Cascade Renewable Transmission Project

Senate Interim Committee on Energy and Environment

September 22, 2022

CASCADE
RENEWABLE TRANSMISSION

Executive Summary

- Cascade Renewable Transmission, LLC is developing the Cascade Renewable Transmission System, a 1,100 MW HVDC transmission line running ~100 miles between The Dalles and greater Portland, Oregon ("Cascade Project" or "Project")
- Cascade Project offers numerous benefits for the Pacific Northwest, including:
  - A secure new pathway for delivering affordable renewable energy generation from east of the Cascades to the I-5 load corridor to meet growing demand and public policy requirements supporting regional decarbonization
  - New jobs for project construction, plus the potential for hundreds of additional jobs to build and operate new renewable generation facilities that will use the new transmission capacity and provide permanent economic tax bases east of the Cascades
  - Proven state-of-the-art HVDC technology, with additional black start capability available, that enhances the stability and reliability of the transmission system (also offering enhanced resiliency to the risks of severe weather events and fires) in addition to increasing transmission capacity
- Cascade Project will be installed **entirely underground and underwater** using proven non-invasive techniques and designed to avoid impact to sensitive natural and cultural resources in the Columbia River environment
- Experienced development team led by PowerBridge, LLC, with success building and operating two similar transmission facilities -- Neptune and Hudson -- in New York (www.powerbridge.us)

Project Overview

Route Summary

Western Interconnection (Harborton)

- Converter Station with direct connection to PGE's Harborton substation in western Portland
- Deliver renewable energy located east of the Cascade into Portland and up the I-5 corridor to Seattle

Overview

- 1,100 MW line rating
- VSC HVDC System
- ~100 Miles underwater and underground
- Bridge the Cascade Mountains while minimizing environmental impact

Eastern Interconnection (Big Eddy)

- Converter Station with direct connection to BPA's Big Eddy Substation outside The Dalles
- Source abundant renewable energy in the heart of BPA's transmission network

Transmission Need Drivers

Transmission capacity across the Cascades is insufficient to address key regional drivers:

1. WA & OR public policy requirements mandating 80% renewable energy by 2030
2. West of Cascades electric demand growth
3. Retirement of the 1,340 MW Centralia Coal Plant located west of the Cascades
4. State climate policies driving electrification of buildings and transportation
5. Replacement of >4GW of east of Cascades fossil generation with eastern renewables

Cascade Project can help the PNW meet climate policies while maintaining system reliability and avoiding the environmental impacts associated with building overhead transmission lines

Renewable Energy Need

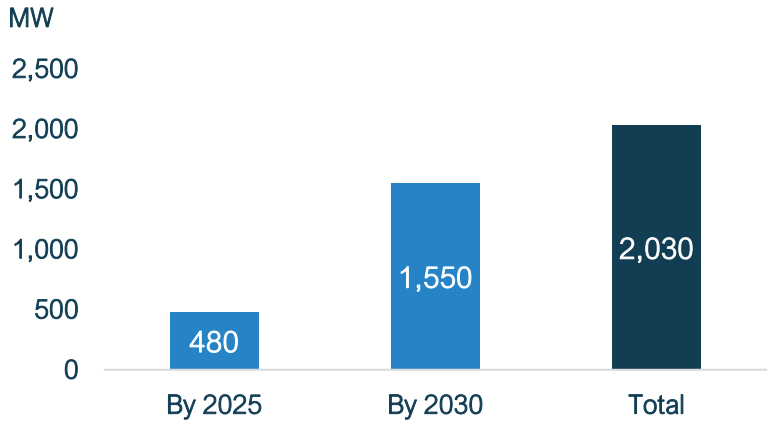
Washington

- Washington utilities need to procure significant quantities of new renewable energy to meet Clean Energy Transformation Act ("CETA") targets in 2030; PSE has estimated a renewable energy need of over 2GW of nameplate capacity by 2030 (1)
- While distributed energy resources and demand side management will play an important role, new, properly sited, utility scale renewable projects will be almost solely located east of the Cascades

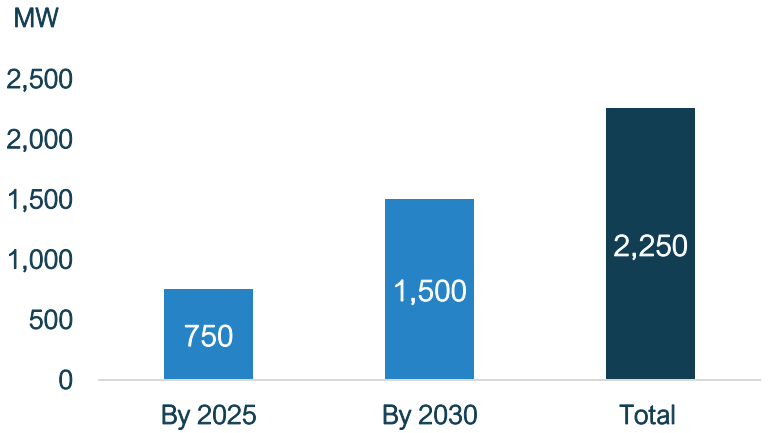
Oregon

- Passage of HB 2021 in 2021, requiring PGE and PacifiCorp to have renewables supply 80% of energy mix by 2030, and 100% by 2040, necessitate a significant ramp up in renewable procurement to meet Oregon Public Policy
- Load growth driven by electrification and renewable interest of large corporate customers could result in additional near-term renewable energy procurement needs as well

PSE Renewable Procurement(1)



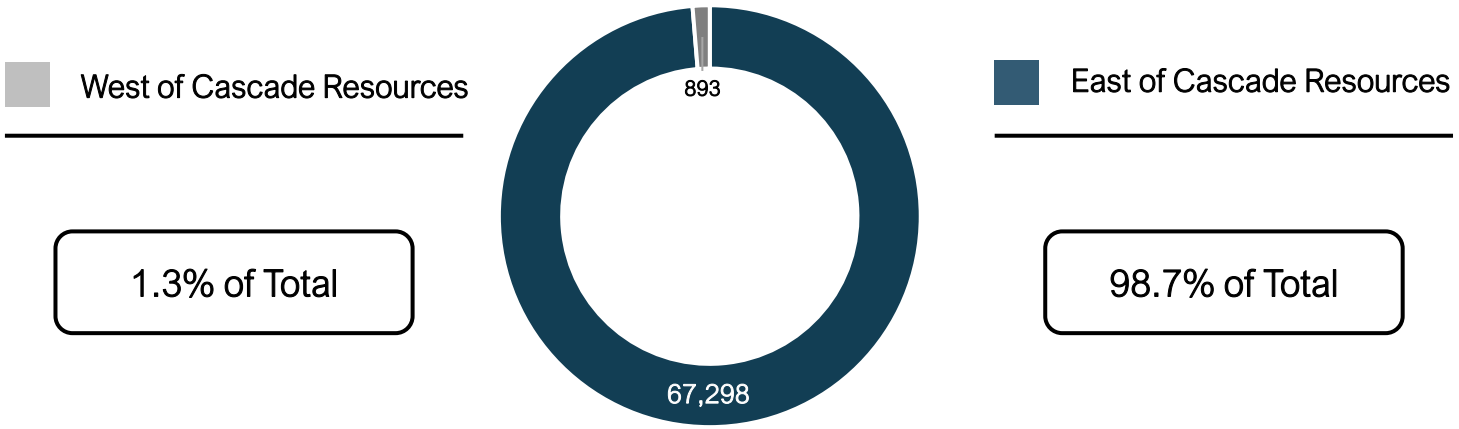
PGE Renewable Procurement (2)



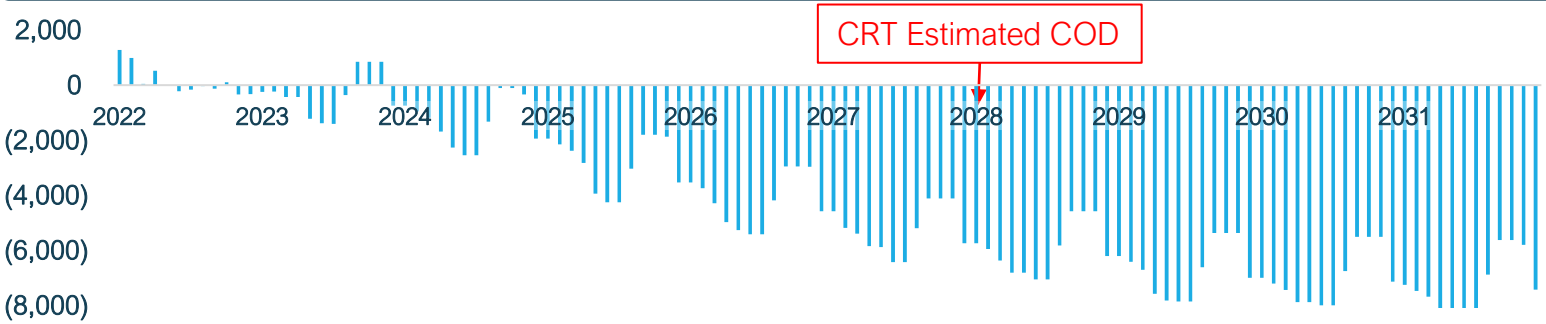
1) PSE 2021 IRP, Annual Resource Addition Preferred Portfolio.
2) Per PGE Filing in Docket UM 2166, assuming 30% renewable resource capacity factor, September 13, 2021, and PGE filing in Docket UM 1953 September 17, 2021.

Cross Cascade Constraint

BPA Renewable Interconnection Queue Analysis (MW)



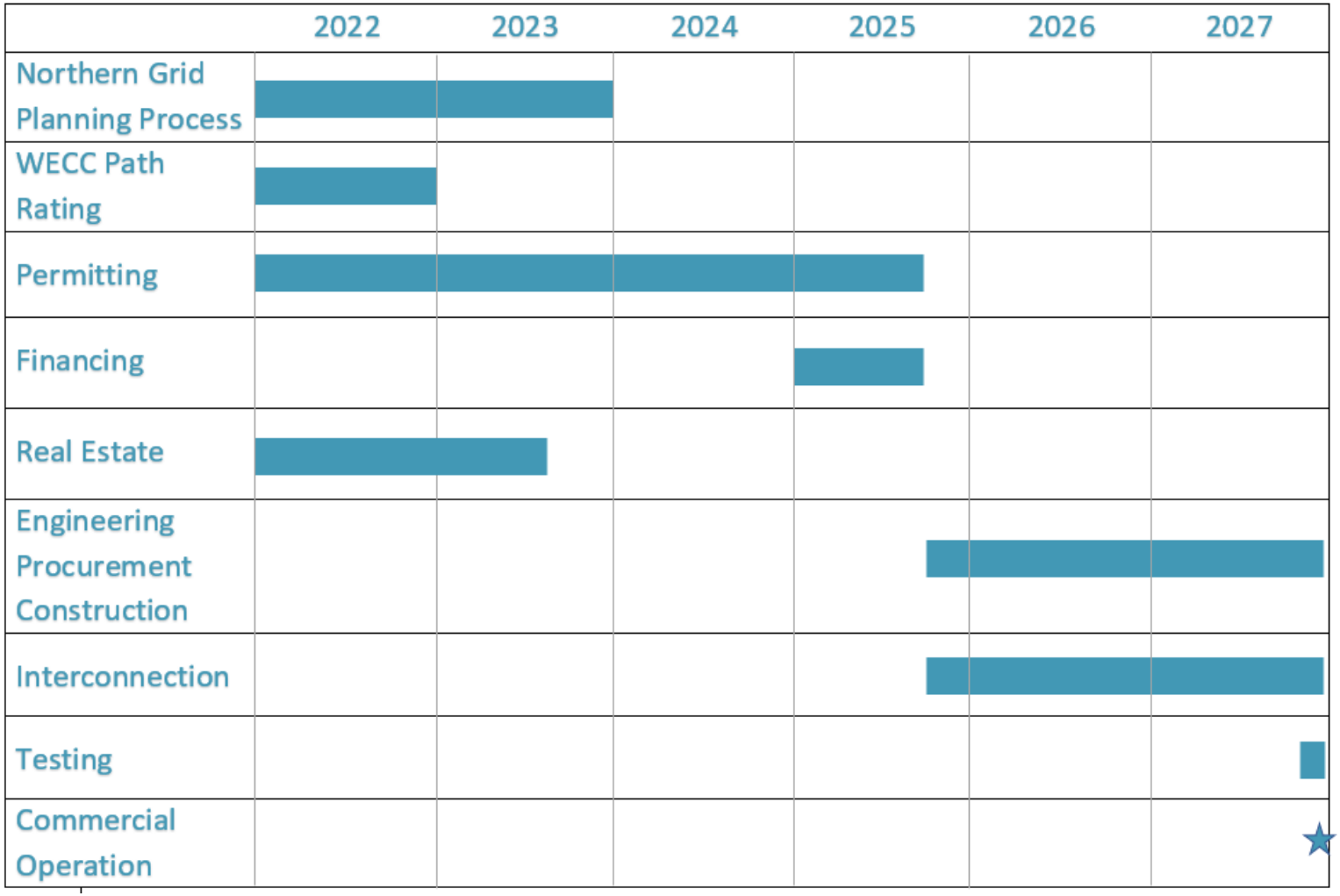
BPA ATC Less Pending Queue on Cross Cascades South (MW)



New Transmission is needed to deliver east of Cascade renewables to west of Cascade load centers

Source: BPA ATC Less Pending Queue as of 8/29/2022, BPA Active Generator Interconnection Queue as of 8/29/2022. Includes interconnection requests Received, In Study, and Completed Study. Does not include Withdrawn or Energized projects or any proposed stand-alone Battery Energy Storage projects.

Project Schedule



Current Status

Accomplished To Date

- Project Team is active in NorthernGrid and has been submitted in the 2022-23 Transmission Planning Cycle
- Completion of WECC Phase 1 and 2 Path Rating and Project Coordination process, and acceptance into Phase 3
- Interconnection requests initiated with PGE and BPA
- Initial study found no environmental, siting, or constructability fatal flaws identified along Project route
- Optimization of in-water and land route for constructability and minimization of impacts
- Experienced development team with committed development capital to move the Project forward
- Active discussions with Native American tribes, regulators, utilities, and key regional stakeholders
- Dedicated Project website, www.cascaderenewable.com

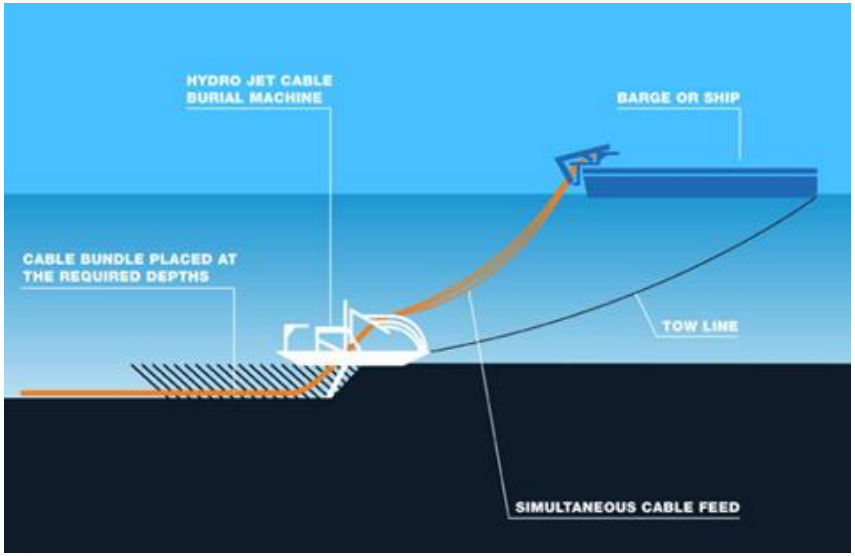
Upcoming

- Ongoing engagement in local and regional transmission discussion and planning working groups
- Additional environmental and engineering studies, including in-river survey work, to further evaluate any Project constraints and prepare permit applications
- Notice Of Intent (NOI) to be filed with Oregon EFSC c. October 1
- Continued tribal engagement and information sharing preparatory to initiation of permitting
- Ongoing outreach and feedback gathering during 2022-23 period
- Targeting late 2027 Commercial Operation Date to help meet public policy needs

HVDC Submarine Cable

The main power cable is less than 6 inches in diameter; two cables are bundled with a fiber optic cable for burial in the riverbed.

The “jet plow” is towed by a barge or ship. Water jets in the plow blade create an 18-inch-wide trench by fluidizing the sediment while the cable is simultaneously laid into the trench, and the sediment settles back down over the cable.



Project Converter Stations

Transbay Cable Converter Station ~ San Francisco, CA

The proposed Cascade Project Converter Stations would each occupy approximately 5 acres and be similar in appearance and technology to the Transbay Cable Converter Station in San Francisco, completed in 2010.

Project Features in Portland

Conceptual view of the underground cable route after exiting the Columbia River in Portland and proceeding toward a converter station site in the Port of Portland Rivergate industrial district. The project interconnects with the existing PGE Harborton substation via a short underground cable in existing roadways and via HDD under the Willamette.

Project Features Near The Dalles

Conceptual view of underground cable route exiting the river and proceeding toward a converter station site adjacent to the existing BPA Big Eddy substation.

Bonneville Dam Bypass

The marine cable exits the River east of the Bonneville Dam and locks, traversing an underground path around the Dam, avoiding the juvenile fish bypass tunnel and other sensitive resources, and reentering the River west of the Dam.

Summary

- Cascade Renewable Transmission is intended to help meet state renewable energy and decarbonization goals and alleviate transmission capacity shortfalls by 2028
- Controllable HVDC line enhances system reliability and resiliency
- Entirely underground and under water, with no visual impact
- Proven technology and construction methodology, employed successfully in the U.S. and throughout the world
- Minimal environmental impact (based on previous experience and to be borne out by consultation and comprehensive studies)
- Hundreds of local construction jobs over 2-year construction period
- Experienced development team with track record of developing, building, and operating comparable projects in the U.S.

Additional Information

HVDC Submarine Projects

Project	Country	Total Miles	Rating	Cable Size(+/-)	Commissioning
ElecLink	UK-France	32	1000 MW	320 kV	2022
North Sea Link	Norway-UK	453	1400 MW	525 kV	2021
NordLink	Germany-Norway	387	1400 MW	500 kV	2020
Nemo	UK-Belgium	87	1000 MW	400 kV	2019
BorWin3	Germany	99	900 MW	320 kV	2019
BorWin2	Germany	120	800 MW	300 kV	2014
Hudson*	NJ/NY, US	7	660 MW	345 kV	2013
TransBay	San Francisco, US	53	400 MW	200 kV	2010
Neptune*	NJ/NY, US	67	660 MW	500 kV	2007
BassLink	Australia	230	500 MW	400 kV	2005
Cross Sound	CT/NY, US	25	330 MW	150 kV	2003

Note: There are also many HVAC submarine cables worldwide, notably for offshore wind. However, the advantage of HVDC is the ability to transmit large quantities of energy over long distances underwater.

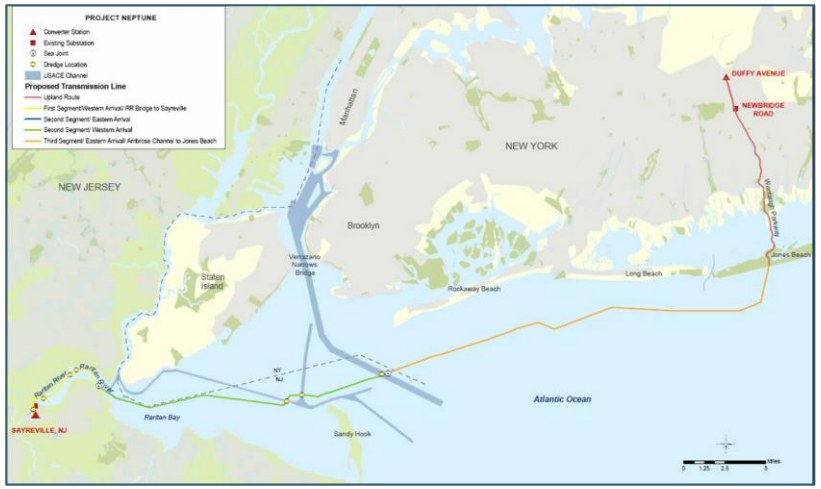
** Projects developed and operated by PowerBridge*

NEPTUNE

Project Description

- 65-Mile-Long, 660-MW HVDC cable linking PJM electricity market with Long Island Power Authority (“LIPA”)
- 51 miles of cable buried undersea, 14 miles underground; two converter stations
- Completed June 2007 – under budget and ahead of schedule
- $650M total cost, financed in the private capital markets, with investment grade rating
- Financing based on a 20-year Firm Transmission Capacity Agreement with LIPA

Route & DC Converter Station

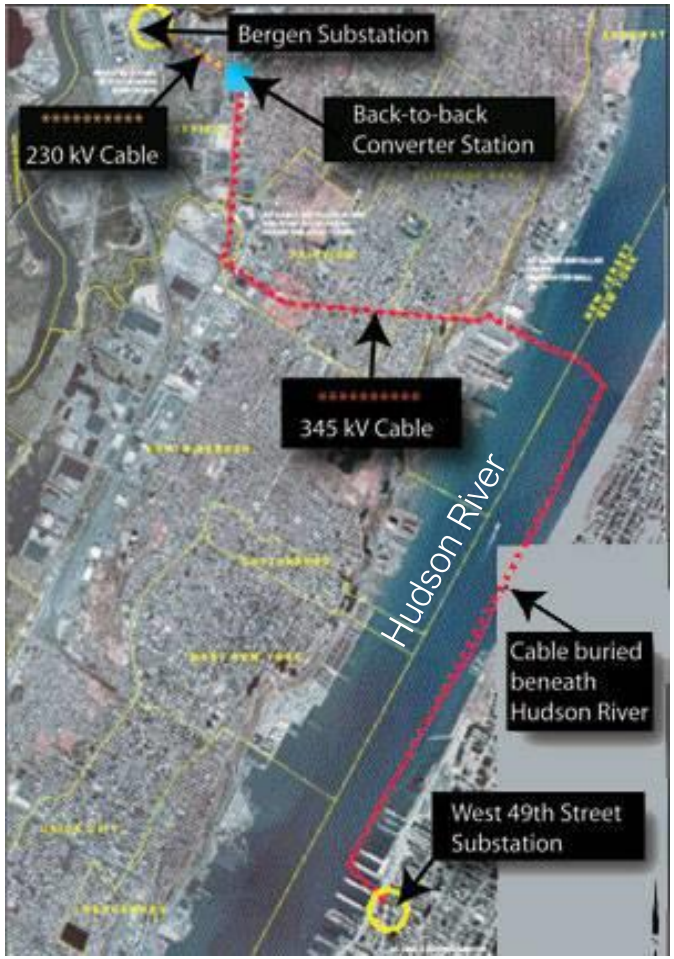


HUDSON

Project Description

- 7-mile underground and underwater power cable linking PJM and NY power grids between Ridgefield, New Jersey and West 49th St. Substation in NYC
- Single back-to-back converter station (AC-DC-AC) located in Ridgefield, New Jersey
- Completed ahead of schedule and under budget May 2013
- Approx. $850 million total cost, financed in the private capital markets with investment-grade rating
- Financing based on a 20-year Firm Transmission Capacity Purchase Agreement for 87.5% of the capacity with the New York Power Authority (NYPA)

Project Route



Challenges Successfully Met

- Overlapping regulatory and permitting regimes (US Army Corps of Engineers, NY State Public Service Commission, NY and NJ environmental agencies, NY State Dept. of Transportation, local planning and zoning requirements; requirements needed to be mutually compatible and major permits in place pre-financing
- Key documents (e.g., Utility Agreement, EPC contract, Management Services Agreement) needed to have compatible provisions for financing
- Tight 24-month time schedules requiring simultaneous work at upland sites, upland cable trenching and installation, and in-water installation
- In-water construction “work windows” restricting time periods available for cable installation for environmental reasons, primarily fish migration and spawning
- Underwater utility crossings
- Management of cable installation in significant public areas, e.g., Hudson River in Manhattan, Jones Beach State Park on Long Island