

***Generation Interconnection  
Facilities Study Report***

***for***

***PJM Generation Interconnection Request  
Queue Position AB1-056***

***“Indian River 230 kV I”***

***May 2018***

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## **A. Transmission Owner Facilities Study Summary**

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### ***1. Description of Project***

US Wind, Inc., the Interconnection Customer (IC), has proposed a 247.8 MW MFO (64.4 MWC) off-shore wind generating facility to be located in the Atlantic Ocean approximately 15 miles off the coast of Ocean City, Maryland. The generating facility will consist of 62 off-shore 4 MW wind turbines. PJM studied AB1-056 as a 247.8 MW injection into the Delmarva Power and Light Company's (DPL) system and evaluated it for compliance with reliability criteria for summer peak conditions in 2019. Project AB1-056 was studied with a commercial probability of 100%. The planned in-service date, as provided by the Interconnection Customer, is October 31, 2021.

The subject generation will require a Point of Interconnection (POI) off DPL's Indian River 230kV North Substation in Sussex County, Delaware to connect to the DPL network. The connection requires the construction of a new 230 kV line terminal position at the Indian River 230 kV North Substation. The new terminal will be constructed in the open position in the existing breaker-and-a-half leg containing the Indian River AT22 terminal between existing Breaker 241 and future Breaker 240.

The IC is required to construct a switching station within 500 feet of the Indian River 230 kV North yard. This station will contain a circuit breaker and the revenue metering equipment and will act as the POI. A short line/bus will connect the POI station to the terminal in the Indian River 230 kV North yard. See Attachment #1.

### ***2. Amendments to the System Impact Study or System Impact Study Results***

The scope of the project as stated in the Impact Study, submitted in September 2016, has changed slightly. Specifically, a more detailed layout was completed which resulted in additional bus supports being required. The more detailed layout allowed the estimates herein provided to be performed in more detail than those provided in the Impact Study. Changes in cost from the impact study are due to these two factors.

The Delmarva Power & Light (DPL) portion of the project is projected to be completed approximately 24 months following an executed Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA). This is assuming a standard land use and environmental permitting and approval process.

### ***3. Interconnection Customer's Milestone Schedule***

The planned in-service date requested by the Interconnection Customer is October 31, 2021. DPL requires 24 months after receipt of a fully executed Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA) to place its facilities in service.

#### ***4. Customer's Scope of Work***

The Interconnection Customer is responsible for all design and construction related activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, will be by the IC. Route selection, line design, and right-of-way acquisition for the IC's facilities are not included in this report and are the responsibility of the IC. Protective relaying and metering design and installation must comply with DPL's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff.

#### **DPL Interconnection Customer Scope of Direct Connection Work Requirements:**

- DPL requires that an IC circuit breaker is located within 500 feet of the DPL substation to facilitate the relay protection scheme between DPL and the IC at the POI.

#### **Special Operating Requirements**

1. DPL will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by a generator breaker, or other method depending upon the specific circumstances and the evaluation by DPL.
2. DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering and telecommunications facilities, owned by DPL.

#### **Additional Interconnection Customer Responsibilities:**

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.
2. The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement.

#### ***5. Description of Facilities Included in the Facilities Study (DPL's Scope of Work)***

##### **Substation Interconnection Estimate**

**Scope:** Build a new 230 kV line terminal at the Indian River 230 kV North Substation. The new terminal will be designed and constructed off an existing breaker and a half leg with Indian River AT22. The project will encompass the design and construction required to add the new 230 kV terminal. (PJM Network Upgrade Number n5115)

**Estimate:** \$2,556,112 (including contingency)

**Construction Time:** 24 Months

**Major Equipment Included in Estimate:**

- Gas Circuit Breaker, 230 kV, 3000A, 50kA, 2-Cycle	Qty. 1
- Disconnect Switch, 230 kV, 3000A, Manual Wormgear	Qty. 2
- Disconnect Switch, 230 kV, 3000A, Manual Wormgear, w/ Grounding Switch	Qty. 1
- Relay Panel, Bus Differential, FL/BU (20")	Qty. 1
- Control Panel, 230 kV Circuit Breaker (10")	Qty. 1
- Revenue Grade Meter	Qty. 2
- CVT, 230kV Class, Single-Phase	Qty. 3
- Surge Arrester, 230kV Station Class, Polymer	Qty. 3

**Estimate Assumptions:**

- Soil borings, geotechnical reports, and soil resistivity data are already available for this substation and will not need to be obtained again to support this project. If this data is not available, additional costs would be incurred to obtain it.
- Soil conditions are normal for this area such that driven piles will not be required, and standard drilled piers or spread footings can be used. If soil borings reveal poor soil conditions, more expensive types of foundations may be required.
- The soil is not contaminated and does not require special handling and disposal.
- A foundation already exists for the additional 230kV breaker required for this project. It is assumed that this foundation is sufficient and does not need to be replaced.
- It is assumed that the two existing bus support structures, three CVT support structures, and two switch stands can all be re-used for this project such that the only new structure needed is the 4-leg A-frame take off structure.
- The line connecting the IC's switching station to the new take-off tower in the Indian River 230kV North yard will be overhead construction and will be constructed by DPL.

**Required Relaying and Communications**

New protective relays are required for the new terminal. An SEL-487 will be required for front line protection and an SEL-387 will be required for back-up protection. One 20" relay panel will be required for front line and back-up protection.

An SEL-451 relay on a 10" breaker control panel will be required for the control and operation of the new 230 kV circuit breaker.

Current and control cables will need to be installed between the IC's control house and the Indian River 230kV North Cable trench system. These will be installed in underground conduit.

The project will require re-wiring of existing relay schemes to accommodate the new 230 kV terminal position.

DPL reserves the right to review the electrical protection design and relay settings for interconnecting customer facilities to ensure that the protective relaying equipment will be compatible with that installed at the remote substations. DPL personnel must be present at the time of commissioning to witness proper function of the protection scheme and related coordination.

#### **6. Total Cost of Transmission Owner Facilities Included in the Facilities Study**

<i>Item</i>	<i>Total Cost</i>
Attachment Facilities	\$2,323,738
Attachment Facilities with Contingency 10%	\$2,556,112
<b>Total Cost</b>	<b>\$2,556,112</b>

#### **7. Summary of the Schedule for Completion of Work for the Facilities Study**

The overall estimated timeline for DPL to place its facilities in service for this project is approximately 24 months after receipt of a fully executed Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA).

<i>Attachment Facility</i>	<i>Timeframe</i>
Engineering, Procurement and Construction	24 months

### **B. Transmission Owner Facilities Study Results**

This section describes facilities identified to be installed (attachment facilities), replaced, and/or upgraded (upgrade facilities) by DPL to accommodate the project. During detailed design and analysis other components may be identified for installation or replacement due to this interconnection.

#### **1. Transmission Lines - New**

Not applicable

#### **2. Transmission Lines - Upgrade**

Not applicable

#### **3. New Substation/Switchyard Facilities**

Not applicable

#### **4. Substation/Switchyard Facility Upgrades**

##### At Indian River 230kV North Substation

- Install one (1) Gas Circuit Breaker, 230kV, 3000A, 50kA, 2-cycle

- Install two (2) Vertical Break Disconnect Switches (230kV, 3000A) w/ Manual Operator
- Install one (1) Vertical Break Disconnect Switch (230kV, 3000A) w/ Manual Operator and Ground Switch
- Install three (3) 230kV Station Class Surge Arresters
- Install three (3) CVT's, 230kV Class, Single Phase
- Install one (1) Relay Panel, Bus Differential (SEL 487B Primary, SEL 387 Backup)
- Install one (1) 230kV Breaker Control Panel (SEL 451)
- Install one (1) 230kV A-Frame (4-Leg) Take-Off Tower
- Relocate two (2) Two-Leg, Three-Phase Low Bus Supports
- Relocate three (3) One-Leg, Single Phase Low CVT Supports
- Demolish a total of seven (7) Drilled Pier Foundations
- Install four (4) Drilled Pier Foundations for A-Frame Take-Off Tower
- Install seven (7) Drilled Pier Foundations for Bus Supports and CVT Supports
- Install two (2) Digital Revenue Grade Meters

## **5. Telecommunications Facilities - Upgrades**

- The new relays will need to be connected to the station's existing Orion LX communications processor, GPS clock, and Ethernet switches.
- Fiber optic cable will be installed between the IC's switching station and the Indian River 230 kV North control enclosure to support any necessary status and control functions. This will be installed in underground conduit.

## **6. Metering & Communications**

A three phase 230 kV revenue metering point will need to be established within the IC facility at the POI. The IC will purchase and install all metering instrument transformers as well as construct a metering structure per DPL's specifications. The secondary wiring connections both at the instrument transformers and at the metering enclosure will be completed by DPL's metering technicians. The metering control cable and meter cabinets will be supplied by DPL and installed by the IC's contractors. The IC will install conduit for the control cable between the instrument transformers and the metering enclosure. The location of the metering enclosure will be determined in the construction phase. The IC will provide 120V power to the meter cabinet. DPL will provide both the Primary and Backup meters. DPL's meter technicians will program and install the Primary & Backup solid state multi-function meters for the new metering position.

Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one meter DNP output for each meter. The IC will be required to make provisions for a POTS line within approximately three feet of the DPL metering position to facilitate remote interrogation and data collection. It is the IC's responsibility to send the data that PJM and DPL require directly to PJM. The IC will grant permission for PJM to send DPL the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH. The ownership of the

metering equipment purchased or installed by the IC shall be transferred to the Transmission Owner at Commercial Operation.

## ***7. Environmental, Real Estate and Permitting***

All work to accommodate the interconnection of AB1-056 is dependent upon the IC obtaining all necessary permits. Moreover, the IC shall be responsible for acquiring all necessary real property rights and acquisitions, including but not limited to: rights of way, easements, and fee simple, in a form approved by DPL. Any setbacks in obtaining the necessary real property rights, acquisitions and permits required for this interconnection may delay the construction schedule.



## 8. Summary of Results of Study

<b>Project Name: Indian River 230 kV I</b>	<b>Indirect Cost (\$)</b>		<b>Direct Cost (\$)</b>		<b>Total Cost (\$)</b>
<b>Attachment Facilities</b>	<b>Material</b>	<b>Labor/Fees/ Equip.</b>	<b>Material</b>	<b>Labor/Fees/ Equip.</b>	
Project Planning and Closing, Permitting, and Material Procurement				\$95,374	\$95,374
Gen. Eng. Design, and Planning				\$35,219	\$35,219
Primary/Physical Design				\$19,444	\$19,444
Below Grade Design				\$3,556	\$3,556
Secondary/Wiring Design				\$38,502	\$38,502
Communications Design				\$9,931	\$9,931
Civil Design				\$73,610	\$73,610
Project Oversight and Material OH	\$88,401	\$102,682			\$191,083
Site Preparation			\$5,000	\$107,671	\$112,671
Below Grade/Foundation Construction			\$137,373	\$410,719	\$548,092
Above Grade/Primary Construction			\$590,410	\$209,071	\$799,481
Secondary/P&C Construction			\$136,818	\$134,860	\$271,678
Demolition and Salvage				\$125,097	\$125,097
<b>Total Cost</b>	\$88,401	\$102,682	\$869,601	\$1,263,054	\$2,323,738
<b>10% Contingency</b>	\$8,840	\$10,268	\$86,960	\$126,305	\$232,374
<b>Grand Total</b>	\$97,241	\$112,950	\$956,561	\$1,389,359	\$2,556,112

Generation projects meeting IRS "Safe Harbor" provisions generally do not incur "CIAC"(Contribution in Aid to Construction), a tax collected by the utility for the state or federal government. DPL does not expect to collect CIAC for this project. If for any reason, "CIAC" would be required for this project, it would be the responsibility of the party owning the generator to pay this cost.

DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering facilities, owned by DPL.

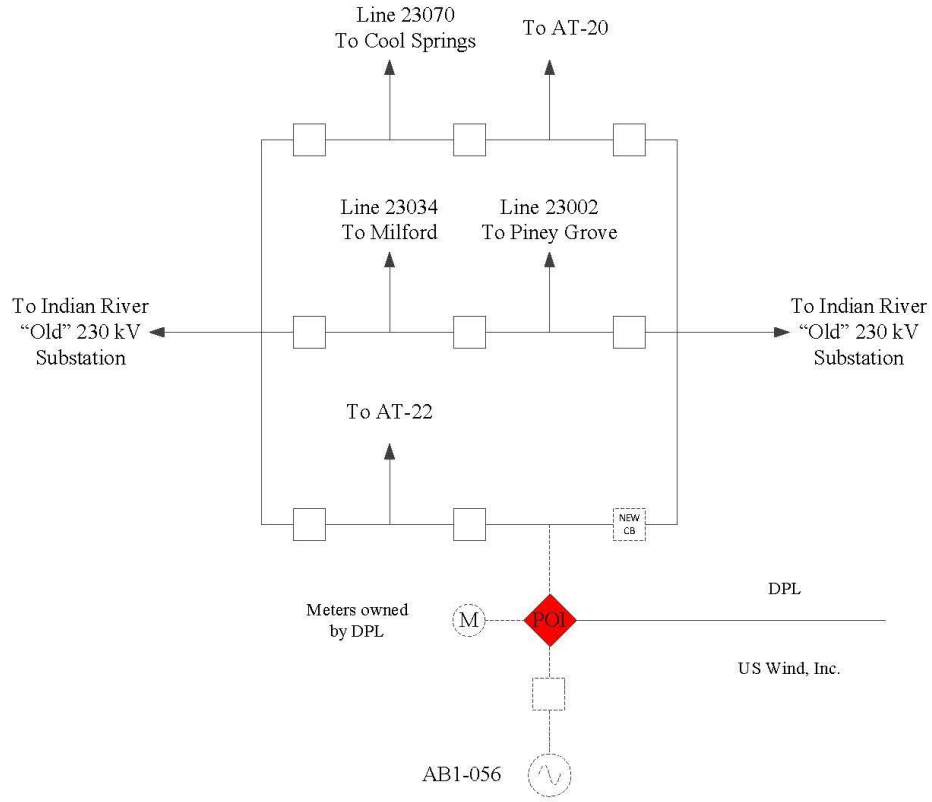
## **9. Schedules**

The overall estimated timeline for DPL to place its direct connect facilities in service for this project is approximately 24 months after receipt of a fully executed Interconnection Service Agreement (ISA) and Construction Service Agreement (CSA).


Storm damage and restoration, time of year limitations, permitting issues, outage scheduling, system emergencies, and contractor and equipment availability could also impact the schedule. It is important to note that this project will be incorporated into the existing project work load at DPL at the time of contract execution. If the work load of existing projects is extensive, resource constraints may cause this project to be delayed beyond the projected in-service date.

**Attachment #1**

# **AB1-056** **Indian River 230 kV I**



An Interconnection Customer circuit  
breaker will be required no more than  
500 feet from the DPL substation.

 Point of Interconnection