

Offshore Wind Project Study Final Technical Report

Long Island Power Authority

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Executive Summary

The Long Island Power Authority (LIPA) with support of its service provider PSEG Long Island and consultant team developed an Integrated Resources Plan and began to analyze and evaluate future generation options and electric transmission system and infrastructure improvements, modifications, and upgrades to advance the development of clean energy technologies.

With a focus on offshore wind, LIPA, in accordance with the New York State Climate Leadership and Community Protection Act seeks to continue to integrate a growing portfolio of new clean energy resources safely, reliably, and economically into the electric grid.

In what started more than 10-years ago as a public private collaboration between LIPA, Con Edison and the New York Power Authority to study the potential for offshore wind and the submittal of an unsolicited lease request to United States Bureau of Energy Management has helped set the groundwork for successful procurements by LIPA and the New York State Energy Research and Development Authority for more than 1,800 megawatts of renewable energy off the southern coast of Long Island.

This report discusses the implications of the reduction of forecasted load in the Long Island electric service territory and the impact of energy efficiency; increasing reliance of wind and other renewable resources on the transmission system; opportunities for interconnecting these resources; and reductions on the reliance of baseload fossil fueled power facilities over the coming years.

Purpose and Goals

For the Long Island electric service territory and throughout New York State there is an increasing interest in and mandate for increasing clean energy technologies and renewable energy generation while reducing dependency on fossil fuels for electric production with goal of a carbon free system by 2040. Through the resources provided, this report will help: realize New York State's first offshore wind project; enhance the study and advancement of a 21st century electric system that is resilient, reliable, and cleaner; and ensure continued growth in the United States' and New York State's clean energy economy as together we work to achieve the aggressive and progressive clean energy mandates in the New York State Climate Leadership and Community Protection Act.

The report sets to achieve:

- Development of an Integrated Resource Plan
- Identification of sources of electric generation and forecast future load
- Identification and evaluation of areas suitable for offshore wind development
- Identification of potential interconnection locations for offshore wind resources
- Procurement of offshore wind generation to help meet the increasing electric usage on Long Island's "South Fork" and meet LIPA's renewable energy requirements
- Evaluation of existing generation and potential future repowering or reduction in fossil fuel baseload generation

LIPA Background

LIPA is one of the largest public power utilities with a diverse and stable customer base serving 1.1 million Long Island electric service customers in Nassau County and Suffolk County (except for the villages of Freeport, Greenport and Rockville Center) and the Rockaway Peninsula in Queens.

Service Territory

Queens/Nassau

Serves approximately 210,512 customers
109 square miles of service territory,
1,035 miles of overhead wire
288 miles of underground cable
75,158 utility poles

Central

Serves approximately 290,018 customers
210 square miles of service territory
2,374 miles of overhead wire
667 miles of underground cable
145,389 utility poles

Western Suffolk

Serves approximately 320,839 Customers
305 square miles of service territory
2,718 miles of overhead wire
1,486 miles of underground cable
152,644 utility poles

Eastern Suffolk

Serves approximately 289,484 customers
606 square miles of service territory
2,823 miles of overhead wire
2,220 miles of underground cable
161,859 utility poles



Offshore Wind Project History

The Long Island Power Authority (LIPA) became engaged in the Long Island - New York City Offshore Wind Collaborative (LI-NYC Collaborative) in 2010. This collaborative was a public-private partnership that included the Long Island Power Authority, Consolidated Edison, and the New York Power Authority that came together to study the potential for an offshore wind project that would be situated south of the Queens/Nassau border.

Based on initial studies it was determined that an offshore wind project could be connected to the electric grid and that there were “no fatal flaws/issues” to prevent moving forward with project planning and engagement. Based on this work, NYPA on behalf of the LI-NYC Collaborative, submitted an unsolicited request for a commercial lease for an approximately 106 sq. mi. area to United States Bureau of Ocean Energy Management (BOEM) in September 2011.

Subsequently, BOEM determined that there was competitive interest in the area and initiated the competitive leasing process, defined a ‘Wind Energy Area’ totaling approximately 81,130 acres, completed an Environmental Assessment (EA) to determine potential impacts associated with issuing a lease, and held a competitive lease sale for commercial wind development in this area.

While New York State was actively engaged in the auction through the NYS Energy, Research and Development Authority (NYSERDA), a private company, Statoil obtained the lease rights to the New York Offshore Wind Area that was a component of the original grant request.

Additionally, in 2015 LIPA issued a Request for Proposals for South Fork Resources which resulted in selection of Deepwater LLC’s South Fork Wind Project, a proposed 90 megawatt offshore wind farm, subsequently increased in size to 130 megawatts. Most recently, NYSERDA selected and contracted with two offshore wind project proposals, totaling nearly 1,700 megawatts – Empire Wind (816 megawatts) and Sunrise Wind (880 megawatts)¹.

In October 2019 NYSERDA finalized contracts with Equinor Wind US LLC for its 816 megawatt Empire Wind Project and Sunrise Wind LLC (a joint venture of Ørsted A/S and Eversource Energy) for its 880 megawatt Sunrise Wind Project to deliver clean, affordable renewable energy to New Yorkers. As LIPA’s 130MW South Fork Offshore Wind Project proceeds through the federal, state and local environmental review and permitting processes, the NYSERDA procurement became the largest procurement for offshore wind in the nation and significantly advanced the CLCPA’s mandate to develop 9,000 megawatts of offshore wind by 2035 and position New York State as the regional hub of this growing industry in the United States.

In sum, there have been a number of significant steps taken by New York State and the Long Island Power Authority to build our renewable energy portfolio, and more specific to this grant, toward development of offshore wind.

These important actions and policies include:

- New York State enacting the Climate Leadership and Community Protection Act (CLCPA), which includes a mandate of 9,000MW of offshore wind by 2035 and a carbon free electric system by 2040
- Long Island Power Authority continuing to procure of renewable generation to meet the mandates of the CLCPA;
- Long Island Power Authority has completed a 20-year power purchase agreement with Deepwater Wind LLC for 90 megawatts, and a contract amendment that increased the total to 130 megawatts of offshore wind to be located in federal waters off of Long Island’s South Fork to be operational in 2022. An important component of this project is the transmission connection from the turbines to landfall and then to our customers. This project has and continues to be seen as a gateway project to develop Long Island’s tremendous offshore wind resource;
- Retention of ABB Consultants LLC to study the impacts of integrating various amounts of offshore wind into LIPA’s transmission network;
- NYSERDA selected and contracted with two offshore wind project proposals, totaling nearly 1,700 megawatts; and
- Long Island Power Authority has developed an *Integrated Resource Plan* to identify future trends and system modifications needed to address the State’s aggressive and progressive clean energy policies.

¹<https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Focus-Areas/NY-Offshore-Wind-Projects>

The LI-NYC Collaborative project was established as a result of increasing interest in reducing the use of fossil fuels for electricity production in the New York City and Long Island metropolitan area, which is increased today. For New York City and Long Island, the use of offshore wind power appears to be one of the few central station renewable resources that could provide a significant amount of clean energy to utility consumers and help to achieve the State mandate in the CLCPA. This clean energy resource will also be supplemented by continued interest in residential, commercial and community solar and battery storage as prescribed in the CLCPA.

Development of wind power in the Long Island, New York City area requires offshore locations due to the incompatibility of high density, high cost land use with the space required for land-based wind and solar power development. The downstate offshore environment has the strong advantage of the availability of strong, consistent, and unobstructed wind. A successful wind-generation project(s) for the New York metropolitan area needs to be large enough to gain economies of scale to compensate for the higher costs of work designing, licensing, building and operating facilities in the harsh marine environment and help start or drive to sustainable development in the State and the northeast-to-mid-Atlantic-region.

Offshore wind facilities have distinct advantages over inland options. In contrast to land-based wind facilities in remote regions of the state, ocean-based wind power is stronger, more consistently available, and can be situated closer to Long Island and New York City. Also, land-based wind power availability tends to diminish during the hottest part of a summer day, which is precisely the time that Long Island, New York City and Westchester customers use the most electricity.

Studies that have been done demonstrate that an offshore wind project(s) could also provide significant market development benefits to the wind industry, create clean-tech jobs and help diversify the State's electricity system. In addition, the projects that are helped through this work and other state and private entities will help demonstrate the State's energy supply needs can be met in an environmentally sound manner while benefiting the State's economy by reducing dependence on imported fossil fuel.

With Deepwater Wind LLC and LIPA coming together on an original 90 megawatt, now 130 megawatt, 15-turbine offshore wind project in a federal lease area, this public/private partnership provides the gateway for utilizing our tremendous offshore resource. This 130MW project along with the two offshore wind projects totaling 1,700 megawatts procured through NYSEERDA have started to move toward an economically viable resource that provides high quality jobs, stimulates the economy and achieves the State's goal of 9,000 megawatts of offshore wind energy by 2035.

Transmission Facilities

LIPA's transmission facilities provide for the delivery of capacity and energy from transmission interconnections and on-Island generating stations to LIPA's electric distribution system.

As of December 31, 2019, the transmission system consists of approximately 1,400 miles of overhead and underground lines with voltage levels ranging from 23 kilovolts ("kV") to 345 kV. The on-Island transmission system has been constructed following standards similar to those employed by other major electric utilities in the Northeast and includes wood poles, steel poles, and lattice steel towers.

Many of the existing transmission structures also support distribution circuits and/or connections for telephone, cable television, or fiber optics. In accordance with the latest North American Electric Reliability Corporation ("NERC") standards, 41 LIPA-owned transmission substations are part of the Bulk Electric System ("BES"). The combined capability of LIPA's BES and non-BES transmission substations is approximately 8,900 million volt-amperes ("MVA").

The transmission system also includes LIPA-owned transformation equipment at 12 generating sites under contract with LIPA that is used to step up the generation voltage to transmission voltage levels, and eight substations that interconnect to independent power producers (“IPPs”) or other generation.

Distribution Facilities

The distribution system comprises 13 kV and 4 kV facilities and a combination of overhead and underground equipment.

There are 152 distribution substations throughout the Service Area that step the voltage down from transmission to distribution levels. The combined capability of LIPA’s distribution substations is approximately 8,300 MVA.

As of December 31, 2019, the distribution system also includes approximately 14,000 circuit miles of overhead and underground line (9,000 overhead and 5,000 underground), and approximately 191,200 line transformers with a total capacity of approximately 13,390 MVA.

A portion of the poles on which LIPA’s distribution facilities have been installed are owned by Verizon Communications and used by LIPA under a joint-use agreement pursuant to which the parties aim to maintain parity.

Transmission Interconnection Facilities

The geographic location of the Service Area restricts the number of transmission interconnections between LIPA’s Transmission and distribution system (“T&D System”) and other systems in the region.

Seven major transmission lines connect the T&D System with the Con Edison system to the west and with Eversource (Connecticut Light & Power) (“ES-CL&P”) and United Illuminating Company to the north and Jersey Central Power & Light (“JCP&L”) to the southwest.

- The Con Edison cable extending approximately 18 miles from Dunwoodie to Shore Road (the “Y-50 Cable”) was placed in operation in August 1978 and is jointly owned by LIPA and Con Edison. Con Edison’s share of the power flowing across the Y-50 Cable is delivered to Con Edison via the two 138 kV cables to Jamaica.
- The East Garden City to Sprain Brook interconnection (the “Y-49 Cable”), installed in 1991, is another major transmission interconnection. The Y-49 Cable comprises submarine and land-based portions totaling approximately 23 miles. This line is owned entirely by NYPA; however, most of the capacity of the Y-49 Cable is used by LIPA under the terms of a contract with NYPA.
- The cable from Northport to Norwalk Harbor (the “NNC”), which was installed in 2008 to replace the original cable installed in 1969, extends approximately twelve miles under the Long Island Sound from the Northport generating station in Suffolk County, New York to Norwalk Harbor, Connecticut. LIPA owns that portion of the line from Northport to the New York-Connecticut state boundary.
- The high voltage direct current (“HVDC”) cable from Shoreham to New Haven (the “Cross Sound Cable” or “CSC”) was constructed under a firm transmission capacity purchase agreement (the “CSC Agreement”) signed between LIPA and Cross Sound Cable Company, LLC (“CSC LLC”) in 2000 under which LIPA agreed to purchase up to 330 MW of transmission capacity. The CSC is owned by CSC LLC. The CSC Agreement, as amended, expires in 2032. The CSC became operational in June 2004.
- In September 2005, LIPA signed a 20-year firm transmission capacity purchase agreement with Neptune Regional Transmission System LLC (“Neptune”) to permit LIPA to import power from

New Jersey over an undersea HVDC transmission cable (the “Neptune Cable”) capable of carrying 660 MW of electricity. The Neptune Cable, owned by Neptune, runs from Sayreville, New Jersey under the Atlantic Ocean and connects with LIPA at its Newbridge Road substation in Levittown. The cable became operational in July 2007.

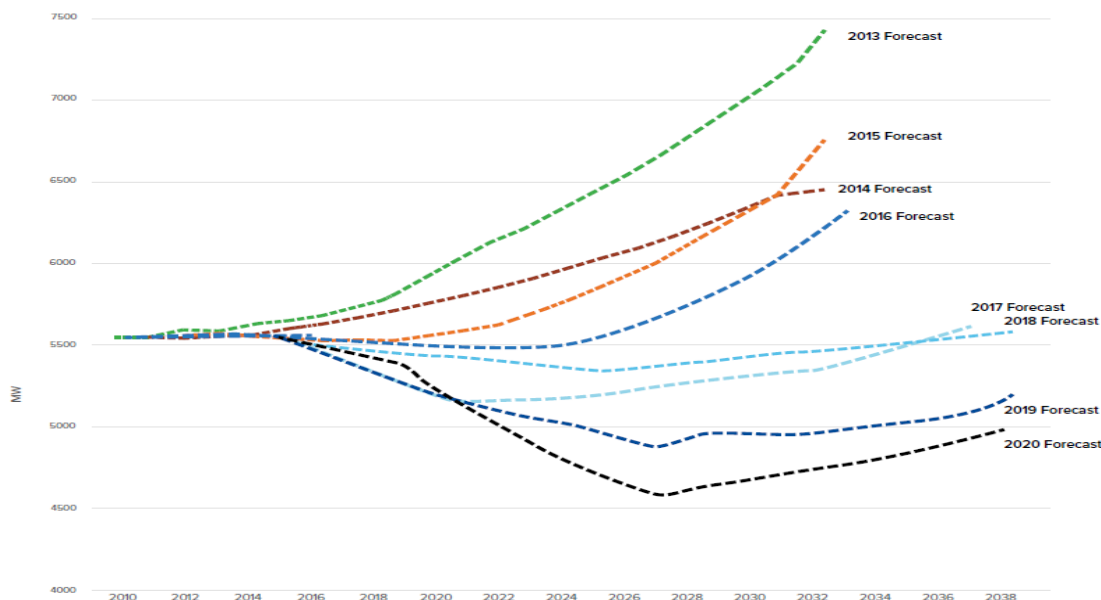
Integrated Resource Planning

In 2017, PSEG Long Island conducted the Integrated Resource Plan (IRP)² of LIPA’s electric resource needs through 2035 and Repowering Studies of the E.F. Barrett (“Barrett”)³ and Port Jefferson⁴ generating stations. The IRP was reviewed by LIPA and an independent consulting firm, the Brattle Group, and was issued for public comment.

The IRP analyzed and evaluated future generation options as well as electric transmission system and infrastructure requirements to address the offshore wind. Given the State mandate for 2,400 megawatts of offshore wind, to be predominantly located off Long Island’s coastline, the information gathered through the development of this Plan will significantly advance the development of offshore wind and integrate this new energy source safely and reliably into the electric grid.

LIPA’s Integrated Resource Plan and Repowering Studies will help address future load forecasts, fossil-fuel retirements and increasing renewable energy generation and storage and the generation and transmission investments that will be needed over the next twenty-years to facilitate the injection of significant renewable energy resources. The IRP is particularly timely and important as Long Island, like the national trend, is seeing reduced load forecasts, will see continued investment in energy efficiency and an increased investment in renewable energy to meet the NYS 100%-by-2040 and 9,000 megawatt offshore wind mandates.

LONG ISLAND ENERGY USE CONTINUES TO DECLINE



² https://www.lipower.org/wp-content/uploads/2016/10/LIPA_EnergyGuide206x9204_22_1720FINAL1.pdf;

FAQ: <https://www.lipower.org/wp-content/uploads/2016/10/Frequently20Asked20Questions20LIPA20201720IRP20and20Repowering20Reports1.pdf>

³ https://www.lipower.org/wp-content/uploads/2016/10/2017-04-19_Barrett_Repowering_Study_Draft1.pdf

⁴ https://www.lipower.org/wp-content/uploads/2016/10/2017-04-19_Port20Jefferson20Repowering20Study_Draft1.pdf

PSEG Long Island projects a decline in peak demand of approximately 750MW by 2030, primarily due to the increased energy efficiency and greater adoption of distributed energy resources such as offshore wind and rooftop solar consistent with state and national trends.

The IRP concluded there would be no need for additional baseload power plants through 2030. Accordingly, Authority staff recommended to the Board in July 2017 that LIPA not contract for new baseload combined cycle power plants or repower existing steam plants. The Brattle Group provided an independent second opinion of PSEG Long Island's reliability planning criteria and the need for proposals for certain combined cycle plants (Caithness II and the repowering of the Barrett and Port Jefferson generating stations). Additionally, NYS Department of Public Service participated in the Brattle Group review and provided a concurring recommendation to LIPA.

In conjunction with the results of the Barrett and Port Jefferson Repowering Studies, the recently released Northport Repowering Study⁵, and current projections as to peak demand, at LIPA's May 2020 Board meeting, staff reported an intention to retire 400-to-600 megawatts of steam unit generating capacity as early as 2022, followed by more retirements after 2024.

In addition, LIPA also intends to ramp down 68 megawatts of simple cycle combustion turbines located in West Babylon and Glenwood Landing in 2020 and 2021, respectively. Additional peaking unit ramp downs are under consideration for 2022 and later, including units located in Glenwood Landing.

The Integrated Resource Plan identifies the generation and transmission investments that may be necessary over the next twenty years to provide reliable electric service to customers at the lowest possible cost. The Repowering Reports review the technical and economic feasibility of building three proposed large combined cycle power plants in place of existing units at the E.F. Barrett, Port Jefferson, and Northport plants.

By analyzing the dramatic increase in energy efficiency, advancing technology, and the expanding base of renewable energy on Long Island, the reports identify a pathway to a modern, clean, reliable and affordable electric grid of the future.

The underlying analysis for the IRP was conducted by LIPA's service provider PSEG Long Island's engineers, energy specialists, planners and consultants and was independently reviewed by the Brattle Group and the Department of Public Service.

A detailed guide with key findings and charts is available at www.psegnyli.com under "About Us."

The key findings of the energy study include:

- Recent peak load forecasts, or the highest demand for electricity in a year, show dramatic reductions driven by greater adoption of energy efficiency and roof-top solar. This decline is consistent with state and national trends
- New York's then-50% Clean Energy Standard (now 70%) requires Long Island to add significant megawatts of new renewable generation by 2030
- New York's then-2,400 megawatt (now 9,000 megawatt) Off-Shore Wind goal for 2035 could lead to significant development of Off-Shore Wind off Long Island's coast
- With flat load growth and the addition of renewable generation, Long Island has surplus energy generation capacity through 2035 and no current need for new large combined cycle gas-fired baseload power plants

⁵ https://www.lipower.org/wp-content/uploads/2020/05/5a.-Northport-Repowering-Study_2020.05.20-Secured.pdf

- 99% of LIPA’s generation contracts are up for renewal by 2030, providing flexibility to transform LIPA’s generation fleet towards the energy grid of the future
- The addition of clean energy generation, such as offshore wind, in LIPA’s system significantly reduces the usage of the legacy E.F. Barrett, Port Jefferson, and Northport steam power plants and increases the need for smaller, more flexible peaking units, batteries and demand response to better support renewable projects by 2030
- The existing E.F. Barrett, Port Jefferson, and Northport power plants continue to operate reliably and can support current needs. Excess generation capacity through 2035 are uneconomic but provides additional reliability and redundancy to the Long Island electric grid beyond typical planning criteria
- The construction of the proposed large combined cycle power plants (E.F. Barrett, Port Jefferson, Northport and Caithness II) would raise the net cost to customers by up to \$5 billion or \$2,215 for the average residential customer through 2030
- Advancing technology and economies of scale are expected to result in dramatic declines in the cost of renewable energy over the period.

LIPA staff’s recommendations include:

- Monitor Long Island energy and demand growth each year and the operating performance of existing power plants
- Evaluate opportunities for economies of scale in offshore wind development by partnering with NYSERDA and other New York electric utilities
- Maintain energy efficiency programs to reduce load by 950 megawatts through 2030 and continue efforts for fair property tax reductions on existing large legacy power plants at the E.F. Barrett, Port Jefferson, and Northport stations
- Study Long Island’s peaking generation fleet and its ability to accommodate increasing renewable generation
- Cancel LIPA’s 2010 Generation RFP with no award and cancel further study of the combined cycle repowering proposals for the E.F. Barrett and Port Jefferson steam plants
- Conduct technology neutral competitive procurements to meet future identified needs and a legislatively mandated repowering study of the Northport steam plant commencing October 2018

LIPA, through its service provider, PSEG Long Island, plans to conduct another Integrated Resource Plan (“New IRP”) commencing end-of-2020 or mid-2021. The New IRP will build upon the analyses, findings, and recommendations of the current IRP and carefully examine all of LIPA’s current power resources and consider an array of potential future projects to meet reliant, resilient and reliable electric needs for customers in compliance with State law.

As described in more detail below, a number of more aggressive State energy goals have been introduced. The New IRP will evaluate the measures needed to meet the CLCPA standards in conformity with LIPA’s policy, including recommendations for energy-saving and beneficial electrification initiatives that deliver safe, reliable and environmentally responsible energy to LIPA customers at the lowest reasonable cost.

Baseload Repowering Studies



Barrett Power Station



Port Jefferson Power Station

Key Findings of the Repowering Studies

- Despite being over 50-years-old, existing units are in good shape
- Growth in energy efficiency and renewables contributes to forecasted surplus of generation through 2035
- E.F. Barrett capacity factor to decline to 6% by 2030 and Port Jefferson to decline to 5% by 2030
- Repowering would increase net costs to customers by up to \$1.2 billion for E.F. Barrett and up to \$0.9 billion for Port Jefferson
- Retirement of existing capacity would accelerate need for new generation.



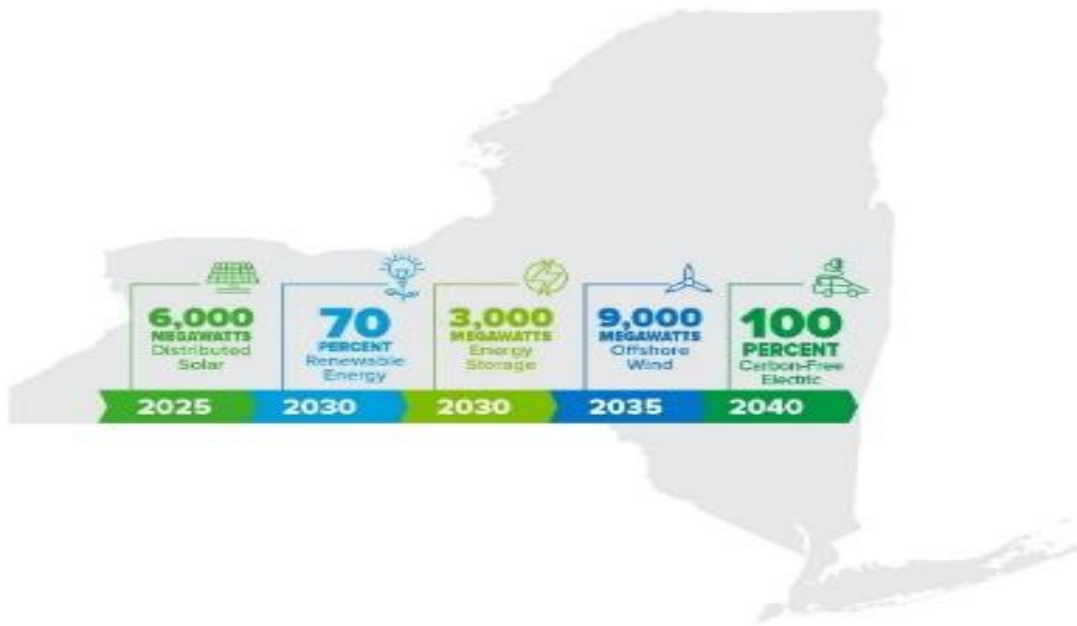
Northport Power Station

In addition, PSEG Long Island recently conducted the Northport Repowering Study in compliance with State law. Similar to the earlier studies mentioned above, this study evaluated the Northport generating facility. That study concluded that:

- repowering the Northport facility would result in increased cost to LIPA customers
- The need for conventional generating resources is declining due to increases in offshore wind, rooftop solar, distributed resources, and energy efficiency.
- Northport's capacity factor is forecasted to decline to just 2.9 percent by 2035
- All repowering options studied increase costs to customers
- Retirement of one of Northport's four existing steam units would save customers approximately \$300 million, with no impact on T&D reliability

The IRP and Repowering studies drew widespread and diverse support as business, not-for-profit, and environment organizations commented:

- **Adrienne Esposito, Executive Director for Citizens Campaign for the Environment** said, “This plan validates our call for a transition away from antiquated energy technology to a modernization of our energy infrastructure in the 21st century and dramatically changes the course of Long Island’s energy future. Advances in technology and economies of scale continue to drive down the cost of wind and solar, making them better long-term choices than building new fossil fuel power plants or repowering existing ones. The plan cites a 77% reduction in air emissions from reduced operating times of the old power plants, which is good for our health and our wallets. Elected officials must stop supporting repowering in order to justified inflated tax payments as we need an energy policy that benefits all Long Islanders, not just a few communities. This transition will occur over time and should be readily embraced.”
- **Mitchell H. Pally, Chief Executive Officer of the Long Island Builders Institute** said, “The Long Island Builders Institute continues to be very concerned over the significant real property tax impacts of a number of electric plants which are only used for a very limited amount of time but pay taxes far in excess of their usage. This report clearly indicates that the time is now for all parties to come to an agreement on both the future of the plants and the taxes being paid by all Long Islanders, as the cost of retrofitting these plants is far in excess in meeting the electric needs of our community.”
- **Gordian Raacke, Executive Director of Renewable Energy Long Island** said, “What we are witnessing here is a historic game changer on how Long Island produces its electricity. LIPA’s latest electric forecast proves that energy efficiency and renewable energy have successfully stabilized the unrelenting growth in electricity usage of the last decades. The analysis shows that solar and offshore wind can supply the bulk of our power needs more economically and without polluting our air, and that clean renewable energy technologies will replace polluting fossil fuel sources over the coming decades.”
- **Lisa Dix, New York Senior Representative for the Sierra Club** said, “The Sierra Club applauds the Long Island Power Authority and PSEG Long Island’s bold progress in transforming Long Island’s utility into a model for the nation. Aggressive investments in energy efficiency, job creating renewable energy such as offshore wind and solar, and modern technologies like battery storage and electric vehicle charging infrastructure will not only slash costs for bill payers, but clean-up Long Island’s air and water, and protect our communities from the devastating impacts of climate disruption.”
- **Sammy Chu, Chairman of the US Green Building Council, Long Island Chapter** said, “I appreciate the approach that LIPA has taken in planning for our future energy generation needs. It makes the most sense for ratepayers to move away from generation resources that provide less and less value to the system moving forward, while responsibly making investments that continue to bridge us to a future that includes more and more renewable generation over time. It's refreshing to see a plan that values the public interest over politics.”
- **Liz Gordon, Director of the New York Offshore Wind Alliance**, said, “LIPA is demonstrating extraordinary leadership with this new Integrated Resource Plan. This plan envisions smart and strategic investments in renewable electric generation that will increase reliability and lower costs for Long Island residents and businesses, while providing clean and emission-free energy for future generations. Offshore wind will play a vital role in this vibrant new energy economy for Long Island.”
- **Anne Reynolds, Executive Director of the Alliance for Clean Energy New York** said, "LIPA's plan is illuminating, showing us that by investing in efficiency and tapping into the great potential for offshore wind, Long Island's grid will meet future needs and be more efficient, clean, and cost-effective."



Governor Andrew M. Cuomo in his 2019 State of the State Address introduced the Green New Deal plan. That plan was largely incorporated into the New York State Climate Leadership and Community Protection Act (“CLCPA”), which was signed into law by the Governor on July 18, 2019.

On April 8, 2020, the Energy Planning Board amended its State Energy Plan (the “SEP”), which was released in 2015 and coordinates state agencies that impact energy policy considering the enactment of the CLCPA.

As amended, the SEP sets the following clean energy and climate targets for the State to meet:

- 40% reduction in greenhouse gas (“GHG”) emissions from 1990 levels by 2030;
- 70% of electric generation from renewable energy sources by 2030;
- 185 trillion BTU increase in on-site energy savings from 2015 baseline by 2025;
- 100% carbon free electricity by 2040;
- 85% reduction in GHG emissions from 1990 levels by 2050;
- 9,000 MW of offshore wind by 2035;
- 6,000 MW of distributed solar by 2025;
- 3,000 MW of energy storage by 2030; and,
- 40% goal, and a minimum target of 35%, of overall benefits from investments in clean energy and energy efficiency to be realized by disadvantaged communities.

Furthermore, the amended SEP adds a new initiative to establish a sustainable electric generation facility cessation mitigation program, calling on state entities to advance strategies to mitigate the impact of power plant closures on hosting communities.

The full impact of the CLCPA on many segments of the economy will be detailed in regulations over the coming years. The Climate Action Council, provided for under CLCPA, has begun work on the Scoping

Plan to accomplish the transition called for in CLCPA. The Scoping Plan is due by January 2023. LIPA's Chief Executive Officer is a statutory member of the 22-member Climate Action Council.

The implementation of CLCPA will fundamentally change the existing generation supply portfolio for the State and Long Island over the next two decades. Pursuant to, among other things, the Integrated Resource Plan ("IRP") conducted by PSEG Long Island in 2017, LIPA's decision to forego new fossil-fuel baseload generation, and its procurement of the State's first offshore wind farm, LIPA is currently positioned to address the State's renewable energy goals through 2024.

LIPA and PSEG Long Island are also continuing to participate in the State's Offshore Wind Master Plan, which involves efforts to license and procure sufficient offshore wind resources to meet the State's goal of 9,000 MW of offshore wind by 2035.

As a significant portion of the planned offshore wind resources will likely be interconnected to the T&D System, additional studies are underway to examine the need for transmission reinforcements and flexible resources (e.g., peaking plants and energy storage) to enable the reliable and cost-effective integration of offshore wind into the local and regional power grid.

Important Milestones of the Evolution of Offshore Wind on Long Island and the Public/Private Collaborative Effort:

- April 2009 - New York Power Authority (NYPA) added to form LI-NYC Offshore Wind Collaborative
- Technical, Environmental and Economic Desktop Studies & Visualization Portrayals Undertaken
- June 2010 - Memorandum of Understanding executed to formally establish the Collaborative and the cost sharing principles among the three utility partners
- September 2011 - On behalf of Collaborative, NYPA submitted an unsolicited lease application to U.S. Bureau of Ocean Energy Management (BOEM) for an area in the New York Atlantic off Long Island to site a future utility-scale offshore wind project. The proposal included the installation of up-to-194, 3.6 megawatt wind turbines, yielding a potential 700 MW of wind energy generation
- June 2012 - On behalf of the Collaborative NYPA submitted an amendment to the initial lease request to accommodate one-quarter nautical mile spacing between shipping lanes and any proposed wind turbines
- June 2016 - BOEM announced the proposed lease sale for 81,130 acres in the New York Atlantic for commercial wind energy leasing, in an area largely like that requested by the Collaborative in its initial lease request
- August 2016 NYSERDA announced its intention to participate in the upcoming BOEM lease auction process in furtherance of its development of New York State's Offshore Wind Master Plan
- August 2016 - NYPA, on behalf of the Collaborative, withdraws its lease request deferring to NYSERDA
- December 2016 - BOEM held a lease sale (i.e., auction) for an area offshore New York, referred to as the "New York lease area." The auction lasted 33 rounds with Statoil Wind US LLC, which bid \$42,469,725, the winner of this lease area
- 2016 - NYSERDA research led to development of the New York State Offshore Wind Master Plan (Master Plan), a comprehensive roadmap and suite of more than 20 studies that encourages the development of offshore wind
- March 2017 - BOEM signs and executes the commercial wind energy lease
- March 2018 – Statoil changes its corporate name to Equinor
- October 2019 - Equinor selected by NYSERDA for development of its 816 megawatt Empire Wind Project in the original lease area solicited by the LI-NYC Collaborative

NB: South Fork Wind is not mentioned as a milestone (Si Kinsella, June 22, 2022).

- **October 2019 Sunrise Wind LLC** (a joint venture of Ørsted A/S and Eversource Energy) for its 880 megawatt Sunrise Wind Project

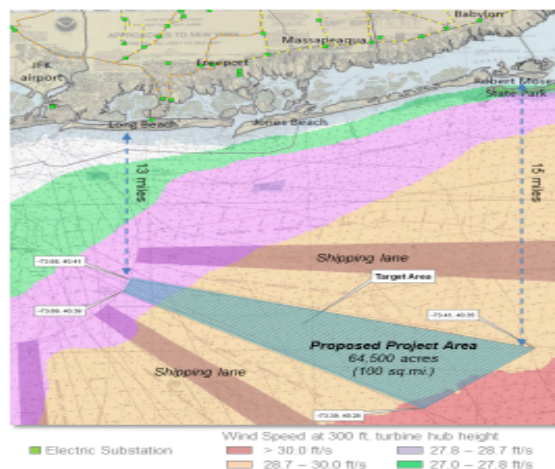
LI-NYC Offshore Wind Collaborative (OSW) Project

As NYS is becoming a national leader in renewable energy, Long Island was and is the centerpiece of that effort. The LI-NYC Offshore Wind (OSW) Project came about through a public-Private Partnership between Con Edison; Long Island Power Authority; and the New York Power Authority (the Collaborative).

Project Overview

LI-NYC Offshore Wind Project is proposed 13 – 15 miles offshore in federal waters

Capacity	350 – 700 MW developed in phases
Location	Outer Continental Shelf away from shipping lanes
Water depth	60 – 120 ft.
Distance	13 – 15 miles offshore
Wind speeds	28 – 30 ft/s
Capacity factor	30 – 35%
Interconnection	
350 MW	Con Edison North Queens, LIPA Rockaways
700 MW	Con Edison East Queens (new), LIPA Rockaways



In September 2008, there was an initial Working Group established (Con Edison & LIPA) to work on and complete a Joint Feasibility Study to determine whether an offshore wind project would be able to interconnect into respective utility service territories. Based on this initial study of 350 megawatts and 700 megawatts of offshore wind being generated, it was determined that the utilities could, with interconnection and system upgrades, interconnect this renewable generation resource.

Joint Feasibility Study Completed March 2009

Project can be interconnected into Con Edison and LIPA systems

Onshore connection

- Underwater cable and new onshore substation will be part of project development
- Construction of a 13-15 mile underwater cable is feasible

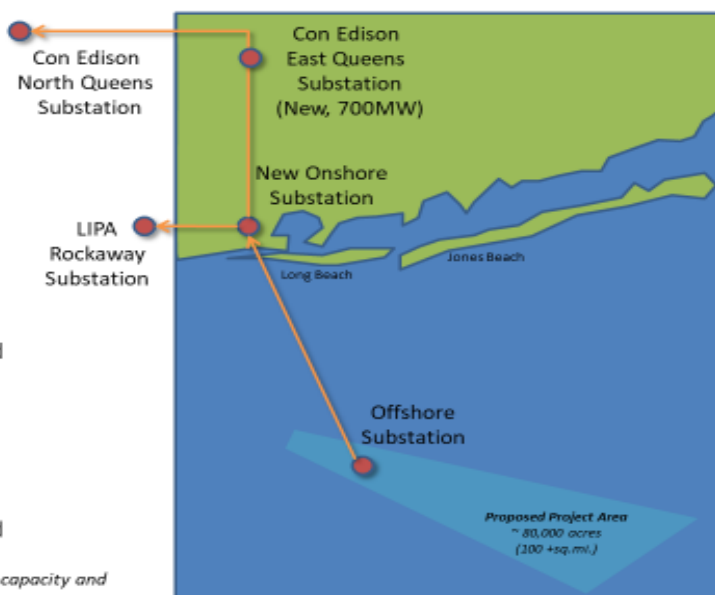
350 MW project

- No new utility substations required
- New 138kV underground cables
- \$400 million upgrades estimated

700 MW project

- New Con Edison substation required
- New 138kV underground cables
- \$800 million upgrades estimated

System interconnection costs are driven by project capacity and are not a function of distance from shore.



LIPA Con Ed Transmission Feasibility Study

- The study evaluated the necessary transmission reinforcement required for 350 megawatts (Phase I) and 700 megawatts (Phase II) of offshore wind generation
- Objectives include:
 - Best interconnection sites
 - Best transmission paths
 - Cost estimates for transmission reinforcement
 - Actual transmission reinforcement
 - Real/Reactive Power
 - Power Flow
 - Short Circuit cases

Phased Approach to Interconnection Study

Phase I Interconnection Upgrades: For a wind power installation up to 350 MW with one new onshore receiving station to transmit power to both utilities

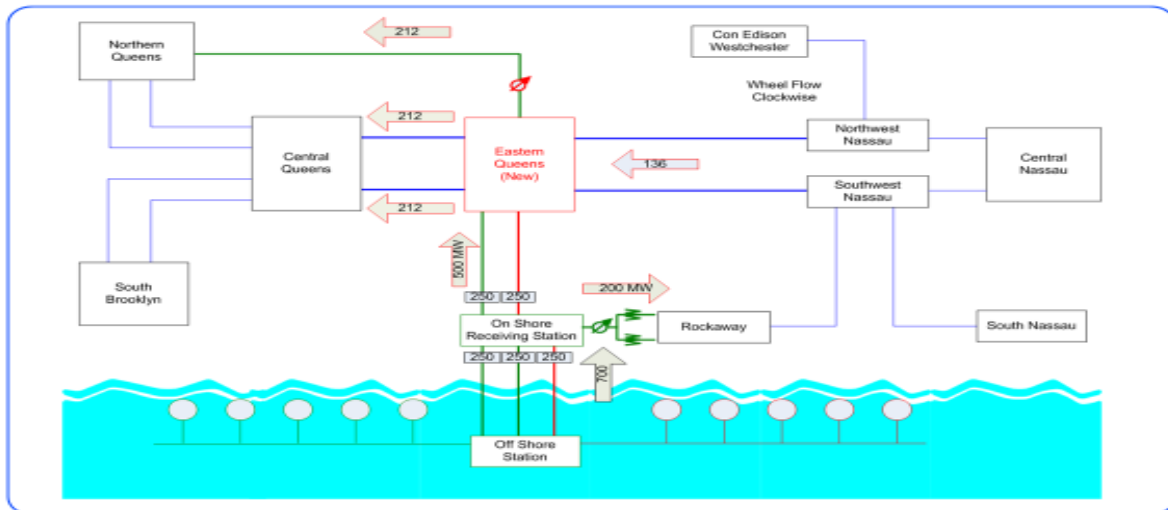
- One new 138 KV Transmission line from the onshore receiver station to an existing ConEd station in northern Queens. The line is purposely routed near the site of a planned station anticipated for Phase II.
- One new connection to the LIPA transmission system in the vicinity of the Rockaways, including a phase angle regulator to control power flow to both utilities.

Phase II Interconnection Upgrades: Increase wind capacity from 350-megawatt-to-700-megawatt offshore wind project to transmit power to both utilities

- One new 138 KV Transmission Station in Queens
- Reconfiguration of the Phase I Con Edison transmission line so that it connects through the new station, with the addition of one phase angle regulator for control of power flow within Queens

- One additional transmission line from the onshore receiver station to the new station in Queens
- Reconfigure 2 existing transmission lines between LIPA and ConEd so that they connect through the new station in Queens. These Ties are already Phase Angle Regulated
- One new connection from the onshore receiver station to the LIPA transmission system in the Rockaways

Power Flow For Phase II



As depicted above Phase 2 Interconnection would be accomplished by:

- Project will be connected to LIPA's 138 kV Transmission system
- 138 kV Onshore Receiving Station located near the existing 69 kV substation
- The Offshore Project will be connected to the Receiving Station via three 138 kV AC Submarine cables that are approximately 15 miles long
- From the new substation in vicinity of the Rockaways, there will be connections to LIPA's 69 kV substation via two 224 MVA, 138-69 kV step-down transformers and a 400 MVA Phase Shifter; and two new 138 kV transmission cables to Con Edison's new 138 kV substation in Queens.

The purpose was to also evaluate the impact of the project on the reliability of both the bulk power system and the local transmission system

- Study Scope was the NYISO Queue (found on NYISO's website)
- Study Period was based on year 2014 power flow base cases from the NYISO 2009 FERC 715 Filing

Criteria, Methodology & Assumptions



Study Area:

- Evaluated the impact of the Project on the following local transmission facilities:
 - ▶ Facilities 69 KV and above at and in proximity to the studied 138 KV Substation
 - ▶ Bulk Supply system in the following zones:
 - Long Island (Zone K)
 - New York City (Zone J)
 - Dunwoodie (Zone I)



- **Base Case Conditions:**
- Preliminary impact of the project was evaluated for summer peak load conditions for the following Base Case conditions:
 - Case 1: Base case without the project. This includes the proposed queued projects listed in the study scope.
 - Case 2: With Project Modeled. The project is modeled as in service at full output. Project was dispatched along with existing generation.

Criteria, Methodology & Assumptions



Study Area:

- **Contingencies:**
 - ▶ Facilities 69 KV and above at and in proximity to the studied 138 KV Substation
 - ▶ Bulk Supply system in the following zones:
 - Long Island (Zone K)
 - New York City (Zone J)
 - Dunwoodie (Zone I)



There was a Preliminary Feasibility Study Analysis and Desktop Studies to demonstrate offshore wind project viability:

- Technical: Can the project be built?
 - Distance from shore
 - Electrical interconnection
- Environmental: Can potential impacts be mitigated?
 - Avian and marine habitats
 - Geotechnical and met-ocean
- Economic: What will the power cost?
 - Estimated costs and market benefits
 - Job development
- Community: Will the community support the project?
 - Visualizations
 - Coordinated outreach approach

Following are the results of the analyses, which may be found at <http://www.linyc offshorewind.com>

Preliminary Feasibility Study Analysis: Technical

No fatal flaws have been identified

Issue	Results of Analysis
Water Depth	Water depths in the proposed location range from 60 - 130 ft (18 - 40 m). Existing installations are as deep as 130+ ft (40+ m).
Distance from Shore	European installations are operating at similar distances offshore, including one located 15 miles offshore of the Netherlands.
Shipping Lanes	Desktop reviews showed no fatal flaws. US Coast Guard identified some existing uses in proposed project area.
Commercial Aviation	No aviation issues were identified that would constitute a fatal flaw. Aircraft fly at a minimum height of 3,000 ft (900 m) when passing over the proposed project site. Further investigation required for potential radar interference concerns.
Commercial and Recreational Fishing	Turbines are expected to be spaced one-half to one mile (0.8 - 1.6 km) apart. Risks to electrical cables and subsurface components need to be assessed when considering dredging and trawling activities within the array. However, the fishing community may pose the greatest resistance.

Preliminary Feasibility Study Analysis: Environmental

Issue	Results of Analysis
Avian	No avian-related fatal flaws were identified at this stage. Additional baseline studies will help characterize expected impacts, identify candidate mitigation measures, and inform the Environmental Impact Study (EIS).
Marine Species & Habitats	Although some impacts to local ecological natural resources are possible, desktop review did not identify any fatal flaws that would currently preclude development.
Geophysical Features	No fatal flaws were identified, and sub-bottom conditions are expected to be compatible with a variety of foundation technologies. Follow-on studies are recommended to enhance site-specific information.

Preliminary Feasibility Study Analysis: Environmental

Issue	Results of Analysis
Met-Ocean Conditions: Wind Speeds	Wind speeds are typically stronger at 13 - 15 miles offshore than closer to shore. Expected average wind speeds and project capacity factors (34 - 43%) are consistent with European offshore projects.
Met-Ocean Conditions: Turbines	Commercially-available offshore turbine technologies are compatible with anticipated average and extreme meteorological and oceanographic conditions in the project area.
Met-Ocean Conditions: Wave Heights	Predicted extreme wave heights will not be as severe as at some European projects, and loads from wind, waves and ocean currents can be addressed by designing system components accordingly.
Noise	Sound from turbine operation will not be audible 13 - 15 miles offshore.

Feasibility Study Results: Community & Visualization

Community opposition less likely with site 13-15 miles offshore

- Turbines are barely visible even from the closest points onshore on a clear day.
- Visualization must be magnified 300% to make the turbines visible in image below.



Feasibility Study Analysis: Economic

Two economic feasibility studies are in progress

Cost Analysis Study

- Estimate of capital cost and recovery requirements is in progress
- Comparison to renewable energy alternatives installed in NYC and Long Island to be included

Economic Impacts Study

- Desktop study of ports available for construction and operation is in progress
- Quantification of temporary and permanent, direct and indirect jobs associated with project sizes of 350 MW and 700 MW to be included

Additional Benefits

- Would result in a meaningful level of renewable resources that directly interconnect into the New York City and Long Island electric systems versus alternatives
- Increased energy and capacity market benefits due to connection in Zones J and K
- Will displace fossil fuel units, reducing air emissions in non-attainment zone

The Collaborative's study (<http://www.linycoffshorewind.com/econstudy.html>) demonstrated that the proposed wind farm of up to 350 megawatts, potentially growing to 700 megawatts to be located 13-to-17 miles off the coast of the Rockaway Peninsula and Long Island, could create up to \$2.7 billion in new

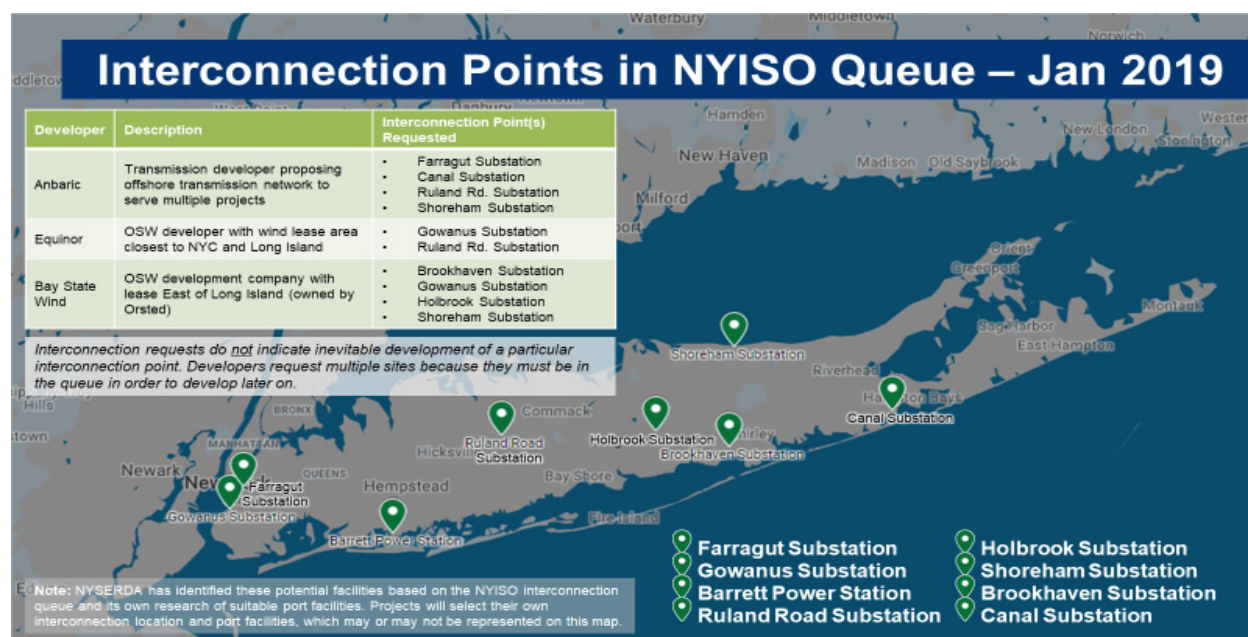
economic activity, including 2,300 to 4,700 jobs during construction and 85 to 170 permanent jobs, depending on project size.

In addition, the project would:

- Achieve a meaningful level of renewable resources located in the downstate “load pocket” that directly interconnects into the New York City and Long Island electric systems
- Displace local fossil fuel generation, reducing air emissions in non-attainment zone
- Wind and other renewable energy sources will provide stable prices for customers, i.e., no fuel price volatility

Following on the Collaborative’s efforts, since 2016, NYSERDA has been conducting research, analysis, and outreach to evaluate the potential for offshore wind energy. This research led the development of the New York State Offshore Wind Master Plan (Master Plan), a comprehensive roadmap and suite of more than 20 studies for the first 2,400 megawatts of offshore wind energy that encourages the development of offshore wind in a manner that is sensitive to environmental, maritime, economic, and social issues while addressing market barriers and aiming to lower costs.

An important component that picks up on the Collaborative’s efforts is the following insert that highlights interest in and interconnection points that are in the NYISO que:



To help facilitate the development of and the transformational opportunities associated with offshore wind, NYS is making significant financial investments.

Workforce Development & Infrastructure Advancement

New York State is investing



\$200 million
in port infrastructure



\$10 million
in workforce development

LIPA Trustees Approve Contract with Deepwater Wind, LLC for Energy Output From the South Fork Offshore Wind Farm

In February 2017, the LIPA Board of Trustees approved a contract with Deepwater Wind, LLC for the energy produced from the 90 megawatt (which has been increased to 130 megawatts) South Fork Offshore Wind Project, which is in a federally approved lease area approximately 30-miles off Long Island's East End from among 20 other proposals. Deepwater Wind, LLC was selected in response to PSEG-Long Island's 2015 South Fork Resources Request for Proposals.

This twenty-year power purchase agreement with Deepwater Wind LLC will interconnect and deliver 130 megawatts of renewable power from approximately 15 turbines to the South Fork of Long Island. As this area is a load pocket that is seeing growth in electric use, this project was approved to help LIPA meet both the increasing electric usage on the South Fork and help meet LIPA's renewable energy goals.

The project, which will be located approximately 30 miles off Montauk is expected to be operational in December 2022. LIPA noted in its selection of the offshore wind farm that *[it] was part of the least cost package of solutions to meet the South Fork's growing energy needs and New York's clean energy goals.*

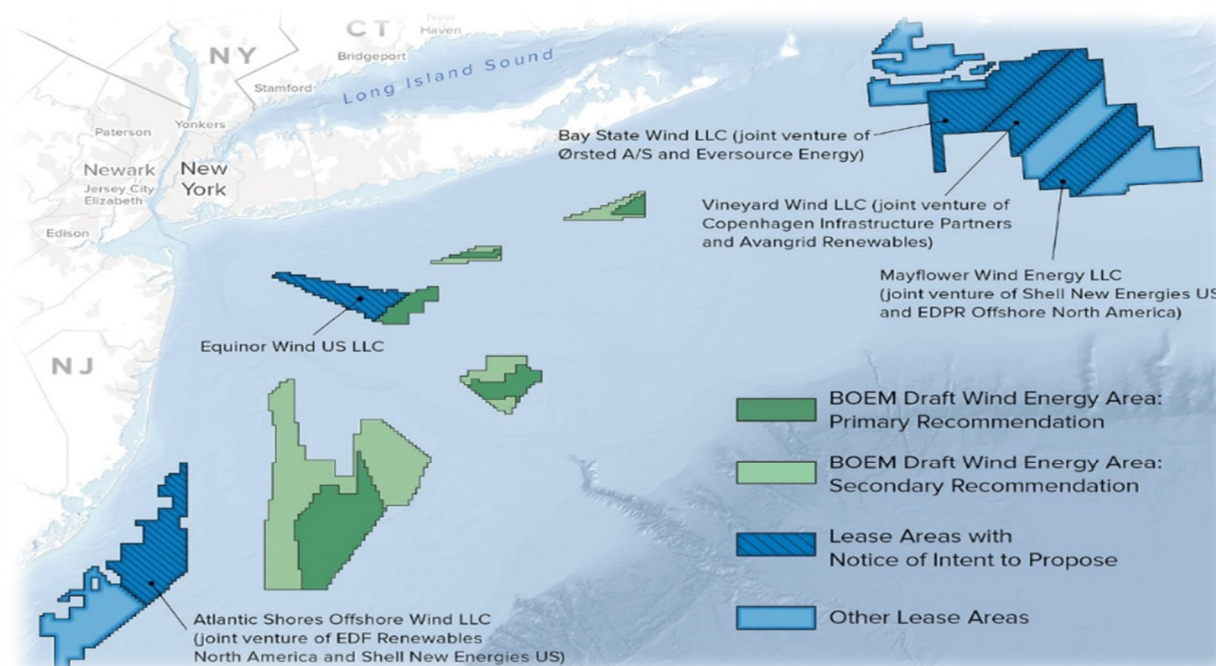


Deepwater's initial proposal that was accepted by LIPA Trustees:

- 15-Turbine wind farm will deliver 90 megawatts of clean energy to an area on Long Island that needs more power
- Interconnected to East Hampton substation
- Target COD date is December 2022
- Existing PPA dated February 6, 2017
- Nominally 90MW (15 x 6 megawatt Turbines)
 - Flexibility for larger turbine sizes – Maximum total permitted 98MW.
- Expected annual delivered energy 371,604 MWh
- Starting price \$160.33/MWh, average annual escalation approximately 2%
- 30 miles offshore – out of sight from Long Island beaches

LIPA, in November 2018, announced that it would also contract for an additional 40 megawatts from Deepwater Wind:

- Use of larger turbines to increase capacity by 32MW to 40MW while maintaining 15 turbines in total
- Expected additional annual delivered energy up to 165,157 MWh
- Will use original contract's undersea cable and interconnection to East Hampton substation
- Expansion starting price \$86.25/MWh with same escalation as original contract.
- Original contract remains unchanged
 - Turbines dedicated to supplying products under the original contract terms will be separately metered
 - Remaining turbines supply the Expansion Products under the terms of the proposed amendment

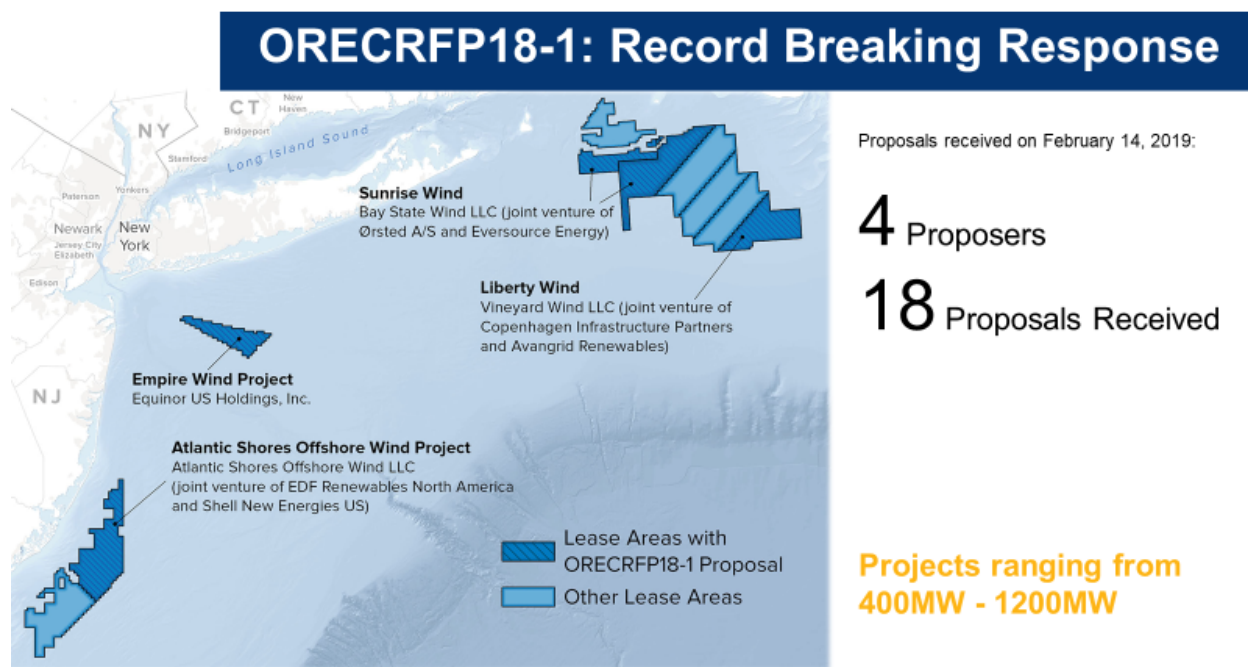


While LIPA has initiated the first offshore wind development in the State, NYS is committed to building 9,000MWs of offshore wind enough to power up to 6 million homes:

- Clean, locally produced power where demand is highest
- Significant investments in infrastructure and communities along New York's coasts and in the Hudson Valley
- Billions of dollars in private sector investment and infrastructure upgrades
- The opportunity for thousands of short- and long-term skilled construction, manufacturing, and operations jobs
- Diversified electricity supply
- Avoid unhealthy greenhouse gas emissions

To start the path to achieving 9,000 megawatts of offshore wind as set out in the Climate Leadership and Community Protection Act (CLCPA), NYSERDA issued a solicitation for offshore wind in November 2018. The law requires the State to achieve a 100% carbon free electricity system by 2040 and to reduce greenhouse gas emissions 85% below 1990 levels by 2050, that at least 70% of New York's electricity come from renewable energy sources by 2030 and calls for the development of 9,000 megawatts of offshore wind energy by 2035 setting a new standard for states and the nation to expedite the transition to a clean energy economy.

New York's first procurement garnered an extremely competitive market response where NYSERDA selected and contracted with two offshore wind project proposals, totaling nearly 1,700 megawatts; Empire Wind (816 megawatts) and Sunrise Wind (880 megawatts).



The offshore wind projects proposed by developers is compartmentalized and summarized in the two inserts below:

Highlights from Public Versions - I

Category	EDF RE Inc. <i>Atlantic Shores</i>	Bay State Wind LLC <i>Sunrise Wind</i>	Equinor Wind US LLC <i>Empire Wind</i>	Vineyard Wind LLC <i>Liberty Wind</i>
Lease Area	OCS-499	Located "in the same lease areas" as the South Fork and Revolution Wind projects	Lease area can support 2 GW; OCS-A 0512	OCS-A 0522
Capacity			408 MW/816 MW	400/800/1200 MW
Interconnection	Interconnect in NYCA	LIPA point of interconnection	Connect directly in NYCA	Interconnection Plan: Ruland Road 138 kV Substation (Melville, NY / Zone K); can handle injections of 800 MW or more of offshore wind energy without deliverability constraints and/or upgrades; HVDC export cable to a grid; Landfall at Jones Beach; the Project's onshore cable will be buried entirely under existing public roads and utility rights-of-way;
Foundation Type	Monopiles and transition pieces	Monopiles and transition pieces	Potential for gravity-based, monopile or jackets	Monopile or Jacket
Corporate Structure	50/50 JV between EDF-RE and Shell	50/50 JV between Orsted and Eversource	100% owned by Statoil	Owned by two funds managed by Copenhagen Infrastructure Partners P/S (CIP) and Avangrid Renewables LLC (Avangrid Renewables)
Key Partnerships		ConEd (Wet Transmission) & NYPA (Dry Transmission)		Anbaric (transmission)
Financing	Provide evidence of financial strength and note that the Proposal is expressly not contingent on receipt of the PTC or the ITC	Orsted and Eversource will both source their portions of the capital contributions to the Project from internally generated cash flow		Vineyard Wind will provide the required security by way of parent guaranty, bank letters of credit, or cash-on-hand security provided by the parent companies in the form of equity capital

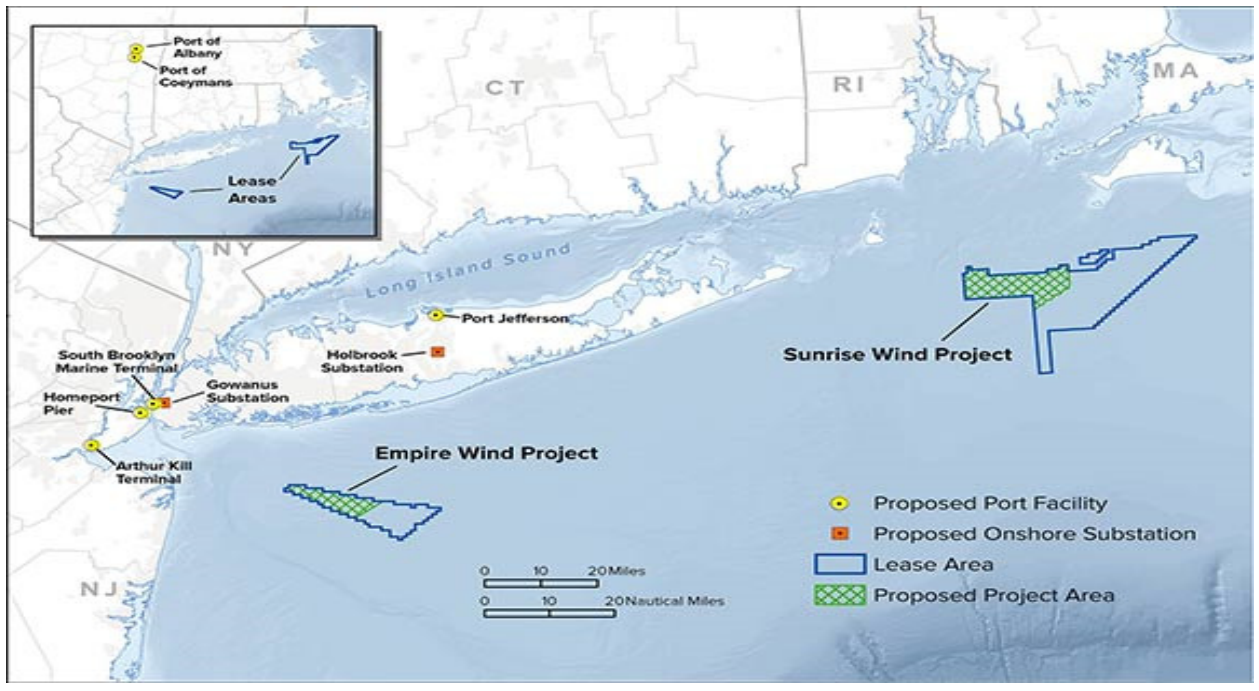
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Highlights from Public Versions - II

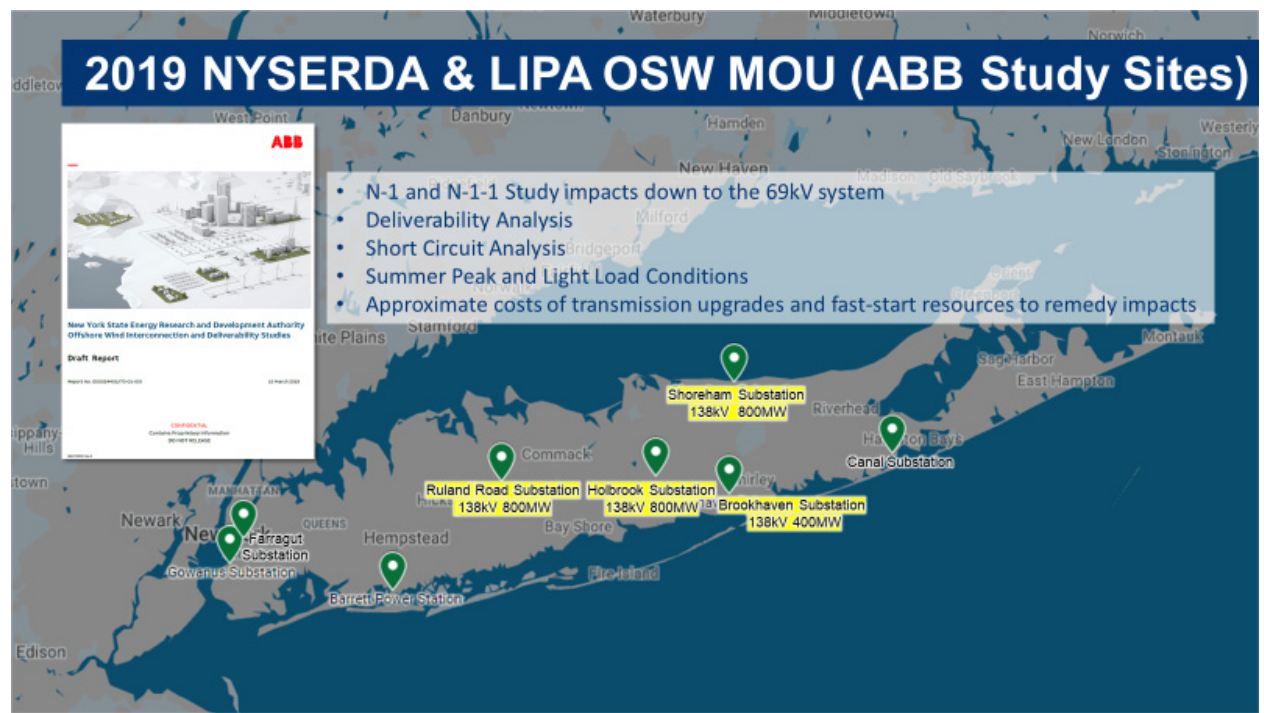
Category	EDF RE Inc. <i>Atlantic Shores</i>	Bay State Wind LLC <i>Sunrise Wind</i>	Equinor Wind US LLC <i>Empire Wind</i>	Vineyard Wind LLC <i>Liberty Wind</i>
Visibility/Viewshed	The distance in statute miles between the nearest shoreline point and the nearest offshore wind generation facility turbine is approximately 8 miles. The closest distance to the nearest large city, Atlantic City, is 25.78 miles	The Project is located far from shore and will have minimal impact on the view of New York State residents. The closest inhabited shore to the Project's WTGs is Block Island, RI, and the closest point from NYS is Camp Hero State Park, which is well outside of the 20 statute mile area of concern; Visual simulations are public	Visibility simulations available	85 miles east of Montauk; all of the Project's wind turbine generators will not be visible from any land-based location in New York
Letters of Support	No documentation of public support in the form of letters from public officials, newspaper articles, or otherwise, is yet available. There is, however, extensive support for the Project from the supply chain, as outlined in the letters of support attached hereto as Attachments 7 to 23		Senator Kaminsky; Assembly Member Cusick; County Executive Curran; County Executive Bellone; Mayor Smith, Village of Nissequogue; Consul General Berg; Wildlife Conservation Society; Atlantic Marine Conservation Society; Captain Paul Eidman (New Jersey); Captain John McMurray (New York); Ellen Redmond, IBEW Women in Renewable Industries and Sustainable Energy; Nassau and Suffolk Building and Construction Trades Council; Triple Five Stony Brook University; Farmingdale State College; ULC Robotics; Edgewise Energy; Amato Law Group	*Adrienne Esposito, Citizens Campaign for the Environment *Wendy Northcross, CEO, Cape Cod Chamber of Commerce *Moncrieff Cochran, Executive Director, Cape Cod Climate Change Collaborative *Dorothy McIver, Greening Greenfield *Alex Papali, Clean Water Action

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The map below shows the lease areas of the two awarded projects, Empire Wind and Sunrise Wind, which are along Long Island's southern coast. The Sunrise Wind project will be interconnecting into LIPA's electric system and Empire Wind will interconnect into ConEd's system.



And, in a cooperative endeavor NYSERDA and LIPA have joined together to undertake an additional study to look at interconnection opportunities and impacts on the electric system that is due to be released by the end of 2020.



Conclusion

The financial resources provided through this Congressionally Directed Project have helped to realize NYS first offshore wind project, potentially the first project in a federally leased area, and to enhance LIPA's efforts at studying and advancing a 21st century electric system that is resilient, reliable, and cleaner that

will incorporate analyses and evaluation that will facilitate the development, installation and implementation of a significant injection of offshore wind.

LIPA's commitment to the LI NYC Offshore Wind Collaborative and subsequent efforts to developing offshore wind and the initial studies have brought a burgeoning industry to our shores. Through the CLCP mandate of 9,000 megawatts of offshore wind and NYSERDA's commitment to a second procurement later this year, there will be continued growth in the nation's and New York's clean energy economy as we work to achieve the aggressive clean energy goals advanced by State and Federal officials.
