LOCAL TRANSMISSION PLAN

PRESENTATION TO NYISO / INTERESTED PARTIES

November 3, 2017

Transmission Planning

PSEG LONG ISLAND

We make things work for you.

LTP Contents: Topics that will be Covered

- Overview of LIPA T&D
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  - Transmission System
  - REV Initiatives/Utility 2.0
- Key Factors Considered
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  - Long Island Load Pockets
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Background

- LIPA owns electric Transmission and Distribution (T&D) system on Long Island
- Acquired from LILCO in 1998
- Power Supply Agreement to meet capacity and energy needs for LIPA system with National Grid renewed in 2013, out to 2028
- Operation Service Agreement to manage electric operations for LIPA's system for 12 years starting January 2014 with PSEG Long Island.
- LIPA, by and through its agent, PSEG Long Island LLC, provides electric service to approximately 1.1 million LIPA customers
- LIPA service area includes Nassau County, Suffolk County, and the portion of Queens County known as the Rockaways, in the State of New York

Transmission System

- LIPA's transmission system is designed to provide adequate capability between generation sources and load centers.
  - Over 1,370 miles of transmission (345 kV, 138 kV) and sub-transmission lines (69 kV, 34.5 kV, 23 kV), delivering power through 179 substations in its electric system.
- Interconnections:
  - Two 345 kV
    - Con Ed: Y49 (NYPA) 637 MW, East Garden City to Sprain Brook (NYISO-BPS)
    - Con Ed: Y50 (LIPA/Con Ed) 653 MW, Shore Road to Dunwoodie (NYISO-BPS)
  - Three 138 kV:
    - ISONE: NNC (LIPA/ES) 436 MW, Northport to Norwalk Harbor
    - Con Ed: Lake Success to Jamaica (903) and Valley Stream to Jamaica (901), Total 300 MW wheel
  - Two HVDC:
    - PJM: Neptune 660 MW, Newbridge Road to Sayreville
    - ISO-NE: CSC 330 MW, Shoreham to New Haven

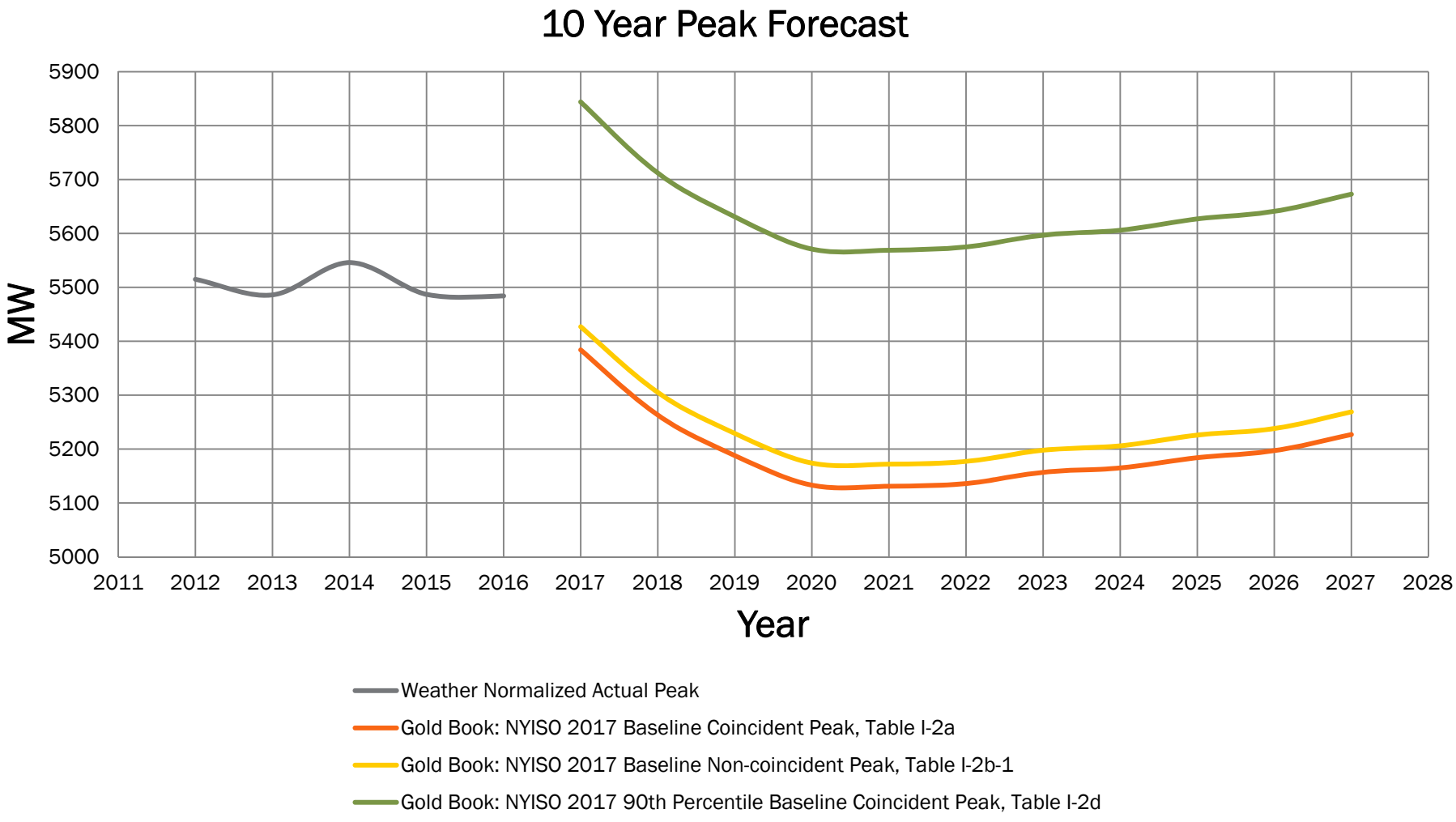
REV Initiatives/Utility 2.0

- South Fork Projects
  - Offshore Wind Energy Project (90 MW)
  - East Hampton and Montauk Energy Storage Projects (5 MW each)
  - Direct Load Control and Energy Efficiency measures (8.2 MW of relief)
- Yaphank Load Reduction Projects
  - Fuel Cell Resources: Feed-in Tariff IV program (~40 MW)
- Smart Wires – Whiteside Project
  - Modular power flow control to mitigate thermal constraints on 69 kV overhead circuit
- http://www.lipower.org/pdfs/company/trans/2017-09-08%20-%20PSEG%20LI%20-%20Utility%202.0%202017%20Annual%20Update_complete.pdf

Key Factors Considered

- Load Growth
- Transmission Planning Criteria
  - PSEG LI Transmission Planning Criteria
    - https://www.psegliny.com/files.cfm/TransmissionPlanningCriteria.pdf
  - Ensure that electric system will meet applicable reliability requirements (NERC/NPCC/NYSRC)
- Targeted Resource Additions
  - South Fork Projects
  - Yaphank Load Reduction Projects
- Local Dispatch Guidelines
  - Gas Burn Reliability Rules & Transient Recovery Voltage
  - Load Pockets

Planning Horizon



Data Sources

- Load Forecast
- NYISO - The Major Source of Base Cases used in Modeling
  - Load Flow
  - Fault Duty
  - Stability
- Generator Owners/HVDC/FACTS Developers
  - MW/MVAR Capability
  - Modeling Characteristics
- Internal Sources
  - EMS Data – PI Historian
  - Equipment Characteristics (e.g., Engineering, Operations)

Models - Major Tools Used

- Thermal / Voltage Analysis
  - PSS®E : Siemens Power Technologies International's (PTI) Power System Simulator-
    - Transmission system load flow; thermal, voltage under normal and contingency conditions
  - TARA : PowerGEM's steady state power flow software tool
    - Load flow studies, N-1-1 power flow analysis and system operating limits analysis
  - MAPS™ : General Electric's (GE) Multi-Area Production Simulation
- Fault Duty
  - ASPEN™ : Advanced Systems for Power Engineering, Inc.; Short circuit analysis program
    - Breaker fault duty analyses
- Stability
  - PSS®E : Siemens Power Technologies International's (PTI) Power System Simulator
    - System Dynamic Simulation
  - Complex Load Model used for Transient Voltage Recovery Studies
- Other
  - Python: Software language utilized for automation of various analysis and data management

Planning Process

- The planning process for the T&D System begins with the load forecast.
- Transmission System Studies: Identify transmission system limitations and recommend reinforcements for an area of the system.
  - Results in the development of major transmission capital projects.
- Limiting load level and year at which this load level is reached are critical factors

Study Overview

- Seasonal Studies
  - System Operating Studies (Summer & Winter) – Highlight system limits/ deficiencies and recommend solutions for the upcoming peak season
  - Operating Guidelines – Provide information to Transmission Operations to address thermal, voltage, or short circuit constraints
- Short Term, Near Term, & Long Term Studies (Current year, Five year, and 10 year assessments)
  - Area Studies –Identify area constraints and recommend solutions
  - Five and Ten year Transmission development plan – Ensure the design of the LIPA transmission system conforms with applicable reliability criteria over the planning horizon
- Compliance Studies
  - Studies to address requirements of NERC reliability standards (NERC TPL-001-4, TPL-007, FAC-014 and FAC-002-2)

Study Overview – Other Major Studies

- NYISO Interconnection Process
  - To assess the impact on the LIPA transmission system of proposed new generation or transmission interconnections
- Short Circuit Study
  - Ensures that there are no overstressed circuit breakers
- Angular Stability Study
  - Ensures that electric system will meet system stability design criteria
- Voltage Recovery Evaluation
  - Impact of load types and resource dispatch
- NYISO coordination efforts
  - RNA, Deactivation studies, etc.

NYISO Interconnection Requests / Ongoing Efforts

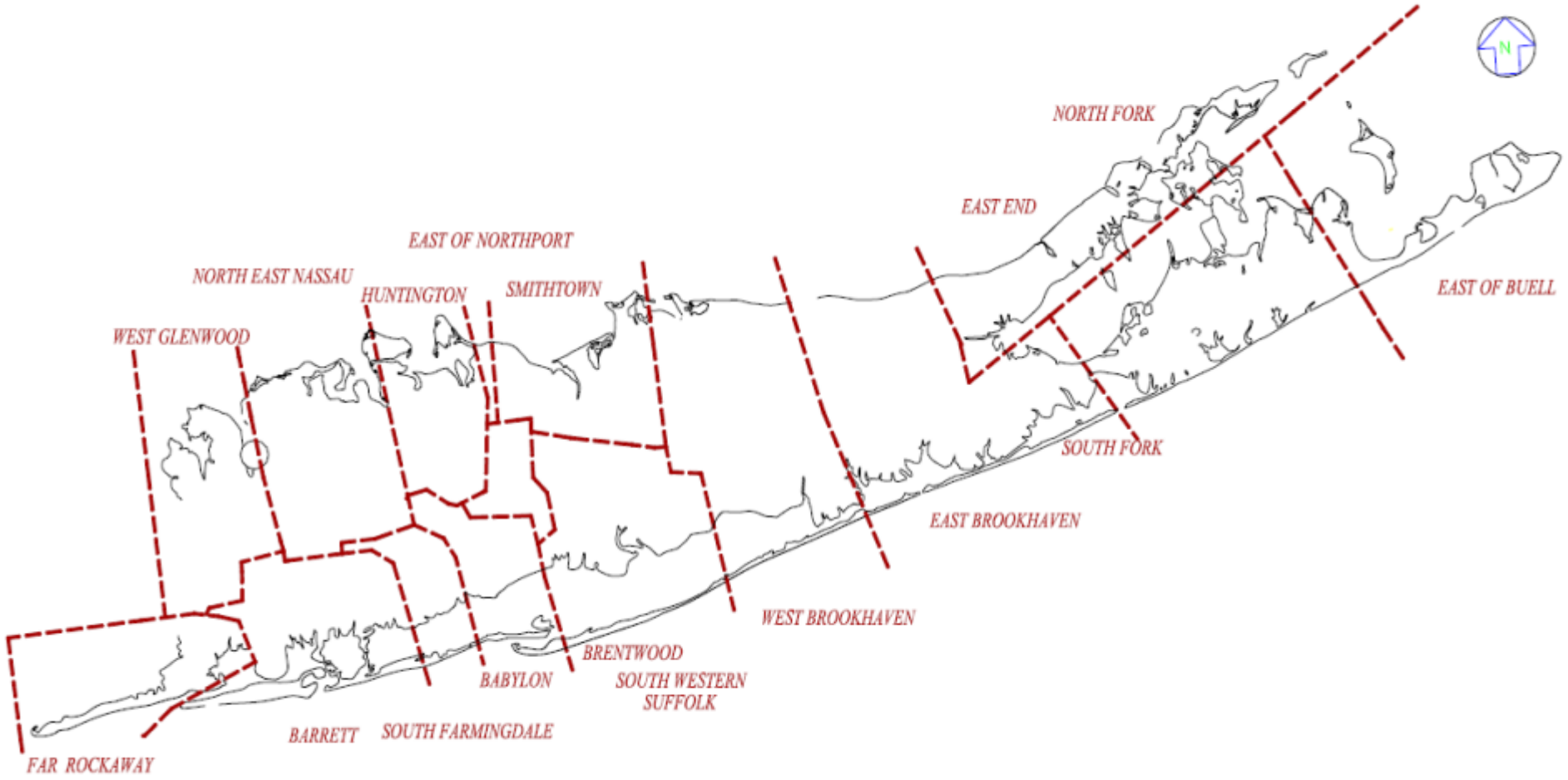
Queue Pos.	Owner/Developer	Project Name	Date of IR	SP (MW)	WP (MW)	Type/ Fuel	Location County/State	Z	Interconnection Point	Utility	S	Last Update	Availability of Studies	FS Complete/ SGIA Tender	Proposed In-Service	Proposed COD
363	Poseidon Transmission 1, LLC	Poseidon Transmission	4/27/11	500	500	DC	NJ - Suffolk, NY	K	Ruland Rd. 138kV	LIPA	10	7/31/17	FES, SRIS, FS	02/02/2017	2020/03	2021/01
401	Caithness Long Island II, LLC	Caithness Long Island II	3/22/13	599	632	CC-D	Suffolk, NY	K	Sills Road Substation 138kV	LIPA	8	6/30/17	SRIS		2018/04	2019/05
467	Invenergy Solar Development, LLC	Shoreham Solar	12/22/14	25	25	S	Suffolk, NY	K	Ridge - Wildwood 69kV	LIPA	9	3/31/17	SRIS		2018/06	2018/06
473	Calverton Solar LLC	Calverton Solar	1/21/15	10	10	S	Suffolk, NY	K	Riverhead - Wildwood 69kV	LIPA	5	12/31/16	FES		2017/Q3	2017/Q3
477	Riverhead Solar Farm LLC	Riverhead Solar	2/18/15	20	20	S	Suffolk, NY	K	Edwards Substation 138kV	LIPA	9	6/30/17	FES, SIS		2018/10	2018/10
487	LI Energy Storage System	Far Rockaway Battery Storage	3/9/15	20	20	ES	Suffolk, NY	K	Far Rockaway Substation 69kV	LIPA	4	5/31/17	FES		2018/10	2018/10
533	Delano Management LLC	Empire Interconnection	2/3/16	275	275	DC	Nassau, NY	K	Far Rockaway Substation 69kV	LIPA	4	8/31/17	FES		2020/04	2020/05
535	sPower Development Company, LLC	Riverhead Expansion	2/23/16	60	60	S	Suffolk, NY	K	Edwards Substation 138kV	LIPA	5	8/31/17	FES		2020/11	2020/12
536	Empire Interconnection LLC	Glenwood	4/19/16	275	275	AC	Suffolk, NY	K	Glenwood/Far Rockaway Station 69kV	LIPA	3	1/31/17	None		2020/04	2020/06
603	Hecate Energy Riverhead, LLC	Riverhead	2/3/17	7.5	7.5	S	Suffolk, NY	K	Wildwood - Riverhead 69kV	LIPA	3	7/31/17	None		2018/06	2018/06
612	Deepwater Wind South Fork, LLC	South Fork Wind Farm	2/14/17	95.5	95.5	W	Suffolk, NY	K	East Hampton 69kV	LIPA	5	5/31/17	None		2022/08	2022/12
649	CR Fuel Cell, LLC	Clare Rose	8/3/17	13.9	13.9	FC	Suffolk, NY	K	William Floyd Substation 69kV	LIPA	2	8/31/17	None		2020/12	2020/12
650	BRT Fuel Cell, LLC	Brookhaven Rail Terminal	8/3/17	18.5	18.5	FC	Suffolk, NY	K	Yaphank Substation 69kV	LIPA	2	8/31/17	None		2019/10	2019/10
651	Yaphank Fuel Cell Park, LLC	Yaphank Solid Waste Management	8/4/17	7.4	7.4	FC	Suffolk, NY	K	North Bellport Substation 69kV	LIPA	2	8/31/17	None		2020/07	2020/07

Reference: NYISO Interconnection Queue 9/30/2017
http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Interconnection_Studies/NYISO_Interconnection_Queue/NYISO%20Interconnection%20Queue.xls

PSEG-LI Definition of a “Firm” Project

- In general, for a project to be considered “Firm” it must meet the following criteria:
  - Full budget approval through internal review
  - Community Outreach plans fully executed
  - Project Management has a defined scheduled start and completion date that is within the current or next year’s cycle
  - Operating Committee approved System Impact Study (SIS) if applicable
  - For projects subject to Article VII, have a determination from NYPSC that Article VII application is in compliance
- Any project that does not meet the above criteria will be considered “Non-Firm”

Long Island Load Pockets

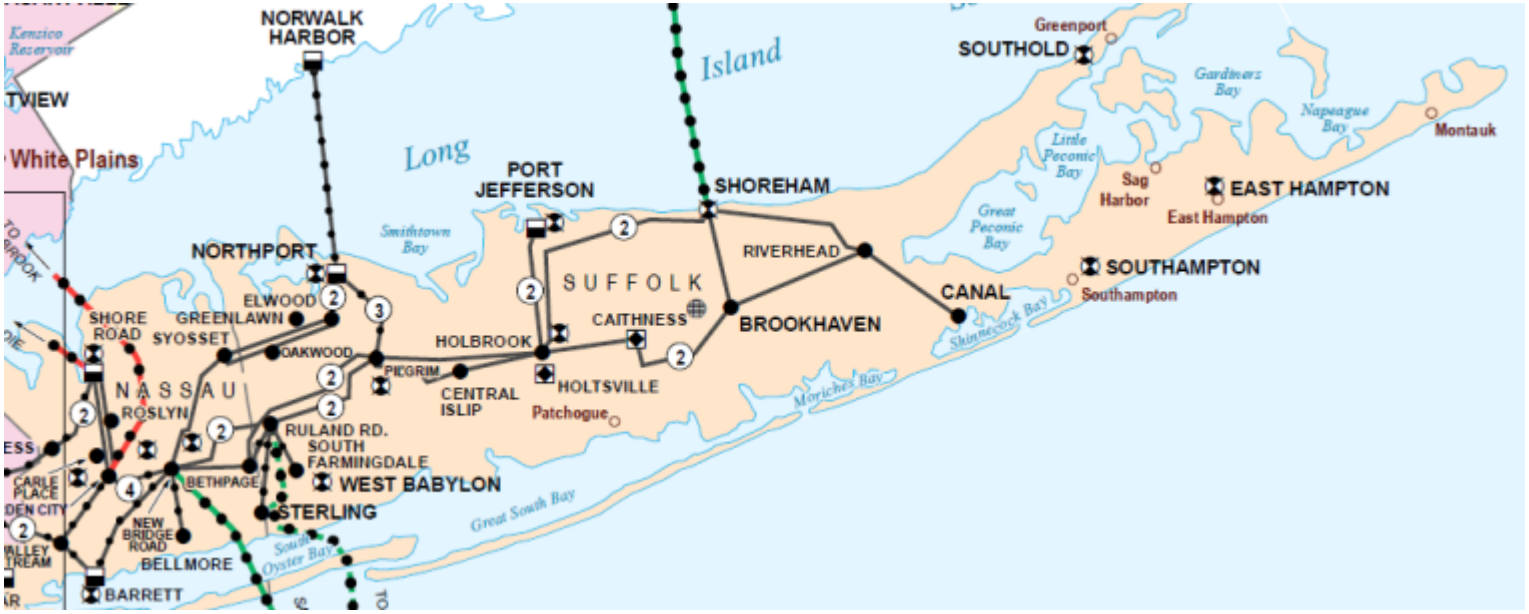


Projects Being Considered

- *The following slides summarize projects that are currently under consideration as part of the on-going planning process. These projects are continually being reviewed and considered as non-firm at this time. Therefore, the need, timing of, and/or the actual project recommendation may be under review.*

Summary of Projects – 100kV & above

Non-Firm Projects - 100 kV and Above	Proposed In-Service Date
138 kV Kings Highway Substation	06/01/2019
138 kV East Garden City to Valley Stream New Circuit	12/01/2020
Wildwood – Riverhead 69 kV to 138 kV Conversion	06/01/2021
138 kV Riverhead to Canal New Circuit	06/01/2021



Projects Being Considered (cont.)

Load Pocket	Project	Summary of Changes	Firm Status	SIS	Article VII	Proposed In-Service Date
Barrett	138 kV East Garden City to Valley Stream New Circuit	Install a new 138 kV Circuit from the East Garden City substation to the Valley Stream substation	Non-Firm	N/A	In Progress	12/01/2020
	69 kV Hempstead Substation	Upgrade the existing Hempstead substation from 23/4 kV to 69/13 kV by tapping the existing East Garden City - West Hempstead 69 kV circuit	Non-Firm	N/A	N/A	2018/2019/ 2020
West Glenwood	69 kV Whiteside Smart Wires	Install Smart Wires technology on the 69 kV Whiteside – Stewart Manor circuit to mitigate thermal constraints on the circuit.	Non-Firm	N/A	N/A	06/01/2019

Projects Being Considered (cont.)

Load Pocket	Project	Summary of Changes	Firm Status	SIS	Article VII	Proposed In-Service Date
Northeast Nassau	69 kV Ruland to Plainview New Circuit	Install a new 69 kV circuit from the Ruland Rd. substation to the Plainview substation	Non-Firm	N/A	N/A	06/01/2020
	69 kV Old Bethpage Substation	Construct a new 69 kV substation by tapping the new Ruland Rd. – Plainview 69 kV circuit (previous item)	Non-Firm	N/A	N/A	06/01/2020
	69 kV Lindbergh Substation	Construct a new 69 kV substation by tapping the existing East Garden City to Meadowbrook 69 kV circuit	Non-Firm	N/A	N/A	06/01/2020 06/01/2021

Projects Being Considered (cont.)

Load Pocket	Project	Summary of Changes	Firm Status	SIS	Article VII	Proposed In-Service Date
South Farmingdale	69 kV Berry St. to South Farmingdale Reconductoring	Reconductor the 69 kV Berry St. – South Farmingdale circuit to increase the thermal rating of the circuit	Non-Firm	N/A	N/A	06/01/2020
Brentwood	69 kV Deer Park Cap Bank	Install a 27 MVAR capacitor bank at the 69 kV Deer Park substation	Non-Firm	N/A	N/A	06/01/2022
Southwest Suffolk	138 kV Kings Highway Substation	Construct a new 138 kV substation by tapping the existing Pilgrim to West Bus 138 kV circuit	Non-Firm	N/A	N/A	06/01/2019
	69 kV MacArthur Cap Bank	Install a 27 MVAR capacitor bank at the MacArthur substation	Non-Firm	N/A	N/A	06/01/2020
	23 kV Fire Island Pines to Ocean Beach New Circuit	Install a new 23 kV circuit from the Fire Island Pines substation to the Ocean Beach substation	Non-Firm	N/A	N/A	06/01/2019

Projects Being Considered (cont.)

Load Pocket	Project	Summary of Changes	Firm Status	SIS	Article VII	Proposed In-Service Date
West Brookhaven	69 kV West Bartlett Substation	Construct a new 69 kV substation by tapping the existing Coram – Ridge circuit	Non-Firm	N/A	N/A	12/01/2018
East Brookhaven	Wildwood to Riverhead 69 kV to 138 kV Conversion	Convert the existing Wildwood to Riverhead circuit from 69 kV to 138 kV	Non-Firm	Under Review	Certified	06/01/2021
	69 kV South Manor to Moriches Reconductoring	Reconductor the 69 kV South Manor - Moriches circuit to increase the thermal rating of the circuit	Non-Firm	N/A	N/A	06/01/2023

Projects Being Considered (cont.)

Load Pocket	Project	Summary of Changes	Firm Status	SIS	Article VII	Proposed In-Service Date
East End	23 kV Navy Road Substation	Construct a new 23 kV substation by tapping the existing Amagansett - Montauk 23 kV circuit	Non-Firm	N/A	N/A	2018/2019
	69 kV Southampton to Canal New Circuit	Install a new 69 kV circuit from the Southampton substation to the Canal substation	Non-Firm	N/A	N/A	06/01/2019

Projects Being Considered (cont.)

Load Pocket	Project	Summary of Changes	Firm Status	SIS	Article VII	Proposed In-Service Date
East End	138 kV Riverhead to Canal New Circuit	Install a new 138 kV circuit from the Riverhead substation to the Canal substation	Non-Firm	Under Review	Not Filed	06/01/2021
	69 kV Bridgehampton to Buell New Circuit	Install a new 69 kV circuit from the Bridgehampton substation to the Buell substation	Non-Firm	N/A	N/A	06/01/2021
	East of Buell 23 kV to 33 kV Conversion	Convert the East Hampton, Buell, Amagansett, Hither Hills, Navy Road, and Culloden Point substation from 23 kV to 33 kV operation	Non-Firm	N/A	N/A	06/01/2023

Projects Being Considered (cont.)

Load Pocket	Project	Summary of Changes	Firm Status	SIS	Article VII	Proposed In-Service Date
East End	69 kV Wainscott Substation	Construct a new 69 kV substation by tapping the existing Bridgehampton - Buell / East Hampton double circuit	Non-Firm	N/A	N/A	06/01/2026
	138 kV Canal to Wainscott New Circuit	Install a new 138 kV circuit from the Canal substation to the Wainscott substation	Non-Firm	Under Review	Not Filed	06/01/2026

Questions?

Document Posted on PSEG Long Island Web site

https://www.psegliny.com/page.cfm/AboutUs/CompanyProfile/DocumentLibrary

Questions?

Please send any comments you may have to

LTP-PSEGLongIsland@pseg.com