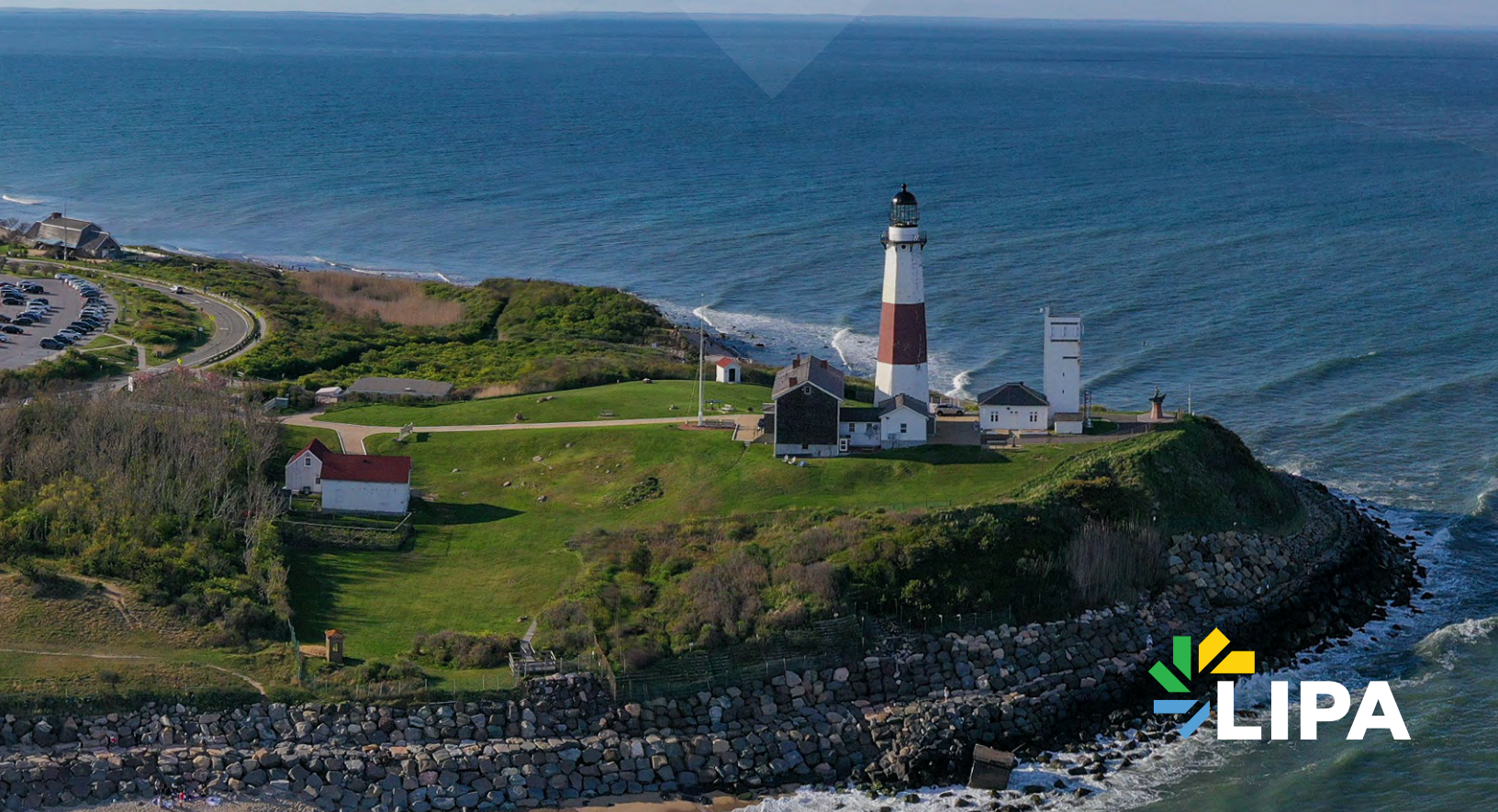
SUMMARY GUIDE

2023 INTEGRATED RESOURCE PLAN

Powering What's Next for Long Island and the Rockaways



LIPA

At LIPA,


the Power is Yours.™
Proudly serving Long Island and the Rockaways.

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Conclusion

Integrated Resource Planning is a collaborative process and includes participation from the public.

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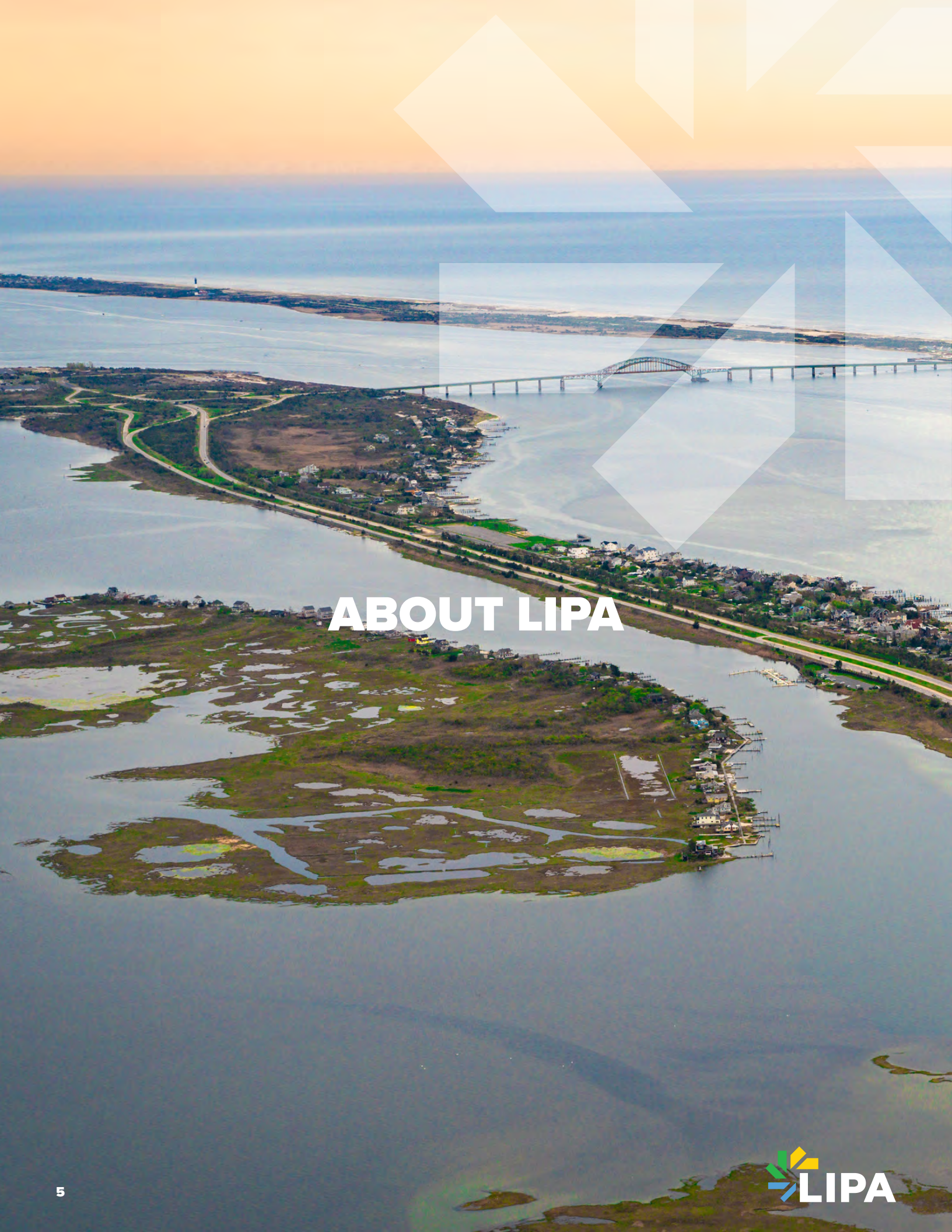
Jones Beach Energy & Nature Center | Wantagh, New York



ABOUT LIPA

Aerial view of Robert Moses State Park | Babylon, New York

PROUDLY SERVING OUR CUSTOMERS WITH **CLEAN**, **RELIABLE**, **AFFORDABLE** ENERGY.

About LIPA

The Long Island Power Authority (LIPA) is the third-largest public power utility in the United States, serving 1.2 million customers. LIPA's purpose is to serve our customers and community by providing clean, reliable, and affordable energy to Long Island and the Rockaways.

LIPA owns the electrical transmission and distribution system serving our community and contracts for most of the management services and power supply used to operate our electric grid. Since 2014, LIPA has contracted with PSEG Long Island for management services, and LIPA provides service to customers under the PSEG Long Island brand name. LIPA owns about 250 megawatts ("MW") of nuclear generation, contracts with National Grid for 3,550 MW of generating capacity, and contracts with other providers for 1,750 MW of on-island generation and 990 MW of transmission cable capacity to facilitate purchases from electric markets in New York, New England, and the mid-Atlantic states.

LIPA is governed by a local Board of Trustees who are responsible for contracting with vendors; setting policy, strategy, and performance metrics for PSEG Long Island's service to our customers; financing the infrastructure investments necessary for a reliable electric grid; and leading Long Island's transition to a clean energy future.

Fast Facts

Customers

Residential Customers: 1,026,143
Commercial Customers: 133,597

Energy Requirements

19,884,053 megawatt-hours

Generating Capacity

~5,550 MW

2023 Peak Demand

~5,000 MW

Transmission System

1,400 miles

Distribution System

Miles overhead: 9,000
Miles underground: 5,000
Transformers: 189,000

Substations

Transmission: 30
Distribution: 152

2024 Proposed Budget

Operating: $4.3 Billion
Capital: $855 Million

Our Purpose

LIPA's purpose is to serve our customers and community by providing clean, reliable, and affordable energy to Long Island and the Rockaways. As a not-for-profit utility, LIPA is a value-driven organization that puts our customers first in every action and decision.

Vision

LIPA's vision is to be our customers' trusted energy partner. To achieve our vision, LIPA will:

- Actively engage with our customers and the communities we serve.
- Respond to our customers' needs and exceed their expectations.
- Be a recognized innovator in our industry to better serve our customers.
- Be known as a steward of our environment and community.

Values

Service: Our work is service. Everything we do is for the benefit of our customers.

Collaboration: Operate as one LIPA team. Everyone is included.

Excellence: One plan, with relentless implementation. Clear performance goals.

Thomas Falcone, LIPA CEO, at the one year anniversary of the Calverton Solar Energy Center in July 2023.

Board of Trustees

A local Board of Trustees govern LIPA. The Board consists of nine Trustees, five of whom are appointed by the Governor, two by the Temporary President of the State Senate, and two by the Speaker of the State Assembly.

The Trustees serve for staggered four-year terms. All Trustees reside on Long Island or in the Rockaways and have relevant utility, corporate Board, or financial experience. LIPA does not compensate Trustees for their service.

Visit **lipower.org** for more information.

Tracey Edwards
Chair

Valerie Anderson Campbell
Trustee

Sheldon L. Cohen
Trustee

Laureen Harris
Trustee

Claudia Lovas
Trustee

Dominick Macchia
Trustee

David Manning
Trustee

Mili Makhijani
Trustee

Board Policies Establish LIPA's Strategic Direction

The LIPA Board provides strategic direction through a set of governance policies. The Board's policies define LIPA's purpose and vision and set expectations for the strategic outcomes that management will deliver in the areas of reliability, customer experience, clean energy, affordability, information technology, and fiscal sustainability. The Board reviews each of its policies annually, and LIPA management reports on outcomes in reports to the Board for each policy.

For more information about the Board's policies, visit **lipower.org/purpose**.

LIPA's Strategic Objectives

Reliability and Resiliency

- Top 10% reliability among peer utilities
- Improve circuit conditions that cause repeated customer outages
- Invest in system resiliency to reduce outages and restoration times from severe weather
- Independently verify and validate PSEG Long Island's emergency restoration planning

Customer Experience

- Deliver top 25% customer satisfaction in J.D. Power studies
- Continual improvement in ease of customer interaction, as measured by customer surveys
- Invest in technology to enhance the convenience of billing, payments, appointments, and emergency restorations

Clean Energy

- 70% renewable energy by 2030
- Zero-carbon electric grid by 2040
- Encourage beneficial electrification of transportation and buildings (i.e., electric vehicles and cold climate heat pumps)

Customer Affordability

- Maintain regionally competitive electric rates
- Prioritize investments to balance cost and service quality
- Maintain affordable electric bills for low-income customers and disadvantaged communities

Information Technology and Cybersecurity

- Deploy modern grid management technology and data analytics benchmarked to the top 25% of utilities
- Protect digital infrastructure and customer data, as measured by an annual independent assessment of cybersecurity practices
- Clearly communicate customer information collection policies

Fiscal Sustainability

- Achieve AA-category credit ratings by reducing LIPA's debt-to-assets ratio from 90%+ to 70% or less by 2030
- Maximize grants and low-cost funding sources
- Develop budgets and financial plans that maximize customer value and aggressively manage costs
- Provide customers and investors with timely, transparent, accurate, and useful information to evaluate LIPA's financial performance and plans

Executive Management

The LIPA team is proud to serve our customers. Our leadership team brings extensive utility experience to the organization in all core business functions, including transmission and distribution operations, power supply, customer experience, information technology, finance, legal, strategy, performance management, communications, and external affairs.

Visit **lipower.org/leadership** for more information on each member of LIPA's management team.

Thomas Falcone
Chief Executive Officer

Mujib Lodhi
Chief Operating Officer

Bobbi O'Connor
General Counsel and Secretary to the Board of Trustees

Billy Raley
Senior Vice President, Transmission and Distribution

Werner Schweiger
Executive Advisor for Operations

Gary Stephenson
Senior Vice President, Power Supply

Donna Mongiardo, CPA
Vice President, Controller

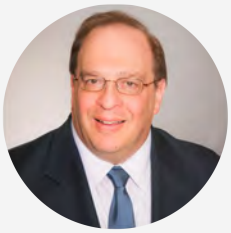
Barbara Ann Dillon, Esq., PHR
Director of Human Resources and Administration

Jennifer Hayen
Director of Communications

Kenneth Kane
Senior Advisor for Oversight

Tom Locascio
Director of External Affairs

Carolyn MacKool
Director of Customer Experience



Rick Shansky
Former Senior Vice President, Power Supply and Wholesale Markets

LIPA would like to acknowledge the many contributions to our customers, including for this 2023 Integrated Resource Plan made by Rick Shansky, who retired in November 2023. Mr. Shansky's career spanned over four decades, starting at the Long Island Lighting Company in 1981.

On behalf of our customers, we thank Mr. Shansky for his 15 years of service at LIPA.

Thomas Falcone, LIPA CEO, and Mark Fischl, Former Vice Chair of the Board, accepting the Sue Kelly Community Service Award at the American Public Power Association's National Conference in June 2023.

Environmental Leadership

Since LIPA's inception in 1998 as a public power utility, we have been committed to protecting the environment. LIPA's vision for power supply is to provide clean, reliable, and resilient electricity to our customers at an affordable cost that both maintains the economic competitiveness of our region and minimizes the economy-wide greenhouse gas emissions for Long Island and the Rockaways by encouraging the electrification of vehicles, buildings, and equipment.

Our environmental leadership includes some of the first and largest renewable energy projects and initiatives to promote decarbonization in New York State:

- In 2011, the Long Island Solar Farm (LISF) began delivering power to customers. LISF is a 32 MW solar farm located at Brookhaven National Laboratory and, at the time, was one of the largest solar farms in the eastern United States. It generates enough renewable energy to power approximately 4,500 homes.

- In 2015, LIPA sought new resources to meet load growth on the South Fork of Long Island. A portfolio of clean resources was selected, consisting of load control programs, battery storage, and an offshore wind farm. In 2017, LIPA signed a Power Purchase Agreement for South Fork Wind – **the first offshore wind farm in federal waters and in New York State.** The 130 MW project will power 70,000 homes and offset 300,000 tons of carbon emissions and is expected to be operational by the end of 2023.

- In 2021, LIPA launched a procurement for **at least 175 MW of bulk energy storage projects.** As of November 2023, negotiations are ongoing with developers of several projects in Suffolk County for completion in 2025.

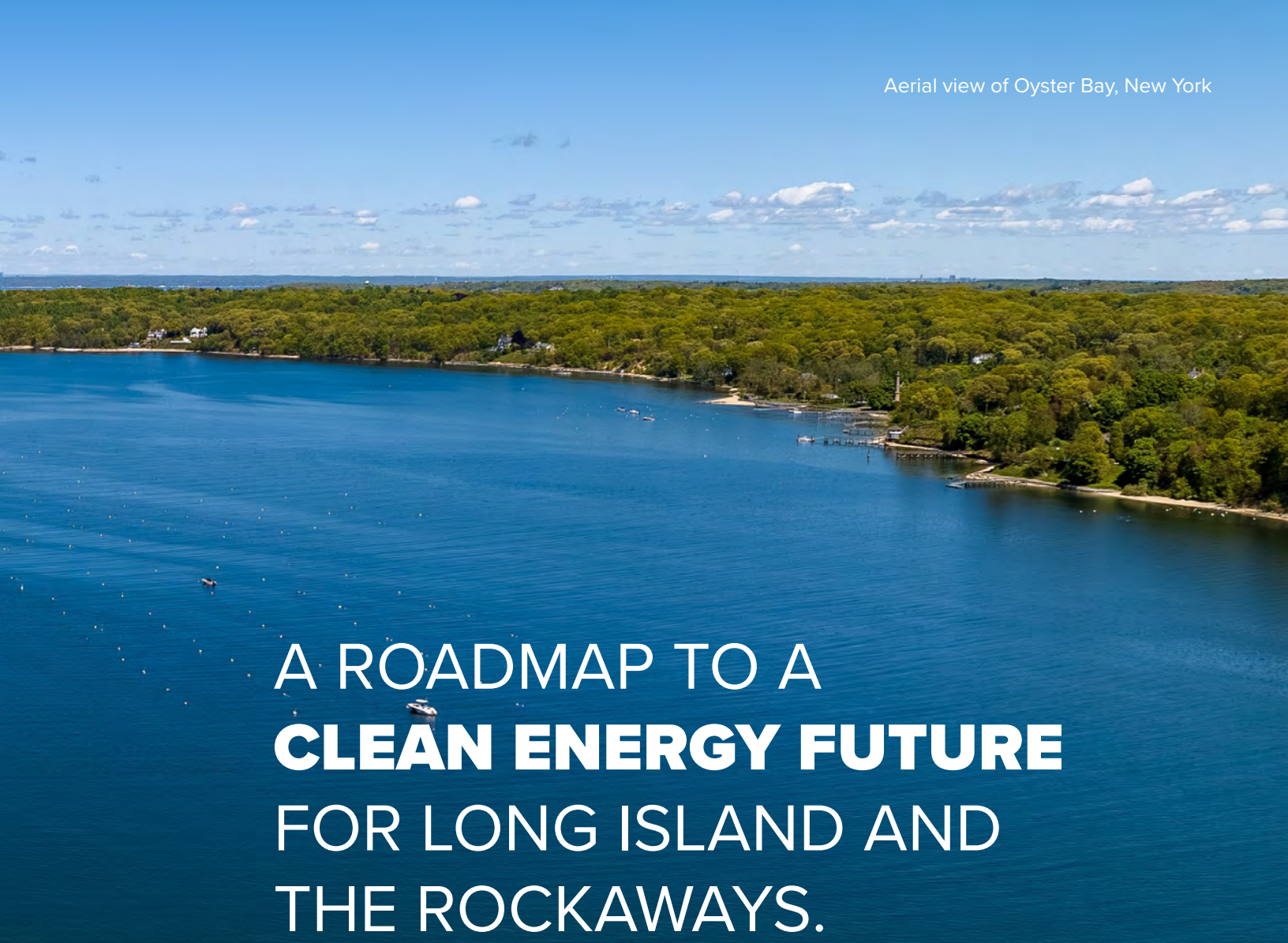
- In 2023, the Board voted to make **LIPA the first electric utility in New York State to implement Time-of-Day ("TOD") rates as the standard billing option**. Most customers will be transitioned to this new rate in 2025.

- By 2030, Long Island and the Rockaways will have 1,200 MW of rooftop solar. As a leader in rooftop solar, **LIPA exceeded New York's target solar goal for 2025 four years early and accounts for 40% of statewide rooftop solar projects** – roughly three times its share of statewide electric sales.

- **LIPA has achieved 5.26 trillion British thermal units ("TBtu") towards its energy efficiency goal of 7.9 TBtu by 2025,** offering a wide selection of incentives, rebates, and programs to both residential and commercial customers on Long Island and the Rockaways to assist them in reducing their energy usage.

Long Island Solar Farm | Brookhaven National Laboratory | Upton, New York

EXECUTIVE SUMMARY



Aerial view of Oyster Bay, New York

A ROADMAP TO A **CLEAN ENERGY FUTURE** FOR LONG ISLAND AND THE ROCKAWAYS.

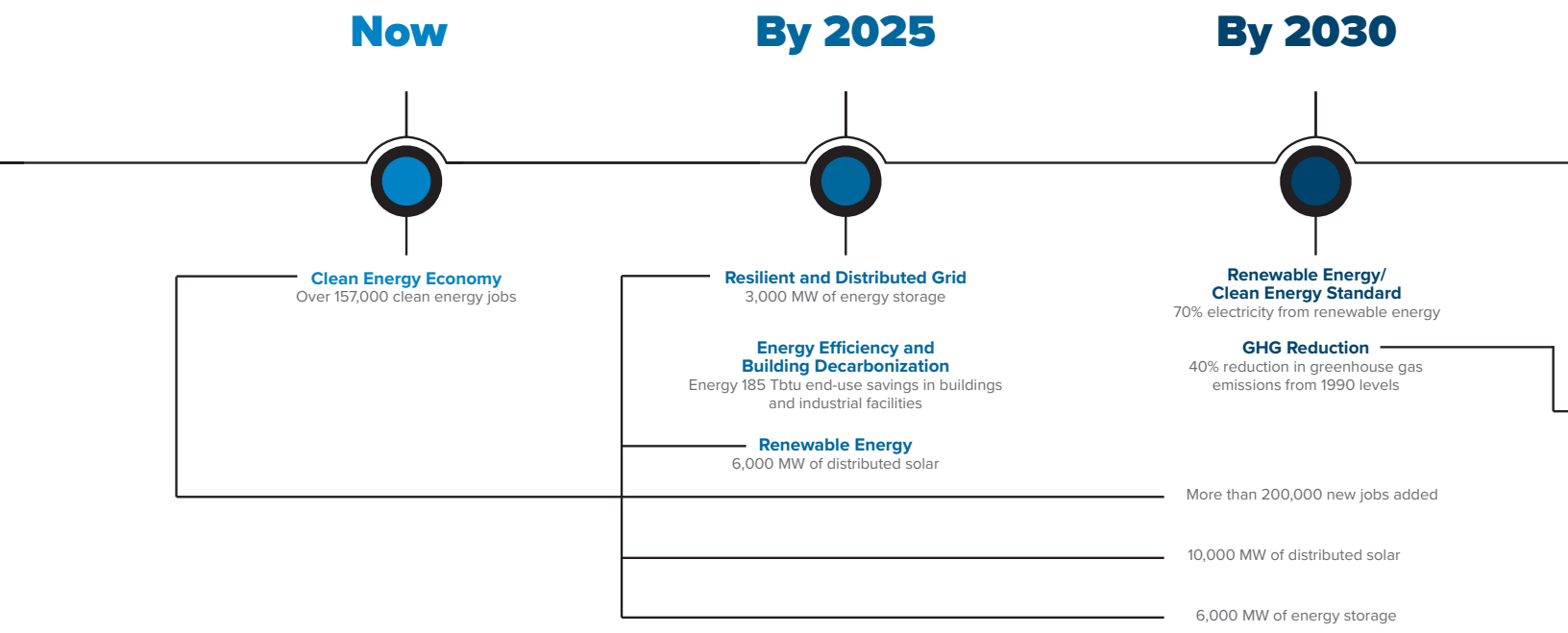
New York State Governor Kathy Hochul speaking at the U.S. Climate Alliance in September 2023.

LIPA periodically conducts an Integrated Resource Plan ("IRP") to study the need for generation, transmission, and demand-side resources to provide clean, reliable, and affordable electricity to Long Island and the Rockaways.

LIPA's last IRP was released in **2017** and it determined that LIPA would not need to add generation to meet load growth through at least 2035, mainly due to increased energy efficiency and renewable energy. As a result, the decision was made to forego new or repowered fossil-fueled generation and instead concentrate on a clean energy future. That future was further defined in 2019 by New York's Climate Leadership and Community Protection Act ("CLCPA" or "Climate Act") and the goals it established for economywide carbon reduction and clean resource additions.

LIPA's 2023 IRP aims to provide an action plan through 2030 to meet interim milestones established in the Climate Act, while framing resource decisions that will need to be made later to achieve 100% zero-emission electricity by 2040. Transitioning to an entirely carbon-free grid involves adding new clean energy sources, investing in transmission, and retiring older, fossil-fueled power plants.

Figure 1: **New York's Climate Act Goals**



New York's Climate Act

Passed in 2019, New York's Climate Act is among the most aggressive in the nation, calling for an orderly and just transition to a clean energy economy that creates good-paying jobs and fosters healthy communities. Figure 1 shows the goals established by the Climate Act, which include time-bound objectives for greenhouse gas ("GHG") emissions reductions from electricity production, sales of zero-emission vehicles, and resource-specific requirements for distributed solar, renewable energy, energy storage, and offshore wind.

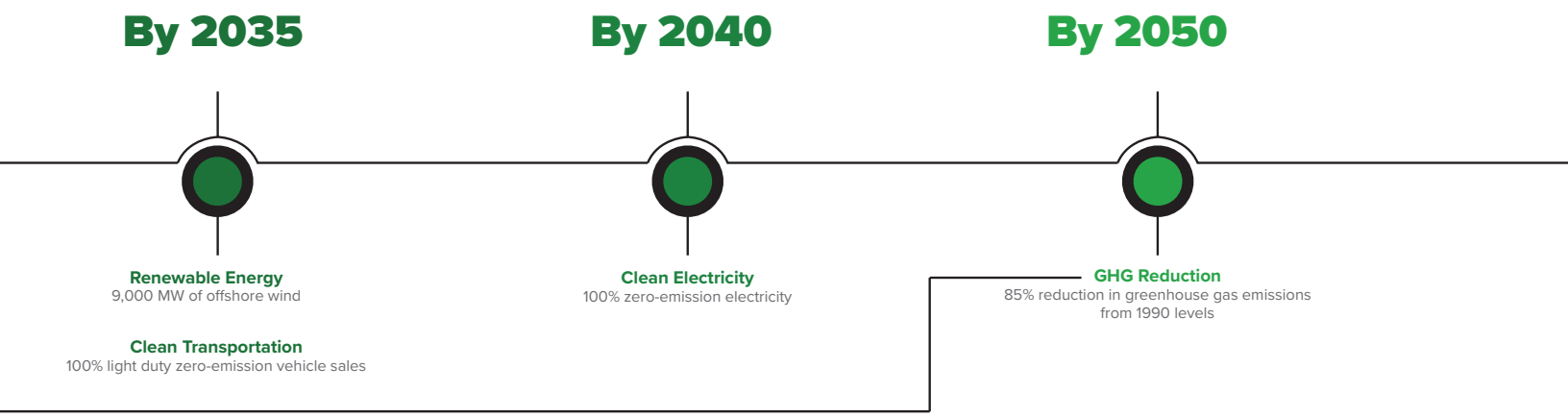
LIPA, along with the state and other New York utilities, is taking action to achieve the goals of the Climate Act, including a 100% zero-carbon electric grid by 2040 and an 85% reduction in economywide carbon emissions by 2050. **A significant portion of the economywide carbon emissions reductions will come from using the zero-carbon electric grid of the future as the clean energy source to decarbonize other sectors of the economy, including transportation, buildings (heating), industry, and agriculture.**

The Climate Act goals will change how our electric system operates and how we plan to ensure best-in-class reliability. The potential impacts of climate change, from unpredictability in weather patterns to an increase in the frequency of extreme weather events, provide further challenges and complexity to the planning process.

To support the implementation of the Climate Act, the action plan developed by the 2023 IRP includes:

- Integrating into the grid substantial new renewable generation and battery storage.
- Investing significantly in the transmission grid serving Long Island and the Rockaways.
- Phasing out fossil-fueled generation over time.
- Using clean electricity to decarbonize heating and transportation, with support for disadvantaged communities and low- and moderate-income customers.

For more information on the Climate Act, please visit **climate.ny.gov**.



KEY FINDINGS

What are the key findings of the IRP?

1. By 2030, the addition of solar and offshore wind resources will cause LIPA's **carbon footprint to decline by over 70%** from 2010 levels.

2. **Offshore wind projects already under development will connect 3,600 megawatts ("MW") to the Long Island grid**, out of a statewide goal of 9,000 MW by 2035, with more to come as forecasts show as much as 18,000 MW or 18 gigawatts ("GW") of offshore wind by 2050.

3. Long Island's high-voltage transmission grid will need to be built out to integrate the large amounts of offshore wind, some of which will be exported to the rest of New York. **The Propel NY Energy project will meet these transmission needs through 2030 and beyond,** although further study is required to assess transmission needs for a zero-carbon electric grid by 2040.

4. As offshore wind and battery storage resources come online, LIPA will be able to **retire up to 800 MW of existing Long Island power plants by 2030.**

5. Demand-side measures, such as LIPA's energy efficiency rebate programs and customer installations of solar photovoltaic ("PV") systems, are projected **to effectively offset economy-driven growth in electricity sales between now and 2030**.

6. **LIPA's transition to TOD rates in 2024 and 2025 will encourage customers to shift energy use outside of peak hours** and thereby help moderate growth in peak electric demand, which is a main driver of the need for investments to upgrade the transmission and distribution ("T&D") system. LIPA will need to further expand on TOD rates with managed charging solutions in future years.

7. **Significant growth in electricity consumption is expected post-2030** as heating and transportation are increasingly electrified.

8. Clean, distributed resources will transform the local electric grid into a two-way street, requiring **upgrades in distribution capacity and controls**, **including the associated information technology ("IT") systems** to intelligently manage the grid.

9. For the post-2030 period, the industry will need to develop **new solutions and technology to balance electric supply and demand** on an hourly, daily, and seasonal basis to fully replace dispatchable fossil units.

KEY INITIATIVES

What are the key initiatives that LIPA needs to undertake through 2030?

1. **Participate in large-scale statewide clean energy procurements** conducted by NYSERDA to achieve New York's 70% renewable by 2030 objective, selectively procured using LIPA's low cost of capital where there are likely to be savings or localized opportunities.

   For more information, see "Decarbonizing the Electric Grid" on page 29.

2. **Procure additional energy storage to reach up to 750 MW on Long Island** in cooperation with NYSERDA and through selective LIPA procurements.

   For more information, see "What storage has LIPA procured to date? Is LIPA on target to meet its share of the state's 3,000 MW by 2025 and 6,000 MW by 2030 storage objectives?" on page 48.

3. Phase out power contracts with Long Island fossil generation owners to **retire up to 800 MW of fossil-fueled generation**.

   For more information, see "What are LIPA's existing fossil fuel power plant contracts and how will they be retired?" on page 34.

4. Work with the project developer and stakeholders to complete the **$3.3 billion Propel NY Energy project to build out the transmission "backbone"** connecting Long Island to the rest of New York for offshore wind.

   For more information, see "Can Long Island's electric grid handle the amount of offshore wind that will be produced?" on page 43.

5. **Implement TOD rates in 2024 and 2025 along with managed charging programs** to minimize the peak hour load increase expected from the increasing electrification of transportation.

   For more information, see "What can LIPA do to encourage customers to reduce electricity consumption during system peak periods?" on page 56.

6. **Develop a multi-year energy efficiency, beneficial electrification, and demand response ("EEBEDR") plan** by July 2024 that maximizes opportunities for cost-effective EEBEDR programs, while investing in **disadvantaged communities** and supporting low and moderate-income customers.

   For more information, see "What are LIPA's plans for customer energy efficiency and demand-side management programs?" on page 57 and "What is being done to help disadvantaged communities meet Climate Act goals?" on page 58.

7. **Increase hosting capacity by 700 MW for distributed energy resources ("DER")**, and continue to promote customer-owned DER including rooftop solar and storage.

   For more information, see "How LIPA is reducing the cost of grid expansion for distributed resources" on page 50.

8. Prioritize the retirement of fossil fuel generating stations and the siting of clean energy storage **in areas within or near disadvantaged communities**.

   For more information, see "What is being done to help disadvantaged communities meet Climate Act goals?" on page 58.

9. Prepare the electric grid to meet the challenge of climate change by designing for the increasing frequency of extreme temperatures and severe weather, configuring supply resources to provide resiliency, and **continuing investments to storm harden the electric grid**.

   For more information, see "Planning for the Effects of Climate Change" on page 59.

10. **Support research into zero-emission, dispatchable generation** to enable the complete replacement of fossil-fueled generation by 2040.

    For more information, see "What are the leading dispatchable emissions-free technologies that are under development?" on page 47.

REPORT FINDINGS

View of Dune Road | West Hampton, New York

TRANSITIONING TO **A ZERO-CARBON ELECTRIC GRID** IS THE **PRIMARY DRIVER** OF THE 2023 IRP.

Background

LIPA has organized this report around themes in the form of answers to frequently asked questions to help customers and stakeholders understand the IRP's assumptions, findings, and next steps.

What is an IRP?

An IRP studies the supply-side (i.e., generation, energy storage), demand-side (i.e., energy efficiency, demand response, distributed energy resources), and transmission investments that LIPA may need to make over the next 10 to 20 years to provide reliable, cost-effective service to customers under a range of scenarios. An IRP considers customer usage trends, existing resources, policy and regulatory requirements, changing technology, risks, and opportunities, among other factors.

The current IRP has a study period of 2023 to 2040, focusing on actions and decisions that need to occur between now and 2030. LIPA will re-evaluate any actions beyond 2030 in the next IRP planning cycle with updated information and assumptions.

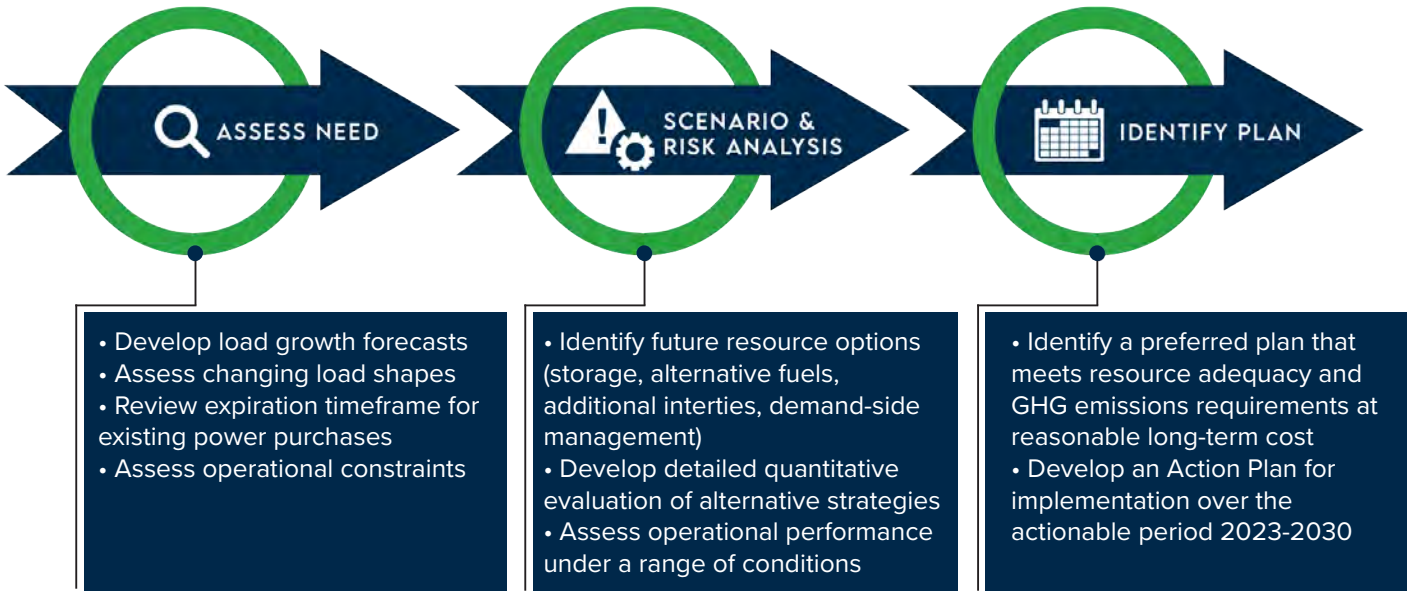
The IRP findings and actions are stable between now and 2030 under a wide range of scenarios, while the conclusions for the period beyond 2030 are subject to significant revision based on developments over the next seven years.

How was the IRP developed?

Figure 2 shows a high-level overview of the IRP process. The modeling and analysis conducted in the IRP utilize a scenario-based approach reflecting various pathways to achieve a clean energy future. Modeling involves projecting customer demand and simulating the dispatch of resources to meet that demand, including costs to purchase generating capacity, energy, and transmission service under existing or planned contracts and through regional power markets.

The scenarios follow trajectories similar to those developed in the Scoping Plan[1] for economywide decarbonization developed by New York's Climate Action Council. For each scenario, the IRP considers a range of options to maintain reliability while complying with the Climate Act's decarbonization targets, including, for example, replacing fossil generation with renewables and/or storage technologies, as well as expanding the use of customer load management and energy efficiency programs.

Figure 2: **Integrated Resource Planning Methodology**



[1] *The New York State Climate Action Council's Scoping Plan can be viewed at https://climate.ny.gov/resources/scoping-plan/*

Which scenarios are modeled in the IRP and how do the scenarios influence the IRP's recommendations?

The IRP's recommendations are based on scenario modeling that assesses the impacts of planning uncertainties and considers alternative solutions to achieve Climate Act targets while satisfying system reliability requirements. The starting point for the scenarios is a base case that includes the clean resource objectives in the Climate Act and follows trajectories for renewable energy development and beneficial electrification of heating and transportation similar to those detailed in the **Scoping Plan** produced by the New York Climate Action Council.

Besides the base case, the following additional scenarios were assessed in the IRP:

- **Accelerated economywide decarbonization** – This scenario assumes faster penetration of EVs and heat pumps, which results in higher load growth in the early years of the planning horizon. **This scenario results in minimal changes in local resource needs compared to the base case during the actionable period from 2023 to 2030**. The relatively modest increase in peak demand can be satisfied by maintaining a portion of the existing fleet of fossil-fueled plants, planned offshore wind resources, and meeting residual reliability needs by importing generating capacity over existing and future transmission interties.

- **Expanded interties from Long Island to other regions** – This scenario assumes another 600 MW transmission intertie to the rest-of-state. **The modeling shows that further expansion beyond the Propel NY Energy project will not be needed during the actionable period of the IRP through 2030**. As more offshore wind is connected to LIPA's system after 2030, future studies will indicate any need for additional transmission interties based on then-current information. For more information about the Propel NY Energy Project's future interties for offshore wind, see the "Offshore Wind" section on page 39.

- **Accelerated transition away from fossil fuel combustion** – This scenario examines potential accelerated decarbonization at a faster pace than the Climate Action Council trajectories for the state. The IRP concluded that the **lack of technological readiness, limited supply, and higher costs of low carbon fuel technologies through 2030 would pose major challenges to meaningful action**.

- **Expanded demand-side measures** – This scenario examines adding demand-side programs beyond the current offerings, which have focused on rebates for efficient end uses and incentives for demand management measures. **The new measures include TOD and utility programs featuring two-way communication and control capabilities for EV chargers, thermostats, and behind-the-meter battery storage systems**. LIPA plans to pursue these measures. For more information on the proposed programs see, "What are LIPA's plans for customer energy efficiency and demand-side management programs?" on page 57.

- **Advanced technologies** – This scenario examines emerging clean generation technologies, including long-duration storage solutions not possible with current lithium-ion batteries. **Each of the solutions tested under this scenario faces significant feasibility challenges through 2030** due to factors such as lack of technological maturity, permitting requirements, and lack of suitable sites on Long Island.

Who conducted the IRP?

LIPA's resource planning process is a **collaborative effort, led by LIPA's service provider, PSEG Long Island, on behalf of LIPA, with active involvement from LIPA staff and assistance from utility consultants. Experts from Brookhaven Science Associates and Stony Brook University** also provided input on emerging technologies such as advanced battery storage, including short- and longer-term feasibility as well as risks and challenges to consider in model development. In addition, LIPA will engage stakeholders and the public through public comment sessions to answer questions and refine IRP recommendations as well as the action plan to be implemented through 2030.

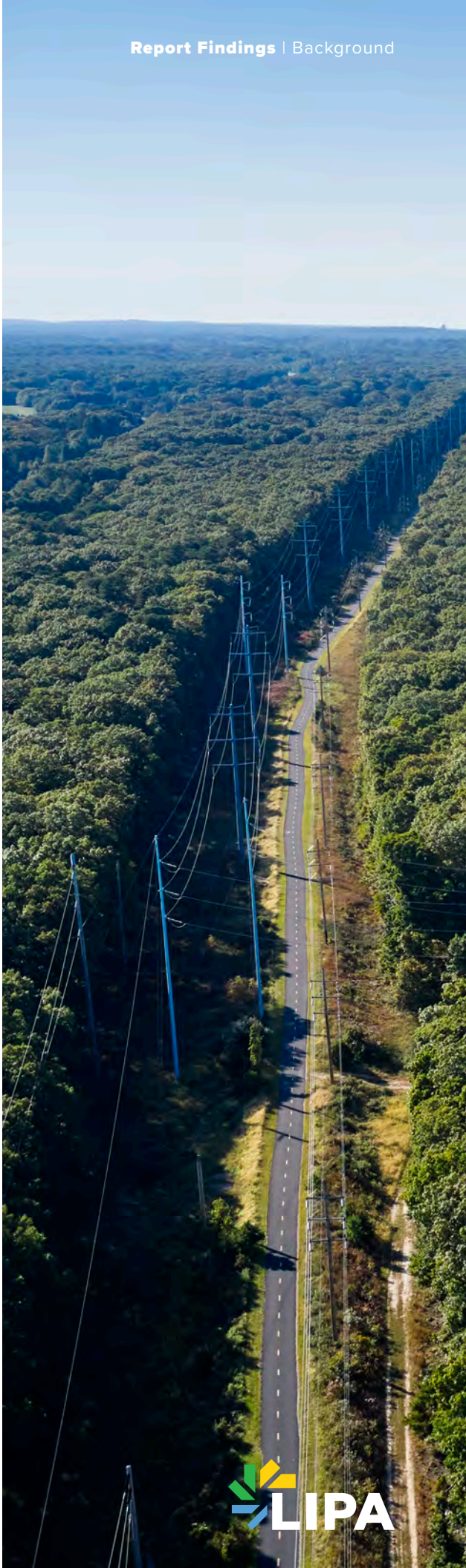
Creating a Resilient Electric Grid

LIPA continues to make substantial investments in the reliability and resiliency of the T&D system, with $77 million invested in storm hardening in the 2023 budget and $84 million proposed in the 2024 budget.

LIPA has invested $6.4 billion since 2016 to reduce the number and duration of outages. Over the past ten years, more than 1,275 miles of distribution mainline circuits have been strengthened, leading to a 49% drop in damage-related outages in storm-hardened zones. LIPA has also storm hardened 10 substations, to protect from dangerous storm surge.

Since 2021, LIPA has taken actions as part of a 5-year storm mitigation plan that include removing hazardous trees, trimming branches that interfere with power lines, and strengthening transmission load pockets.

With these programs, and others, the minutes of interruptions experienced by customers due to a major storm hitting Long Island is expected to be reduced by an additional 18% between 2021 and 2025. More information on the actions LIPA is taking to strengthen the electric grid can be found on page 59.



View of the North Shore Rail Trail | Wading River, New York

Decarbonizing the Electric Grid

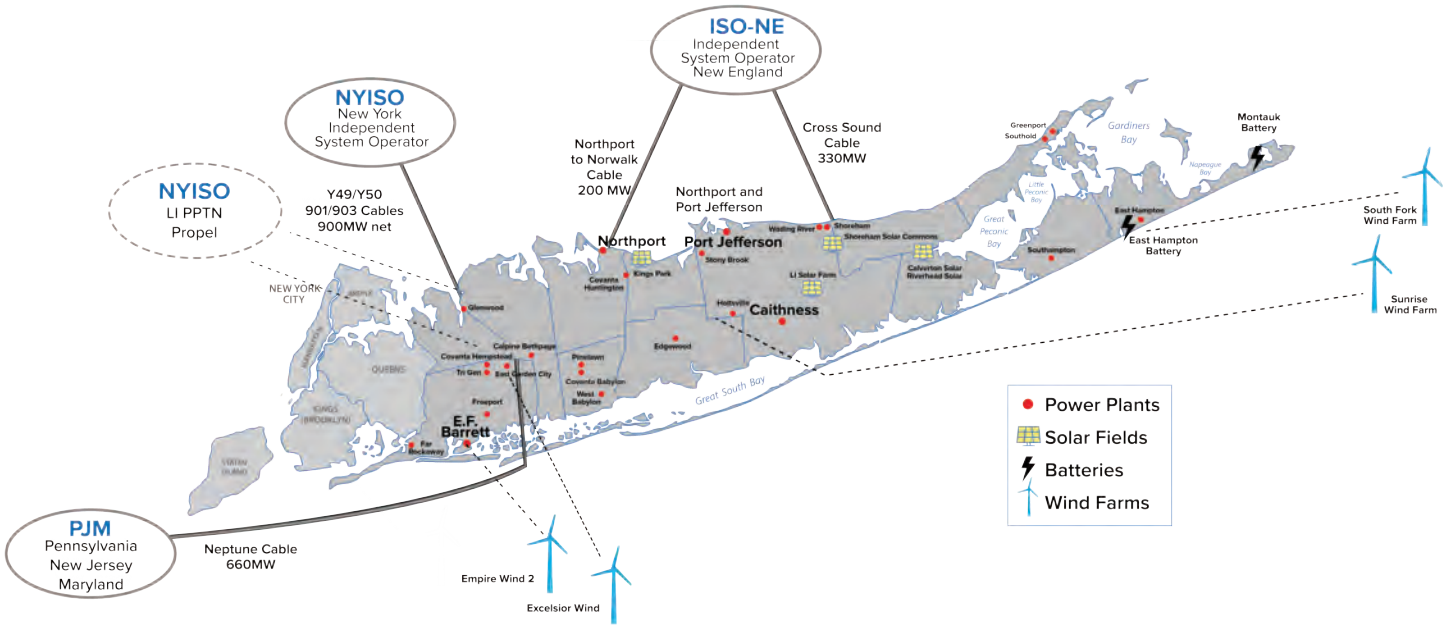
How does LIPA supply the electricity needs of its customers?

LIPA's service territory spans Nassau and Suffolk Counties in Long Island and the Rockaway Peninsula in Queens County. **Jutting out off the coast, Long Island is at the tail end of New York State's electric grid. Our geographical location poses unique challenges, from seasonal weather events (i.e., winter storms and hurricanes) to constrained interties with regional electric grids.**

Electricity is generated at power plants or renewable energy sites and moves through a complex system, referred to as the electric grid, which includes substations, transformers, and power lines that connect electricity producers to customers. Much of Long Island is interconnected for reliability and commercial purposes, forming a redundant, resilient network that is planned, controlled, and operated centrally by the local utility and the New York State Independent System Operator ("NYISO").

Figure 3 shows that Long Island's electric resources consist of seven major interconnection cables to regional markets, dozens of fossil-fueled power plants, five solar farms, and two battery storage systems. There are multiple power supply projects under development, including four major offshore wind projects and three additional interties to LIPA's service territory.

Figure 3: **Long Island and the Rockaways Electric Grid**

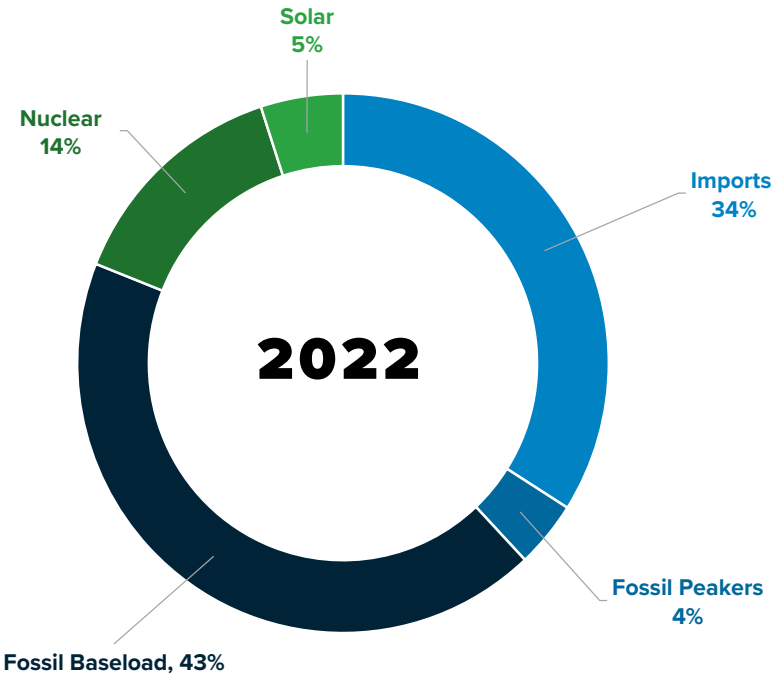


How does the electric grid meet Long Island's energy needs today?

Electric loads vary throughout the year, with the highest loads typically occurring on weekday afternoons in the summer (referred to as the "peak"). **Since electricity can only be stored in limited quantities, generation and imports must be controlled to match customer demand on a minute-by-minute basis.** The most efficient or economical power plants run all day long and are known as "baseload plants." Smaller generating plants that can be started up quickly, but with higher operating costs, are run only to meet the peak loads of each day – these are known as "peakers." LIPA also imports power to fill needs not met by on-island generation or when power production costs are lower in neighboring regions. LIPA's power imports are sourced from the Nine Mile Point 2 and FitzPatrick nuclear power plants in Oswego, New York and electricity markets throughout New York State and neighboring regions.

Figure 4 shows that approximately 47% of LIPA's power is produced by local fossil-fueled power plants and 19% is from emissions-free solar farms and nuclear plants. **34% of LIPA's power supply is from imports** purchased each day in the New York, New England, and Mid-Atlantic electricity markets. Since market purchases are pooled from many different power stations, the ultimate source of energy production can only be estimated.

Figure 4: **Sources of Long Island Electricity Production in 2022**



Note: The solar category includes both customer-owned solar and utility-scale solar farms.

How will LIPA bring cleaner energy sources to Long Island and the Rockaways?

The IRP anticipates that additional solar, storage, and offshore wind resources will need to be developed and connected to the electric grid. LIPA has three options for procuring these resources. First, LIPA's electric rate tariff provides for payments to customer-owned solar and storage for the energy they supply to the grid. Second, LIPA may issue Requests For Proposals to construct utility-scale resources. Third, LIPA can contract with NYSERDA to purchase a share of the renewable energy credits ("RECs") it regularly procures from clean energy suppliers. NYSERDA is the state's designated procurement entity for purchasing RECs from wind and solar projects and "storage credits" from energy storage projects to meet Climate Act goals for investor-owned utilities. Similar to the other state utilities, LIPA may purchase on a voluntary basis up to its pro rata share of the RECs and storage credits obtained by NYSERDA, based on its share of the statewide load. LIPA serves about 12-13% of the state's load and has been a participant in the statewide cost-sharing arrangement.

LIPA has the option to employ its access to low-cost capital for a portion of its needs under an ownership arrangement. However, at present, the only generation owned by LIPA is an 18% share of the Nine Mile Point 2 nuclear plant in Oswego, New York. LIPA expects to rely on the NYSERDA procurements for a significant portion of its clean energy supply since those procurements benefit from economies of scale (particularly for offshore wind) and statewide scope (i.e., the ability to contract for utility-scale solar and land-based wind located off Long Island), both of which result in reduced cost. **LIPA plans to procure independently, using its access to low-cost capital, where it finds it is likely to be able to do so at a lower cost or where there are localized clean energy opportunities**. Examples of such opportunities include LIPA's procurement of the South Fork Wind project, which will help meet local energy demand on the South Fork of Long Island, storage to bolster system reliability needs in certain locations, and Long Island-based utility-scale solar and storage projects. In this way, **LIPA plans to meet the state's clean energy goals at the lowest possible cost for its customers by using all of the tools available to derive the best outcomes**.

Installation of the first monopile foundation for the South Fark Wind Farm | July 2023

Photo courtesy of Ørsted

What resources are being added to decarbonize the Long Island electric grid?

LIPA and New York State are taking actions on both the demand- and supply-sides to achieve a zero-carbon electric grid. On the demand-side, enhanced energy efficiency programs and incentives that encourage customers to install rooftop solar, storage, and heat pumps and switch to EVs will play important roles in helping Long Island and the state reduce GHG emissions. On the supply side, **Figure 5** shows the clean energy resources under development that will add thousands of megawatts of new clean resources to the Long Island and Rockaways electric grid by the early 2030s. These include:

- 1,419 MW of customer-owned solar and local solar farms
- 3,628 MW of offshore wind
- 750 MW of battery storage

With expected additions, the future clean energy portfolio is expected to total about 5,800 MW compared to LIPA's 2023 peak demand of approximately 5,000 MW. While the sheer size of the additions is impressive, adding 1 MW of battery storage, solar, or wind is insufficient to replace 1 MW of fossil fuel generation. Some fossil fuel generation will be needed to serve as backup to intermittent generation until new technologies for long-duration, dispatchable, emissions-free resources become available at scale. This fossil generation will run less, serving to balance renewables, so the carbon emissions of the Long Island grid will decline steeply. *For more information, see "How will the system's peak load change through 2040?" on page 55.*

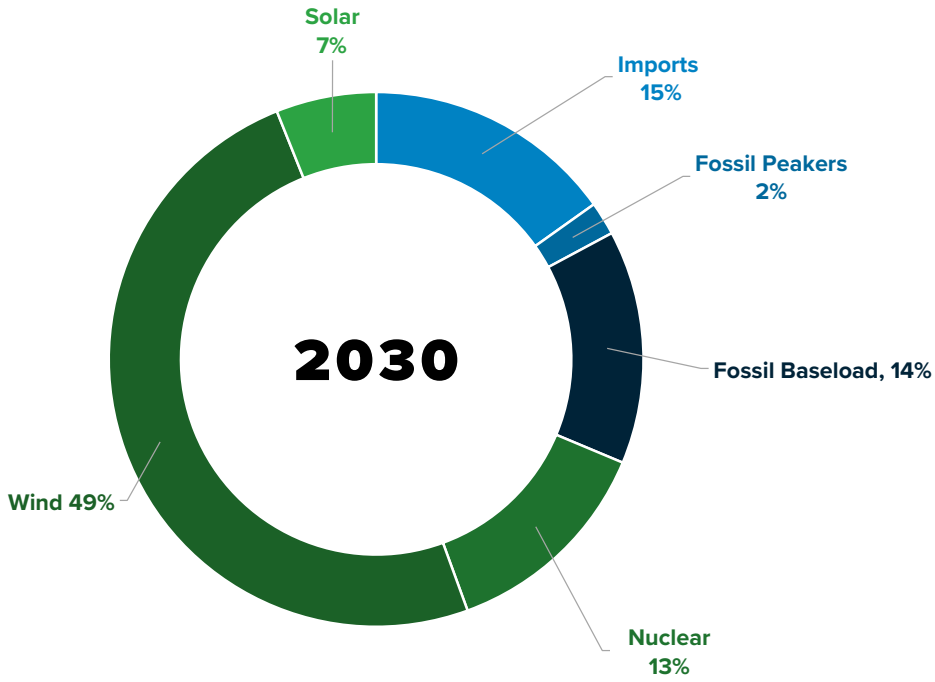
Figure 5: **Long Island Clean Energy Projects in Service by the Early 2030s**

Solar (1,419 MW)	**Size** (MW_{AC})	**In-Service** (Est./Act.)
Long Island Solar Farm	32	2011
Eastern Long Island Solar Project	11	2013
Shoreham Solar Commons	25	2018
Riverhead Solar	20	2019
Kings Park Solar 1 and 2	4	2019
Solar Feed-in Tariffs I-III	89	2021-2022
LI Solar Calverton	23	2021
Behind-the-Meter	1,200	2030
Solar Communities (FIT V)	15	2025
Offshore Wind (3,628 MW)	**Size** (MW_{AC})	**In-Service** (Est./Act.)
South Fork Wind Farm	130	Early 2024
Sunrise Wind	924	Mid-to-Late 2020s
Empire Wind 2	1,260	Late 2020s
Excelsior Wind	1,314	2030s
Energy Storage (750 MW)	**Size** (MW_{AC})	**In-Service** (Est./Act.)
East Hampton & Montauk Storage	10	2018 & 2019
2023 RFP Awards (Pending)	175+	2025
Future Storage Additions	565	2030
TOTAL	**5,797** (MW_{AC})	

What will be the sources of Long Island's electricity in 2030?

Figure 6 shows that by 2030, nearly half of the power supply to Long Island will be sourced from offshore wind, with an additional 19% from zero-carbon solar and nuclear. Long Island fossil plants will provide 16% of electric needs, while imports from neighboring electric grids are projected to provide 15%.

Figure 6: **Sources of Long Island Electricity Production in 2030** | 22,011 GWh

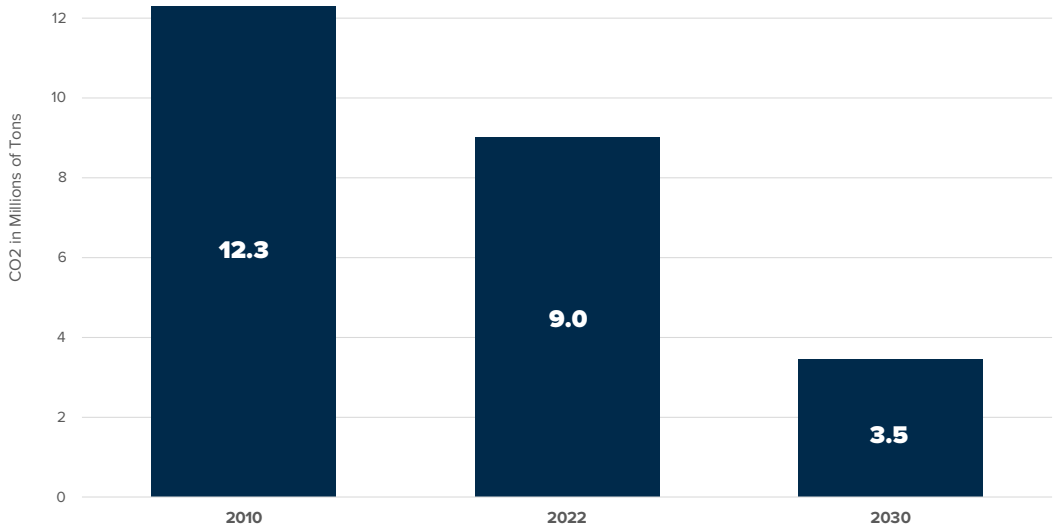


Note: The solar category includes both customer-owned solar and utility-scale solar farms. Estimate excludes recently announced Excelsior Wind.

How will new clean energy resources affect LIPA's carbon footprint through 2030?

Figure 7 shows that LIPA's carbon footprint is projected to decline over 70% by 2030 compared to 2010. Much of this depends on adding offshore wind to the Long Island electric grid.

Figure 7: **Carbon Emissions Footprint for LIPA's Power Supply from 2010 to 2030**



Note: 2030 estimate excludes recently announced Excelsior Wind.

What is the outlook for fossil fuel generation for LIPA's service territory?

As new clean energy sources are added to the grid, LIPA will ramp down its fossil fuel power purchase agreements. Contracts for selected units will be extended into the 2030s to support system operating flexibility and reliability, primarily to balance the intermittency of renewables and serve as backup during lulls in offshore wind production and when the sun goes down. **Figure 8** shows the remaining contract terms for LIPA's existing power purchases by category and indicates the potential for ramping down contracts that are not needed. **Nearly all of LIPA's power purchase agreements are subject to renewal by 2030, so the portfolio can be re-shaped based on need.** The complete elimination of fossil generation will require the development of new technology that can be deployed reliably at scale for dispatchable emissions-free resources. There are several demonstration projects of potential technologies that are in various phases of development. For more information, see "What are the leading DEFR technologies that are under development" on page 44.

Figure 8: **Phase-Out of Fossil Fuel Power Contracts**

What are LIPA's existing fossil fuel power plant contracts and how will they be retired?

LIPA's single largest fossil fuel purchase agreement is the Power Supply Agreement ("PSA") with National Grid Genco for 3,550 MW of Long Island Lighting Company ("LILCO") era legacy generation. **Under the PSA, LIPA has the right to cease purchasing electricity from selected units before the contract's expiration in April 2028. LIPA has retired 420 MW to date, with around 200 MW of additional combustion turbine retirements pending**. As shown in **Figure 9**, LIPA expects to ramp down some of the Genco steam turbines that will not be needed for system reliability but will likely extend the PSA for units that will be necessary post-2028 under the existing Federal Energy Regulatory Commission ("FERC") regulated cost-of-service arrangement.

The timing for ramping down the steam turbines at "E.F. Barrett" (Island Park), Port Jefferson, and Northport will be determined based on further analysis. The facilities were originally intended for baseload use during the LILCO era but have operated at annual capacity factors below 25% (see **Figure 10**), which indicates a reduced need to keep the units in service. IRP modeling indicates that any steam turbines that remain in service by 2030 would operate at a capacity factor well below 10%.

For LIPA's other expiring power purchase agreements, all options remain on the table — whether to let the contracts expire or extend under renegotiated terms. Generators without power purchase agreements have the option to operate as merchant plants, selling their energy and capacity in the NYISO power market, as long as they are able to meet pending regulations on emissions from generating sources.

Figure 9: **Long Island Fossil Fuel Unit Retirements to Date and Planned Near-Term Retirements**

Retired Unit	Technology	Size (MW)	Retirement Date
E.F. Barrett Gas Turbine ("GT") #7 (Island Park)	Gas Turbine	18	2011
Far Rockaway	Steam	100	2012
Glenwood Landing	Steam	228	2012
Montauk Diesels 2 to 4	Diesel	6	2013

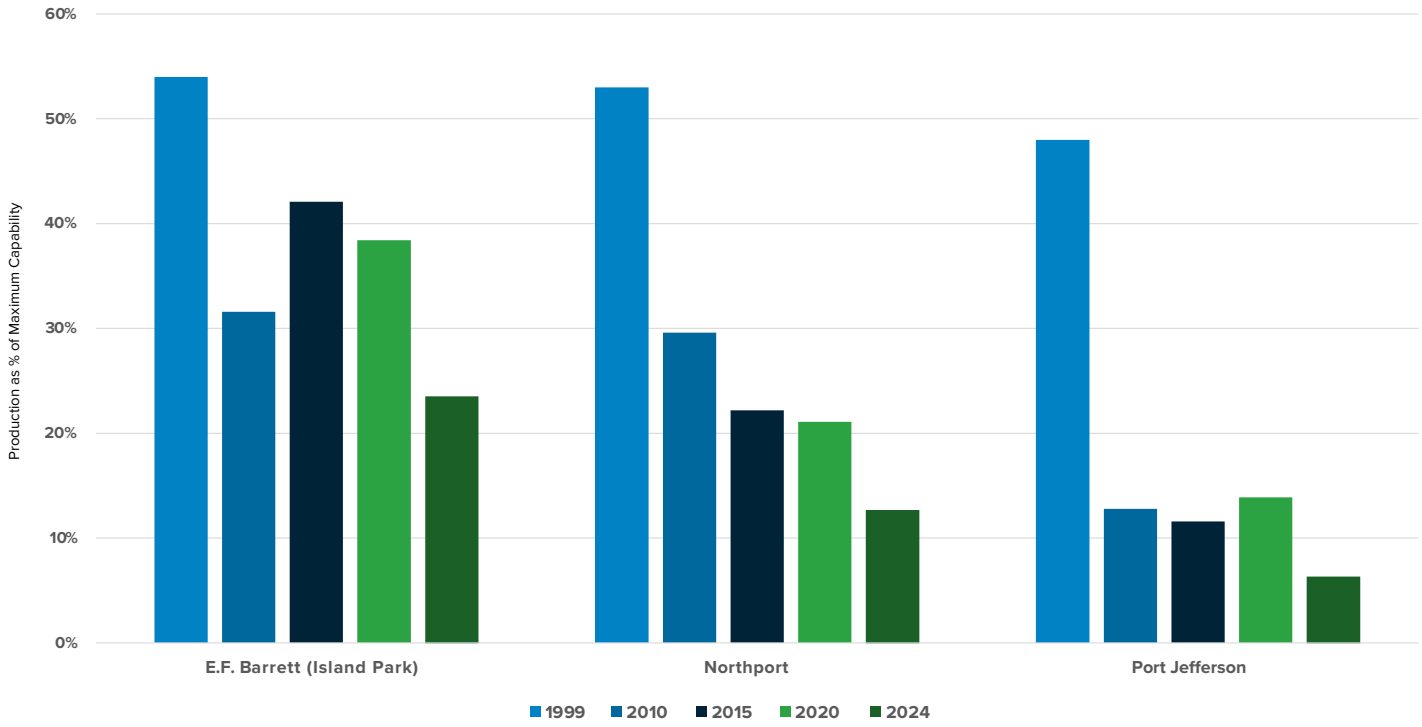
Planned Near-Term Retirements	Technology	Size (MW)	Retirement Date
Shoreham GT #1 and #2	Gas Turbine	71.5	2025
Glenwood GT #1	Gas Turbine	15	2025
Glenwood GT #3	Gas Turbine	55	2025
West Babylon GT #4	Gas Turbine	52	2025
E.F. Barrett (Island Park)	Steam Turbine	188-376	by 2030
Port Jefferson	Steam Turbine	188-376	by 2030
Northport	Steam Turbine	up to 387	by 2030

Note: The exact order, amount, and timing of steam turbine retirements to be determined.

How much do the Long Island fossil fuel power plants run?

Capacity factors are the ratio of annual electric energy production as compared to the theoretical maximum. New baseload power plants typically need to run at capacity factors in excess of 70% to be economic. While Long Island's baseload plants built post-2000 continue to operate close to their design duty, the LILCO-era steam turbines, which are well maintained but have been in service for 50 to 70+ years, are no longer operating as originally intended. As shown in **Figure 10**, while each plant was running around a 50%+ capacity factor in the 1990s, **the production (and resulting GHG emissions) at each plant has declined sharply in recent years and is projected to further decline as offshore wind and other renewables continue to be added to the electric grid**.

Figure 10: **Long Island Has Become Less Dependent on Steam Turbines for Baseload Generation**



What will happen to the tax and PILOT payments at Barrett, Northport, and Port Jefferson if some or all of the plants are retired?

Between 2018 and 2022, LIPA entered into settlement agreements to gradually lower the payments on these plants 47% by 2027, saving our customers approximately $554 million. For most units that are ramped down before 2027, payments will continue according to the settlement schedules through 2027. For any units that may continue to operate past 2027, proportional payments on the remaining capacity will be made at the 2027 levels for up to five additional years.

What are the U.S. EPA's recently proposed regulations to limit carbon emissions from new and existing fossil fuel units? How will they affect Long Island fossil fuel generators?

In May 2023, the EPA proposed new greenhouse gas ("GHG") guidelines under the Clean Air Act ("CAA") for new and existing power plants. The standards focus on large baseload plants that plan to operate far into the future to ensure they control GHG emissions starting in 2030. The CAA requires large emission sources to use control technologies that are adequately demonstrated considering cost and energy requirements and environmental impacts. Under the new proposed standards, carbon capture and sequestration ("CCS") and alternative fuel co-firing with low-GHG hydrogen (transitioning to entirely clean hydrogen over time) are identified as best systems of emissions reduction ("BSER"), with CCS and low-GHG fuels identified as separate compliance "pathways."

Any large, frequently operating combined-cycle natural gas-fired power plant would have to either install a 90% efficient CCS system by 2035 or operate nearly entirely on clean hydrogen by 2038. These requirements may apply in the future to several combined cycle generators on Long Island, such as the Caithness Energy Center, which operates a 350 MW combined-cycle unit. Since CCS is unlikely to provide a viable solution for Long Island, local units subject to the BSER standards would likely choose the clean fuel pathway provided in the proposed rules.

Long Island's steam turbines operating on oil and gas would not be subject to the BSER requirement because of their low capacity factors but would need to meet minimum standards for GHG emissions per megawatt-hour. National Grid reports that all its Long Island steam turbines, which are located at the E.F. Barrett, Port Jefferson, and Northport power stations, currently meet the proposed standards. The new standards likely would not apply to most, if not all of Long Island's many combustion turbines, which operate at low capacity factors and are used mainly for summer and winter peak conditions. Nonetheless, any combustion turbines expecting to operate post-2040 would need to at a minimum convert to clean fuel to comply with the state's Climate Act.

The EPA's CCA proposal is in the early stages of rulemaking and will likely continue to evolve before it is adopted.

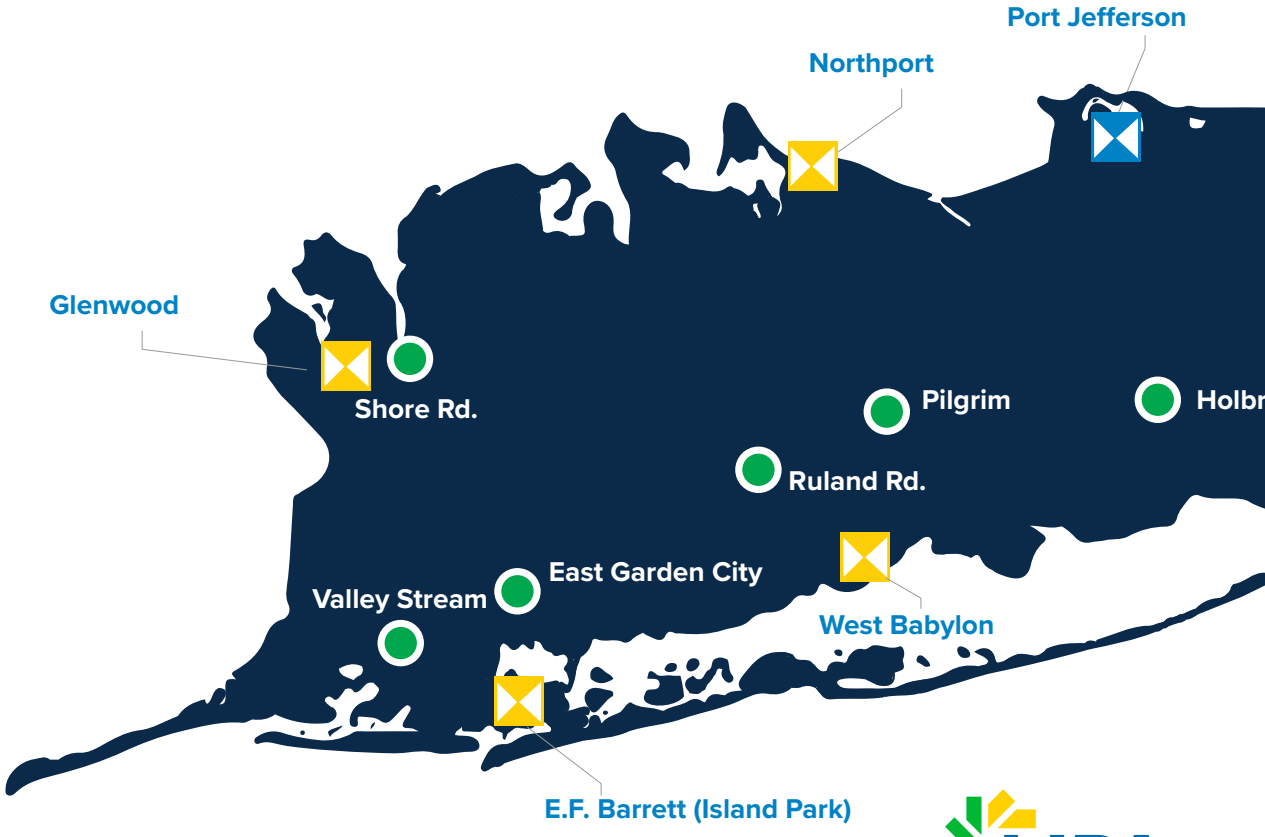
Can existing sites for fossil fuel generation be repurposed for clean energy?

Existing transmission infrastructure was built to export power from generation locations to the rest of the electric grid. **As older fossil fuel units are phased out, their interconnection rights and export capacity can be repurposed for offshore wind and storage additions**. **Figure 11** shows some of the fossil fuel generation sites that may be repurposed for clean energy. **LIPA has proposed to develop battery storage at the Shoreham and West Babylon sites**. The E.F. Barrett site will host a new substation as part of the Propel NY Energy transmission project, which will partially repurpose the site for offshore wind. The 1,260 MW Empire Wind 2 project is planning to construct an onshore substation nearby E.F. Barrett, with a connection to the new Propel NY Energy substation. LIPA may exercise its right to purchase other generating sites from National Grid for repurposing when the existing fossil fuel plants are shut down. Such sites could be leased to clean energy developers for storage or transmission facilities or developed for LIPA's own projects.

Has LIPA reviewed the effects of its fossil-fired plants on disadvantaged communities?

LIPA has prioritized shutting down power plants within or near areas classified as disadvantaged communities. Four such plants are scheduled to be shut down between 2025 and 2028 (see **Figure 9** on page 35). The remaining fossil fleet will operate less frequently and thereby emit less as more and more clean generation is placed in service before being phased out completely by 2040 or possibly converted to clean fuels.

Figure 11: **Potential Repurposing Sites on Long Island**



Disadvantaged communities in LIPA's service territory include:

Nassau County
Westbury Village, New Cassel, Elmont, Hempstead Village, Uniondale, East Meadow, Valley Stream Village, South Valley Stream, Inwood, Oceanside, Roosevelt, Long Beach City, Glen Cove City, and East Massapequa

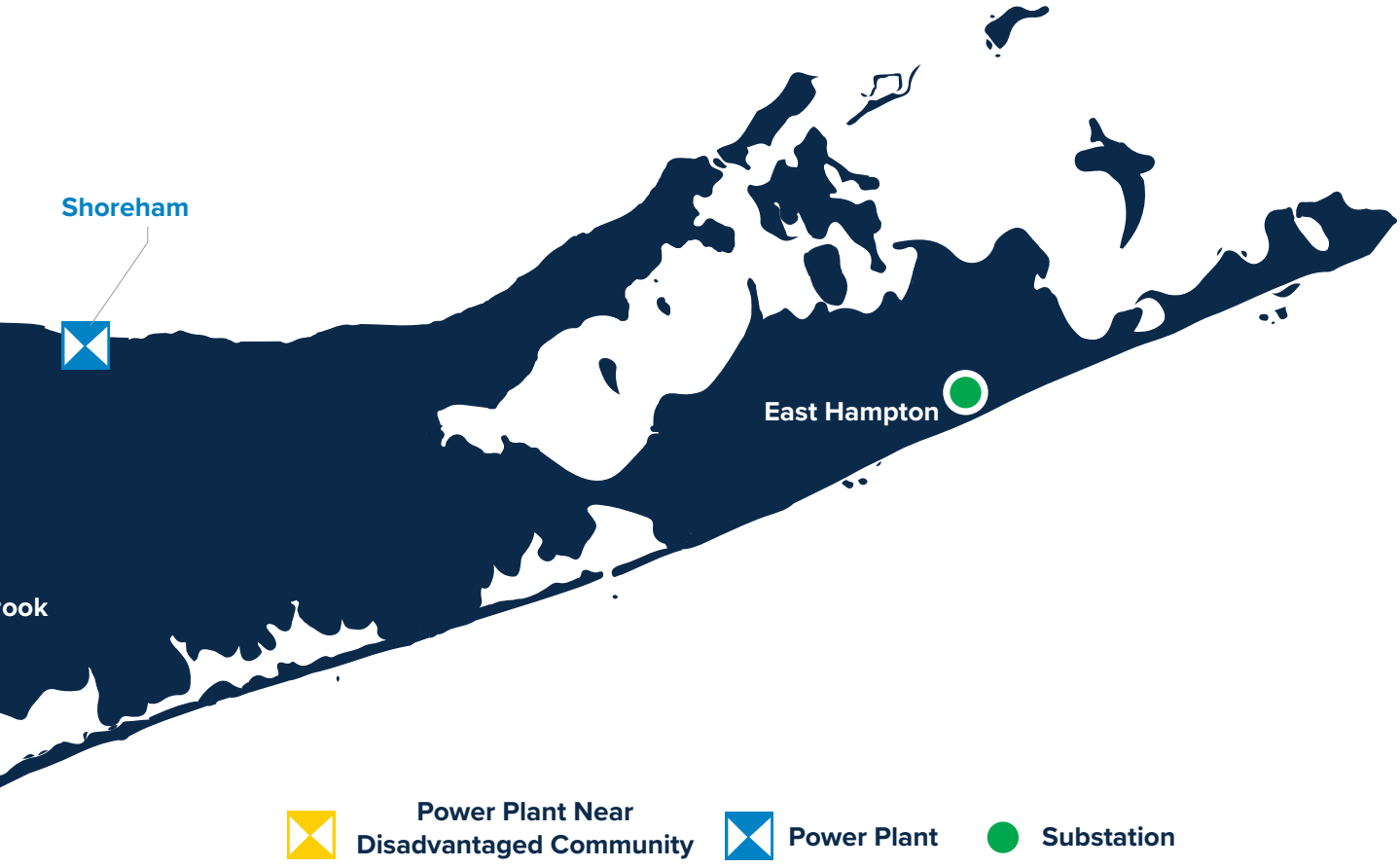
Suffolk County
Huntington Station, East Farmingdale, Wyandanch, West Babylon, North Amityville, Copiague, Lindenhurst Village, Brentwood, Islandia Village, Bay Shore, North Bay Shore, Central Islip, Ridge, Patchogue Village, Yaphank, Shirley, Mastic, Calverton, Flanders, Westhampton Beach Village, and Tuckahoe

Queens County
The Rockaways

To view an interactive map of disadvantaged communities across New York State visit: **https://on.ny.gov/3FJ5kCk**

Has LIPA considered a faster transition to renewables than what is in the Climate Act?

The most significant components of the state's plan for decarbonizing downstate New York's electricity supply between now and 2035 are the addition of up to 9,000 MW of offshore wind projects and their associated grid upgrades. The development schedules for many of these projects are established but could be delayed. Further discussion of delay risks can be found in the offshore wind section on page 39. At this point, **accelerating the downstate offshore wind and transmission projects already in the pipeline is unlikely, as are significant new resource additions before 2030 (the IRP action period) that are not already in the permitting process.**



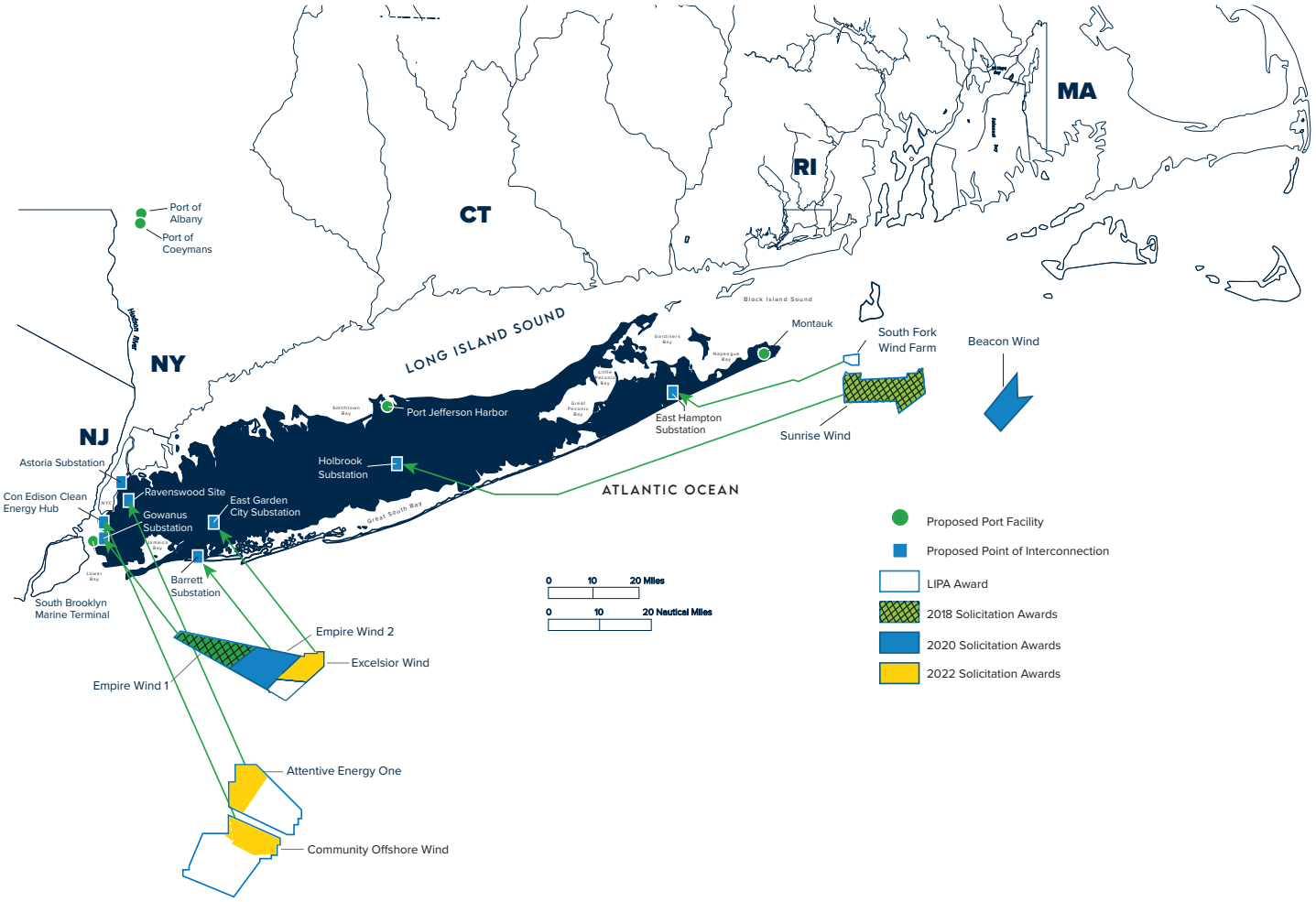
Offshore Wind

What is the state's master plan for the development of offshore wind?

Offshore wind is poised to become the largest source of energy for Long Island and the Rockaways by 2030. State policymakers have focused on offshore wind as a crucial addition for the downstate region, complementing land-based renewables from upstate and Canada as the means to decarbonize the state's electric sector, recognizing that there are limits to the development of land-based renewable energy in the downstate region. The NYSERDA procurement processes for offshore wind, other renewables, and storage ensure that the most cost-effective projects are selected for state contracts while meeting Climate Act goals for specific resource categories.

The Climate Act sets a goal of 9,000 MW of offshore wind energy by 2035, enough to power 6 million homes, and contracting and development activities are on track to meet this goal. As shown in **Figure 13**, **8,400 MW of offshore wind is in development, with ~3,600 MW expected to connect to Long Island.**[2] **The Scoping Plan issued by the Climate Action Council anticipates that as much as 18 GW of offshore wind resources may be needed to achieve a zero-carbon grid by 2040.**

Figure 12: **Current Procurements for Offshore Wind Development** | 3,600 MW of Offshore Wind to Connect to Long Island



[2] *On June 22, 2023, the New York Public Service Commission directed the NYISO to plan for interconnection of at least 4,770 MW of offshore wind into New York City, in addition to at least 3,000 MW to be connected into Long Island pursuant to the Long Island Offshore Wind Export Public Policy Transmission Project.*

Figure 13: **Contracted New York Offshore Wind Projects**

Project Name	Owner	Size (MW)	Contract Off-Taker	Contract Award Date	Interconnect Utility	In-Service Date
South Fork Wind	Ørsted and Eversource	130 MW	LIPA	2017	LIPA	Early 2024
Empire Wind 1	Equinor Wind US LLC	816 MW	NYSERDA	2019	Con Edison	Mid-to-late 2020s
Sunrise Wind	Ørsted and Eversource	924 MW	NYSERDA	2019	LIPA	Mid-to-late 2020s
Empire Wind 2	Equinor Wind US LLC	1,260 MW	NYSERDA	2021	LIPA	Late 2020s
Beacon Wind	Equinor Wind US LLC	1,230 MW	NYSERDA	2021	Con Edison	Late 2020s
Attentive Energy One	TotalEnergies, Rise Light & Power, Corio Generation	1,404 MW	NYSERDA	2023	Con Edison	2030s
Community Offshore Wind	RWE Offshore Renewables and National Grid Ventures	1,314 MW	NYSERDA	2023	Con Edison	2030s
Excelsior Wind	Vineyard Offshore	1,314 MW	NYSERDA	2023	LIPA	2030s

What are the risks of developing such large-scale offshore wind projects?

Offshore wind faces many development risks as the sponsors execute all the steps needed to make projects come together, such as federal and state permitting, interconnection studies, contracting, equipment procurement, and financing. Permitting for onshore cables and substations may result in delays due to route and design changes to address community concerns. **At the time of this report, LIPA's South Fork Wind project has nearly completed construction after having experienced some of these delays**. The larger projects procured by NYSERDA, which are still in the pre-construction phase, are currently facing their own set of challenges.

Why have offshore wind project developers sought contract amendments with NYSERDA?

In June 2023, offshore wind project developers currently under contract with NYSERDA filed petitions with the PSC for the ability to amend contracts for Empire Wind 1 and 2, Sunrise Wind, and Beacon Wind to increase pricing, citing a combination of supply chain difficulties, labor, interconnection costs, and inflation which have led to increased costs to develop the projects. The requests varied for each project, with increases ranging from 27% to 66% of the per-megawatt-hour cost of the Offshore Wind RECs that would have been paid by electric customers statewide. In October 2023, the PSC denied the petitions.[3]

What happens if some of the offshore wind projects are delayed or canceled?

If the NYSERDA projects are delayed or canceled, it likely will require adjustments to the retirement schedules for LIPA's fossil-fuel generators, but there are many paths to meet the state's objective of 9,000 MW of offshore wind by 2035. **The offshore wind resource is large, with many different leaseholders, so even if one project falls through another will take its place**. Even for the current projects, if canceled, the work completed to date to design and permit the projects would remain available for a future proposal.

What is Governor Hochul's '10-Point Action Plan'?

In October 2023, Governor Hochul released a 10-Point Action Plan to expand and support the growing large-scale renewable energy industry in New York, reaffirming the state's commitment to achieving the Climate Act goals. The plan outlines a comprehensive set of actions being taken to lay the foundation for a sustainable future for all New Yorkers through the expansion of the state's growing clean energy economy and renewable energy sector, including **another round of offshore wind and renewable project awards in the near future, and accelerated future competitive procurements to backfill any contracted projects that are canceled**.[4]

[3] *Public Service Commission, Title of Matter/Case: In the Matter of Offshore Wind Energy, 23105/15-E-0302; 18-E-0071*
[4] ***https://www.nyserda.ny.gov/All-Programs/Large-Scale-Renewables***

South Fork Wind Farm

LIPA's South Fork Wind Farm **was one of 21 projects proposed in response to a 2015 LIPA Request for Proposals to meet the growing energy demands of the eastern end of Long Island**.

In January 2017, the LIPA Board of Trustees approved a power purchase agreement to buy energy from the project, which was the **first such agreement of its kind in the nation at the time**. As an electric utility, LIPA will buy the energy, capacity, ancillary services, and renewable energy credits from the project, which is being developed by Ørsted and Eversource.

South Fork Wind was initially proposed as a 90-megawatt project. In November 2018, LIPA agreed to purchase an additional 40 megawatts of clean energy from the project – extra power available from improving turbine technology.

Years in the making, final project approval was granted by the U.S. Department of the Interior's Bureau of Ocean Energy Management in January 2022 with significant milestones made since, including:

- **Groundbreaking** – February 2022
- **Onshore cable installation** – May 2023
- **First monopile foundation** – June 2023
- **Offshore wind substation installation** – July 2023
- **Onshore substation completion** – August 2023
- **First turbine installation** – November 2023

The wind farm consists of 12 Siemens wind turbine generators, running 318 feet in blade length and spanning over 656 feet in rotor diameter – about the length of two football fields.

Located 35 miles east of Montauk Point, South Fork Wind will deliver power to the local substation in the Town of East Hampton through undersea and underground transmission cables from the offshore wind farm.

South Fork Wind is an important part of Long Island's ability to meet our share of the statewide goals and once completed, will add enough renewable electricity to the Long Island grid to power 70,000 homes and offset 300,000 tons of carbon emissions yearly.

South Fork Wind's first turbine tower, blades, and narcelle preparing to leave the Port of New London, Connecticut on October 31, 2023.

Photo courtesy of Ørsted

Can Long Island's electric grid handle the amount of offshore wind that will be produced?

State policymakers recognize that our region's transmission backbone must be expanded for offshore wind. In 2020, LIPA and Con Edison conducted technical studies to assess the need for system expansion and, based on the results, recommended to the PSC that additional transmission cables would be needed to enable the transmission of offshore wind from Long Island to New York City, Westchester County, and the rest of the state.[5] In 2021, the PSC declared a Public Policy Transmission Need and directed the NYISO to procure the necessary transmission development, with costs to be shared by electric customers statewide. In June 2023, the NYISO selected a project proposed by Propel New York Energy, a consortium of the New York Power Authority and New York Transco LLC. **The Propel NY Energy transmission project is expected to cost $3.3 billion and will be paid for by customers statewide. This project will allow for the export of surplus power from at least 3,000 MW of offshore wind projects connecting to Long Island** and greatly enhance the ability of the Long Island grid to integrate offshore wind as well as import firm energy during wind lulls.

The Propel NY Energy project includes:

- Three new high-voltage cables from Long Island to New York City and Westchester.
- Capacity to handle the full output of 3,000 MW of offshore wind interconnected to Long Island without curtailment.
- Corresponding increases in transfer capability between Long Island and the rest of the state for the import and export of energy, with improved system operational flexibility.

Figure 14: **Improving the Long Island Transmission Backbone for Offshore Wind**

5: The LIPA Board policy on 'Public Policy Transmission Planning,' requires LIPA staff to evaluate whether public policy requirements drive the need for physical modifications to the Long Island Transmission District ('Long Island PPTNs'). For more information, visit: lipower.org/purpose.

Does the PSC's recent decision denying price increases for offshore wind developers affect the Propel NY Energy project?

No, the Propel NY Energy project will continue as offshore wind projects will be developed and ultimately interconnected into the Long Island electric grid to transmit power to the rest of the state to meet the goals of the Climate Act. **The Propel Project is not specific to any single offshore wind project but rather is required to meet the state's goal of 9,000 MW of offshore wind by 2035**.

Dispatchable Emission-Free Resources ("DEFRs") and Storage

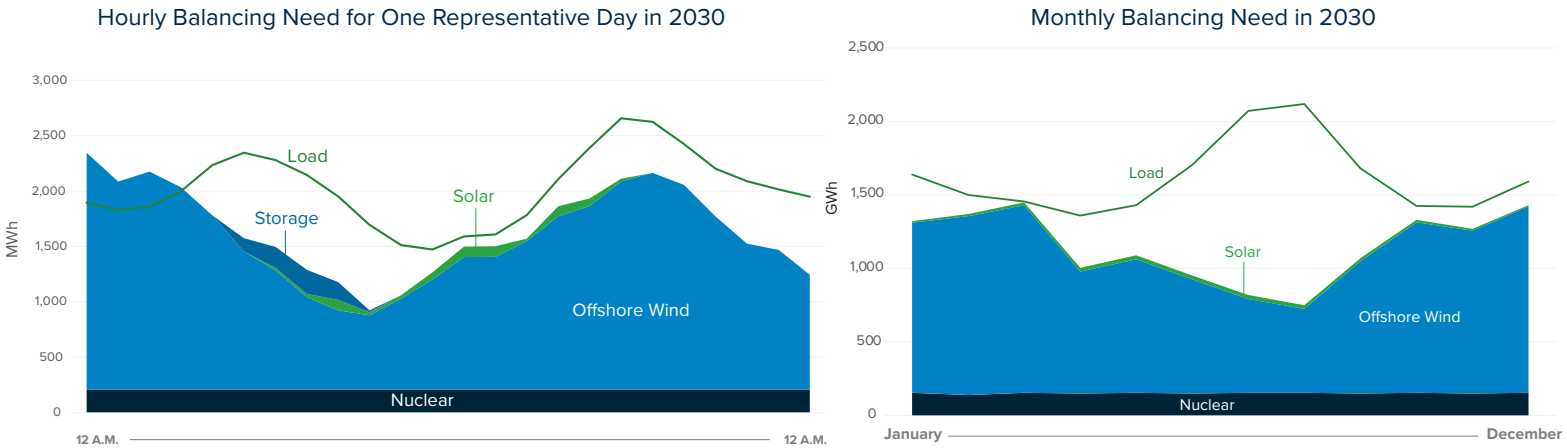
How does offshore wind affect the operation of LIPA's electric grid?

Offshore wind is expected to have an average annual capacity factor of around 50%, but there is considerable variation in output on a daily and seasonal basis. **Figures 15 and 16** illustrate supply and demand balancing when a large percentage of the power supply is produced from offshore wind.

Figure 15 shows a system load projection for a representative day in 2030 versus the projected output of the non-dispatchable resources (i.e. nuclear, wind and solar) assumed to be available for that day. The gap between the load and the non-dispatchable resources would have to be served by controllable imports, local fossil generation, and energy storage. The load curve peaks in the morning and again in the early evening when the daily peak hour tends to occur. The significant dip during the daytime is due to the impact of behind-the-meter solar. Wind generation occurs at all times of the day but tends to be stronger at night. For this particular day, in some of the early morning hours the available wind resource is in excess of local needs and would be exported off-island, whereas for the other hours the wind could be used locally.

Figure 16 shows that over the course of a typical year there is normally less wind during the summer peak season than at other times of the year. This means that even with a buildout of offshore wind interconnecting to Long Island, LIPA will remain dependent on imports and local dispatchable resources for local reliability and will need to maintain portions of the existing fossil-fueled fleet for load balancing for the time being. **In the post-2030 period, new technologies and clean fuels will be needed to replace the operational flexibility of fossil generation with DEFRs such as long-duration storage, clean hydrogen, and CCS**. For more information, see the "What is the statewide plan to achieve a zero-carbon electric grid by 2040" section on page 46.

Figures 15 and 16: **System Balancing Need Large-Scale Development of Offshore Wind**



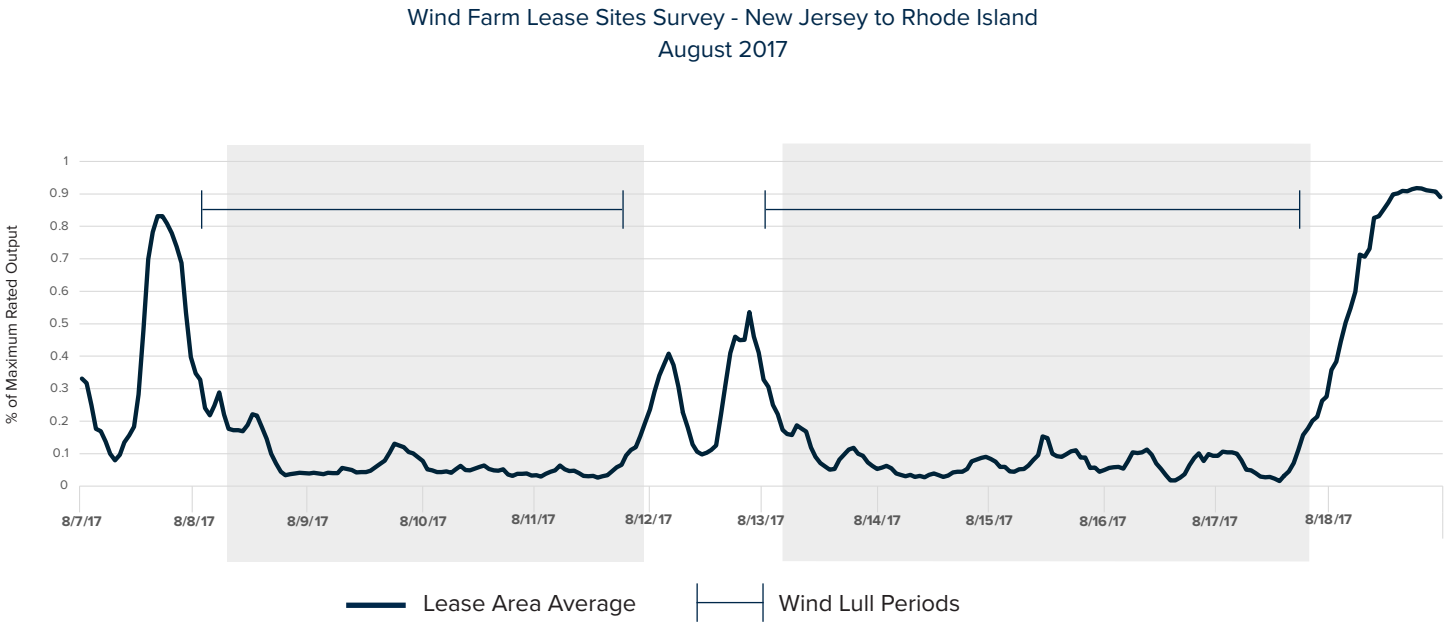
Note: On a monthly basis, the net storage effect is effectively zero.

What are wind lulls and how do they affect grid operations?

Integrating offshore wind into the existing downstate power system presents certain challenges for electric system operations. A recent report by the New York State Reliability Council[6] finds that, for the northeastern Atlantic seaboard, wind lulls — defined as energy production less than 20% of full potential output – lasting up to 24 hours occur on average 30 times each year. Wind lulls of 48 hours or longer occur on average about seven times per year. About 70% of these wind lulls occur during the peak four-month summer period from June to September. **Figure 17** shows an example of one of the most extreme offshore wind lull periods of the last two decades, which affected the entire Atlantic seaboard from New Jersey to Rhode Island and extended over ten days in August 2017.

Long Island will need sufficient backup resources to withstand multi-day wind lulls. These needs cannot be met with existing storage technologies, due to their limited duration (generally four hours) and the need for an energy source to charge.

Figure 17: **Modeled Offshore Wind Output for Extreme Wind Lull Events that Occurred in August 2017**



How will Long Island maintain reliability through 2030?

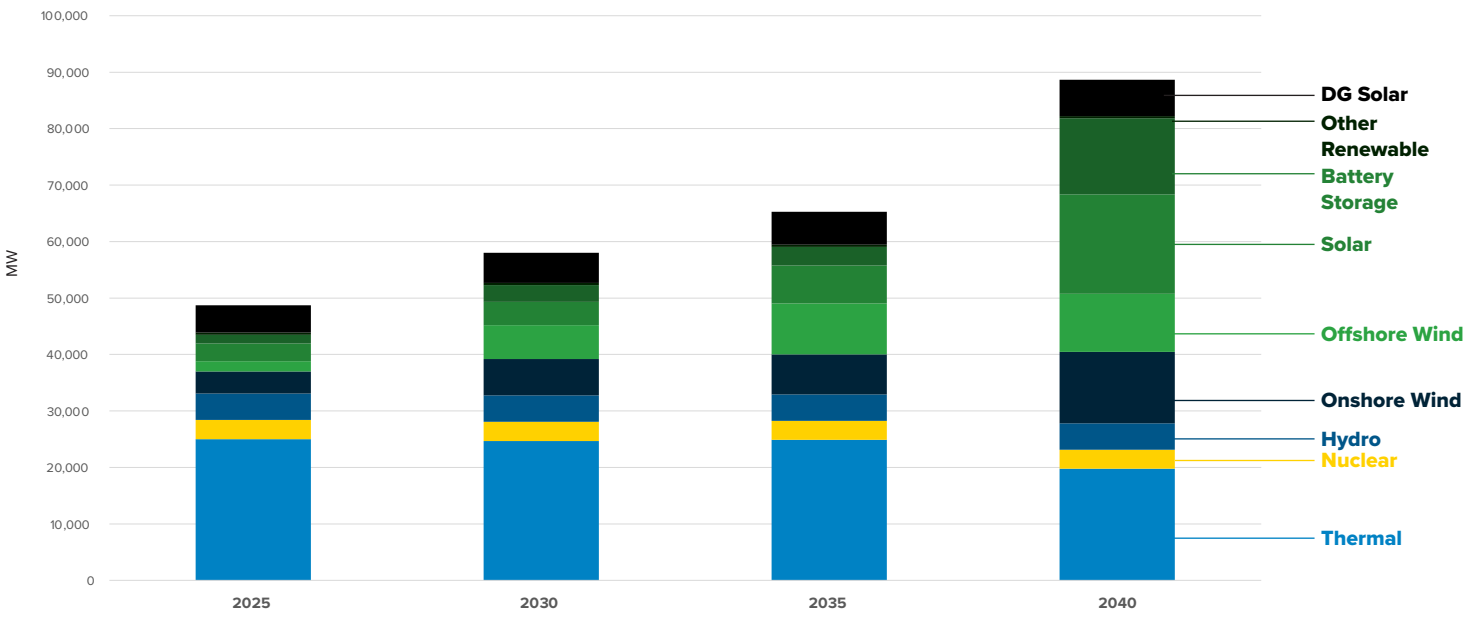
The resource additions required to implement the Climate Act, including offshore wind farms, the Propel NY Energy offshore wind transmission project, and new energy storage projects, will be sufficient to ensure local reliability through 2030. Significant additional clean resources and DEFRs will be needed after 2030 to meet the Climate Act's goal to phase out fossil fuels by 2040 and address evolving state and federal initiatives to limit GHG emissions.

6: *The report, "Offshore Wind Data Review NYSRC Preliminary Findings," can be viewed at* ***https://www.nysrc.org/wp-content/uploads/2023/06/NYSRC-Wind-Impacts-05232315805.pdf.***

What is the statewide plan to achieve a zero-carbon electric grid by 2040?

Figure 18 shows the statewide installed generating capacity projection from the Zero Emission Study prepared for NYSERDA and DPS in 2021, which was used as an input in the Climate Action Council's Scoping Plan for economywide decarbonization. **The study projects a total need for 90 GW of installed generating capacity by 2040, including about 18 GW of "other thermal" generation capacity that would remain operational for backup power needs fueled by renewable natural gas or other clean fuels (i.e., hydrogen) and 15.5 GW of battery storage**. NYISO's 2021-2040 System & Resource Outlook Report[7] projects a need for up to 120 GW by 2040, including between 27 and 45 GW of DEFRs, depending on the scenario assumptions.

Figure 18: **Climate Action Council Scoping Plan Projections for New York Installed Capacity Through 2040**



What are Long Island's projected resource needs between 2030 and 2040?

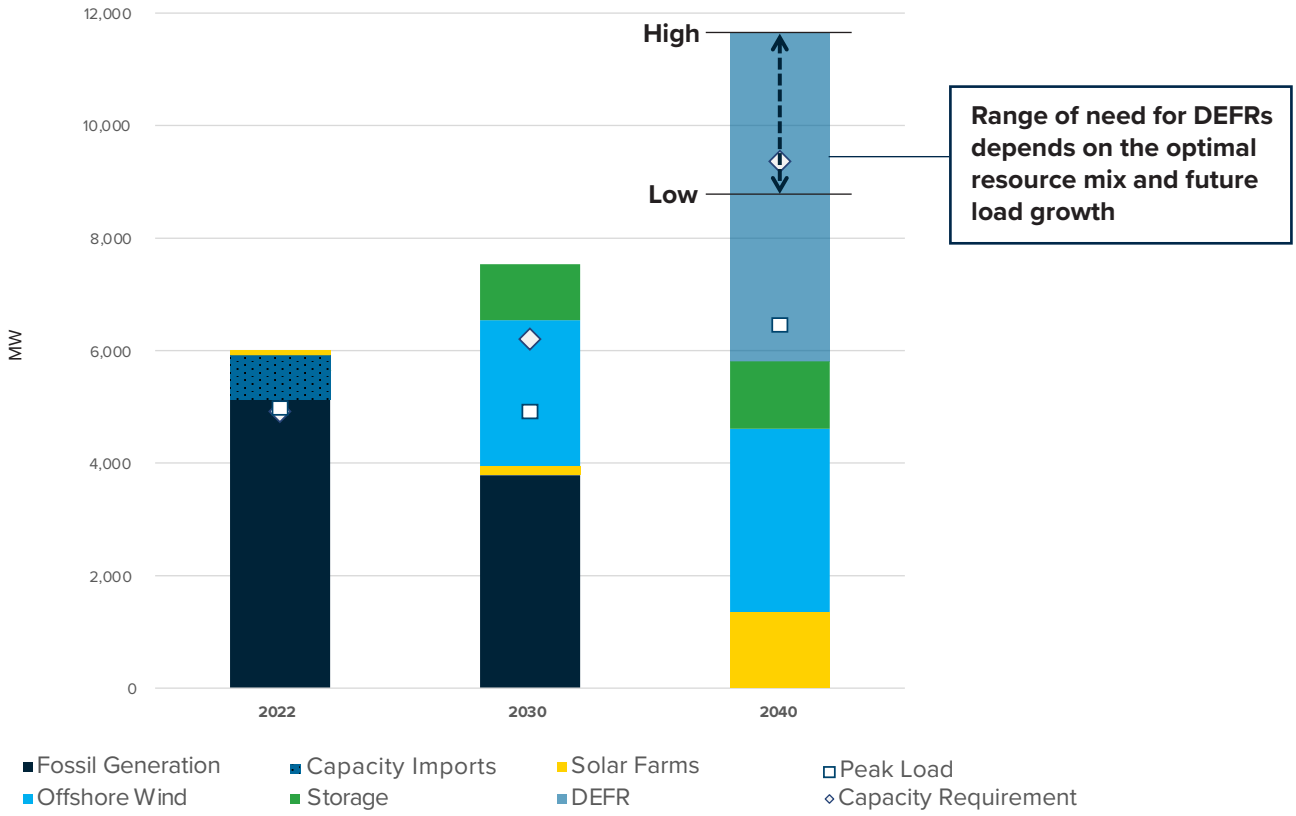
Figure 19 shows the Long Island resource need for 2022 and the IRP base case scenario for projected years 2030 and 2040. **The chart shows that, in addition to the offshore wind and storage resources called for in the Climate Act, Long Island will need between 3 and 6 GW of DEFRs by 2040 to meet the capacity requirement, equivalent to replacing the existing fleet of fossil-fueled power plants with zero-emission resources**.

There are two main reasons for the increase in the local capacity requirement between 2030 and 2040. **First, Long Island's peak load is expected to increase by about 1,400 MW, driven primarily by the electrification of transportation.** Second, the available resource mix is expected to change significantly, as fossil generation is replaced by solar, wind, short-duration storage, and DEFRs. 1 MW of solar, wind, or storage provides less of a reliability contribution than 1 MW of fossil generation, for the reasons described above, and therefore total installed capacity, including DEFRs to backup renewables during wind lulls, must increase.

The optimal mix of storage, renewables, and DEFRs in the post-2030 timeframe remains uncertain at this time.

7: ***The Outlook: Key Findings Datasheet - NYISO***

Figure 19: **Long Island Generation Capacity**



Note: The chart does not include customer-owned solar and other behind-the-meter resources, which help to reduce the load that LIPA needs to serve.

What are the leading DEFR technologies that are under development?

DEFRs represent a proxy technology that will be needed in the future to replace the flexibility of modern combustion turbines to serve system demand when intermittent generation is unavailable. DEFR technologies currently under development include turbines and fuel cells driven by hydrogen or biogas and small modular nuclear reactors. Biogas, also known as renewable natural gas ("RNG"), is a mixture of methane and other gases produced from the decomposition of organic matter. The advantages of RNG include compatibility with existing infrastructure and preservation of jobs and tax revenues from natural gas distributors. The downsides include limited current and future supply in the Northeast and an unclear path for carbon accounting under New York rules and regulations. National Grid, the natural gas supplier for Long Island's residential and commercial customers, has announced targets to serve up to 20% of gas demand with RNG by 2030 and blend 20% green hydrogen and 30% RNG in their gas network by 2040.

Considerable attention is focused on the development of hydrogen-based solutions. "Green hydrogen" can be produced in an electrolyzer using surplus renewable power and converted back into electricity through re-electrification in gas turbines, engines, or fuel cells. At the federal level, the U.S. Department of Energy ("DOE") has identified co-firing with hydrogen as a pathway for compliance with stricter GHG emissions standards (see "What are the U.S. EPA's recently proposed regulations to limit carbon emissions from new and existing fossil units" on page 36). The 2021 Infrastructure Investment and Jobs Act appropriates $9.5 billion for the DOE clean hydrogen program, and the Inflation Reduction Act provides additional policies and incentives for hydrogen, including a production tax credit that has further boosted a U.S. market for clean hydrogen. **Many demonstration projects for generating electricity with hydrogen are in development nationwide**. For example, the Cricket Valley Energy Center, one of the state's newest and most efficient natural gas-burning generators located about 20 miles east of Poughkeepsie, has announced a demonstration project with General Electric as the first step toward 100 percent conversion of the plant to clean fuel.

Another potential solution that has received some attention at the national level is carbon capture and storage. Most carbon capture research has focused on underground or undersea sequestration at locations with favorable geologic formations, such as oil and gas fields. Such opportunities do not exist on Long Island and are thought to be limited in New York State but further research is needed.

What storage has LIPA procured to date? Is LIPA on target to meet its share of the state's 3,000 MW by 2025 and 6,000 MW by 2030 storage objectives?

LIPA currently has 10 MW of 8-hour utility battery storage at two installations on the South Fork of Long Island. **On the customer-side, Long Island was the first region of the state to offer residential battery storage incentives**, with about 2,000 installations to date. The residential battery storage market appears to be on an exponential growth path. **LIPA's pending transition to Time-of-Day rates will provide another revenue stream to incentivize customers to install storage to reduce their electric bill**, which should give a further boost to the residential storage market in our service territory.

Going forward, it will make sense to site a significant portion of the Climate Act's statewide storage targets in the LIPA and Con Edison service territories. **LIPA has an ongoing solicitation for 175+ MW of utility-scale battery storage to be located on Long Island, and NYSERDA is actively developing its strategy for statewide storage solicitations, which may include locational carve-outs or incentives for downstate New York**.

Would accelerating LIPA's share of the state's 2025 and 2030 storage goals lower costs or GHG emissions by allowing the early retirement of more peaker plants?

The IRP modeled the addition of 325 MW of storage on Long Island by 2025, ramping up to a total of 750 MW by 2030, compared to a system peak load of about 5,000 MW. **The economics of adding more storage beyond the assumed amount of 750 MW by 2030 are not favorable at present. The early addition of storage would have a limited effect on the reduction of carbon emissions through 2030, with the primary driver of such carbon reductions being the addition of offshore wind to the Long Island electric grid. Without the additional clean energy supply, storage does not have a significant impact on carbon emissions**.

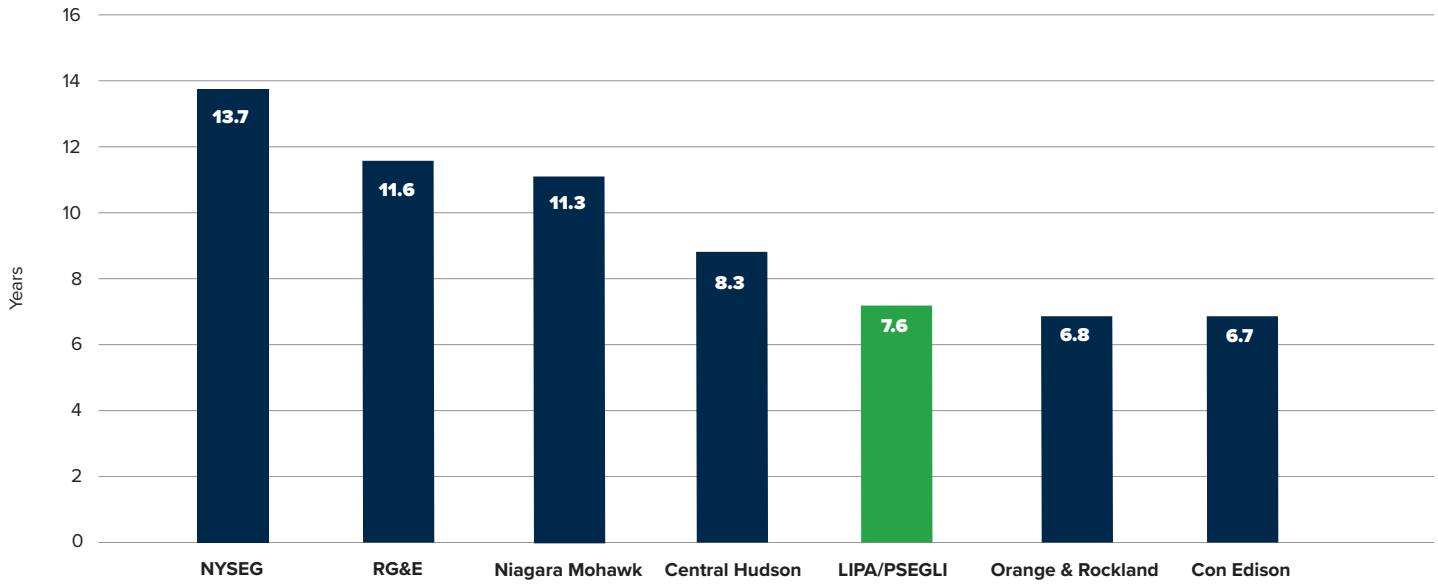
Nonetheless, storage will be essential to help replace a portion of the reliability and dispatchability attributes of fossil generation and to meet future load growth driven by accelerating customer adoption of EVs and building electrification beginning in the late-2020s. **The industry anticipates that energy storage costs will decline in the coming years as battery storage technologies mature and new non-lithium ion solutions are developed, and this should improve the overall economics of storage installations**.

Utility Scale and Rooftop Solar

What is the outlook for more solar on Long Island?

LIPA estimates that by 2030 Long Island will have over 1,200 MW of rooftop solar and 200 MW of solar farms, putting the region on track to exceed LIPA's 1,300 MW share of the statewide 10,000 MW solar goal. Customers have been installing solar at a steady pace of about 6,500 new systems per year since 2017, which has reduced LIPA's load growth by about 60 MW per year. There remains significant untapped potential, including brownfield sites and parking lots. **Figure 20 shows that LIPA's service territory is among the most attractive places in New York to install rooftop solar, with a typical customer seeing a payback in 7.6 years**. LIPA continues to explore the potential for new feed-in-tariffs to help incentivize solar projects benefiting low- and moderate-income residents and disadvantaged communities.

Figure 20: **Simple Payback Period for a Typical Residential Rooftop Solar Project**



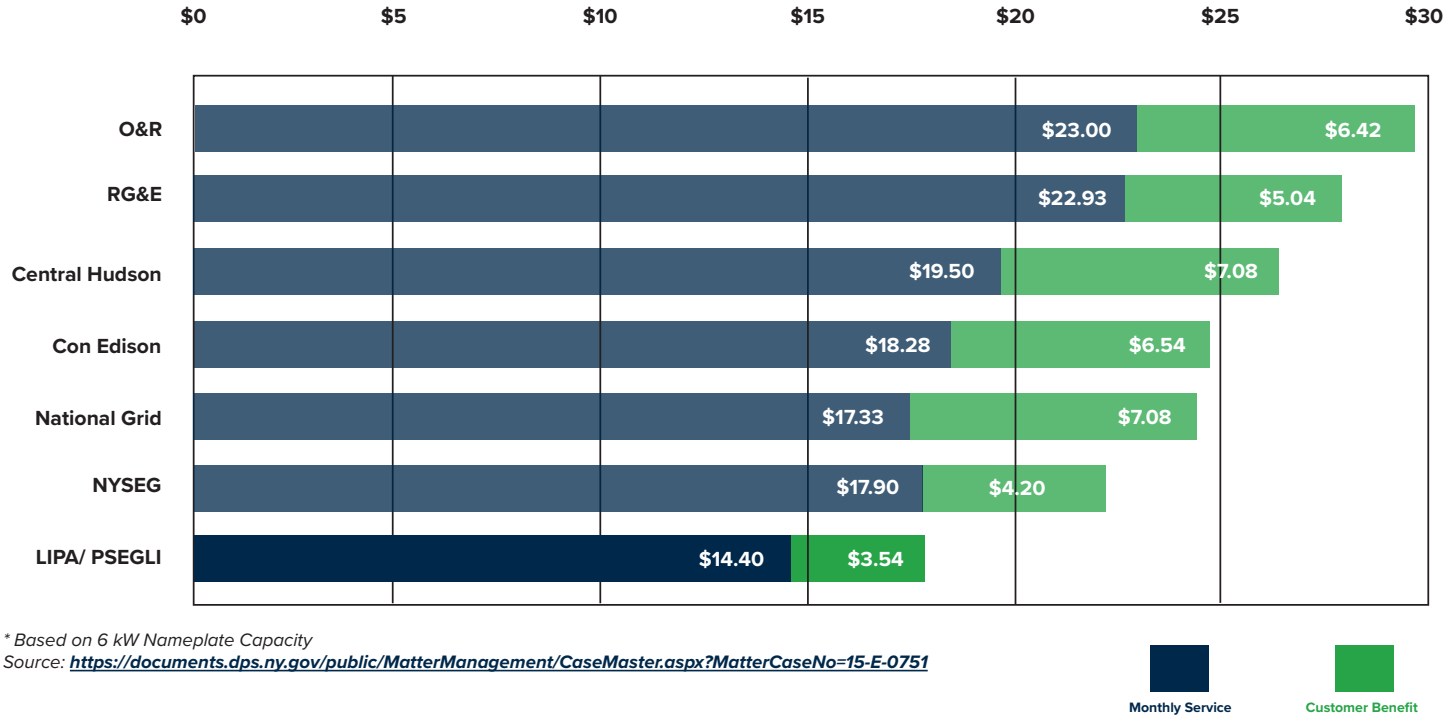
What causes the economics of rooftop solar to be so favorable for LIPA customers?

Typically, customers who add rooftop solar choose a system big enough to generate the same amount of electricity each year that their household consumes. The solar customer's production and consumption are not matched, meaning the customer sells excess generation to the grid sometimes and buys it back at other times (i.e., overnight and during the winter months), relying on the electric grid to balance production and consumption.

With net metering, LIPA and other New York utilities allow customers with distributed generation to "bank" credits for the electricity they generate when they aren't using it. This essentially allows the customer to sell electricity to the grid at the fully loaded retail rate (i.e., the full cost of the energy, backup generation, electric transmission and distribution system, and customer service), rather than just the avoided cost of the energy the excess solar generation is displacing. As a result, customers' delivery and power supply charges from the utility are mostly or even entirely avoided, leaving primarily the fixed monthly charge, which pays for only a portion of the billing and fixed costs of providing electric service to the home or business.

This benefit is especially useful for LIPA customers because LIPA's fixed charges are the lowest of all the major New York utilities, as shown in **Figure 21**. Another factor that favors Long Island for solar installations is its relatively high average daily solar insolation. According to figures compiled by the National Renewable Energy Laboratory, southeast New York has the highest solar irradiance in the state.

Figure 21: **Monthly Fixed Charges Compared to Major New York Utilities**



** Based on 6 kW Nameplate Capacity*
Source: https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=15-E-0751

How will the electric grid change with the influx of distributed solar?

Distributed solar and storage transform the electric grid into a two-way street, requiring upgrades for both capacity and controls. LIPA's service provider, PSEG Long Island, has mapped the T&D system's "hosting capacity" (i.e., the ability of the electric grid to interconnect generation) across LIPA's entire service territory and determined that over 37% of the distribution feeder circuits have less than 1 MW of spare capacity, and 3% have no spare capacity at all.

LIPA is taking actions to ensure the system will be able to handle growth in DERs:

- Developing new approaches to incorporate DER forecasts in planning for local feeder capacity.
- Deploying a DER Management System platform to provide greater visibility to system operators so that they can monitor and manage DERs larger than 1 MW.
- Making targeted facility upgrades to expand hosting capacity where we project significant growth in DER penetration.

What is LIPA doing to reduce the cost of grid expansion for distributed resources?

LIPA is seeking a federal grant for $250 million toward $550 million of upgrades to the distribution system to allow for additional interconnection capacity for distributed solar and storage. The proposal builds upon two recent actions taken by LIPA to address hosting capacity constraints and lower interconnection costs for project developers, including:

- A recently launched Interconnection Cost Sharing 2.0 Framework, under which the cost of upgrades that can benefit multiple DER projects are shared among those projects and with customers.
- A study to identify distribution system constraints and technical solutions to address those constraints on LIPA's distribution circuits, utilizing the latest distribution system modeling technology, smart inverter breakthroughs, and recently upgraded hosting capacity mapping technology.

LIPA will partner with developers and municipalities to interconnect community solar and other DERs serving low-income customers and disadvantaged communities.

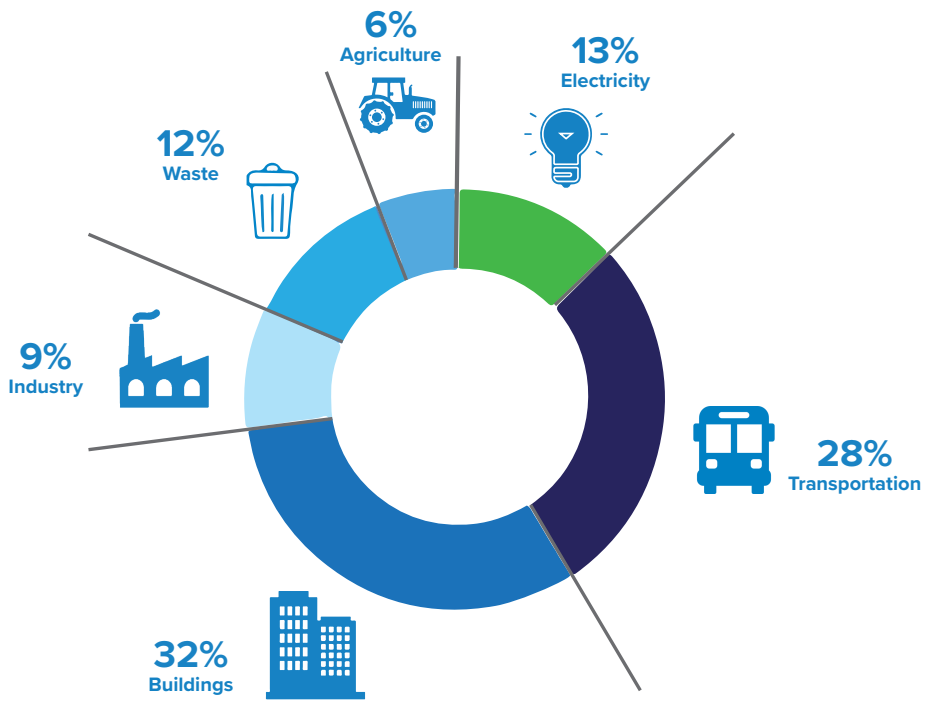
Electrification of Transportation and Heating

What are New York's objectives for electrification?

Electric vehicles ("EVs") and heat pumps are key pillars of the state's policy to achieve an 85% reduction in economywide GHG emissions by 2050. **Most of New York's carbon emissions come from transportation and the heating of residential and commercial buildings**, as shown in **Figure 22**. New York aims to achieve a zero-carbon electric grid by 2040 and to use that grid as the fuel of the future for transportation and heating.

New York is phasing out the sale of most internal combustion engine cars by 2035, and studies show that one to two million New York homes will need to be electrified with heat pumps by 2030, including all new single-family and low-rise residential buildings and 10-20% of commercial space heating, to meet the Climate Act objectives. LIPA and the state offer tools and services to electrify Long Island transportation and heating, including rebates, TOD electric rates, and infrastructure development.

Figure 22: **New York State Carbon Emission Sources**



*Source: **New York State Department of Environmental Conservation 2022 Statewide GHG Emissions Report***

How many Long Island and Rockaways customers drive EVs?

Long Island and the Rockaways have 41,000 registered EVs, which is approximately 21% of the electric vehicles in New York as compared to approximately 13% of the state's electric load. With new federal tax credits, limited maintenance, and low fuel costs, lifetime ownership costs of EVs are on par with internal combustion engine vehicles, while the cost of batteries, a significant component of EVs, will continue to decline with improved technology and the maturity of the supply chain. LIPA anticipates that EV adoption will increase significantly and is planning for and supporting that transition by its customers.

What is LIPA doing to support customers' transition to EVs?

LIPA has a variety of programs and activities to support EVs. These include:

- Offering customers savings opportunities through TOD rates, which provide low super off-peak electric rates to encourage nighttime charging, with savings for a typical EV of $56.50 per month.
- EV Hosting Capacity Maps to assist developers in finding suitable locations for EV fast charging.
- Incentives and rebates for developers to install EV Level 2 and fast chargers.
- Transformer replacements to increase the distribution grid's capacity for EV charging.

LIPA is further studying the EV market and customers' transportation electrification journey, including managed charging and vehicle-to-everything (i.e., the electric grid and building). LIPA aims to further improve the customer experience for EV owners over the next several years by adding tools and resources, along with customizing education and outreach based on customer segments and needs.

How many electric chargers are available in LIPA's service territory?

LIPA has an $88 million plan to build out the infrastructure to support more than 4,550 chargers across Long Island and the Rockaways by 2028, as shown in **Figure 23**. LIPA facilitates the transition to EVs through an EV make-ready program and by upgrading the electric grid to support charging.

LIPA's EV incentives include rebates for Level 2 EV chargers and covering 100% of the utility-side make-ready cost and between 50%-100% of the customer-side make-ready cost for fast chargers, with higher levels of support provided for chargers in disadvantaged communities. LIPA also supports infrastructure upgrades to serve public sector electric vehicle fleets (i.e., government, municipalities, and not-for-profits) and public transport (i.e., school and transit buses) and added a fleet advisory service in 2022. LIPA continues to study the EV charging market and plans to make continued enhancements to programs to support the electrification of transportation.

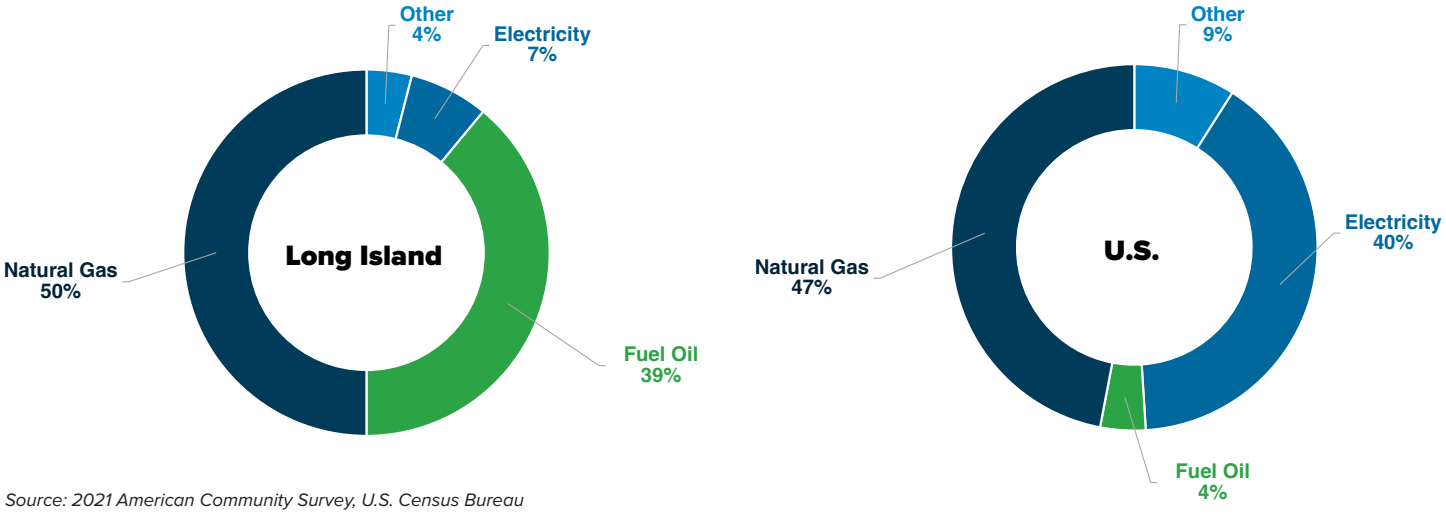
Figure 23: **Publicly Available Electric Vehicle Chargers in LIPA's Service Territory**

PORT TYPE	2021	2022	2023	2024	2025	2026	2027	2028	TOTAL
	ACTUAL	ACTUAL	LIPA TARGET	FORECAST	FORECAST	FORECAST	FORECAST	FORECAST	
LEVEL 2	0	87	400	293	558	774	1,007	933	**4,052**
DC FAST CHARGER	48	100	103	54	68	47	47	30	**498**
TOTAL	48	187	503	347	626	821	1,054	964	**4,550**

How do Long Island and the Rockaways customers currently heat their homes?

LIPA is particularly focused on the electrification of heat because Long Island and the Rockaways are an ideal market for heat pumps – 39% of homes heat with oil, as shown in **Figure 24**. That's about ten times the national average, and these homes could potentially see significant savings by switching to a heat pump (see **Figure 25**). **Currently, 7% of Long Island homes are heated with electricity, compared to 40% nationally**.

Figure 24: **Long Island Homes Heat with Oil at 10x the National Average**



Source: 2021 American Community Survey, U.S. Census Bureau

What is LIPA doing to support customers' transition to heat pumps?

LIPA offers substantial rebates for customers installing heat pumps, which complement newly enacted federal tax credits. **There are also enhanced incentives for low- and moderate-income customers**. LIPA and its service provider, PSEG Long Island, are also undertaking several initiatives to aid customers and installers, including:

- Developing a customer tool to aid in the heat pump decision-making process factoring in weather, energy rates, customer household data, fuel source, and available technologies.
- Enhancing outreach to customers with a high propensity to adopt heat pumps and ensuring they have the proper educational materials, decision support, and a direct link to a qualified contractor network.
- Studying building envelope weatherization and financing opportunities.

Are heat pumps cost-effective for customers?

With LIPA rebates and federal tax credits, **LIPA estimates that between 400,000 and 500,000 Long Island and Rockaways households could save money by installing a cold climate heat pump**. This presents an extraordinary opportunity to help customers save money and accelerate New York's decarbonization. **These savings opportunities are primarily available when customers are replacing existing central air conditioning and/or heating equipment or for new construction**.

Figure 25 shows the economic and carbon impact for a typical Long Island single-family home that heats with fuel oil and needs to replace an aging central air conditioning unit. **A cold climate heat pump could reduce heating costs for a home with oil heat by approximately $2,300 per year and reduce carbon emissions by 46%**. The additional cost of the heat pump would pay for itself in less than one year. As the carbon intensity of the electric grid declines over the next twenty years, the carbon reduction from using a heat pump will approach 100%.

In new construction, heat pumps pay for themselves immediately because builders avoid the upfront cost of installing fossil fuel equipment and separate air conditioners, as heat pumps also provide air conditioning. **Figure 26** shows the savings from installing a heat pump instead of a gas furnace in a newly constructed home. With LIPA rebates and federal tax credits, the upfront savings from a heat pump is approximately $4,700, with the annual savings totaling $931. There are additional incentives available for low-income households.

The examples are typical, however, every home is different. LIPA recommends getting quotes from several contractors to estimate how much you might save from installing a cold climate heat pump.

Figure 25: **Heat Pumps Save Money and Carbon for Oil Heat**[8]

Existing Building - Oil Burner	Buy New Central Air Conditioning	Buying New Air-Source Heat Pump
Upfront Cost	$7,278	$16,687
LIPA Rebate*	-	($5,383)
Federal Tax Credit*	-	($2,000)
Net Cost	**$7,278**	**$9,304**
Annual Home Heat Bill	**$3,824**	**$1,487**
Annual Savings	-	$2,336
Payback Period	-	0.9 years
Carbon Footprint from Heating (2022)	-	-46%
Carbon Footprint from Heating (2040)	-	-100%

Figure 26: **Heat Pumps Save Money and Carbon for New Construction**[8]

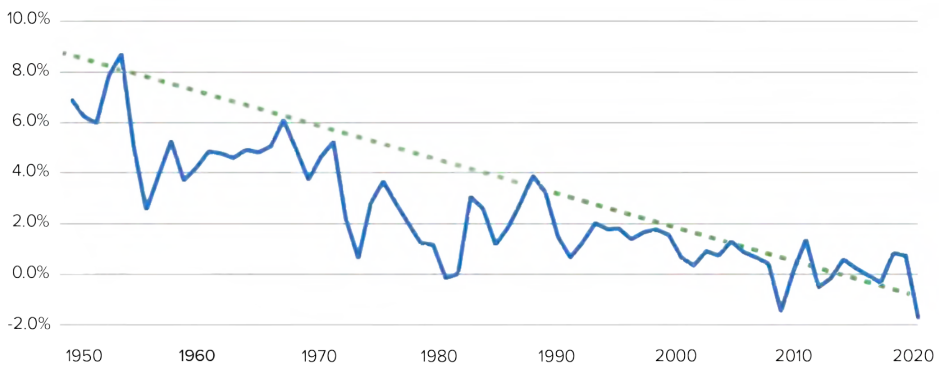
New Construction - Gas Furnace	Buy New Central Air Conditioning + Gas Furnace	Buying New Air-Source Heat Pump
Upfront Cost	$14,080	$16,687
LIPA Rebate*	-	($5,383)
Federal Tax Credit*	-	($2,000)
Net Cost	**$14,080**	**$9,304**
Annual Home Heat Bill	**$2,366**	**$1,435**
Annual Savings	-	$931
Payback Period	-	Immediate
Carbon Footprint from Heating (2022)	-	-25%
Carbon Footprint from Heating (2040)	-	-100%

Can the electric grid handle the electrification of transportation and heating?

Studies indicate that electricity use will grow between 65 and 80% by 2050, primarily to electrify the transportation and building sectors that currently produce most of the state's carbon emissions. That level of electrification will not only increase the overall electric load, but also eventually shift the system peak demand from the summer to the winter.

While 80% load growth may sound like a lot, it is less than 2% per year when spread over 30 years. As shown in **Figure 27**, in the 1950s, electric sales grew an average of 8% annually, roughly doubling every nine years. That pace slowed to about 7% in the 1960s, 4% in the 1970s, 3% in the 1980s, 2% in the 1990s, and less than 1% in 2000s. Meeting the growing electric needs of consumers over the next 30 years will require grid modernization and investment, including innovative electric rate designs (i.e., TOD rates), new customer programs, and smarter grid technologies. However, **meeting this load growth is something electric utilities have done before**.

Figure 27: **U.S. Electricity Growth Since 1950 (3-Year Rolling Average)**



Source: Monthly Energy Review, U.S. Energy Information Agency, March 2021.

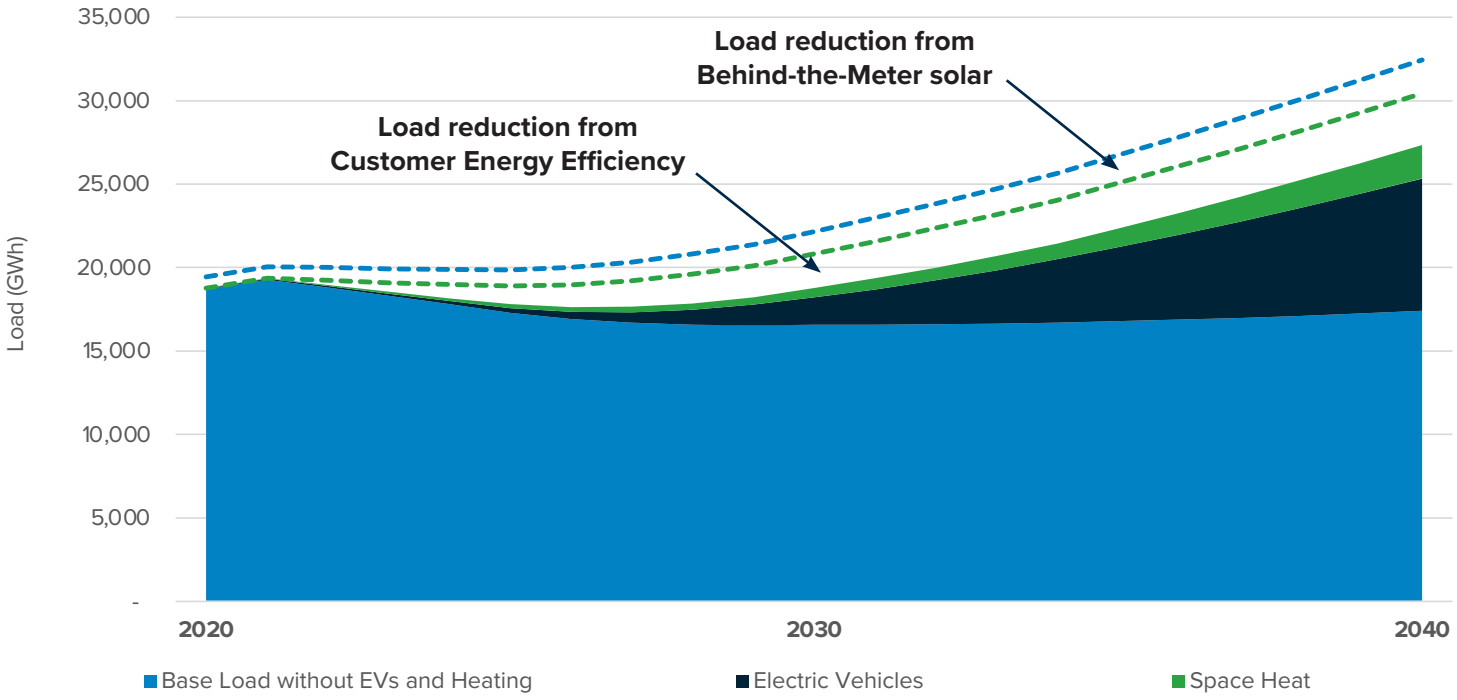
8: *These examples reflect an average Long Island End Use Load Profile built by NREL. Fuel price assumptions include a retail residential natural gas price of $19.62/MMBtu, the average monthly price between Aug 2022 and July 2023 published by the U.S. Energy Information Association, and a retail fuel oil price of $4.59/gallon, which is the weekly average home heating oil price for Long Island region during the period between Oct-31-2022 and Oct-23-published by* ***NYSERDA****.*

Electrification and Electricity Sales Through 2040

How will electricity sales on Long Island and the Rockaways change through 2040?

As shown in **Figure 28**, electricity sales are expected to remain steady through 2030 as energy efficiency and rooftop solar continue to moderate growth driven by the economy, while **electrification of transportation and heating will result in significant load growth post-2030**.

Figure 28: **LIPA Electricity Sales Projection Through 2040**

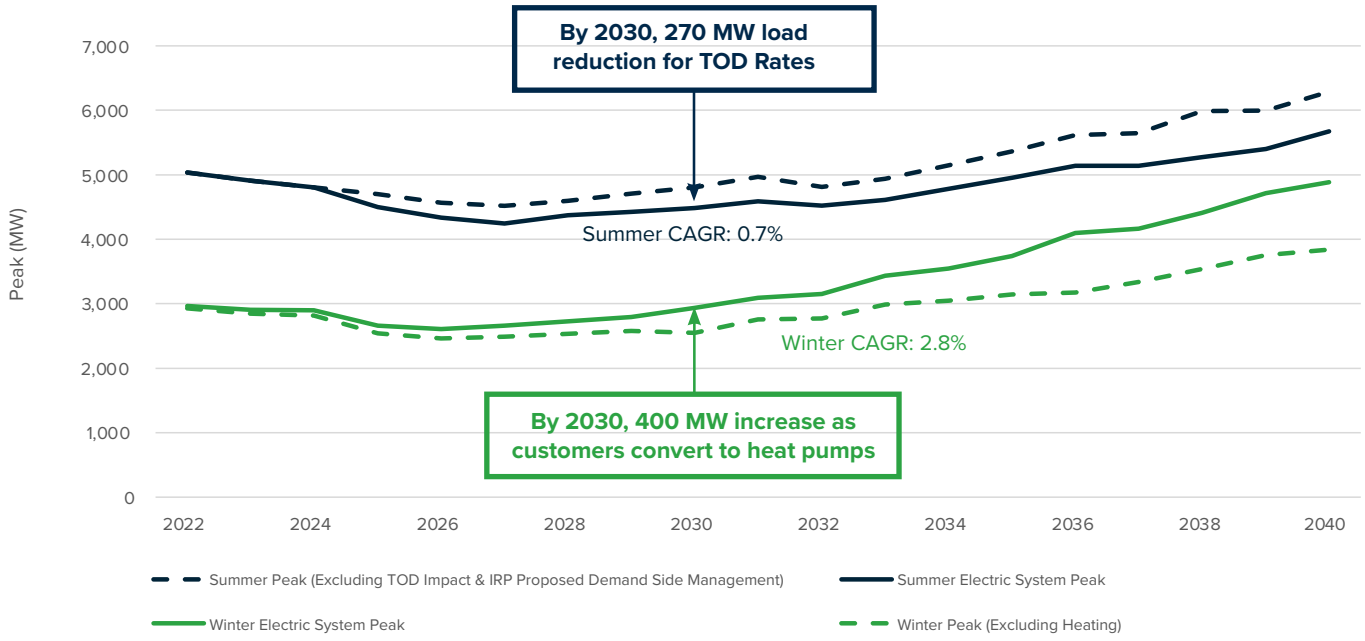


How will the system's peak load change through 2040?

Figure 29 shows the trend for peak demand on Long Island and the Rockaways through 2040. **The IRP estimates that changing customer usage patterns in response to TOD rates will result in a peak load reduction of 270 MW by 2030 or 6% of the total load**. This will reduce the need for system expansion of transmission and distribution system and generation, resulting in cost savings for LIPA that are passed back to customers through electric rates.

Beyond 2030, electrification will drive sharp growth in the system's peak load. The effect can be mitigated if customers adopt smart EV charging practices, which LIPA is encouraging through TOD rates and future managed charging programs. Consequently, **despite increasing electrification, the 2040 system peak is not expected to exceed the record peak of 5,915 MW experienced in July 2011**. **Additionally, while heating electrification will drive significant growth in winter peak load, LIPA is projected to remain a summer peaking utility through 2040**.

Figure 29: **Summer and Winter Peak Electric Demand Through 2040**



What can LIPA do to encourage customers to reduce electricity consumption during system peak periods?

LIPA has introduced a standard offer TOD Rate to take effect in 2024. Most customers will be transitioned to this new rate in 2025. **The TOD rate will allow customers to save on their bills when using electricity during off-peak hours**.

The peak period for demand is currently 3 p.m. to 7 p.m. during weekdays. **In terms of decarbonization, power generated during peak demand hours emits up to 50% more carbon than electric generation outside of those hours**. The generating units that have to run during peak hours are among the least efficient and highest emitting.

Developing and implementing new or enhanced electric rate designs is crucial to managing the sales growth and peak demand from the electrification of transportation and heating. As shown in **Figure 30**, customers who run home appliances in off-peak hours can see typical savings of up to $12 per month on their electricity bills, depending on the rate plan, and an additional $14 per month by pre-cooling their homes in the summer. Customers with electric vehicles and/or home energy storage systems can save $40-108 per month by charging at night.

Figure 30: **Customer Bill Savings on the TOD Rate and Super Off-Peak Rates vs. the Flat Rate**[9]

	TOD Rate (Save before 3 p.m. or after 7 p.m.)	**Super Off-Peak Rate** (Smaller savings before 3 p.m. or after 7 p.m. and larger discounts between 10 p.m. and 6 a.m.)
Initial Savings (Before any Changes to Electric Use)	**Save $3.50 per month**	**Save $5.75 per month**
Dishwasher	Save $0.50 per month	Save $1.50 per month
Washing Machine	Save $1.75 per month	Save $4.50 per month
Electric Dryer	Save $2.25 per month	Save $6.00 per month
Pre-Cool Home (Before 3 p.m.)	Save $12.75 per month (in the summer)	Save $13.75 per month (in the summer)
Pool Pump	Save $4.00 per month (in the summer)	Save $6.50 per month (in the summer)
Battery Storage Optimized Use	Save $40.00 per month	Save $51.25 per month
Electric Vehicle	Save $43.50 per month	Save $56.50 per month
Total Savings (including changes)	`Save up to $91.50 per month ($108.25 in the summer)	`Save up to $125.50 per month ($147.75 in the summer)

When customers choose to shift their usage to less costly times of the day, it decreases the amount of generation capacity and delivery infrastructure needed during peak times, reducing carbon emissions, and lowering system costs, with the cost savings passed back to customers through electric rates.

More information can be found in LIPA's **fact sheet** about the TOD rate.

What are LIPA's plans for customer energy efficiency and demand-side management programs?

Energy efficiency ("EE") and demand-side management ("DSM") are crucial components to achieving New York's objective of an 85% reduction in economywide GHG emissions by 2050. The Climate Act requires 185 trillion Btu of EE by 2025.

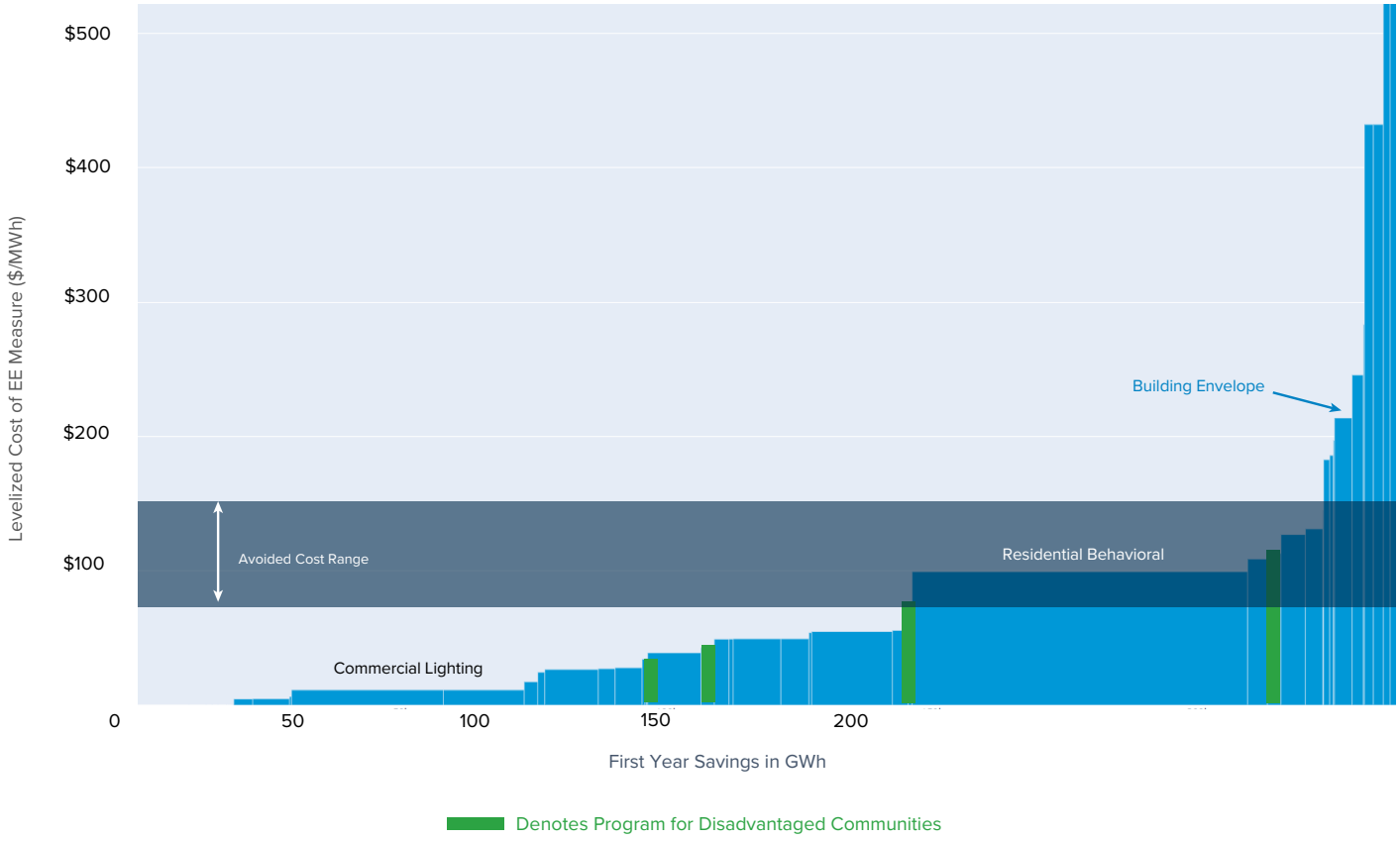
LIPA invests approximately $90 million annually on EE and DSM programs, which are paid for by a DER charge on customers' bills. These programs include rebates for EV chargers, heat pumps, refrigeration, and other programs. LIPA's TOD rates further incentivize customers to shift the use of appliances and EV charging outside high-cost peak hours.

The IRP envisions several new DSM programs in future years, including managed systems for charging, heating, and cooling that signal customer-owned devices to shift energy usage from peak load hours in the summer and winter. These measures can be applied to smart charging/discharging for EVs, networked customer-owned storage, and smart thermostats and water heaters. LIPA is also exploring vehicle to grid ("V2G") opportunities, including using school bus fleets as electricity storage devices during summer peak periods when school is out, and new rules for customers who want to use their EVs as emergency backup for electric service to residences. **IRP analysis indicates that emerging advanced DSM measures, together with TOD rates, could reduce the system peak load by up to 500 MW by 2030**.

The IRP recommends the development of a multi-year energy efficiency program with a goal to maximize investment in cost-effective measures, as measured in terms of $/ton of carbon reduction relative to the cost of renewable generation. A multi-year program is necessary to manage customer rate impacts and match incentives to the expected rate of uptake by customers. **Figure 31** illustrates how programs are selected. Each bar shows the projected cost and potential GWh savings for a particular EE program. LIPA compares the projected cost of the program to the projected savings (i.e., LIPA's avoided costs triggered by the demand reduction, as shown as a shaded range on the chart), which include direct costs for power supply and imputed costs for GHG emissions reductions. Programs that have a net benefit using this cost test, which is standard throughout the industry, are included for funding in LIPA's EE budget.

9: These estimates are based on average household appliance usage. The typical household already uses most of its electricity off-peak, so the "initial savings" is without assuming changes to electric usage. The additional savings estimates for dishwashers, laundry, pool pumps, and electric vehicles assume customers move their appliance usage to the lowest price period. The "initial savings" does not include savings for customers with pool pumps or EVs, as their usage is higher than the typical customer. Pre-cooling and pool pump savings only apply to the summer months. The battery storage example shows the savings available from using residential storage to optimize a TOD rate. LIPA will help every customer estimate their individual savings potential based on their actual usage patterns.

Figure 31: **Cost-Effectiveness of Energy Efficiency Programs**



What is being done to help disadvantaged communities meet Climate Act goals?

The Climate Act requires that at least 35% of the benefits from investments go to disadvantaged communities and low- to moderate-income customers on a statewide basis. The benefits can take various forms, such as residential envelope measures to improve energy efficiency, EV incentives and charging stations, heat pump incentives and programs, low-income energy assistance and low-income community solar programs, such as LIPA's 15 MW feed-in tariff.

LIPA will fully comply with the Climate Act and follow guidelines developed by the state's Climate Justice Working Group, which has designated certain areas in the state as disadvantaged communities. LIPA continues to work with NYSERDA and other state agencies to identify measures that qualify as clean energy assistance in disadvantaged communities and will comply with pending requirements to periodically report on progress through a statewide reporting system being developed by NYSERDA.

Planning for the Effects of Climate Change

How does climate change affect our region's electric grid?

Extreme heat can overheat equipment and increase energy demand due to the widespread use of air conditioners and other cooling systems, putting a significant strain on the grid. Extreme cold weather is also a risk due to stress put on equipment, mechanical failures, and interruptions of fuel supply. **Figure 32** summarizes certain system vulnerabilities and adaptation measures. LIPA's ongoing initiatives targeting climate resiliency include:

- Incorporating rising temperatures into load forecasting, with average temperatures increasing 0.5 degrees Fahrenheit per decade, which approximates to 50 MW of peak system load per decade.
- Designing the power system for higher peak temperatures.
- Planning adequate backup power sources for clean generation, including long-duration storage and dispatchable emissions-free resources, to accommodate solar and wind variability and lulls.

A key objective set by the LIPA Board is to mitigate the effects of climate change through multi-year programs that reduce the number and duration of outages after significant storms. **Since 2016, LIPA has invested over $6.4 billion in infrastructure to improve the reliability and resiliency of Long Island's electric grid**. These investments include:

- Designing the electric grid for Category 3 hurricane winds.
- Hardening the worst-performing distribution circuits.
- Elevating flood-prone substations.
- Hardening transmission supply to every substation in a load pocket.[10]
- Reducing the number of customers behind each smart switch to less than 500 to minimize customer outages from an electrical fault (i.e., a tree coming into contact with a wire).
- Increasing hazard tree removal and deploying data analytics to the tree trim cycle.
- Increasing the use of technology to improve the protection of electrical circuits.

Figure 32: **Electric System Climate Vulnerabilities and Adaptation Measures**

Future Climate Hazards

- Average temperate increase **0.5°F per decade under a moderate** emissions scenario
- Heat waves increase in frequency, duration, and intensity
- Precipitation increases by 13% through 2050
- Sea level rises 1.3 feet by the year 2040
- Extreme events of all types increase in frequency and intensity

System Vulnerabilities

- Extreme heat may cause overheating across a variety of system assets
- Sea level rise and flooding may damage assets situated in flood zones, coastal areas, and low-lying topographies
- Extreme wind and ice storms may damage overhead assets such as poles and towers
- Emergency response, worker safety, public safety, 0&M, outage prediction, load forecasting, capacity planning, reliability planning, and asset management may all be impacted by climate hazards in significant and varying degrees

Adaptation Measures

- LIPA has already undertaken some adaptation measures to improve resilience, including upgrading and replacing equipment and constructing cooling systems and flood-proof stuctures
- LIPA is assessing additional measures across the system that improve reliability and increased resilience

10: A "Load Pocket" is an area on the electrical system that, because of transmission limitations, must have internal generation resources available as the area cannot be served entirely by external sources.

What studies related to climate change are currently underway?

LIPA and PSEG Long Island participate in the New York Independent System Operator ("NYISO"), New York State Reliability Council ("NYSRC"), and Electric Power Research Institute ("EPRI") working groups on planning for future extreme weather events.

NYSRC's Extreme Weather Working Group is developing criteria for resource planning and operating the state's power system to increase resiliency in the event of more extreme weather events. EPRI's Climate READi collaborative convenes thought leaders, government stakeholders, scientific researchers, and electric industry experts to build an informed and consistent approach to evaluate climate data, assess asset vulnerability at all levels from planning to operations, identify risk mitigation options, and inform decision making on optimal investment prioritization.

Using these sources of industry, government, and scientific knowledge, LIPA is conducting a **Climate Change Vulnerability Study** that supports infrastructure planning, system operations, and emergency response by providing information used for:

- Climate projections
- Identification of high-impact/low-likelihood extreme weather events
- System exposure assessments and impact ranking

The Climate Change Vulnerability Study will be followed by a Climate Change Resilience Plan reflecting the latest climate science, which will be used to update strategies for addressing gradual climate change and extreme events, such as more frequent heat waves and renewable energy production droughts.

Will customers have to pay for all these investments to mitigate climate change?

LIPA continues to pursue significant grant opportunities to help offset the cost of climate resiliency measures for its customers. LIPA's status as a public power utility makes it eligible for federal grants for storm recovery not available to for-profit utilities. As shown in **Figure 33**, LIPA has received multiple grants from the Federal Emergency Management Agency ("FEMA") for mitigation programs, including hardening of the overhead distribution system that sustained damage during Superstorm Sandy (2012) and Tropical Storm Isaias (2020). These FEMA grants have reduced costs that would otherwise be paid by customers by $1.8 billion over the last decade, with an additional $458 million of pending awards.

Figure 33: **Summary of Storm Costs and FEMA Grants**

$ in millions

Federally Declared Weather and Other Events	LIPA Recovery Costs	Federal Grants
Tropical Storm Irene (2011)	$170	$154
Superstorm Sandy (2012) **Sandy Mitigation**	$671 --	$604 $665
Winter Storm Nemo (2013)	$17	$11
Winter Storm Stella (2017)	$14	$4
Tropical Storm Isaias (2020) **Isaias Mitigation**	$309 --	$276 $446*
COVID-19 Pandemic (2020-2022) **COVID-19 Pandemic Mitigation**	$26 --	$6* $10*
Tropical Storm Ida (2021)	$9	$7
Winter Storm Elliott (2022)	$3	$2*
Total	**$1,219**	**$2,185**

*Applied for - LIPA waiting for FEMA decision.

Managing the Cost of the Clean Energy Transition

What are the costs and benefits of the state's clean energy transition?

The state's Climate Action Council issued a statewide Scoping Plan that included a study[10] to model technical pathways for New York to achieve the economywide decarbonization targets of the Climate Act and evaluate the implications of these pathways on energy demand, GHG emissions, and costs. The "Integration Study" includes an estimate of the costs and benefits of the policies needed to implement the state's clean energy transition across multiple sectors, including electricity, transportation, and heating. **The study concluded that the Scoping Plan initiatives would produce net benefits of more than $100 billion for the state as a whole** (i.e., the amount by which the cost of compliance would be exceeded by avoided costs and health benefits associated with cleaner air).

A notable feature of the Scoping Plan is the economywide Cap-and-Invest program, under which the revenues collected from the sale of carbon dioxide emission allowances to power plants and other sources would be used to fund clean energy programs and otherwise offset consumers' costs for the clean energy transition. LIPA intends to work with the responsible state agencies to develop regulations and procedures to assure that a fair share of these funds are dedicated to Long Island.

How will the clean energy transition affect LIPA's electric rates?

Most of the costs for the state's clean energy transition will be paid by electric load-serving entities, such as LIPA, according to their proportionate share of the statewide load. This means that the clean energy additions and transmission grid expansion for clean energy, including NYSERDA's contracts for offshore wind projects interconnected to Long Island and upgrades to LIPA's transmission grid for offshore wind, will be paid for by customers statewide. Likewise, LIPA customers will contribute to statewide costs for projects located in other regions.

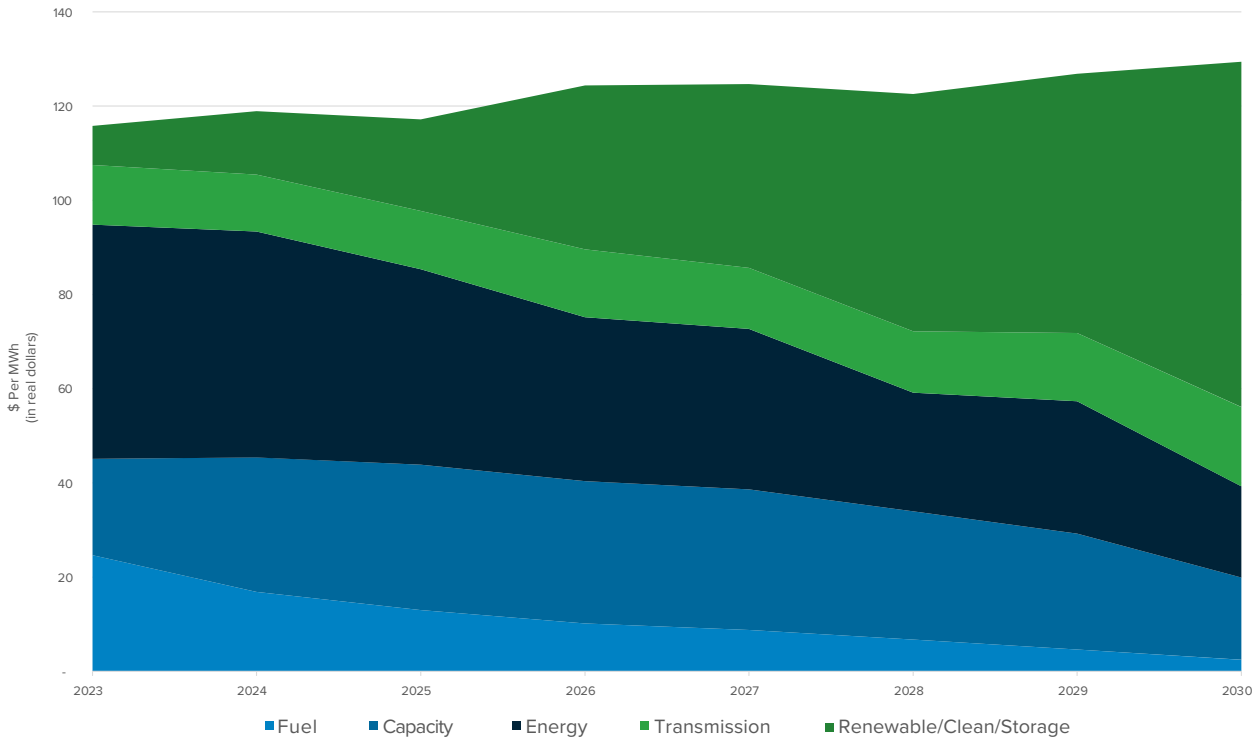
The changes in LIPA's Power Supply Charges between now and 2030 are relatively predictable (excluding volatile commodity prices) as we have reasonable cost estimates for much of the clean resource buildout that is currently under development and will be placed in service over the next seven years. As clean energy resources are added through 2030, LIPA estimates that its costs for clean energy, energy storage, and associated transmission upgrades will grow from less than 10% of the Power Supply Charge today to over 50% by 2030 (see **Figure 34**). Much of these increases in clean energy costs will be offset by declining commodity costs and the associated cost of fossil-fueled infrastructure.

Based on what we know currently, the Power Supply Charge, which accounts for about half of LIPA's total electricity charge, is expected to grow at about 2% per year in real dollars through 2030, assuming reasonably stable commodity costs. This is encouraging news for customers planning to increase their electricity consumption by switching to EVs and heat pumps. As discussed in the "Electrification of Transportation and Heating" section, these technologies are not only good for the environment, but also offers consumers significant opportunities to save money on their energy bills.

Estimates beyond 2030 are subject to significant uncertainty, as technological innovations in generation, storage, and clean fuels needed to reach zero emissions by 2040 are unknown and can only be assumed. Project location and technology, also have a significant effect on cost, but remain to be selected through competitive procurements over the next two decades. Additionally, as discussed above, the rules and regulations to implement the economywide Cap-and-Invest program are still being determined and will influence consumer costs, benefits, and electric bills.

[10] *See: https://climate.ny.gov/-/media/project/climate/files/Appendix-G.pdf*

Figure 34: **Projected Power Supply Costs Through 2030**

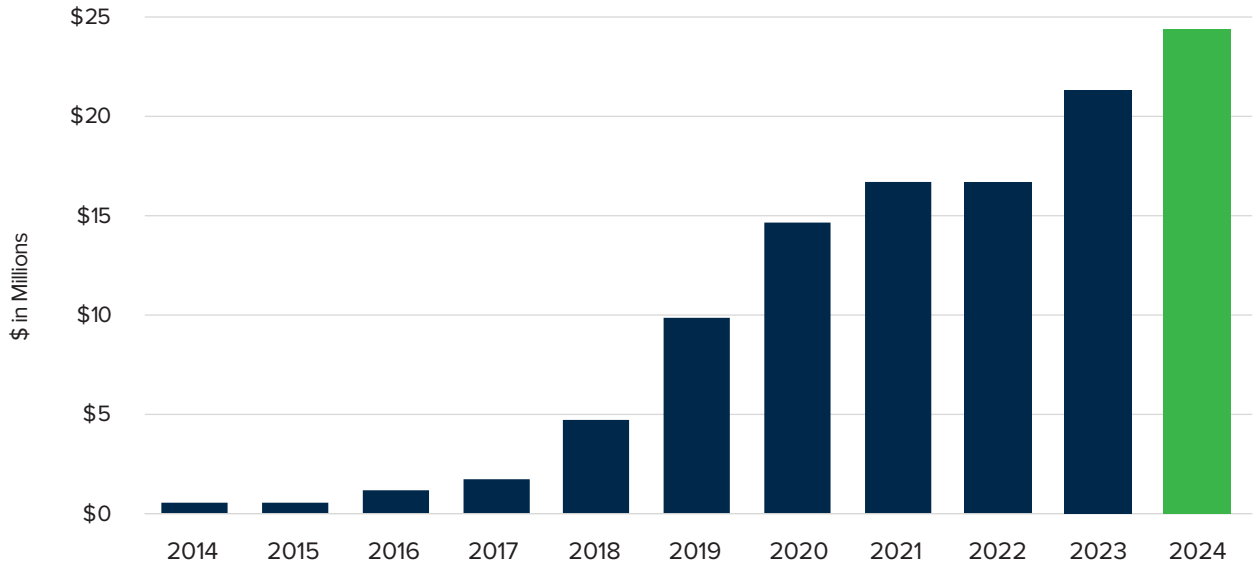


Note: Assumes forward market prices for commodities and electricity.

How does LIPA assist its financially vulnerable customers?

LIPA offers electricity bill discounts to low- to moderate-income ("LMI") customers with the goal that energy bills should be no greater than 6% of household income. We routinely assess and update our energy affordability discounts based on the economic conditions facing households on Long Island and the Rockaways. **In July 2022, LIPA increased its base LMI discounts by 33%**. In 2023, LIPA made a 6.7% increase to adjust for cost-of-living increases experienced by our customers. For 2024, LIPA is proposing an additional $4 million (a 20% increase) through a combination of a 3.8% increase in the average discount and a 25% increase in participation levels by the end of the year.

Figure 35: **Funding for Low-Income Customer Discounts**



Many customers experienced financial distress during the COVID-19 pandemic and could not pay their electric bills. In response, LIPA instituted an arrears management program and forgave all arrears incurred through May 1, 2022, for participating LMI customers, funded partly by a $9.8 million New York State budget appropriation. **Over 11,000 LMI customers benefited from arrears relief totaling $25 million**.

For those customers who struggled financially due to COVID-19 but did not meet LMI criteria, LIPA offered forgiveness of balances owed up to $2,000 through that same period under the Phase 2 Forgiveness Program. **Approximately 39,000 customers received bill credits through this program, totaling an estimated $37 million**. A similar program for small commercial customers with demands that never exceeded 40 kW or that averaged less than 20 kW over an annual period was made available in February 2023. The bill credits for arrears forgiveness for small commercial customers benefited approximately 750 small commercial customers and totaled approximately $1.2 million.

How is LIPA assisting low- to moderate-income customers in making the transition to clean energy?

LIPA offers enhanced heat pump incentives for low-income customers to ensure that LMI households can afford to transition to clean, electric heat pumps. These enhanced rebates are complemented by new federal tax credits for LMI households, with point-of-sale rebates up to $8,000 for any heat pump used for home heating and cooling.

LIPA also provides enhanced support for low-income households to make home efficiency improvements. Households can receive personalized energy audits and free or discounted energy-efficient appliances. LIPA's 2023 budget included $5.5 million to support weatherization (sealing and insulation) projects for LMI households, lowering heating and cooling bills and providing extra comfort by eliminating leaks and drafts.

Technician installing Cold Climate Heat Pump

CONCLUSION

Aerial view of Rockaway Beach | Queens, New York

THE FINDINGS OF THE 2023 IRP OFFER A LOOK AT AN EVOLVING ENERGY LANDSCAPE OF **RENEWABLE TECHNOLOGIES** AND **DECARBONIZATION INITIATIVES.**

Next Steps

The findings of the 2023 IRP offer a look at an evolving energy landscape of renewable technologies and decarbonization initiatives. The plan illustrates how LIPA can meet and exceed the goals of New York's Climate Act while maintaining the two most critical aspects of service to customers – reliability and affordability. The energy landscape is certain to shift over the course of the next five years, and LIPA is well-positioned to navigate those changes.

While the analysis for the 2023 IRP is complete, the work is not done. Follow-up studies to the IRP are currently underway, including:

- Identifying any reliability deficiencies or operational concerns with expected generation retirements.
- Reviewing storage needs and identifying preferred Long Island and Rockaways points of interconnection.
- Establishing a new multi-year energy efficiency program.
- Reviewing the customer journey for EV and heat pump electrification and deploying new tools and programs to assist both customers and installers.
- Assessing projected resource margins for extreme weather events, including low renewable output, high summer temperatures, and increasing duration of heat waves.
- Completing the Climate Vulnerability Study and Resilience Plan.

Opportunities for Public Participation

The public can participate in the 2023 IRP planning process by attending one of the informational sessions scheduled for Long Island and the Rockaways. Public comment session dates will be announced on **lipower.org** and through an email list. Interested parties can visit the IRP webpage for more information and to keep up to date with progress on the IRP. Interested parties can also sign up for LIPA's IRP email list to receive IRP-related notifications via email. The public can also submit written comments and suggestions using the contact forms on the PSEG Long Island and LIPA websites.

Acknowledgements

LIPA's resource planning process is a **collaborative effort, developed by LIPA's service provider, PSEG Long Island, with active involvement from LIPA staff and assistance from utility consultants and industry researchers**, who provided input on emerging technologies such as advanced battery storage, including short- and long-term feasibility as well as risks and challenges to consider in model development.

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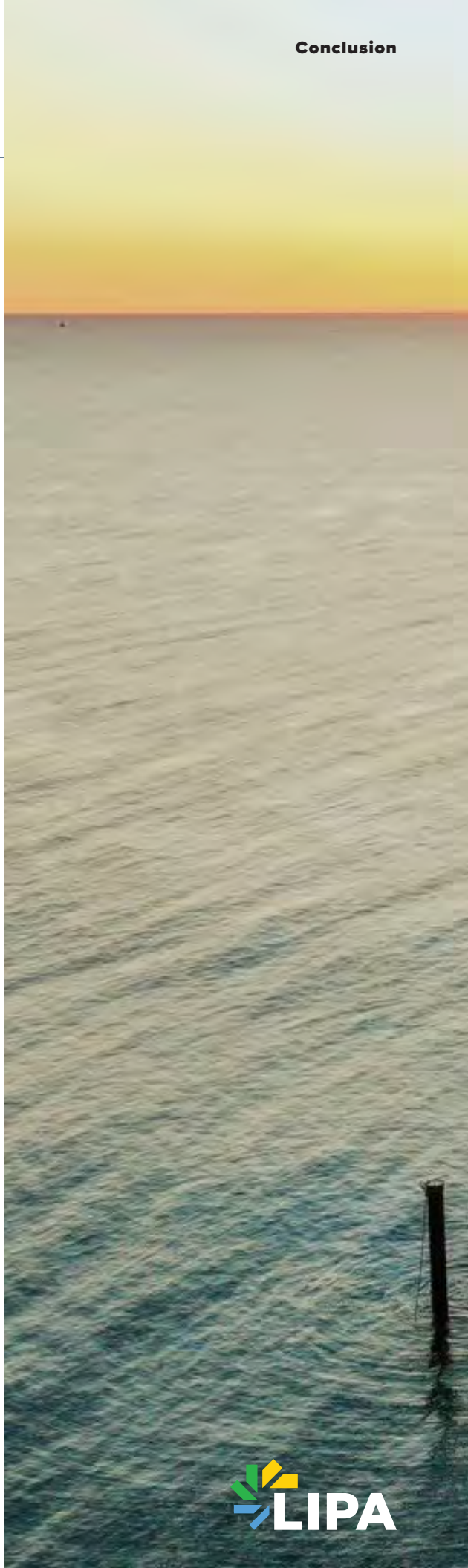
- PSEG Long Island
- The Brattle Group
- M. J. Beck Consulting
- Brookhaven Science Associates
- Stony Brook University



Laying Cable for the South Fork Wind Farm | Wainscott, New York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