

Empire Offshore Wind LLC

Empire Wind 1 Project  
Article VII Application

**Exhibit E-1**  
**Description of Proposed Transmission Line**

June 2021

**TABLE OF CONTENTS**

EXHIBIT E-1: DESCRIPTION OF PROPOSED TRANSMISSION LINE ..... E-1-1

- E-1.1 Introduction..... E-1-1
- E-1.2 Description of the Proposed Transmission Line..... E-1-2
  - E-1.2.1 Submarine Export Cables..... E-1-2
  - E-1.2.2 EW 1 Onshore Export Cables..... E-1-3
  - E-1.2.3 Onshore Interconnection Cables ..... E-1-3

**TABLES**

Table E-1.2-1 Characteristics of Proposed Transmission Lines..... E-1-2

**ACRONYMS AND ABBREVIATIONS**

Empire, the Applicant	Empire Offshore Wind LLC
EW 1	Empire Wind 1
HVAC	high-voltage alternating-current
in	inch
in <sup>2</sup>	square-inch
km	kilometer
kV	kilovolt
Lease Area	Bureau of Ocean Energy Management-designated Renewable Energy Lease Area OCS-A 0512
m	meter
mi	mile
mm	millimeter
mm <sup>2</sup>	square millimeter
nm	nautical mile
NYSPSC or Commission	New York State Public Service Commission
POI	Point of Interconnection at the Gowanus 345-kV Substation
Project	EW 1 Project transmission facilities in New York
SBMT	South Brooklyn Marine Terminal
XLPE	cross-linked polyethylene

## EXHIBIT E-1: DESCRIPTION OF PROPOSED TRANSMISSION LINE

### E-1.1 Introduction

Empire Offshore Wind LLC (Empire, or the Applicant) proposes to construct and operate the Empire Wind 1 (EW 1) Project as one of two separate offshore wind projects to be located within the Bureau of Ocean Energy Management-designated Renewable Energy Lease Area OCS-A 0512 (Lease Area). The proposed transmission system for the EW 1 Project will connect the offshore wind farm to the point of interconnection (POI), and will include 230-kilovolt (kV) export and 345-kV interconnection lines traversing a total of approximately 17.5 miles (mi) (15.2 nautical miles [nm], 28.2 kilometers [km]) within the State of New York. An electric transmission line with a design capacity of 125 kV or more, extending a distance of one mile or more, is subject to review and approval by the New York State Public Service Commission (Commission or NYSPSC) as a major electric transmission facility. This application is being submitted to the Commission pursuant to Article VII of the New York Public Service Law for the portions of the EW 1 Project transmission system that are located within the State of New York (collectively, the Project).

The Project will interconnect to the New York State Transmission System operated by the New York Independent System Operator, Inc. at the Gowanus 345-kV Substation (the POI). The Gowanus 345-kV Substation is owned by the Consolidated Edison Company of New York, Inc. The Project's onshore facilities, including the onshore cable route, onshore substation, and the POI, are located entirely within Brooklyn, Kings County, New York.

The Article VII components of the EW 1 Project include:

- Two three-core 230-kV high-voltage alternating-current (HVAC) submarine export cables located within an approximately 15.1-nm (27.9-km)-long, submarine export cable corridor from the boundary of New York State waters 3 nm (5.6 km) offshore to the cable landfall in Brooklyn, New York;
- A 0.2-mi (0.3-km)-long onshore cable route and substation including:
  - Two three-core 230-kV HVAC EW 1 onshore export cables buried underground from the cable landfall either directly to the cable terminations or to a vault within the onshore substation;
  - An onshore substation located at the South Brooklyn Marine Terminal (SBMT), which will increase the voltage to 345 kV for the onshore interconnection cables; and
  - Two 345-kV cable circuits, each with three single-core HVAC onshore interconnection cables, buried underground from the onshore substation to the POI.

This Exhibit addresses the requirements of 16 New York Codes, Rules and Regulations § 88.1 and provides a description of the Project's proposed transmission lines, including the submarine export cables and onshore cables. All proposed transmission lines for the Project are submarine or underground, as described in **Exhibit E-3: Underground Construction**; with the exception of structures that may be associated with the onshore substation and POI (see **Exhibit E-2: Other Facilities**), there are no towers or foundations associated with the proposed transmission lines.

## E-1.2 Description of the Proposed Transmission Line

Table E-1.2-1 summarizes the characteristics of the proposed transmission lines, which includes the submarine export cables and the onshore export and interconnection cables.

**Table E-1.2-1 Characteristics of Proposed Transmission Lines**

Characteristics	Submarine Export Cables	EW1 Onshore Export Cables a/	Onshore Interconnection Cables
Number of circuits	2	2	2
Number of cables per circuit	1	1 a/	3
Number of cables (total)	2	2 a/	6
Design voltage	245 kV	245 kV	362 kV
Voltage of initial operation	230 kV	230 kV	345 kV
Length of each cable	17.3 mi (27.9 km)	< 0.1 mi (< 0.1 km)	0.2 mi (0.3 km)
Cable diameter	11.8 in (300 mm)	11.8 in (300 mm)	5.2 in (132 mm)
Cable cross-sectional area	109 in <sup>2</sup> (707 cm <sup>2</sup> )	109 in <sup>2</sup> (707 cm <sup>2</sup> )	21 in <sup>2</sup> (137 cm <sup>2</sup> )
Number of conductors per cable	3	3	1
Conductor characteristics			
Diameter	2 in (50.5 mm)	2.2 in (56.8 mm)	2.2 in (56.8 mm)
Cross-section	3.1 in <sup>2</sup> (2,000 mm <sup>2</sup> )	3.9 in <sup>2</sup> (2,535 mm <sup>2</sup> )	3.9 in <sup>2</sup> (2,535 mm <sup>2</sup> )
Material	copper	copper	copper
Insulator design	XLPE	XLPE	XLPE

Note:

a/ The EW1 onshore export cables between the cable landfall and the onshore substation will consist of a three-core 230-kV HVAC bundle and are not expected to differ from the submarine export cables; the submarine export cables will extend from the shoreline either directly to the cable terminations or to a vault within the onshore substation.

### E-1.2.1 Submarine Export Cables

From the Lease Area, two 230-kV (voltage of initial operation; design-voltage 245-kV) submarine export cables will be installed within a single cable corridor traversing the New York Bight and entering New York Bay. The Project’s submarine export cable corridor begins where the cable route crosses the state boundary 3 nm (3.5 mi, 5.6 km) offshore, which occurs approximately 3.4 nm (3.9 mi, 6.2 km) southeast of Rockaway Point at the southwestern corner of Long Island, and 4.8 nm (5.5 mi, 8.8 km) east of the tip of Sandy Hook in New Jersey. From there, the submarine cable route travels northwest into Lower New York Bay, under the Verrazzano-Narrows Bridge between Brooklyn and Staten Island, and north to the cable landfall at SBMT in Brooklyn, New York, on the east side of Upper New York Bay.

The length of the submarine export cable corridor in New York is approximately 15.1 nm (17.3 miles, 27.9 km) from the state boundary offshore to the cable landfall. The submarine export cables will be HVAC. Each of the two HVAC submarine export cables will consist of a three-core cable with copper conductors enclosed in a cross-linked polyethylene (XLPE) insulation system, and two integrated optical fibers for communication and temperature measurements. The cable insulation is rated for voltage levels up to 245 kV.

Each of the 3.1-square-inch (in<sup>2</sup>) (2,000 square-millimeter [mm<sup>2</sup>]) bundled copper power conductors will be within insulated power cores. The conductors will be made of stranded copper wires and will be protected

against longitudinal water ingress by means of a water-blocking compound, yarns, and/or tapes. The power cores will incorporate a semi-conductive lead alloy inner sheath together with a polymeric sheathing, which will prevent radial water ingress into the power cores. A semi-conductive water swellable tape will be applied over the insulation screen to prevent longitudinal water ingress.

The three insulated power cores will be laid together in a trefoil formation together with fiber optic elements and extruded polymeric-shaped fillers. The extruded fillers are placed in the interstices between the power cores to give a substantially round shape to the power core bundle. An armoring package made of an armoring bedding and a layer of either steel, or steel and polymeric, armor wires flushed with bitumen will be applied over the bundle. Finally, an outer serving made of black polypropylene yarns will be applied over the armoring package.

Colored polypropylene yarns will be applied helically over the outer serving; the cable will be marked at specified lengths every 0.62 mi (1 km), as well as every 328 feet (ft) (100 meters [m]) of the last kilometer. The entire three-core submarine export cable will be up to approximately 11.8 inches (in) (300 millimeters [mm]) in outer diameter. A cross-section of the submarine export cable is provided in **Exhibit E-3**.

### **E-1.2.2 EW 1 Onshore Export Cables**

The EW 1 onshore export cables will extend from the cable landfall to the onshore substation at SBMT in Brooklyn. As indicated in **Table E-1.2.1**, the EW 1 onshore export cables are not expected to differ from the submarine export cables and will extend from the shoreline either directly to the cable terminations or to a vault within the onshore substation. Therefore, the onshore export cable system for this segment of the Project route will be the same as the system described in Section E-1.2.1.

The cable landfall will be installed by pulling cables through conduits pre-installed in the bulkhead at the shoreline of SBMT. From the cable landfall, the EW 1 onshore export cables will extend approximately 260 ft (80 m) to the vault or cable terminations with the proposed onshore substation at SBMT.

### **E-1.2.3 Onshore Interconnection Cables**

The proposed onshore substation will increase the voltage for interconnection into the POI at the existing Gowanus 345-kV Substation in Brooklyn. From the onshore substation, the approximately 0.2-mi (0.3-km)-long interconnection cable route will traverse along 2nd Avenue and will cross 28th Street to reach the POI. Details on the proposed onshore substation are provided in **Exhibit E-2**.

The interconnection cable corridor will contain two circuits of three single-core HVAC with copper conductors enclosed in XLPE insulation, for a total of six cables, with a voltage of 345-kV (voltage of initial operation; 362-kV design voltage).<sup>1</sup> The conductor within each single-core cable will have a cross-sectional area of approximately 3.9 in<sup>2</sup> (2,535 mm<sup>2</sup>). Semi-conductive swelling tape will be applied over the insulation screen, and each dielectric cable will be sheathed in polyethylene, with a metallic laminated or lead sheath as a longitudinal water barrier. The interconnection cables will each be approximately 5.2 in (132 mm) in outer diameter. A cross-section of a typical onshore interconnection cable is found in **Exhibit E-3**. Two separate fiber optic cables, each approximately 1.1 in (30 mm) in outer diameter, will also be installed alongside the interconnection cables for communications.

---

<sup>1</sup> Design voltage is based on the highest voltage that can be sustained under normal operating conditions at any time and at any point in a system.

The interconnection cables and fiber optic cables will be housed in duct banks. The configuration of the six interconnection cables and fiber optic cables within the duct banks may vary along the installation corridor. Each of the concrete duct banks will be approximately 3 ft (0.9 m) high by 3 ft (0.9 m) wide, for a total width of 6 ft (1.2 m). In certain areas, there may be a separation between duct banks due to site conditions and spacing constraints. Up to two joint pits (manholes) will be located along the interconnection cable corridor to provide access; however, one or more of these may be determined to be unnecessary and omitted in the final design, if possible, based on cable pulling limitations. The actual length between joint pits will vary due to site-specific and cable installation constraints. Duct bank and joint pit layouts and preliminary location of vaults are provided in **Exhibit 5: Design Drawings**.