PJM Generator Interconnection Request

Queue #G21

Meyersdale North 115 kV

Facilities Study Report

April 2003
#206929

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INTRODUCTION

Description of Project

Meyersdale Windpower L.L.C., under PJM Generation Interconnection Request Queue G21 has proposed a new 48 MW generating facility consisting of 36 wind turbines to be installed in Summit Township, Somerset County, Pennsylvania. The project will be connected as an energy-only resource to the FirstEnergy (FE) Meyersdale North 115 kV Substation utilizing a new 34.5 kV underground interconnection line and new 34.5/115 kV power transformer installed at the existing FE Meyersdale North substation facility.

The proposed service date for the project is November 1, 2003.

Study Scope

The scope of this study is to determine the direct connect and FirstEnergy system upgrades required to accommodate the proposed Meyersdale Windpower L.L.C 115kV transmission generation connection point.

The FE transmission system has been evaluated based on load flow analysis, dynamic stability, short circuit capability and breaker adequacy. Provided are scope of work, cost estimates, and engineering/construction schedules for direct connection and network upgrades required for the proposed G21 generation connection.

FACILITY STUDY

Scope of Meyersdale Windpower L.L.C. Work

Meyersdale Windpower L.L.C. will design, furnish and install:

- A new 34.5 kV interconnection line between new wind turbine generator facilities and FE's existing Meyersdale North 115 kV Substation. The 34.5 kV interconnection line will have an approximate length of 2.5 miles.
- New generation relaying, control, interconnection metering, and supervisory control and data acquisition (SCADA) equipment.
- Dedicated communication circuits for direct transfer trip relaying from FE's Rockwood Substation, for SCADA communication to the transmission system control center, and for dialup access to revenue metering.
- A new control building to contain generation interconnection and substation relaying, control, and SCADA equipment as required at Meyersdale North 115 kV Substation.
- New 115/34.5 kV line terminal additions at Meyersdale North 115 kV Substation including the addition of one 115/34.5 kV power transformer, one 115 kV circuit breaker, one 115 kV motor operated disconnect switch, two 34.5 kV circuit breakers, one cable terminator structure, one 8-10 MVAR capacitor bank (if required), and associated 115 kV and 34.5 kV electrical bus, structure, foundation, oil containment system, grounding, conduit, and cable networks.
- Grading and site development activities at Meyersdale North 115 kV Substation as required to accommodate the new 115/34.5 kV line terminal additions, including permitting, earthwork, fencing, access drives, and storm water management facilities as required.
- Easements and parcel acquisitions for the 34.5 kV line and for the substation facilities located on FE property at Meyersdale North 115 kV Substation.

Scope of FirstEnergy (FE) Work

FE shall design, furnish and install the following direct connection equipment at Meyersdale North 115 kV Substation:

- One 115 kV circuit breaker, one 115kV transmission line termination structure, three 115 kV disconnect switches, three 115 kV capacitor voltage transformers and associated electrical bus, structure, foundation additions.
- Remove and relocate the existing 115 kV line termination.
- New bus relaying and control and relaying associated with the generator interconnection.
- Grading and site development activities as required to accommodate the new 115 kV circuit breaker, disconnect switches and bus including permitting, earthwork, fencing, access drives, and storm water management facilities.

FE shall design, furnish and install the following system upgrade equipment at Rockwood 115 kV Substation

- One 115 kV circuit breaker with disconnect switches in the existing Penn Mar 115kV circuit exit with associated electrical bus, structure, foundation additions.
- New and relocated line terminal relaying including direct transfer trip to the Meyersdale Windpower L.L.C. and Arnold REC generator interconnections.

Scope of Work at Arnold Substation

First Energy shall design, furnish and install the following system upgrade equipment at the Arnold 115kV substation at Meyersdale Windpower LLC expense:

- Dedicated communication circuit and receiver for direct transfer trip relaying from FE's Rockwood Substation.

Meyersdale Windpower L.L.C. Milestone Schedule

Meyersdale Windpower L.L.C. has established the following major milestone dates:

34.5 kV Interconnection Line & 115 kV Substation Energized	September 15, 2003
Turbine Erection Complete	October 10, 2003
Commercial operation date	November 1, 2003

These major milestone dates are contingent upon the timely completion of project development and construction activities, including financing and permitting.

Description Of Facilities Included In The Study

Facilities owned and operated by Meyersdale Windpower L.L.C. shall comply with the FirstEnergy document "*Requirements for Transmission Connected Facilities"*. The generation interconnection facilities required for this project are generally depicted in the enclosed attachment A2 "Meyersdale North – G21 Relay Sketch (dated 3/31/03)".

The FE 115 kV system design shall be based upon the following criteria:

Electrical Design

General Design Requirements

System frequency:	60 hertz
Elevation, AMSL:	2254 feet
Isokeraunic level:	40
Maximum ambient temperature:	40 degrees C
Minimum ambient temperature:	-40 degrees C
Maximum conductor operating temperature:	100 degrees C
Wind Loading (round shapes):	25 psf
Ice loading – Substations (no wind):	1 inch
Seismic zone:	Per ASCE 7-98, per Fig. 9.4.1.1(a) and (b). Equipment qualification per IEEE 693-97

Voltage and Current Ratings

Nominal phase-to-phase:	115 kV
Maximum phase-to-phase:	121 kV
Basic impulse level (BIL):	550 kV
Maximum continuous current carrying capacity:	2000 A
Design fault current:	40 kA
Maximum fault clearing time:	30 cycles

Clearances and Spacing

Recommended rigid bus center-to-center phase spacing:	84"
Minimum phase-to-phase, metal-to-metal distance:	53"
Recommended phase-to-ground:	45"
Minimum phase-to-ground:	42"
Minimum vertical clearance from live parts to grade:	11'-7"
Minimum horizontal clearance from live parts:	6'-1"
Minimum conductor clearance above roads in switchyard:	20'-2"
Minimum bottom of insulator to top of foundation:	8'-6"

Meyersdale Windpower L.L.C -115 - 34.5kV Substation Additions

Protection Requirements

The attached sketch provides details of the relay requirements for the Meyersdale North Generation substation.

This substation will contain, at minimum, one 115kV circuit breaker, one 115kV-34.5kV (wye ground – delta) transformer and one 34.5kV breaker.

Minimum protective relaying requirements for this substation installation include primary and backup relays plus a breaker failure relay and an intertie relay. The 115kV breaker shall be purchased with four sets (12 total) of 2000:5 A MR C800 CTs.

The intertie relay shall be an SEL-351, including 27, 59, 81, 67V and 67N elements. The source for the intertie relay shall be CTs on the transformer side of the 115kV circuit breaker.

The primary protective relay shall have the 87T function as a minimum. The Backup Protective Relay shall have as a minimum the 50, 51, 50N and 51N functions for the transformer high side and the 51G function for the transformer low side. (Note: Directional relays may be required to provide the required relay coordination).

SEL-587 (primary) and SEL-551 (backup, non-directional) or SEL-351 (backup, directional) digital relays are acceptable for these functions. The use of any other relays will require prior approval from FE.

The source for the primary protection shall be CTs on the bus side of the 115kV circuit breaker and the low side of the transformer. The source for the backup protection shall be CTs connected to the transformer side of the 115kV circuit breaker.

A breaker failure relay (SEL-501 or FE approved equivalent) shall be utilized on the 115kV circuit breaker. The source for the breaker failure fault detector shall be CTs on the bus side of the 115kV circuit breaker. Any protective trip of this breaker shall initiate the failure to trip scheme.

Bus protection (SEL-387) is required for the bus section between FE's 115kV breaker at Meyersdale North and the generator's 115kV breaker. This relay shall trip both of these breakers.

All primary, backup intertie and 115kV bus protection relays shall trip the generator's 115kV circuit breaker. A separate tripping path for primary and backup relaying is required.

The breaker failure relay shall trip the 115kV breaker at Meyersdale North substation and the transformer low side breaker.

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 disturbance or loss (for example - dc battery and charger) to assure proper operation of the protection scheme. FirstEnergy shall review and approve the proposed protective scheme(s) of the Meyersdale facility prior to final engineering.

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.

Direct Transfer Trip Equipment

A communications channel between Rockwood substation and the Meyersdale North generation is to be acquired and maintained for Direct Transfer Trip communications.

An RFL-9745 DTT receiver shall be installed at the Meyersdale North Generation substation. Receipt of DTT from FE shall trip all generation connected to Meyersdale North substation. Loss of the DTT channel shall also trip all generation connected to Meyersdale North substation.

Metering Requirements

A revenue metering installation is required for this installation. Requirements are outlined in FirstEnergy's *"Requirements for Transmission Connected Facilities"* document. The enclosed attachment A2 ":Meyersdale North – G21 Relay Sketch" provides additional metering information related to the Meyersdale North Generation project.

Operational metering is also required for this generation connection. These requirements are also outlined in FirstEnergy's *"Requirements for Transmission Connected Facilities"* document.

Additionally, the project must meet PJM metering requirements described in the PJM document *"Generator Interconnections and Operations Manual*"(Revision 1, dated 3/3/01 or subsequent version),Section 2 p. 12-13 and Section 5, p. 13-18.

Meyersdale North-115 kV Substation Additions

Purpose and Necessity

The Meyersdale North 115 kV Substation will serve to interconnect the proposed 48 MW generating facility (PJM queue #G21) to the FE 115 kV transmission network and provide for the reliable operation of the FE 115 kV system. The design and construction of the Meyersdale North 115 kV Substation will be the responsibility of FE and shall comply with all applicable FE and PJM design and operating standards.

Drawings

The one-line diagram, site plan and electrical plan drawings are attached.

Major Equipment/Material List

- Reinforced concrete structure and equipment foundations.
- Galvanized steel line termination, bus, and equipment support structures.
- Rigid aluminum bus and station post insulator support system.
- One 115 kV, 2000 A, 40 kA dead tank, gas circuit breaker
- Three 115 kV, 2000 A, 44 kA Short-Time (sym) and 114 kA peak withstand, V-type center-break, manual operated disconnect switches.
- Three 115 kV capacitor voltage transformers
- Substation protective relaying and control switchboard frames and equipment for the scheme depicted on the attached Meyersdale North – G21 sketch dated 03/13/03.

Cost Estimate

The estimated total cost for the 115 kV substation additions is **$869,000** excluding the cost to prepare the facility study preliminary design drawings.

Project Schedule

Design Engineering	03/2003 – 07/2003
Material Procurement	04/2003 – 07/2003
Substation Construction	06/2003 – 09/2003
Acceptance Testing	08/2003 – 09/2003

Rockwood-115 kV Substation Additions

Purpose and Necessity

Due to the amount of generation being added at Meyersdale North, a 115 kV circuit breaker must be added at Rockwood to eliminate the four-terminal line that is created by the addition of generation at Meyersdale North substation. The breaker will create a Rockwood-Penn Mar circuit. The design and construction of the Rockwood 115 kV Substation will be the responsibility of FE and shall comply with all applicable FE and PJM design and operating standards.

Major Equipment/Material List

- Reinforced concrete structure and equipment foundations.
- Galvanized steel equipment support structures.
- One 115 kV, 2000 A, 40 kA dead tank, gas circuit breaker
- Two 115 kV, 2000 A, 44 kA Short-Time (sym) and 114 kA peak withstand, V-type center-break, manual operated disconnect switches.
- Substation protective relaying and control switchboard frames and equipment for the scheme depicted on the attached Meyersdale North – G21 sketch dated 03/13/03.

Cost Estimate

The estimated total cost for the 115 kV substation additions is **$423,000**.

Project Schedule

Design Engineering	04/2003 – 07/2003
Material Procurement	04/2003 – 07/2003
Substation Construction	07/2003 – 09/2003
Acceptance Testing	08/2003 – 09/2003

Arnold Substation Generation Interconnection Additions

Purpose and Necessity

Due to the amount of generation being added at Meyersdale North, it is possible that the combined generation at Arnold and Meyersdale North could be isolated into a self-sustaining island, therefore, the Arnold substation generation must be direct transfer tripped by FE relaying at Rockwood for a 115 kV circuit outage. First Energy will coordinate with Somerset REC on the design and installation of the equipment needed at Arnold Substation. The work required shall comply with the FE Requirements for Transmission Connected Facilities.

Major Equipment/Material List

Direct transfer trip receiver and dedicated communication circuit for the scheme depicted on the attached Meyersdale North – G21 sketch dated 03/13/03.

Direct Transfer Trip Equipment

A communications channel between Rockwood substation and the Arnold substation generation is to be acquired and maintain for Direct Transfer Trip communications

An RFL-9745 DTT receiver shall be installed at Arnold substation. Receipt of DTT from FE shall trip all generation connected to Arnold substation. Loss of the DTT channel shall also trip all generation connected to Arnold REC substation.

Cost Estimate

FE estimates that the Arnold REC cost will be **$37,000**.

Proposed Arnold REC Project Schedule

Design Engineering	04/2003 – 07/2003
Material Procurement	04/2003 – 07/2003
Substation Construction	07/2003 – 09/2003
Acceptance Testing	08/2003 – 09/2003

SUMMARY OF COSTS AND SCHEDULE

Cost of Facilities Included in Study

Meyersdale North – 115kV Substation Additions:	
Engineering	$79,000
Material	$225,000
Labor	$366,000
Construction Indirect	$106,000
Return	$93,000
Total (excluding the Facility Study)	**$869,000**
Rockwood – 115kV Substation Additions:	
Engineering	$62,000
Material	$139,000
Labor	$119,000
Construction Indirect	$58,000
Return	$45,000
Total	**$423,000**
Arnold REC Generation Interconnection Modifications:	
Total (estimated by FE; TBD by Arnold REC)	**$37,000**

Project Schedule for Facilities Included in This Report

Activity	Start	Finish
Conceptual design	2/01/03	4/01/03
Detailed engineering design and procurement	3/15/03	7/15/03
Construction	6/01/03	9/15/03
115 kV transmission – FE tie-in outage	9/01/03	9/15/03
115 kV substation energization	9/15/03	9/15/03
Project commercial operation	11/01/03	11/01/03

Qualifiers

The accomplishment of the work on the FirstEnergy system is dependent on the following:

- Obtaining approval from PJM for the necessary outages to support the schedule.
- Obtaining FE distribution and REC circuit outages without installing temporary equipment.
- No equipment delivery environmental or regulatory delays.
- Acceptable weather.
- No contractor problems.
- No force majeure.

ATTACHMENTS

A1: Project Area

A2: Meyersdale North – G21 Relay Sketch

A3: Meyersdale North One-Line Diagram (drawing PN-246-02-01)

A4: Meyersdale North Property Plan (drawing A-15426)

A5: Meyersdale North Electrical Plan (drawing B-15262)