customer furnish and install at its expense transfer trip equipment at its facility to send tripping signals from the Customer's facility to (an) FE location(s) for Customer breaker failure to trip protection. This additional protection will also necessitate, at the Customer's expense, the purchase and installation of transfer trip equipment at the FE location(s) and a dedicated communication channel(s) between the FE location(s) and the Customer's facility, including any lease fees for the communications channel, if applicable. See Section 5.2 for additional information.

FE will review and approve all Customer distribution transformer protective relay settings pertaining to the protection outlined in the minimum relay requirements, as well as one-line diagrams and AC/DC schematics showing protective devices and their respective inputs, outputs and tripping paths. It is requested that these documents be sent electronically to FE at least 90 days prior to the planned in-service date to allow sufficient review time.

Prior to energization and upon completion of the new Customer substation, FE personnel will complete a substation checkout. The procedure will include verifying the installation, ratings, and test results of the major power equipment connecting to the FE transmission line and connections and settings of the related protective relays. FE personnel may opt to witness functional testing, which will need to be coordinated in advance with FE by the Customer.

Note: FE will not be reviewing any settings pertaining to Customer's internal facility protection or device coordination with other protective equipment.

5.2 Customer Protection Requirements

The Customer Substation shall consist of, at a minimum, the following:

- Two transformers with a 138 kV delta or wye ungrounded connected high-side and a grounded wye low-side.
- Two 138 kV circuit breakers on the high side of the transformation.
- The circuit breaker shall be fully rated to interrupt available fault current when calculated according to the latest ANSI standard.
- Bypass switches shall NOT be installed across the breaker. If the added reliability benefit of being able to keep the substation energized while performing breaker maintenance is desired, a ring bus or dedicated sparing circuit breaker is required.
- If the circuit breaker uses gas as an interrupting medium, the device shall be equipped with a low gas pressure alarming/ tripping/ lockout scheme (as appropriate for the particular device) in order to minimize the possibility of a transmission fault resulting from a loss of insulating gas.
- The main 138 kV circuit breaker should have a high-side motor operator air-break switch and spring operated ground switch.
- The low side of the transformer shall have either a dedicated circuit breaker or be connected to a bus where each feeder exiting the bus has a dedicated circuit breaker.
- The Customer metering should be within their transformer zone of protection.
- Follow fig 1B of the transmission connected facility document for the location of the main beaker motor operated switch and the meter.
- Follow fig 11A of the transmission connected facility document for the minimum requirements for the transformer protection.
- Protection schemes as outlined below.

The transformer shall have the following minimum protection installed:

- All protective functions listed below shall trip, at minimum, the transformer high-side circuit breaker. A separate tripping path for primary and backup relaying is required. All required relays shall be utility grade devices. The relaying system shall have a reliable source of power independent from the AC system or immune to AC system disturbances or loss (for example - DC battery and charger) to ensure proper operation of the protection scheme.
- The FE recommended protective relaying for this installation include:
- Overall Transformer Differential Protective Relay - minimum functions: 87T. (FE standard device is SEL-587 or SEL-487E)
- Primary Transformer Differential Protective Relay – minimum functions: 87T. (FE standard device is SEL-587 or SEL-487E)
- Backup Transformer Protective Relay - minimum functions: High-side - 50, 51, 50N and 51N: Low side - 51G. (FE standard device is SEL-551)

- Breaker Failure (BF) Relay - BF with associated hand-reset lock out relay (LOR). TR breaker failure relay must trip the main 138 kV breaker to isolate the failed breaker from the transmission system.
- The 138 kV source for overall transformer differential protection shall be CTs in the line side of the transformer breaker. The low side source for overall differential protection shall be at the bus/line side of the low side transformer breaker or the summation of the CTs on the exit side low side breakers/reclosers. Stand-alone CTs will be required as necessary to allow for keeping overall differential protection in service if any exit bypass fuses are utilized.
- The 138 kV source for primary transformer differential protection shall be CTs in the high-side bushings of the transformer. The low side source for primary differential protection shall be from CTs on the transformer low-side bushings.
- The source for the high-side backup transformer protection shall be separate CTs from the overall differential CTs on the line side of the transformer breaker (CTs closest to the transformer).
- The source for the low side backup protection shall be a CT connected to the low side transformer neutral and shall utilize a separate 51G input into the backup relay.

The Bus shall have the following minimum protection installed:

- All protective functions listed below shall trip, at minimum, the transformer high-side circuit breakers and 138 kV main breaker. A separate tripping path for primary and backup relaying is required. All required relays shall be utility grade devices. The relaying system shall have a reliable source of power independent from the AC system or immune to AC system disturbances or loss (for example - DC battery and charger) to ensure proper operation of the protection scheme.
- The FE recommended protective relaying for this installation include:
    - PRI and BU bus differential relays - (FE standard device is SEL-487B)
    - Breaker Failure (BF) Relay for the main 138 kV breaker - BF with associated hand-reset lock out relay (LOR). Also required are an automatic motor-operated disconnect switch and a ground switch in order to trip the breakers at the remote terminals to isolate the failed breaker from the transmission system if there is a breaker failure operation. (FE standard device is SEL-451)

It is required that the Customer send finalized substation one-lines to FE for approval prior to the start of detailed engineering. The final design package shall be provided to FE for approval prior to construction.

Settings for the 138 kV protection shall be provided by the Customer to FirstEnergy Transmission Protection for coordination approval. The Customer is solely responsible for protecting its own equipment in such a manner that electrical faults or other disturbances on the FE system do not damage its equipment.

It is understood that the Customer diesel generation will have a closed transition that is no more than 100 milli seconds and no other backfeed source is to be installed at this location. Thus, it has been determined that generation inter-tie protection is not required. If more generation facilities are installed at a future date, or modification to the backup diesel generation then an additional application, study, and revised direct connection requirements would be necessary.

5.3 FE Protection Requirements

To coordinate with proposed Customer substation, the relay settings at the following stations will need adjusted.

- London Substation
- Tangy Substation

5.4 Short Circuit Data

The short circuit levels at the line tap to the Customer 138 kV bus are the following:

Short Circuit values at 138 kV

Three phase faults = 11.2 kA
Single line to ground fault = 7.6 kA.

Transmission System Impedances at 138 kV, 100 MVA base

Positive sequence Z1 = (0.7 + j3.6) %
Zero sequence Z0 = (2.48 + j8,48) %

The fault currents provided are bolted, symmetrical values for present, normal transmission system conditions. Future increases in fault currents are possible and it is the Customer's responsibility to upgrade their equipment and/or protective equipment coordination when necessary.

5.5 Revenue Metering Requirements

Revenue metering will be installed on the primary side of the Customer's step-down transformer in accordance with the FE "Requirements for Transmission Connected Facilities" document, applicable tariffs, or an Interconnection Agreement. The revenue metering must be located on the load side of the step-down transformer fault interrupting device and within the local zone of fault protection of the facility.

FE will pull and terminate the secondary cable between the instrument transformers and the meter. The Customer is responsible for installing the CTs, VTs, and socket enclosure. The Customer must also provide and install the associated steel conduits and VT secondary junction box with circuit breaker and disconnect switch. For details see the FE Revenue Metering Installation Requirements (**Appendix D**) for Transmission Connected Retail and Wholesale Load Customer Facilities in the FE "Requirements for Transmission Connected Facilities" document **Appendix E.**

5.6 Supervisory Control and Data Acquisition (SCADA)

Operational metering through the use of SCADA of the Customer's analog values (MW, MVAR and Voltage) is not required for the interconnection. If the Customer is installing an RTU (remote terminal unit) and wishes to have it monitored by the FE System Control Center, additional communications requirements would be mandated so as to adhere to FE standard engineering practices (frame relay, circuit, router, etc.…). The Customer has an option to request SCADA for operational metering and FE line switches. The additional SCADA cost would be the Customer's responsibility.

6.0 Power Quality Requirements

The Customer shall adhere to the FE power quality criteria which can be found in section 5.5 of the FE "Requirements for Transmission Connected Facilities" document which is referenced in the 'Additional Resources' section in **Appendix E** of this report.

6.1 Harmonic Injection Levels

The Customer must ensure that harmonic injection levels are limited to levels specified in the most recent version of the IEEE 519 requirements. If required by FE, harmonic measurements should be taken at the Customer substation after the facility is in service to assure compliance. FE must have unfettered access to the measured data upon request.

6.2 Voltage Flicker

Voltage flicker for infrequent events such as large motor starting will be evaluated based upon the resulting percent voltage dip per event (see Annex A of IEEE Std. 1453). In no case shall the resulting percent voltage dip per motor starting event exceed 3% on the FE transmission system. The connected

facility shall be designed and operated such that Pst does not exceed 0.8 and Plt does not exceed 0.6 for more than 1% of the time (99% probability level) using a minimum assessment period of one week. If required by FE, flicker measurements should be taken at the Customer substation after the load is in service to assure compliance. Should a Power Quality meter be deemed necessary to be installed in the Customer's facility, it would be by the Customer and at the Customer's expense. FE must have unfettered access to the measured data upon request.

7.0 Siting/Licensing

Due to the voltage of the connection, approval from the state regulatory commission will be required. Approval can generally take from 90 days to 18 months after filing depending on scope of work.

8.0 Transmission System Scope of Work

8.1 Connection Facilities

The Customer substation will be connected to the 138 kV line by a line extension of approximately 3.3 miles of 795 ACSR conductor. The line extension will terminate on a FE approved, Customer owned, take-off structure just outside of the Customer substation.

See **Appendix C.1** for Proposed Delivery Point Concept One-line Diagram (not for construction).

8.2 Scope of Direct Connection

- Tap the London – Tangy 138 kV Line at/near Structure Number 13814 and build approximately 3.3 miles of 795 ACSR Conductor.
- Install two 138 kV switches with SCADA control on the network line and one 138 kV switch with SCADA control on the tap.
- Terminate the tap line on a FE approved, Customer owned take off structure just outside of the Customer substation.
- Install 138 kV revenue metering equipment at the Customer substation within the local zone of protection.
- Protection/terminal end relay settings review required at London and Tangy substations.

8.3 Scope of Reinforcement work

There are no transmission system reinforcements beyond the direct connection facilities required on the FE transmission system to accommodate this load connection request.

9.0 Schedule

It is anticipated that the proposed connection facilities and any necessary reinforcements can be completed in approximately **26 Months** after the execution of a Service Contract or Construction Agreement. This includes time for engineering, material delivery and construction.

The schedule assumes that there is no outage, right-of-way, or permitting issues. Note that outages are difficult to obtain during peak summer load months and the construction schedule could be impacted. The Customer must agree to an alignment such that no danger tree rights will be required from adjacent property owner(s). If not, the ROW costs may be increased as well as the project duration.

10.0 Cost Analysis

Transmission Cost Table (FirstEnergy)
Internal Use Only

INTENTIONALLY REDACTED

Distribution Cost Table (Ohio Edison)
Internal Use Only

INTENTIONALLY REDACTED

Customer Cost Table

Estimate No.	Description	Total with Tax	Tax	Total Cost
OE-T-5895	Install one 138 kV load-break air switch with SCADA control on the new tap and build approximately 3.3 miles of new 138 kV line to the POI with the Customer.	$10,301,735.00	$1,125,878.00	$9,175,857.00
OE-T-5897	Build last span to POI with Customer	$63,641.00	$6,955.00	$56,685.00
OE-S—6528	Integrate Customer protection and controls to the FE transmission system[1]	$55,617.33	$6,078.19	$49,539.14
	Total	**$10,420,993.33**	**$1,138,911.19**	**$9,282,081.14**

[1]Refer to Section 10, Appendix A and Appendix B of FE's "Requirements for Transmission Connected Facilities" document for additional details.

Due to the rules of the FE Operating Company retail tariffs, the cost of metering for a new Customer is the responsibility of the Operating Company.

Actual cost allocation or revenue screening will be determined according to the retail tariff based on the costs included above in the Distribution Cost Table and the Customer Cost Table. Consult the Operating Company rates department for assistance and/or guidance.
Total costs for behind-the-meter generation addition do not include any costs related to the state regulatory requirements or the retail tariff.

FE herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any connections to the transmission system.

The Customer is responsible for the design, purchase, installation, and cost of the equipment leading up to the defined POI at their facility. Since the Customer is responsible for this portion of the project, associated cost estimates and anticipated schedules are not included within this report. The cost and timeline reflected above are for ideal conditions with little to no unforeseen risk. Due to the unknown risks associated with constructing transmission infrastructure it should be anticipated that the cost and timeline may increase with the increased difficulty and challenge of construction. Any escalation in cost or time schedule as result of construction and design challenges of this project may be directly attributed to the Customer.

11.0 Conclusion and Recommendation(s)

The DLS was performed by FE Transmission Planning and Protection. The Customer can be provided service for the transmission connection in approximately 26 months after an executed Service or Construction Agreement is received. This schedule assumes no outage, siting, permitting, or right-of-way acquisition conflicts occur. The transmission line siting assumes the following: minimal wetlands, streams, or ecological features are in the project area and will not significantly impact the schedule.

There were no Planning Criteria violations identified during the study.

The Customer is required to comply with the requirements outlined in the FE "Requirements for Transmission Connected Facilities" document.

Please note the results of this study report are subject to change. This study is based upon the current configuration of the FE transmission system and includes only those proposed projects with signed Delivery Point agreements and assigned RTEP numbers. Delivery Point agreements executed subsequent to the completion of this study and implemented transmission system reinforcement may impact the study results and cause the study to be performed again at the Customer's cost. FE will use best efforts to inform the Customer should this occur. Any additional load or generation to be served by the Customer's substation in excess of 2 MVA will need to be approved and may require additional study by FE.

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Transmission Planning

Rani Solic
Transmission Protection

Appendix A – Customer Information

City of Columbus Division of Water
Summary of Load / Generator Connection
2/15/2024

FE Operating Company: Ohio Edison

Operating Company Division: East

Customer Information

Company / Customer Name: City of Columbus Division of Water

Connection Category (Retail / Wholesale): Retail Application Number: 2023-0237

Facility Address: 5993 Home Road

City: Delaware State: OH Zip: 43065 County: Delaware

Nearest Intersection: Dublin Road & Home Road

Customer Connection Request

Requested In-Service Date: 09/01/2026 Connection Type: Load

Load Information

Existing Load: N/A MVA @ N/A % PF

Load Request #1: 6.1855 MVA @ 90 % PF
Requested Date: 09/01/2026

Load Request #2: _____ MVA @ _____ % PF
Requested Date: _____

Load Request #3: _____ MVA @ _____ % PF
Requested Date: _____

Generation Information

Existing Gen: N/A MW

Gen Request #1: 7.0 MW
Requested Date: 09/01/2026

Gen Request #2: _____
Requested Date: _____

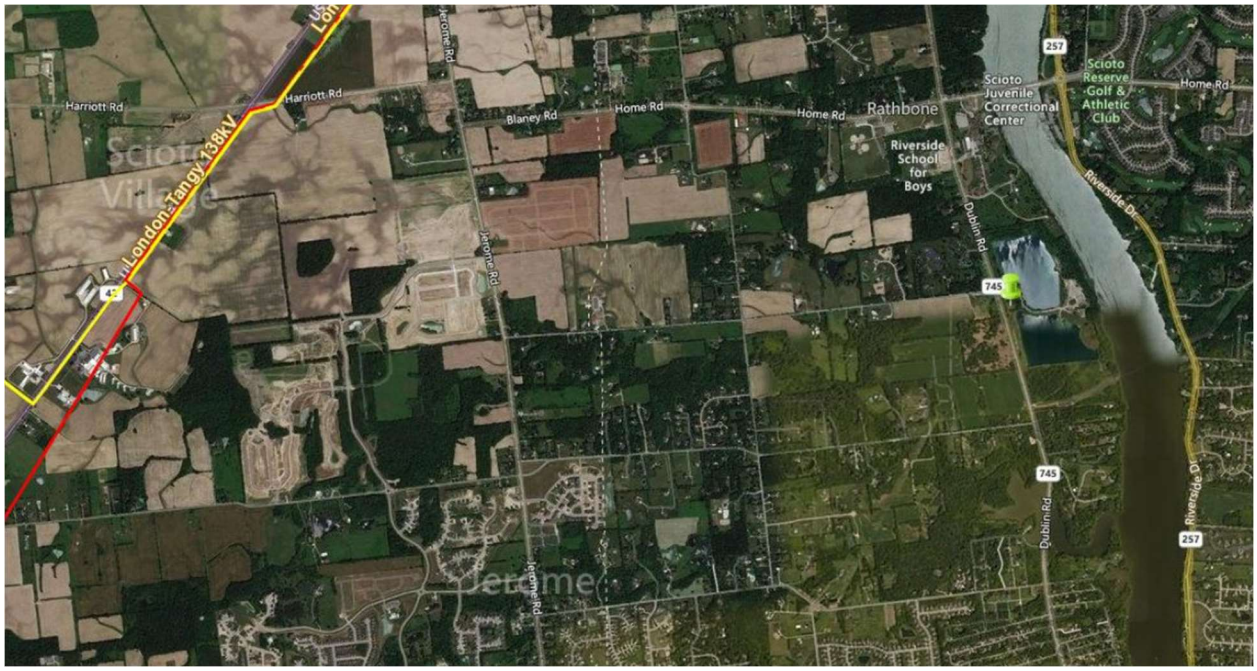
Gen Request #3: _____
Requested Date: _____

Connection Options

1) Transmission Facility Name: London – Tangy Line 138 kV

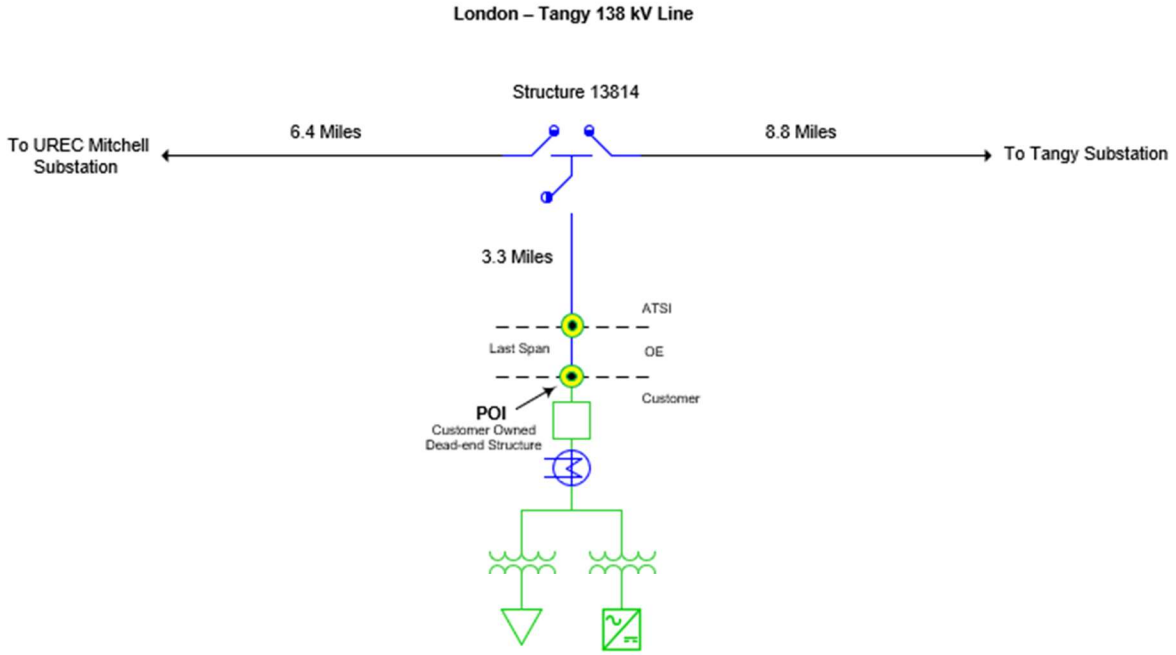
2) Transmission Facility Name: _____ _____ kV

Appendix B – Geographical Location



Appendix C.1 – Planning One-Line Diagram

Proposed Delivery Point Concept One-Line Diagram (not for Construction)



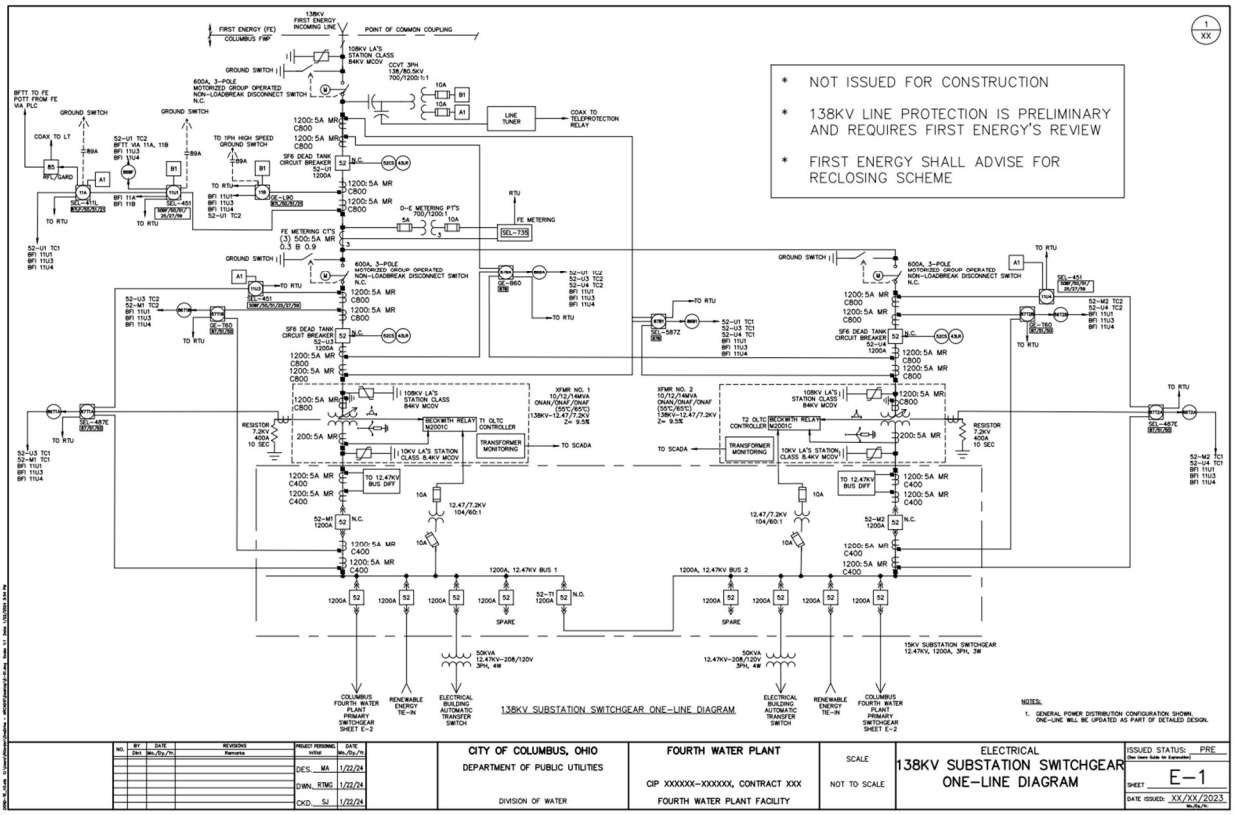
Transmission Scope of Work

- Install (3) 138 kV load-break air switches with SCADA control on the London – Tangy 138 kV Line approximately 6.4 miles from UREC Mitchell 138 kV Substation and 8.8 miles from Tangy 138 kV Substation.
- Leave enough room for a future 138 kV ring bus and potential second feed to the Customer.
- Build 3.3 miles to point of interconnection with customer
- Install 138 kV metering in customer's facilities
- Protection/ terminal end relay settings review required at London and Tangy 138 kV Substations

POINT OF INTERCONNECTION	◉
EXISTING FACILITIES	———
FE	———
EXISTING CUSTOMER EQUIPMENT	———
NEW CUSTOMER EQUIPMENT	———

Appendix C.2 – Customer One-Line Diagram

Proposed City of Columbus Division of Water Substation One-Line Diagram

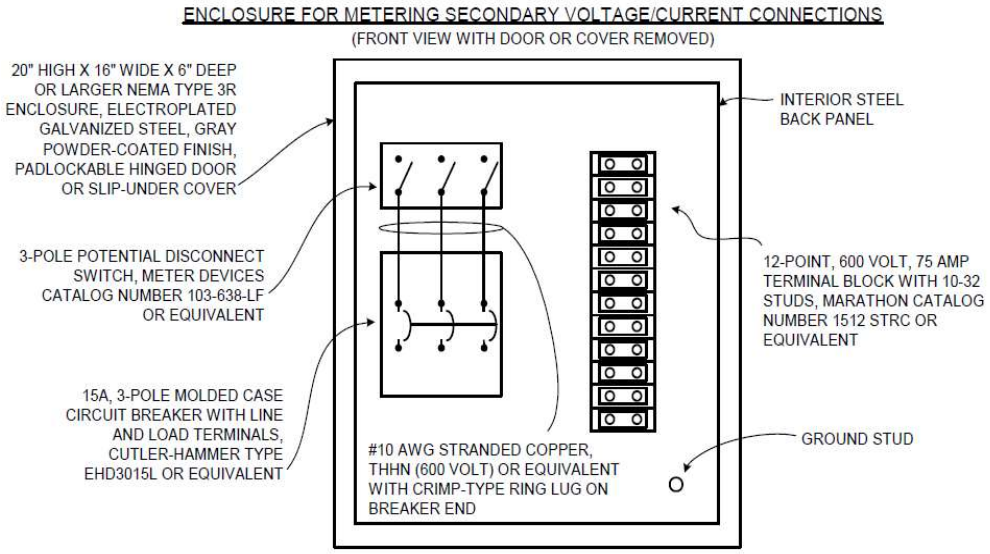


Appendix D – Revenue Metering Installation Requirements

FirstEnergy Revenue Metering Installation Requirements for Transmission Connected Retail and Wholesale Load Customer Facilities

- This Appendix D is intended to address detailed revenue metering installation requirements for transmission connected retail and wholesale load Customer facilities. These requirements are in addition to the revenue metering requirements outlined in the FE "Requirements for Transmission Connected Facilities" and the Detailed Load Study reports.
- After applying for connection to the FE Transmission System, the Connecting Party shall consult with FE Transmission Planning and FE Meter Engineering to determine the appropriate revenue metering installation design. The Connecting Party must provide FE with detailed facility information including the proposed substation one line, substation layout, expected loads (initial and future), and required in-service date to ensure proper specification of metering equipment. It is critical for this information to be provided as early in the facility design phase as possible so that FE has a reasonable period of time to purchase and install the metering equipment prior to the in-service date.
- FE will provide and maintain the revenue metering equipment for each transmission connected retail or wholesale facility as specified in the electric service tariff or Interconnection Agreement. The revenue metering equipment provided and maintained by FE includes, but is not limited to, the instrument transformers, secondary wires, meter(s), and meter socket(s). The Connecting Party shall provide, at its own expense, the space, structures, enclosures, and conduits necessary for the metering installation. The Connecting Party is responsible for mounting the instrument transformers, conduits, enclosures, and meter socket(s).
- FE will provide and install the secondary wiring between the instrument transformers and the meter socket(s). The Connecting Party may pull the wiring through the conduit if requested by FE.

  If the metering will be connected to a system voltage rated 69 kV or higher, then the Connecting Party shall provide, install, and maintain a pad lockable weatherproof enclosure containing a three-pole circuit breaker and a three-pole potential disconnect switch for connection to the voltage transformer secondary wires. The enclosure shall include a 12-point terminal block with 10-32 studs for termination of voltage and/or current transformer secondary wires. See the figure below for device details and general arrangement. The enclosure shall be mounted in a readily accessible location below the instrument transformers and shall be used for FE wiring only. The enclosure shall be secured with a FE-owned padlock. This enclosure may in some cases be required for metering connected to a system voltage rated 23 kV, 25 kV, 34.5 kV, or 46 kV.
- Instrument transformers must be readily accessible to authorized FE representatives for the secondary wiring installation. Location of the instrument transformers shall be such that the height of their bases does not exceed 20 feet above grade.



- Conduit shall be 1-1/2 inch (minimum) galvanized rigid steel conduit. Flexible galvanized steel (liquid tight) conduit may be used between instrument transformers.
- Meter sockets shall be installed in readily accessible locations approved by the FE Meter Services section. This includes locations inside the substation if authorized FE representatives can gain access by use of a standard FE lock or, if the FE will permit, by contacting a Customer representative who is capable of providing access within a reasonable time period.
- The meter socket(s) shall be installed by the Connecting Party generally within 50 feet of the instrument transformers unless an alternate design has been approved by the FE Meter Services section.
- A meter socket shall be mounted such that the centerline of the meter is approximately five feet above final grade.
- Most FE revenue meters are equipped with a wireless communication card that is used to provide remote access for FE's billing data collection system. If wireless service is not sufficient in a particular location, the Connecting Party, at its own expense, shall provide a dialup telephone line for FE's remote connection to the revenue meter. The Connecting Party shall consult with FE regarding the telephone line, but the general specifications are as follows:
    - Standard analog voice grade telephone line or equivalent with dial tone.
    - The telephone line shall be two-pair or four-conductor with RJ-11 / Male termination. FE will make the final connection to the meter.
    - Must be able to receive incoming calls.
    - Must be a direct line to the meter with no operator interception or operations required.
    - Install necessary telephone cable and associated conduit between telephone company source and meter socket or enclosure.
    - Telephone line must be tagged with phone number, including area code.
    - Telephone line must be installed and operational prior to the Customer's service being energized.
- Where vehicle traffic may interfere with or damage metering equipment, the Connecting Party must install concrete filled steel barrier posts to protect such equipment.
- Before the metering equipment installation is started, the Customer/contractor must contact FE Meter Services or Meter Engineering to coordinate installation details, material delivery, and construction schedule.

Appendix E – Additional Resources

FirstEnergy, Transmission Planning & Protection "**Requirements for Transmission Connected Facilities**" – describes in detail the full requirements for Customers connecting to the FE transmission systems.

Available online at https://firstenergycorp.com/content/dam/feconnect/files/wholesale/Requirements-for-Transmission-Connected-Facilities.pdf

FirstEnergy "**Transmission Planning Criteria**" – describes in detail the transmission system thermal and voltage criteria, planning process, conditions for various contingencies, and some equipment standards.

Available online at https://www.firstenergycorp.com/content/dam/feconnect/files/wholesale/FEC-Planning-Criteria.pdf