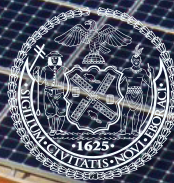


PowerUp NYC



Mayor's Office of Climate &
Environmental Justice



The City of New York
Mayor Eric Adams

September 2023

Table of Contents

- Letter from the Mayor..... 5**
- Introduction..... 7**
 - Planning for Our Clean Energy Future 7
 - Key Research Findings 9
 - From Planning to Action: PowerUp Initiatives 10
 - A Just Transition 12
 - The PowerUp Planning Process 14
- Context: NYC’s Energy Systems Today 19**
 - Operationalizing a Clean Energy Transition 19
 - NYC’s Historic Energy Sources 20
 - Energy System Resilience and Vulnerabilities 22
 - Climate and Energy Policy Landscape 24
- Taking Action: Energy and the Grid 31**
 - Greening the Grid 31
 - NYC’s Commitment to Clean Energy Infrastructure 32
 - Energy and Grid Initiatives 37
- Taking Action: Buildings..... 51**
 - Upgrading NYC Buildings 51
 - Beneficial Electrification & Building Upgrades 51
 - Electrification Retrofit Challenges 54
 - Buildings Initiatives 62
- Taking Action: Transportation 69**
 - Addressing Pollution and Public Health 69
 - Accelerating Electric Vehicle Adoption 69
 - Transportation Initiatives 72
- Next Steps..... 79**
- Appendices..... 81**
 - End Notes 82
 - Glossary 90
 - Acknowledgements 92



Letter from the Mayor



My fellow New Yorkers,

The climate crisis we face demands that we come together and take action to build a cleaner, greener, and more just city for all New Yorkers. A key element of that work is creating a resilient, sustainable energy system that can keep the lights on without pumping carbon emissions into our air – and that is what *PowerUp NYC* is all about.

PowerUp NYC is a year-long planning study that examines the city’s energy system and identifies initiatives that can be carried out during my administration. These initiatives will set up the energy system for long-term sustainability, reliability, and resiliency. Though every aspect of environmental planning as it relates to climate is crucial, energy planning requires the most in-depth research and the most proactive thinking. It must be done through a lens of equity and inclusion to ensure that the energy transition is inclusive of all New Yorkers, particularly those who are most vulnerable and historically underserved.

My predecessors, including Mayors Bloomberg and de Blasio, demonstrated their commitment to addressing climate change head on, making NYC a global climate leader, and I am proud to build on their important initiatives. In 2017, after the United States was pulled out of the Paris Agreement, New York City was the first city to reenter the agreement, and we pledged to contribute to the global push for decarbonization. Since then, NYC has committed to achieving carbon neutrality by 2050 and an electric grid powered 100% by clean energy resources by 2040.

This portion of the *PowerUp NYC* study covers the main pillars of our energy system – transportation, buildings, and the electric grid. It also examines community solar, which gives New Yorkers energy credits on their bills, lets renters benefit from solar, creates local jobs, and builds community wealth.

Along with *PlaNYC: Getting Sustainability Done* and the Environmental Justice NYC report, *PowerUp NYC* outlines our city’s overall climate and environmental justice goals. Together, we can address energy challenges to solve the greatest challenge of our generation.

Eric Adams

Introduction

In spring of 2023, the Adams Administration published its first strategic climate plan — *PlaNYC: Getting Sustainability Done*, the fifth iteration in New York City (NYC) history. *PlaNYC* lays out ambitious city-wide climate targets and initiatives to achieve a cleaner, greener, and more equitable future as we do our part to fight climate change. *PowerUp NYC (PowerUp)* — NYC's first ever Long-Term Energy Plan (LTEP) — establishes a roadmap for how we will accomplish *PlaNYC*'s clean energy and decarbonization goals and go even farther in three key sectors: the Energy Grid and Community Energy Systems, Buildings, and Transportation.

PLANNING FOR OUR CLEAN ENERGY FUTURE

As the City of New York's action plan for achieving more sustainable and equitable energy systems, *PowerUp* will be updated and re-released every four years to address evolving challenges, opportunities, and solutions.ⁱ The plan focuses on achieving two primary goals:

- 1. Identify specific, near-term actions that the City will advance in the next four years to stay on track to meet our climate action goals and policy mandates**

Policy mandates include the 2019 NYC Climate Mobilization Actⁱⁱ (CMA) and 2019 New York State Climate Leadership and Community Protection Act (CLCPA).ⁱⁱⁱ Closely aligned, the CMA and CLCPA are two of the most ambitious climate policies in the nation, setting the City and State on a course to achieve net-zero greenhouse gas (GHG) emissions economy-wide by 2050. Other policy goals include advancing renewable energy development for a 100% carbon-free electric grid by 2040, ensuring the resilience and reliability of our energy systems, investing in clean energy resources in disadvantaged communities, creating local job opportunities, and making clean energy accessible and affordable for all (see "Climate and Energy Policy Landscape" on p. 24 to learn more).


- 2. Educate and engage NYC communities in local energy planning processes**

The City of New York is committed to supporting a just transition to a clean energy future through community-based planning and thoughtful public engagement. Recommendations put forth in *PowerUp* reflect an inclusive approach that addresses priorities and concerns of a broad cross-section of local stakeholders. Many aspects of the *PowerUp* planning process, such as selecting research topics and crafting action items, were completed in close collaboration with community members and with public health, well-being, and equity at the forefront of decision-making.

A unique, first-of-its kind process led by the Mayor's Office of Climate & Environmental Justice (MOCEJ), *PowerUp* is the product of an inclusive, year-long study conducted in collaboration with diverse stakeholders, including experts from environmental justice (EJ) organizations, energy industry professionals, and NYC residents across the five boroughs. This public engagement process created a space for open dialogue and participation in which stakeholders helped guide the vision and development of creative solutions that address the critical problems our city and energy systems face today.

FROM PLANYC TO POWERUP

Much of the *PowerUp* planning and drafting work was completed concurrent with, and was informed by, the development of *PlaNYC: Getting Sustainability Done*, which details more than 70 actions the City is taking to achieve our climate action goals. Both *PowerUp* and *PlaNYC* involved robust community participation, industry engagement, and an all-of-government approach to planning.

Drawing on novel research, technical guidance, and public input, *PowerUp* expands upon *PlaNYC* with additional actions the City will take to achieve a just transition to a clean energy future. *PowerUp* also reiterates several *PlaNYC* commitments, adding detail on implementation pathways. Initiatives common to both *PowerUp* and *PlaNYC* are denoted throughout this report by the icon: 

Both reports identify key near- and long-term actions for the following sectors, with several shared themes:

Energy Grid and Community Energy Systems

- Supporting development of, and access to, large-scale and community-level renewable energy projects

- Investing in climate infrastructure on City-owned property
- Advocating for legislative and utility rate-structure reform to improve affordability and access to clean energy systems, particularly in historically disadvantaged communities

Buildings

- Reducing polluting emissions and transitioning to fossil fuel-free electric building systems
- Addressing cost-effectiveness and barriers to decarbonizing affordable housing, market-rate buildings, and the municipal portfolio

Transportation

- Encouraging more New Yorkers to choose walking, biking, and transit instead of driving
- For New Yorkers who must drive, expanding access to clean, electric-powered forms of transportation
- Prioritizing EJ areas and historically disinvested communities disproportionately impacted by air pollution and other environmental hazards

Read PlaNYC at: climate.cityofnewyork.us



NYC School Bus Umbrella Services (NYCBUS) electric-powered school bus. Source: MOCEJ

KEY RESEARCH FINDINGS

The *PowerUp* planning process also included novel research to fill knowledge gaps and yield findings that could inform actionable strategies for the City to undertake in the next four years. In addition to topics mandated by NYC local law, our team researched issues identified by expert guidance and community input. Key research themes and takeaways include the following (see the *PowerUp Technical Appendices* for more detail):

ENERGY GRID AND COMMUNITY ENERGY SYSTEMS

- **In-City Wind:** There are limited siting opportunities for roof-mounted and ground mounted wind turbines in the city. Most viable sites would generate more electricity using solar panels, making in-city wind an unfavorable option for energy infrastructure development.
- **Energy Storage on City-Owned and Private Property:** Pairing in-city storage with clean energy generation and/or transmission infrastructure offers a viable pathway to displace aging power plants and reduce NYC's reliance on fossil fuels. There is approximately 400 megawatts (MW) of storage potential on City-owned unused vacant land and parking lots that could be used to deploy 1MW+ battery storage projects, about 300 MW of which has passed initial review by relevant City agencies. Repurposed power plant sites were also analyzed and found to have over 3,000 MW of storage potential.
- **Leveraging Publicly Owned Real Estate for Community Solar:** This topic explored opportunities to use City-owned buildings and land to support infrastructure for community solar. Research included: a financial analysis of the optimal financing structure for community solar development, considering available tax benefits on a state and federal level; a prioritization framework for selecting development sites; and a starting list of potential sites for a City-led pilot.
- **Grid Readiness and Electrification:** The utility Con Edison has upgrades planned for many of their distribution networks to address grid readiness challenges related to building. However, additional investments and upgrades may be required, and many projects will have substantial lead times. This indicates that the

City and Con Edison should coordinate on additional near-term planning to ensure that the grid will not be a bottleneck to electrification and achieving our climate targets.

BUILDINGS

- **Building Electrification and Heat Pumps:** All-electric space heating systems, like heat pumps, can reduce emissions 50% to 75% compared to standard gas heating technologies for residential buildings, and 11% to 36% for commercial buildings, for equipment installed in 2023. Emissions reductions for building electrification will increase as we approach a 100% renewable grid in 2040. These systems are cost-effective in NYC for all new residential and commercial buildings. All-electric DHW systems can decrease emissions 70% to 90% compared to standard gas-fired systems, for equipment installed in 2023. Though they are currently cost-effective for new single-family residential and commercial buildings, they are not yet cost-effective in new multifamily buildings.
- **Affordability Challenges and "Missing Money":** Existing building electrification costs are more of a challenge. This research analyzed the amount of money needed to ensure that retrofits are affordable and have a reasonable payback period in rent-regulated unsubsidized housing buildings, and existing and anticipated federal and state funding programs, or City initiatives.

The analysis found a funding gap of \$30,000 to \$40,000 per unit for electrification retrofits and energy costs over a 18-year life cycle in multifamily buildings, depending on the extent of upgrades needed and building type. This means we need additional funding and financing to decarbonize the NYC building stock. While these costs are substantial, it is important to note that technological or process innovation could significantly reduce capital costs in the future, and utility rates may also fluctuate.

- **Cost of Cooling and Heating:** One complex issue raised by the clean energy transition is owner-tenant utility bill allocation. In most NYC rental buildings, owners pay for heating via gas, fuel oil, or district steam bills, while tenants pay for cooling via their electric bills. As the industry transitions to all-electric buildings, there are new viable pathways to equitable distribution of heating and cooling. These include: 1) owners

installing submeters so they can split heating costs with renters and renters continuing to pay for cooling; 2) owners taking on cooling costs but increasing rents, which raises transparency and renter protection issues; and 3) renters taking on heating costs and owners reducing rents accordingly to ensure that rent plus utilities remain below 30% of household income. The City will provide guidance on navigating this shift to ensure that tenants are safe and comfortable in their homes and costs are allocated equitably.

TRANSPORTATION

- **Electric School Buses:** The City has set targets for all new school bus purchases to be electric starting in 2027 and for the school bus fleet to be fully electric by 2035. However, electric school buses have high incremental upfront costs relative to conventional vehicles and require new charging infrastructure. The NYC Department of Transportation (DOT) projects that NYC must install 45,000 chargers across the five boroughs by 2030 and more than 200,000 chargers by 2050.^{iv}

Vehicle to grid (V2G) charging uses an EV’s battery to pull energy from the grid for storage when electricity is cheap and acts as a generator to push energy back to the grid when energy is more expensive. V2G can provide additional revenue to school bus fleet owners and operators, easing some of the electrification cost burden.

FROM PLANNING TO ACTION: POWERUP INITIATIVES

The participation and lived experiences of NYC residents, industry expert guidance, and our team’s research on technical solutions, policies, programs, and implementation best-practices informed the development of the initiatives outlined in this report, which focus on three key sectors:

ENERGY GRID AND COMMUNITY ENERGY SYSTEMS

To decarbonize NYC’s electricity sector by 2040 in accordance with the New York State CLCPA, the City is supporting multiple long-distance transmission projects to bring clean energy from Canada and upstate New York to NYC residents.

To boost local clean energy production, the City is committed to making NYC an offshore wind hub by helping bring 12 Gigawatts of wind power online and creating 8,000-13,000 total jobs related to the offshore wind ecosystem by 2035. The City will install 1,000 Megawatts of solar citywide by 2030 – much of it through distributed community solar and Public Solar. We will ensure clean energy reliability by aiming to meet the state projected need of 4,000 Megawatts of energy storage in NYC by 2040. We are reforming zoning codes, streamlining permitting processes, supporting the expeditious closing of in-city power plants, and applying for federal clean energy funding to achieve this goal.

BUILDINGS

Buildings produce nearly 70% of city-wide greenhouse gas emissions and 66% of fine particulate matter (PM2.5) air pollution in NYC – primarily through burning fossil fuels for space and water heating.

To reduce these emissions, the City is helping building owners implement Local Laws 92, 94, and 97 of 2019, which require green roofs or solar panels on new construction and set emissions limits for large buildings. Building initiatives aim to reduce polluting emissions, transition to fossil fuel-free electric building systems; and address cost-effectiveness and barriers to adoption for affordable housing, market-rate buildings, and the municipal portfolio.

TRANSPORTATION

Transportation generates around 30% of NYC’s total greenhouse gas emissions. To decarbonize the transportation sector, NYC has three primary goals: electrify public transit and City fleets, support electric vehicle (EV) adoption and shift to alternative modes of sustainable transportation, and reduce the effects of heavy-duty trucks on environmental justice communities.

To achieve these goals, we are pursuing federal funding and updating zoning regulations to create a network of EV fast charging hubs, where EV fast chargers will be within 2.5 miles from one another by 2035. We are working across City agencies and with private partners to deploy all-electric light-duty vehicle fleets for both ride-share companies and City operations by 2030.

POWERUP INITIATIVES AT A GLANCE

Energy Grid	Increase Availability of Offshore Wind Power	Support Offshore Wind Interconnection and Transmission
		Make NYC an Offshore Wind Industry Hub
	Expand Energy Storage Capacity across NYC	Explore Opportunities to Install Storage at Retired Power Plant Sites
		Reform the NYC Zoning Resolution to Support Electricity Storage, Clean Power Generation, and Electrification
		Reduce Permitting Delays by 50% for Energy Storage Systems
	Develop Energy Storage and Solar Power Generation on City-Owned Land	Install Climate Infrastructure on All Viable City-Owned Property by 2035
Enhance Solar and Storage on City-Owned Property		
Use City-Owned Property for Community Solar Development	Create a Community Solar Pilot	
Prepare NYC’s Grid for Electrification	Launch Public Solar NYC	
	Support Demand Response Programs Citywide	
Ensure the Resilience of NYC’s Power Systems	Mandate Grid-Responsive Thermostats	
	Launch Resiliency Hubs citywide	
Buildings	Reduce Costs of Electrifying Rent-Regulated, Unsubsidized LMI Housing	Implement Creative Ways to Close the Funding Gaps for Existing Building Retrofits
		Expand Existing Technical Assistance and Financing Programs
	Increase Tenant Protection and Prevent Energy Burden for New Yorkers	Advocate for Progressive Energy Rate Structures
		Advocate for Increased Utility Bill Assistance
		Increase Community Engagement in the Energy Landscape
	Catalyze Innovation and Scale Electrification	Phase Out Use of Fossil Fuels in Existing Buildings and Equipment
Implement Innovative Clean Energy Solutions for Affordable and Public Housing		
	Promote Awareness and Education on Building Electrification Solutions for 1-4 Family Buildings and Other Small Building Owners	
Transportation	Expand Access to Personal and For-Hire EVs	Support Transition of Personal Vehicles to EVs
		Electrify the Taxi and For-hire Industries
	Electrify School Buses	Incorporate Electrification Requirements in 2025 Contract Renegotiation with School Bus Fleet Vendors
		Implement Lessons Learned from Vehicle-to-Grid Pilots
		Acquire State and Federal Funding for New Bus Purchases
	Reduce Pollution from City Fleets	Launch Training Program for Electric School Bus Operations and Maintenance and Provide Ongoing Support
Electrify the City’s Fleet		
Reduce Pollution from Heavy-duty Vehicles	Electrify On-road Freight Movement	
	Reduce the Effects of Trucks in Our Communities and on Our Infrastructure	

A JUST TRANSITION

Access to clean, affordable, and reliable energy is crucial to the well-being of all New Yorkers. This means New Yorkers must have access to cooling equipment in their homes and the ability to pay the utility bills that make cooling possible on hot summer days, during heatwaves, and as needed to live safely and comfortably. It means keeping the lights on during storms and maintaining power for life-saving medical devices and critical building loads. It also means getting goods and people where they need to go using efficient forms of transportation that keep our air clean and New Yorkers healthy.

Discriminatory energy siting processes have left a legacy of health disparities across NYC populations, with EJ communities suffering from disproportionately high rates of chronic diseases like asthma, Type II diabetes, heart disease, and vulnerability to COVID-19, among others.^v Clean energy infrastructure breaks the tradition of concentrating polluting fossil fuel power plants in EJ and disadvantaged communities, including communities of color and low-income areas (see "New York's Disadvantaged Communities Criteria (DAC)" on p. 13 for more information).

In the face of the climate crisis, bigger energy challenges and inequities are upon us. In recent years, New Yorkers have experienced more frequent and intense climate events, such as extreme heat, hurricanes, and flooding. In Fall of 2021, Hurricane Ida hit the east coast, causing large-scale power outages and resulting in the deaths of thirteen NYC residents.^{vi} With these types of weather events expected to occur on an increasingly frequent basis, we must take bold action to protect all New Yorkers, prioritizing our most vulnerable communities and businesses. Reliable energy infrastructure must also be climate resilient — for example, rooftops can host solar installations and mechanical equipment, keeping mechanical equipment out of the basement.

The City of New York is committed to supporting and co-creating innovative solutions with public, private, and community partners to address these multi-faceted problems. These solutions will promote climate justice and realize a just energy transition. Such a transition is a shift from polluting fossil fuels to a clean energy future that supports and prioritizes investments in

historically marginalized communities, involves robust community energy planning, and creates accessible pathways to good-paying jobs.^{vii}

The City is also leveraging local climate data and well-vetted research from a global community of climate scientists to inform long-term planning and decision-making. We are quantifying the impacts of planet-warming GHG emissions and pollutants that come from our building, transportation, and energy generation sectors and incorporating projections for future sea-level rise and changing weather patterns to make wise capital investments that will keep New Yorkers safe and stand the test of time.

As a leader in climate and clean energy policy, the City is well positioned to harness new, once-in-a-generation levels of federal funding to invest in climate action and accelerate the clean energy transition. This is a simultaneous opportunity to support local jobs — by creating workforce development pathways, equity — by ensuring that all communities benefit meaningfully from the clean energy transition, and public health — by reducing hazardous air pollution.

PowerUp details NYC's plan to lead the charge on clean energy and climate action catalyzing meaningful action today and building the innovative infrastructure and green economy of the future.

NEW YORK'S DISADVANTAGED COMMUNITIES CRITERIA (DAC)

In 2017, the New York City Council adopted Local Laws 60 and 64 which require the City's Environmental Justice Interagency Working Group to prepare a citywide report on environmental justice and make its findings public. In 2023, MOCEJ will release that report and provide a comprehensive view of the present state of environmental justice in New York City. This report will be used to inform the EJNYC Plan, which will propose solutions to address environmental injustices in consultation with the impacted communities and embed environmental justice considerations into City decision-making.

To identify and prioritize EJ neighborhoods for priority climate and energy programs and investments, New York State adopted criteria for disadvantaged communities, described below:

In 2019, New York State signed the Climate Leadership and Community Protection Act (CLCPA) into law. A cornerstone of the CLCPA was identifying and considering disadvantaged communities in regulatory actions. Under the

CLCPA, disadvantaged communities are defined as "communities that bear burdens of adverse public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate-income households."

The disadvantaged communities criteria (DAC), adopted by the New York State Department of Environmental Conservation in March 2023, aim to provide a framework to guide the equitable implementation of New York's ambitious CLCPA by requiring reductions in air pollution and climate-altering greenhouse gas emissions and targeting clean energy and energy efficiency investments in vulnerable communities.

For more information on the DAC criteria, visit: climate.ny.gov/Resources/Disadvantaged-Communities-Criteria



The City of New York is committed to supporting a just transition to a clean energy future through community-based planning and thoughtful public engagement. Source: MOCEJ

THE POWERUP PLANNING PROCESS

As noted, the planning process that drove development of the *PowerUp* initiatives included three prongs: community-level engagement; industry expert feedback; and technical research.

COMMUNITY ENGAGEMENT FOR INCLUSIVE ENERGY PLANNING

Historically, city planning has involved limited interaction with community members impacted by proposed policy and program interventions. The status quo has excluded groups like low-income communities of color, women, and youth. When community voices are at the table it helps to ground solutions in real challenges and generate more diverse and creative ideas. Based on their experiences at home, at work, at school, and in transit, everyday New Yorkers can offer key insights to help address systemic challenges and changes necessary to realize a clean energy future for all.

Acknowledging this, our team partnered with five community-based organizations (CBOs) to support meaningful neighborhood-level

participation, address complex challenges across the five diverse boroughs, and foster a shared sense of ownership in the *PowerUp* planning process and resulting initiatives.

- Manhattan: WE ACT for Environmental Justice
- Staten Island: Staten Island Chamber of Commerce
- Brooklyn: El Puente
- Bronx: South Bronx Unite
- Queens: Chhaya CDC

CBOs helped lead outreach and engagement with diverse residents of frontline communities. Our team organized a series of public feedback sessions in 2022, which included: five virtual community town halls, each tailored to a different borough; a general in-person convening; and several virtual deep-dive sessions on technical research topics. Town halls were used to communicate the key steps and objectives of *PowerUp*, explain the fundamentals and benefits of energy efficiency and clean energy technologies and solutions, and encourage robust participation in the City’s long-term energy planning process.

CBO Partners and Their Outreach Boroughs



The City partnered with five community-based organizations (CBOs) to lead meaningful neighborhood-level engagement in the city’s long-term energy planning process.

Community engagement was guided by four key pillars:

- **Partnership:** Prioritizing collaboration and inclusion to involve community members in decision-making. This included working with locally trusted CBO partners to identify key stakeholders to bring to the table, connecting the goals and context of *PowerUp* to people’s lived experiences, creating tailored presentations relatable to diverse audiences, highlighting local energy concerns, and encouraging attendees to share their perspectives and priorities.
- **Accessibility:** Providing resources and holding convenings to maximize participation from a wide group of New Yorkers. This included holding sessions virtually and in-person, at different times of day, including live language interpretation and translations of materials when possible, and making materials available online.
- **Transparency:** Publicly sharing the purpose, steps, and status of *PowerUp* planning and initiative development throughout the project process, including by posting community feedback, questions, and concerns online and leveraging our CBO partners to maintain open channels of communication.
- **Accountability:** Tracking attendance and participation at town halls to evaluate whether a representative cross-section of stakeholders was involved and to inform iterative outreach and engagement efforts. This included refining and adding new strategies as necessary and committing to continual improvement.

The first long-term energy plan for the City of New York will incorporate lessons learned from the community engagement process to refine it in future iterations of *PowerUp*, continuing to prioritize diverse stakeholder input in shaping the City’s clean energy policies and initiatives.

Three cross-cutting themes emerged from the community engagement process and are embedded across all *PowerUp* initiatives:

- **Affordability:** Many low-to-moderate-income households will need financial assistance, technical support, and other easy-to-access resources to make the transition to renewably-powered, all-electric building equipment. City-led initiatives must ensure that households’ utility bills will not increase unfairly from making this necessary switch.
- **Health:** Reducing emissions is essential to improving local air quality and public health. As the City tracks the success of *PowerUp* initiatives, it must include public health indicators that provide transparency and accountability on this front.
- **Equity:** The City must continue to foster engagement with EJ and historically marginalized communities to ensure that the clean energy transition is a just transition, with a focus on community-based planning and workforce development.



PowerUp Community Town Hall, December 2022 — one of several held to facilitate public participation in NYC’s long-term energy planning process. Source: Kinetic Communities Consulting

ENERGY TECHNICAL WORKING GROUP

To provide additional input on *PowerUp* research, planning, and initiative development, we convened an Energy Technical Working Group (ETWG) — a volunteer-based, cross-sector group of 24 experts in the efficiency and clean energy fields. ETWG members included voices from government, utilities, energy and renewable energy industries, the transportation sector, building sector, environmental justice advocacy groups, consumer advocacy groups, and other organizations focused on the clean energy transition.

ETWG members helped guide research across the areas of their expertise, identify topics, scopes, and methods, and contextualize results. The ETWG helped ensure that *PowerUp* was aligned with City and State energy policies, met the requirements of NYC local laws, and was grounded in the needs of all New Yorkers, particularly EJ and disadvantaged communities.

TECHNICAL RESEARCH

As summarized earlier in this chapter, our team conducted research on a number of topics mandated by NYC local laws. Methodologies and findings for these topics are detailed further in the *PowerUp Technical Appendices*:

- **Local Law 104 of 2018:** Assessing and mapping wind energy generation potential within the five boroughs, particularly in waterfront areas and on tall buildings.^{viii}
- **Local Law 99 of 2019:** Assessing the feasibility of replacing in-city gas fired power plants with battery storage powered by renewables, and assessing the readiness of NYC's electric grid to accommodate anticipated increases in customer electricity demand due to building electrification.^{ix}
- **Local Law 181 of 2019:** Studying the feasibility of installing utility-scale energy storage on private buildings throughout the city.^x
- **Local Law 154 of 2021:** Studying the technical feasibility, costs, and environmental impact of adopting building electrification technologies.^{xi}

Additionally, our consulting team closely reviewed the extensive body of existing reports and analyses that have examined NYC's energy systems and the transformations needed to meet our climate and equity goals. The team also conducted original research chosen to fill knowledge gaps identified by stakeholder and expert input.

KEY TERMS

Building Electrification: The process of transitioning from fossil fuel-fired systems to electric ones. Examples include replacing fossil fuel-powered heat sources like boilers with heat pumps, and substituting gas stoves with induction stoves.

Community-Based Organization (CBO): Local nonprofit group that focuses on addressing neighborhood or local-level community needs.

Decarbonization: The process of removing sources of greenhouse gas emissions (such as oil heating systems or gas-powered cars) from use to reduce emissions.

Energy Grid: A network of power lines and stations used to import, export, and deliver energy from its generation or storage source to end users (customers).

Energy Storage: The ability to store electricity in large-scale batteries for use during peak load times, or when renewable energy sources are not generating power.

Energy Technical Working Group (ETWG): Volunteer group of cross-sector clean energy experts who helped guide NYC's long-term energy planning process for *PowerUp*.

Environmental Justice (EJ): The fair treatment and meaningful involvement of all people regardless of race, national origin, or income, with respect to the development and implementation of environmental laws, regulations, and policies.

Greenhouse Gas (GHG): Any gas that absorbs and traps heat from the sun. Commonly known greenhouse gases include carbon dioxide and methane.

Grid Distribution: Localized part of the electric grid that reduces high voltage energy flow to a usable format, and transfers energy directly to its end use in homes and businesses.

Grid Transmission: Part of the electric grid that transfers energy over long distances and at high voltages.

Heat Pump: An electrical device that moves heat from one place to another, like a refrigerator. Heat pumps can be used for space cooling and heating, and to generate hot water.

In-City Wind: Wind energy that can be generated by turbines located inside the city.



The *PowerUp* research team studied the potential for implementing several clean energy solutions across NYC, including in-city wind, utility-scale energy storage powered by renewables, and building electrification technologies. Photo source: Adobe Stock



Vernon Boulevard, Queens. Source: MOCEJ

Context: NYC's Energy Systems Today

We rely on energy to heat and cool our homes, run our businesses and schools, transport goods, and get people where they need to go. The way we choose to generate and source this energy has significant consequences for the well-being of all New Yorkers and the planet.

OPERATIONALIZING A CLEAN ENERGY TRANSITION

Traditionally, we have relied primarily on fossil fuels — nonrenewable resources like coal, natural gas, and oil. Fossil fuels emit high levels of pollutants when burned, including the GHGs responsible for warming our planet. In addition to damaging natural ecosystems, degrading water and air quality, and increasing climate risks like extreme weather, fossil fuels also harm human health. Fossil fuel combustion produces criteria air pollutants — six common pollutants known to harm public health and the environment. These can complicate cardiovascular conditions, contribute to respiratory illnesses like asthma, and increase vulnerability to viruses like COVID-19, among other ailments (see "Beyond Carbon Emissions" on p. 23 for more detail).

Conversely, clean energy technology like solar, wind, hydroelectric power, and energy storage can help us build a more sustainable and resilient energy future while growing NYC's economy and creating thousands of well-paying green jobs.

GREENING THE GRID

NYC currently relies more heavily on fossil fuels to generate electricity than the rest of New York State. While upstate NY receives about 90% of its electricity from zero-emissions sources, only 11% of electricity in NYC comes from renewable

resources.^{xii} This is primarily because it is difficult to site large-scale renewable energy generation infrastructure in or near densely populated urban areas like NYC and to build long-distance transmission lines to source renewables from farther afield. Until recently, roughly 25% of NYC's energy was generated by the Indian Point nuclear power plant in the Hudson Valley.^{xiii} While nuclear is not typically considered to be a renewable fuel, it is an emissions-free energy source. With the plant's closure in 2021, our emissions profile has temporarily shifted to more fossil fuel generated electricity.^{xiv}

However, the City of New York is catalyzing and advancing the development of clean energy infrastructure that will transform our grid for the better. Multiple projects are already underway to make renewable sources of electricity more readily available to New Yorkers and to displace our most polluting sources. These projects are detailed in the following chapter.

REDUCING RELIANCE ON IN-CITY POWER PLANTS

Due to transmission constraints that limit that amount of energy that can flow to the city from upstate or neighboring regions, NYC draws on energy generated by 24 in-city fossil fuel plants, which are located disproportionately in EJ and disadvantaged communities.^{xv} Several of these are large baseload plants, which generate power for daily consumption. Another subset of plants, known

as peakers, operate only when energy demand is at its highest; this tends to happen on the hottest days of the year when air conditioning demand is high. The majority of the peaker plants are over 50 years old and the least efficient and dirtiest sources of energy generation in NYC, emitting high levels of GHGs and pollutants that degrade air quality and threaten human health.^{xvi} Some of these plants are slated for retirement as new large-scale renewable energy projects come online.

Additionally, the NYS Department of Environmental Conservation (DEC) adopted the 2019 Peaker Rule to reduce the allowable level of ozone-contributing pollutant emissions from peaker plants.^{xvii} From 2021 to 2023, this rule led to the closure of nearly 1,000 megawatts (MW) of energy generation from the oldest and dirtiest plants and will lead to more closures through 2030.^{xviii}

NYC'S HISTORIC ENERGY SOURCES

New York City has been a pioneer in energy infrastructure development for over a century. NYC's first power grid was developed in the 1880s with the construction of the Pearl Street Station

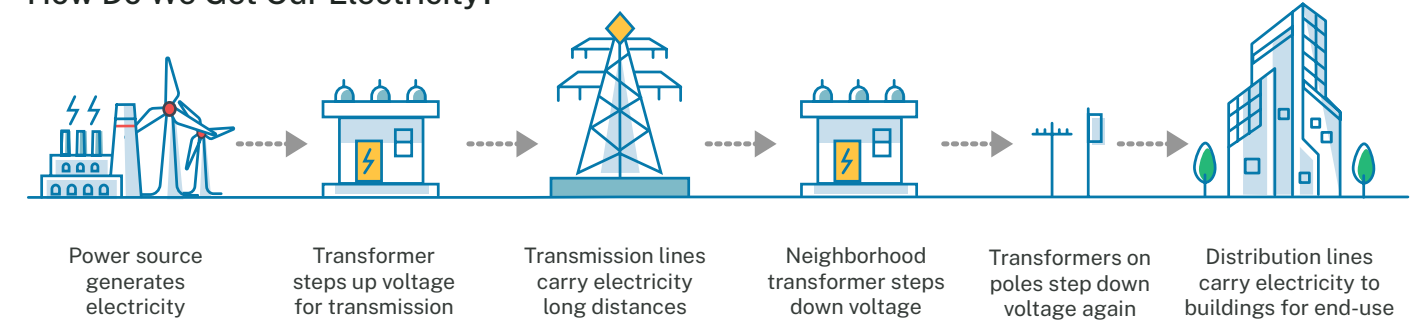
in Lower Manhattan — the very first commercial central power plant in the nation.^{xix} However, as was the standard of the day, the plant burned coal to generate electricity, creating health hazards for plant workers and the public. Since closing the dirty coal plants of the 19th century, the City has made nation-leading commitments to develop clean energy resources. Today, NYC is on the verge of a historic energy transition, from the polluting fossil fuels of the past to solar, wind, and hydro power backed by reliable energy storage.

To advance this transition as rapidly and cost-effectively as possible, we must begin with a clear understanding of the energy sources we draw on today — namely electricity, natural gas, and steam.

ELECTRICITY

NYC uses an average of 142.5 gigawatt hours of electricity each day — enough to power an average U.S. hospital for nearly 19 years.^{xx} The amount of electricity we consume day-to-day varies according to multiple factors, including the weather, season, time of day, and day of the week. We typically use more electricity on weekdays than weekends, during evening hours, and in the summer when many of us switch from oil and natural gas-based heating equipment like boilers and furnaces to electric cooling systems like air conditioning

How Do We Get Our Electricity?



At the utility scale, after electricity is generated by a power source, such as a conventional fossil fuel-burning power plant or renewable resources like wind or solar, transformers step up the voltage for long-distance transmission. At the local level, another series of transformers step the electric voltage back down for distribution to buildings and end-use.

units. NYC's electricity demand will evolve as we transition from fossil fuel-based systems for buildings, vehicles, and other infrastructure, to electric systems powered by a renewable grid.

In NYC, Con Edison is the primary local distribution company providing electric delivery service and is regulated by the Public Service Commission (PSC). A small area of the Rockaways is served by the Public Service Electric & Gas Company Long Island (PSEG LI), (see "Managing New York's Energy Systems" on p. 23 for more).

There are three primary components of the electric grid:

- **Generation:** Electricity is produced at power plants and has traditionally been generated largely by burning fossil fuels. Historically, coal had been the dominant fuel type, but natural gas and fuel oil have become increasingly common since the 1980s. As NYC transitions to a clean energy economy, our grid will be powered increasingly by renewable resources like solar, wind, and hydroelectric power.
- **Transmission:** Electricity travels long distances via high voltage transmission lines from the source of generation to NYC neighborhoods.
- **Distribution:** At the local scale, transformers step down voltage to the level compatible with our buildings, equipment, and other end uses.

NATURAL GAS

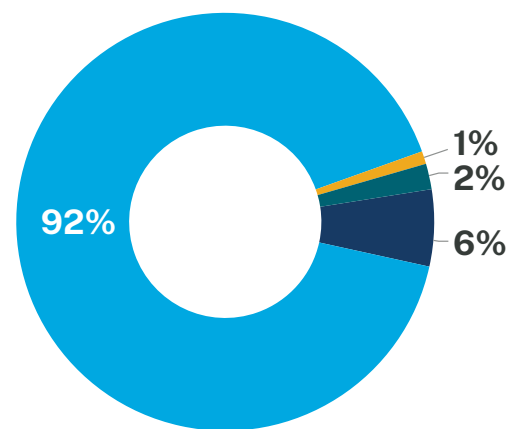
Many New Yorkers rely on natural gas to heat their homes, produce hot water, and cook. In NYC, the utilities Con Edison and National Grid distribute natural gas through networks of pipelines and gas mains to buildings where it is used to fuel furnaces, boilers, stoves, water heaters, and other appliances.

Natural gas is extracted from the earth largely through hydraulic fracturing, or fracking, which poses high levels of environmental risk. While it is a lower emissions fuel than coal or oil, natural gas still produces significant GHGs and other emissions when burned. This includes pollutants like carbon monoxide and PM2.5, which degrade indoor and outdoor air quality and threaten occupant health.. Though New York State banned the extraction of natural gas, New Yorkers are still highly dependent on gas piped in from beyond state lines. In 2021, natural gas accounted for nearly 65% of total energy used across New York City, 89% of energy used in residential buildings, and 72% of energy used for home heating.^{xxi}

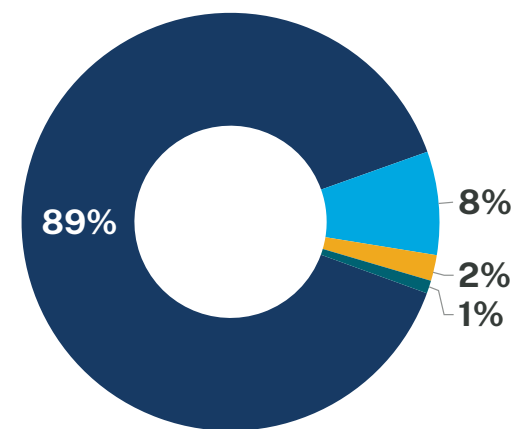
Natural gas pipelines and mains can also leak methane, a GHG that has more than 80 times the warming power of CO₂ on a 20-year timescale.^{xxii} Leakages resulting from piping gas to NYC alone are responsible for 29 million tons of CO₂ equivalent (MTCO₂e) each year — equivalent to the annual emissions of more than six million gas-powered cars or nearly eight coal-fired power plants.^{xxiii}

This impact is significant — NYC's calculated citywide GHG emissions increases by roughly 68% when accounting for this leakage and methane's planet warming impacts.^{xxiv} Because methane has such a strong effect on short-term warming, cutting emissions can immediately slow the rate of global warming. Curbing natural gas use is critical to meeting our climate targets and ensuring a safe and healthy future.

Upstate NY Energy Profile



Downstate NY Energy Profile



■ Fossil Fuel ■ Hydro Pumped Storage ■ Zero Emissions ■ Other renewables

For NYC, fuel types in the Downstate NYC Energy Profile include the following: Fossil Fuels (coal, oil, and natural gas); Zero Emissions (solar, wind, and nuclear); Other Renewables (biomass — wood and waste). NYC currently relies on fossil fuels to generate the majority of our electricity, while upstate New York uses mostly zero-emission sources. However, the City has been accelerating development of multiple large-scale clean energy infrastructure projects to achieve our goals of a 100% clean energy grid by 2040 and net-zero citywide emissions by 2050. Source: MOCEJ, based on 2021 NYISO data

STEAM

On-Site Steam Boilers: In NYC, over 80% of large multifamily buildings are heated by steam boilers and distribution systems powered by on-site fossil fuel combustion.^{xxv} Steam systems not only produce planet-warming GHG emissions and other pollutants that degrade indoor and outdoor air quality and compromise human health, but they are often old and perform poorly, with loud clanging pipes, radiators that leak water, and a tendency to under and overheat occupant spaces.

District Steam: Con Edison provides steam to certain buildings in Manhattan through a shared district steam system that is the largest in the nation and serves roughly 1,500 customers.^{xxvi} The steam is produced by burning natural gas at central plants and distributed to buildings through pipelines below the city's street. In some cases, district steam plants use co-generation — a process in which gas is burned to generate electricity first, and resulting waste heat is captured to then produce steam. Although co-generation can be more efficient than traditional steam generation, such plants typically still burn polluting fossil fuels. In 2021, Con Edison released a report detailing potential actions, investments, and strategies the company can take to help the City achieve economy-wide net-zero emissions by 2050 and increase energy resilience, while continuing to provide core services.^{xxvii}

Campus Steam: In campus-style properties, multiple buildings are heated by steam generated by central boilers, somewhat like a smaller-scale version of city district steam. Often, when boilers are replaced at the end of useful life, steam distribution systems are not repaired, forcing new boilers to work harder, creating inefficiencies, and shortening the lifespan of new equipment. Campus steam has an additional retrofit challenge, as these distribution systems cannot be easily retrofitted to use electric-powered technology, like centralized heat pumps.

ENERGY SYSTEM RESILIENCE AND VULNERABILITIES

Energy resilience — the ability of energy systems to anticipate, adapt to, and rapidly recover from disruptive events — is a key pillar of an equitable

energy future and a growing concern as NYC faces more frequent and intense climate risks. The City, Con Edison, and NYISO have all released reports reviewing future system reliability, examining how climate change and demand projections will impact the power system in New York and how that will affect grid reliability and resiliency.^{xxviii} As the impacts of climate change grow more severe, we must take bold action to ensure the resilience of our energy systems in parallel with transitioning to cleaner and more efficient technologies.

EXTREME WEATHER EVENTS

The NYC energy system is vulnerable to disruptions by extreme weather events like powerful coastal storms, extreme rain and wind, and flooding. Storms can damage distribution systems and transmission lines, with damage from downed trees, flooding, and lightning. During Hurricane Sandy in 2012, damage from coastal storm surge flooding and high winds caused power loss to over 800,000 electric customers in the City, inflicting an estimated \$19 billion in damages and lost economic opportunity and resulting in the deaths of 44 NYC residents.^{xxix} Nearly ten years later, Hurricane Ida caused similar damage, cutting off electricity to hundreds of thousands of customers across the NYC region and claiming the lives of another thirteen New Yorkers.^{xxx}

The New York City Panel on Climate Change (NPCC) develops regional projections of sea level rise, temperature, and precipitation for decades between present and 2100. The City and partners leverage this data to inform planning and policy to ensure NYC is prepared for future extreme weather events. For example, the City's *Climate Resiliency Design Guidelines* incorporate these projections to provide guidance on flooding elevation requirements and future heating and cooling needs.^{xxxi}

EXTREME HEAT

Extreme heat also impacts energy reliability and human health. Each summer, heat kills an average of 350 New Yorkers, disproportionately in disadvantaged communities.^{xxxii} Already a danger on its own — particularly for those with existing chronic conditions — extreme heat also drives up the energy demand for cooling, which can strain the electrical grid and increase the likelihood of power outages. This compounds risks by disrupting

cooling and exposing more people to dangerous temperatures. Such outages can increase mortality and hospitalization rates for a range of conditions, including cardiovascular, respiratory, and renal disease. People who rely on electric medical equipment or perishable medicine are particularly vulnerable during outages.^{xxxiii} Furthermore, extreme heat can reduce concentration and productivity, impacting children and workers even before they suffer major health consequences.^{xxxiv}

In 2023's *PlaNYC*, the City committed to addressing the risks of extreme heat by increasing access to indoor cooling. While more than 90% of NYC households reported having air conditioning in 2017, access in some neighborhoods was as low as 76%.^{xxxv} Even with access to cooling equipment, the cost of running an air conditioner or heat pump can be prohibitively expensive for some, leading to additional risk of heat-related deaths. *PlaNYC* outlines the City's commitment to developing a maximum summer indoor temperature policy

BEYOND CARBON EMISSIONS: CRITERIA POLLUTANTS AND PUBLIC HEALTH

In addition to warming our planet, fossil fuels also emit a wide range of criteria pollutants — pollutants scientifically proven to damage human health and regulated by the US EPA under the Clean Air Act.^{clix}

Particulate Matter (PM2.5): PM2.5 is the term for any fine inhalable particles in the air that are less than 2.5 microns in diameter — 30 times smaller than a human hair. PM2.5 primarily results from diesel vehicle exhaust and burning fossil fuels, like coal, heating oil, and natural gas. These fine particles travel into the respiratory tract and can reach the lungs, causing infections, asthma, and heart disease.

Sulfur Oxides (SOx): SOx are a group of gases, the most dangerous of which is sulfur dioxide (SO₂). SOx are emitted primarily by power plants and industrial facilities and can degrade respiratory health, particularly for people with underlying conditions like asthma.

Nitrogen Oxides (NOx): NOx is formed by burning fossil fuels and it is emitted primarily by motor vehicles and power plants. NOx also

by 2030 and establishing mandatory cooling requirements in new construction. *PlaNYC* also includes several initiatives to reduce the urban heat island effect and cool our built environment, such as increasing tree canopy cover and installing reflective cool roofs.

WINTER PEAKING

Currently, the strain on our electric grid is most pronounced during the summer cooling season. However, in the coming decades as we transition to electric-powered heating equipment like heat pumps, peak demand is expected to shift to the winter, increasing the potential for winter outages. Winter power outages impact not just electric-powered heating equipment, but also modern gas-fired equipment that needs electricity to operate. Utilities and regulating bodies are taking this transition into consideration in planning for future resilience and capacity of the electric grid.

has negative impacts on respiratory health and can interact with other chemicals in the air to produce ozone and PM2.5. It can also interact with water, oxygen, and other chemicals in the atmosphere to produce acid rain.

Ground Level Ozone: Ground level ozone is not emitted directly into the air. It is created by a chemical reaction between NOx and pollutants emitted by cars, power plants, and other industrial sources. Exposure to ground level ozone can cause respiratory issues, increase the frequency of asthma attacks, and make people more susceptible to infections.

Carbon Monoxide (CO): Carbon Monoxide is emitted when fuels are combusted, including burning fuels in cars or trucks, small engines, stoves, lanterns, grills, fireplaces, gas ranges, or furnaces. CO can reduce oxygen flow to the heart and brain when inhaled at high concentrations. Although outdoor levels of CO typically are not high enough to cause serious complications for most people, CO levels can build up indoors and reach dangerous and even lethal levels. NYC law requires CO detectors to be present in dwelling units.^{clix}

CLIMATE AND ENERGY POLICY LANDSCAPE

New York City and State have enacted nation-leading laws, adopted bold policies and regulations, and dedicated billions of dollars to curb GHG emissions and mitigate the worst impacts of the climate crisis. The Federal government has also passed legislation and allocated once-in-a-generation funding that supports the development of clean energy infrastructure and well-paying green jobs across multiple sectors of the economy. Below is a brief overview of key laws, policies, and funding sources, many of which are addressed in later chapters.

NEW YORK CITY

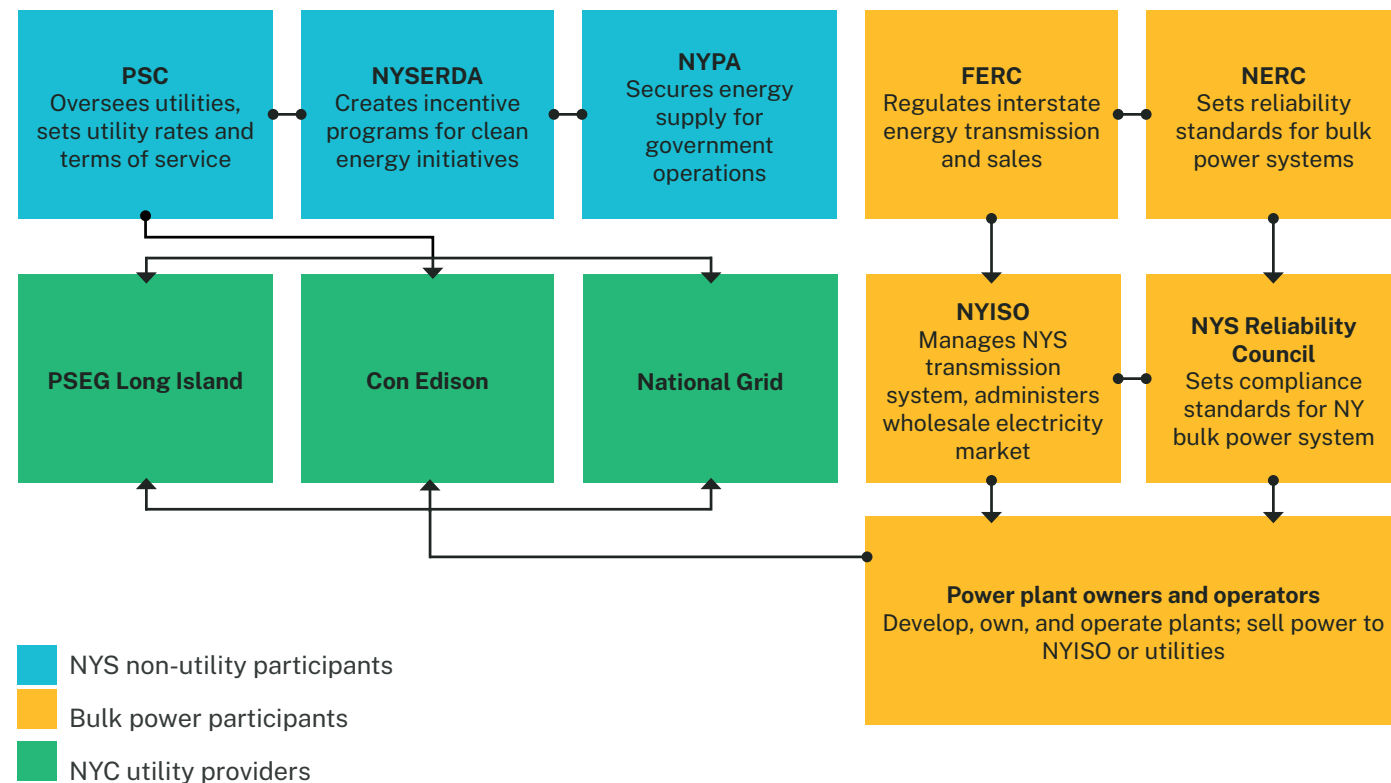
The City of New York has established some of the most ambitious climate and clean energy goals in the nation. To date, we have committed to achieving net-zero emissions — reducing citywide GHG emissions by 100% — by 2050, and to helping meet the State’s mandate of zero-emissions electricity

by 2040. The City is leading by example with even more rapid decarbonization commitments for municipal operations, including a 40% reduction in municipal GHG emissions by 2025 and a 50% reduction by 2030. Several City agencies have also set their own commitments, such as the New York City Housing Authority (NYCHA) commitment to reducing portfolio-wide emissions 80% by 2050.^{xxxvi}

Legislation

With 70% of citywide emissions coming from the building sector, NYC has prioritized building decarbonization through several landmark pieces of legislation. In 2009, the City enacted the Greener, Greater Buildings Plan (GGBP), a comprehensive suite of laws that included Local Laws 84 and 87 of 2009, which established annual energy benchmarking, building energy audits, and retro-commissioning for large buildings (those over 25,000 square feet).^{xxxvii} Harnessing this momentum and nearly a decade’s worth of building energy data, the City has since enacted paradigm-shifting laws that dramatically advance the speed and scale of building efficiency and decarbonization.

Key Electric Industry Participants in New York



New York’s energy systems are managed and regulated by a variety of entities at the local, state, regional, and federal levels.

MANAGING NEW YORK’S ENERGY SYSTEMS

New York’s energy systems are managed and regulated by a variety of entities at the local, state, regional, and federal levels. These include:

Bulk Power Participants:

- **Federal Energy Regulatory Commission (FERC):** FERC is a federal entity that regulates electric transmission and the wholesale electricity markets nationwide. FERC also ensures that rates are just and reasonable for customers.
- **New York Independent System Operator (NYISO):** NYISO is an independent non-governmental organization that manages the State’s bulk electric grid and competitive wholesale electric marketplace. NYISO does not own power generation plants or transmission lines, but works with power providers, utilities, and other stakeholders to operate the electric grid and meet power needs.
- **New York State Reliability Council (NYSRC):** NYSRC is a nonprofit entity whose mission is to promote and preserve the reliability of the New York State Power System by developing, maintaining and, when needed, updating the Reliability Rules that govern the NYISO’s operation of the state’s bulk power system, and all entities engaging in electric transmission, ancillary services, and energy and power transactions on the New York State Power System.
- **North American Electric Reliability Corporation (NERC):** NERC is a nonprofit corporation overseen by FERC, responsible for ensuring the reliability and security of the bulk power system in North America.
- **Power plant owners and operators:** These entities develop, own, and operate plants, and sell power to NYISO or utilities.

NYS Non-Utility Participants:

- **New York Power Authority (NYPA):** NYPA is largest state public power authority in the nation, NYPA controls 16 power generating facilities, over 1400 circuit-miles of transmission linesⁱ and sells power, delivered by Con Edison infrastructure, to the New York City government, as well as several other large institutions in the City, including the MTA, PANYNJ, and NYCHA.
- **NYS Department of Public Service (DPS) and the Public Service Commission (PSC):** DPS is the staff arm of the PSC, which regulates New York State electric, gas, steam, and water utilities to ensure just and reasonable rates, as well as safe, adequate, and reliable service for consumers.
- **New York State Energy Research and Development Authority (NYSERDA):** NYSERDA supports and promotes energy efficiency and renewable energy sources, works with stakeholders across the state including residents, developers, local government officials, business owners, and utility representatives to promote clean energy in New York State.

Utility Providers

New York utilities sell and deliver electricity and gas to homes and businesses; utilities in New York include Con Edison, National Grid, and Public Service Enterprise Group Long Island.

- **Climate Mobilization Act (CMA) of 2019:** A historic suite of laws to reduce citywide emissions by 40% by 2030 and 80% by 2050. NYC strengthened this commitment in 2019 to net-zero emissions economy-wide by 2050. The CMA includes the following laws:
 - **Local Law 97:** Sets first-ever emission limits for large buildings that goes into effect in 2024, with annual penalties for non-compliance. Emissions limits grow significantly more stringent in 2030.^{xxxviii}
 - **Local Law 92/94:** Requires building green roofs and/or solar PV systems on certain new construction and renovation projects.^{xxxix}
 - **Local Law 95:** Requires publicly posted energy grades on buildings over 25,000 square feet.^{xl}
 - **Local Law 96:** Establishes a Property Assessed Clean Energy (PACE) financing program to fund qualifying energy efficiency and renewable energy projects.^{xli}
- **Local Law 154 of 2021:** Sets CO2 emissions limits on fossil fuel-combusting systems in new construction buildings, effectively requiring installation of all-electric systems for heating, cooling, hot water, and cooking. The law goes into effect in 2024, with requirements phasing in through 2027.

The City has also set aggressive goals to reduce emissions from the transportation sector, which accounts for nearly 30% of citywide GHG emissions.^{xliii} This includes a target for establishing a 100% electric municipal fleet by 2040, achieving a 100% electric school bus fleet by 2035, and increasing the availability of electric vehicle chargers and sustainable public transit options in the coming years.

Codes

NYC is driving building industry transformation by adopting progressively more efficient energy codes, including the NYStretch Energy Code Overlay. The NYStretch code is a voluntary supplement to the Energy Conservation Construction Code of New York State developed by NYSERDA that local governments looking to set more stringent standards can adopt.^{xliiii} These codes, paired with Local Law 154 of 2021, will ensure that new construction is highly efficient and all-electric.

Zoning

The City of Yes for Carbon Neutrality proposal was certified by the New York City Planning Commission in April 2023. The citywide zoning amendment was shared with all 59 community boards and five Borough Presidents for review and recommendation. If passed, the zoning amendment will support clean energy, energy storage, energy-efficient buildings, electric vehicles, stormwater management, and waste reduction in NYC by removing unnecessary zoning barriers.

Examples of anticipated zoning changes include increasing the amount of allowable rooftop space for solar installations, allowing community solar and energy storage projects in more districts, addressing wall height and thickness restrictions that limit building retrofits, and creating more areas for electric vehicle charging. The City Council will vote on the zoning amendment Fall 2023.

Climate Budgeting

In 2023, the NYC Office of Management and Budget (OMB) introduced Climate Budgeting — meaning the climate impacts of City investments will be considered and prioritized in all budgetary planning. Climate Budgeting will also be used to track progress towards the City’s climate action goals and identify high-impact, cost-effective solutions where more action is needed.^{xliiv}

NEW YORK STATE

New York State has set equally ambitious policy goals and commitments that are closely aligned with those of the City to address the climate crisis and transform our energy systems. These include:

- **Climate Leadership and Community Protection Act of 2019 (CLCPA):** A landmark state policy, the CLCPA calls for a 70% reduction in emissions from electricity generation by 2030 and 100% zero emissions electricity by 2040. The State will direct 40% of investments to achieve these targets to disadvantaged communities, reflecting the State’s commitment to a just energy transition.^{xliiv}

The CLCPA also outlines a plan to electrify 1 million homes across and make another 1 million electrification-ready by 2030. In 2022, the State announced a new \$250 million Climate Friendly Homes Fund to support these goals by providing financing for electrification measures in 10,000 small multifamily properties over five years.^{xliiv}

NYC’S GHG EMISSIONS INVENTORY

NYC can much more effectively mitigate emissions it can measure. Therefore, NYC’s GHG inventories are its first line of defense in curbing emissions. These inventories:

- Quantify citywide emissions, within NYC’s geographic boundaries, and emissions generated by City government operations and activities;
- Allow the City to assess its progress towards its climate goals and pinpoint its largest emissions drivers; and
- Help inform City policy.

NYC’s GHG Inventories have shown that within NYC boundaries buildings are responsible for the vast majority of emissions (68%), followed by transportation (28%) and finally solid waste and wastewater (4%).^{clxi}

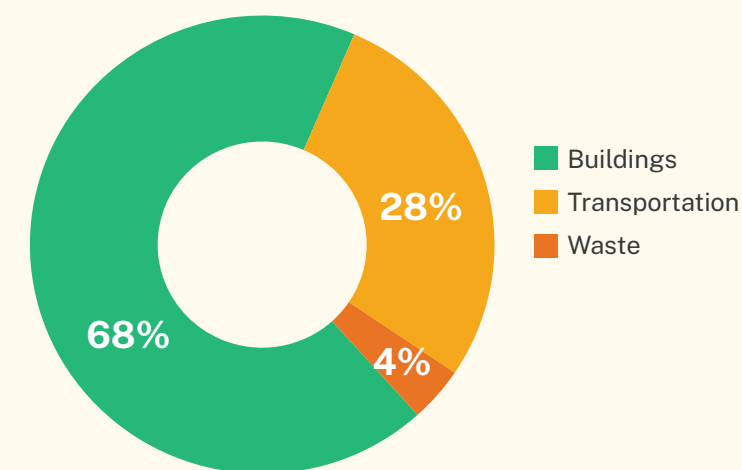
The City is now also measuring emissions that occur outside city boundaries but that are associated with activities. This includes publishing a first-of-its-kind consumption-

based emissions inventory, which covers the production and distribution of products New Yorkers consume. Separately, the City has completed a CLCPA inventory in line with NY State accounting, which assesses the emissions associated with importing fossil fuels and the near-term warming impacts of methane.

These inventories will help inform the City’s advocacy on state and federal policy. For example, by integrating the citywide and consumption-based inventories we have found that food consumption is the third largest contributor to citywide emissions. In addition, the CLCPA inventory revealed the significant impact natural gas leakages have on near-term warming. This type of tracking and transparency will be crucial as we continue to evaluate the effectiveness of programs and policies in reaching climate targets.

Citywide, city government, CLCPA, and consumption-based inventories are all available at climate.cityofnewyork.us/initiatives/nyc-greenhouse-gas-inventories/.

NYC 2021 Citywide Emissions Sources



The building sector is by far the largest contributor to citywide emissions in NYC, accounting for more than two-thirds the City’s emissions in 2021. Source: MOCEJ, Greenhouse Gas Inventories

- **Clean Energy Standard (CES):** Codified under the CLCPA, the CES sets obligations for load-serving entities — utilities and energy service companies that sell electricity to retail customers — to purchase RECs.^{xlvii} In 2020, the PSC established the Tier 4 Program to increase access to RECs with a tier exclusively available within NYC.^{xlviii}
- **New York State Department of Environmental Conservation (DEC) Peaker Power Plant regulations:** This rule sets an emissions limit on nitrogen oxides (NOx) and has already resulted in the closure of some of the least efficient and most polluting peaking units. The rule is expected to lead to the closure of oldest, remaining units by 2030.^{xlix}
- **New Efficiency: New York:** NYS established a statewide target to reduce energy use in buildings and industrial facilities by 185 trillion British thermal units (Btu) in 2025 — enough to power nearly two million homes every year.^l
- **Environmental Bond Act of 2022:** The largest in state history, the 2022 Environmental Bond Act will provide \$4.2 billion in investments to help municipalities update community and natural infrastructure, improve public health and reduce pollution, preserve farms, forests and parks, and safeguard drinking water.^{li}
- **Appliance and Equipment Efficiency Standards Act of 2022:** This act requires NYSERDA, in consultation with DPS, to adopt energy efficiency standards for products and appliances that reduce energy and/or water consumption.^{lii}
- **Build Public Renewables Act of 2023 (BPRA):** Passed as part of NY’s annual budget, the BPRA requires NYPA to provide only renewable energy to customers by 2030, prioritizing access for low-to-moderate-income (LMI) customers. The BPRA will leverage labor agreements to create tens of thousands of green union jobs.^{liii}
- **All-Electric New Buildings Law of 2023:** Inspired by NYC’s Local Law 154, the NYS All-Electric New Buildings Act prohibits fossil fuel hookups in new buildings. The law will take effect in 2026 for buildings under seven stories, and in 2029 for buildings over seven stories.^{liv}

FEDERAL

In recent years the Biden Administration has enacted laws and created programs to accelerate the country’s transition to a clean energy economy. Initiatives like the Federal Sustainability Plan (Executive Order 14057)^{lv} and U.S. National Blueprint for Transportation Decarbonization^{lvi} provide roadmaps for advancing economic growth and equity by building a zero-carbon future.

Additional legislation is helping states and cities turn that future into reality by providing unprecedented levels of funding for decarbonization and environmental justice projects. Notably, this legislation includes:

- **Bipartisan Infrastructure Law (BIL) of 2021:** The BIL — also known as the Infrastructure Investment and Jobs Act (IIJA) — is a \$1.2 trillion investment in repairing and modernizing the nation’s infrastructure in the face of climate change.^{lvii} This includes \$550 billion in spending over the next five years, over half of which is allocated to improving transportation — the leading cause of GHG emissions nationwide — by supporting projects like zero-emissions school buses, electric vehicle charging, and public transit, in addition to road and bridge infrastructure improvements.^{lviii} The BIL also provides significant funding for other climate-related infrastructure needs, like strengthening the power grid and improving environmental resiliency.
- **Inflation Reduction Act (IRA) of 2022:** The IRA is a landmark legislative package that invests nearly \$370 billion in clean energy and climate change through programs like the Greenhouse Gas Reduction Fund, tax credits and rebates for homeowners and businesses, and support for local governments.^{lix} The IRA will increase production of clean energy sources, decrease electricity costs, and lower GHG emissions. One study estimates that by 2030, the IRA will cut US net emissions by up to 44% from a 2005 baseline, nearly ten percent more than pre-IRA projections.^{lx}
- **Creating Helpful Incentives to Produce Semiconductors for America (CHIPS) and Science Act of 2022:** CHIPS funding is primarily an effort to revitalize the American semiconductor industry but roughly one-quarter

of the \$280 billion is intended to accelerate growth of zero-carbon industries and advance climate-relevant research over the next five years.^{lxi, lxii} For example, \$20 billion is expected to be directed towards pushing innovative climate technologies from the prototype stage into the mass market. This is especially crucial, as roughly 60% of the technologies needed to achieve a net-zero economy are not yet commercially available.^{lxiii}

- **Justice40 Initiative:** Justice40 established a goal of allocating 40% of total federal climate investment to underserved communities that are overburdened by pollution and climate change.^{lxiv} The initiative covers investments in renewable energy and energy efficiency, clean modes of transit, sustainable housing, training and workforce development, water and wastewater infrastructure improvements, and remediation and reduction of legacy pollution. Justice40 is a major step in advancing the principles of environmental justice and redressing past harms and inequities.
- **National Building Performance Standards (BPS) Coalition:** Launched by the Biden Administration, the BPS Coalition is a growing group of more than 40 state and municipal governments — including NYC — that is committed to crafting, implementing, and sharing policies that equitably reduce building emissions.^{lxv} The federal government provides resources and support to help Coalition members achieve their goals.

KEY TERMS

Clean Energy Grid: An energy grid that draws power predominantly from carbon-free (and air pollution free) sources, including solar, wind, and hydroelectric energy.

Climate Budgeting: A new process that requires all City-funded projects and investments to consider climate impacts before approval.

Natural Gas: Fossil fuel that consists primarily of methane, a greenhouse gas up to 80 times stronger than carbon dioxide over 20 years, and extracted by fracking.

Peaker Power Plants: Old and inefficient fossil fuel power plants that are in NYC environmental justice communities, and only operate during days with high electricity demand, such as hot days with a lot of air conditioning use.

Public Service Commission: Agency within the New York State government that regulates all utilities including water, electricity, gas, and telecommunication.

Reliability: Ability of the energy grid to keep the power on during high electricity demand events (like heat waves) and during extreme weather events like hurricanes.

Resiliency: Ability of the energy grid to recover from unexpected equipment failures or damaging climate events like hurricanes. Resiliency is necessary for reliability.

Steam Systems: Used to heat many NYC buildings. Steam is created either by a central boiler, or by waste heat produced when burning fossil fuels to generate electricity.



Dudgeon Offshore Wind Farm. Source: Jane Arne Wold, Equinor

Taking Action: Energy and the Grid

The City of New York is taking bold steps to turn our climate commitments into action, accelerating a just transition to a clean energy grid that supports energy affordability, housing security, and economic development. The City is prioritizing investments in EJ and disadvantaged communities that have been disproportionately harmed by polluting fossil fuel infrastructure, and is dedicated to building equity, improving public health, enhancing quality of life, and creating well-paying jobs to benefit all New Yorkers.

GREENING THE GRID

To achieve City and State climate action goals and mandates in the coming years NYC's electricity system will undergo a transformation. This will require rapid electrification of NYC's building and transportation sectors and the evolution and expansion of our energy generation and grid infrastructure to supply the clean and reliable electricity needed to power them. The process will involve two parallel tracks:

- **Developing Clean Energy Infrastructure:** Our electricity generation fuel mix will be supplied increasingly by renewables such as wind and solar to displace and ultimately retire dispatchable in-city fossil fuel-fired power plants, driving down GHG emissions and pollution. As we increase our reliance on weather-dependent renewable resources we will also invest in supporting infrastructure like long-distance transmission lines, and grid-balancing technologies like battery storage.
- **Ensuring Grid Reliability and Resilience:** To bolster reliability and resilience and meet increasing electricity demand as we electrify our buildings and transportation sectors, our grid is evolving. A recent NYISO report projects that by 2025 NYC's electricity system could see a

reliability deficit, meaning there is an immediate need for comprehensive and innovative clean energy interventions to: 1) ensure the grid has enough capacity to meet peak electricity demand days, 2) support electrification, and 3) retire polluting power plants in environmental justice communities as soon as possible.^{lxvi}

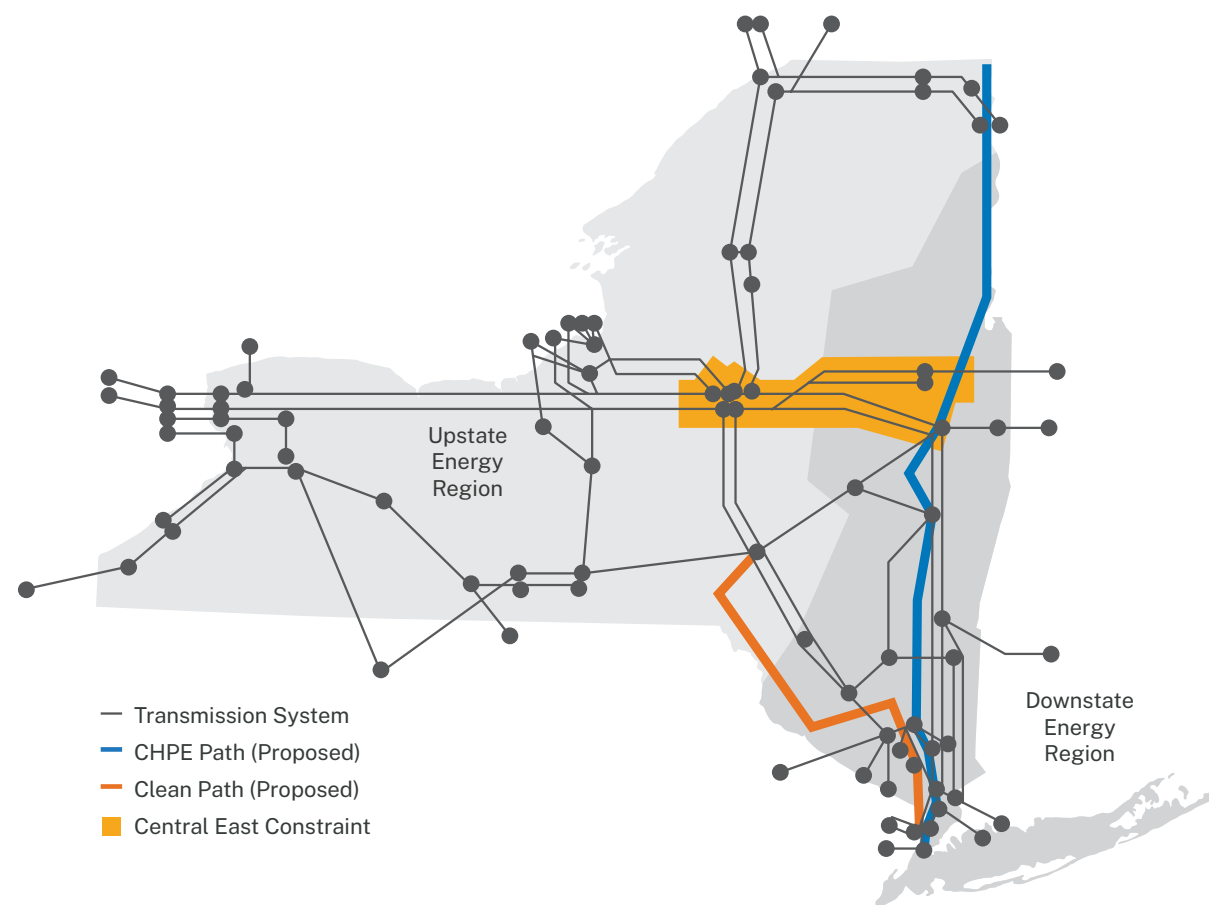
Similarly, as part of the research informing this report, the City conducted a grid-readiness study of electrification's impacts on transmission and distribution systems. The study found that as peak electricity demand increases with building and transportation electrification, we will require electrical grid upgrades in many parts of the city (see the *PowerUp Technical Appendices* for more details on this research and findings).

These results reaffirm the need to accelerate development of clean energy and storage resources and to ensure that retiring polluting power plants will not compromise grid reliability. Efforts to strengthen grid and system resiliency is a top priority as the frequency, duration, and severity of extreme weather events attributable to the climate crisis increase. The City is committed to ensuring that energy-related investments facilitate a more resilient electricity system that can withstand, respond to, and rapidly recover from potential disruptions.

NYC'S COMMITMENT TO CLEAN ENERGY INFRASTRUCTURE

The City is working to bring clean energy infrastructure online rapidly, targeting four priority areas: building out utility-scale transmission infrastructure that will bring more zero-emissions electricity to the city; expanding NYC's renewable energy portfolio through in-city solar and offshore wind deployment; ensuring grid resilience and reliability through technologies like battery storage and efficient thermal energy networks; and supporting community-scale energy systems.

New York's Electric Grid Transmission Infrastructure



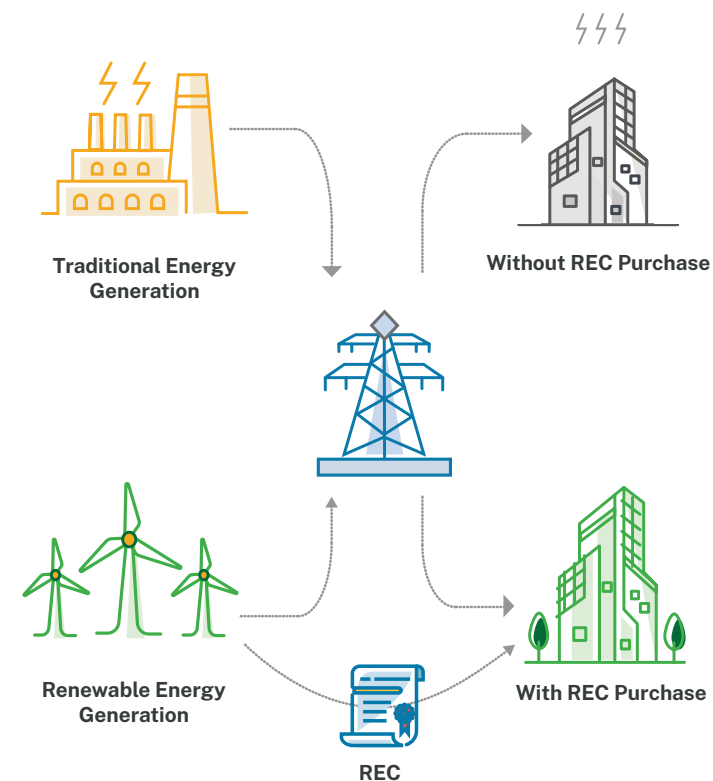
Existing high voltage transmission lines do not have enough capacity to bring clean upstate power to New York City and the Downstate Region, as indicated by the Central East Constraint highlighted in yellow. The Clean Path NY and Champlain Hudson Power Express (CHPE) projects will bring more renewable solar and hydroelectric power downstate to help achieve a zero-emissions grid by 2040. Source: NYC MOCEJ, *PlaNYC: Getting Sustainability Done*, 2023

UTILITY-SCALE TRANSMISSION

Multiple utility-scale transmissions projects are already underway to make renewable sources of electricity more readily available to New Yorkers and displace our most polluting power plants. The NYS Public Service Commission (PSC) approved two long-distance transmission projects in 2022 — Clean Path NY (CPNY)^{lxvii} and Champlain Hudson Power Express (CHPE)^{lxviii} — which will bring hydroelectric power from Canada and solar and wind power from upstate New York to NYC.

The City catalyzed development of these projects by committing to procure clean energy through the purchase of Tier 4 Renewable Energy Credits (RECs), which will substantially fund these projects to deliver clean, renewable solar, wind, and hydroelectric power from upstate New York and Canada into New York City's grid. These are the largest transmission projects contracted for New York State in 50 years and will allow the city to meet its goal of having 100% renewable power for City government operations.

How Do RECs Work?



Electricity generated by renewable energy infrastructure typically flows to the same electric grid as energy generated by traditional fossil fuel-powered plants. Utility customers receive electricity powered by this mix of clean and polluting sources. RECs enable customers to verify, purchase, and track the environmental attributes and benefits of renewable energy produced and sent to the grid. One REC is equal to 1 MWh of renewable generation and provides the purchaser with exclusive rights to claim use of that electricity.

THREE PILLARS OF THE CLEAN ENERGY TRANSITION

1. Reduce demand by prioritizing energy efficiency first

The less electricity we use, the less stress we place on the grid and the less new clean energy infrastructure like wind and solar we need to build and finance. Measures to reduce demand include installing high efficiency heating and cooling equipment such as heat pumps, upgrading lighting and building controls, and improving insulation.

2. Switch from polluting fossil fuels to electricity

Today, we rely on oil and natural gas to heat our buildings and on gasoline and diesel to power our cars and trucks. To meet our climate goals, we must switch these vehicles and buildings to run on electricity whenever feasible.

3. Make electricity clean

As buildings and vehicles electrify, it will be critical to ensure electricity is generated from clean, renewable sources. We are already making progress with a New York State mandate in place for a 100% zero-emissions electricity grid by 2040.

To ensure that this energy transition is just, it must put equity, affordability, and public health at the forefront of all decisions.

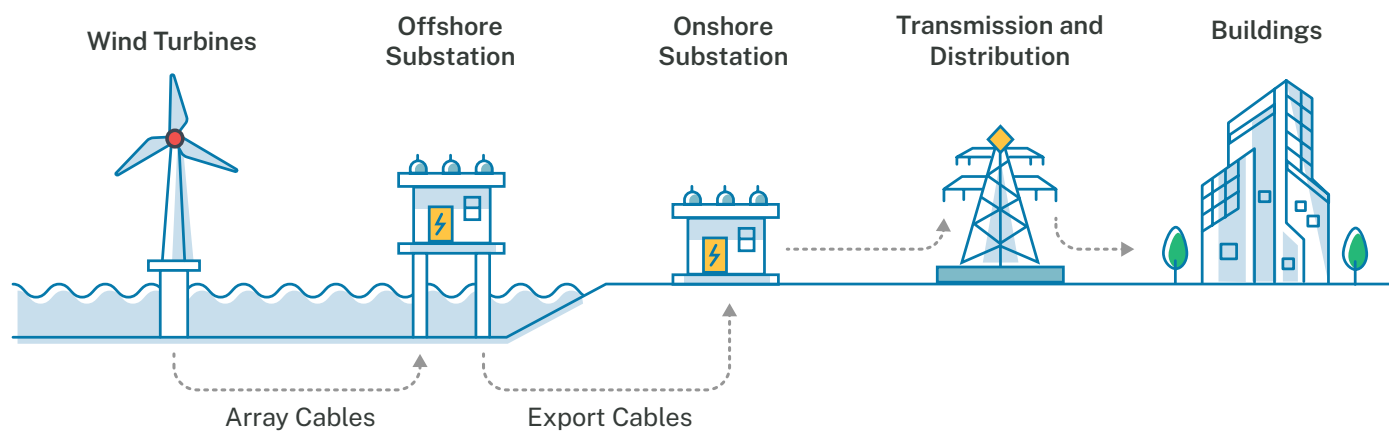
OFFSHORE WIND POWER

The State is seeking to procure 9 Gigawatts (GW) of offshore wind (OSW) energy by 2035 — enough energy to power 6.75 billion homes.^{lxxix} This is the largest commitment to OSW in the country and key to meeting climate goals and mandates. Combined, these projects are projected to reduce NYC's fossil fuel use for electricity by over 80% by 2030.^{lxxx}

OSW projects that will serve NYC are under development in the New York Bight — an area of the ocean that extends from the south shore of Long Island to the U.S. Outer Continent Shelf — as well as in other sites on the Continental Shelf thanks to extensive efforts by the New York State Energy Research and Development Authority (NYSERDA) and the U.S. Department of the Interior's Bureau of Ocean and Energy Management (BOEM).^{lxxxi} BOEM identifies Wind Energy Areas (WEAs), which are locations that have completed environmental review and have the fewest apparent environmental and user conflicts, making them suitable for commercial OSW.^{lxxxii}

As of 2023, NY has five OSW projects in active development — the largest pipeline in the nation totaling more than 4,300 MW — nearly halfway to the State's 9,000 MW goal. Empire Wind 1 is the first OSW project expected to provide clean electricity directly to NYC and is located in the closest WEA, fifteen miles offshore; additional WEAs are fifty miles or more from the city.^{lxxxiii} A cable land fall and substation for the project will be located at the South Brooklyn Marine Terminal in Sunset Park Brooklyn, and the project will connect to the electric grid at

How Does Offshore Wind Work?



Electricity from OSW is generated by ocean winds spinning large turbines that produce an electrical current. Offshore substations step up the voltage of this current and transmit it to shore via cables buried under the seabed. Onshore, these cables connect to substations that step the electric voltage level back down for local distribution and end-use.

Con Edison's Gowanus Substation. Siting approvals for the transmission lines within New York's borders — underwater and on land — are issued by the PSC.

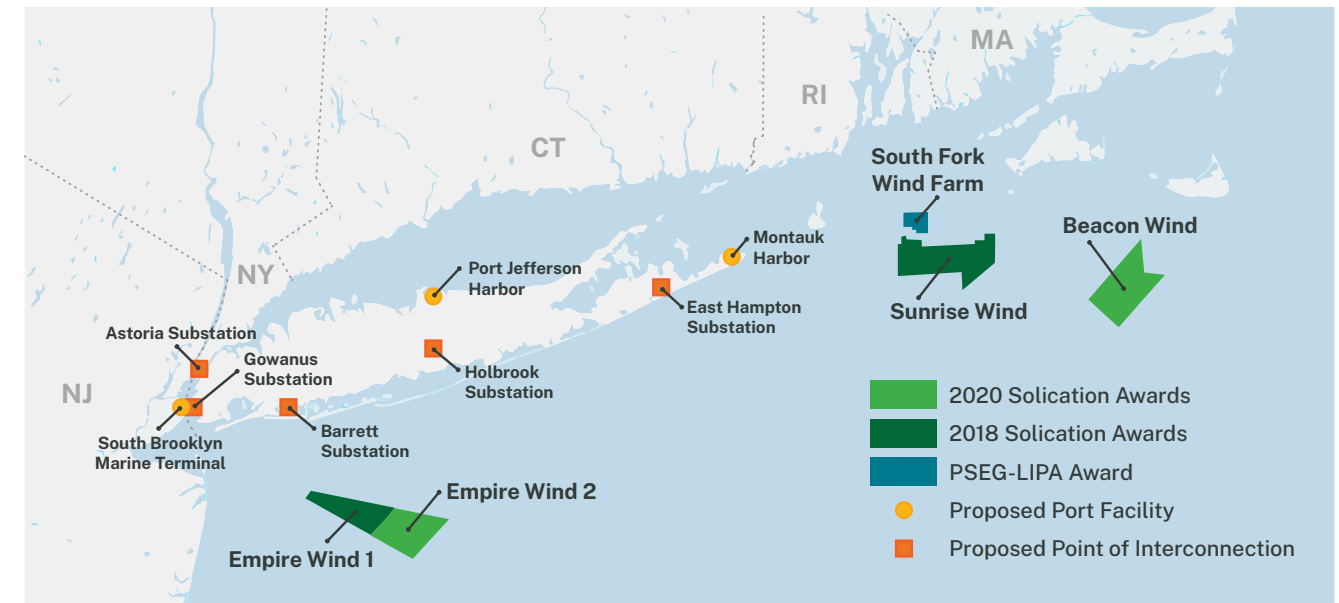
Additionally, starting in 2024, Con Edison is developing the Brooklyn Clean Energy Hub to host future OSW interconnection infrastructure and connect to up to 1,500 MW of renewable wind energy,^{lxxxiv} enough capacity to power 375,000 homes.

SOLAR ENERGY

Solar power is an important part of NYC's clean energy transition. Rooftop solar panels enable building owners to generate their own emissions-free electricity and can save residents money by reducing the amount of electricity they need to buy from their utility. On-site and community-level solar can also help reduce demand and strain on the grid energy, especially when combined with energy storage. The costs of solar equipment and installation have fallen dramatically in recent years, making it viable in many parts of NYC. As such, the City has set a target to deploy 1,000 MW of solar citywide by 2030 — enough to power 250,000 homes. We are already approaching the halfway mark, with 433 MW installed thus far.^{lxxxv}

NYC has made great strides to accelerate progress through initiatives like: ElectrifyNYC, a program that trains community-based organizations to offer solar services for one-to-four family homes; a property tax abatement for solar and storage installation; and engagement with the State on regulatory matters to reduce barriers to in-City solar. City policies and

NYC Offshore Wind Area Map



As of 2023, NYS has five offshore wind projects in active development, totaling more than 4,300 MW — nearly halfway to the State's goal of 9,000 MW by 2035. Empire Wind 1 is the first project expected to provide clean electricity directly to NYC. Source: NYSERDA

legislation have also helped advance solar adoption, including: Local Laws 92 and 94 of 2019, which require solar or green roofs on all new buildings or major roof renovation projects; and the NYC Housing Preservation and Development (HPD) Solar Where Feasible program, which requires solar installation on affordable housing whenever cost-effective. In addition, the City committed to installing 100 MW of solar power generation on City-owned buildings by 2025. Every two years, under Local Law 24 of 2016, the NYC Department of Citywide Administrative Services (DCAS) monitors our progress to this goal and conducts a "Solar Readiness" feasibility assessment for potential new projects.^{lxxxvi}

ENERGY STORAGE

Battery energy storage systems complement variable renewable resources like wind and solar energy, storing energy generated during sunny or windy periods and sending power back to the grid when needed, such as evenings and cloudy or low-wind days. This grid-balancing function can help maximize the amount of energy we can draw from clean resources and prevent curtailment — the intentional reduction of energy output from renewable resources by system operators when energy supply exceeds grid demand. Co-locating storage with solar power generation can also provide money-saving and resiliency benefits to building owners and residents by storing the solar energy produced onsite to use later during expensive utility peak demand periods and during power outages.

Energy storage can also help provide resiliency to the grid in load pockets, or areas with transmission limitations that require local sources of energy supply. Further, large-scale battery storage may reduce the need for the city to operate peaker plants or eventually replace them, improving local air quality while still providing energy reliability.

Utility-scale energy storage systems are safe for communities and do not have the same safety concerns as smaller-scale batteries that exist in appliances such as e-bikes. All energy storage systems in NYC are highly regulated by local, state, and federal authorities, and must go through multiple stages of rigorous safety testing. NYC ensures these systems are safe by coordinating between the Fire Department of NYC (FDNY), NYC Department of Buildings (DOB), and Department of City Planning (DCP) to uphold all aspects of fire, building, and zoning code.

The City has established a goal of developing 500 MW of energy storage capacity within the city by 2025. As the largest property owner in NYC, the City can use public land for clean energy development under certain circumstances. NYC Local Law 99 of 2019 requires the City to explore opportunities for battery storage to replace or reduce in-city gas generation, and Local Law 181 of 2019 requires the City to explore opportunities to site energy storage within the city.

UTILITY THERMAL ENERGY NETWORKS (UTENS)

Utility thermal energy networks (UTENS) are a series of pipe loops between multiple buildings and energy sources that carry water at ambient temperature. Buildings can connect to the ambient water loops with water source heat pumps to provide heating, cooling, and hot water to their spaces. These networks can extract or reject heat into the ground in a system called a geothermal heat pump or ground source heat exchanger. In NYC, underground temperatures remain between 55°F and 65°F throughout the year. That means much less energy is required than it is when heat is exchanged with outdoor air.^{lxxvii} UTENS can also exchange heat with water discharged from wastewater treatment plants, sewage pipes, and data center waste heat.

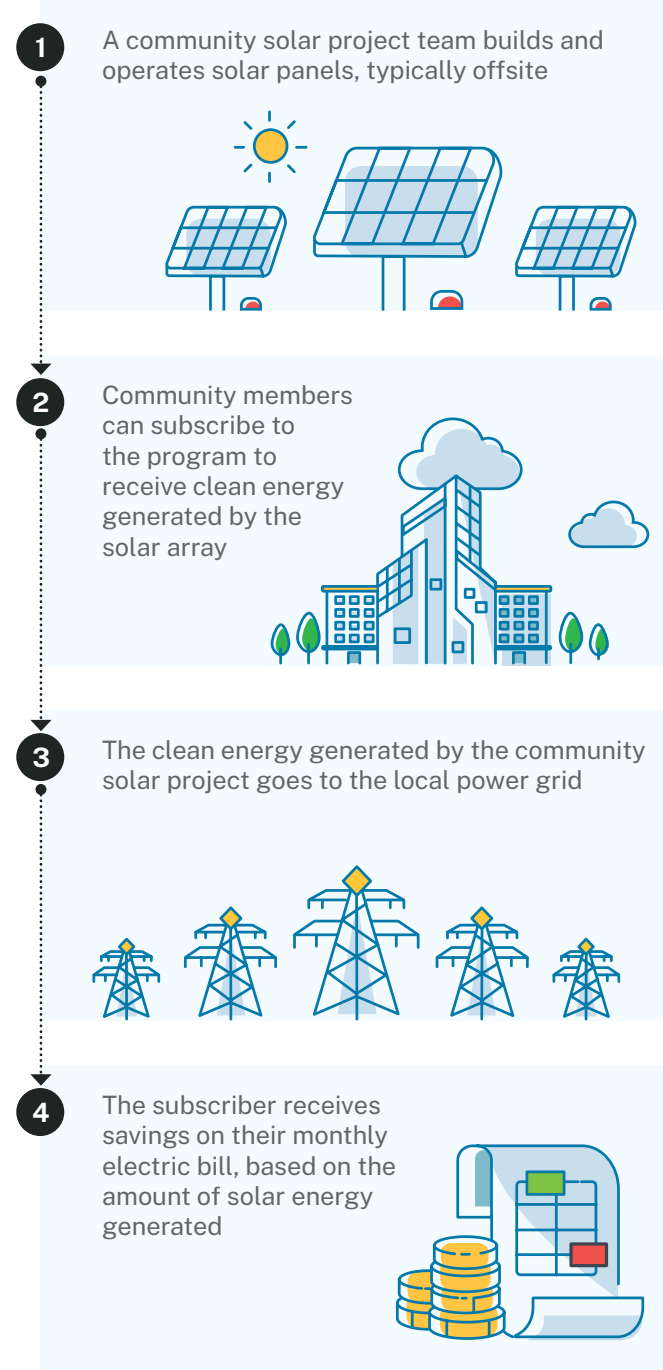
In 2022, New York State passed the Utility Thermal Energy Networks and Jobs Act, which removes legal barriers to utility development of thermal energy networks and directs utilities to begin thermal energy network pilots within each major utility territory.^{lxxviii} In addition, NYC passed Local Law 2 of 2022 to create a City demonstration program for geothermal exchange systems.^{lxxix} The analysis of City properties for a potential district geothermal exchange system is ongoing.

COMMUNITY ENERGY SYSTEMS

Electric utility customers can subscribe to community solar projects and receive energy credits towards their individual electricity bills. Community solar opens the door for renters to benefit from solar power by applying electricity cost savings to their bills. As a result, community solar is a sustainable and equitable solution to energy parity for those who do not own their roofs. It allows access to solar energy for those who rent their homes and therefore cannot install solar systems on their roofs — the majority of New Yorkers.

Community solar is common in New York State but scarce in NYC due to barriers such as space limitations and higher costs of materials and labor, along with historic disparity of solar program funds in NYC. As of 2023, there was over 1,015 MW of community solar capacity installed within New York State and only 43 MW installed within New York City.^{lxxx} Community solar offers opportunities to reduce New Yorkers' energy bills, train and hire residents for green jobs, and build local wealth with shared ownership models.

How Does Community Solar Work?



Community solar offers a viable pathway to increase access to clean energy benefits and financial savings for renters and local businesses. Community solar programs can also provide green job opportunities for residents and a way to build local wealth using shared ownership models — particularly in disadvantaged communities and other EJ areas.

BIOGAS PRODUCTION

The NYC Department of Sanitation (DSNY) collects 24 million pounds of waste every day, 76% of which could be recycled, composted, or otherwise diverted away from landfills.^{lxxxi} For food scraps and yard waste, NYC has the largest curbside organics collection program in the country which we are working to turn into compost and other beneficial uses.

When organic matter decays, it produces a combination of methane and carbon dioxide which varies depending on the conditions of this decay. Methane is a far more potent GHG than carbon dioxide, and if decay is not controlled, methane is emitted directly into the atmosphere. Methane produced from controlled decay, such as at a wastewater resource recovery facility, is often used for on-site heat, but the excess is flared to the atmosphere to convert it into carbon dioxide and lower its GHG potential. If the flared methane is instead captured and re-used to produce heat or electricity, there is a net benefit as the captured methane is being put to a beneficial use while emitting carbon dioxide in lieu of methane.

The NYC Department of Environmental Protection (DEP) at the Newtown Creek Wastewater Resource Recovery Facility, New Yorkers' food scraps and wastewater biosolids are turned into renewable energy through a full-scale co-digestion program that the City has been running since 2016.^{lxxxii} Co-digestion means adding food waste to the anaerobic digestion phase of wastewater treatment to produce biogas, compost, and other soil amendments. The excess biogas that would otherwise be flared is cleaned to natural gas standards and injected into the natural gas grid to be a direct replacement for fossil-derived natural gas. NYC plans to expand this program to recover and beneficially use this valuable renewable energy resource.

ENERGY AND GRID INITIATIVES

The following section covers key opportunities and potential solutions to promote a just transition to a clean and reliable grid and equitable access to energy.

INCREASE AVAILABILITY OF OFFSHORE WIND POWER

NYC will have more access to renewable and clean energy in coming years as OSW projects and new transmission lines are completed. NYC is ensuring that as we electrify our buildings and transportation sectors we can meet increased electricity demand with clean and reliable sources.

To that end the City will invest in and advocate for transformative clean energy generation and transmission infrastructure projects that will help achieve our 2050 carbon neutrality goals and meet the State's commitment to an emissions-free electric grid by 2040.

1 Support Offshore Wind Interconnection and Transmission (PlaNYC)

Capitalizing on our location as a coastal city, NYC will continue to support the development of OSW as a powerful resource for renewable energy generation.

Advance OSW Project Siting and Development: As with the process of developing Empire 1, the City will continue to be an active party and supporter in PSC proceedings for OSW siting to ensure that projects meet the needs and priorities of all New Yorkers. We will also support direct interconnection of electricity generated offshore to substations in the five boroughs. The power produced by these OSW farms will displace in-city fossil fuel generation, reduce criteria pollutants and GHG emissions, and improve air quality.

Many steps are required to see an OSW project through to completion. First, project developers must submit a bid to BOEM to win a lease within a WEA. Then they must submit a bid to NYSERDA to win a power purchase agreement (PPA), a commitment by NYSERDA to purchase Offshore Wind RECs (ORECs) on behalf of New York State's ratepayers. Additionally, while OSW developers currently own, operate, and maintain the transmission lines that transfer energy produced offshore to the grid, utilities such as Con Edison own and operate grid interconnection infrastructure, and

lines siting approvals are issued by the PSC. OSW equipment also requires port and interconnection space, which limits the number of suitable locations within NYC.

This complex project process requires developers to coordinate with multiple parties, including regulatory bodies at the City, State, and Federal levels. The City and State are working closely with OSW developers to address these and other logistical challenges and to identify the best ways to deliver renewable energy to New Yorkers. The City will also use grid-readiness modeling data completed for PowerUp's technical research to help evaluate new infrastructure needs, identify potential interconnection sites that minimize negative impacts to neighboring properties, and strengthen the power grid to meet future demand.

Promote Additional Utility-Scale Transmission:

In addition to supporting transmission from OSW projects to the grid, we will continue to support the CPNY and CHPE transmission projects to provide other forms of clean energy from upstate NY and Canada.^{lxxxiii} The City will continue to participate in the NYISO's public policy planning process and advance proposals for the new transmission infrastructure necessary to support increasing power demand from electrification and help achieve concurrent State and City policy goals.

2 Make NYC an Offshore Wind Industry Hub

PlaNYC

With large-scale OSW projects in development around NYC, we have an opportunity to bolster the industry and drive economic growth in the city.

Establish NYC as a Regional Wind Hub: We are expanding economic opportunities and job growth by positioning NYC to become a major hub in the Northeastern U.S. for the OSW industry. NYC boasts a skilled labor force, access to domestic and international supply chains through the Port of New York and New Jersey, and proximity to OSW lease areas in the New York Bight. According to the New York City Economic Development Corporation (NYCEDC) industry vision plan, "OSW NYC: Equitable Opportunity for a Sustainable Future," NYC has the potential to create roughly 13,000 OSW-related jobs for New Yorkers by 2035.^{lxxxiv} These include jobs in all project phases, from planning and development to operations and maintenance, as well as indirect jobs associated with creating ancillary infrastructure and induced jobs generated by industry spending on consumer goods and services.

Invest in Education and Workforce Development:

NYCEDC is partnering with high schools and investing in local higher education institutions and workforce development organizations to train the future workforce that will develop, manufacture, install and operate the equipment and infrastructure required to make OSW energy work. For example, NYCEDC is providing over \$10 million in capital and programmatic funding to facilitate connections and partnership with industry for campuses throughout the City University of New York (CUNY) system that are well positioned to train New Yorkers for these jobs.

Build Capacity of Local Businesses: NYCEDC is also supporting job creation by providing capacity building support and technical assistance to business enterprises that have the potential to become a part of the industry, especially Minority, Women and Disadvantaged Business Enterprise (MWDBE) firms and manufacturing firms. For example, the OSW NYC Waterfront Pathways program assists small-to-mid-size MWDBEs working in, or seeking to pivot to, waterfront construction and OSW-related industries.^{lxxxv} This capacity building program offers expert resources, education, and information on NYCEDC projects to help improve access to and awareness about City contracting opportunities, and to position participating firms to secure OSW and waterfront construction-related work. NYCEDC is also supporting local manufacturing and industrial firms, with a focus on those involved in the supply of intermediate and standard elements (e.g., fabrication & machining, electrical manufacturing, and marine contractors) in learning about and entering the industry.

Activate our Marine Terminals: NYCEDC is investing more than \$287M with OSW energy developer Equinor into revitalizing the South Brooklyn Marine Terminal to allow the facility to serve as an industry anchor in NY Harbor.^{lxxxvi} Other sites in NYC are ready to support the growth of the sector. This includes private proposals, such as Arthur Kill Terminal and the Staten Island Marine Terminal just south and north of the Outerbridge Crossing on Staten Island's South and West Shore, and public sites, ranging from the historic disused Dry Dock 4 at the Brooklyn Navy Yard to the Rossville Municipal Site, a 33-acre City-owned waterfront industrial property in Staten Island that is ready to transform into a state-of-the-art OSW port facility, for manufacturing and assembling OSW related components.

Support Innovation: Finally, NYCEDC is committed to ensuring new OSW technologies and approaches that contribute to reducing the levelized cost of energy for OSW are created in New York. For example, NYCEDC is supporting the OSW Innovation Hub, created in partnership with Equinor, NYU Urban Future Lab and the National OSW Research and Development Consortium which focuses on scaling and bringing novel technological solutions to the rapidly growing U.S. OSW industry through investing in start-ups.^{lxxxvii} Additional investments to support OSW research and development will follow.

EXPAND ENERGY STORAGE CAPACITY ACROSS NYC

In 2022, NYSERDA and the NY State Department of Public Service (DPS) filed New York's 6 GW Energy Storage Roadmap which lays out a pathway and details the need for 6 GW (6,000 MW) of energy storage across the state by 2030. This roadmap includes over 2,000 MW needed in NYC by 2030, increasing to 4,600 MW in NYC by 2035 to support the renewable electricity grid.^{lxxxviii} Energy storage development requires careful planning and coordination with many stakeholders, including site owners, utilities, regulators, and the communities surrounding planned projects, especially in disadvantaged communities.

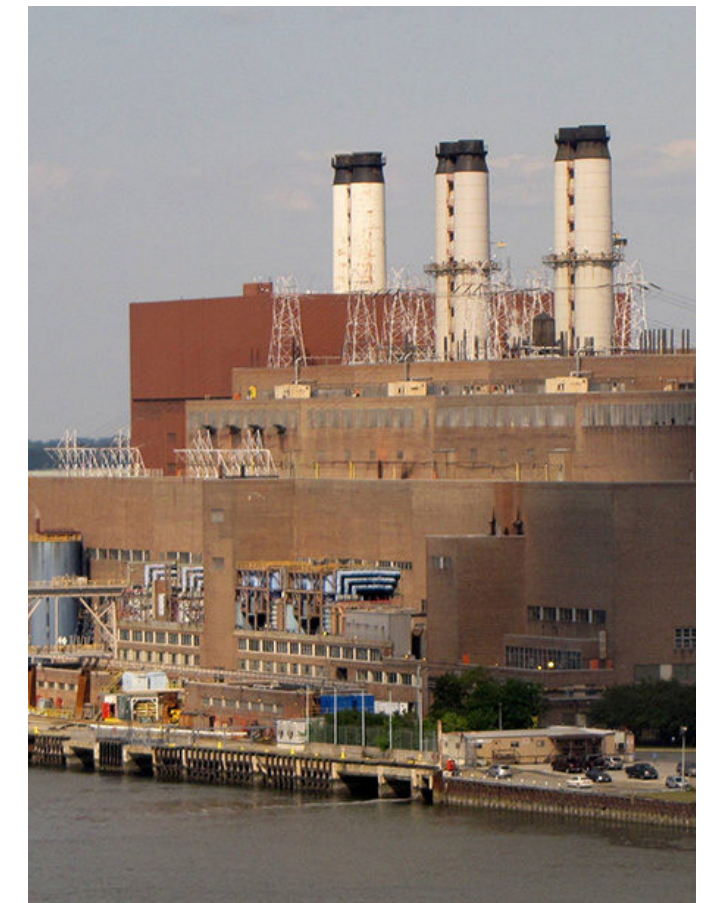
There are several other siting factors that constrain the potential for energy storage development, particularly for commercial-scale projects or those with a capacity of 1 MW or greater. Some potential development sites are in areas impacted by climate hazards such as coastal flooding. This complicates the feasibility of project planning and execution. In recent years, supply chain disruptions have slowed deployment of storage, both within and outside of NYC. The City is actively exploring multiple pathways to address these challenges and expand storage capacity equitably to increase access to renewable energy and improve the resilience of our electric grid.

3 Explore Opportunities to Install Storage at Retired Power Plant Sites

In-city power plants slated for retirement offer potential sites for new energy storage projects and offer the benefit of existing electrical infrastructure and grid interconnections. As shown in the table on page 40, our team's research found that repurposed power plant sites have

REPURPOSING POWERPLANTS: ASTORIA GATEWAY FOR RENEWABLE ENERGY (AGRE)

The Astoria Gateway for Renewable Energy (AGRE) project will utilize a retired powerplant as a site for clean energy development.^{clxii} The decades-old NRG facility closed its doors in May of 2023 and will be revived by Equinor and BP as a converter substation. Becoming operational in the late 2020's, the AGRE station will shepherd 1,239 MWs of renewable energy generated by the Beacon Wind offshore wind project. Equinor, BP, and Beacon Wind have also partnered to support a community-based Technology and Media Center for underserved youth at the Variety Boys and Girls Club of Queens.



The retired NRG plant in Astoria Plant will be repurposed as a site for clean energy development as part of the Astoria Gateway for Renewable Energy (AGRE) project. Source: Ben Schumin, Creative Commons

Estimated NYC Potential for Utility- and Distributed Energy Resource (DER)-Scale (>1 MW) Storage Potential, by Owner-Land Category

Storage Category	# of Lots	Land Area (Acres)	Storage Potential (MW)
City-Owned and Leased Property	47	14	412
Vacant Land	32	12	367
Municipal Outdoor Parking (15% of Total Lot)	15	1	45
Private Vacant Land	1,241	241	7,219
Repurposed Power Plant Sites	7,577	102-104	3,120
Total	8,865	356-358	10,750

There is approximately 400 MW of storage potential on City-owned unused vacant land and parking lots that could be used for battery storage projects. Repurposed power plant sites represent over 3,000 MW of storage potential, which could meet a significant share of NYC's projected storage needs of 4,600 MW by 2035. Source: MOCEJ *PowerUp* technical research

the potential to host more than 3,000 MW of storage capacity— significant progress towards NYC's projected storage needs of 4,600 MW by 2035. However, local community members may prefer to repurpose these properties for other opportunities, like alternative clean energy projects or public space and should be actively involved in the decision-making process. Adding to this complexity, existing power plant properties are owned by the energy generators, not the City, so acquisition and remediation of these sites may add significant costs.

4 Reform the NYC Zoning Resolution to Support Electricity Storage, Clean Power Generation, and Electrification

We will advocate for enactment of the Zoning Resolution to implement Department of City Planning's City of Yes for Carbon Neutrality initiative. This will modify zoning regulations to enable more renewable energy and electric infrastructure investments along with energy efficiency improvements to building. City of Yes for Carbon Neutrality will expand rooftop and yard allowances to accommodate more electrified equipment like heat pumps, solar canopies, and Energy Storage Systems (ESS).

The initiative will also update Zone Green, the City's original sustainability zoning regulations that were passed in 2012, to promote better-than-code building performance.

NYC zoning regulations currently limit energy storage locations to manufacturing districts and specific commercial districts that only allow storage projects under 10,000 square feet. This is a significant barrier to developing projects in residential areas, including those adversely impacted by electric system outages.^{lxxxix}

To unlock the potential energy storage capacity storage in manufacturing districts and increase the total potential capacity citywide, this will include allowing energy storage facilities larger than 10,000 square feet in area in commercial districts. The resolution will ensure projects are built safely and in accordance with the City's land use regulations. New allowances for storage will allow the City to build on the analysis performed for *PowerUp* to identify sites for large-scale electric battery storage on City-owned properties, leased private properties, municipal outdoor parking lots, and existing fossil fuel power plants.

5 Reduce Permitting Delays by 50% for Energy Storage Systems

Reforming the City's Zoning Resolution will complement recommendations made in NYC's 2022 Building and Land Use Approval Streamlining Taskforce (BLAST) Report, *Get Stuff Built*, which recommends the adoption of a specific battery storage code and an amendment to current regulations that require battery storage projects to undergo a City Environmental Quality Review.^{xc}

Currently, it takes several years for energy storage system development projects to receive the necessary permits. The process has seen improvements since a 2019 FDNY rule^{xcii} that set standards and procedures for outdoor storage installations. However, long permitting times still hinder energy storage development. We will reform the administrative processes for reviewing residential electric battery storage permit applications and publish permit application guidance through the DOB and FDNY to reduce the time to obtain City permits necessary for construction.

We will clarify the FDNY Certificate of Approval (COA) criteria for applications and renewals for standardized approvals of batteries and fire protection systems that are proven to meet the City's requirements. Streamlining this process will improve the overall storage development process and allow NYC to more quickly take advantage of the energy benefits provided by storage.

DEVELOP ENERGY STORAGE AND SOLAR POWER GENERATION ON CITY-OWNED LAND

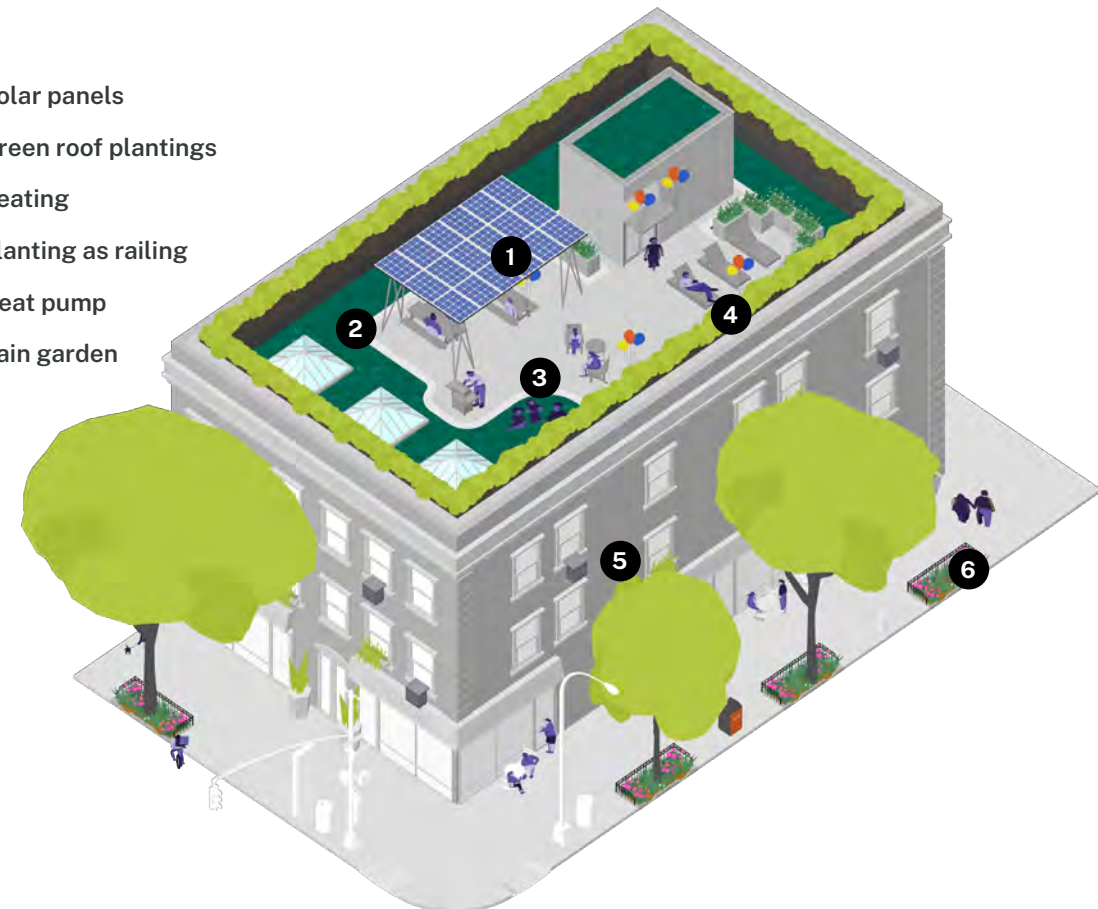
Previous initiatives have focused on the development of renewable energy resources and battery storage on private land or offshore. However, clean energy infrastructure can be developed on City-owned land as well. As the City scales up solar projects on municipal properties, we will apply lessons learned to collaboratively deploy energy storage on these properties.

6 Install Climate Infrastructure on All Viable City-Owned Property by 2035 (PlaNYC)

As the largest property owner in NYC, the City will install climate infrastructure on all viable City-owned property. This expands on prior solar initiatives to consider optimizing solar, storage, electrification equipment, green roofs, and other infrastructure that advances climate solutions.

Co-locating Climate Infrastructure Solutions

- 1 Solar panels
- 2 Green roof plantings
- 3 Seating
- 4 Planting as railing
- 5 Heat pump
- 6 Rain garden



Installing solar arrays, battery storage, heat pumps, and other renewable energy infrastructure on city-owned properties will reduce energy costs, create new employment opportunities, and improve city-wide resilience

Co-Locate Climate Infrastructure: Space is a significant constraint in NYC. Because of that we will find efficiencies in co-locating climate infrastructure, such as installing solar canopies above green or blue roofs, electrification equipment, and battery storage on rooftops to maximize space, benefits, and safety. In addition to installing such infrastructure on City-owned roofs, we will expand our focus to install climate infrastructure on City-owned property everywhere it is feasible by 2035.

Reduce Administrative Bottlenecks: Despite our position as the largest single property owner in NYC, there are specific obstacles that come with energy development on public land. Specifically, there are administrative hurdles to developing City-owned land, including the Uniform Land Use Review Procedure (ULURP) and competition requirements for leasing City-owned land. The ULURP process is meant to provide transparency within the development process on public land^{xcii} but it can take months or even years to complete. For solar or storage to be built on public land, developers sign a formal lease with the City or enter into a concession agreement, which can trigger a ULURP review. The COVID-19 pandemic and resulting procurement

delays and supply chain issues caused clean energy development on City-owned land to be even more challenging. Large-scale battery projects also come with high capital costs that can be prohibitive to fund with City capital dollars without private financing. The City is working via BLAST, City of Yes, and our Capital Project Delivery Reform efforts to reduce the time necessary for these important processes. The city will continue to pursue creative public and private partnerships to explore how to scale these projects.

Set an Energy Storage Goal for City-Owned Lots: The City will evaluate a goal for energy storage development on City-owned land based on the portion of City-owned lots that would be feasible for siting storage projects. As shown in the table below, the storage siting analysis our team conducted for this report finds vacant or underutilized lots available to develop over 400 MW of storage. Approximately 75% of these sites passed an initial review by the managing City agencies – although further review would likely be necessary – and the remaining sites have yet to be reviewed.

Utility- and DER-Scale Storage Potential, by City Agency			
Storage Category	# of Lots	Land Area (Acres)	Storage Potential (MW)
Properties Reviewed by City Agencies	20	10	306
Dept. of Citywide Administrative Services	12	2	50
Economic Development Corporation	2	0	8
Housing Preservation and Development	4	2	57
Dept. of Small Business Services	2	6	191
Unreviewed City-Owned and Leased Property	27	4	106
Total	47	14	412

Pairing in-city storage with clean energy generation and/or transmission infrastructure offers a viable pathway to displace aging power plants and reduce NYC’s reliance on fossil fuels. Of the roughly 400 MW of storage potential on City-owned land, about 300 MW has passed initial review by relevant City agencies. Source: MOCEJ *PowerUp* technical research

Scale Deployment through Power Purchase Agreements (PPAs): Currently, the City uses capital dollars to install solar photovoltaics that the City will own and operate, or enters into a PPA with a solar developer that incorporates site-access terms and conditions to allow the developer to access to public property. The PPA procurement pathway is the most direct and fast route to install standalone battery storage systems on City property, with the potential to cover as many viable City-owned buildings as possible in the near term. The City is actively pursuing PPAs to scale deployment of solar on City roofs.

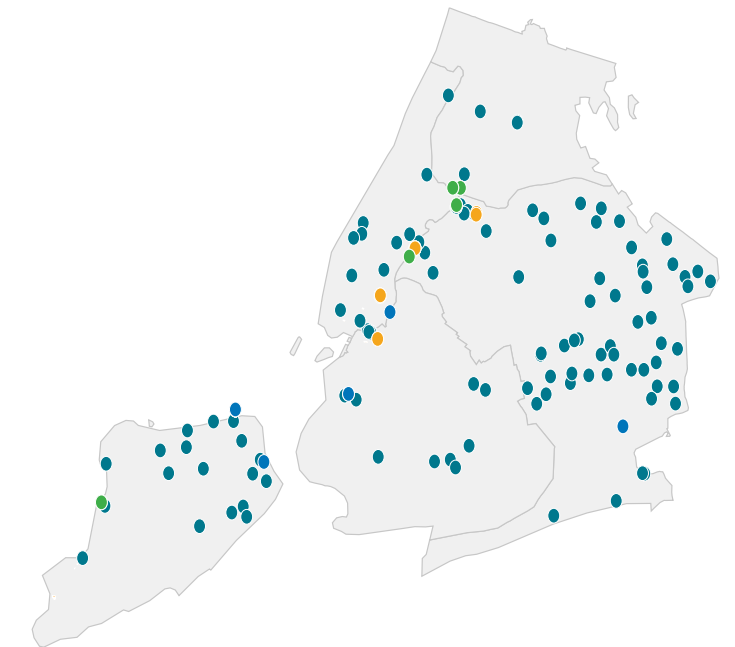
Refine Best Practices for Implementation: While progress toward the City’s goal of installing 100 MW of solar generation on municipal buildings was initially slow – largely due to procurement delays and labor issues, many of them related to the pandemic – a recent emphasis on more agile strategies has increased the scale and momentum of project completions. The City is refining best-practices for installing solar infrastructure more efficiently and cost-effectively with each project, and the equipment supply chain and workforce of skilled solar contractors are growing. City-led clean energy initiatives in *PlaNYC* and *PowerUp*, such as maximizing climate infrastructure on City owned properties, along with the close coordination and partnership with stakeholders will help meet the solar targets.

7 Enhance Solar and Storage on City-Owned Property PlaNYC

By enhancing existing and new solar arrays with energy storage, we can increase grid reliability and resilience in EJ communities, which are particularly susceptible to climate-related power-loss events. NYC will lead by example in the transition to clean energy by taking advantage of the City’s physical assets and exploring opportunities to site energy storage on public properties.

Create an Energy Storage Pilot Program on City-Owned Property: Although energy storage is important for reaching climate goals, there are major procedural obstacles that must be overcome to reach the scale of development necessary. To address these hurdles, we will establish an energy storage development pilot program. Currently, DCAS has 10MW of energy storage projects in development. Beyond those, we will commit to making 15-30 sites identified by the analysis conducted for this report available to deploy

Battery Storage Siting Opportunities in NYC



PowerUp analysis identified more than 10,000 MW of energy storage potential at more than 8,000 lots across the five boroughs. Source: MOCEJ analysis

large-scale (greater than 250 kWh) battery storage facilities. As shown in the map above, there are numerous City-owned locations that could provide opportunities for siting battery storage throughout the city. Though we will not own these storage sites, we will use the City’s position as the largest landowner in NYC to facilitate development.

Over the course of this pilot program, we will explore using multiple site access mechanisms to facilitate storage development, including leasing City-owned property, issuing concessions to developers, and entering PPAs. Where ULURP is necessary, we will explore a bundled ULURP procedure by combining multiple properties into single ULURP application and procurement processes, which could expedite approvals and permitting. However, we are committed to ensuring many qualified developers can install battery storage on City owned property to catalyze a diverse market and will design site access tools and procurements to advance this goal. We will also, in conjunction with developers, promote a roadmap for multi-site leasing.

Issue A Request for Information (RFI) to Understand Pathways to Energy Storage on City-Owned Land: We will solicit information from private sector developers, financial institutions, and energy advocates to streamline the deployment of energy storage at an accelerated pace. The intent of the RFI is to ascertain the preferred procurement methods and administrative pathways to siting and approvals, including the details of contract structures (such as key site access terms and conditions), financial arrangements, and land use terms. The RFI will further assess the financial needs specific to large-scale electricity storage developers.

USE CITY-OWNED PROPERTY FOR COMMUNITY SOLAR DEVELOPMENT

As the largest property owner in NYC, the City has a unique opportunity to leverage public property to catalyze development of community solar projects, making neighborhood-scale clean energy more readily available and bringing direct benefits to EJ and other disadvantaged communities.

8 Create a Community Solar Pilot

The City will create a community solar pilot to allow solar development on three to five City-owned properties, with a shared savings model that will provide energy bill discounts to subscribers in Disadvantaged Communities.

Extend the PPA Model to Community Solar: As detailed, the City uses PPAs for a number of clean energy projects, in which developers are granted access to develop a solar project on City-owned land and the City signs a contract to purchase the power generated for a set period of time.

The same process will be applied to the City’s community solar pilot projects, with developers granted site access agreements to City-owned rooftops and PPAs used as the contract model to ensure that the energy produced by the solar panels will be “used” or purchased by community solar subscribers. As part of the pilot, the City will evaluate and develop a bill crediting structure to ensure that subscribers receive appropriate discounts on their utility bills. We also aim to streamline site access agreements to create standardized terms and requirements and a stronger internal community solar knowledge-base throughout City agencies.

Prioritize High-Capacity Sites in EJ Areas: Sites for the community solar pilot will be chosen based on estimated capacity, roof readiness, and annual energy production at each site, the existing power hosting capacity established by the utility around the project locations, and whether the property is within an EJ area. Estimated capacity and EJ status of each location are provided within the Local Law 24 report.^{xciii} Estimated capacity is a key criterion because higher capacity projects typically have a better return on investment and a site’s hosting capacity must be sufficient to ensure that the project can cost-effectively interconnect with the electrical grid without incurring excessive costs for electrical grid infrastructure upgrades.

Prioritizing project sites in EJ areas will help ensure that clean energy investments and environmental benefits are going to historically marginalized communities and will also enable projects to receive the maximum available IRA incentives.

Align with Opportunities for Educational and Vocational Training: Potential non-energy benefits, such as opportunities to create local green jobs, or provide educational and vocational training, will also be a consideration in project siting. The table on page 45 provides a non-exhaustive list of potential sites that may be considered for the community solar pilot. Additional sites will be evaluated for community solar application following report release. While narrowing down this list of potential solar installation sites, we prioritized public schools operated by NYC DOE. Siting solar infrastructure on schools provides a unique opportunity to teach students about clean energy and climate change and develop training pathways to well-paying green jobs. An example of this type of project is the rooftop solar installation at Thomas A. Edison Career and Technical Education High School in Jamaica Hills, Queens.^{xciv}

9 Launch Public Solar NYC (PlaNYC)

As announced in *PlaNYC: Getting Sustainability Done*, the City will launch a Public Solar program for 1-to-4 family low-income homeowners in EJ communities.^{xcv} This will provide 3,000 homes over the next five years with intentional outreach and financial assistance to install rooftop solar, including potential funding mechanisms such as grants, bridge loans, and other financing support. This effort is aimed at increasing access to solar and clean energy benefits for historically marginalized communities through two main

innovative ownership options. The Public Solar program will install rooftop solar via direct ownership for LMI buildings in addition to an innovative public option where a City-affiliated entity would directly install and own the solar, sharing the benefits with residents.

Leverage Federal and State Funding and Incentives: There is currently more funding available than ever before to advance community solar projects. The City plans to apply for funding from the U.S. Environmental Protection Agency Greenhouse Gas Reduction Fund (EPA GGRF) to

support the Public Solar initiative.^{xcvi} In alignment with the EPA GGRF application timeline, we will create an implementation roadmap for the first phase of the Public Solar initiative. The roadmap will use NYS DACs and other indicators to identify priority areas for program outreach and community engagement (See "NY’s DAC Criteria" on p. 13 to learn more). We will work collaboratively through public-private partnerships to identify potential funding mechanisms for different building typologies and ownership structures that will be used. The implementation plan will also identify



Potential City-Owned Development Sites for Community Solar Pilot Program			
Site	Borough	City Agency	Estimated Capacity
J.H.S. 151 Lou Gehrig	Bronx	DOE	259 kW
Emma Lazarus High School	Manhattan	DOE	206 kW
FDNY Bronx Central Office	Bronx	FDNY	180 kW
P.S. 329 Surfside	Brooklyn	DOE	161 kW

Public schools offer potential community solar pilot locations that can provide valuable opportunities for students to learn about clean energy, and develop training pathways to well-paying green jobs. Source: MOCEJ *PowerUp* technical research. Photo: Rooftop solar installation at a Thomas A. Edison Career & Technical Education High School, Queens. Source: MOCEJ

opportunities for expansion beyond the 1-4 family home pilot to support existing City led efforts to deploy solar and other clean energy technologies on affordable and public housing. Public Solar will promote investments in disadvantaged communities aligned with the federal Justice40 Initiative and NYS CLCPA.

Additional federal funding opportunities are available via IRA tax benefits for community solar projects, particularly those serving LMI communities. The IRA also allows any project owned by a municipality to receive all federal tax credits for which the project is eligible and creates a direct pay mechanism to receive credits in cash in lieu of decreased income taxes.

Federal tax credits include the Investment Tax Credit (ITC), which municipalities like NYC and other tax-exempt nonprofit entities like CBOs have historically been prohibited from leveraging.^{xcvii} IRA incentives can be combined with the existing Community Adder program, which is run by NYSERDA and provides upfront incentives for eligible community solar projects.^{xcviii}

Analysis conducted for *PowerUp* shows that combining all benefits available for these projects would cover the City's cost of development and provide hundreds of dollars in bill savings for subscribers each year (see the *PowerUp Technical Appendices* for more detail). Additional community solar financial incentives were excluded from this analysis including NYSERDA's Inclusive Community Solar Adder (ICSA),^{xcix} separate from the existing Community Adder Program — which at the time of this report is under development and undergoing the stakeholder feedback process and NYSERDA's Affordable Solar and Storage Predevelopment and Technical Assistance fund, which provides up to \$200,000 in funding for community solar projects to overcome challenges within the pre-development stage.^c

Expand Solar Where Feasible: In addition to launching Public Solar, the City is working with agency partners to expand programs like HPD's Solar Where Feasible (SWF) with the addition of federal funding. SWF is an existing solar program that builds rooftop solar on affordable housing developments. Since 2020, the program has supported over 12 MW of cost-effective solar with a payback period of 10 years or less on new and existing development deals.^{ci}

Successful programs like SWF have the potential to scale up and further increase access to solar for affordable housing and thousands LMI New Yorkers across city with a combined portfolio of nearly 15,000 buildings, up to 3,000 of which are likely strong candidates for solar. An expanded SWF program could result in up to 7 MW of additional solar per year to help create millions of dollars in energy bill savings.

PREPARE NYC'S GRID FOR ELECTRIFICATION

In the coming decades, building and transportation electrification will increase demand on the electric grid, requiring distribution system upgrades in many parts of the city, additional generation resources, and new transmission lines. Ensuring that NYC has reliable power in the coming decades will require planning and investment in both the short and long term.

The City continues to work with utilities, the NYISO, the State, and Federal regulators to plan for a future with higher peak electricity demand. This includes advocating to regulators for the transformation of New York City's energy infrastructure so we can power our city with renewable electricity and support large scale electrification. The City supports utility investment in transmission and distribution upgrades, while it takes action to lower energy demand at peak times. Strategies to reduce demand include the use of grid-responsive load management and technologies that are capable of exporting energy back to the grid, such as battery storage and vehicle-to-grid EV charging.

10 Support Demand Response Programs Citywide

Broadly, demand response programs support power grid stability and reduce emissions associated with peak power generation by calling for reduced energy use when demand on the electric grid is at its highest. The City manages one of the largest demand response portfolios within NYS: led by DCAS, 616 locations across 35 agencies and organizations have committed 116 MW of demand reductions for the upcoming summer 2023 season.

While enrollments in summer demand response programs reflect current peak demand profiles of the NYS power grid, it is anticipated that



Grid transmission infrastructure. Source: Adobe Stock.



Utility hardening, Maspeth, Queens. Source: MOCEJ

winter demand response programs will become increasingly vital as heating and transportation electrification efforts progress. DCAS is evaluating all areas of opportunity to meet these needs and address the shift from a summer to winter peaking electric grid, including the value of establishing targets for the deployment of demand response capabilities within City-owned facilities that require additional capital upgrades

The City will also promote participation in electric demand response programs in partnership with Con Edison and NYISO, not only for City-managed facilities but across multiple sectors, including residential, commercial, and industrial building owners.

11 Mandate Grid-Responsive Thermostats PlaNYC

Through New York City's adoption of the latest energy code standards from NYSERDA, the NY Stretch code, new heating and/or cooling systems that operate from the electric grid are required to install grid responsive thermostats that have the capability to respond to peak events. Residential spaces will be required to have programmable thermostats equipped with demand responsive controls.

Any potential future requirements for demand response must consider a maximum allowable temperature for residential spaces to ensure that spaces are kept at a safe temperature even when a demand response event is active. We will consider this as we develop a maximum indoor temperature policy, as detailed in *PlaNYC (2023)*.

ENSURE THE RESILIENCE OF NYC'S POWER SYSTEMS

Given the increased likelihood of extreme weather due to climate change, it will become more challenging to ensure the reliability and resilience of the power system. This task will grow in importance as electricity demand increases and we see peak grid conditions during winter months in NYC. We will invest in new renewable and storage resources and plan with energy resilience in mind to ensure a reliable energy system for New Yorkers.

Broader resiliency planning ensures that blackouts and brownouts be kept to a minimum, so that the greater NYC area can have a consistent source of electric power. Resiliency planning on a local level is crucial, particularly for EJ communities that

have been historically underserved. When we meet energy demand locally, community members can stay comfortable during extreme temperatures, have consistent access to health and emergency services, and continue to operate their businesses and homes without fear of losing power during periods of peak load.

12 Launch Resiliency Hubs Citywide PlaNYC

Launch Ten Community Resiliency Hubs by 2030: We will leverage federal funding to launch resiliency hubs—community spaces protected from climate hazards such as flooding and extreme heat. These hubs, which could include libraries and existing community spaces, will function year-round as normal gathering places for events and social connection.

Resilience hubs have multiple climate benefits, as they are typically designed to be energy, flood, and heat resilient, while also using clean energy. With capital upgrades, these centers will have features such as back-up power supplied by energy storage to provide consistent safe temperatures, medication storage, charging stations, and emergency communication.

We have already begun developing a Resiliency Hub strategy. HPD has received \$9 million to incorporate two community Resiliency Hubs in areas that have or are at risk of flood and storm-related disasters.^{cii} NYCHA was awarded a Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) grant for \$256,000 to plan a network of Resiliency Hubs across its campuses.^{ciii} If federal funding is available, we are committed to opening 10 Resilience Hubs by 2030, to ensure vulnerable New Yorkers have access to multi-hazard safe spaces.

Launch a NYCHA Building-Level Resilience Hub Pilot to Support Critical Systems: NYCHA is installing on-site solar and battery storage to provide power to critical systems in the event of an outage at Borinquen Plaza I's Buildings 3 and 4, as well as the adjacent community center.^{civ} With backup power, the community center would become a resilience hub, providing residents and the community with a cooling center during extreme heat events. NYCHA, in partnership with NYPA and the National Renewable Energy Laboratory (NREL), completed the feasibility study in 2022. NYCHA will release a request for proposals in 2023.



Utility repair in progress, Manhattan. Source: MOCEJ

KEY TERMS

Co-location: Using the same space for multiple uses, such as installing a solar canopy above rooftop heat pump equipment. A strategy to maximize benefits of different technologies and infrastructure.

Community Solar: A solar panel array that benefits and provides savings to multiple community “subscribers,” or energy offtakers, to lower their monthly energy costs without requiring installation of solar systems on their own property.

Demand Response: A program that encourages lower electricity use during peak energy hours, often through financial incentives.

Energy Efficiency: The process of using less energy to generate the same outcome. For example, an LED lightbulb uses at least 75% less energy than an incandescent light bulb while producing comparable levels of light.

Environmental Justice: Fair inclusion and treatment of all people with regards to environmental policy and practices.

Environmental Justice Community: A community that is disproportionately exposed to high levels of pollution due to unfair siting of environmental hazards such as power plants.

Grid Interconnection: The electrical connection between energy generators and the broader energy grid.

Industry Hub: Area with a high concentration of a specific business. NYC aims to become an offshore wind industry hub.

Offshore Wind (OSW): Wind turbines located off the coast that turn ocean wind into energy.

Power Purchase Agreement (PPA): A long-term contract between a developer and a customer where the developer builds and operates a renewable energy system, and the customer purchases the electricity produced by that system.

Resiliency Hub: A community space such as a library or school that has been outfitted solar and energy storage for backup power to endure climate hazards such as extreme heat or flooding, and that can protect people during extreme weather events.

Solar Power: Energy generated by the sun and captured by solar panels for electricity.

Utility Thermal Energy Network (UTEN): Underground pipe networks that carry water at ambient temperatures, and can provide heat pumps with a source of or outlet for heat.

Value of Distributed Energy Resources (VDER) or Value Stack: A new mechanism created by the New York State Public Service Commission to compensate energy created by distributed energy resources, like solar. The Value Stack compensates projects based on when and where they provide electricity to the energy grid and compensation is in the form of bill credits.

Taking Action: Buildings

There are more than one million buildings in NYC. They are the spaces where we live, learn, work, and play, and an essential part of the lives of the city’s roughly 8.5 million residents. With a wide variety of space uses and needs, types, and designs — including residential, commercial, and industrial; high-rise and low-rise; masonry, wood, and steel construction — NYC’s buildings can be as unique as its residents.

LEADING WITH BUILDINGS

Approximately 70% of planet-warming GHG emissions citywide, and 66% of health-threatening fine particle emissions, come from our buildings.^{cv} These emissions and pollutants are attributed primarily to burning fossil fuels like oil and natural gas for space and water heating.

In response, the City has enacted groundbreaking laws and regulations to decarbonize the buildings sector. Notably, this includes Local Law 97 of 2019, which establishes first-ever emissions limits for large buildings, and Local Law 154 of 2021, which mandates the phase-out of fossil fuel-based equipment in new construction (see "Climate and Energy Policy Landscape" on p. 24 for more).

Transitioning our buildings off polluting fossil fuel-based equipment is essential to achieving our climate action and quality-of-life goals. Buildings are not only our greatest contributors to the climate crisis, but also one of our greatest opportunities to make impactful change.

BENEFICIAL ELECTRIFICATION & BUILDING UPGRADES

Achieving necessary emissions reductions will require full or partial electrification of our buildings. Electrification is the process of transitioning from fossil fuel-based systems and equipment — like gas boilers, furnaces, and stoves — to electric-powered ones like heat-

pumps. Heat pumps are highly efficient systems that can provide space heating and cooling, heat water, and use far less energy than traditional systems to keep occupants comfortable. Beneficial electrification aims to ensure that the process of shifting to all-electric building systems saves consumers money over the long run, enables better grid management, and reduces negative environmental impacts.

Integrating major energy efficiency measures into comprehensive plans for building electrification will play a critical role in this process. For instance, many buildings owners will benefit from beginning with building envelope improvements like roof repairs, insulation upgrades, and window replacements. Not only can this efficiency-first approach immediately begin to reduce heat and energy loss, cut utility costs, and improve occupant comfort, but it can also enable the installation of smaller, more cost-effective mechanical systems in the next phase of electrification.

As detailed in the previous chapter, New York City and State are taking bold action to transition our electric grid to fully renewable resources, in parallel to electrifying our buildings. Even with NYC’s current electric grid fuel mix, electrifying buildings today with equipment like heat pumps will achieve significant emissions reductions and quality-of-life benefits, which will only continue to grow as we accelerate our progress toward a 100% carbon-free electric grid.^{cvi}



NYC’s buildings account for roughly 70% of citywide emissions, presenting a major opportunity for climate action. Source: MOCEJ

BUILDING RETROFIT SOLUTIONS

Energy efficient building retrofits provide multiple benefits to New Yorkers. Beyond energy and emissions savings, holistic retrofits that include air-sealing, insulation, and ventilation upgrades can help control pests, improve indoor air quality, and enhance thermal comfort. However, these retrofits often require other building improvements first, including roof repairs and asbestos and mold abatement, which may increase project costs but provide additional occupant benefits. Some key retrofit solutions include:

Envelope Upgrades: A building’s envelope, which includes exterior walls, roofs, windows, and doors, protects residents from exterior elements. The quality of the envelope can significantly impact resident comfort and a building’s longevity and operational efficiency. Envelope upgrades often include enhanced insulation and new windows, along with air-sealing to keep out drafts, moisture, pests, and pollutants. This keeps heat inside on cold days and spaces cool on hot ones, reducing energy demand. By completing envelope improvements as the first step in a comprehensive retrofit, owners can size down heating and cooling equipment, saving money on both capital costs and energy bills.

Heating, Ventilation, and Air Conditioning (HVAC) Upgrades: To transition off fossil fuel equipment and benefit from an increasingly

clean electric grid, building owners will need to replace existing HVAC equipment with electric heat pumps. Heat pumps can provide space heating, cooling, and water heating, and can be more than three times as efficient than traditional oil and gas-based systems.

Lighting Upgrades: Light emitting diode (LED) lights are up to 90% more efficient than traditional incandescent bulbs and have much longer lifespans.^{clxiii} Unlike traditional bulbs, LED lights do not emit heat, reducing cooling loads in the summer. Comprehensive retrofits can also include upgrades to lighting control systems, as well as daylighting controls that maximize the use of natural light whenever possible.

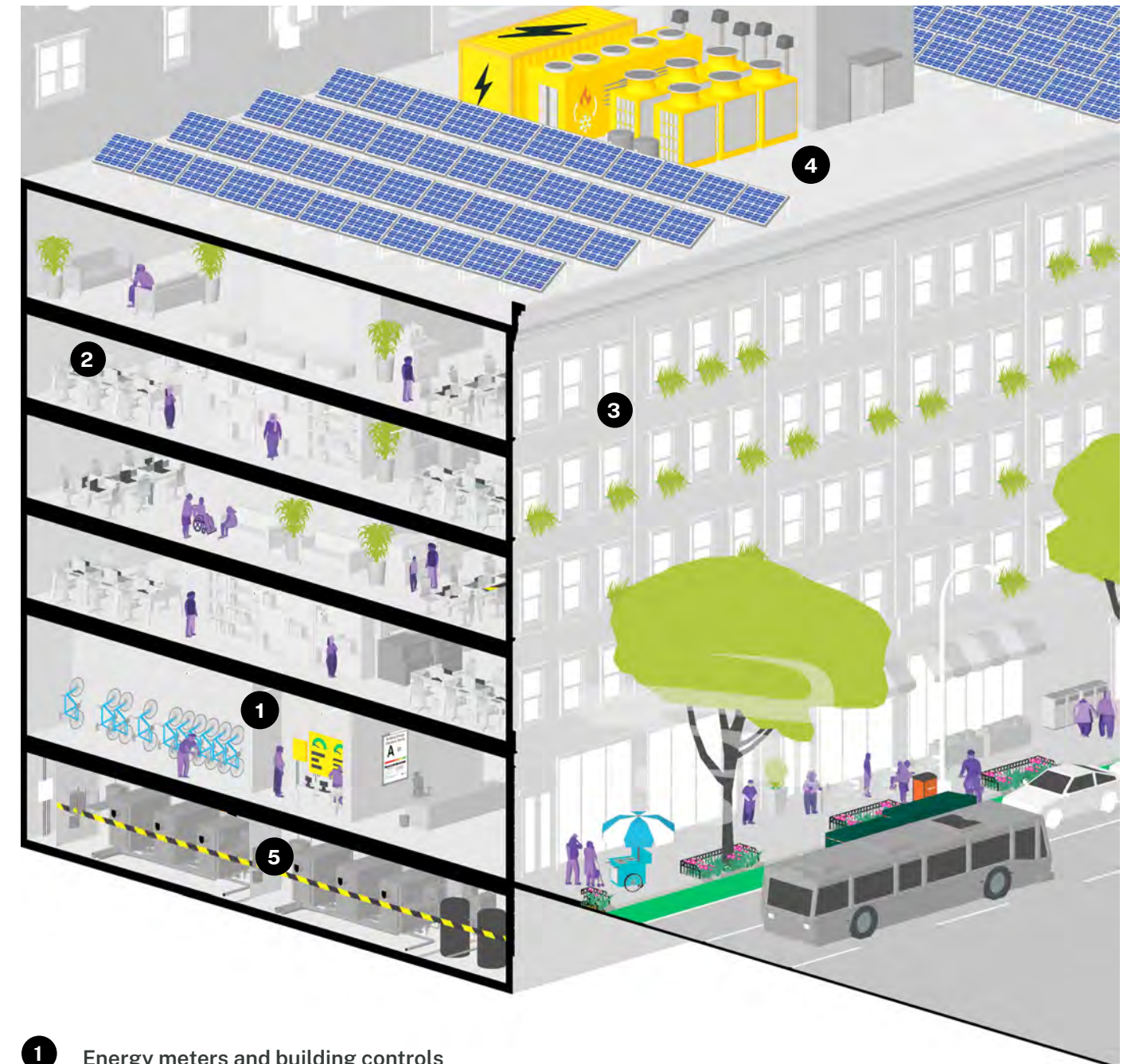
Electric Cooking Equipment: Induction cooktops and electric stoves are cleaner alternatives to gas stoves and do not emit carbon monoxide or other toxic gases into homes and the air, improving indoor air quality and occupant health. Induction stoves also have faster cook times and precise temperature control.

On-Site Solar & Green Roofs: Local Law 92/94 of 2019 requires all new buildings, and alterations on existing building roof decks, to construct green roofs, install solar, or utilize a combination of the two. This can act not only as an insulation upgrade and generate electricity, but also help reduce the urban heat island effect and promote thermal comfort.



Green roof with native meadow and wildlife habitat at Kingsland Wildflowers, Greenpoint, Brooklyn. Source: MOCEJ

Building Retrofit Solutions



- 1 Energy meters and building controls
- 2 Ultra-efficient LED lights, sensors, and controls
- 3 High-performance windows and facade improvements
- 4 Solar panels, electric battery storage, and heat pumps
- 5 Old oil/natural gas boilers taken offline and replaced by rooftop heat pumps

Building owners can dramatically reduce energy use and associated GHG emissions while improving occupant comfort and quality of life with strategic upgrades to the building envelope, high-efficiency lighting and energy control systems, and electrification of major HVAC equipment.

ELECTRIFICATION-READY RETROFITS: HEALTH, SAFETY, AND RESILIENCE

NYC's building stock must be electrified in a comprehensive way that both meets our climate goals and prioritizes the well-being of all New Yorkers. Many NYC residents live in older buildings that require long-deferred maintenance and significant repairs. Systemic challenges like historic disinvestment, discriminatory land use and financial policies, and impacts of the COVID-19 pandemic have limited the ability of historically marginalized populations to access financing for needed improvements.

Before energy-related measures begin, many buildings may require immediate health and safety repairs to address dangers like asbestos, lead, mold, and structural damage. Additional steps may be needed to: ensure thermal comfort and reduce exposure to dangerous temperatures that can lead to hypothermia or exacerbate existing chronic health conditions;^{cvi} improve air quality and reduce risk of respiratory illness; reduce noise pollution; and reduce potential flood-related damages.

As the impacts of the climate crisis become more severe, extreme heat and flooding will increasingly affect how residents live and buildings operate. Resiliency and adaptation measures must be considered when planning for the future, such as siting HVAC systems and other critical equipment above projected flood levels to avoid service disruptions during severe weather events.

NYC HPD has published design guidelines that establish minimum standards for HPD-financed affordable housing. The guidelines detail project requirements to meet NYC's climate laws and objectives, as well as recommended "reach" criteria to accelerate building decarbonization while incorporating best practices for resiliency, health, and safety.^{cvi} These guidelines provide a decarbonization template for all NYC housing, beyond just HPD.

Additionally, NYC Local Law 41 of 2021 mandates that all City capital projects incorporate resiliency into their design, after a five-year pilot program.^{cix} The City is currently building out *Climate Resiliency Design Guidelines* based on this mandate and partnering with City agencies to apply them to real-world projects, quantify costs and benefits of resilient design specific to NYC capital projects, and institutionalize resilient design via a scoring metric.

ELECTRIFICATION RETROFIT CHALLENGES

STRATEGIC PHASING AND PARTIAL ELECTRIFICATION

Building owners must also account for the timing and phasing of retrofit projects in their capital plans. For example, some owners may be able to streamline construction costs and timelines by taking a comprehensive, whole-building retrofit approach, completing health and safety measures, envelope improvements, and HVAC upgrades concurrently. However, many owners will likely need to phase in upgrades over longer time horizons, and therefore must consider the strategic order of projects — for example, undertaking electrification-readiness health and safety projects first or upgrading the building envelope before sizing and installing electric heating and cooling systems.

For properties where fossil fuel systems still have more than 10 years of useful life left, owners should consider beginning with partial electrification, if full electrification is not possible. This phased approach can involve strategies like installing heat pumps to cover most of the building's heating load while continuing to run existing boilers on the coldest days. Partial electrification can allow building owners to schedule and sync project investments with existing capital cycles and equipment retirement dates, and to defer costs for other infrastructure upgrades that will be needed for full building electrification, like electrical panel replacement.

CAPITAL PLANNING AND UPFRONT COSTS

While constructing new buildings without fossil fuel-based systems is relatively straightforward, retrofitting an existing building to run on electricity instead of gas or oil is not. Construction can be costly, disrupt building use, and displace residents. Building owners may be resistant to invest in retrofits and potentially forgo rent revenues while occupants are displaced. In addition, electrification retrofits can require hiring design professionals, filing permits, and conducting financial and logistical planning.

Furthermore, electrification retrofits typically have high upfront costs, which can include upgrades to the building envelope, mechanical equipment, and distribution systems. Older buildings may also have to address deferred maintenance or bring

systems up to current code. Many NYC buildings also have aging electrical connections to the grid and will need wiring and electrical panel upgrades to support increased demand as fossil-fuel based systems are replaced with electric ones. Costs depend heavily on a building or campus' baseline energy use, system types, specific upgrades, and other unique characteristics and constraints.

Despite upfront costs, retrofits provide myriad benefits, such as efficient air conditioning, improved air quality, enhanced occupant health and comfort, increased marketability, and avoided penalties for non-compliance with NYC's Local Law 97 of 2019 emissions limits.

Depending on a building's baseline fuels for heating and hot water, electrification can also lower utility bills. For instance, heating with electricity is cheaper than fuel oil. While district steam and natural gas prices are currently cheaper than electricity, recent gas costs are increasing at a higher rate than electricity. And as more buildings transition off fossil fuels and there are fewer district steam and natural gas system users, prices for those energy sources will likely go



NYC DOB building inspection. Source: DOB

up. Additionally, as NYC's large-scale renewable energy projects come online, electricity is expected to become even more cost-effective, making electrification a sound long-term investment.

EQUITY AND ACCESS TO FINANCING

Not all New Yorkers have equal access to financing and capital for home and business building upgrades — particularly organizations or individuals that provide affordable housing, or include LMI residents. These inequities often stem from historic injustices and practices like redlining — the systematic denial of financial services like mortgages, insurance, loans, and services to residents of certain areas based on race or ethnicity. In more recent times, periods of economic hardship, like the 2007-2009 recession, COVID-19 pandemic, and recent impacts of inflation have reinforced and exacerbated this divide, with Black and Latinx communities disproportionately affected. Many NYC communities facing the greatest hurdles to retrofit financing are the same ones that have historically borne the brunt of the city's environmental hazards.

ENERGY BURDEN AND INSECURITY

Building electrification and the just transition to a clean energy future must also consider the financial security of NYC residents, including energy burden. Energy burden is a metric used to measure the percentage of household income spent on energy bills. The PSC has set a target that no household should spend more than 6% of income on energy bills; those that exceed this threshold are considered to be energy burdened.^{cx}

In 2019, the Mayor's Office of Economic Opportunity and MOCEJ conducted an energy burden study to assess the effectiveness of current low-income utility discount levels in reducing low-income families' energy cost burdens to no more than 6% of pre-tax income.^{cx} The study was done using publicly available 2017 Public Use Micro Sample data, which is part of the American Community Survey (ACS).^{cxii}

The study determined that there are more than 480,000 low-income families in NYC that pay over 6% of their income toward energy utilities.^{cxiii} Given that the average family size in the city is approximately 2.26 people, this represents over one million New Yorkers — a significant number of families struggling to afford their utility bills. This

figure likely underestimates the number of low-income energy cost burdened families because the study was based on out-of-pocket spending and did not factor in the large number of families who pay for energy utilities indirectly through their rent, which is a common practice landlords use to allocate heating expenses for residents in multi-family buildings.

Extreme energy burden can lead to energy insecurity — the inability to pay for basic energy needs like heating, cooling, and lighting. Energy insecurity can drive households to adopt practices that inadvertently compromise their health, such as heating their homes with polluting gas stoves or forgoing the use of cooling equipment even on dangerously hot days. Energy insecurity can negatively impact mental and physical health. Research shows that children in energy insecure households are at risk of poorer health outcomes than their peers, with constant financial stress and caregivers often forced to choose between paying for utility bills or other necessities.^{cxiv}

Several factors contribute to energy burden and insecurity, including:

- **Energy efficiency** of building equipment and quality of the thermal envelope, which affect the amount of energy that residents use. Due to historically unfair housing policies and redlining there is a lack of access to affordable and healthy housing in NYC, especially for people of color and low-income households. This means energy insecure households are more likely to live in buildings that have physical deficiencies like inefficient and outdated equipment, and poor weatherization. These inequitable building issues not only degrade resident health and comfort but also compound affordability problems by driving up energy use and utility costs.
- **Utility rates**, which affect the costs of electricity, gas, and district steam, are agreed upon during PSC rate case agreements. In NYC, most customers are charged based on volumetric rates, or how much electricity they use (see "Utility Rate Structures" on p. 59).
- **Metering configurations**, which affect the utilities that residents, versus owners, are responsible for paying (see "Metering Configurations" on p. 57).

Alleviating energy burden is administratively difficult and sometimes costly. While a number of utility and government programs reduce qualifying customers' electric utility bills, such as the Home Energy Assistance Program (HEAP)^{cxv} and Con Edison and National Grid's Energy Affordability Programs,^{cxvi} these discounts can be insufficient to fully alleviate energy burden and are only available to the lowest income New Yorkers.

Additionally, programs may not always be fully transparent or serve all eligible New Yorkers. Furthermore, in New York State, HEAP only provides utility assistance during winter months and does not assist with utility costs in the summer. The cost of running an air conditioner or heat pump can be prohibitively expensive for LMI households, putting them at greater risk of heat-related deaths.

In 2019, NYS passed the Housing Stability & Tenant Protection Act (HTSP), enacting sweeping changes to strengthen tenant protections.^{cxvii} A key change was made to retrofit costs for tenants. Under New York's Rent Stabilization laws, owners may increase rents when they make qualified Major Capital Improvements (MCI) to a building or Individual Apartment Improvements (IAI). MCIs are improvements that impact the full building (such as boiler replacements, electrical rewiring, and roof work), while IAIs are upgrades that impact a single tenant (such as a new stove or refrigerator).

HSTP regulates and limits how, and to what extent, MCIs can be passed down to tenants. Increases in rent due to MCIs are limited to 2% of tenant rent at the time of the MCI award.^{cxviii} This minimizes the impact of building retrofits on tenants, but may limit some building owners' ability to invest in electrification, as some costs may not be recouped.



Installing a heat pump window unit at Woodside Houses as part of NYCHA's Clean Heat for All program. Source: NYCHA

METERING CONFIGURATIONS

There are three key types of metering configurations in NYC buildings:

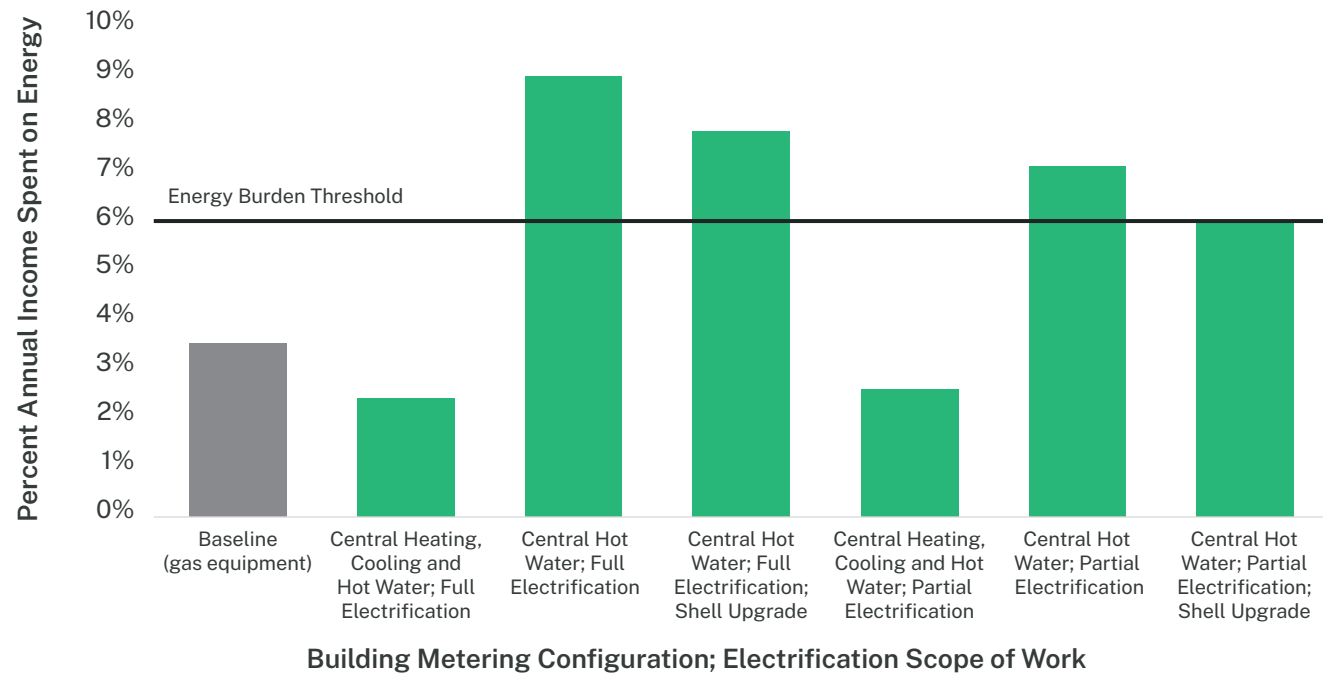
Master-Metered: Master-metered buildings have one meter that monitors the energy use of an entire building. Cost of master-metered buildings can be divided up by the building owner and allocated to tenants. Frequently, master-meters are used for common area electrical energy use such as hallways, lobbies, stairwell, and gas or electric-related hot water systems, like showers and kitchen faucets, and heat in the wintertime. Water is seldom metered separately for each unit — most multifamily buildings are master-metered for water, and because water is heated within the building by a water heater, the cost of heating water is accounted for by electric or gas use, not within the water bill.

Direct-Metered: Direct-metered buildings are buildings that have multiple meters that individually monitor the portion of the building in which they are located. Often, direct meters are installed per individual unit. Direct meters

monitor and charge individual residents for their plug-in load use such as televisions, laptops, phones, air conditioners, and sometimes gas equipment like stoves or boilers. Therefore, in direct-metered residential buildings each resident receives an individual electricity bill at the residential rate set by the serving utility. Direct metering methods in residential buildings enable residents direct, real-time information about energy use. Direct-metered multi-use buildings monitor usage within common areas and charge a commercial usage rate as set by the utility.

Sub-Metered: Submetering refers to the use of meters in addition to the master-meter installed by a utility company. Submeters are typically used to measure electricity consumption by energy type. Therefore, submetering requires the installation of individual electricity meters, water meters, and gas meters to monitor and charge residents for usage. The submeter also monitors consumption of electricity from each piece of equipment within a building (e.g., HVAC systems, outdoor and indoor lighting, kitchen appliances) to fully measure usage by type.

Potential First-Year Impacts of Electrification Retrofits and Metering Configurations on Tenant Energy Cost Burden



Tenant first-year energy burden analysis for a typical LMI pre-war multi-family residential building with fewer than seven stories and existing gas equipment. Columns labeled with "Central Hot Water" represent situations where only water heating is master-metered and other energy uses are directly paid by tenants. Half of the above scenarios would result in tenants crossing the threshold for energy cost burden, without regulation. Source: MOCEJ analysis — see *PowerUp Technical Appendices* for more detailed methodology and findings.

UTILITY COST SHIFTING

In most NYC rental buildings — both affordable and market-rate — owners pay for heating via gas, fuel oil, or district steam bills, while tenants pay for cooling via their electric bills. As buildings transition to electric-powered heating systems, tenants may face a higher direct share of utility costs. Currently, the NYC real estate industry lacks clear guidance on how to navigate this cost shift. The graph above shows how several building electrification and metering scenarios might shift utility costs and impact the energy burden incurred by LMI tenants. Columns labeled with "Central Hot Water" represent situations where only water heating is master-metered and other energy uses are directly paid by tenants. As illustrated, without regulation, half of these scenarios would push tenants over the threshold for energy cost burden.

However, as the industry has accelerated the transition to all-electric buildings, some owners and tenants have negotiated new billing configurations that present viable pathways to

more equitable distribution of energy costs, each with unique advantages and challenges:

- Building owners can install submeters on heating equipment, enabling them to split heating costs with tenants, according to usage. Tenants continue to pay for cooling.
- Owners can take on cooling costs and increase rents accordingly, although this raises concern that tenants would not be motivated to use energy efficiently as they would not see billing and usage data directly. This would require policy changes to protect tenants.
- Residents can take on heating costs and the building owner reduces rents accordingly, to ensure that residents' housing costs (rent plus utilities) remain below 30% of household income. This approach will require policy changes and appropriate utility allowances to protect tenants.

NYC HPD has also published the Electric Heating Policy, which provides guidance on owner-tenant billing strategies for affordable housing.^{cxix}

UTILITY RATE STRUCTURES & RATE CASES

Traditionally, electric utilities charge customers based on volumetric rates, or how much electricity they use. However, there are several rate structures that offer more progressive and affordable options, particularly for LMI individuals:

- **Tiered Rates:** Customers are charged incrementally more when they reach certain levels of electricity demand.
- **Time of Use (TOU) Rates:** Electricity prices differ depending on the time of day energy is used.
- **Income-Based Rates:** Customers with an income below a certain threshold (e.g., a percentage of the federal poverty level or the state's median income) pay a fixed rate.
- **Demand-Based Rates:** Customers pay a fixed-rate based on their period of highest electricity consumption or usage during a pre-specified peak period that is then added to the customers volumetric bill charges.

As part of the PSC's recently adopted 2023-2026 rate structure for Con Edison electricity and natural gas, the City and other stakeholders successfully advocated for several items that

advance a just transition to a clean energy economy. These items include:

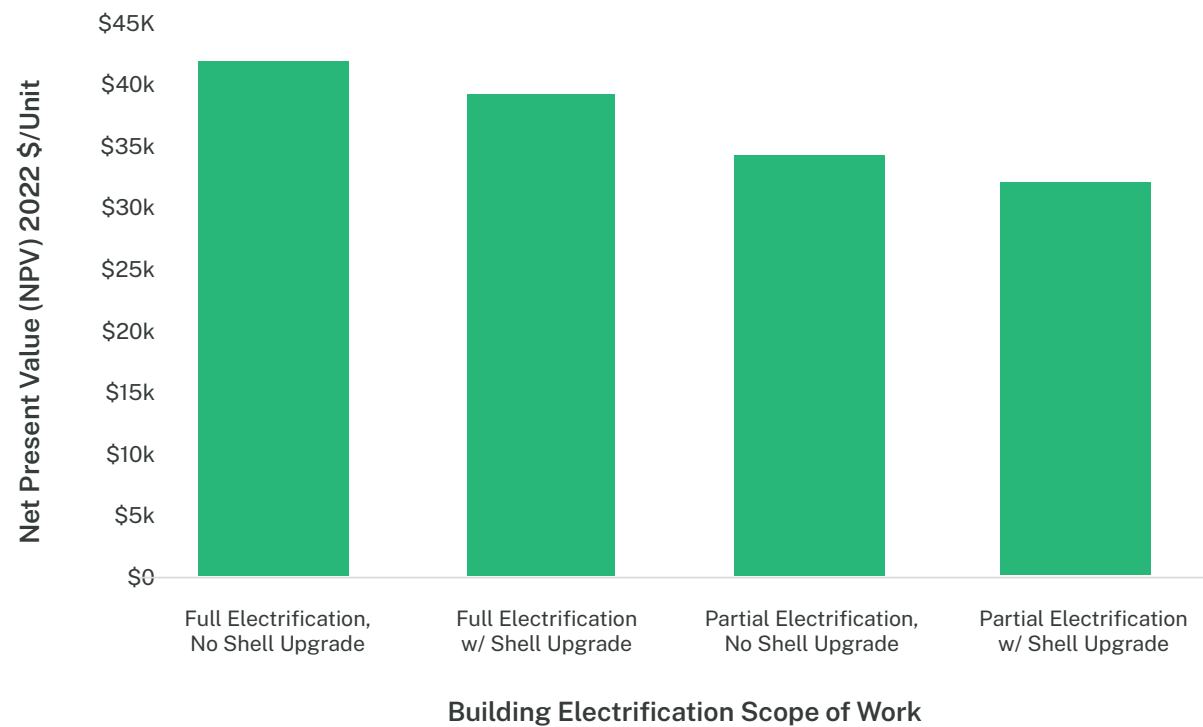
- Suspension of residential service terminations due to non-payment during periods of high temperatures
- Formalization of cold weather protections during the November 1st to April 15th heating season
- Assurance that all qualifying customers, without limit, will be accepted into Con Edison's Energy Affordability Plan
- Waiver of electric and gas reconnection fees for low-income customers
- Advanced notice of reporting requirements for high-tension customers impacted by voltage reductions
- Expansion of rate structures that address continuing costs of heat pumps for residential customers

Additionally, the City and other stakeholders successfully advocated for the adoption of an annual reporting requirement that will provide comprehensive information regarding Con Edison capital investments, outages, energy efficiency and electrification efforts, clean energy spending, and programs marketed to and implemented within disadvantaged communities.



Solar panel installation on the roof of Queensbridge Houses. Source: NYCHA

Average NYC Funding Gap for Building Electrification Upgrades



The average funding gap for rent-stabilized, unsubsidized multifamily housing in NYC ranges from \$30,000 to \$40,000 per unit for electrification retrofits and energy costs over a 18-year life cycle. The funding gap includes upfront costs, ongoing energy expenditures, energy efficiency cost savings, and electrification tax incentives. Costs vary by baseline building conditions and retrofit scope of work. Source: MOCEJ analysis — see *PowerUp Technical Appendices* for more detailed methodology and findings.

CLOSING THE FUNDING GAP

Traditionally, building owners can obtain significant loans and funding for upgrades when they acquire or refinance their buildings, typically on 15-year cycles. There are often limited funding opportunities outside of these capital cycles to cover upfront construction cost gaps or to meet ongoing operation and maintenance needs. Several Federal, State, and utility funding programs, incentives, and tax credits — such as the Inflation Reduction Act — cover a portion of building electrification costs. However, most do not cover the full cost or the significant investments needed for pre-electrification and health and safety measures like electrical panel upgrades, roof repairs, or environmental hazard abatement (see "Funding, Incentives, Tax Credits, & Programs for Building Decarbonization" on p. 61 to learn more).

As noted, many households will also need financial support to cover electric utility costs, which may increase for some in the short-term. The graph above shows the average funding gap across all

rent-stabilized, unsubsidized housing units in NYC. This funding gap includes upfront costs, ongoing energy expenditures, energy efficiency cost savings, and electrification tax incentives.

While this analysis shows a significant funding gap for buildings undergoing electrification retrofits from an existing gas system, life cycle costs are positive for buildings switching from fuel oil or electric resistance heating systems. This analysis was completed considering current technology, and it is important to note that technological or process innovation could significantly reduce capital costs in the future, and utility rates may fluctuate in future years and substantially change this calculation.

With limited financial resources, building owners must often prioritize repairs. Since tenants cannot make decisions about rental units or buildings, their needs may not align with the property owners' interest. This can create conflicting opinions about priority housing upgrades.

FUNDING, INCENTIVES, TAX CREDITS, & PROGRAMS FOR BUILDING DECARBONIZATION

The following is a list of notable funding and financing incentives. Incentives are ever evolving; the NYC Accelerator can help to navigate current incentives.

Utility Programs

Con Edison and National Grid offer a variety of energy efficiency and electrification programs, including for building envelope upgrades, energy-efficient appliances, and heat pumps. Some incentives specifically target affordable housing and priority neighborhoods in Brooklyn and Queens.

NYC Green Housing Preservation Program

Offers low to no-interest loans for small and mid-sized multifamily building owners to implement energy efficiency and water conservation projects.

NYS Homes and Community Renewal Programs

- **Weatherization Assistance Program (WAP):** WAP assists income-eligible homeowners and renters by reducing heating and cooling costs through energy-conservation upgrades.
- **Climate Friendly Homes Fund:** Helps fund energy-efficiency and electrification measures in multifamily buildings located in economically disadvantaged areas.

NYSERDA Programs

- **Comfort Home:** Provides a free consultation for residential "seal and insulate" packages with incentives of up to \$4,000 for air leak seals, insulation upgrades, and high-performance windows.
- **Multifamily Buildings Low-Carbon Pathways:** Offers incentive packages for multifamily building owners to upgrade or install building envelope improvements, ventilation, heat pump heating and cooling, and heat pump water heaters.

- **RTEM + Tenants:** Targets commercial office building electricity consumption by sharing up to 33% of the cost of real-time energy management services in leased commercial offices.

Federal Programs

- **Greenhouse Gas Reduction Fund:** Provides one-time grants to develop large programs that reduce GHG emissions through two initiatives: Zero-Emissions Technologies, and General Assistance and Low-Income and Disadvantaged Communities.
- **Inflation Reduction Act Tax Credits for Homeowners:** Offers income tax credits up to 30% of project costs (up to \$3,200 annually) for energy efficiency, electrification, and renewable energy home upgrades.
- **Inflation Reduction Act Tax Deductions for Commercial Buildings:** Provides a tax reduction of up to \$1.80/square foot to building owners who decrease building energy use by 50% through efficient heating, cooling, lighting, and ventilation upgrades (updates to the deduction are currently in progress).
- **Energy Efficiency and Conservation Block Grant Program:** Helps fund state, city, and tribal efforts to improve energy efficiency and reduce carbon emissions.
- **HCR Clean Energy Initiative:** Provides gap financing for the decarbonization work aligned with HCR's Sustainability Guidelines Stretch Goal standards for Adaptive Reuse (AR) projects.

BUILDINGS INITIATIVES

The following section covers key opportunities and potential solutions to accelerate the transition to low-emission, efficient, healthy, and comfortable buildings.

Implementing upgrades such as caulking windows, installing new roofs, insulating walls, installing heat pumps and solar, will vastly improve the indoor living environments. Doing it in a way that commits to maintaining affordability can play a role in preserving affordable housing.

REDUCE COSTS OF ELECTRIFYING RENT-REGULATED, UNSUBSIDIZED LMI HOUSING

To make building upgrades affordable, reduce energy burden, and address health and safety inequities, we must prioritize a comprehensive approach to meet our climate and sustainability targets for buildings without increasing financial burden or accelerating displacement and gentrification. If we cannot bring down the current cost of electricity or comprehensively subsidize and expand programs for electrification retrofits, New Yorkers may continue to face project costs and ongoing maintenance costs as barriers to building electrification.

The City will pursue opportunities to close funding gaps for building upgrades and electric systems by expanding existing programs, leveraging State and Federal funds, advancing green financing mechanisms, and providing free technical guidance to help building owners streamline retrofit costs.

13 Implement Creative Ways to Close the Funding Gaps for Existing Building Retrofits

The influx of federal funding provides an opportunity to fill the funding gap; the City will take several actions to focus this funding where it is needed in NYC.

Leverage Federal Funding and Community Development Financial Institutions (CDFIs): To continue expanding and supporting City programs and services, we will leverage federal IRA funding in addition to private sector sources. We will also explore grant opportunities through federal agencies, including the Housing-Related Hazard Capital Fund (HRHCF) and the Lead-Based Paint Capital Fund (LBPCF).^{cxx} This funding can be used

to support unexpected electric utility delays, including point-of-service reviews or relocations, and for abating environmental hazards, but does not cover deferred maintenance. HPD's HomeFix, as detailed below, can assist certain homes with deferred maintenance.

We will partner with CDFIs for outreach and implementation of these programs and funds. CDFIs have strong connections to local communities and deep knowledge of the needs and goals of the New Yorkers they serve, and they will be crucial partners, particularly for the affordable housing stock. The City will work with these CDFIs to train them on energy efficiency programs and climate retrofits, and partner with them to distribute EPA GGFR and other IRA funding.

Advocate for NYC's Fair Share of Federal Funding: The unprecedented infusion of federal funding through the IRA and BIL provides an opportunity to close the funding gap for electrification retrofits and accelerate the process of decarbonizing NYC's buildings. The IRA provides more than \$360 billion in clean energy and climate funding through new programs like the Greenhouse Gas Reduction Fund (GGFR) and expanded tax credits and direct-consumer rebates.^{cxxi} We will work with Federal and State partners to ensure NYC gets its fair share of funding and that the funding is distributed equitably. We will also work with NYC residents to ensure they can access and benefit from these funds by providing them with up-to-date information and assistance with incentives and tax credits.

Support and Develop Green Financing Tools and Programs: This includes increasing the supply of green financing available for existing buildings. Upfront incentive offerings at the start of construction will further remove risks to owners pursuing complex electrification projects and reduce delays in pooling capital and obtaining financing.

We will support existing programs such as the Property Assessed Clean Energy (PACE) program. PACE is an innovative financing tool that helps commercial and multifamily building owners fund energy efficiency and renewable energy projects.^{cxxii} It offers long-term, fixed-rate financing, covering up to 100% of project costs with no cash up-front from the owner. Additionally, the City is exploring new financing tools for climate retrofit

programs to assist in meeting Local Law 97 requirements while improving energy efficiency and building resiliency.

14 Expand Existing Technical Assistance and Financing Programs

Existing initiatives aim to provide technical assistance and financial support to buildings undergoing decarbonization retrofits. The City will support and expand these in the following ways:

Expand Existing City Programs and Resources: The City offers programs that provide technical assistance and guidance to owners pursuing building decarbonization and electrification retrofits. The City will expand on these programs to increase access to technical assistance and financing for health- and safety-related remediation efforts and electrification retrofits.

The NYC Accelerator offers technical guidance and support for building owners and decision-makers to decarbonize their buildings, including by helping them navigate and access financing and incentive programs available through the City, State, and utilities.^{cxxiii} An expanded Accelerator will provide resources to buildings beyond those subject to Local Law 97, including smaller buildings, and include technical assistance on resiliency retrofits.

HPD's HomeFix program provides LMI households living in 1-4 family homes technical assistance and low-cost or forgivable loans to repair deficiencies that pose hazards to the occupants.^{cxxiv} This may include deferred maintenance projects that will abate environmental hazards like asbestos, lead, and mold. HPD will expand to integrate pre-weatherization, health-related scopes of work into existing programs that fund building envelope and interior finish retrofits. This expansion will be necessary as we scale and accelerate building retrofits across the city.

Together, the programs address multiple building types and assist property owners with a breadth of sustainability and resiliency improvements to buildings. We will continue to expand program services and capacities to fully serve the needs of the NYC building sector.

Advocate for Increased State Weatherization Assistance: We will continue advocating for increased financial assistance through the State's Weatherization Assistance Program (WAP) so New

Yorkers receive the necessary support to complete envelope work that will improve health and comfort and drive down energy loads and utility costs.^{cxxv} We will also refer owners to weatherization resources offered through NYSERDA's Climate Friendly homes initiative.

INCREASE TENANT PROTECTION AND PREVENT ENERGY BURDEN FOR NEW YORKERS

The City is committed to achieving a just energy transition and intent on providing relief to overburdened families who need assistance paying for energy. To create a more equitable energy market and accelerate the pace of residential building upgrades and decarbonization, we must address some of the key factors that contribute to energy burden, including energy rate structures, metering regulations, and limited utility bill assistance. Implementing strategies to prevent energy burden for LMI households will increase the accessibility of building electrification technology and make it more attractive to New Yorkers.

15 Advocate for Progressive Energy Rate Structures

In Con Edison's most recent electric and gas rate cases, the City advocated for the PSC to expand Rate IV — the recently adopted demand-based rate — to address different technology types, incentivize building electrification, and reduce energy burden for NYC consumers.

Our proposal, which was included in the adopted joint proposal for new rates, included a more targeted campaign by Con Edison to increase customer awareness around Rate IV (the fact that it can likely decrease electricity bills). The campaign would include communication materials explaining demand charges and strategies for minimizing electricity demand on peak-hours that New Yorkers could implement.

In addition, we advocated for Con Edison to educate contractors participating in the NYS Clean Heat program, a program that offers rebates and financing options to NY homeowners looking to install heat pumps.^{cxxvi} The goal of this education would be to teach contractors about Rate IV and equip them with materials to share with residential customers summarizing what Rate IV is, describing how this rate can benefit them, and explaining the steps customers would take to utilize Rate IV.

Education of the contractor workforce will help deliver a cohesive message to customers about the facts and benefits of electrification.

We will continue to advocate to the PSC for progressive electric rate structures and improvement of existing rate structures, and rates that promote energy security and affordability for LMI customers, and that advance building electrification. We aim to work collaboratively with the State, Con Edison, and other stakeholders to use energy rate structures to promote energy security.

16 Advocate for Increased Utility Bill Assistance

Advance HEAP Reform: We will continue to advocate for reforms to the State's Home Energy Assistance Program (HEAP), which provides financial assistance to low-income New Yorkers to cover heating costs in the winter and the purchase of an AC in the summer, but which currently does not provide utility assistance during summer months.^{cxvii} Additionally, we are committed to continuing to advocate for easier and more comprehensive enrollment into programs such as HEAP.

Leverage Data to Drive the Expansion of Utility Bill Assistance:

As noted, an analysis of 2017 Public Use Micro Sample data determined that there are more than 480,000 low-income families in NYC that pay over 6% of their income toward energy utilities, making them energy burdened.^{cxviii}

We are in the process of updating this study using the 2021 ACS data and broadening the study to gain an even deeper understanding of energy cost burdened families.^{cxix} Once updated information is available, we will use the new findings to inform our advocacy for broadened utility bill assistance. We will work with the Energy Affordability Policy working group, established at the State level by the PSC, and use the information gleaned from the updated study to reach more vulnerable households within NYC and promote energy equity.

Publish Guidelines on Owner-Tenant Utility Bill Allocation in Electrified Affordable Housing: As buildings transition to electrified heating and hot water systems and grapple with the complexities of energy cost-shifting and split incentives, the City will aim to provide clarity on equitable ways to allocate costs. The City will publish guidelines on how utility bills should be allocated for electrified

affordable housing. Specifically, these guidelines will provide information on how utility bills should be broken up for housing that is transitioning from a central heating structure to a unit-by-unit heat pump setup that provides heating and cooling.

HPD is leading in this area through its publication of Electric Heating Policy, which provides guidance on owner-tenant utility billing strategies for HPD buildings.^{cxix} Additionally, HPD has reformed the utility allowances administered by the housing agencies to accurately reflect current heat pump technologies. The NYC Accelerator assistance program will expand to include utility rate information and assistance ensuring that efficiency measures will be paired with electrification of HVAC systems.

17 Increase Community Engagement in the Energy Landscape

The need to identify energy burdened families and advocate for rate assistance goes hand in hand with the need to provide opportunities for NYC communities to be more involved with the City, State and Federal energy landscape. Creating a more accessible, community-based process for energy and system planning is important. The City will encourage local utilities to do more targeted outreach and frequent visits with community organizations and provide these organizations resource assistance and compensation to disperse information to the community.

This outreach would allow state regulators and utilities to explain important issues that can assist customers from a financial and sustainability perspective. This method of community outreach has been successful in the past. For example, community engagement campaigns focused on gas safety and calling "911" if you smell a suspicious odor have been successful.

As we strive to meet our emission targets over the next few decades, there are opportunities for more coordinated partnerships with the local utilities to discuss energy efficiency, building electrification, access to renewables and more. Providing utility messaging for customer outreach and education (both in written materials and at events) in expanded languages for communities will also assist in propelling more engagement with customers. In accordance with its electric and natural gas rate plans, Con Edison will now offer

information in English, Spanish, Russian, Chinese, Korean, Polish, and Bengali based on Company and external data (e.g., census data) regarding language preference in local communities.

CATALYZE INNOVATION AND SCALE ELECTRIFICATION

Providing programs and incentives that promote retrofitting existing buildings, and modernizing outdated City zoning regulations can help us get there.

18 Phase Out Use of Fossil Fuels in Existing Buildings and Equipment (PlaNYC)

At equipment replacement is the most cost effective and feasible time to electrify building systems. The City will work to ensure replacements phase out fossil fuels and transition to sustainable solutions.

Phase out Capital Spending in Fossil Fuel Infrastructure: To reduce reliance on fossil fuels in City-owned and operated buildings, we will phase out capital spending on fossil fuel-fired equipment, appliances, and building systems. We have already begun replacing certain fossil fuel-fired equipment with electric alternatives and will develop a strategy to electrify almost all equipment as it is replaced. Phasing out capital spending on fossil fuel heating, cooling systems, and equipment will send a strong signal to NYC's design and construction markets that they must prepare for a rapid transition to all electric appliances and equipment. This strategy will consider appropriate uses for biogenic fuels, or fuels derived from organic matter.

We will undertake an analysis to identify building typology specific electrification solutions and identify the hardest-to-electrify buildings and systems. This will lead to a phase-out implementation schedule and drive innovative strategies to address hardest-to-electrify systems on a timeline that aligns with our GHG reduction goals. The analysis will also identify appropriate ways to replace natural gas used in buildings with zero-carbon fuels, such as biofuels, which are created from renewable sources like waste cooking oil and food scraps.

Explore pathways to phase out fossil fuel equipment citywide: We will explore legislation that will phase out the replacement of building



Building envelope improvements are an important retrofit solution to reduce heat and energy loss in buildings, cut GHG emissions, and enhance occupant comfort. Source: MOCEJ

systems, equipment, and appliances that combust fossil fuels citywide. These would include boilers and furnaces for heating and hot water, absorption chillers for cooling, gas stoves and gas dryers, and other equipment that combusts fossil fuels.

Legislation could require replacement of fossil fuel fired building systems and appliances with electric systems and appliances at end of useful life, beginning at a date certain to give building owners and professional communities time to prepare.

The phase-out would consider sales of combustion systems, equipment and appliances; restrictions on operational permits for combustion equipment; and new mandates for electrical upgrades at the time of an alteration to make a building “electrification-ready” with adequate electric capacity and infrastructure for future heat pumps, electric cooking installations, and electric vehicle and micromobility devices chargers where appropriate.

Advance electrification retrofits in Affordable Housing:

For affordable housing in NYC, HPD will be investing in energy retrofits as it implements its recently published Design Guidelines, as detailed in *PlaNYC 2023*.^{cxxxix} These guidelines require all electric and flood resilient new construction projects. For existing buildings, the preservation guidelines will be used to guidelines will be used to spur partial or full electrification in more than 5,000 units of affordable housing by 2026 and incorporate energy efficiency, resiliency, and health upgrades. In addition, the HPD Retrofit Electrification Pilot will incentives and technical support for up to 1,200 dwelling units.

19 Implement Innovative Clean Energy Solutions for Affordable and Public Housing

NYC will continue to invest in decarbonizing our affordable and public housing through the following innovative programs.

Implement NYCHA Clean Heat for All: We will implement the NYCHA Clean Heat for All program to ensure that all New Yorkers will be able to participate equitably in the clean energy transition. Clean Heat for All was launched in 2022 in partnership with NYPA and NYSERDA, to invest \$70 million to the development and production of 30,000 window-mounted cold climate heat pumps for units in multifamily public housing.^{cxxxix} Installing traditional heat pump technologies is often prohibitively expensive and disruptive to residents,

due to high upfront costs, electric panel upgrades, and refrigerant lines needs that require wall drilling. Clean Heat for All seeks to address these barriers to clean heating and cooling adoption through easy-to-install window heat pumps that avoid building modifications.

By deploying affordable and minimally disruptive heat pump technologies, NYCHA will be better positioned to meet its target of 80% greenhouse gas reductions by 2050, as mandated by Local Law 97, and NYCHA residents will have greater access to clean heating and cooling systems that they can directly control. The apartment upgrade scope will include light-touch weatherization measures, such as window replacements, in addition to purchase and installation of window-mounted heat pumps.

Demonstrating these user-friendly and affordable heat pumps throughout NYCHA’s portfolio will provide a pathway for other residential buildings to electrify using this innovative technology.

NYCHA ACCESSSolar: In Spring 2023, NYCHA announced expansion of ACCESSolar, which aims to achieve 30 MW of solar by 2026, reducing electricity rates for low-to-moderate-income households. According to the recent announcement, “the electricity generated from these systems will provide a discounted electricity rate for approximately 725 New York City households. Most of this power will be reserved for LMI New Yorkers, including NYCHA residents who pay their own electric bills and Section 8 voucher holders across the city.”^{cxxxix}

HPD Decarbonization Roadmap: Also in Spring 2023, HPD released their *Decarbonization Roadmap for Multifamily Affordable Housing*.^{cxxxix} This roadmap outlines comprehensive clean energy and energy efficiency strategies to meet Local Law 97 requirements and create safe and climate resilient buildings.

20 Promote Awareness and Education on Building Electrification Solutions For 1-4 Family Buildings and Other Small Building Owners

While New York City, State, and local utilities offer various rebates, tax credits, and loans for building electrification, efficiency, and weatherization, the processes of navigating and accessing them can be challenging. There is a lack of cohesive literature on state, federal, and local programs, incentives, and rules, making it difficult for building

owners to find information necessary to take full advantage of existing opportunities. Additionally, some building owners may be aware of these incentives but not know which incentives can be used together, or “stacked”. As it stands, most sources of funding for building efficiency and electrification are disconnected from one another, with no streamlined process to apply.

We can improve program transparency and information-sharing to increase awareness and accessibility of funding sources by creating and sharing literature with interested building owners about available incentive programs, application processes, and programs that can be stacked.

For example, the NYSERDA *Heat Pump Planner* acts as a resource guide for building owners looking to electrify their buildings.^{cxxxv} The guide covers the basics of electrification and available options, as well as operational concerns including information on timing, finding a contractor, energy cost shifts, and available state incentives. The creation and expansion of this guidance is led by NYSERDA and promoted by the NYC Accelerator. The DOB will amplify it through its education and outreach unit.

Beyond this resource, we will promote State, utility, and U.S. Department of Energy resources into DOB’s education and outreach. We will maintain these and other resources in an online platform for building owners and managers to access the suite of available programs, the respective application process, and specific program rules.

For customized guidance in 1-4 family homes, the ElectrifyNYC program acts as a “one-stop-shop” for electrification retrofit applicants to gather any necessary or helpful information, though limited to Queens and Staten Island.^{cxxxvi} ElectrifyNYC provides information on all available sources of rebates, tax credits, financing options, and other programs that are available on a Federal, State, and local level. Industry practitioners, real estate owners, and developers will also be able to access trainings on how to access and bundle multiple program offerings, including energy bill assistance resources and incentives directed to LMI housing. This program will sunset at the end of 2024 and similar methods will continue through the NYSERDA regional clean energy hubs program, expanding to all NYC boroughs and the state.^{cxxxvii}

KEY TERMS

Building Envelope: Parts of the building that separate the inside from the outdoors, including exterior walls, roofs, windows, doors, and insulation.

Electrification: The process of replacing fossil fuel-based systems and technologies with ones powered by electricity.

Energy Burden: The percentage of household income spent on energy bills. The PSC considers households spending more than 6% of their income on energy bill to be energy burdened.

Energy Insecurity: Inability to afford reliable energy connection for basic electricity needs.

Funding Gap: The difference between what an individual or building owner can afford to pay and the total cost of an energy efficiency or electrification project.

Metering Configuration: The way that a building’s energy use is measured and monitored, whether at a whole-building or individual unit level.

Strategic Phasing: Planning building electrification measures to coincide with existing equipment life cycles and required upgrade timelines. This ensures that electrification equipment is installed at the most economical time.

Utility Allowance: A pre-defined subsidy provided to regulated affordable housing for utility payments.

Utility Rate Structure: A utility’s method for determining how much to charge for electricity, whether by volume of energy used, differing rates depending on total energy demand, or tiered rates based on income.

Weatherization: Increasing a home or building’s protection from storms and cold weather by implementing measures like improving insulation or sealing windows.



Photo Source: Adobe Stock

Taking Action: Transportation

New York has long been a multi-modal, public transit-friendly city. Through the NYC Streets Plan, the City has promoted increased walking, biking, and use of public transit, and through our Vision Zero Action Plans strived to make mobility safe for all. These plans, coupled with the City's extensive network of bike lanes, expansion of bikeshare and e-scooter share, and programs to prioritize buses, have increased the total share of trips made by biking, walking, and public transit. As of fall 2022, these modes accounted for 65% of trips made in NYC.^{cxxxviii} By 2050, the City aims to increase this share to 80% of all trips. Many of the initiatives that the City is implementing to achieve this goal are highlighted in *PlaNYC – Getting Sustainability Done*.

ADDRESSING POLLUTION AND PUBLIC HEALTH

NYC's transportation sector currently accounts for roughly 30% of citywide GHG emissions. While this is a far lower share than in other cities — largely due to New Yorkers' high adoption of walking, biking, and mass transit — many trips not suitable for those modes are taken in privately owned on-road vehicles, taxis, and for-hire vehicles. These private vehicles account for 90% of transportation-based energy use in NYC and are the largest contributors to transportation-related emissions and air pollution. Through our *PowerUp* initiatives, the City is prioritizing solutions that advance and accelerate the decarbonization of this sector.

In New York State, 92% of vehicle energy demand is fueled by petroleum products, which emit planet-warming GHGs and pollutants that degrade our environment and local air quality. For example, on-road vehicles produce 25% of local nitrogen oxides emissions, 14% of PM2.5 emissions, and also form ozone, all of which increase rates of respiratory and cardiac hospitalizations, asthma emergency department visits, and premature deaths.

Heavy-duty vehicles — such as large buses and trucks — largely run on diesel fuel and are responsible for moving freight in and around NYC and providing critical emergency services. About 200 million tons of freight move into, out of, or within the city each year, with 90% of goods transported by heavy-duty trucks.^{cxxxix} The resulting air pollution - which includes GHGs, particulate matter and black carbon - threaten human health and exacerbate the global climate crisis. Our reliance on diesel trucks disproportionately burdens disadvantaged communities and communities of color, many of which are adjacent to the city's industrial areas and are now home to a growing concentration of last-mile delivery facilities. Along with buildings, car and truck traffic are the emissions sources most responsible for disparities in air quality between different NYC neighborhoods.^{cxli}

ACCELERATING ELECTRIC VEHICLE ADOPTION

Although most cars and trucks still run on gasoline and diesel, electric vehicles (EVs) are becoming increasingly cost-competitive and popular. DOT has

projected that we will need EV market penetration of 400,000 vehicles across the five boroughs by 2030 and 1.6 million vehicles by 2050 to achieve the City's carbon neutrality goals.^{cxli} As NYC transitions to a clean energy economy, we are taking action to overcome hurdles that have historically hindered greater EV adoption — such as limited access to charging stations and challenges unique to for-hire vehicles and heavy-duty vehicles — while leading by example with our municipal fleet.

HEAVY-DUTY VEHICLES

Reducing emissions and pollutants from heavy-duty vehicles is not as straightforward as it is with other vehicles, because they are significantly more difficult and expensive to electrify. Batteries for heavy-duty vehicles must be bigger and hold more power, which drives up vehicle and charging costs. NYC relies on heavy-duty vehicles to move freight and maintain business operations throughout the city and provide emergency services and this reliance creates challenges to reducing their use.

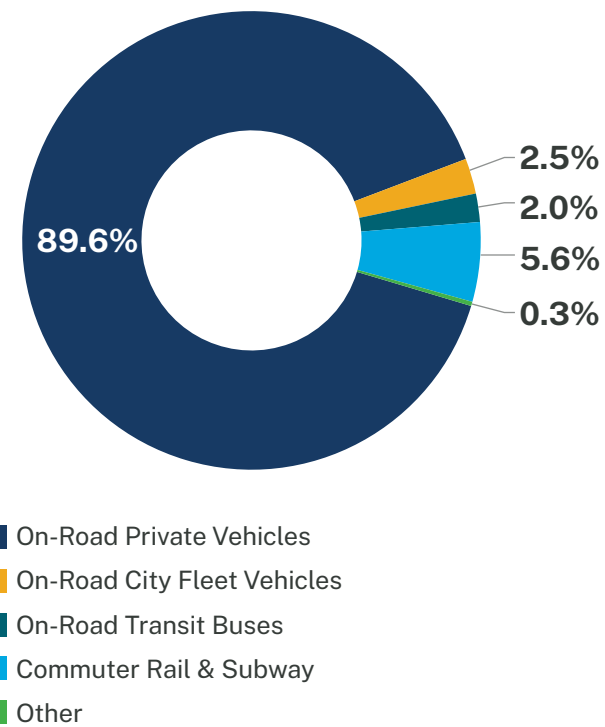
The City is already examining pathways to reduce heavy-duty vehicle pollution. For instance, the NYC Department of Transportation (NYC DOT) released *Delivering New York: A Smart Truck Management Plan for New York City* in 2021, examining the safety, efficiency, and sustainability of NYC's trucking industry and plans for improvement going forward.^{cxlii} The BIL and the IRA also include multiple federal funding levers to support pollution reduction from heavy duty vehicles. This includes new tax credits and direct payments, as well as new competitive programs like the \$1 billion Clean Heavy Duty Vehicle program.^{cxliii}

FOR-HIRE VEHICLES

Mayor Adams announced in the 2023 State of the City that Uber and Lyft will be required to achieve a zero-emissions fleet in NYC by 2030.^{cxliv} Current policy acknowledges that market penetration necessitates EV adoption in both the public and private sectors. This includes the City's fleet, freight and trucks; privately-owned vehicles; taxis; and for-hire vehicles (FHV) like those dispatched by Uber, Lyft, and other companies.

To further this goal, electrification policies acknowledge that the variability of vehicle use and size will pose unique challenges and distinct cost considerations. The City continues to work with the State, utilities, and the private sector to ensure

Drivers of NYC's Transportation Emissions



On-road private vehicles account for nearly 90% of all transportation-related emissions in NYC. Source: MOCEJ

energy reliability and the construction of a robust network of vehicle charging infrastructure to support transportation electrification.

PUBLIC TRANSIT

Trips taken via NYC's public transit system — including subways, railroads, and buses — avoids over 17 million MTCO_{2e} per year that would otherwise be emitted if New Yorkers used other modes of transportation.^{cxlv} Our subway is already powered by electricity and the Metropolitan Transportation Authority (MTA) has committed to transitioning to an all-electric bus fleet by 2040 to reduce GHG emissions, other pollutants, and noise.

CITY-OWNED FLEETS AND SCHOOL BUSES

In recent years, our fleet has emitted over 250,000 tons of carbon dioxide equivalent, and converting the fleet to all-electric would have huge implications on the City's ability to meet climate targets. The City is committed to procuring EVs for City-owned fleets of cars, school buses, and heavy-duty vehicles like sanitation trucks and ambulances to reduce emissions from our transportation sector and lead the way for broader

Various Electric Vehicle Types Charging



The City is prioritizing transportation solutions that will accelerate market penetration of charging infrastructure and electric vehicles of all types, to achieve our climate action goals while promoting equitable access to transit opportunities.

market transformation. The City operates over 30,000 vehicles, both owned and leased, making it the largest municipal fleet in the United States.^{cxlvi} We have set a target to reduce GHG emissions from the fleet by 50% by 2025 and have committed to transitioning our light- and medium-duty on-road vehicles and all non-emergency trucks to an all-electric fleet by 2035.

In addition, NYC has over 10,000 school buses that support roughly 9,000 routes servicing schools across the five boroughs. As of 2022, New York City and State are requiring all new school buses purchased in the 2027 school year or later to be zero-emission vehicles and for all operating school buses to be converted to electric by September 1, 2035.^{cxlvii}

There are several considerations involved in achieving these goals. For instance, NYC's school bus fleet is operated by more than 50 different vendors, meaning that the switch to an all-electric fleet must be completed in coordination with many parties. Bus fleet personnel will also require training for driving, properly maintaining EVs, and optimizing charging for electric bus routes, energy needs, and intra-day energy price fluctuations.

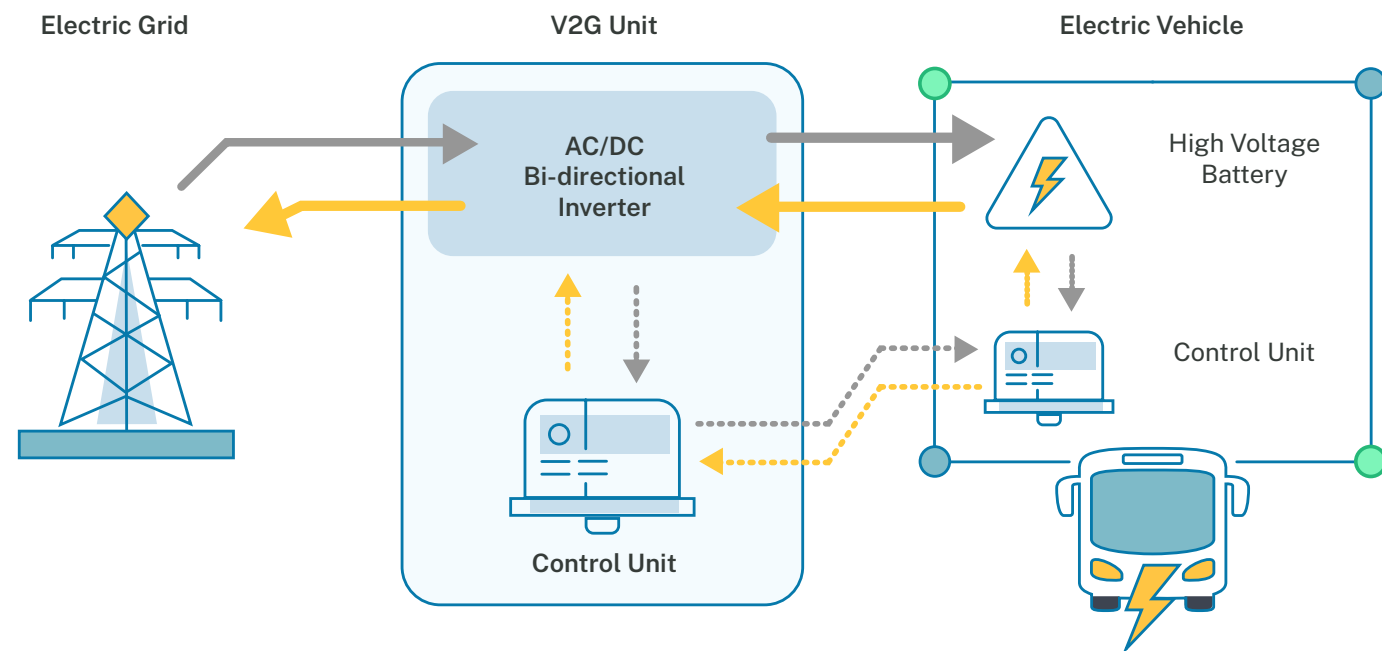
Additionally, while the price of electric school buses is likely to decrease as technologies and economies of scale improve, they are currently three to four times the cost of new diesel school buses, on average, largely due to supply chain challenges and the high cost of batteries.^{cxlviii}

EV CHARGING

School Buses: Beyond the costs of the buses themselves, transitioning to an all-electric school bus fleet will require significant investments in charging infrastructure. School bus operators will need to make upfront decisions about the type of charging infrastructure and number of chargers they need for their fleet. These decisions will often need to be made months or years before implementation due to long order lead times and the nature of the infrastructure planning process, limiting the ability to test equipment and operational assumptions before purchasing the first round of buses. Planning decisions will also be shaped by constraints like the size of school bus lots. NYC school bus lots are notoriously cramped, and operators likely will struggle to fit all currently housed buses plus new charging infrastructure in an accessible manner. Bus operators will also need to rely on outside resources or upskill staff and build expertise in engineering, installing, and maintaining this equipment.

All Vehicles: Challenges related to charging infrastructure are not unique to the City's school buses but are universal to all types of EVs. As of April 2023, there were approximately 36,000 EVs registered in NYC — roughly 1.7% of all registered vehicles — yet less than 2,000 chargers had been installed. DOT projects that NYC must have 45,000 chargers installed across the five boroughs by 2030 and more than 200,000 chargers by 2050 to achieve our climate action goal.^{cxlviii}

How Do Vehicle-to-Grid (V2G) Charging Systems Work?



V2G charging systems use a vehicle's battery to pull energy from the electric grid when electricity is cheap, and store it for use later at times when grid electricity is more expensive.

Vehicle-to-grid (V2G) Charging Systems: V2G charging is an innovative solution to use EVs for energy storage. A V2G vehicle uses the vehicle's battery to pull energy from the grid for storage when electricity is cheap and acts as a generator to push energy back to the grid at times when energy is more expensive. This generates a net profit while also reducing strain on the grid. V2G can provide additional revenue to vehicle and fleet owners and operators, easing some of the costs of electrification.

TRANSPORTATION INITIATIVES

The following section covers key actions that the City is taking to decarbonize NYC's cars, buses, and most energy-intensive modes of transportation to promote a sustainable, reliable, and equitable transportation system. We can cut emissions significantly by making electric transportation more accessible and enabling all New Yorkers who must drive to drive electric. We can leverage unprecedented levels of federal funding available through the Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL) to help achieve these goals.

EXPAND ACCESS TO PERSONAL AND FOR-HIRE EVS

Charging infrastructure availability and EV costs are still relatively prohibitive in NYC, hindering many New Yorkers who must drive from accessing electric transportation options. Accelerating uptake of EVs means making charging infrastructure more widely available and addressing solutions for both personal and for-hire vehicles (FHV).

21 Support Transition of Personal Vehicles to EVs

PlaNYC

The City has set ambitious policies to accelerate adoption of EVs and catalyze rapid deployment charging infrastructure. We will use regulations and incentives to support the transition of all New Yorkers' personal vehicles to electric vehicles. However, in order to electrify transportation in NYC, we must first ensure that all EVs, whether personally owned or part of a commercial fleet, have access to charging infrastructure. We will make direct investments and collaborate with partners in the private sector to create a comprehensive network of publicly accessible

fast charging hubs across the city and ensure that every New Yorker is no more than 2.5 miles from an electric vehicle fast-charging hub by 2035, as committed in 2023's *PlaNYC*.

Expand Curbside and Fast Charging: We will pursue federal funding from the US DOT's National Electric Vehicle Infrastructure Formula Program (NEVI), which allocates \$1B annually nationwide to state governments.^{cxlix} NYS is poised to receive \$175M over five years to focus on electric vehicle fast charging along Alternate Fuel Corridors, nationally-identified highways that are critical for interstate passenger and freight transportation. The Charging and Fueling Infrastructure Grant Program (CFI) includes funding for both curbside charging in community or urban settings and fast charging along critical highways.^{cl} The City intends to submit applications for these funds to bring the Federal Highway Administration (FHWA) in as a partner to expand both curbside charging and fast charging in the city.

Update Zoning Regulations for Additional Charging: As part of the City of Yes for Carbon Neutrality Citywide Zoning initiative, we will update zoning regulations to allow public EV charging facilities in all commercial districts, more than doubling the commercial land area available for EV charging facilities. The text amendment will also facilitate the expansion of EV charging in existing parking facilities.

22 Electrify the Taxi and For-hire Industries

PlaNYC

New York City's more than 13,500 taxis^{cli} and approximately 100,000 FHVs are a key component of the City's transportation system, enabling many New Yorkers to achieve high levels of mobility without owning cars. Expanding access to electric transportation requires electrifying the taxi and for-hire industries. The Taxi and Limousine Commission (TLC) published *Charged Up! TLC's Roadmap to Electrifying the For-hire Transportation Sector in New York City* in 2022, which established the goal of electrifying the vast majority of the FHV fleet by 2030.^{clii}

In addition to this goal, TLC will establish the Green Rides Initiative. This initiative will result in high-volume for-hire services (HVFHS), such as Uber and Lyft, incrementally increasing the number of trips taken by EVs between 2024 and 2030, with the goal of making all non-wheelchair-

accessible trips in EVs by 2030. As part of this initiative, TLC will work with drivers and HVFHS companies to ensure that drivers have adequate access to incentives for purchasing and charging EVs and ample access to charging infrastructure — including fast and level-2 charging in areas where taxi and for-hire vehicle drivers live and work — to meet the goals of the initiative.

ELECTRIFY SCHOOL BUSES

Transitioning to a fleet of electric school buses will be costly and challenging, but by leveraging an unprecedented influx of federal funding, we can significantly improve the cost-effectiveness and accelerate the process.

Leverage Federal Funding: There are multiple opportunities to make the transition to electric school buses easier and more cost effective. For one, the federal BIL is providing more than \$5 billion over five years through the US EPA's Clean School Bus Programs to help with the transition to clean vehicles.^{cliii} Funding opportunities include both a grant program and a recurring competitive rebate program. NYC school bus operators received 51 electric school buses through the EPA Clean School Bus Rebate program in 2022.^{cliv}

Repower Diesel Buses: A potential cost-saving alternative to buying new electric buses is to "repower" existing diesel buses by replacing the diesel engine with an electric drive system and battery. This can be done in a matter of weeks, making it faster than ordering new electric buses. Repowering can also be more cost effective, but the process depends on the individual bus characteristics such as age and model.

Adopt Innovative Charging Strategies: Where operationally feasible, sharing charging stations between multiple buses would decrease the necessary investment in charging infrastructure. Managed charging, or charging buses during a time of the day when electricity is at a lower cost, would provide further cost savings. Additionally, school buses are strong candidates for managed charging and V2G, as their set routes and inactivity during the summer months mean they typically are not driving during peak electric demand periods.

Analysis shows that implementing managed charging alone could save bus operators 62% on electricity costs associated with electric school buses (see the *PowerUp Technical Appendices* for

more detail). V2G may further improve this prospect, though it may come with upfront equipment costs and require hourly charging optimization to ensure that operators are generating revenue. Powering hubs developed on vacant city lots or through public-private partnerships may also serve as critical support for school bus charging needs. These power hubs could offer charging infrastructure to school vendors with cramped lots, school bus operators in the middle of their routes, or vendors experiencing delays in getting their charging infrastructure up and running.

23 Incorporate Electrification Requirements in 2025 Contract Renegotiation with School Bus Fleet Vendors

In the next contract negotiation with school bus fleet vendors in 2025, we will incorporate requirements to electrify the fleet. We will work to support the electrification of school buses with routes serving or passing through environmental justice communities, to counteract the adverse impacts of poor air quality in these areas.

As part of this work, we will explore public-private partnerships to develop powering hubs, prioritizing these communities, to offer additional charging infrastructure to vendors and operators in need. As we recognize the risks inherent in launching a relatively new technology and process in disadvantaged communities, we will work closely with bus operators to provide additional support in the operation and launch of electric school buses, such as managing vehicle downtime and determining the charging needs of newly electrified fleets.

24 Implement Lessons Learned from Vehicle-to-Grid (V2G) Pilots

Led by NYC School Bus Umbrella Services' (NYCSBUS), a not-for-profit corporation that provides bus services to NYC students, we will complete a V2G EV School Bus Case Study at Zerega Avenue in the Bronx. The results of the study, along with the results of numerous pilots conducted in other cities, will be analyzed to inform future rollouts of V2G infrastructure and programs.

The V2G pilots serve to uncover the on-the-ground challenges of V2G maintenance and operations and the opportunities to expand the programming. These pilots inform the best practices that will guide the deployment of 50 electric buses in the upcoming 2023-2024 academic year and the broader transition to an electric school bus fleet.

V2G PILOT: WHITE PLAINS, NY

ConEdison and National Express created a pilot V2G school bus program in White Plains that ran for three years.^{clxiv} The purpose of the pilot was to gauge V2G viability, investigate whether electric buses meet operational requirements on a standard bus route, and examine the battery impacts of V2G. Overall, V2G was deemed viable, and buses were able to meet regular operational requirements with high community satisfaction. Though electric bus batteries did degrade faster, it was just due to faster charging cycles. The White Plains pilot can serve as a strong starting point for NYC's investigation into electric school buses as V2G assets.

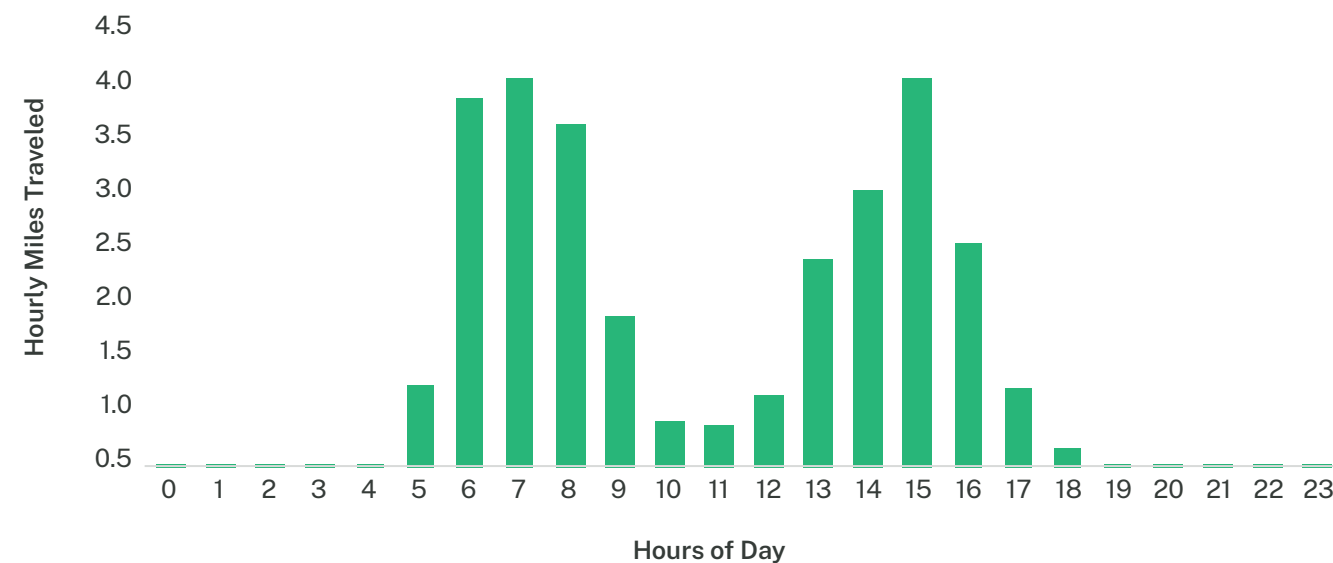
25 Acquire State and Federal Funding for New Bus Purchases

We will continue to explore grant and rebate opportunities through the U.S. Environmental Protection Agency's Clean School Bus Programs to help bring down costs of repowering or acquiring electric buses. The first costs of new electric school buses remain high during this early period of the electric vehicle transition. As we gain clarity around the opportunities afforded by the IRA, we will leverage Federal incentives and newly budgeted State incentives to ensure the electrification of school buses is fulfilled equitably. We will also work with local utilities to understand and benefit from any incentives for installing charging infrastructure or savings from participation in electric vehicle charging programs.

26 Launch Training Program for Electric School Bus Operations and Maintenance and Provide Ongoing Support

We will expand workforce opportunities and train school bus operators and maintenance staff to participate in the EV transition. Training programs will address driving considerations and basic vehicle and charger maintenance as well as the complexities of managing charging to meet route needs with minimal costs. As the use of V2G systems progresses from pilots to broader implementation, training will also cover these operations. NYCSBUS recently received funding

School Year Weekday Driving Profile



NYC's school buses drive two routes a day: one in the morning hours to take students to school and one in the afternoon to take students home. These predictable use patterns make NYC school buses strong candidates for managed charging and V2G, as their set routes mean they typically are not driving during peak electric demand periods.

from NYSERDA to work with Bronx Community College to develop a state-wide training program for electric school bus operators and maintainers. In addition, the City will explore the feasibility, costs and benefits of self-repowering school buses for electrification with NYCSBUS. This effort will offer training opportunities for maintenance staff and inform future repowering efforts, which will likely drive down costs. This work will serve as an initial training needs assessment, and we will continue to develop these programs.

REDUCE POLLUTION FROM CITY FLEETS

With the largest municipal fleet of vehicles in the nation, the City is leading by example in the transition to EVs to reduce transportation-based emissions and pollutants.

27 Electrifying the City's Fleet

With such a large fleet, we will have to invest significantly in new vehicles and more charging infrastructure. Our fleet includes law enforcement and emergency response vehicles, which will have different charging needs and patterns.

Transition to a Clean Fleet: We will lead by example with investments in City-owned zero-emissions assets. We will fully execute the Department of Citywide Administrative Service's (DCAS's) *Clean Fleet Transition Plan* to complete the commitment to electrifying city-owned vehicles and investing

in the support structures to properly maintain and operate the new fleet.^{clv} We will further negotiate terms that would allow electric vehicle charging and, where feasible, solar photovoltaic panels on carport canopies. However, this type of development would be highly dependent on the building type and characteristics.

Pursue Federal Funding Levers: One of the new federal financing levers from the IRA includes a series of tax credits or direct payments, including for EVs, available to municipal governments from 2023 to 2032. The City will be able to submit for a credit of up to \$7,500 per vehicle. This will dramatically support the City's ability to purchase these vehicles and convert to electric.

REDUCE POLLUTION FROM HEAVY-DUTY VEHICLES

Reducing pollution from heavy-duty vehicles is crucial to reducing emissions and improving local air quality and health. The City will work to accelerate adoption of electric-powered trucks, reduce pollution from truck idling, and establish low-emission freight zones.

28 Electrify On-road Freight Movement (PlaNYC)

Expand the NYC Clean Trucks Program: We will continue advancing transportation policy to accelerate the transition from conventional to electric vehicles. We will expand the NYC Clean

FREIGHT ELECTRIFICATION – MANHATTAN BEER DISTRIBUTORS

In 2021, Manhattan Beer Distributors purchased a fleet of five electric Volvo trucks to distribute inventory from the company's warehouse in the South Bronx. The purchase was made as part of the NYC Clean Truck Program in partnership with New York State. Manhattan Beer Distributors serves 25,000 customers in and around NYC and serves as a primary example investing in on-road freight movement.^{clxv}



Manhattan Beer Distributors EV truck charging at the company's South Bronx Warehouse. Source: MOCEJ.

Trucks Program, which promotes a cleaner environment by offering incentives to truck owners to replace their old polluting vehicles with cleaner new ones. The program will be expanded to encourage uptake of zero-emissions travel for last mile freight deliveries, with a focus on policies that will reduce the impacts of freight traffic in environmental justice communities.

Establish Low-Emissions Freight Zones: The City will explore ways to incentivize the use of low- and low/zero emission trucks through the creation of low-emission freight zones in areas with the highest concentration of truck traffic and the worst public health outcomes. We will study a range of pricing, regulatory, and incentive options, and pilot a program to benefit one or more environmental justice communities by 2027. Other global cities such as London have used low-emissions zones to catalyze shifts to sustainable modes and EVs.

Explore Incentive Opportunities: To catalyze the decarbonization of freight trucking, the City will explore further incentives for fleet owners to purchase medium- and heavy-duty electric vehicles as part of a broader strategic investment plan developed with industry partners. We will also seek funding to develop shared, publicly accessible electric charging depots for trucks and other medium-duty vehicles. These charging depots will be developed through public-private partnerships.

29 Reduce the Effects of Trucks in Our Communities and on Our Infrastructure

PlaNYC

Truck traffic and idling leads to heavy air pollution that degrades human health and is often concentrated in EJ communities. The City is committed to a number of actions to mitigate these harms and get polluting trucks off NYC streets.

End Unlawful Truck Idling: NYC has the largest resident idling complaint program in the United States, and the only program that offers monetary incentives for reporting idling.^{clvi} While the program has grown significantly, many large fleets continue to idle repeatedly. By 2024, we will implement a series of reforms to continue to increase participation and improve the program's effectiveness through increased fines, streamlined processes, and simplified participation to ensure that trucks are not contributing to pollution or GHG emissions while parked.

Promote Rail, Marine Shipping, and Cargo Bike Deliveries: We will also improve rail and maritime infrastructure as part of the Blue Highways Program,^{clvii} to expand alternative modes for moving freight to and across the five boroughs. We will promote commercial cargo bikes for last-mile deliveries to reduce the impact of short-haul trucking, as outline in 2023's PlaNYC.

We will continue to support NYC DOT's commercial cargo bicycle pilot which incubates micro-distribution centers in densely populated neighborhoods. These programs will supplement the City's full execution of both *Delivering New York: A Smart Truck Management Plan for New York City* and *Delivering Green: A Vision for a Sustainable Freight Network Serving New York City* to improve the safety of truck movement while also improving efficiency and operations to run businesses sustainably.^{clviii}

Require Transportation Management Plans: The Mayor's Office, working in collaboration with the City Council, will propose local legislation requiring projects including as-of-right buildings — which generate significant truck and vehicle traffic — to provide a Transportation Management Plan (TMP).

The goals of TMPs will be to identify measures to improve transportation safety and operations while promoting citywide traffic reduction by prioritizing marine and rail freight movement. TMPs will

also be required to address air quality, including through prioritizing alternative fuel vehicles.

As a functional step of the building permitting process, this requirement would apply to all projects meeting the established criteria, whether they are as-of-right or subject to City Environmental Quality Review (CEQR) and include last-mile-delivery centers built in manufacturing districts if they generate significant vehicle traffic.

KEY TERMS

Charging Depot: A location with multiple large-scale electric vehicle chargers where medium- and heavy-duty trucks can charge overnight.

Electric Vehicle (EV): While typical cars and trucks run by burning gasoline and diesel, electric vehicles can plug into specialized power outlets and run on electricity without emitting pollution.

Fleet: A fleet consists of the vehicles owned by a business, government, or some other organization, as opposed to the vehicles owned by an individual.

For-Hire Vehicle (FHV): A vehicle that provides transport in exchange for a fee, like those dispatched by rideshare companies like Uber and Lyft.

Heavy-Duty Vehicle: Very large vehicles including cargo trucks, trailers, and tractors, that typically exceed 26,000 pounds.

Last-Mile Delivery: Last step in the delivery process where products are transported from a local distribution facility directly to the customer's location. Has significantly increased in the last decade and since the COVID-19 pandemic with the rise of e-commerce.

Managed Charging: Charging large electric vehicles like school buses at times of day when electricity demand is low, and therefore cheaper to utilize.

Vehicle-to-Grid (V2G) Charging System: Uses an electric vehicle like a battery storage system, charging the vehicle when energy demand is low, and selling energy back to the grid when energy demand is high.



EV charging infrastructure for the NYC municipal fleet. Source: MOCEJ.



Photo by Martina Mainetti on Unsplash

Next Steps

Climate change is a generational crisis. In recent years New York City has experienced increasingly frequent and intense rainfall, as well as hurricanes, floods, extreme heat, and poor air quality due to Canadian wildfires. *PowerUp*, the City’s first-ever Long-Term Energy Plan, is an important component of the City’s climate action and resulted from collaboration with environmental justice experts, residents, and energy professionals.

PowerUp is a combination of science-based research, local and state climate policy, and stakeholder input that has generated innovative initiatives to address climate change, energy, and equity challenges.

Its action-based ideas for the energy grid and community energy systems, buildings, and the transportation sector will invigorate the local green economy, reduce air pollution, and minimize our city’s contributions to the climate crisis. They will advance a just transition by improving public health, good-paying creating jobs, reducing energy cost burden, and building community wealth.

Anticipating an unprecedented influx of state and federal funding, the City has identified and begun to implement initiatives to achieve 100% clean energy by 2040, electrify the building sector, and decarbonize transportation.

This report’s findings on energy storage on City-owned land, community solar, grid readiness, and the funding gap for electrification retrofits and energy costs will help the City in its implementation and help us meet our ambitious climate goals.

The City is committed to incorporating feedback from diverse stakeholders, including environmental justice organizations, industry professionals, and academic experts to inform NYC’s energy priorities. We are grateful for the comprehensive input provided to make this report a reality and eager to continue collaboration as we tackle implementation challenges. This report proves that community involvement in energy planning can lead to creative ideas that benefit all New Yorkers.

The City has some of the most ambitious clean energy goals and policies in the country. In this report, we have laid out concrete steps to achieve them. The City looks forward to working with existing and new public, private, and community partnerships to implement our ever-growing portfolio of clean energy initiatives.



Appendices

End Notes
Glossary
Acknowledgements

End Notes

- i 2017 N.Y.C. Local Law No. 248, N.Y.C. Admin. Code §§ 3-126. https://www.nyc.gov/assets/buildings/local_laws/ll248of2017.pdf
- ii 2019 N.Y.C. Local Law No. 97, N.Y.C. Admin. Code § 26. https://www.nyc.gov/assets/buildings/local_laws/ll97of2019.pdf.
- iii Chapter 106 of the Laws of 2019. <https://www.nysenate.gov/legislation/bills/2019/S6599>.
- iv New York City Department of Transportation. (2012). Electrifying New York: An Electric Vehicle Vision Plan for New York City in 2021. <https://www.nyc.gov/html/dot/downloads/pdf/electrifying-new-york-report.pdf>.
- v U.S. Environmental Protection Agency. (2023). Power Plants and Neighboring Communities. <https://www.epa.gov/power-sector/power-plants-and-neighboring-communities>; see also Wu, X., et al. (2020). Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis. *Science advances*, 6(45), p.4049. [/projects.iq.harvard.edu/covid-pm](https://projects.iq.harvard.edu/covid-pm).
- vi Plumer B. (2021). New York Storm Updates: As Ida Deaths Rise, N.Y. Leaders Look Toward Future Storms. *The New York Times*. <https://www.nytimes.com/live/2021/09/03/nyregion/nyc-flooding-ida>.
- vii United Nations Development Program. (Nov. 3, 2022). What is a just transition? And why is it important? <https://climatepromise.undp.org/news-and-stories/what-just-transition-and-why-it-important>.
- viii 2018 N.Y.C. Local Law 108, N.Y.C. Admin. Code §§ 24-806. [882ac9e9-43b1-45ea-a4f7-5fedda9ef6aa.pdf](https://www.nyc.gov/assets/legistar1/com/5fedda9ef6aa.pdf) (legistar1.com).
- ix 2019 N.Y.C. Local Law 99, N.Y.C. Admin. Code §§ 3-126. <https://nyc.legistar1.com/nyc/attachments/909ae4bd-5b95-42aa-86e6-373e26926c5c.pdf>.
- x 2019 N.Y.C. Local law 181, N.Y.C. Admin. Code §§ 4-207. [4e3f44ec-dc7e-4b34-9623-461752774a7d.pdf](https://www.nyc.gov/assets/legistar1/com/4e3f44ec-dc7e-4b34-9623-461752774a7d.pdf) (legistar1.com).
- xi 2021 N.Y.C. Local Law 154, N.Y.C. Admin. Code §§ 24-177.1 [ll154of2021.pdf](https://www.nyc.gov/assets/legistar1/com/ll154of2021.pdf) (nyc.gov).
- xii NYISO, et al. (2021). Power Trends 2021: New York's Clean Energy Grid of the Future. [hereinafter Power Trends 2021]. <https://www.nyiso.com/documents/20142/2223020/2021-Power-Trends-Report.pdf/471a65f8-4f3a-59f9-4f8c-3d9f2754d7de>.
- xiii U.S. Energy Info. Admin. (Nov. 17, 2022). New York Energy Consumption Estimates 2021. <https://www.eia.gov/state/print.php?sid=NY>.
- xiv U.S. Energy Info. Admin. (Apr. 30, 2021). New York's Indian Point nuclear power plant closes after 59 years of operation. <https://www.eia.gov/todayinenergy/detail.php?id=47776>.
- xv New York City Mayor's Office of Climate and Environmental Justice. PlaNYC: Getting Sustainability Done (2023), page 64. <https://climate.cityofnewyork.us/initiatives/planyc-getting-sustainability-done/>
- xvi New York City Environmental Justice Alliance, et al. (May 2020). Dirty Energy, Big Money. A PEAK Coalition Report. 7. https://8f997cf9-39a0-4cd7-b8b8-65190bb2551b.filesusr.com/ugd/f10969_9fa51ccc611145bf88f95_a92dba57ebd.pdf.
- xvii 6 N.Y.C.R.R. § 227-3. govt.westlaw.com (Link)
- xviii NYIDO. (2023). 2023 Power Trends: A Balanced Approach to Clean and Reliable Grid. <https://www.nyiso.com/documents/20142/2223020/2023-Power-Trends.pdf/>.
- xix Carl Sulzberger. (Apr. 2013). History: Pearl Street. *IEEE Power & Energy Magazine*. <https://magazine.ieee-pes.org/marchapril-2013/history-7/>.
- xx U.S. Energy Info. Admin. (Dec. 21, 2022). Commercial Building Energy Consumption Survey (CBS): Electricity. <https://www.eia.gov/consumption/commercial/ConsumptionSurvey>.
- xxi U.S. Energy Info. Admin. (June 15, 2023). New York State Profile Data: Consumption & Expenditures. <https://www.eia.gov/state/data.php?sid=NY#ConsumptionExpenditures>.
- xxii Int. Energy Agency. (n.d.). Methane and Climate Change. <https://www.iea.org/reports/methane-tracker-2021/methane-and-climate-change>.
- xxiii NYC Mayor's Office of Climate & Environmental Justice. (2021). New York City Citywide CLCPA Inventory (2005 - 2021), p. 5. <https://climate.cityofnewyork.us/wp-content/uploads/2023/04/NYC-Citywide-CLCPA-Inventory-2005-2021.pdf>.
- xxiv *ibid.*, p. 8.
- xxv NYC Mayor's Office of Sustainability. (2016). One City Built to Last: Technical Working Group Report. https://www.nyc.gov/assets/sustainability/downloads/pdf/publications/TWGREport_04212016.pdf.
- xxvi ConEdison Inc. (Mar. 2023). Company History and Statistical Information: Electrical Steam Statistics. <https://www.coned.com/en/about-us/corporate-facts>.
- xxvii ConEdison, Inc. (Apr. 2021). Long-Range Plan: Our District Steam System. <https://www.coned.com/-/media/files/coned/documents/our-energy-future/our-energy-projects/steam-long-range-plan.pdf>.
- xxviii NYISO. (Nov. 12, 2020). New Climate Change Study Examines Resilience and Reliability of New York Energy Grid. <https://www.nyiso.com/-/new-climate-change-study-examines-resilience-and-reliability-of-new-york-energy-grid>. (citing Paul J. Hibbard, et al., Climate Change Impact and Resilience Study – Phase II, NYISO (Sep. 2020), which reviews prospective 2040 power system reliability impacts and examines several energy demand models that examine anticipated impacts of the Climate Leadership and Community Protection Act).
- xxix NYC Special Initiative for Rebuilding and Resiliency. (n.d.). What happened during Sandy and why. <https://www.nyc.gov/site/sirr/about/what-happened-during-sandy-and-why.page>.
- xxx U.S. Energy Info. Admin. (Sep. 15, 2021). Hurricane Ida caused at least 1.5 million electricity customers to lose power. <https://www.eia.gov/todayinenergy/detail.php?id=49556#:~:text=CESER's%20situation%20reports%20show%20that,power%20restored%20within%2024%20hours>.
- xxxi NYC Mayor's Office of Climate & Environmental Justice. (2022). The NYC Climate Resiliency Design Guidelines v4.1. <https://climate.cityofnewyork.us/wp-content/uploads/2022/10/CRDG-4-1-May-2022.pdf>.
- xxxii NYC Department of Health. (June 16, 2022). Health Dep't Released Report on Heat-Related Mortality in New York City. <https://www.nyc.gov/site/doh/about/press/pr2022/heat-related-mortality-report.page>.
- xxxiii Joan A. Casey, et al. (Dec. 2020). Power Outages and Community Health: a Narrative Review. *Curr. Environ. Health Rep.* <https://pubmed.ncbi.nlm.nih.gov/33179170/>.
- xxxiv Jisung Park. (Feb. 26, 2017). Temperature, Test Scores, and Human Capital Production, Harvard University. https://scholar.harvard.edu/files/jisungpark/files/temperature_test_scores_and_human_capital_production_-_j_park_-_2-26-17.pdf.
- xxxv City of New York Government. (2022). Household air conditioning. Environment & Health Data Portal. <https://a816-dohbesp.nyc.gov/IndicatorPublic/beta/data-explorer/housing-safety/>.
- xxxvi NYCHA. (n.d.). NYCHA Climate Mitigation Roadmap: Meeting local Law 97 through Energy Efficiency and Beneficial Electrification. 1. <https://www.nyc.gov/assets/nycha/downloads/pdf/NYCHA-LL97-Whitepaper.pdf>.
- xxxvii NYC Mayor's Office of Long-Term Planning & Sustainability. (Oct. 2012). Overview of the Greener, Greater Buildings Plan. https://www.nyc.gov/html/gbee/downloads/pdf/greener_greater_buildings_plan.pdf.
- xxxviii 2019 N.Y.C. Local Law 97, www.nyc.gov/assets/buildings/local_laws/ll97of2019.pdf
- xxxix 2019 N.Y.C. Local Law 92, https://www.nyc.gov/assets/buildings/local_laws/ll92of2019.pdf; 2019 N.Y.C. Local Law 94, https://www.nyc.gov/assets/buildings/local_laws/ll94of2019.pdf.
- xl 2019 N.Y.C. Local Law 95, N.Y.C. Admin. Code §§ 28-309.12.1, https://www.nyc.gov/assets/buildings/local_laws/ll95of2019.pdf.
- xli 2019 N.Y.C. Local Law 96, N.Y.C. Admin. Code § 11-30, <https://nyc.legistar1.com/nyc/attachments/27e757ec-6591-4eed-ae88-bbe68d92a8c1.pdf>.
- xliv Office of the New York City Controller. (2021). Climate Dashboard. <https://comptroller.nyc.gov/services-for-the-public/nyc-climate-dashboard/energy/>.
- xliii NYSEDA. NYStretch Energy Code: 2020 Outreach, Training and Resources. <https://www.nyserda.ny.gov/All-Programs/Clean-Resilient-Building-Codes/NYStretch-Energy-Code-2020#:~:text=NYStretch%2D2020%20is%20a%20supplement,more%20stringent%20local%20energy%20code>.
- xliv New York City Mayor's Office of Climate and Environmental Justice. PlaNYC: Getting Sustainability Done (2023), page 16
- xliv Government of the State of New York. (n.d.). New York's Climate Leadership & Protection Act. <https://climate.ny.gov/>.
- xlvi NYS Department of Homes & Community Renewal. (n.d.). Climate Friendly Homes Fund. <https://hcr.ny.gov/climate-friendly-homes-fund>.
- xlvii NYSEDA. (n.d.). Clean Energy Standard. <https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Standard>.

- xlvi NYISERDA. (2023). Tier 4 – New York City Renewable Energy. <https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Standard/Renewable-Generators-and-Developers/Tier-Four>.
- xlix NYISO. (July 7, 2022). Public Policies and the Transformation of NY’s Electric Grid. [https://www.nyiso.com/-/public-policies-and-the-transformation-of-new-york-s-electric-grid#:~:text=The%20Department%20of%20Environmental%20Conservation's,\(MW\)%20of%20electricity%20generation](https://www.nyiso.com/-/public-policies-and-the-transformation-of-new-york-s-electric-grid#:~:text=The%20Department%20of%20Environmental%20Conservation's,(MW)%20of%20electricity%20generation).
- l NYISERDA. (n.d.). New Efficiency: New York. <https://www.nyserda.ny.gov/about/publications/new-efficiency>.
- li New York State. (n.d.). Environmental Bond Act Overview. <https://www.ny.gov/programs/clean-water-clean-air-and-green-jobs-environmental-bond-act>.
- lii NYISERDA. (n.d.). Appliance and Equipment Efficiency Standards. <https://www.nyserda.ny.gov/All-Programs/New-York-State-Appliance-and-Equipment-Efficiency-Standards>
- liii NYPA. (May 5, 2023). Legislation Gives NYPA Additional Authority to Advance Renewable Generation and Decarbonization in New York State. <https://www.nypa.gov/news/press-releases/2023/20230503-legislation>.
- liv New York State Assembly. (n.d.). The All-Electric Buildings Law: What it means for you. <https://www.assembly.ny.gov/all-electric-buildings/>.
- lv The White House Council on Environmental Quality. (Aug. 2022). Implementing Instructions for Executive Order 14057: Catalyzing Clean Energy Industries and Jobs through Federal Sustainability. https://www.sustainability.gov/pdfs/EO_14057_Implementing_Instructions.pdf.
- lvi United States Department of Energy Office of Energy Efficiency & Renewable Energy. (2022). The U.S. National Blueprint for Transportation Decarbonization: A Joint Strategy to Transform Transportation. <https://www.energy.gov/eere/us-national-blueprint-transportation-decarbonization-joint-strategy-transform-transportation>.
- lvii Pub. L., 117-56 (Nov. 15, 2021). Infrastructure Investment and Jobs Act. <https://www.congress.gov/bill/117th-congress/house-bill/3684/text>.
- lviii U.S. Dep’t Transportation. (Jul. 5, 2022). Fact Sheet: Climate and Resilience in the Bipartisan Infrastructure Law. <https://www.transportation.gov/bipartisan-infrastructure-law/fact-sheet-climate-and-resilience-bipartisan-infrastructure-law>.
- lix The Congress of The United States. (2022). Summary: The Inflation Reduction Act of 2022. https://www.democrats.senate.gov/imo/media/doc/inflation_reduction_act_one_page_summary.pdf
- lx Ben King, et al. (July 28, 2022). A Congressional Climate Breakthrough. Rhodium Group. <https://rhg.com/research/inflation-reduction-act/>.
- lxi The White House. (Aug. 09, 2022). FACT SHEET: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China. <https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/>.
- lxii Lachlan & Jun Ukita Shepard. (Aug. 22, 2022). Congress’s Cliamt Triple Whammy: Innovation, Investment, and Industrial Policy. RMI. <https://rmi.org/climate-innovation-investment-and-industrial-policy/>.
- lxiii U.S. Energy Info. Admin. (n.d.). Innovation needs in the Sustainable Development Scenario. <https://www.iea.org/reports/clean-energy-innovation/innovation-needs-in-the-sustainable-development-scenario>.
- lxiv The White House. (2022). Justice40: A Whole-Of-Government Initiative. <https://www.whitehouse.gov/environmentaljustice/justice40/>.
- lxv National BPS Coalition. (2021). About the National BPS Coalition. <https://nationalbpscoalition.org/>.
- lxvi NYISO. (2023). Short-Term Assessment of Reliability: 2023 Quarter 1. “Short-Term Assessment of Reliability: 2023 Quarter 1.” New York Independent System Operator.
- lxvii Clean Path NY. (n.d.). www.cleanpathny.com/.
- lxviii Champlain Hudson Power Express. (n.d.). <https://chpexpress.com/>.
- lxix NYISERDA. (2023). New York’s Commitment to Clean Energy. <https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/About-Offshore-Wind>.
- lxx NYISERDA. (Nov. 30, 2021). Largest Renewable Energy and Transmission Projects in New York State in the Last 50 Years. <https://www.nyserda.ny.gov/About/Newsroom/2021-Announcements/2021-11-30-Clean-Path-NY-Champlain-Hudson-Power-Express-Renewable-Energy>.
- lxxi Bureau of Ocean Energy Management. (June 14, 2021). Atlantic Wind Lease Sale 8 (ATLW-8) for Commercial Leasing for Wind Power on the Outer Continental Shelf in the New York Bight-Proposed Sale Notice. <https://www.govinfo.gov/content/pkg/FR-2021-06-14/pdf/2021-12442.pdf>.
- lxxii United States Bureau of Ocean Energy Management. (n.d.). What Is a And Energy Area (WEA). <https://www.boem.gov/renewable-energy/state-activities/what-wind-energy-area-wea>.
- lxxiii NYISERDA. (n.d.). Offshore Wind Projects: over 4,300 megawatts under active development statewide. <https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/Focus-Areas/NY-Offshore-Wind-Projects>.
- lxxiv ConEdison, Inc. (n.d.). Brooklyn Clean Energy Hub. <https://www.coned.com/en/our-energy-future/our-energy-vision/where-we-are-going/were-ready-for-offshore-wind>.
- lxxv Office of the New York City Controller. (n.d.). Climate Dashboard. <https://comptroller.nyc.gov/services/for-the-public/nyc-climate-dashboard/energy/>.
- lxxvi NYC Department of Citywide Administrative Services. (2022). City of New York Municipal Solar-Readiness Assessment. https://www.nyc.gov/assets/dcas/downloads/pdf/energy/reportsandpublication/local24_2022.pdf.
- lxxvii NYC Department of Design and Construction Office of Sustainable Design. (June 2021). Geothermal Heat Pump Systems Manual. <https://www.nyc.gov/assets/ddc/downloads/Sustainable/GeothermalHeatPumpManual.pdf>.
- lxxviii Chapter 375 of the Laws of 2022 of New York. <https://www.nysenate.gov/legislation/bills/2021/S9422>.
- lxxix 2022 N.Y.C. Local Law 2. <https://nyc.legistar1.com/nyc/attachments/792c1ff4-9599-4edf-8007-f4b2800219a6.pdf>
- lxxx New York State. (2023). Solar Electric Programs Reported by NYISERDA: Beginning 2000. <https://data.ny.gov/Energy-Environment/Solar-Electric-Programs-Reported-by-NYISERDA-Beginn/3x8r-34rs>.
- lxxxi New York City Department of Sanitation. (2023).
- lxxxii NYC Water Staff. (2018, September 27). Closing the Loop: When Wastewater Treatment Becomes Resource Recovery. Medium. <https://medium.com/nycwater/closing-the-loop-when-wastewater-treatment-becomesresource-recovery-8266d1d576cc>
- lxxxiii Clean Path NY. (n.d.). Our Clean Energy Future is All Renewable: All New York. <https://www.cleanpathny.com/>; Champlain Hudson Power Express. (n.d.). RELIABLE. CLEAN. POWER. <https://chpexpress.com/>.
- lxxxiv NYCEDC. (Sep. 2021). Offshore Wind: Equitable Opportunity For A Sustainable Future. <https://edc.nyc/sites/default/files/2021-09/NYCEDC-Offshore-Wind-NYC-Plan.pdf>.
- lxxxv NYCEDC. (Mar. 14, 2023). NYCEDC Launches First-In-Nation Offshore Wind and Waterfront Training Program for Minority, Women-Owned, and Disadvantaged Business Enterprises. <https://edc.nyc/press-release/nycedc-launches-offshore-wind-training-program-mwdbe>.
- lxxxvi The Office of the Mayor of New York City. (Mar. 3, 2022). Mayor Adams Announces Agreement to Transform South Brooklyn Marine Terminal Into Leading Offshore Wind Hub. [https://www.nyc.gov/office-of-the-mayor/news/105-22/mayor-adams-agreement-transform-south-brooklyn-marine-terminal-leading-offshore#/>0](https://www.nyc.gov/office-of-the-mayor/news/105-22/mayor-adams-agreement-transform-south-brooklyn-marine-terminal-leading-offshore#/).
- lxxxvii Equinor. (June 09, 2022). Offshore Wind Innovation Hub Launched in New York. <https://www.equinor.com/news/us/offshore-wind-innovation-hub-launched-in-new-york>.
- lxxxviii NYISERDA. (2022). New York’s 6 GW Energy Storage Roadmap: Policy Options for Continued Growth in Energy Storage. <https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Energy-Storage/ny-6-gw-energy-storage-roadmap.pdf>.
- lxxxix New York City Department of Planning. (2023). City of Yes. <https://www.nyc.gov/site/planning/plans/city-of-yes/city-of-yes-overview.page>.
- xc New York City Government. (2022). Get Stuff Built: Blast Report. <https://www.nyc.gov/assets/home/downloads/pdf/press-releases/2022/GetStuffBuilt.pdf>.
- xci New York City Fire Department. (Aug. 13, 2019) Notice of Adoption of New Fire Department Rule 3 RCNY 608-01, entitled Outdoor Stationary Storage Battery Systems. <https://www.nyc.gov/assets/fdny/downloads/pdf/codes/3-rcny-608-01.pdf>.
- xcii Uniform Land Use Review Procedure. (n.d.). <https://www.nyc.gov/site/brooklyn99/resources/uniform-land-use-review-procedure-ulurp.page>.
- xciii The New York City Emergency Management Department. (Nov. 15, 2022). Weather Emergency Protocols Report Local Law 24/2011. www.nyc.gov/assets/em/downloads/pdf/local_law_reports/local_law_24_weather_emergency_2022.pdf.
- xciv New York City Department of Citywide Admin. Services. (Feb. 10, 2022). Solar Installation at Queens High School Helps City Reach Clean Energy Milestone and Provides Learning Opportunities for Students. <https://www.nyc.gov/site/dcas/news/21-022/solar-installation-queens->

high-school-helps-city-reach-clean-energy-milestone-provides.

xcv PlaNYC 2023, at 71.

xcvi United States Environmental Protection Agency. (June 29, 2023). Greenhouse Gas Reduction Fund. www.epa.gov/greenhouse-gas-reduction-fund.

xcvii Office of Energy Efficiency & Renewable Energy. (Mar. 2023). Homeowner’s Guide to the Federal Tax Credit for Solar Photovoltaics. <https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics>.

xcviii NYSERDA. (n.d.). Community Adder. <https://www.nyserda.ny.gov/All-Programs/NY-Sun/Contractors/Dashboards-and-incentives/Community-Adder>.

xcix NYSERDA. (n.d.). Inclusive Community Solar Adder. <https://www.nyserda.ny.gov/All-Programs/NY-Sun/Contractors/Dashboards-and-incentives/Inclusive-Community-Solar-Adder>.

c NYSERDA. (n.d.). Affordable Solar and Storage Predevelopment and Technical Assistance (PON 3414). [New York State Energy Research and Development Authority](https://www.nyserda.ny.gov/All-Programs/NY-Sun/Contractors/Dashboards-and-incentives/Inclusive-Community-Solar-Adder).

ci New York City Department of Housing Preservation & Development. (2023). Solar Where Feasible. <https://www.nyc.gov/site/hpd/services-and-information/solar-where-feasible.page>.

cii U.S. Department of Housing and Urban Development. (2022). Final PHA Agency Plan: Annual Agency Plan for Fiscal Year 2023. <https://www.nyc.gov/assets/nycha/downloads/pdf/NYCHA-Final%20Annual-PlanFY23-10.14.22.pdf>.

ciii NYCHA. (Oct. 2021). Climate Change At NYCHA: A Plan to Adapt. https://www.nyc.gov/assets/nycha/downloads/pdf/Climate-Change-at-NYCHA_lores_single-pages.pdf.

civ New York City Government. (Apr. 25, 2023). Mayor Adams and NYCHA Announce Plans for the Installation of New Rooftop Solar Panels on NYCHA Buildings, Advancing Commitment to ACCESSolar, Which Aims to Achieve 30 Megawatts of Solar by 2026, Reducing Electricity Rates for Low-to-Moderate-Income Households. www.nyc.gov/site/nycha/about/press/pr-2023/pr-20230425.page. See also: NYCHA. (2023). NYCHA ACCESSolar Solicitation for Solar Photovoltaic Systems. https://www.nyc.gov/assets/nycha/downloads/pdf/2023_ACCESSolar_Solicitation.pdf.

cv NYC Mayor’s Office of Climate & Environmental Justice. (n.d.) Energy Benchmarking: New York City Energy Water Performance Map. <https://www.nyc.gov/site/sustainability/codes/energy-benchmarking.page>

cvi NYC Mayor’s Office of Sustainability. (2021). Pathways to Carbon-Neutral NYC: Modernize, Reimagine, Reach. <https://www.nyc.gov/assets/sustainability/downloads/pdf/publications/Carbon-Neutral-NYC.pdf>.

cvii Kathryn Lane, et al., Burden and Risk Factors for Cold-Related Illness and Death in New York City. *Int. J. Environ. Res. Public Health* 2018, 15(4), 632. <https://www.mdpi.com/1660-4601/15/4/632>.

cviii NYC Department of Housing Preservation & Development. (n.d.). HPD Design Guidelines for Preservation: Version 1.0. [New York City Department of Housing Preservation and Development](https://www.nyc.gov/site/hpd/design-guidelines-for-preservation).

cix 2021 N.Y.C. Local Law 41.

cx New York State Public Service Commission. (n.d.). Energy Affordability & Electric and Natural Gas Bill Reform Programs. <https://dps.ny.gov/system/files/documents/2022/11/electric-gas-relief-program-fact-sheet.pdf#:~:text=Adopted%20an%20energy%20burden%20target,that%20is%20spent%20on%20energy>.

cxii New York City Mayor’s Office of Sustainability and the Mayor’s Office Economic Opportunity. (Aug. 2019). Understanding and Alleviating Energy Cost Burden in New York City. <https://climate.cityofnewyork.us/wp-content/uploads/2022/10/Understanding-and-Alleviating-Energy-Cost-Burden-in-NYC-Aug-2019.pdf>.

cxiii *ibid.*; see also United States Census Bureau. (n.d.). Public Use Microdata Sample (PUMS), Overview. <https://www.census.gov/programs-surveys/acs/microdata.html>.

cxiiii *ibid.*

cxv New York City Government. (June 16, 2022). Health Department Releases Report on Heat-Related Mortality in New York City. <https://www.nyc.gov/site/doh/about/press/pr2022/heat-related-mortality-report.page>; see Diana Hernández. (Oct. 2016). Understanding ‘energy insecurity’ and why it matters to health. <https://www.sciencedirect.com/science/article/pii/S0277953616304658?via%3Dihub>.

cxvi The State of New York. (n.d.). Home Energy Assistance Program (HEAP) Overview. <https://otda.ny.gov/programs/heap/>.

cxvii conEdison. (n.d.). Energy Affordability Program. <https://www.coned.com/en/accounts-billing/payment-plans-assistance/help-paying-your-bill>; nationalgrid. (n.d.). Energy Affordability Program. <https://www.coned.com/en/accounts-billing/payment-plans-assistance/help-paying-your-bill>.

cxviii New York State Department of Homes and

Community Renewal. (2019). Overview, Housing Sustainability & Tenant Protection Act of 2019. <https://hcr.ny.gov/system/files/documents/2021/08/rent-laws-overview-english-10-2019.pdf>.

cxviii New York State Department of Homes and Community Renewal, Office of Rent Administration. (June 2023). Guide to Rent Increases for Rent Stabilized Apartments. hcr.ny.gov/system/files/documents/2023/07/fact-sheet-26-07-2023.pdf.

cxix New York City Department of Housing Preservation & Development. (n.d.). HPD Electric Heating Policy. [New York City Department of Housing Preservation and Development](https://www.nyc.gov/site/hpd/services-and-information/electric-heating-policy).

cxx United States Department of Housing and Urban Development. (n.d.). Capital Fund Housing-Related Hazards and Lead Based Paint Funding. https://www.hud.gov/program_offices/public_indian_housing/programs/ph/capfund/hrh#:~:text=The%20Housing%2Drelated%20Hazard%20Capital%20Fund%20program%20is%20a%20competitive,hazards%20and%20other%20housing%20hazards.

cxxi The Congress of The United States. (2022). Summary: The Inflation Reduction Act of 2022. https://www.democrats.senate.gov/imo/media/doc/inflation_reduction_act_one_page_summary.pdf.

cxixii United States Department of Energy. (n.d.). Property Assessed Clean Energy programs: State and Local Solution Center. <https://www.energy.gov/scep/slsc/property-assessed-clean-energy-programs>.

cxixiii New York City Mayor’s Office of Climate & Environmental Justice. (2022). NYC Accelerator. <https://climate.cityofnewyork.us/initiatives/nycaccelerator/>.

cxixiv New York City Department of Housing Preservation & Development. (n.d.). HomeFix. <https://www.nyc.gov/site/hpd/services-and-information/homefix.page>.

cxixv New York State Department of Homes and Community Renewal. (n.d.). Weatherization Assistance Program. <https://hcr.ny.gov/weatherization>.

cxixvi NYSERDA. (n.d.). NYS Clean Heat Program: Heat and cool your home the better way. [New York State](https://www.nyserda.ny.gov/Programs/Regional-Clean-Energy-Hubs).

cxixvii New York State Office of Temporary and Disability Assistance. (n.d.). Home Energy Assistance Program (HEAP). [New York State](https://www.nyserda.ny.gov/Programs/Regional-Clean-Energy-Hubs).

cxixviii New York City Mayor’s Office of Sustainability and the Mayor’s Office Economic Opportunity. (Aug. 2019). Understanding and Alleviating Energy Cost

Burden in New York City. [“Understanding and Alleviating Energy Cost Burden in New York City.” New York City Mayor’s Office of Sustainability and Mayor’s Office for Economic Opportunity](https://www.nyc.gov/site/hpd/services-and-information/understanding-and-alleviating-energy-cost-burden-in-new-york-city).

cxixix United States Census Bureau. (June 15, 2023). 2021 Data Release New and Notable. <https://www.census.gov/programs-surveys/acs/news/data-releases/2021/release.html>.

cxixxx New York City Department of Housing Preservation & Development. (n.d.). HPD Electric Heating Policy. [New York City Department of Housing Preservation and Development](https://www.nyc.gov/site/hpd/services-and-information/electric-heating-policy).

cxixxxi PlaNYC 2023, p. 59.

cxixxxii NYCHANow. (Aug. 2022). \$70M Initial Investment Will Decarbonize NYCHA Buildings with New Electric Heat Pumps. <https://nychanow.nyc/70-million-initial-investment-will-decarbonize-nycha-buildings-with-new-heat-pump-electrification-technologies/>.

cxixxxiii NYCHANow. (Apr. 25, 2023). Mayor Adams and NYCHA Announce Plans for the Installation of New Rooftop Solar Panels on NYCHA Buildings, Advancing Commitment to ACCESSolar, Which Aims to Achieve 30 Megawatts of Solar by 2026, Reducing Electricity Rates for Low-to-Moderate-Income Households. [New York City Housing Authority](https://www.nyc.gov/site/nycha/about/press/pr-2023/pr-20230425.page).

cxixxxiv New York City Department of Housing Preservation & Development. (2023). Decarbonization Roadmap for Multifamily Affordable Housing. [“Decarbonization Roadmap for Multifamily Affordable Housing.” New York City Department of Housing Preservation and Development](https://www.nyc.gov/site/hpd/services-and-information/decarbonization-roadmap-for-multifamily-affordable-housing).

cxixxxv NYSERDA. (n.d.). Heat Pump Planner. <https://cleanheat.ny.gov/planner/>.

cxixxxvi New York City Government. (n.d.). ElectrifyNYC. [https://www.nyc.gov/site/electrifynyc/index.page#:~:text=ElectrifyNYC%20\(Electrify%20New%20York%20City,and%20other%20energy%20efficiency%20upgrades](https://www.nyc.gov/site/electrifynyc/index.page#:~:text=ElectrifyNYC%20(Electrify%20New%20York%20City,and%20other%20energy%20efficiency%20upgrades).

cxixxxvii NYSERDA. (n.d.). Regional Clean Energy Hubs Program. <https://www.nyserda.ny.gov/All-Programs/Regional-Clean-Energy-Hubs>.

cxixxxviii PlaNYC 2023, p. 94.

cxixxxix New York City Department of Transportation. (May 201). Delivering New York: A Smart Truck Management Plan for New York City. [“Delivering New York: A Smart Truck Management Plan for New York City.” New York City Department of Transportation](https://www.nyc.gov/site/transportation/delivering-new-york-a-smart-truck-management-plan-for-new-york-city).

cxl New York City Department of Citywide

- Administrative Services. (2019). The New York City Community Air Survey: Neighborhood Air Quality 2008-2020. "The New York City Community Air Survey: Neighborhood Air Quality 2008-2020." [City of New York](#).
- cxli New York City Department of transportation. (2012). Electrifying New York: An Electric Vehicle Vision Plan for New York City in 2021. <https://www.nyc.gov/html/dot/downloads/pdf/electrifying-new-york-report.pdf>.
- cxlii New York City Department of Transportation. (2021). Delivering New York: A Smart Truck Management Plan for New York City. "Delivering New York: A Smart Truck Management Plan for New York City." [New York City Department of Transportation](#).
- cxliii United States Environmental Protection Agency. (June 29, 2023). Inflation Reduction Act: Clean Heavy-Duty Vehicle Program. <https://www.epa.gov/inflation-reduction-act/clean-heavy-duty-vehicle-program>.
- cxliv Office of the Mayor of New York. (Jan. 26, 2023). Mayor Adams Outlines "Working People's Agenda" for NYC in Second State of the City Address. <https://www.nyc.gov/office-of-the-mayor/news/063-23/mayor-adams-outlines-working-people-s-agenda-nyc-second-state-the-city-address#/0>.
- cxlv MTA. (n.d.). MTA Sustainability Efforts. https://new.mta.info/system_modernization/sustainabletransit.
- cxlvi New York City Department of Citywide Administrative Services. (2023). Fleet Management. <https://www.nyc.gov/site/dcas/agencies/fleet-services.page>.
- cxlvii NYSEDA. (n.d.). Electric School Buses. <https://www.nyserda.ny.gov/All-Programs/Electric-School-Buses#:~:text=New%20York%20State's%20fiscal%20year,to%20be%20electric%20by%202035>.
- cxlviii New York City Department of transportation. (2012). Electrifying New York: An Electric Vehicle Vision Plan for New York City in 2021. <https://www.nyc.gov/html/dot/downloads/pdf/electrifying-new-york-report.pdf>.
- cxlix U.S. Department of Transportation. (Feb. 10, 2022). Fact Sheet: National Electric Vehicle Infrastructure Formula Program. [fhwa.dot.gov/bipartisan-infrastructure-law/nevi_formula_program.cfm](https://www.fhwa.dot.gov/bipartisan-infrastructure-law/nevi_formula_program.cfm).
- cl U.S. Department of Transportation. (Mar. 14, 2023). Charging and Fueling Infrastructure Grant Program. <https://www.transportation.gov/rural/grant-toolkit/charging-and-fueling-infrastructure-grant-program>.
- cli New York City Taxi & Limousine Commission. (n.d.). Yellow Cab. [New York City Taxi and Limousine Commission](#).
- clii New York City Taxi & Limousine Commission. (2022). Charged Up! TLC's Roadmap to Electrifying the For-Hire Transportation Sector in New York City. "Charged Up! TLC's Roadmap to Electrifying the For-Hire Transportation Sector in New York City." [New York City Taxi and Limousine Commission](#).
- cliii U.S. Environmental Protection Agency. (2023). Clean School Bus Program. <https://www.epa.gov/cleanschoolbus>.
- cliv U.S. Environmental Protection Agency. (2022). EPA \$18.5 Million Rebate Will Put Clean School Buses on the Streets of New York City. [EPA \\$18.5 Million Rebate Will Put Clean School Buses on the Streets of New York City | US EPA](#).
- clv New York City Department of Citywide Administrative Service. (2022). Clean Fleet Transition Plan. <https://www.nyc.gov/assets/dcas/downloads/pdf/fleet/clean-fleet-transition-plan-october-2022.pdf>.
- clvi New York City Department of Environmental Protection. (n.d.). Transportation Emissions: Citizens Air Complaint Program. <https://www.nyc.gov/site/dep/environment/idling-citizens-air-complaint-program.page>.
- clvii New York City Department of Transportation. (2023). Blue Highways Program: Activating NYC's Waterways for the Sustainable Movement of Goods. [New York City Department of Transportation](#).
- clviii NYC Department of Transportation. (2021). Delivering Green: A Vision for a Sustainable Freight Network Serving New York City. <https://www.nyc.gov/html/dot/downloads/pdf/freight-vision-plan-delivering-green.pdf> vision for a sustainable freight network serving New York City ([nyc.gov](#)).
- clix 42 U.S.C. §§ 7401, Clean Air Act (1970). <https://www.govinfo.gov/app/collection/uscode>
- clx NYC Local Law 191 (2018) https://www.nyc.gov/assets/buildings/local_laws/ll191of2018.pdf
- clxi NYC Mayor's Office of Climate & Environmental Justice. (2022). NYC Greenhouse Gas Inventories. <https://climate.cityofnewyork.us/initiatives/nyc-greenhouse-gas-inventories/>.
- clxii bp. (Mar. 3, 2023). Beacon Wind to repower community with renewable energy facility. https://www.bp.com/en_us/united-states/home/news/press-releases/beacon-wind-to-repower-community-with-renewable-energy-facility.html.
- clxiii United States Department of Energy. (n.d.). Lighting Choices to Save You Money. <https://www.energy.gov/energysaver/lighting-choices-save-you-money>.
- clxiv conEdison. (Apr. 12, 2022). Con Edison and Partners Go to School with Findings from E-School Bus Project. <https://www.coned.com/en/about-us/media-center/news/2022/04-12/con-edison-and-partners-go-to-school-with-findings-from-e-school-bus-project>.
- clxv New York City Department of Transportation. (Aug. 12, 2021). NYC DOT Announces Arrival of All-Electric Delivery Trucks to New York City. [New York City Department of Transportation](#).

Glossary

ACS	American Community Survey	DEC	New York State Department of Environmental Conservation	IAI	Individual Apartment Improvement	PM2.5	Fine Particulate Matter
AGRE	Astoria Gateway for Renewable Energy	DER	Distributed Energy Resource	ICSA	Inclusive Community Solar Adder	PPA	Power Purchase Agreement
BIL	Bipartisan Infrastructure Law (see IIJA)	DHW	Domestic Hot Water	IIJA	Infrastructure Investment & Jobs Act (see BIL)	PSC	NYS Public Service Commission (see DPS)
BLAST	Building & Land Use Approval Streamlining Task Force	DOB	NYC Department of Buildings	IRA	Inflation Reduction Act	REC	Renewable Energy Certificate
BOEM	U.S. Bureau of Ocean and Energy Management	DOE	U.S. Department of Energy	ITC	Investment Tax Credit	RFEI	Request for Expressions of Interest
BPRA	NYS Build Public Renewables Act	DOT	U.S. Department of Transportation	LBPCF	Lead-Based Paint Capital Fund	SOx	Sulfur Oxides
BPS	National Building Performance Standards Coalition	DPS	NYS Department of Public Service (see PSC)	LED	Light-Emitting Diode	SWF	Solar Where Feasible
BRIC	Building Resilient Infrastructure & Communities	EJ	Environmental Justice	LMI	Low and Moderate Income	TLC	Taxi & Limousine Commission
CBO	Community-Based Organization	EJNYC	Environmental Justice New York City	LTEP	Long-Term Energy Plan (also referred to as PowerUp)	TMP	Transportation Management Plan
CES	NYS Clean Energy Standard	EPA	U.S. Environmental Protection Agency	MCI	Major Capital Improvement	TOU	Time of Use
CEQR	City Environmental Quality Review	ESS	Energy Storage System	MOCEJ	Mayor's Office of Climate & Environmental Justice	ULURP	Uniform Land Use Review Procedure
CDFI	Community Development & Financial Institutions	ETWG	Energy Technical Working Group	MTA	Metropolitan Transport Authority	UTEN	Utility Thermal Energy Network
CHIPS	Creating Helpful Incentives to Produce Semiconductors for America Act	EV	Electric Vehicle	MW	Megawatt	V2G	Vehicle-to-Grid
CHPE	Champlain Hudson Power Express	FDNY	New York City Fire Department	MWDBE	Minority, Women and Disadvantaged Business Enterprise	WAP	Weatherization Assistance Program
CLCPA	NYS Climate Leadership and Community Protection Act	FEMA	Federal Emergency Management Agency	NERC	North American Electric Reliability Corporation	WEA	Wind Energy Area
CMA	NYC Climate Mobilization Act	FERC	Federal Energy Regulatory Commission	NOx	Nitrogen Oxides		
CO	Carbon Monoxide	FHV	For-Hire Vehicle	NREL	National Renewable Energy Laboratory		
COA	Certificate of Approval	GGBP	NYC Greener, Greater Buildings Plan	NYC	New York City		
CPNY	Clean Path New York	GGRF	Greenhouse Gas Reduction Fund	NYCEDC	NYC Economic Development Corporation		
CUNY	City University of New York	GHG	Greenhouse Gas	NYCHA	NYC Housing Authority		
DAC	Disadvantaged Community	GW	Gigawatt	NYCSBUS	NYC School Bus Umbrella Services		
DCAS	NYC Department of Citywide Administrative Services	HEAP	Home Energy Assistance Program	NYISO	New York Independent System Operator		
DCP	NYC Department of City Planning	HPD	NYC Department of Housing Preservation & Development	NYPA	New York Power Authority		
		HRHCF	Housing-Related Hazard Capital Fund	NYS	New York State		
		HTSP	Housing Stability & Tenant Protection Act	NYSERDA	NYS Research & Development Authority		
		HVAC	Heating, Ventilation, & Air Conditioning	OSW	Offshore Wind		
		HVFHS	High-Volume For-Hire Services	PACE	Property Assessed Clean Energy		

Acknowledgements

PowerUp NYC reflects the hard work, ideas, creativity, and dedication of hundreds of individuals from multiple City agencies and offices and scores of community and non-profit organizations, elected officials, academics, and business leaders who contributed their time, energy, and knowledge of the city to help shape the vision and policies of this plan. The success of this effort would not have been possible without their involvement.

We would especially like to thank:

NYC CHIEF CLIMATE OFFICER

Rohit Aggarwala

POWERUP TEAM

Amy Sohn, Christopher Rice, Claudia Villar-Leeman, Daphne Lundi, Ellie Kahn, Helen Chananie, Isabela Brown, Julia Casagrande, Lydia Wiener, Madison Hertzog, Nikki Joseph, Ross MacWhinney, Samuel Man, Seth Berkman, Summer Sandoval, Tallant Burley, Victoria Cerullo, Riena Harker

ENERGY TECHNICAL WORKING GROUP (ETWG)

Bill Acker, Bill Acker, Executive Director, New York Battery & Energy Storage Technology Consortium
 Laurie Wheelock, Executive Director, Public Utility Law Project of New York
 Andy Darrell, New York Regional Director, Environmental Defense Fund
 Zack Dufresne, Executive Director, New York Solar Energy Industries Association
 Bryan Grimaldi, Vice President, National Grid
 Vlad Gutman-Britten, Director of Policy & Analysis, New York Energy Research & Development Authority
 Shrvanthi Kanekal, Resiliency Planner, NYC Environmental Justice Alliance
 Kyle Kimball, Vice President, New York University (previously Consolidated Edison Company of New York)
 Kevin Lanahan, Vice President, New York Independent System Operator
 Maureen Leddy, Director, New York State Department of Environmental Conservation
 Ben Mandel, Vice President, CALSTART
 Anne Reynolds, Executive Director, Alliance for Clean Energy New York
 Maritza Silva-Farrell, Program Officer, Future of Work(ers), Ford Foundation (previously ALIGN)
 Zachary Steinberg, Senior Vice President, Real Estate Board of New York
 Julie Tighe, President, New York League of Conservation Voters
 Esther Toporovsky, Executive Vice President, Housing Partnership Development Corp.
 Jessica Waldorf, Director of Policy Implementation, New York State Department of Public Service
 Sam Wilt, Senior Policy Analyst, Natural Resources Defense Council
 Tom Wright, President, Regional Plan Association
 Daniel Chu, Energy Planner, PEAK Coalition Lovinia Reynolds, Energy Democracy Coordinator, UPROSE
 Cristina Garcia, Program Manager, Consolidated Edison Company of New York (previously Building Electrification Institute)
 Matthew Vasilakis, Managing Director, Building Electrification Institute

COMMUNITY BASED ORGANIZATION PARTNERS

Dani Castillo, Program Director, El Puente
 Arif Ullah, Executive Director, South Bronx Unite
 Leslie Vasquez, Clean Air Program Office, South Bronx Unite
 Rekha Malhotra, Interim Chief of Staff, Chhaya Community Development Corporation
 Jose Miranda Jr, Director of Programs, Chhaya Community Development
 Sonal Jessel, Director of Policy, WE ACT for Environmental Justice
 Brian Licata, Membership Retention Manager, Staten Island Chamber of Commerce

POWERUP RESEARCH TEAM

Energy & Environmental Economics (E3): Zak Suttle — Project Manager, Samantha Lang — Assistant Project Manager, Snuller Price — Technical Lead, Andrew DeBenedictis, Andrew Solfest, Caitlin McMahon, Chelsea Petrenko, Christa Heavey, Dyami Andrews, Hayden Dahmm, Jared Landsman, Jordan Shenhar, Kevin Steinberger, Kenzie Schwartz, Michaela Levine, Molly Bertolacini, Paul Picciano, Sierra Spencer, Zach Tzavelis
Willdan Group: Sean Chavez
Kinetic Communities Consulting (KC3): Daphany Rose Sanchez — Executive Director, Angel Chen — Sustainability Consultant
Topsight Advisors: Bomee Jung — Principal

AGENCIES PARTNERS

City University of New York (CUNY) — Sustainability Office, Department of Citywide Administrative Services, Department of Cultural Affairs, Department of City Planning, Department of Environmental Protection, Department of Buildings, Department of Education — Sustainability Office, Department of Finance, Department of Health and Mental Hygiene, Department of Transportation, Department of Sanitation, Economic Development Corporation, Industrial Development Agency, Fire Department, Housing Preservation and Development, Mayor's Office of Immigrant Affairs, Mayor's Office of Economic Opportunity, NYC Housing Authority, NYC School Bus Umbrella Services, Office of Management and Budget, School Construction Authority

PowerUp NYC is published pursuant to NYC Local Law 248 of 2017 (Long-Term Energy Plan mandate), Local Law 104 of 2018 (in-city wind study), Local Law 99 of 2019 (battery storage on retired power plants study), Local Law 181 of 2019 (utility-scale storage on private buildings study), and Local Law 154 of 2021 (electrification technology and grid reliability study).

