Joint Con Edison – LIPA
Offshore Wind Power Integration Project
Feasibility Assessment

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Executive Summary:

This report summarizes the findings with respect to a critical aspect of a recently announced joint initiative to investigate the potential of renewable energy. Engineers from Con Edison and LIPA combined forces to determine the feasibility of their transmission systems to connect with and support a large source of new wind power to be located off the south shore of Long Island.

The joint study evaluated the necessary electric transmission system requirements that would be required to obtain wind power in increments of 350 MW, an amount that is equivalent to a moderate fossil power generating facility. This initial phase of the project focused only on the necessary electric transmission required for the on-shore portion of the project. The infrastructure and costs for the anticipated offshore wind and transmission to landfall have not yet been evaluated.

The study determined the following:

> For a wind power installation up to 350 MW, a new transmission line from an on-shore receiver station to an existing station in northern Queens, combined with a connection to the LIPA transmission system in the vicinity of the Rockaways, is optimal from a simplicity and cost perspective.
>
> For a phased wind power installation greater than an initial amount of 350 MW, it would be necessary to build new transmission lines from an on-shore receiver station to a new substation in the vicinity of eastern Queens, combined with a connection to the LIPA transmission system in the vicinity of the Rockaways. In addition, existing transmission lines between LIPA and Con Edison would be reconfigured to connect at the new station, allowing each utility its full access to the wind power. This configuration provides deliverability, reliability, and synergies for future growth and expansion.

Beneficial Environmental Impact

A 350 MW wind facility operating at 30% capacity factor would generate about 920,000 megawatt-hours per year, enough energy for over 250,000 homes.

The New York Public Service Commission estimates that every megawatt-hour of displaced fossil power in the state is equivalent to 900 pounds of carbon dioxide or CO_2. Therefore, a wind facility of this size would displace 400,000 tons of CO_2 annually, equivalent to removing 68,000 cars from local roads.

New renewable resources will help meet the New York State Renewable Portfolio Standard (RPS) and expected federal renewable energy goals and provide for added fuel diversity.

Background Information

An interest in reducing the use of fossil fuels for electricity production has generated interest in all types of renewable energy options. For New York City and Long Island, the potential use of offshore wind power appears to be a renewable resource that could provide a significant amount of clean energy to consumers. The practical aspects of harnessing wind and assessing the cost of putting a successful wind project into commercial service are the subject of this study.

In theory, any successful wind generation project for the New York metropolitan area must be centralized and large enough to be cost effective. It must interact with the electric grid at a high-voltage transmission level, and provide power on the order of hundreds of megawatts (MW). It must also be close enough to where electricity is used, so that energy can be harnessed economically due to lower transmission costs.

A New York City - Long Island area wind project warrants an offshore location due to the sheer size and number of wind turbines, coupled with the availability of strong, consistent and unobstructed wind. Wind's relative low-energy density makes it necessary to build large wind turbines in order to generate reasonable amounts of wind power.

An offshore wind facility of this size has distinct advantages over inland options. Ocean-based wind power is stronger, more consistently available, and can be situated closer to New York City and Long Island in contrast to land-based wind facilities in remote regions of the state. Also, land-based wind power availability, rather than that of offshore facilities, tends to drop off during the hottest part of a summer day, which is precisely the time that Con Edison and LIPA customers use the most electricity. The higher transmission costs add to the expense of remote land-based wind power

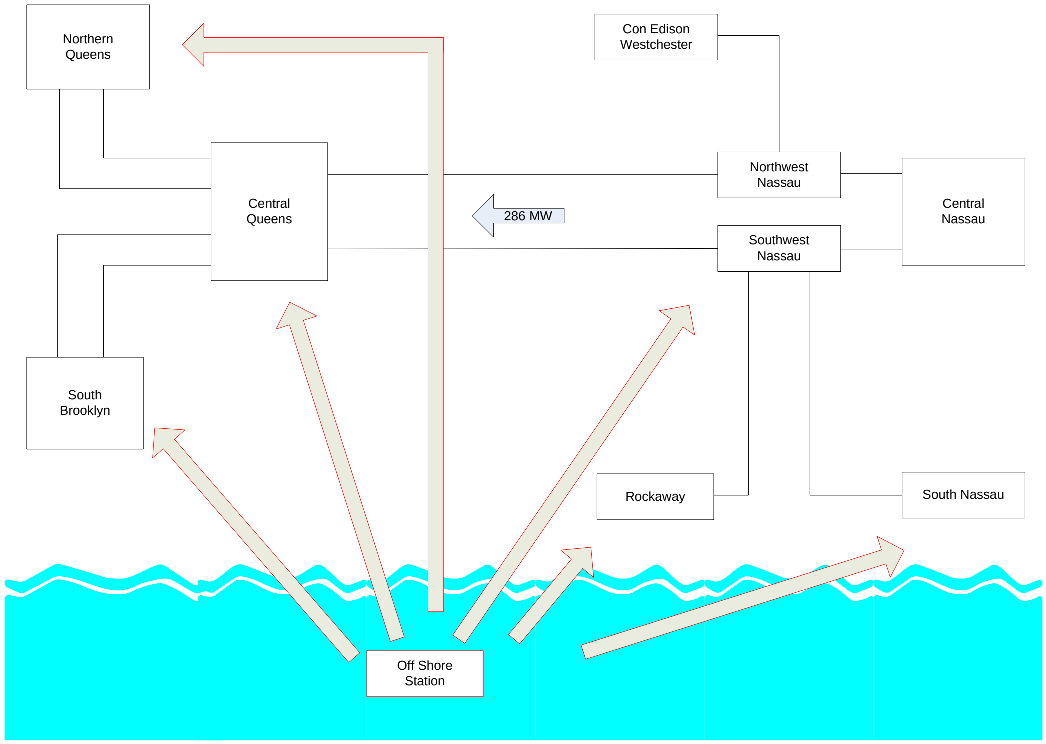
Scope and Objectives

This study evaluated the necessary transmission reinforcement required for 350 MW and 700 MW of generation. Preliminary analysis showed that more than 700 MW would require significant reinforcement in the transmission system, which would significantly increase the cost of the project.

The main objectives of this study include identifying and agreeing on the best interconnection sites, identifying the transmission paths required to deliver wind power to substations of each entity's electric system, and obtaining "order of magnitude" cost estimates for required transmission system reinforcement.

This study identifies the basic transmission system reinforcements required to deliver energy produced by a potential wind farm located off the coast of Long Island in the Atlantic Ocean with a connection to the Con Edison and LIPA electric systems.

Options Evaluated



The study considered six separate single points of interconnection. No one solution was considered to be best in all categories of reliability, cost-effectiveness and expandability. A two-phased approach with multiple points of interconnection was then considered.

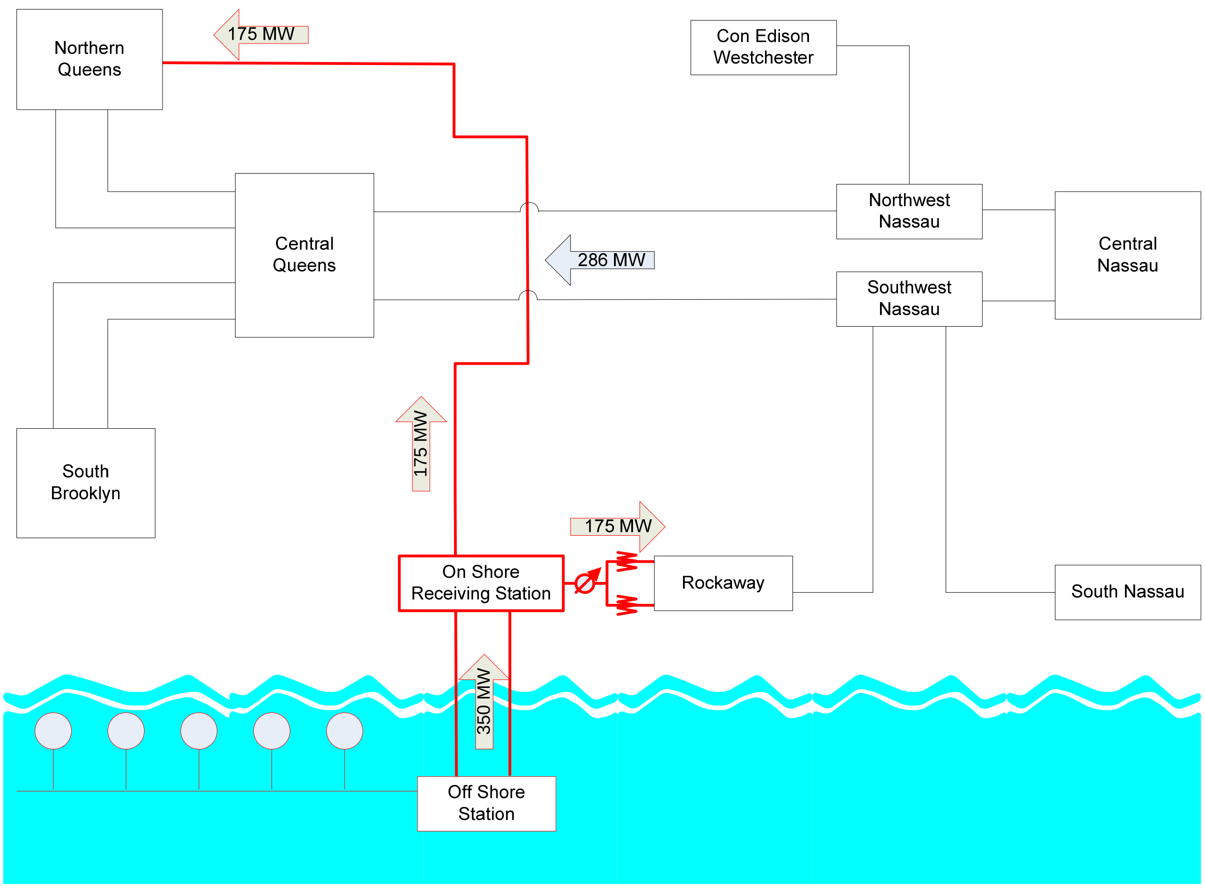
The phased approach has several advantages over the individual options:

1. Large construction costs are distributed at roughly the same level over time. No economies of scale were observed.
2. Multiple points of entry for wind power within both utilities improve flexibility and reliability.
3. The utilization of 138 kV voltage for this project allows for immediate and cost effective connectivity with the existing transmission infrastructure, and provides for a longer run of submarine cable to the wind farm, with minimal need for reactive compensation.
4. The location of the proposed Eastern Queens substation between Con Edison and LIPA provides opportunities for mutual support and sharing of resources, without taxing either utility's present infrastructure limitations.
5. The establishment of the Eastern Queens substation will support future electricity demand growth in the Con Edison service area, and could provide connectivity for potential future generation.
6. The power flows at each stage of development are within the existing transmission-system capabilities.

Each phase is described below in detail.

Phased-In Approach – Phase I

Phase I of the interconnection assumes the establishment of the offshore wind site with a capacity of 350 MW. New transmission would connect the on-shore station to the LIPA transmission system in the vicinity of the Rockaways, and the on-shore station to the Con Edison transmission system in northern Queens. This phase can accommodate up to 350 MW of wind power, shared equally between LIPA and Con Edison, without impacting the current interchange between the utilities. Power to the Northern Queens station will be provided on a single 138 kV feeder that is routed to pass near the location of the anticipated Eastern Queens transmission station. A spare set of conduits for this line could also be built in anticipation for a second transmission path to be established in Phase II. The following diagram shows the new infrastructure that would be installed during phase 1 in red:



The following table provides a gross order-of-magnitude estimate for the on-shore transmission Phase I infrastructure:

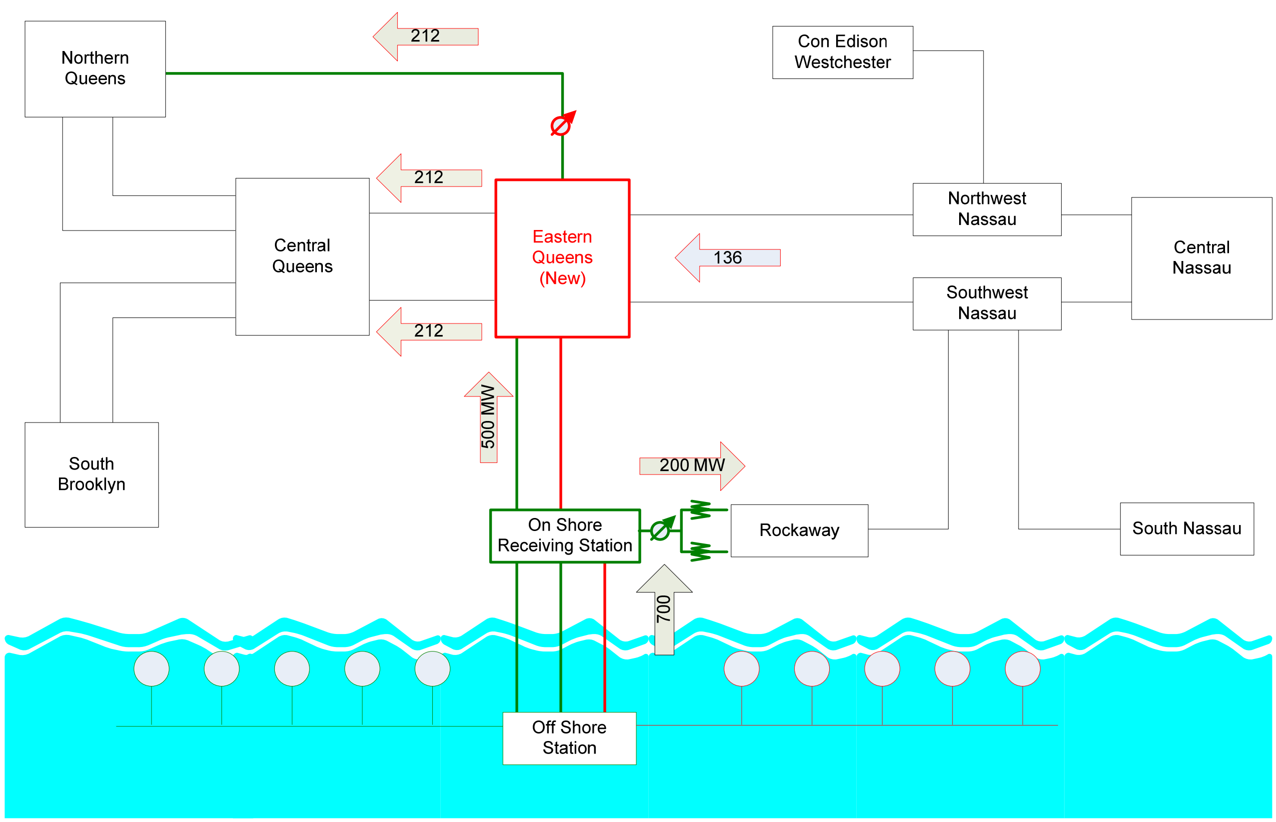
Phase I: Wind = 350 MW	Cost Description (Transmission Upgrades Only)	Costs
	Northern Queens: 2 Bus Sections, Breakers, MODs	$35
	On-shore to Northern Queens (1 Transmission path+2nd conduit)	$320
	LIPA Work At On-Shore Station	$60
	Total Phase I Costs (2009 $Millions)	**$415**

Phased-In Approach – Phase II

Phase II assumes the expansion of an existing 350 MW Phase I facility up to 700 MW. The transmission system will include a new substation at Eastern Queens. The first transmission path is cut at Eastern Queens, leaving one transmission path going to Northern Queens and one transmission path coming from the On-Shore station. A second transmission line is run in parallel to the Eastern Queens / On-Shore station line. Two existing transmission lines between Central Queens and LIPA are rerouted to be intercepted by the Eastern Queens substation. An electrical device called a phase angle regulator is required on the transmission line between Eastern Queens and Northern Queens to regulate power flows from Eastern Queens into the Con Edison system.

Phase II can accommodate up to 700 MW of wind power, shared equally between LIPA and Con Edison. Power up to 200 MW for LIPA is tapped at the On-Shore Station as in Phase I, connected to LIPA's Rockaway substation. The remaining power for LIPA will be delivered through the Eastern Queens station by reducing the current net flow from LIPA to Con Edison by 150 MW, from 286 MW to 136 MW. Power for Con Edison can be delivered through the Eastern Queens station into the Northern and Central Queens stations.

The following diagram shows the incremental infrastructure changes for phase II in red, and the previous phase I infrastructure in green:



The following table provides a gross order-of-magnitude estimate for the Phase II expansion of transmission infrastructure as well as the total cost of both phases:

Phase II: Wind = 700 MW	**Cost Description (Transmission Upgrades Only)**	**Costs**
	Eastern Queens 138 kV Station (8 Breakers)	$200
	Transmission Costs (2nd Trans Path + Reroute)	$100
	PAR for Eastern Queens to Northern Queens Tie	$30
	Redirect Con Ed - LIPA Ties thru Eastern Queens	$76
	LIPA Expansion at On-shore Station	N/A
	Total Phase II Costs (2009 $Millions)	**$406**
	Cumulative Costs (Phase I and II)	**$821**

Conclusions

The connection of a large offshore wind power facility is feasible within the context of the current transmission infrastructure of the Con Edison and LIPA utilities.

For a wind power installation with capacity up to 350 MW, utilization of the existing station in Northern Queens combined with a connection to the LIPA transmission system in the Rockaways is optimal for simplicity and cost.

For an expansion to a larger installation (up to 700 MW) the establishment of a new station in the vicinity of Eastern Queens provides additional capability to supply Con Edison and LIPA with their full share of the expanded wind facility. This solution is optimal for flexibility, reliability improvement, and synergies with future transmission opportunities.

Next Steps

Con Edison and LIPA are in the process of developing a plan to move the wind project evaluation forward. This would involve a more detailed assessment of the potential options, refinement of interconnection costs and construction plans and conducting an evaluation of the impact that a wind farm would have on grid operations. In order to gather the more detailed information that will be required to perform this assessment, Con Edison and LIPA plan to issue a Request for Information so that equipment manufacturers, wind developers and other interested parties can provide the necessary input. In addition, Con Edison and LIPA plan to initiate the process for installing wind monitoring equipment in the Atlantic Ocean to collect wind data and characteristics to support the assessment of the wind potential off of Long Island and Queens.