

CLIMATE FOR CHANGE

***A COMPLETE CLIMATE JOBS
ROADMAP FOR NEW YORK CITY***

ILR School



MAY 2022



COVID-19 DEDICATION FOR NEW YORK CITY WORKERS

This report is dedicated to all of the workers who fought to protect New Yorkers' lives since the start of the COVID-19 pandemic. Those seen and unseen, counted and missed, we honor your memory. The dedication and bravery of these workers is at the center of New York City's story of resilience. Many of the unions who make up Climate Jobs New York suffered disproportionate losses. Nurses of the New York State Nurses Association were at the frontline from the start, treating patients night and day while simultaneously fighting for protections for all workers. Members of the Building and Construction Trades worked around the clock to build temporary hospitals and hand out personal protective equipment. They also organized nationally to donate masks and respirators to healthcare workers (National Nurses United and North America's Building Trades Unions, 2020). Two-thirds of District Council 37's active members were deemed essential, serving our city in spite of the risks (Garrido, 2021). The union's 150,000 members represent two-thirds of city employees lost to the virus (District Council 37, 2021). Members of the Transport Workers Union of America AFL-CIO, Local 100 navigated the deep uncertainty of this health crisis and risked their lives to transport fellow essential workers. Since March 2020, over 12,000 Metropolitan Transport Authority workers were infected and 170 employees have died (Rivoli, 2021). Among many others, NYC bus and subway operators, track workers, Service Employees International Union 32BJ maintenance and cleaning staff showed up each day despite the hazards. All of these workers continue to be a critical part of the City's recovery. We thank you and we honor you.



*NYC Building & Construction Trades Council Video
Recognizing Our Heroic Essential Workers*

ACKNOWLEDGMENTS

Cornell's Labor Leading on Climate program would like to thank Climate Jobs New York and the many unions, labor federations, and environmental and community groups who participated in this process and continue to show bold leadership and commitment to tackling climate change and inequality.

Special thanks go to:

American Federation of State County and Municipal Employees (AFSCME),
District Council 37 & District Council 9

Building & Construction Trades Council of Greater New York (BCTC)

Communications Workers of America (CWA)

International Brotherhood of Electrical Workers (IBEW), Local 3

International Union of Operating Engineers (IUOE), Local 30

International Union of Painters and Allied Trades (IUPAT)

Construction and General Building Laborers', Local 79

New York City Central Labor Council, AFL-CIO (NYCCLC)

New York City District Council of Carpenters and Joiners of America

New York State Nurses Association (NYSNA)

32BJ Service Employees International Union (SEIU)

Transport Workers Union (TWU) of America AFL-CIO, Local 100

United Association of Journeymen and Apprentices of the Plumbing and
Pipe Fitting Industry of the United States and Canada (UA)

Utility Workers Union of America, Local 1-2

The Labor Leading on Climate program would also like to thank the over 60 leaders from the local labor and environmental movements, policymakers, and experts in the climate, energy, and labor fields whom we interviewed to help develop the recommendations in this report.

CONTRIBUTORS

REPORT AUTHORS

Lara Skinner **Guiding Principal**

Director, Labor Leading on Climate Initiative, Worker Institute at Cornell University, ILR School

Anita Raman **Research Lead**

Research and Policy Development Associate, Labor Leading on Climate Initiative, Worker Institute at Cornell University, ILR School

Avalon Hoek Spaans **Contributing Author & Design Lead**

Research and Policy Development Associate, Labor Leading on Climate Initiative, Worker Institute at Cornell University, ILR School

Melissa Shetler **Contributing Author & Workforce Development Specialist**

Labor and Workforce Consultant

Midori Valdivia **Contributing Author & Transportation Specialist**

President and Owner, Midori Valdivia Consulting

TEAM MEMBERS

Katherine Solis Fonte
Report Production Lead
Editing, Graphic Design

Zach Cunningham
Editing, Content Review

Stephanie Olszewski
Report Production

Rhonda McCelland
Editing, Report Production

Hunter Moskowitz
Research & Methodology

STUDENT SUPPORT

Alex Foley
Research Lead

Samuel George Jr.
Research Support

James Granata
Editing Support

Jasmin Higo
Research Support

Samiha Hamdi
Research Support

Nathan Lamm
Research Support

Ilham Nugraha
Research Support
& Graphic Design

Byron Song
Research Support

Scott Siegel
Research Support

DIRECTOR'S MESSAGE

In 2017, Cornell University's ILR School released a groundbreaking report, *Reversing Inequality, Combating Climate Change: A Climate Jobs Program for New York State* (Skinner & Cha, 2017). This report was based on interviews, policy research, and educational convenings that brought labor, industry, environmental, environmental justice, and government leaders together to design high-impact job strategies to meet the state's climate, equity, and jobs goals.

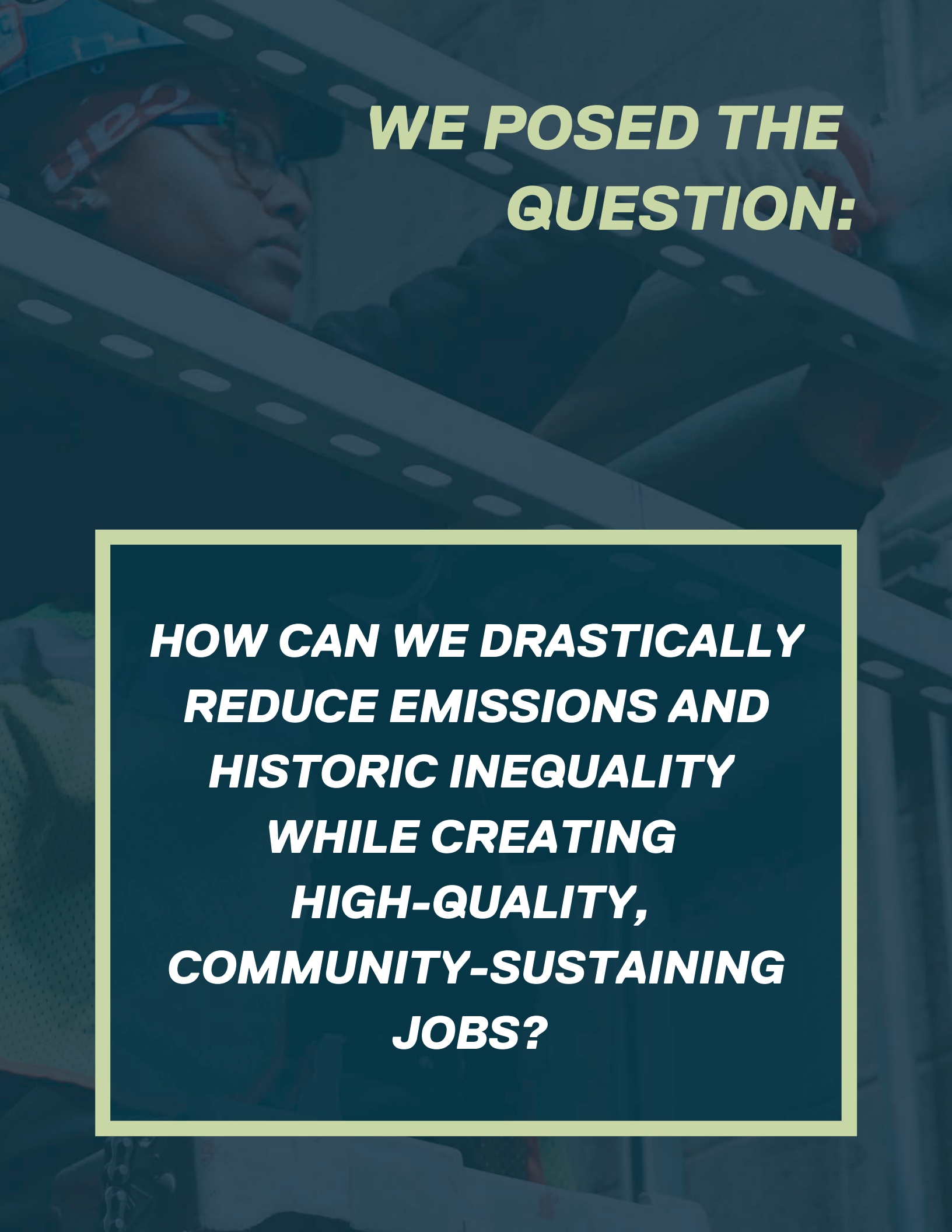
The 2017 recommendations showed how New York could simultaneously address the crises of inequality and climate change through bold climate policies that would drive high-quality job creation and economic development. One of the report's featured recommendations – to build 8 gigawatts of offshore wind by 2030 with a Project Labor Agreement requirement that ensured high-quality job creation for all – was adopted in 2019, making New York a leader in the development of offshore wind.

Cornell's multi-dimensional research, policy and educational process also sparked the formation of Climate Jobs New York (CJNY) – a union-led climate organization that repositions unions as engines to fight climate change alongside racial and economic inequality. It also led to the formation of Climate Jobs plans and coalitions in many other U.S. states.

Cornell is thrilled to update the 2017 report and release a new Climate Jobs Program for New York City in 2022. With the new Mayor, Eric Adams, and an almost entirely new City Council, New York City has the opportunity to lead the world in building a diverse, inclusive and equitable clean energy economy that beats back the worst impacts of climate change.



Dr. Lara Skinner
Director, Labor Leading on Climate

A background image of a construction worker wearing a hard hat and safety glasses, working on a steel beam. The image is dark and has a blue tint.

***WE POSED THE
QUESTION:***

***HOW CAN WE DRASTICALLY
REDUCE EMISSIONS AND
HISTORIC INEQUALITY
WHILE CREATING
HIGH-QUALITY,
COMMUNITY-SUSTAINING
JOBS?***

EXECUTIVE SUMMARY

KEY POINTS

- New York City is on the frontline of the climate crisis. Record-shattering extreme events and worsening worker conditions show that climate change is already here.
- The City has some of the highest income and racial inequality in the nation, and COVID-19 has exacerbated this situation. Climate change threatens to worsen inequality, as the most vulnerable people are often hit first and worst.
- New York City's climate goals are not ambitious enough. Achieving the City's distributed solar installation goal by 2030 would meet less than 9% of existing summer electricity demand (Ammirato et al., 2021). Emissions have been increasing - with the exception of the pandemic - and without significant vision and investment in new and updated infrastructure it will not meet its decarbonization goals.
- Climate work is not happening at scale. The City allocated only 1.4% of its Capital Budget specifically to energy-efficiency and greenhouse gas emissions reduction in 2022, and only \$10 million in green job training programs in 2021 (Mayor's Office of Management and Budget, 2021; New York City Council, 2021).
- Major job opportunities exist if we do climate work, and they span nearly every economic sector. These work areas include: building retrofits, renewable energy installations, grid modernization, public transportation, clean energy manufacturing, resilient infrastructure, and more.
- New jobs in the clean energy economy need to be family-sustaining, long-term careers. Jobs in this space are too few and are often not covered by labor standards. In New York State, labor standards apply on projects 1 megawatt or larger, however, most distributed solar projects are much smaller than this.
- There are huge opportunities to scale up programs, building equitable opportunities and expand access to those people most hurt by historic inequalities. Within the buildings, energy, transportation, workforce development, and resilience and adaptation sectors, this is a historic chance for workers to lead the way towards a healthier, safer, more equitable New York City.

A CLIMATE JOBS CHECKLIST FOR MAYOR ERIC ADAMS

While many recommendations will extend to 2030 and beyond, the City can have significant positive impact in the immediate future. This is a list of priority items for the next three years to make NYC healthier, safer, and more climate-friendly.

BUILDINGS

☐ **TRANSFORM ALL K-12 NYC PUBLIC SCHOOLS TO BE CARBON-FREE AND HEALTHY BY 2030**

Making this investment would create thousands of good jobs in the communities that need them most, while making schools healthier and safer for over 1.2 million students, teachers and staff.

☐ **TRANSFORM NYCHA TO BE CARBON-FREE AND HEALTHY, TRANSFORM NYC HEALTH + HOSPITALS TO BE HIGH-EFFICIENCY AND HEALTHY BY 2030**

Safer and healthier NYCHA buildings would benefit 550,000 NYCHA residents and employees and grow union job opportunities for residents. Safer and healthier NYC H+H buildings would benefit over 1.2 million patients per year and staff.

ENERGY

☐ **INVEST IN LOCAL OFFSHORE WIND DEVELOPMENT AND INVESTIGATE THE POTENTIAL FOR GREEN HYDROGEN PRODUCTION AT PORTS AND SUBSTATIONS**

Offshore wind investment is critical to NYC's energy security, and a feasibility study on green hydrogen hubs at urban offshore wind ports would be the first of its kind.

☐ **EXPAND NYC'S ORGANICS COLLECTION AND DEVELOP BIOGAS AND COMPOST PRODUCTION UNDER A PLA**

Expanding biogas production from food waste would generate millions in City income, create 1,494 high-quality direct jobs, and power critical infrastructure like hospitals.

TRANSPORTATION

☐ **REQUIRE A PUBLIC BUILDOUT OF 50,000 ELECTRIC VEHICLE CHARGERS BY NYC DOT UNDER A PROJECT LABOR AGREEMENT**

Treating public charging stations as critical infrastructure would create 1,496 installation jobs as well as local jobs in electric vehicle and charger manufacturing, operations and maintenance.

☐ **MANDATE ELECTRIC VEHICLE INSTALLATION TRAINING PROGRAM (EVITP) CERTIFICATION FOR CHARGER INSTALLATIONS TO SUPPORT GOOD JOBS AND ENSURE SAFETY**

This mandate would create a well-trained, green workforce focused on building out public charging stations on New York City streets.

RESILIENCE AND ADAPTATION

☐ **MAKE EVERY NYC ROOF A GREEN ROOF OR COOL ROOF BY 2030**

Requiring an energy-saving reflective paint or flood risk-reducing vegetation layer on every roof could create over 23,790 union jobs per year for eight years and reduce energy costs for renters and owners by 10%.

☐ **CONVERT 10% OF NEW YORK CITY TO PERMEABLE OPEN STREETS BY INCREASING PERVIOUS SURFACES WITH PREVAILING WAGE AND LOCAL HIRING REQUIREMENTS**

This could create 22,313 direct jobs from installing permeable pavement and green infrastructure to prevent flooding. It could increase economic activity for 150,000 small businesses by adding streetside capacity.

WORKFORCE DEVELOPMENT

☐ **EXPAND FUNDING FOR DIRECT ENTRY PRE-APPRENTICESHIP TRAINING**

Expanding program funding and expanding allowable costs would ensure pathways to good union jobs. Funding stipends, child-care vouchers, and transportation assistance could bolster participation from frontline and historically marginalized communities.

☐ **EXPAND THE MAYOR'S OFFICE OF TALENT AND WORKFORCE DEVELOPMENT**

Expanding this office and facilitating coordination among agencies would successfully provide economic opportunities for those who need it most.

☐ **COMMUNITY HIRE**

Passing State legislation that allows the City to use targeted hiring in its bid specification would ensure that community hiring goals can be expanded and implemented effectively.

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INTRODUCTION

Climate change is an environmental catastrophe and one of the most important social, racial, and economic justice issues of our time. Storms such as Hurricane Ida have shown that every New Yorker will feel the impacts of climate change. However, vulnerable groups—frontline and low-wage workers, communities of color, the elderly, and others—will suffer most, shouldering a disproportionate burden of this crisis.

New York State has the highest income inequality in the country, with New York City (NYC) being the most unequal metro area in the state (Economic Policy Institute, 2022). Income disparities by race are stark: in 2019, the median household income for a White family was \$103,272 versus only \$51,991 for Black families and \$47,963 for Hispanic families (New York University, 2020). Additionally, the City Council reported in 2021 that the median salary for men was \$21,600 higher than for women among the City’s workforce (New York City Council, 2021).

The COVID-19 pandemic amplified NYC’s crisis of inequality. Hospitalization rates and age-adjusted fatality rates among Black and Hispanic New Yorkers were more than double those for White residents (University at Albany, 2020). Some of this inequality stems from the relatively larger proportions of Black and Hispanic essential workers in the state. These residents are also more likely than the White labor force to rely on public

transportation and to commute farther (University at Albany, 2020).

The City Comptroller indicated that 75% of all NYC frontline workers are people of color (NYC Comptroller, 2020). Climate change exacerbates existing inequality, making it imperative that climate protection policies also embody strategies to decrease inequalities.

Climate scientists have made it clear that this decade—from 2020 to 2030—is crucial to addressing climate change. Without drastic reductions in our emissions by 2030, we will lock ourselves into catastrophic levels of planetary warming. NYC is particularly vulnerable to extreme storms, sea-level rise and flooding, intense heat, and corrosion.

Without bold climate action, rising temperatures will cause NYC to continue to experience dangerous storms similar to Hurricane Sandy and tropical storms Elsa, Henri, Ida, and Isaias. These events are costly and cause flooding, forceful winds, and power outages. Such storms also affect the health and safety of all New Yorkers, hitting socially vulnerable residents the hardest (U.S. Environmental Protection Agency, 2021).

As a coastal city, New York is susceptible to sea-level rise and increased flooding from storms. Sea-level rise and storm surges damage city infrastructure including buildings, roads, transportation systems,

energy systems, and wastewater management. Small changes in sea levels can markedly increase the number of storm surges in the city (SLR, 2022). By 2050, 37% of buildings in Lower Manhattan will be exposed to storm surges. Groundwater table rise is also expected to expose 39% of Lower Manhattan streets with underground utilities to water infiltration and corrosion (New York City Economic Development Corporation, 2022). Thirty-five of NYC's 51 Council seats are waterfront districts, further demonstrating how pertinent sea-level rise and flooding are to the city and its residents.

The number of days exceeding 90 degrees Fahrenheit in NYC is expected to increase by 2050, and extreme heat is more than an inconvenience (New York City Panel on Climate Change, 2013); it poses threats to vulnerable populations and outdoor workers, places excess demand on the power grid, and strains the health care system. While NYC's overall infrastructure leaves it vulnerable as one of the most intense urban heat islands, micro-urban heat islands exist in South Bronx, Harlem, central Brooklyn, and parts of eastern Queens. Neighborhoods such as Mott Haven, East Harlem, Jamaica, and Bedford Stuyvesant, which are primarily communities of color and have higher-than-average poverty rates, therefore face greater risks from extreme heat and its health consequences (Maldonado & Choi, 2021).

Another disastrous effect of climate change is corrosion. Over time, the increased presence of carbon dioxide with higher temperatures and humidity can lead to premature concrete erosion. The current effects of climate change are projected to result in one in six structures

experiencing concrete erosion by 2100 (Stewart et al., 2012). Corrosion can also affect NYC's water supply, energy systems, and transit systems (Zimmerman et al., 2019).

As the 10th largest economy in the world and a city with one of the largest carbon footprints, NYC has a critical role to play in leading the fight against climate change and for a diverse, inclusive clean energy economy that lifts all New Yorkers (New York City Economic Development Corporation, 2022; Wei et al., 2021).

Climate change, racial injustice, and economic inequality and recovery are not separate issues. They are intersecting crises which require ambitious goals and effective policies that deliver significant reductions in emissions and pollution, high-quality jobs, and investment in the frontline communities that have suffered most from environmental injustices and historic inequities.

Based on a close assessment of NYC's climate and energy profile and the latest climate science, the following climate jobs recommendations speak to the present moment. Climate change is a massive challenge yet offers an unprecedented opportunity to invest in our communities, our health, and our future.

NYC can show the rest of the world how to make schools, public housing, and health and hospital systems clean, green, and healthy. Our students, teachers, staff, and residents deserve carbon-free and healthy buildings. Investments in these types of buildings can create good jobs for local residents, greatly lower the city's energy bill, and manage climate change.

The City can also lead the way in offshore wind and green hydrogen, shifting to renewable energy while ensuring that high-quality jobs in construction, operations, and manufacturing are created for frontline, waterfront communities that can grow with this industry.

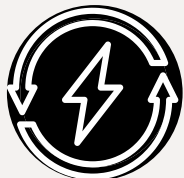
In response to the COVID-19 pandemic, NYC can rebuild, expand, and electrify its transit system. The city's transit system is climate-friendly and provides an excellent alternative to private vehicles; it also employs at least 70% people of color and expands access to jobs for many New Yorkers who cannot afford a car (NYC Comptroller, 2020).

The City can improve its resilience and adapt to climate change while developing a greener, cleaner, and more livable New York for all. Investments that protect critical assets can save millions of tax dollars in disaster recovery costs and create high-quality jobs for thousands of local residents.

These are just a few examples of the climate jobs recommendations in this report and a bold vision for strengthening New York's economy, tackling climate change, and addressing racial and economic inequality through the creation of high-quality union jobs targeted at those who need them most.



RECOMMENDATIONS SUMMARY



BUILDINGS

- Transform all K-12 NYC public schools to be carbon-free and healthy by 2030 by conducting deep retrofits and installing the equivalent of 1.1 gigawatts of solar energy and 3.3 gigawatts of battery storage.
- Transform all New York City Housing Authority buildings to be carbon-free and healthy by 2030: couple hazard condition reduction measures with deep energy efficiency retrofits, install the equivalent of 1.2 gigawatts of solar energy and 1.2 gigawatts of battery storage, invest in NYCHA green spaces, and provide a green cleaning training program.
- Transform all NYC Health + Hospitals buildings to be high-efficiency and healthy by 2030; conduct retrofits and install the equivalent of 860 megawatts of solar energy.
- Establish a publicly-owned local development corporation to provide local installation of deep retrofits and renewable energy by 2023.

ENERGY

- Make NYC an offshore wind hub by installing 3 gigawatts by 2030 and an additional 12 gigawatts by 2040, and investigate green hydrogen potential at ports and substations.
- Modernize the grid and install 6 gigawatts of battery storage by 2030.
- Achieve 100% of NYC's biogas thermal potential by diverting all food waste into City-owned waste resource recovery facilities by 2025.

TRANSPORTATION

- Accelerate improvements to the existing transit system, construct the Triboro--a direct connection between Brooklyn, the Bronx, and Queens by 2030 with potential extension to Staten Island, construct a gold-standard bus rapid transit corridor on Utica Avenue by 2030 and additional transit corridors in the Bronx, Queens, and Staten Island by 2035, and restore Fair Fares initiative funding.
- Prioritize equity in the electric vehicle transition, ensure high-quality job creation for public charging installations, support local electric bus manufacturing and assembly, establish an electric bus upskilling program, and ensure new jobs are high-quality union positions by 2030.
- Install 300 miles of protected bike lanes, ensure Citibike access in all boroughs, install 150,000 bike shelters, and reduce cycling barriers by subsidizing Citibike memberships by 2025.

RESILIENCE AND ADAPTATION

- Install green roofs or cool roofs on 100% of NYC buildings by 2030.
- Convert 10% of NYC roads to permeable “Open Streets”, increase pervious surfaces and install green infrastructure, and ensure new jobs are high-quality union positions by 2030.
- Implement Renewable Rikers and install a solar farm, battery storage, a wastewater resource recovery facility, and a composting facility, ensure high-quality job creation by 2035.
- Prevent corrosion of critical infrastructure by requiring coating application and inspection certifications on all NYC public works by 2022.

WORKFORCE DEVELOPMENT

- Expand the Mayor’s Office of Talent and Workforce Development to develop a robust system of interagency cooperation to achieve workforce development goals.
- Increase funding for direct entry pre-apprenticeships to support expanded career opportunities for frontline communities and low-income New Yorkers, encourage the State Legislature to remove community hiring barriers, and utilize Project Labor Agreements and Labor Peace Agreements on all work with the NYC Economic Development Corporation.
- Mandate labor voice in all clean energy debates by ensuring labor representatives are appointed to all key climate decision-making boards, and fund a Climate Jobs Institute at the New York State School of Industrial and Labor Relations at Cornell University by 2023.

BUILDINGS

NYC is home to one million buildings. These structures and their uses are as diverse as the city's residents: public housing developments, single-family homes, office towers, multi-family properties, schools, hospitals, warehouses, and others.

Buildings are the largest source of emissions in NYC, accounting for 70% of all greenhouse gases released annually (Bonczak, Chua, & Kontokosta, 2020). Much of the existing building stock is energy-inefficient, aging, and in need of repair. These buildings also pose notable climate risks: 72,000 buildings and 400,000 residents are within a 1% annual chance floodplain (NYC Department of City Planning, 2022). If the City intends to reduce emissions, ensure sustainability, and become resilient, then vital repairs, comprehensive retrofits, and ambitious renewable energy projects are needed.

Because buildings produce the majority of greenhouse gas emissions, action in this sector can be highly impactful. NYC has committed to the Climate Mobilization Act, an accelerated approach to achieving carbon neutrality and reducing greenhouse gas emissions by 80% by 2050 (Bonczak, Chua, & Kontokosta, 2020). With the passage of this Act, the City is on the path to addressing climate change in a tangible way.

Aligning public and private building stock with emissions goals presents enormous opportunities for job creation and pathways to union careers. NYC has a union workforce that carries a variety of skills needed to conduct this work. Electricians (International Brotherhood of Electrical Workers [IBEW] Local 3), operating engineers (International Union of Operating Engineers [IUOE] Local 30), painters (The International Union of Painters and Allied Trades [IUPAT] District 9), laborers (Local 79), cleaners (32BJ Service Employees International Union [SEIU]), carpenters (New York City District Council of Carpenters), repairers (DC37 American Federation of State, County and Municipal Employees), plumbers and pipefitters (United Association of Plumbers and Pipefitters [UA]), utility workers (Utility Workers Union of America) and other professionals are responsible for constructing and maintaining much of the City's critical infrastructure to create safe, habitable, and operable buildings. These workers are highly trained and capable of performing retrofits and installations within public and private building stock.

The shift from commitment to implementation will take daring leadership and creative solutions. NYC must initiate broad programs to spur job creation, deep retrofits, renewable energy installations, and building electrification. Through public investments in carbon-free and healthy public buildings, specifically schools; the New York City Housing Authority (NYCHA) portfolio; and NYC Health + Hospitals, the City can lead the way in meeting goals laid out in the Climate Mobilization Act. Additionally, by quickly executing and scaling up public building retrofits, the City will be able to reduce carbon emissions and to pilot new technologies that accelerate private sector compliance while driving down costs.

The City must commit to growing this workforce by expanding career pathway opportunities to frontline communities and ensuring labor standards—whether it invests directly in its own building stock or does so indirectly (i.e., through grants or public purchasing power). These initiatives require targeted local hiring goals that ensure paid on-the-job training along with expanded pre-apprenticeship and registered apprenticeship opportunities. Thousands of well-paying union jobs will result, and underserved communities will have an entryway into the middle class. This section contains recommendations to help meet NYC’s goals and to make sure that the City supports frontline workers and communities in the process.

***BUILDINGS ACCOUNT
FOR 70% OF ALL
NYC EMISSIONS***

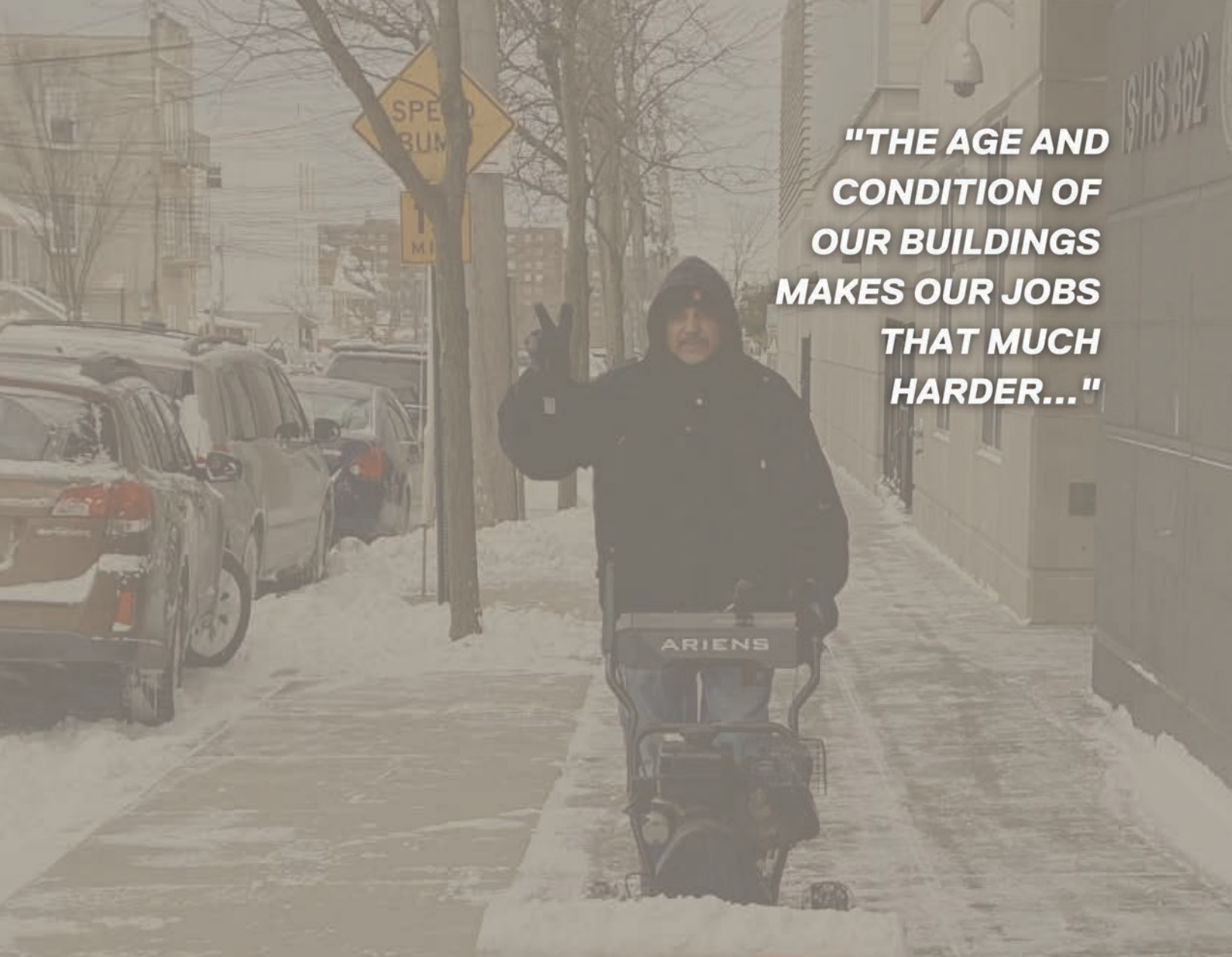
***RETROFITTING
BUILDINGS WOULD
EMPLOY WORKERS OF
EVERY TRADE***

CARBON-FREE AND HEALTHY PUBLIC BUILDINGS

The City of New York owns and operates 17,000 properties (NYC Department of City Planning, 2021). These buildings present an immediate opportunity to prioritize climate jobs. While each type of building and agency will need retrofits tailored to its function, the City can ensure that each agency centers the goals of carbon-free and healthy buildings and high-quality union jobs in capital planning.

The City should prioritize carbon-free and healthy schools, ensuring that these buildings are safe both for the students and staff who occupy them and for the communities that surround them. This transition can pave the way for carbon-free and healthy buildings citywide and lay a blueprint for more effective models of building decarbonization. For example, these models can bring expanded carbon reduction goals to NYCHA and NYC Health + Hospitals. With 2,410 buildings, the majority of which are 50 years old or more, NYCHA is in dire need of investment to foster a healthier living environment (NYCHA, 2020). Comprehensive retrofits, solar installation, and system upgrades—together with the implementation of Section 3 hiring requirements—will accomplish this goal while creating high-quality jobs for NYCHA residents. NYC Health + Hospitals has more than 70 hospitals and care centers that require energy reliability; knowledge gained from this initiative can inform upgrades, renewables, and long-term battery storage at other city facilities (NYC Health + Hospitals, 2022).

The federal government has taken steps to center community equity in its green building agenda. NYC has an opportunity to serve as a model for the country by stressing the importance of decarbonizing the city while guaranteeing that policies and incentives bring good jobs to traditionally disadvantaged communities. The same communities which bear the brunt of underemployment and unemployment in the city are also facing the most immediate impacts of climate change. Targeting efforts in these communities on deep retrofits, quality jobs, local hire mandates, and renewable energy infrastructure investments will ensure that as we “green” NYC, the benefits will be shared by all.



**"THE AGE AND
CONDITION OF
OUR BUILDINGS
MAKES OUR JOBS
THAT MUCH
HARDER..."**

"When buildings are this old, we have to put in double the amount of effort. Many schools have poor ventilation, windows over 40 years old, and very poor energy efficiency ratings. Roofs are also very old and leak. My coworkers often have to stay overnight to make sure boilers are running properly when the temperatures are below freezing. Otherwise pipes might freeze and burst, which has happened in the past. Staying overnight means time away from our families, and we are unable to get proper rest between shifts. We work hard to go the extra mile, but the buildings themselves need to be upgraded. These improvements would be a major step for our public schools, and it would better the health and safety of everyone."

Angel Ocasio (pictured above) - NYC Schools cleaner

Member of SEIU 32BJ

(32BJ represents over 5,000 school cleaners and handypersons in NYC public schools.)

MAKE NYC SCHOOLS SAFER, HEALTHIER, AND CARBON-FREE

Transform all NYC K–12 public schools to net zero by conducting deep retrofits and installing 1.1 gigawatts of renewable energy plus 3.3 gigawatts of battery storage by 2030 under a Project Labor Agreement.

The NYC Department of Education (DOE) covers 1,876 schools (DOE, 2022). Many of these buildings are antiquated (with an average age of 69 years) and in need of repair (Mayor’s Office of Sustainability, 2021). They house inefficient air conditioning and heating systems, deteriorating rooftops, and outdated electrical systems. These buildings also rely heavily on carbon-intensive energy sources for heating, cooling, and electricity, whereas only approximately 2% of school energy is produced from solar (Mayor’s Office of Sustainability, 2020).

To qualify as a carbon-free and healthy school district, every DOE building must be energy efficient, electrified, and powered by renewable energy by 2030. The City should conduct deep retrofits to reduce existing school buildings’ energy use by 50% of the 2019 baseline where applicable. In addition, all newly constructed schools must be energy efficient (with energy use intensity no greater than 20 kBtu/square foot per year), electrified, and equipped with on-site solar.

The City should install 1.1 gigawatts of renewable energy on school rooftops, and

other City-owned properties to meet remaining school energy needs. It should consider incorporating building-integrated photovoltaics such as photovoltaic windows, facades, skylights, and vertical solar arrays into school buildings during construction or deep retrofits to add surface area for energy production. The City should also craft a detailed plan describing how it will meet all on-site heating, cooling, and electricity needs with renewable energy by 2030.

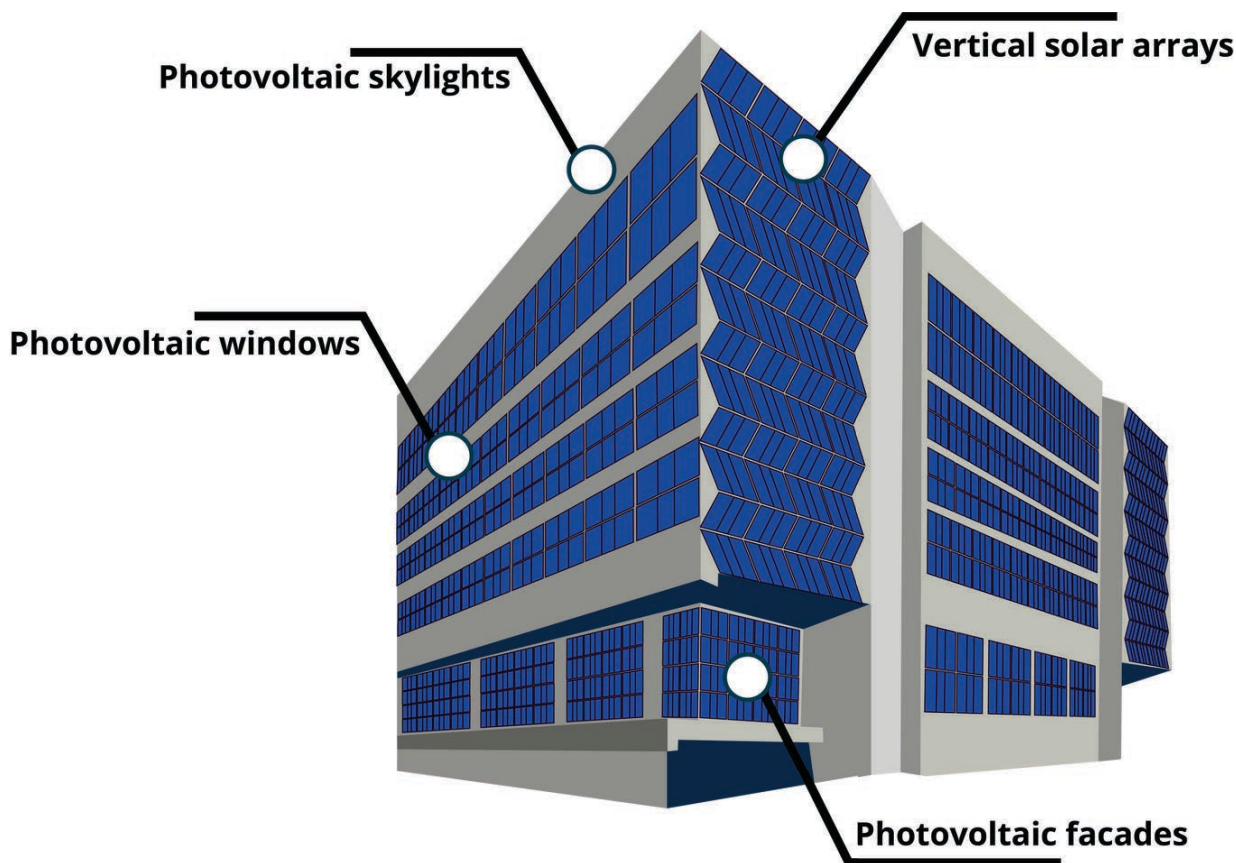
The City should also make schools community resilience hubs by adding 3.3 gigawatts of battery storage in schools and their surrounding neighborhoods. Schools will then be able to maintain power during extreme events and grid failures. After Hurricane Sandy, 76 public schools became evacuation shelters for students and families (Barron, 2012). Twenty-six DOE buses were used to transport 45,000 public housing residents to school evacuation shelters (NYC Office of the Mayor, 2012). With extreme events becoming more common and schools being a central community resource, schools must be equipped with battery storage that can provide back-up power during emergencies. Adding storage is also a

CARBON-FREE AND HEALTHY SCHOOLS

smart City decision because it would provide power to the grid along with the potential to generate income during peak summer months when schools are out of session.

NYC must prioritize the deep energy retrofits and solar installations in frontline, environmental justice communities first. Neighborhoods with the most attributable asthma hospitalization rates and emergency department visits among children, and those with the highest number of students in buildings that are in fair or poor structural condition, should also take precedence.

The NYC DOE spends approximately \$275 million per year on energy for school buildings—all of which can be redirected if every school becomes net zero (Climate Jobs New York, 2021). These funds could be used for school programs and to hire additional staff and teachers. By prioritizing investment in school building retrofits and solar energy installations, the school system can save millions of dollars in energy costs while creating thousands of well-paying union jobs for frontline communities. This initiative will provide renewable energy for NYC's public schools while leading the way towards the City's targeted 80% reduction in carbon emissions by 2050.

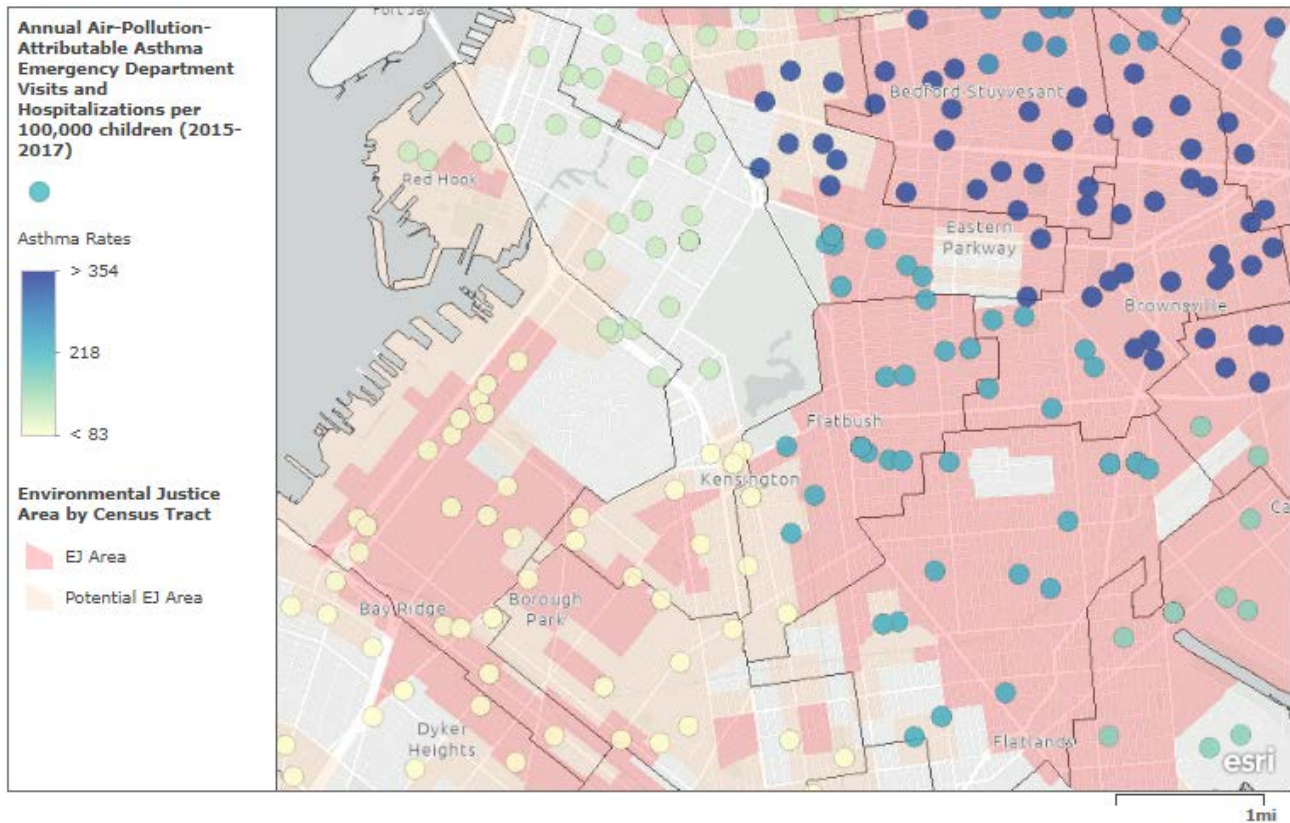


A school building with integrated photovoltaics on its facades, windows, and skylights along with vertical solar arrays on the wall.

CARBON-FREE AND HEALTHY SCHOOLS

Several active campaigns offer support and momentum to prioritize schools: Climate Works for All's Creating Green, Healthy Schools and Climate Jobs New York's Carbon-Free and Healthy Schools

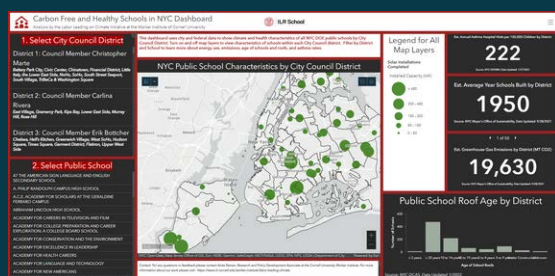
each outline reasons to expedite the implementation of these recommendations (Climate Jobs New York, 2021; Nguyen et al., 2021).



NYC OpenData, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA | NYC OpenData, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA | Department of City Planning.

There are distinct differences in health outcomes among NYC children even within a small area of one borough. This is a snapshot of schools around Prospect Park, Brooklyn. Bedford Stuyvesant-Crown Heights (top right) has an average of 332 air-pollution-attributable annual childhood hospital visits per 100,000 children compared to Downtown-Heights-Park Slope (top left), which only has 121 visits per 100,000 children. Areas with higher asthma rates also tend to be Environmental Justice zones, defined by NYC as "low-income or minority communities located in the city (NYC Mayor's Office of Climate and Environmental Justice, 2021)."

Resource: NYC DOE Public School Dashboard



View dashboard at: <https://bit.ly/3wGYBFx>

This interactive dashboard allows the user to view school characteristics (year built, energy use, emissions, solar installations, asthmatic child hospital visits, roof age, environmental justice areas or opportunity zones) and trends across districts and boroughs.

Regions and districts with older and more inefficient schools, higher childhood hospital visits, and environmental justice areas should be prioritized for retrofits and solar installations.

CARBON-FREE AND HEALTHY SCHOOLS

ESTIMATED JOB CREATION:

Conducting deep retrofits and installing solar plus battery storage to meet the energy needs of all public schools could create nearly 62,804 direct jobs over 8 years or 7,850 direct jobs per year.

ENSURING HIGH-QUALITY JOBS:

Requiring a Project Labor Agreement will guarantee that all work is performed safely and with targeted hiring goals that ensure paid on-the-job training and high-quality career pathways for women, justice-involved individuals, and frontline community members.

CARBON EMISSIONS REDUCTION:

Becoming a net-zero NYC school district could reduce emissions by 713,382 metric tons of CO₂e by 2030, equivalent to taking about 154,000 cars off the road (Mayor's Office of Sustainability, 2020; U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$14.5 billion or \$1.8 billion per year for 8 years.

LOOKING AHEAD: BUSES AS BATTERY STORAGE: VEHICLE-TO-GRID TECHNOLOGY AND UNION ELECTRIC VEHICLE PRODUCTION

Nationwide, union-made electric school buses are doubling as battery storage, electric grid modulators, and revenue generators. Thomas Built Buses, which possesses 40% of the school bus market (de la Garza, 2021), is supplying vehicle-to-grid-capable electric school buses built by United Auto Workers. Vehicle-to-grid—a system of bidirectional electrical energy flow between a vehicle battery and the electric grid—is enabling schools to store energy during idle times and sell power back to the grid as needed. At Beverly Public Schools, the Thomas Built Saf-T-Liner C2 Jouley electric school bus provided 3 megawatt-hours of electricity to National Grid in the summer of 2021 (Morris, 2021). National Grid used battery storage 30 times for more than 50 hours to reduce peak demand (Thomas Built Buses, 2021). Thomas Built Buses estimates that utility companies are paying school districts thousands of dollars per bus for this service (Thomas Built Buses, 2021). “Labor is always looking to the future, and today the future is Jouley the bus,” said Christopher Pratt, President of United Auto Workers Local 5287.]

MAKE NYCHA SAFER, HEALTHIER, AND CARBON-FREE

Grow union job opportunities for residents by ensuring paid on-the-job training along with expanded pre-apprenticeship and registered apprenticeship opportunities to conduct the following work involving hazard mitigation, deep retrofits, green infrastructure, building maintenance and operations, and solar installation in NYCHA buildings by 2030:

1 Couple hazardous condition reduction measures with deep energy efficiency retrofit measures to provide maximum, immediate benefits to NYCHA residents. Ensure lifecycle replacements of appliances and aim to decrease on-site energy use intensity by 50%.

2 Using rooftops and building integrated photovoltaics, NYCHA should install 1.2 gigawatts of solar energy and 1.2 gigawatts of battery storage to meet their energy demands.

3 Allocate \$2 billion over 8 years to the NYC Parks Department to hire full-time staff with local hire requirements to transform, manage, and maintain NYCHA green spaces with edible community gardens; safer playgrounds for residents; and green infrastructure, including urban forestry.

4 Implement an immediate moratorium on non-green cleaning products and provide a green cleaning training program to all custodial staff. Ensure NYCHA employees have the right to refuse hazardous work, and notify workers and residents of any previous or new exposure to chemical use in buildings as well as any risks of harm.

CARBON-FREE AND HEALTHY NYCHA

NYCHA is the largest public housing authority in the United States, providing public affordable housing to over 540,000 residents across 335 developments—or 1 out of every 15 New Yorkers (NYCHA, 2021). Most NYCHA buildings are more than 50 years old and are in seriously poor condition due to chronic disinvestment (NYCHA, 2020, 2021).

NYCHA currently requires \$40 billion for major repairs alone, yet City, Federal, and Tenant funds (NYCHA, 2022) provided merely 9% of needed funds in 2021.

Crumbling NYCHA infrastructure is putting New York families at risk: lack of heat and hot water, lead, and mold are known issues but are not funded similarly to a public health crisis (CBS New York Team, 2022; Morales, 2021; News 12 Staff, 2022). Chronic disinvestment in public housing is part of a larger story of structural racism in America and directly influences the health outcomes of people of color (Healey, 2021). Most NYCHA residents are low-income people of color, with more than 88% being Black or Hispanic with an average annual gross income of \$24,503 (NYCHA Performance Tracking and Analytics Department, 2021).



Photo: NYCHA residents install rooftop solar arrays on Brooklyn NYCHA buildings.

CARBON-FREE AND HEALTHY NYCHA

**THE LACK OF PRACTICAL INVESTMENT
IN NYCHA HOUSING AND SERVICES IS
PERPETUATING STRUCTURAL RACIAL
INEQUALITIES IN NYC.**

**IN 2021, THE CITY SPENT OVER
1200 TIMES
MORE PER PERSON ON INCARCERATION
THAN ON AFFORDABLE HOUSING AND
BASIC SERVICES THROUGH
NYCHA**

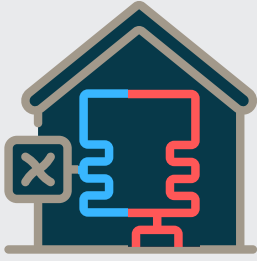
This amounts to
\$556,539
per person on incarceration and only
\$459
per NYCHA resident for housing, basic
services, job opportunities and more.

**CREATING HIGH-QUALITY JOBS
THROUGH INVESTMENT IN THE
REPAIR AND MAINTENANCE OF
AFFORDABLE HOUSING CAN REDUCE
THE NUMBER OF INCARCERATED
INDIVIDUALS AND IMPROVE
LIVELIHOODS IN NYC.**

(Stringer, 2021; Zangerle & Obichere, 2021; Schnepel, 2017).

Climate change and the related increase in extreme weather events will continue to amplify inequities and NYCHA building vulnerabilities (Yale E360, 2020). The impacts of Hurricane Sandy vividly illustrate the reality of this risk and plague certain buildings to this day (Zangerle & Obichere, 2021). The storm caused over \$3 billion in damage to NYCHA properties. Ten percent of NYCHA's developments were directly affected by the storm surge. The consequences were far-reaching: 386 buildings were without heat or hot water; more than 400 buildings suffered power outages; electrical and gas meter rooms flooded; and underground electrical conduits, electrical panels, and boilers were destroyed (NYCHA, 2022). Today, 47% of NYCHA residents meet the criteria of the U.S. Social Vulnerability Index and have a reduced "ability to prepare for, respond to and recover from emergency events." Nearly one-quarter of all NYCHA buildings will be inside the 100-year floodplain by 2050 (Williamson, 2021).

To be a carbon-free and healthy NYCHA, the City should couple needed repairs with deep retrofits to reduce existing NYCHA buildings' energy use by 50% of the 2021 baseline where applicable by 2030. Examples of such measures include but are not limited to the following: replace heat and hot water systems with geothermal and electric heat pumps, energy-efficient window upgrades to replace all non-operating windows, energy-efficient appliance replacement for all non-working resident appliances, and lead paint abatement and mold remediation while installing increased insulation.



WHAT IS A HEAT PUMP?

A heat pump is a device that uses a small amount of energy to move heat from one location to another. There are three main types of heat pumps: air-to-air, water source, and geothermal. They collect heat from the air, water, or ground outside the building and concentrate it for use inside.

United Association of Plumbers and Pipefitters Trains 500 Members in New York on Heat Pumps and Expands Green Trainings to Include Heat Pumps, Heat Pump Water Heaters, and Thermal Energy Networks

The United Association of Plumbers and Pipefitters (UA) held an all-day train-the-trainer session on heat pump performance on August 4, 2021 at UA Local 22 in West Seneca, NY. Since then, 500 UA members in NY have completed the heat pump training. Steamfitters Local 638 In NYC has implemented heat pump training for all their nearly 400 apprentices. As New York commits to some of the strongest climate and decarbonization goals in the country, the UA recognizes that scaling efforts to electrify systems will effectively reduce the state's building emissions. The New York State Energy Research and Development Authority awarded a funding match to promote the development of high-tech products to train current and future technicians on heat pump technologies. The UA continues to offer its GPRO-UA Green Building training course, which covers the fundamentals of green building, green plumbing, and green mechanical systems. The course has been updated to include heat pumps, heat pump water heaters, and thermal energy networks as well. The UA also offers water quality courses to teach risk assessment and prevention strategies for all piped systems in buildings and will soon be adding a course on improving building air quality.

International Union of Operating Engineers Train Apprentices on Energy-conserving Heat Pump Technologies



Photo above: International Union of Operating Engineers Local 30 - Union apprentices working with a heat pump trainer. The heat pump trainer is focused on new HVAC technology applicable to almost any facility where the power source is electricity rather than fossil fuels.

CARBON-FREE AND HEALTHY NYCHA

The City should install 1.2 gigawatts of renewable energy on rooftops, parking lots, and other City-owned property to meet remaining energy needs. It could incorporate building-integrated photovoltaics such as photovoltaic windows, facades, skylights, and vertical solar arrays into NYCHA buildings during deep retrofits to add surface area for energy production. The City should also assemble a detailed plan on how it will meet all on-site heating, cooling, and electricity needs with renewable energy by 2030. It should further prioritize installation of geothermal heat pumps or air source heat pumps in decarbonizing its heating and cooling needs where applicable. Investing in 1.2 gigawatts of battery storage would enable NYCHA to have back-up power and to serve as cooling centers and community resilience hubs in the face of climate emergencies.

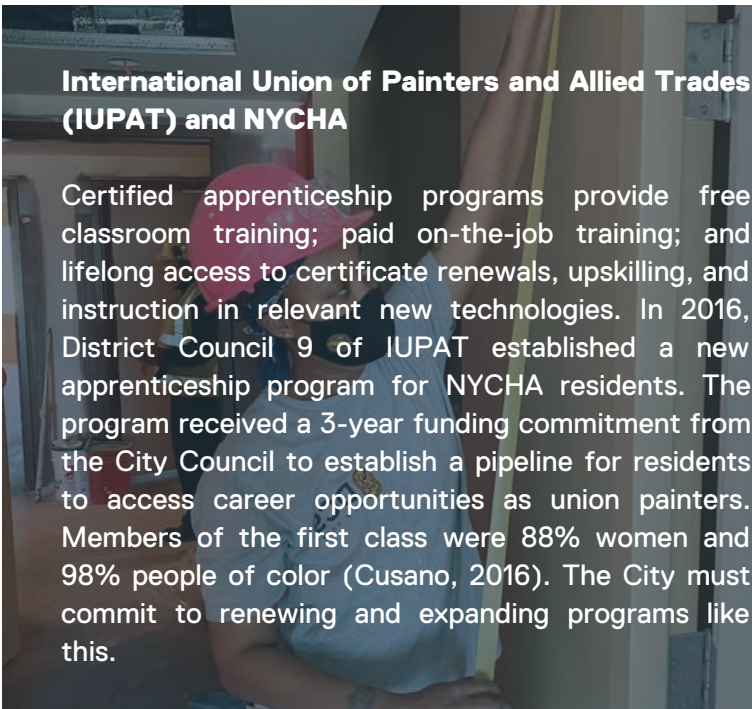
These investments will collectively reduce NYCHA's long-term total expenditures, as 13% of its current budget goes directly to utility costs (Zangerle & Obichere, 2021). Ultimately, realizing these goals while providing direct hiring and job training to residents is critical as climate risks continue to balloon.

NYCHA has been building a pipeline of residents who are ready, willing, and able to enter the construction industry. The jobs generated by meeting energy standards will create thousands of new work opportunities for NYCHA residents. Direct Entry pre-apprenticeship programs provide the tools, training, and expertise necessary to access union career opportunities. These programs address not only standard soft skills in workforce

development and a basic understanding of the construction industry; they also use credible messengers, include access to mentors, and forge relationships with industry experts to promote success.

Both pre-apprenticeship and expanded apprenticeship opportunities can help ensure a pipeline of qualified workers available to meet the potential of Section 3 hiring requirements—a provision of the Housing and Urban Development Act of 1968.

NYCHA's capital work comes with an existing Local Hire and Prevailing Wage Mandate. Section 3 requires that economic opportunities and employment which are produced by federal assistance to public housing authorities shall be directed, "whenever possible, to public housing residents and other low and very low-income residents" (Opportunity NYCHA, 2019). In addition to Section 3 employment, the Resident Employment Program requires that, where there are contracts greater than \$500,000, 15% of labor costs must be spent on resident hiring (Opportunity NYCHA, 2019).



International Union of Painters and Allied Trades (IUPAT) and NYCHA

Certified apprenticeship programs provide free classroom training; paid on-the-job training; and lifelong access to certificate renewals, upskilling, and instruction in relevant new technologies. In 2016, District Council 9 of IUPAT established a new apprenticeship program for NYCHA residents. The program received a 3-year funding commitment from the City Council to establish a pipeline for residents to access career opportunities as union painters. Members of the first class were 88% women and 98% people of color (Cusano, 2016). The City must commit to renewing and expanding programs like this.

A man in a blue jacket with a '79' patch is speaking into a microphone at a construction site. The background shows various construction equipment and vehicles. The text is overlaid on the right side of the image.

**"ONE OF MY
GREATEST JOYS IS MY
ROLE WORKING WITH
LABORERS LOCAL 79
AND EXTENDING THE
SAME OPPORTUNITIES
I HAD TO OTHER
FOLKS FROM
MY COMMUNITY."**

Justice Favor is no stranger to public housing. He is also no stranger to the impacts of extreme weather events on frontline communities. His life was transformed when he accessed a middle-class career through a union apprenticeship. Justice grew up in Hammel Houses in Rockaway, Queens and saw the effects of Hurricane Sandy on his community firsthand. In his journey, he has risen from apprentice to journeyman to union official. "One of my greatest joys is my role working with Laborers Local 79 and extending the same opportunities I had to other folks from my community. Through Section 3 and the Project Labor Agreement with NYCHA, we have created direct pathways into life-changing careers for NYCHA residents. I look forward to seeing a real investment in a carbon-free and healthy NYCHA. I know firsthand that residents are ready, willing, and able to be the ones to do that work."

CARBON-FREE AND HEALTHY NYCHA

Given its extensive building stock, NYCHA has an opportunity to leverage its vast purchasing power to bring low-carbon products to market and spur high-quality manufacturing jobs. The partnership between NYCHA and New York Power Authority (NYPA) in 1995 on energy efficient refrigerators is one of the most cited case studies on how a city can use its market and bulk purchasing power to reduce emissions. The agencies launched a request for proposals for 30% more efficient refrigerators and guaranteed the awarded manufacturer a purchase of at least 20,000 items. They also hired a NY-based company to de-manufacture old refrigerators (Nolden, 1996). In 2021, NYCHA, NYPA, and the New York State Energy Research and Development Authority launched a similar initiative, challenging manufacturers to produce a cold-climate heat pump product that could be installed in public housing windows. These types of initiatives around green technologies and carbon-reducing measures can create local manufacturing jobs. With Labor Neutrality Agreements, local hiring provisions, and in-state production, a new energy efficiency market can be harnessed to expand economic opportunities for those who need it most.

There is national support and local momentum to decarbonize and upgrade public housing buildings through the work of several active campaigns like the Green New Deal for Public Housing. Local groups in NYC—including NYCHA residents themselves—have been advocating for this transition for years. It is time to invest in NYC residents and communities and make NYCHA carbon-free and healthy.

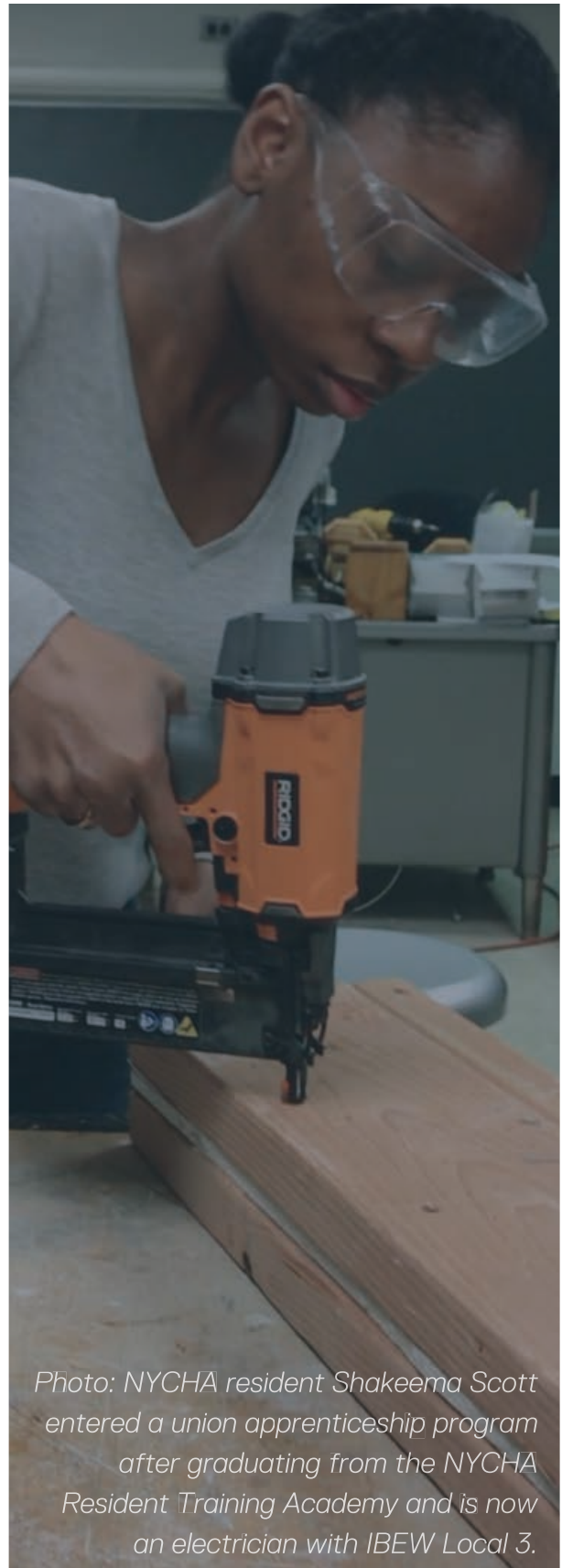


Photo: NYCHA resident Shakeema Scott entered a union apprenticeship program after graduating from the NYCHA Resident Training Academy and is now an electrician with IBEW Local 3.

CARBON-FREE AND HEALTHY NYCHA

ESTIMATED JOB CREATION:

To address existing repairs, perform deep retrofits, install on-site distributed solar and battery storage, and significantly invest in NYCHA greenspaces for resilience would create nearly 242,859 direct jobs over 8 years or 30,357 direct jobs per year.

ENSURING HIGH-QUALITY JOBS:

All work, including long-term operations and maintenance, must be completed under a Project Labor Agreement with local hire requirements that prioritize direct hiring and job training of NYCHA residents. NYCHA should ensure that the same decarbonization and retrofit standards, including labor standards with local hires, are part of the request for proposals for NYCHA Permanent Affordability Commitment Together (PACT) and infill. By combining these measures with Carbon-Free and Healthy initiatives in public schools and public hospitals, the City can optimize its purchasing power to bring green technologies to market and incentivize local manufacturing growth under Labor Peace Agreements and Buy America, Buy NY provisions.

CARBON EMISSIONS REDUCTION:

Becoming a net-zero NYCHA could reduce emissions by 649,076 metric tons of CO₂e by 2030, equivalent to taking about 140,000 cars off the road (U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$52.8 billion or \$6.6 billion per year for 8 years.

POTENTIAL FUNDING:

Mechanisms to fund these improvements: 75% through the NYS Green Bank via the New York State Energy Research and Development Authority (Foran et al., 2022; NY Green Bank, 2021); 5% with existing federal funds; and 20% through the City budget. Although New York State Energy Research and Development Authority funds would not carry Prevailing Wage—Section 3 requirements, existing federal funds to NYCHA would activate Davis-Bacon Act requirements and ensure all work is covered by Prevailing Wage. The City can also participate in the bulk purchase and distribution of materials to transform buildings to be carbon-free and healthy to greatly lower implementation costs.

LOOKING AHEAD: CLIMATE RISK DISCLOSURE, RENT CAPS, AND BUILDING VACANCY TAX

Hurricane Ida's recent effects have revealed varying climate risks among NYC neighborhoods and housing types. These risks must be addressed equitably and reduced as much as possible. The City Council should consider introducing legislation that requires all landlords to disclose climate risks to potential tenants, including but not limited to flood risk, storm surge risk, and heatwave risk. A rent cap must be implemented across all NYC rental apartments in relation to climate and environmental factors such as the air quality index, tree canopy coverage, building age, elevation, and storm surge risk: apartments with higher climate risks must be required to have lower rent costs until risks are substantially remediated. Additionally, New York City could impose a tax on the many unused or vacant apartments in the city. This would not only raise revenue, but also encourage landlords to rent out vacant apartments and address housing shortage within the city.

MAKE NYC HOSPITALS AND HEALTH CENTERS SAFER, HEALTHIER, AND HIGH-EFFICIENCY

NYC Health + Hospitals should perform energy efficiency retrofits; install the equivalent of 860 megawatts of solar energy on rooftops and surrounding areas under the existing Project Labor Agreement; and expand apprenticeship programs for local, targeted communities by 2030.

With more than 70 patient care centers across the city, NYC Health + Hospitals is the largest public health care system in the United States. City hospitals need sufficient investment to ensure they are safe and resilient. They also require tools to reduce emissions and to invest in cleaner, more efficient electricity production. NYC Health + Hospitals has set ambitious goals that include electricity reduction, on-site power generation, and upgrades to improve infrastructure performance (NYC Health + Hospitals, 2021).

These aims should be fully supported. NYC Health + Hospitals can go further by installing renewables. To meet half of their existing energy needs, hospitals would need to install the equivalent of 430 megawatts of solar by 2025 and another 430 megawatts by 2030. Given their size, hospitals could install building integrated photovoltaics on much of their building envelope in addition to their rooftops. If hospitals cannot support direct-distributed solar energy installations on roof space and parking lots, then neighboring businesses and buildings should support the buildout

and host distributed solar on their properties connected directly to the hospital grid. Work should be covered by a Project Labor Agreement with community hiring goals that will open expanded pre-apprenticeship and registered apprenticeship opportunities for frontline communities.

ESTIMATED JOB CREATION:

Retrofits and installation of distributed solar would create nearly 16,722 direct jobs over the next 8 years or 2,090 direct jobs per year.

ENSURING HIGH-QUALITY JOBS:

Requiring a Project Labor Agreement will guarantee that all work is performed safely and with targeted hiring goals that ensure paid on-the-job training and high-quality career pathways.

CARBON EMISSIONS REDUCTION:

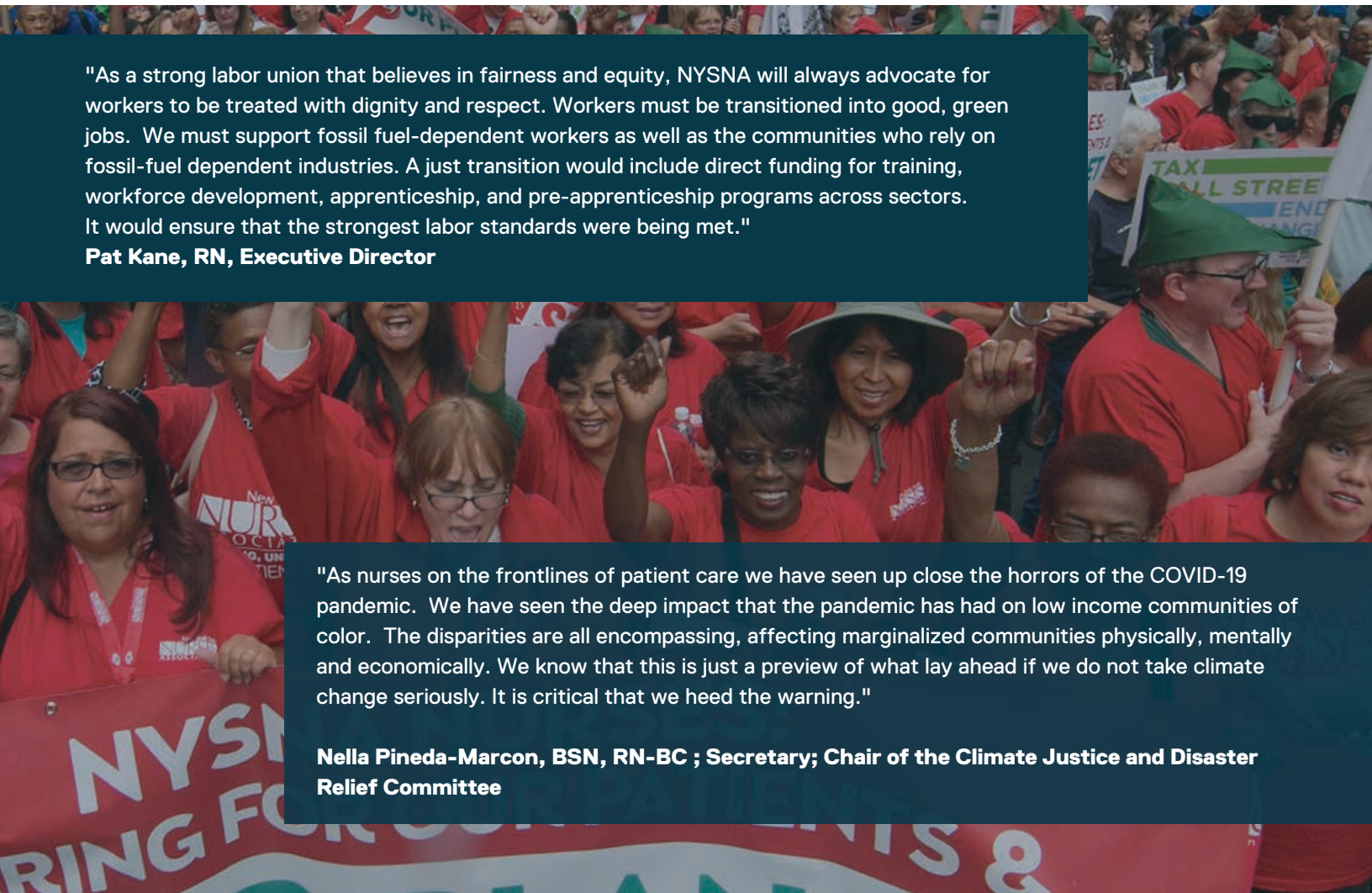
Becoming a highly-efficient hospital system would reduce emissions by 269,304 metric tons of CO₂e by 2030, equivalent to taking about 58,000 cars off the road (U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$4.38 billion or \$547 million per year for 8 years.

New York State Nurses Association Fighting for Climate and Environmental Justice

The New York State Nurses Association has been making climate and environmental justice a priority since Hurricane Sandy in 2012. Nurses were on the frontlines of this disaster, evacuating hundreds of patients and maintaining patient care. These heroes showcased the best of New York while also revealing the urgent need for upgraded, more resilient hospitals. The work did not end there though. NYNSA nurses felt it was their duty to go into the hardest hit place like The Rockaways to do medical checks on impacted residents. This was the roots of what would later become the NY Relief Network (NYRN). Through NYRN, teams of NYSNA nurses have been deployed on medical missions to places such as the Philippines, Florida, Puerto Rico, and the Virgin Islands in the aftermath of climate-related disasters. NYSNA members continued to educate themselves and their patients about the links between public health and climate and environmental justice. It became quite clear that "Climate Change is A Health Crises." NYSNA made sure to be part of major marches and rallies that ensued, including the People Climate March in 2014 (photo below). Out of this activism came the Climate and Environmental Justice Committee. NYSNA is now a key partner in several climate and environmental coalitions, speaking at rallies, giving testimony and talking to legislators.



"As a strong labor union that believes in fairness and equity, NYSNA will always advocate for workers to be treated with dignity and respect. Workers must be transitioned into good, green jobs. We must support fossil fuel-dependent workers as well as the communities who rely on fossil-fuel dependent industries. A just transition would include direct funding for training, workforce development, apprenticeship, and pre-apprenticeship programs across sectors. It would ensure that the strongest labor standards were being met."

Pat Kane, RN, Executive Director

"As nurses on the frontlines of patient care we have seen up close the horrors of the COVID-19 pandemic. We have seen the deep impact that the pandemic has had on low income communities of color. The disparities are all encompassing, affecting marginalized communities physically, mentally and economically. We know that this is just a preview of what lay ahead if we do not take climate change seriously. It is critical that we heed the warning."

Nella Pineda-Marcon, BSN, RN-BC ; Secretary; Chair of the Climate Justice and Disaster Relief Committee

ESTABLISH A PUBLICLY OWNED LOCAL DEVELOPMENT CORPORATION TO PROVIDE LOCAL INSTALLATION OF DEEP RETROFITS AND RENEWABLE ENERGY

Create a public entity to install most of NYC’s solar energy potential—at no cost to renters or owners—and conduct deep energy efficiency retrofits with high-road labor standards and bulk purchase union-manufactured equipment by 2023.

Achieving a 40% emissions reduction by 2030 requires that the City invest in work that will help building owners and tenants overcome barriers to adopting renewables and retrofit measures. Some of these obstacles include difficulty predicting costs, lengthy permitting and approval processes, challenges fronting costs, an insufficient number of workers, extra costs for flat roofs, and excessively long payback periods. Building owners who applied for financial assistance to comply with Local Law 97 have been met with delays due to the COVID-19 pandemic (Cruz, 2020). Labor-side issues also persist: solar installations below 1 megawatt—which applies to most NYC buildings—and most energy efficiency retrofit work are not covered by Prevailing Wage, Project Labor Agreements, Labor Peace Agreements, or Buy America provisions.

A new local development corporation could solve many of these challenges at once. The City could pay owners for space on their buildings to install solar panels, building-integrated photovoltaics, battery storage, electric vehicle chargers, heat pumps, and/or green roofs (vegetation) or cool roofs (reflective paint) free of charge. Because the work would be managed by a publicly owned entity, it would require labor standards on all installations regardless of size. New Yorkers would have the option to purchase these installations and retrofits on a payment plan if they so chose.

This new program would create thousands of high-quality union careers for NYC frontline communities in manufacturing, installation, operations, and maintenance.

PUBLIC RENEWABLE ENERGY AND RETROFIT PROGRAM

WHAT IS LOCAL LAW 97?

This law sets energy-efficiency requirements and greenhouse gas emission limits for most NYC buildings over 25,000 square feet by 2024, with even stricter limits by 2030.

The renewable energy and retrofit work should be conducted by highly trained electricians, operating engineers, painters, laborers, and others. IBEW Local 3, IUOE Local 30, IUPAT District 9, and Laborers Local 79 are skilled in this work and offer frontline communities a pathway into union careers.

The local development corporation should promote in-state manufacturing and bulk purchasing of panels, heat pumps, and chargers among other equipment to lower costs and scale up the work.

To enhance efficiency, reduce costs, and minimize disruption, the installation can be completed by a team who finishes all work in one or two visits.

This effort would provide myriad benefits: it would substantially reduce energy costs, which are prohibitive for many building owners and renters; improve building resilience; and, in some cases, reduce the risk of penalties from not complying with Local Law 97. Solar panels and building-integrated photovoltaics would produce large quantities of renewable energy. Battery storage would add building resilience. Electric vehicle chargers would enable more electric vehicle adoption. Heat pumps would enable heating and cooling with on-site renewables. Green and cool roofs would lower energy costs and improve panel efficiency. The local development corporation would assume all risks and costs, creating a win-win situation for renters and building owners.

A construction worker wearing a white hard hat and a high-visibility safety vest is working on a building site. The background shows construction materials and structures.

LOOKING AHEAD: CITY CRYPTOCURRENCY CARBON TAX

To fund this historic transition to net zero and to help New York building owners comply with Local Law 97, the City should strongly consider applying a carbon tax to all cryptocurrency transactions. Cryptocurrency is energy-intensive and contributes to high emissions. In 2020, a single bitcoin transaction produced an estimated 402 kg of CO₂ emissions—equivalent to nearly 1,000 miles driven by a passenger vehicle (Trespacios & Dijk, 2021; U.S. EPA, 2022). Taxing each cryptocurrency transaction and using the income to subsidize the local development corporation's upfront cost of renewables and retrofits could drastically reduce emissions, hold cryptocurrency accountable to its high carbon intensity, and create energy burden relief for New York families who need it most.

ENERGY

NYC is steadily releasing greenhouse gases that contribute to a warming planet and threaten humans' existence locally and globally. So far, the Earth's temperature has increased by 1 degree Celsius, and warming is causing "increases in droughts, floods, and some other types of extreme weather; sea-level rise; and biodiversity loss" (Allen et al., 2018, p. 53). The Intergovernmental Panel on Climate Change has stated with high confidence that "the remaining equivalent budget available for emissions is very small, which implies that large, immediate, and unprecedented global efforts to mitigate greenhouse gases are required [to prevent temperature increases above 1.5 degrees Celsius]" (Allen et al., 2018, p. 36).

NYC is reliant on fossil fuel combustion for energy, with natural gas and petroleum having produced about 78% of the city's emissions in 2020. Achieving warming of no greater than 1.5 degrees Celsius requires cities like NYC to reduce their emissions by 80% less than 1990 levels by the year 2050. To date, the City has not shown a purposeful, consistent, and sizeable decline in emissions. Prior to the pandemic, emissions were on an upward trend.

The City employs 145,000 utility workers, many of whom are represented by unions such as IBEW Local 3, Utility Workers Union of America Local 1-2, United Association of Plumbers and Pipefitters Local 1, and New York City District Council of Carpenters Local 740.(New York State Department of Labor, 2022). Union workers are primarily responsible for operating 24 city power plants and 16 peaker plants belonging to Con Edison, NRG Power, Astoria Generating Co., LS Power/Rise Light & Power, and NYPA. (UWUA Local 1-2, n.d.). It is important to note that these are high-quality, well-paying jobs with lifelong access to continuing education. The City has also seen a rise in clean energy workers; these employees are involved in the research, development, and production of components, goods, or services for clean energy, renewable electric power generation, and energy efficiency sectors. About 65% of clean energy workers are employed in Manhattan, and 35% are distributed in the other four boroughs.(NYSERDA, 2021). Unionization is lower for wind and solar jobs; in 2021, 10% of wind and solar workers were unionized compared to 16% of natural gas workers (U.S. Department of Energy, 2021).

NYC's peak summer electricity demand is 11,500 megawatts (Ammirato et al., 2021), which it meets with a combination of upstate and local electricity generation. The City's 24 natural gas plants and 16 peaker plants (Diaz, 2020) across the five boroughs meet roughly half of its energy needs. In 2021, approximately 85% of the city's local grid used fossil fuel sources, primarily natural gas.

There has been momentum towards converting existing plants into battery storage facilities. In 2020, NYPA signed a Memorandum of Understanding with the Peak Coalition to transition six of its natural gas peaker plants to battery storage and low- to zero-carbon technologies (NY Power Authority, 2020).

Rise Light & Power, which owns Ravenswood Generating Station, the City's largest power plant, plans to convert the station into 300 megawatts of battery storage and to build transmission lines to connect it to renewable sources (Kinniburgh, 2022).

As of April 2022, there were 298 megawatts of solar energy installed in NYC. Ninety-four percent of the city's solar installations have been small-scale residential projects (NY Solar Map, 2021). Because most residences install fewer than 1 megawatt—the threshold at which labor standards are activated in New York State—there is no assurance that these solar jobs provide family-sustaining income and long-term careers.

NYC is beginning to see development of offshore wind energy production and job creation. Equinor has contracted with New York State Energy Research and Development Authority to provide a total of 2,046 megawatts of energy directly to the city by 2028. It is also establishing an operations and maintenance base in Sunset Park, Brooklyn, which will be a source of local operations jobs (New York State Energy Research and Development Authority, 2022).

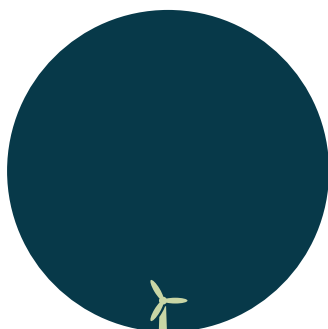
NYC has made several commitments to decarbonize its economy; the City intends to install 1,000 megawatts of solar energy by 2030 and has met close to 30% of this goal thus far (NYC Mayor's Office of Climate and Environmental Justice, 2021 & NYC Solar Map, 2022). It had installed 14 megawatts on municipal buildings as of September 2021 and aims to install 100 megawatts by 2025. (NYC Mayor's Office of Climate and Environmental Justice, 2021 & The City of New York, 2021). Five hundred megawatts of energy storage are also planned to be installed by 2025. (NYC Mayor's Office of Climate and Environmental Justice, 2021). The City is mandating building efficiency with Local Law 97 and hopes to connect to the 12 gigawatts of offshore wind. (NYC EDC, 2021).

Though the City's existing commitments show leadership, they are not ambitious enough to substantially reduce emissions or to become net zero by 2050. The City's 1,000-megawatt solar goal and direct connection to 2,046 megawatts of offshore wind by 2030 will not meet even 30% of summer electricity demand—let alone additional electricity demand after full building electrification and the installation of electric vehicle charging stations. At current energy consumption levels, electrification of the building and transportation sectors would require at least another 10,500 megawatts of renewables to replace fossil fuel sources.

**NYC USES AS MUCH
ENERGY AS
67 COUNTRIES
AND TERRITORIES
COMBINED**



NEW YORK STATE HAS STILL NOT TAPPED INTO 97% OF ITS OFFSHORE WIND ENERGY POTENTIAL



(4.3 GW)
AMOUNT OF OSW
ACTIVELY BEING
DEVELOPED IN NYS



(131.7 GW)
REMAINING
OSW POTENTIAL IN
NYS

(NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY, N.D.; LOPEZ ET AL., 2012)

Transforming nearly every aspect of NYC's economy is a tremendous opportunity. Fortunately, the city has the natural resources and workforce needed to realize a net-zero economy. It has unparalleled capacity for renewable energy from solar and offshore wind. It has the ingenuity to produce green hydrogen and sustainable biofuels from renewable sources. Its size and density positions it well to convert its organic waste into useful energy and prevent methane flaring in environmental justice zones. It also has the potential to heat and cool infrastructure with sewer thermal, effluent, and geothermal sources. Tapping into emission-free energy treasure troves could create millions of high-paying and family-sustaining jobs. These developments can be accomplished while making energy more accessible and affordable to all New Yorkers.

By transitioning to a low-carbon economy, NYC can be energy-independent and energy-secure to serve as a role model for the world. Producing solar energy within the five boroughs and building offshore wind infrastructure for easy connection will enable the City to create high-quality jobs, alleviate inequality, reduce emissions, and demonstrate self-reliance. As home to the United Nations, NYC can show how less dependence on fossil fuels—which often spark and perpetuate geopolitical conflict—can create more peace, security, and resilience here and around the globe.

To achieve these reductions, NYC needs workers who will manufacture and install solar and wind infrastructure, install transmission lines, maintain and operate renewable energy generation plants and storage facilities, repurpose natural gas infrastructure, and retrofit power plants. The City also needs to ensure that this work provides high wages, good benefits, and safe working conditions. This section contains recommendations to help meet these goals and to make sure that NYC supports frontline workers and communities in the process.

MAKE NYC AN OFFSHORE WIND HUB AND EXPLORE GREEN HYDROGEN DEVELOPMENT

NYPA can build 3 gigawatts of offshore wind by 2030 and an additional 12 gigawatts by 2040 under a Project Labor Agreement and conduct a feasibility study on green hydrogen production potential at offshore wind ports and onshore substations.

At present, NYPA has the procurement capacity to develop, own, and install 3 gigawatts of offshore wind by 2030 and an additional 12 gigawatts by 2040. The City should project future energy demands under energy efficiency scenarios and collaborate with NYPA to get to net zero well before 2050. Having NYPA develop power could be the most effective way to produce high-quality, affordable power in the public interest. For manufacturing and assembly, the City should consider appropriate city- and state-owned substation locations including Oakwood Beach, Prince's Bay, and Floyd Bennett Field (New York State Energy Research and Development Authority, 2019).

NYPA should also conduct a feasibility study on establishing green hydrogen hubs at NYC offshore wind ports and onshore substations, where offshore wind power can eventually be used to aid in the production of green hydrogen. This type of study would be one of the first of its kind in the world. Findings could help to explain how green hydrogen can be produced and distributed in large-scale urban areas such as NYC. Green hydrogen could be produced at scale from offshore wind, and

NYC, in collaboration with the state, should accelerate its offshore wind plans to ensure NYC can meet its energy demand from renewables and have sufficient offshore wind power to support the development of green hydrogen.

Installation and maintenance of offshore wind components should be completed under a Project Labor Agreement with Priority Hire Agreements for frontline communities. New York was the first state to pass a Project Labor Agreement requirement for OSW construction work. These parameters will ensure that the work is performed by highly skilled workers with a paid on-the-job training pipeline from New York's most disadvantaged communities. NYPA can take all legally permissible steps to guarantee that 50% of offshore wind components are manufactured locally and in-state to drive the creation of high-quality manufacturing jobs. The City should also make certain, to the maximum extent possible, that this work is performed under a Labor Neutrality Agreement so that workers are granted a democratic, collective voice on the job.

OFFSHORE WIND AND GREEN HYDROGEN

ESTIMATED JOB CREATION:

Installing a total of 15 gigawatts of offshore wind by 2040 could create 220,158 direct jobs over 18 years or 12,231 direct jobs per year. Requiring 50% local manufacturing could create 85,617 manufacturing jobs over 18 years.

ENSURING HIGH-QUALITY JOBS:

A Project Labor Agreement would ensure that workers installing and maintaining the 15 gigawatts of offshore wind earn fair compensation and have strong worker protections. NYC already has a Project Labor Requirement for all offshore wind construction work. Setting a target of 50% local in-state manufacturing would ensure local manufacturing jobs, contribute directly to New York's economy, and strengthen the offshore wind supply chain in the Northeast region.

CARBON EMISSIONS REDUCTION:

Installing a total of 15 gigawatts of offshore wind could reduce emissions by 26,520,900 metric tons of CO₂, equivalent to taking about 5.71 million cars off the road (U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$61.2 billion or \$3.4 billion per year for 18 years.

LOOKING AHEAD: GREEN HYDROGEN

Green hydrogen can play a key role in decarbonizing the world's economy. The United States currently produces approximately 10 million tons of hydrogen per year, which is used for a variety of high-temperature, energy-intensive industrial manufacturing and agricultural processes (Office of Energy Efficiency & Renewable Energy, n.d.). Nearly all hydrogen produced in the country today is "gray hydrogen," meaning that it is derived from natural gas steam methane reforming with no carbon capture and storage system in place (Gül et al., 2019). Only 1% of the hydrogen produced today is "green hydrogen" (i.e., produced with zero emissions) (Nelson et al., 2020). As we chart a path to net-zero emissions by 2050, green hydrogen has the potential to decarbonize sectors and processes where no direct use of electricity is applicable; examples include cement making, steel production, air travel, shipping, and heavy transportation equipment. Green hydrogen can store and deliver energy: it can store renewable energy on its own and, when used in combination with fuel cells, it can produce electricity, heat, and power with no emissions except water (Office of Energy Efficiency & Renewable Energy, n.d.; Alternative Fuels Data Center, n.d.). In NYC, green hydrogen could be particularly helpful for reducing emissions in the transportation sector. Green hydrogen fuel-celled airplanes and freight locomotives are in development because hydrogen performs better than electric batteries for long-distance, heavy loads and cold weather (North American Council for Freight Efficiency, 2020). Green hydrogen can potentially be used as a feedstock to produce ammonia for ships rather than the high-carbon bunker fuel that the shipping industry presently uses (Gallucci, 2021). Producing green hydrogen will require a large amount of excess renewable energy and water; as such, its use should focus on specific applications in hard-to-abate sectors.

**"NEW YORK IS AT A CROSSROADS – AND
SCHENECTADY WORKERS ARE READY TO
GET TO WORK"**

**- CARL KENNEBREW, PRESIDENT OF IUE-CWA,
THE INDUSTRIAL DIVISION OF THE
COMMUNICATIONS WORKERS OF AMERICA.**

**THE INTERNATIONAL UNION OF ELECTRICAL WORKERS -
COMMUNICATIONS WORKERS OF AMERICA (IUE-CWA) CALLS FOR
HIGH-QUALITY OFFSHORE WIND MANUFACTURING JOBS AT GENERAL
ELECTRIC SCHENECTADY PLANT**

In 2021, IUE-CWA and Climate Jobs New York launched a campaign calling on lawmakers and the company General Electric (GE) to invest in offshore wind manufacturing jobs in Schenectady, New York. Skilled workers at the Schenectady GE plant along with labor, business, environmental, and social justice groups are advocating to build offshore wind turbines and lead the way towards a greener American economy.

Also known as the “electric city” Schenectady is known for its manufacturing capacity and union job creation. Over decades, General Electric has outsourced its manufacturing, resulting in dwindling middle-class union jobs and a less secure domestic supply chain. Once a campus of 300,000 workers, General Electric now has less than 1,000, and most of these jobs are now in Poland.

IUE-CWA and GE workers are calling on New York to make Schenectady a manufacturing powerhouse once again, but this time in offshore wind production. The campaign -- Green Jobs Green Economy -- states that for every 100 factory jobs created, the city will gain another 150 local jobs and \$3 million in economic growth.

MODERNIZE THE GRID AND INSTALL 6 GIGAWATTS OF BATTERY STORAGE BY 2030

NYC should update its transmission and distribution infrastructure including mandatory smart meters, enhanced breakers and capacitors, and improved accessibility to information technology infrastructure and networks. In conjunction with grid modernization, NYPA should install 6 gigawatts of utility-scale battery storage by 2030 in connection with NYPA-owned-and-operated solar and wind projects. All work should be carried out under a Project Labor Agreement with Local Hiring Requirements.

As NYC electrifies its buildings and transportation systems, demand will shift seasonally. Statistics suggest that peak winter energy demands will occur by 2035 (Urban Green Council, 2021). Battery storage offers an appealing solution to NYC's changing peak demand with projected continual lowering of the costs of utility-scale battery storage (Cole, Fraizer, & Augustine, 2021). To prepare for this shift and to strengthen NYC's grid in the face of rising climate risk, NYC must implement other demand flexibility measures and update its transmission and distribution infrastructure (e.g., mandatory smart meters for all buildings, enhanced breakers and capacitors, and improved accessibility to information technology infrastructure networks). Con Edison estimates that the company will have installed 5 million smart meters by 2022 (Con Edison, 2022).

Many utilities such as Con Edison have downsized their permanent workforce over the last few decades, resulting in a reduction in maintenance and improvements. This has left NYC more vulnerable to extreme weather events. Transitioning to a low-carbon energy system will require significant investments in the grid. This is a chance to rebuild a highly-skilled utility workforce and ensure that these are high-quality union jobs.

Additionally, stronger coordination should occur between in-city, in-state, and regional grid and energy stakeholders including but not limited to the Federal Energy Regulatory Commission, New York State Energy Research and Development Authority, The New York Independent System Operator, The New York State Public Service Commission, and NYPA as more large-scale renewables come online regionally.

GRID RELIABILITY AND ENERGY INDEPENDENCE

ESTIMATED JOB CREATION:

Modernizing the grid and installing 6 gigawatts of battery storage would create nearly 56,253 direct jobs over 8 years or 7,031 direct jobs per year.

ENSURING HIGH-QUALITY JOBS:

Requiring a Project Labor Agreement and Local Hiring Requirements will guarantee that work is completed fairly while creating local jobs for frontline communities.

CARBON EMISSIONS REDUCTION:

Modernizing the grid and installing 6 gigawatts of battery storage would reduce emissions by 10,608,360 metric tons of CO₂e by 2030, equivalent to taking about 2.29 million cars off the road (U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$16.1 billion or \$2 billion million per year for 8 years.

LOOKING AHEAD: LONG-DURATION STORAGE

Long-duration energy storage will be vital for resilience and energy security as NYC electrifies infrastructure and expands renewables. These storage systems use thermal, mechanical, electrochemical, or chemical mechanisms to store renewable energy for days or weeks at a time (Bettol et al., 2021). Such technologies can provide reliable energy to NYC during intermittent solar or wind energy production times, reduce demand on the grid, and provide back-up energy during extreme events.

In January 2022, New York State Governor Hochul doubled the state's energy storage target to at least 6 gigawatts by 2030. The Governor also committed to continuing the state's agenda to phase out NYC's fossil fuel peaker plants (Hochul, 2022), which can be retrofitted to host long-duration energy storage systems. These technologies can help NYC fully decarbonize the power sector by delivering peak power and storing renewable energy from wind and solar production. In September 2021, the U.S. Department of Energy announced \$17.9 million in funding for long-duration energy storage projects (Office of Energy Efficiency & Renewable Energy, n.d.), with additional funding available from New York State. Over the next several decades, this type of storage can create new jobs through several means: the development of long-duration storage facilities; research and development of related technologies; the mining and manufacturing of necessary materials; and facility construction, maintenance, and operations.

INCREASE NYC'S RESILIENCE BY CONVERTING FOOD WASTE TO HEAT ENERGY

Achieve 100% of NYC's biogas thermal potential by diverting all food waste into City-owned waste resource recovery facilities by 2025.

NYC transports approximately 1.3 million tons of food waste to landfills every year—enough to fill more than 250 subway cars per day (NYC Mayor's Office of Long-Term Planning and Sustainability, 2013). In landfills, these organics break down into methane (a potent greenhouse gas) and contribute to the 3% of emissions produced by the City's waste sector.

When the City throws away food, it is losing an energy source and a chance to reduce emissions and generate income. The NYC Department of Environmental Protection's wastewater resource recovery facilities are equipped with anaerobic digesters that break down organic waste and generate by-products called biogas and biosolids. Some of this gas is used as a renewable energy source for boilers. The remaining gas can be cleaned up in a biogas capture and processing system, sold, and added to the grid to be used for electricity or for the heating and cooling of critical infrastructure, a process called gas-to-grid (Adams, 2018). NYC facilities do not currently have enough systems and capacity needed to clean the biogas to grid quality, resulting in flaring of pollutants into surrounding communities (Maldonado, 2022).

The gas-to-grid process allows for fewer trips to landfills, fewer landfill emissions overall, and reduced methane flaring from wastewater resource recovery facilities. The biosolids remaining after digestion can be composted and used as nutrients for green infrastructure (Platt et al., 2013).

If NYC used digesters to convert all its food waste to biogas, the city would provide energy to critical infrastructure such as hospitals. These buildings require large amounts of uninterrupted energy to regulate air circulation and to maintain temperature-sensitive equipment.

According to NYC's Department of Environmental Protection, with the right investments, existing City digesters can break down 100% of the city's food waste into biogas (Dawson, 2020). To add biogas to the grid, the City must develop, own, and operate biogas processing and capture systems at city wastewater resource recovery facilities.

ORGANICS TO ENERGY

To use food waste for biogas, the City must create an immediate mandatory residential, commercial, and industrial organics collection program.

The City Council estimates that mandatory organics collection would cost \$40 million to establish and that savings from transporting waste to landfills would offset this cost (Barnard, 2020). The installation of biogas generation capacity for food waste would generate tens of millions in funding and help expand and manage citywide organics collection and composting. Because anaerobic digesters at wastewater resource recovery facilities such as Newtown have trouble processing green waste or commercially compostable plastics, composting facilities will continue to remain necessary.

The City Council further recommends that NYC's Department of Sanitation provide organics bins to every pick-up location (New York City Council, 2020).

Following a similar model to San Francisco, the City can pass an immediate mandatory organics separation ordinance and hire “zero-waste facilitators” for the Department of Sanitation—City employees who are trained to assist property managers and educate tenants on adhering to mandatory separation requirements (San Francisco Board of Supervisors, 2009).

Permanent City-agency jobs can be created throughout the biogas production process. Workers will be needed to construct and operate new biogas capture and processing systems. Workers will also be needed at waste transfer stations, where food is converted into a bioslurry. The City should invest in pre-apprenticeship and workforce transition training programs for existing workers that prioritize the skills necessary for 21st-century innovation in wastewater management, including new implementation and control technologies.



ORGANICS TO ENERGY

ESTIMATED JOB CREATION:

Adding biogas processing and capture capacity to handle all city food waste could create 1,494 direct jobs over 3 years or 498 direct jobs per year. This initiative would also create three times more permanent compost use jobs than landfilling jobs.

ENSURING HIGH-QUALITY JOBS:

City-agency jobs can be created throughout the biogas production process, from construction and operation to supply chain. The City should invest in pre-apprenticeship and workforce transition training programs for existing workers that prioritize the skills necessary for 21st-century innovation in wastewater management, including new implementation and control technologies. Using the compost created from biogas production for resilience measures (e.g., soil erosion control, stormwater management, and green infrastructure) can also create permanent City-agency jobs. Investing in compost distribution creates three times more jobs than investing in landfilling (Platt et al., 2013).

CARBON EMISSIONS REDUCTION:

Digesting 100% of food waste could reduce emissions by at least 689,940 metric tons of CO₂ per year, equivalent to taking about 149,000 cars off the road (U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$230 million or \$76.7 million per year for 3 years.

LOOKING AHEAD: TURNING WASTE PROCESSES INTO LOW-CARBON HEATING AND COOLING

SEWER THERMAL ENERGY USE

- The process of recuperating energy from sewer wastewater.
- The energy is then returned to the community to heat and cool New York City buildings.
- SE False Creek in Vancouver is a neighborhood entirely heated with sewer thermal heat
- Colorado is in early stages of sewer thermal utilization and Maryland is making this energy eligible for renewable energy credits (District of Columbia Water and Sewer Authority, 2021).

EFFLUENT HEAT RECOVERY

- The process of capturing energy from clean water effluent, the output of wastewater treatment heading to the harbor.
- The energy can then be used to heat and cool the city's water resource recovery buildings and processes.

TRANSPORTATION

Tackling the climate crisis requires a sweeping shift in how NYC moves goods and people. The transportation sector continues to be one of the greatest contributors to greenhouse gas emissions; in fact, it is the nation's largest source of greenhouse gases (U.S. Environmental Protection Agency, 2021). In New York State, transportation accounted for 47% of greenhouse gas emissions in 2018 (U.S. Energy Information Administration, 2021). It is estimated that the transportation sector accounted for 25% of emissions in NYC alone in 2020 (Bonczak et al., 2020). The city is at a critical juncture: with the promise of transport electrification, growing traffic congestion, and the frequency of climate events (e.g., flooding) that affect aging infrastructure, the transportation sector must meet the moment.

NYC IS UNIQUE IN THAT MASS TRANSIT IS INHERENTLY PREVALENT IN RESIDENTS' LIVES.



PRE-PANDEMIC COMMUTE TRAVEL EXCEEDED

5.5 MILLION

SUBWAY TRIPS



2.2 MILLION

BUS TRIPS

PER AVERAGE WEEKDAY IN A CITY OF 9 MILLION PEOPLE

(NEW YORK CITY TRANSIT, 2020, 2021)

NYC DOT develops policies, regulates, operates and maintains the City's:



16,350
bus stops



12,000 miles of
sidewalks



6,300 miles
of roadways

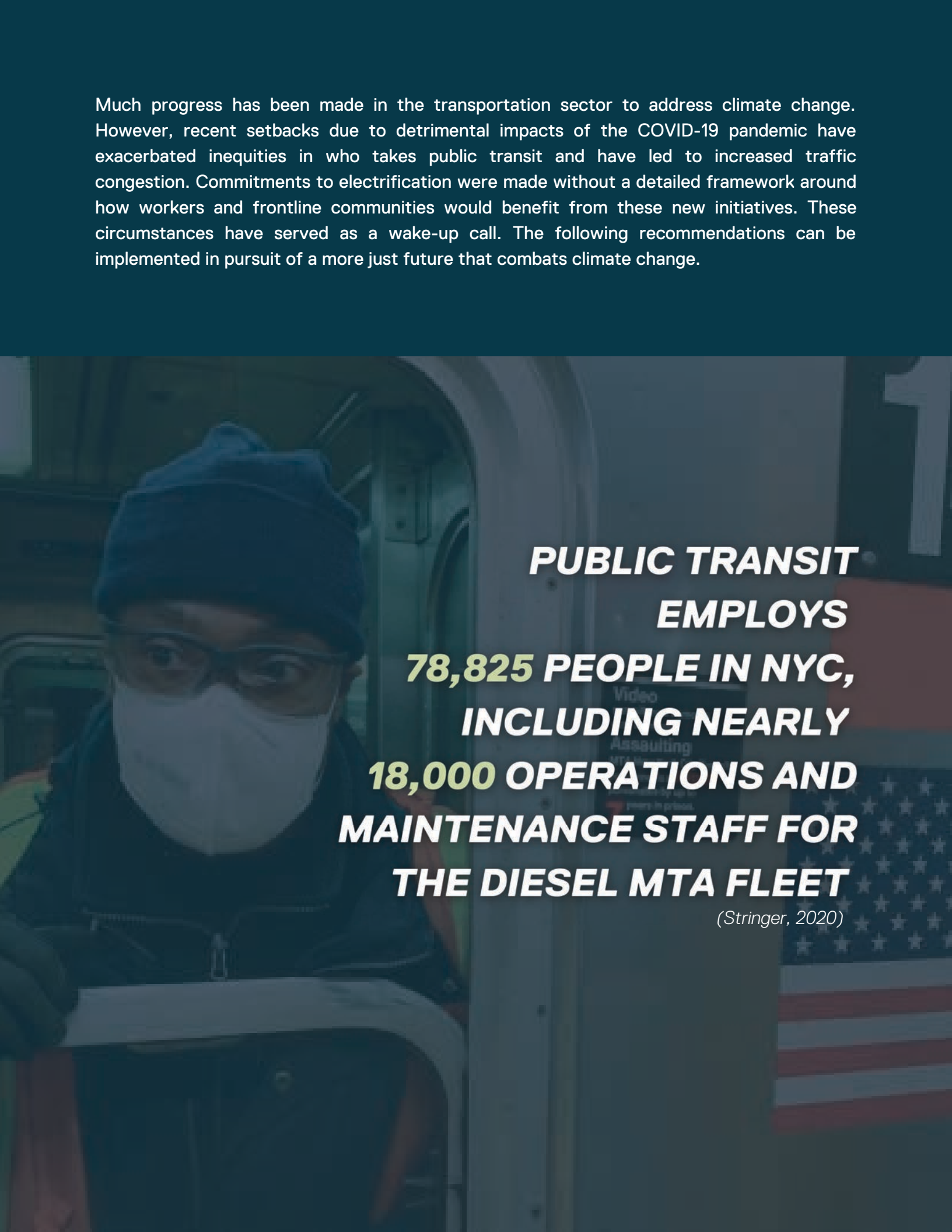


1,375 bike
lane miles

(NYC OFFICE OF THE MAYOR, 2020)

THE METROPOLITAN TRANSIT AUTHORITY (MTA) OPERATES THE CITY'S SUBWAY AND BUS SYSTEM, COMMUTER RAILROADS (LONG ISLAND RAIL ROAD AND METRO-NORTH RAILROAD), AND CERTAIN BRIDGES AND TUNNELS.

Much progress has been made in the transportation sector to address climate change. However, recent setbacks due to detrimental impacts of the COVID-19 pandemic have exacerbated inequities in who takes public transit and have led to increased traffic congestion. Commitments to electrification were made without a detailed framework around how workers and frontline communities would benefit from these new initiatives. These circumstances have served as a wake-up call. The following recommendations can be implemented in pursuit of a more just future that combats climate change.



**PUBLIC TRANSIT
EMPLOYS
78,825 PEOPLE IN NYC,
INCLUDING NEARLY
18,000 OPERATIONS AND
MAINTENANCE STAFF FOR
THE DIESEL MTA FLEET**

(Stringer, 2020)

IMPROVE PUBLIC TRANSIT TO INCREASE RIDERSHIP AND ADDRESS INEQUITIES

1

Rebuild, expand, and accelerate improvements to the existing transit system

2

Construct the Triboro—a direct transit connection between the Bronx, Queens, and Brooklyn by 2030 with potential extension to Staten Island

3

Construct a gold-standard bus rapid transit corridor on Utica Avenue by 2030

4

Ensure that transit is accessible and affordable by restoring funding to the Fair Fares initiative

Early in the pandemic, subway ridership plummeted 90% compared to 2019. Traffic congestion has since returned to pre-pandemic levels in NYC whereas subway and bus ridership have yet to rebound (Martinez, 2021). Bus ridership saw declines of 75%. More people in NYC are now acquiring and driving vehicles, and this diversion from public transit may compromise the City's climate goals (Rosa, 2021).

While electrification is one strategy to combat climate change, getting New Yorkers out of their cars is another powerful way to reduce greenhouse gas emissions. Public transit must be viable and safe to support the City's most vulnerable and essential while preserving climate goals. Before the pandemic, the MTA removed 17 million metric tons of carbon emissions from the air per year by providing public transit services (MTA Department of

PUBLIC TRANSPORTATION

Environmental Sustainability and Compliance, 2019). Seamless, frequent and reliable public transit service in this region is within reach. Refocusing expansion on historically underserved areas is critical. Millions of New Yorkers rely on transit every day, especially lower-income families and communities of color (Office of the New York State Comptroller, 2022). An analysis of MTA subway data showed that neighborhoods with lower median household incomes had higher ridership during the pandemic compared with wealthier neighborhoods in the same period. In addition, 55% of all frontline workers use the subway as their primary mode of transportation, and many continued to take transit during the worst waves of COVID-19 (Kaufman et al., 2020).

The following recommendations will rebuild a transit system in disrepair. Suggestions are intended to expedite in-progress projects and to present an expansive vision for connecting underserved communities.

1) Rebuild, expand, and accelerate improvements to the existing transit system

Optimize federal dollars to catch up on the State of Good Repair and ensure subway drainage systems are annually cleaned to boost resilience

The State must leverage new federal funding to catch up on the State of Good Repair backlog and maintain good service levels to bring people back to transit during the pandemic. Additional maintenance staff should be hired to clear all City transit subway drains annually rather than on a 4- or 15-year cycle.

According to the Regional Plan Association, 20% of MTA's subway entrances face the threat of flooding in extreme weather scenarios (Negret & McNulty, 2021). In other words, 400 subway entrances may be inaccessible to New Yorkers during an extreme climate event. Water is an inevitable reality in a 100-year-old subway system. Furthermore, 418 of NYC's 665 miles of subway track underground (New York City Transit, 2020). Fourteen million gallons of water are pumped out each day (Hu & Barnard, 2021). The MTA has a system-wide drainage system that can manage 1.5 inches of rain per hour; the subways are equipped with 285 pump rooms alongside the tracks that funnel excess water from leaks, rain, or rapid snowmelt into the sewer system (Pokorny, 2021). Clearing debris and blockages from the drainage infrastructure is critical to managing stormwater in the subway system. This process ensures that standing water is not on the train tracks, which can cause delays and hinder safe system operations during major storms.

The MTA has struggled to prioritize drain clearing—only 5 years ago did the corporation develop a map of all drain locations to monitor maintenance performance. An MTA Inspector General report indicated that, to meet the annual goal for track drain cleaning as of August 2021, it would take 15 years to clean the entire system (Pokorny, 2021). The inspection and clearing process for drain boxes can be quite labor-intensive—and justly so. Although the MTA determined that it must increase its cleaning goal, the corporation committed in 2021 to targeting areas for a biannual inspection and set a

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goal to address 2,500 drains a year, amounting to a 4-year cleaning cycle.

Annual subway drain cleaning and pump room maintenance to prevent flooding is the way forward. Additional staff must be hired to conduct preventive maintenance and to address just-in-time needs during related events.

Accelerate key projects such as Second Avenue Subway Phase II and Penn Station Access

Preliminary funding has been made available for these two ambitious projects that add service to areas in Manhattan and the Bronx. However, NYC must work with the MTA to build these projects efficiently and on a more accelerated timetable.

Second Avenue Phase II is part of the subway system's largest expansion in decades. Phase I opened for service in 2017 with higher ridership than anticipated. Phase II extends the Lexington Avenue 4/5/6 trains service from 96th Street to 125th Street with new accessible stations at 106th Street and 116th Street on Second Avenue and at 125th Street at Park Avenue along with a connection to Metro-North. East Harlem will thus have a one-seat ride to Midtown Manhattan. The project is estimated to cost \$6.4 billion (Luczak, 2022). The Federal Transit Administration authorized the engineering phase of the project in January 2022 (New York State Governor, 2022). The City must encourage the MTA and the Federal Transit Administration to accelerate this project as much as possible. The MTA has cited a 2030 end date, but having this connection by 2026

would support New York City's recovery.

Another project, Penn Station Access, builds four new accessible Metro-North stations in the Bronx at Hunts Point, Parkchester/Van Nest, Morris Park, and Co-op City. These stations allow for direct connections from the Bronx to Grand Central and Midtown Manhattan. The project is estimated to cost \$2.87 billion with a completion date of 2027.

These projects must be expedited to increase demand, and the City should work with the MTA to reduce the timeline.

While the above expansion projects are underway, they still revolve around movement to and from Manhattan. Yet economic hubs in NYC have changed, particularly in light of the pandemic. Connecting the outer boroughs with new transit lines will be pivotal to NYC's economic recovery and will partly rectify long-standing disinvestment in communities of color.

2) Construct the Triboro—a direct transit connection between the Bronx, Queens, and Brooklyn by 2030 with potential extension to Staten Island

NYC should advocate for the Regional Plan Association Triboro, a 24-mile above-ground rail expansion project that would provide connections between Brooklyn, Queens, and the Bronx; this project would also connect 17 subway lines and four commuter rail lines (Barone et al., 2016). Triboro contemplates the development of an electric rail line using an existing right-of-way for freight movement. The MTA recently completed a feasibility study and announced the start of an environmental

PUBLIC TRANSPORTATION

review process for the Interborough Express a similar transit line that only connects Queens and Brooklyn (MTA, 2022). The inclusion of the Bronx in the Interborough Express is paramount in this expansion of the public transit system if equity is to be at the center of new transportation initiatives.

Bus rapid transit is also a viable and cost-effective approach to these outer-borough connections. The City and State should follow the Triboro plan and include the Bronx in any outer borough-focused expansion project.

ESTIMATED JOB CREATION:

Building the Triboro (or Interborough Express, including the Bronx) by 2030 could create 55,680 direct jobs over 8 years or 6,960 direct jobs per year. Requiring 50% local manufacturing could create an additional 3,600 jobs.

ENSURING HIGH-QUALITY JOBS:

A Project Labor Agreement would ensure that workers building these new systems earn fair compensation and have strong worker protections. Setting a target of 50% local in-state manufacturing would ensure that local manufacturing jobs contribute directly to New York's economy.

CARBON EMISSIONS REDUCTION:

The Triboro could reduce emissions by 2,064,164 metric tons of CO₂e annually post completion, equivalent to 260,000 homes' energy use for one year (U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$4.8 billion or \$600 million per year for 8 years.

WHAT IS "GOLD-STANDARD" BUS RAPID TRANSIT?

Bus rapid transit is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective service. As bus rapid transit has features similar to a light rail or subway system, it is much more reliable, convenient, and faster than regular bus services. Because bus rapid transit is above-ground, it can be more resilient to climate events than underground subway systems, which can more easily flood. No bus rapid transit system in the United States currently meets the "gold standard" as evaluated by the Institute for Transportation and Development Policy.

- Dedicated right-of-way with bus-only lanes
- Busway alignment where a center-of-roadway or bus-only corridor keeps buses away from the busy curbside where cars park, stand, or turn
- Off-board fare collection with payment at a station to eliminate delays
- Intersection treatments that give exclusive priority to buses at intersections
- Platform-level boarding to allow for easy boarding versus curbside bus stops

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3) Construct a gold-standard bus rapid transit corridor on Utica Avenue by 2030

Brooklyn has experienced tremendous population growth but has seen little accompanying public transit expansion. Community leaders and elected officials have long highlighted the Utica Avenue Corridor, an eight-mile corridor in Brooklyn, as an area in need of transit. A Transit Task Force established by the Brooklyn Borough President in 2020 echoed this concern (Martinez & Dowd, 2020). The B46 and B46 Select Bus Service are some of the busiest bus routes in NYC, serving close to 50,000 people per day. Initial subway expansion plans called for a subway to Utica Avenue, and certain provisions were made to integrate an extension of the 2/3, 4/5, and A/C lines. Then, in the 1960s, an extension was designed on the Eastern Parkway Line (2/3) but was never built (New York City Transit, 2020). Cost has often been cited as an obstacle to subway expansion projects such as this. The MTA recently led a Utica Avenue Transit Improvements Study to determine the most suitable transit mode for the area.

The City should work with the MTA to install a “gold-standard” bus rapid transit corridor for Utica Avenue as the starting point of a larger vision towards bus rapid transit connecting communities underserved by the subway network.

Bus rapid transit is a way that global leaders in public transit have led expansion. These projects are known to be more cost-effective than underground subways while delivering similar community benefits.

For instance, the average operational speed of bus rapid transit in Bogotá, Colombia (26.2km/h) is much faster than traditional buses (10km/h) and is comparable to NYC subway speeds (Tsivanidis, 2019). From a climate perspective, Bogotá’s government reported a 43% reduction in SO₂ emissions, an 18% reduction in NO_x, and a 12% decline in particulate matter after implementation of bus rapid transit (Bel & Holst, 2018). Meeting climate goals and building transit access can substantially benefit the Crown Heights and East Flatbush areas of NYC.

ESTIMATED JOB CREATION:

Building the Utica Avenue Bus Rapid Transit by 2030 could create 5,760 direct jobs over 8 years or 720 jobs per year. Requiring 50% local manufacturing could create an additional 372 jobs.

ENSURING HIGH-QUALITY JOBS:

A Project Labor Agreement would ensure that workers building these new systems earn fair compensation and have strong worker protections. Setting a target of 50% local in-state manufacturing would ensure that local manufacturing jobs contribute directly to New York’s economy.

CARBON EMISSIONS REDUCTION:

The Utica Avenue Bus Rapid Transit could reduce emissions by 12,256 metric tons of CO₂e annually post-completion, equivalent to 1,540 homes’ energy use for one year.

ESTIMATED COST:

\$497 million or \$62.1 million per year for 8 years.

PUBLIC TRANSPORTATION

Multi-borough bus rapid transit expansion

The MTA should review other potential corridors for bus rapid transit. Expansion could include Flatbush Avenue in Brooklyn, East/West Fordham Road in the Bronx, Roosevelt and Hillside Avenues in Queens, and Hylan Boulevard and Narrows Road in Staten Island—which would collectively add 37 more miles of bus rapid transit.

ESTIMATED JOB CREATION:

Expanding bus rapid transit to the Bronx, Queens, and Staten Island by 2035 can create 27,090 direct jobs over 13 years or 2,083 jobs per year. Requiring 50% local manufacturing can create 1,751 manufacturing jobs over 13 years.

ENSURING HIGH-QUALITY JOBS:

A Project Labor Agreement would ensure that workers building these new systems earn fair compensation and have strong worker protections. Setting a target of 50% local in-state manufacturing would ensure that local manufacturing jobs contribute directly to New York's economy.

CARBON EMISSIONS REDUCTION:

Multi-borough bus rapid transit expansion could reduce emissions by 501,538 metric tons of CO₂e annually post-completion, equivalent to 63,200 homes' energy use for one year.

ESTIMATED COST:

\$2.34 billion, or \$180 million per year for 13 years.

4) Ensure that transit is accessible and affordable by restoring funding and building automatic opt-in to the Fair Fares initiative

A rebuild and expansion of NYC's public transit system will not be possible without reducing barriers to access for working families. Families living in poverty have cited transit affordability as a problem, with 28% of Black and Latinx residents noting that they face difficulty affording the MTA fare. This rate rose during the pandemic (Chatterjeelrene, Lew, & Torres, 2022).

The Fair Fares program, which provides a 50% discount on subway and bus fares, launched to much fanfare in 2019 after a lengthy push from riders and advocates such as the Riders Alliance and the Community Service Society.

The City government must work to build awareness of this incredible transit benefit (Ley, 2022), and funding must be restored to the pre-pandemic amount of \$106 million to enhance program access. Moreover, eligibility should be expanded, and participants should not be forced to navigate the bureaucratic hassles of sign-up: the Human Resources Administration should include an automatic opt-in option for New Yorkers already receiving Administration-provided benefits. Centering equity means that NYC must prioritize vulnerable communities to ensure a just recovery.

ESTIMATED COST:

\$106 million



LOOKING AHEAD: SUSTAINABLE AVIATION

Sustainable aviation fuel, a biofuel produced from biomass and agricultural waste, holds promise for decarbonizing aviation in NYC and around the world. Aviation currently produces 12% of transportation emissions in the United States, and jet fuel consumption is expected to double in the next two decades (Holladay et al., 2020; Overton, 2019). John F. Kennedy airport in NYC is one of the largest consumers of jet fuel on the East coast (Ronk & Pietrzak, 2021). Momentum for the production and distribution of sustainable aviation fuel is growing in states like California, but no commercial sustainable aviation fuel production is currently happening in states on the East coast despite feedstock supply and demand for jet fuel. Potential areas of growth include the construction of biorefinery facilities; maintenance of jet fuel transport pipelines; and fuel transportation via ship, rail, or truck (Holladay et al., 2020). Though the Port Authority of New York and New Jersey and airports themselves do not buy jet fuel, they can facilitate and set standards for interested parties including airlines, fuel producers, and fuel transporters.

PROVIDE EQUITABLE ELECTRIC TRANSPORTATION FOR WORKERS AND COMMUNITIES

1

Center environmental justice communities in the electric vehicle transition

2

Ensure that buildout of public charging infrastructure is centered in high-quality job creation and equity

3

Leverage public investment in electric bus commitments to support local manufacturing and assembly

4

Establish a large-scale electric bus upskilling program for City operations and maintenance bus staff and ensure that new jobs are high-quality union positions

Transport electrification is gaining momentum as a prime strategy to mitigate the climate crisis. Electrification provides an opportunity to reduce greenhouse gas emissions while building a new industry and, in turn, high-quality jobs and positive economic impact. The negative public health effects of diesel and gas-powered vehicles from the release of greenhouse gas emissions, carbon monoxide, diesel particulate matter, and nitrogen oxides

cannot be understated (Pan et al., 2021; Weitekamp et al., 2020).

Reducing pollutants in the air is critical to the health of our families, children, and neighbors.

As part of the \$1.2 trillion Infrastructure Investment and Jobs Act signed into law in November 2021, funding is provided for an electrification transition (The White House,

ELECTRIC VEHICLE TRANSPORTATION

2021). President Biden also signed an executive order with a target of zero-emission vehicles accounting for 50% of all U.S. vehicle sales by 2030. Combined with Governor Hochul's signature on legislation that effectively bans the sale of new internal combustion engine cars, off-road vehicles, light-duty trucks, and equipment by 2035, the backdrop for electrification is in place.

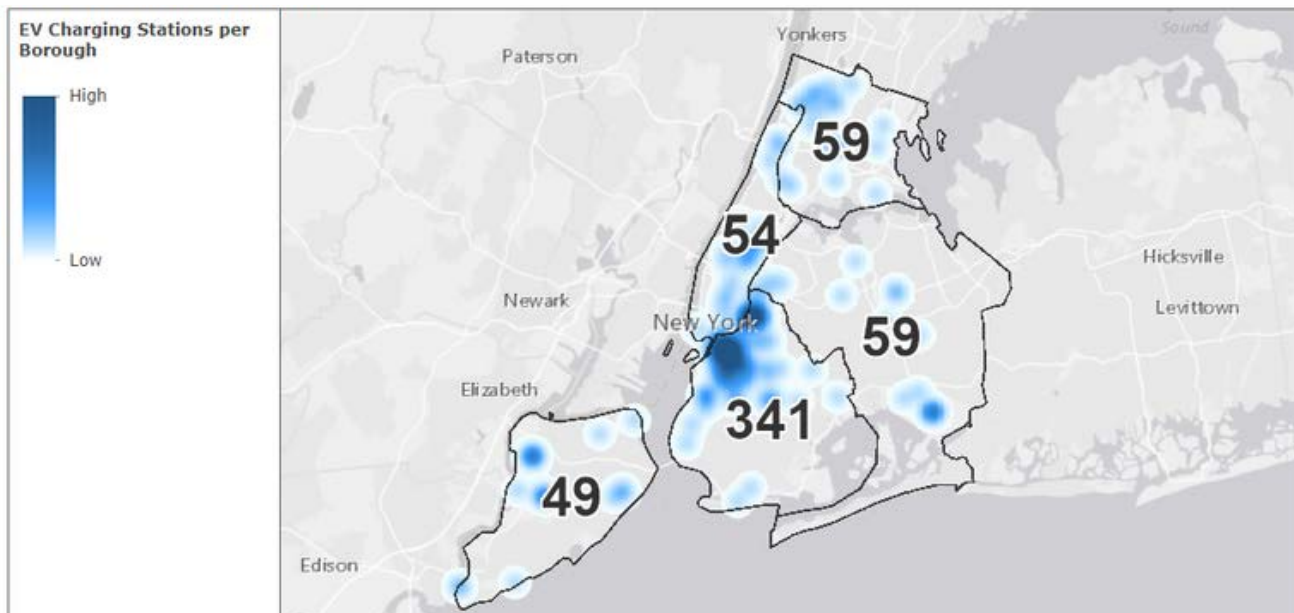
On the personal electric vehicle front, NYC is at a precipice of change with an increase in forecasted demand. Alongside these personal vehicles, the city currently has 1,400 publicly accessible Level 2 plugs and 117 publicly accessible fast-charging plugs (NYC DOT & NYC Mayor's Office of Climate and Sustainability [NYC DOT & NYC MOCS], 2021). NYC has also acknowledged the need to provide a plan to install 46,000 on-street public charging stations by 2030 (NYC DOT & NYC MOCS, 2021).



In January 2022, the New York State Energy Research and Development Authority reported the following numbers of electric vehicles registered in each NYC borough: 6,197 in Queens, 5,102 in Manhattan, 4,630 in Brooklyn, 1,844 in Staten Island, and 1,094 in the Bronx (NYSERDA, 2022).



ELECTRIC VEHICLE TRANSPORTATION



Although Queens has the most electric vehicles registered, Brooklyn has five times more public electric chargers installed (NYSERDA, 2022).

Esri, HERE, Garmin, USGS, EPA, NPS | Esri, HERE, NPS

Notable progress has been made in the City's and State's commitment to electrify transportation, with an all-electric bus and municipal fleet expected by 2040 and a new commitment for an all-electric school bus fleet by 2035 (City of New York, 2021; MTA, 2021; NYC Department of Citywide Administrative Services, 2021). Coalitions such as Electrify NY, NYC Clean Bus Coalition, Clean Fuels NY, and NYC Environmental Justice Alliance have successfully advocated for State and City commitments to green their fleets and ensure that the benefits go to environmental justice communities (Empire Clean Cities, n.d).

MTA runs 5,800 buses on over 400 routes and is the largest municipal fleet in the nation. Moreover, 75% of MTA bus depots are in low- to moderate-income communities. Converting the MTA fleet

has tremendous public health benefits for these communities (MTA Bus Company, 2021).

In 2018, the MTA committed to convert to an all-electric bus fleet by 2040 and plans to purchase 500 all-electric buses by 2024. Yet the public transit system currently only operates 15 all-electric buses (MTA Bus Company, 2021). In 2019, MTA purchased fifteen 60-foot articulated all-electric buses from New Flyer of America. While most of these buses were manufactured in Alabama, a portion of the work was slated to take place in Jamestown, New York. Jobs to Move America has successfully advocated for labor standards for electric bus manufacturing using their U.S. Employment Plan model to center good jobs and equity (Jobs to Move America, 2020).

ELECTRIC VEHICLE TRANSPORTATION

Building local manufacturing requirements for the State and the City are critical. The MTA has a contract commitment of almost 13% “New York State Content” for each of its initial bus procurements (NYCT Transit, 2019). Most recently, the MTA procured 60 electric buses in 2021.

In October 2021, the City committed to having an all-electric school bus fleet by 2035 (City of New York, 2021; Metropolitan Transportation Authority [MTA] Bus Company, 2021; NYC Department of Citywide Administrative Services, 2021). There are currently 10,700 school buses citywide; NYC manages about 960 in partnership with the NYC School Bus Umbrella Corporation (New York City Council, 2021). This fleet transports nearly 150,000 school children every day (Chang, 2022).

Estimates suggest that only 1,439 electric school buses are currently in use nationwide, representing less than 1% of all school buses (Johnson, 2021). According to New York League of Conservation Voters, moving to an all-electric school bus fleet could remove 2.9 million tons of carbon dioxide emissions each year (NYC Clean School Bus Coalition, 2022).

The City pledged to purchase 75 electric buses for the NYC School Bus Umbrella Corporation over the next 2 years—yet 2035 is only 12 years away with nearly 11,000 school buses to electrify (New York League of Conservation Voters Education Fund, 2021). Governor Hochul also made a commitment in the 2022 state budget for 100% electric school bus commitment by 2035. NYC would be on the cutting edge of school bus and public transit fleet conversions.

To date, these commitments have not been detailed through comprehensive approaches to high-quality jobs and pathways for automobile and bus manufacturing workers. They also do not guarantee a just transition for people who operate and maintain these fleets. NYC must leverage its massive upcoming public investments—most notably the Infrastructure Investment and Jobs Act—to ensure that this transition creates well-paying union jobs and provides defined career pathways for current workers in the transportation industry.

The following recommendations prioritize equity for workers and communities while seeking to address the climate crisis.

1) Center environmental justice communities in the electric vehicle transition

NYC should ensure that local environmental justice communities are prioritized and directly consulted about areas where electric vehicle assets will be deployed, including bus depots and yards that will be retrofitted to accommodate electric vehicles. This transition marks an important moment to enhance public engagement and to amplify the voices that often go unheard in these processes.

2) Ensure that buildout of public charging infrastructure is centered in high-quality job creation and equity

NYC’s DOT should lead a public buildout of on-street NYC charging infrastructure to ensure that the work is completed safely and efficiently. The City’s DOT should install, operate, and maintain 50,000 public chargers by 2030 under a Project Labor

ELECTRIC VEHICLE TRANSPORTATION

Agreement and require Electric Vehicle Installation Training Program Certification for the installation of chargers to ensure safety standards and to support good jobs.

ESTIMATED JOB CREATION:

Installing 50,000 public chargers could create 1,496 direct jobs or 187 jobs per year for 8 years. Many more jobs could be created through charger operations and maintenance and through the manufacturing of both chargers and electric vehicles in New York State.

ENSURING HIGH-QUALITY JOBS:

This work should be managed by DOT under a Project Labor Agreement and require an Electric Vehicle Installation Training Program Certification.

CARBON EMISSIONS REDUCTION:

There is a strong correlation between electric vehicle charger availability and electric vehicle adoption across the United States (Bui et al., 2020). The difference in annual emissions between a gasoline-powered vehicle and electric vehicle in NY is 9,310 tons, equivalent to charging 514,000 smartphones for a year CO₂e (U.S. Department of Energy, n.d.; U.S. Environmental Protection Agency, 2021).

Estimated cost:

\$272 million or \$34 million per year for 8 years.

LOOKING AHEAD: "REPOWERING" EXISTING SCHOOL BUSES

In January 2022, NYC was first in the nation to have five diesel school buses converted to electric school buses. Also called a “repower,” school bus conversions are less than half the cost and require less wait time than a new electric bus (Wachunas, 2022). Repowers create opportunities for existing bus mechanics, save the City money, and prevent these buses from being resold and producing emissions elsewhere.

3) Leverage public investment in electric bus commitments to support local manufacturing and assembly

NYC should leverage its public investment in electric buses to ensure that manufacturing jobs are created locally. The City should require at least 50% of public charging infrastructure and new electric vehicle public transportation, municipal fleets, and school buses to be manufactured or assembled in New York State. The City should also institute Local Hiring Requirements for all manufacturing.

ELECTRIC VEHICLE TRANSPORTATION

ESTIMATED JOB CREATION:

Manufacturing 50% of school buses alone in-state could create 3,638 direct manufacturing jobs over 8 years. NYC could consider repowering 50% of its remaining school buses which could create additional direct jobs for bus mechanics.

ENSURING HIGH-QUALITY JOBS:

A Labor Peace Agreement would ensure that electric vehicle manufacturing workers have organizing protections. A Project Labor Agreement would ensure that repower mechanics are provided a fair wage and acceptable working conditions. Setting a target of 50% local in-state manufacturing and Buy America requirements would ensure that this activity contributes directly to New York's economy.

ESTIMATED COST:

\$2.14 billion or \$267 million per year for 8 years.

4) Establish a large-scale electric bus upskilling program for City operations and maintenance bus staff and ensure that new jobs are high-quality union positions

To support an equity-focused transition that prioritizes existing high-quality union bus jobs, the City should require that a large-scale up training program be developed for bus mechanics and associated maintenance staff. These personnel will then be prepared to support operations for an all-electric fleet. The City could model the up training on the Certified EV Technician program in California, a 16-week program that is free for existing and displaced mechanics. The program addresses topics such as the electrical principles and development of electric vehicles, high-voltage safety, battery construction and management, the maintenance and repair of hybrid vehicles, and the conversion of a combustion engine car to an electric vehicle (Clean Tech Institute, n.d.).

The City and the MTA must also guarantee that the current 17,862 MTA and NYC transit operations and maintenance bus staff who work on diesel and hybrid vehicles are retained in the transition to electric buses. Current diesel and hybrid bus mechanics will thus shift to supporting electric bus operations and maintenance as the City continues to build and retain a high-quality, diverse, and well-paid workforce.



Photo: Transport Workers Union Local 100 Rally.

A group of IBEW Local 3 members and apprentices, including foreman Allison Ziogas, holding signs and banners during a demonstration.

International Brotherhood of Electrical Workers Local 3 Prepares Members and Apprentices for Electric Vehicles, Solar, Green Building Practices and More

The International Brotherhood of Electrical Workers (IBEW) Local 3, through its Educational and Cultural Trust Fund of the Electrical Industry, offers a wide range of climate and clean energy trainings to prepare its members and apprentices for work in the new energy economy. The Educational and Cultural Trust Fund offers courses on electric vehicle infrastructure installation, solar panel installation, alternative energy systems, and G-PRO, which covers green professional building skills training like sustainability in electrical systems, lighting, heating and cooling, distributed and renewable energy generation, and assuring building performance and job management. To date, nearly 4,000 IBEW Local 3 members and apprentices have completed these courses.

IBEW Local 3 has also offered weekend-long training sessions focused on the climate crisis and the emerging clean energy economy. To demonstrate the importance and value of solar installations, Local 3 installed a solar system on the roof of its union hall in Long Island City. The innovative 90 degree system with vertical wall mounts is highly visible from the Brooklyn-Queens Expressway and the Long Island Expressway.

IBEW Local 3 foreman, Allison Ziogas, pictured above, along with twenty Local 3 journeymen workers, helped build the first net-zero public school in New York City – Staten Island's Kathleen Grimm School (P.S. 62). The IBEW Local 3 crew installed a 650 kilowatt system, including over 2,000 solar panels and 62 inverters, plus combiner boxes and other equipment. The net-zero school also incorporates a number of energy efficiency measures including LED classroom lighting, permeable paving systems, displacement induction units for HVAC, and more advanced lighting, power and ventilation cords (Urban Green Council, 2016).



LOOKING AHEAD: PILOT A PUBLIC IN-ROAD WIRELESS ELECTRIC VEHICLE CHARGING SYSTEM BY 2023

The City should pilot an in-road wireless electric vehicle charging system on a one-mile section of the Brooklyn–Queens Expressway when the Expressway is undergoing renovations. This expressway is already receiving federal funding from the Infrastructure Act (Marsh, 2021). These types of projects can increase convenience and save time for commuters by eliminating the need to find a charging station. Such projects can also catalyze electric vehicle usage among people concerned about access to charging stations and eventually lead to a reduction in the size of car batteries. NYC can create wireless charging grant programs with the NYC Department of Transportation to support additional installations while requiring Prevailing Wage and Buy America requirements. Installing one mile of dynamic road would cost an estimated \$1.04 million. This effort and all future dynamic road work should be completed in accordance with consistent labor standards and Buy America requirements. Such initiatives would create jobs for electrical powerline installers and repairers, electricians, and general laborers in the City.

REIMAGINE ROADWAYS TO SUPPORT BICYCLISTS

1

Install 300 miles of protected bike lanes

2

Expand Citibike to all neighborhoods in the five boroughs

3

Convert 5% of free street parking spaces to 150,000 bike shelters by 2025

4

Reduce cycling barriers by subsidizing Citibike memberships for low-income New Yorkers

One trend during the pandemic involved an increase in the use of active transportation such as cycling. The summer of 2021 saw a peak for Citibike, one day after Hurricane Ida swept through the City's subway system. Individuals took over 1.8 million more bike trips in 2020 compared to 2019—a 33% jump—at locations including the four East River bridges, Brooklyn's Prospect Park West, and Kent Avenue (NYC DOT, 2021). Weekend cycling rates rose 63% across the City between 2019 and 2020 (NYC DOT, 2021).

Although cycling has become an attractive mobility option, safety on the streets remains paramount.

A roadway network that prioritizes only passenger vehicles is neither climate-focused nor equitable. The City can implement the Regional Plan Association's Five Borough Bikeway, which calls for 300 miles of new protected lanes. In addition to 125 miles of existing lanes, this bikeway would add up to a total of 425 miles of bike lanes connecting city residents (Freudenberg et al., 2020).

The City can build protected bike lanes while streamlining and accelerating existing bike lane remediation and repair. The City should also pursue Citibike expansion for all New Yorkers by 2025 and develop programs to make Citibike more accessible and affordable for all.

FIVE-BOROUGH BIKE ACCESS

For example, the City should provide free Citibike membership for New Yorkers living below the federal poverty line each year.

Meanwhile, NYC can create more linkages between cycling and public transit use. The City can work with the MTA to transform subway stations and city commuter rail

stations into intermodal hubs with bike shelters for personal bikes and Citibike docks. Converting just 5% of free street parking—which is a public resource to be shared by all—into bike shelters for up to 900,000 New Yorkers will encourage this carbon-free transportation mode.

ESTIMATED JOB CREATION:

Implementing the Regional Plan Association's Five Borough Bikeway proposal, Installing 150,000 secure bike shelters, and expanding Citibike to every square mile of NYC could create up to 17,329 direct jobs over 3 years or an average of 5,776 direct jobs per year.

ENSURING HIGH-QUALITY JOBS:

Bus lane expansion and bike shelter installation would create thousands of new jobs under existing NYC DOT union contracts and labor agreements. A City contract with Citibike for the expansion of bikes and docks would fall under New York State Prevailing Wage law for public construction (New York State Department of Labor, n.d.).

CLIMATE RESILIENCE BENEFITS:

Accessible biking infrastructure and diverse modes of transportation are critical to achieving climate resilience. As was the case during Hurricane Ida, traditional transportation modes may be inaccessible following extreme events. This recommendation enables more New Yorkers to get out of harm's way and maintain normal operation.

ESTIMATED COST:

\$1.49 billion or an average of \$498 million per year for 3 years.

IN NYC TODAY THERE ARE:

**1.5 FREE CAR
PARKING SPOTS PER
1 CAR**

**1 BIKE PARKING
SPOT PER
116 BICYCLES**

(TRANSPORTATION ALTERNATIVES, 2021)



RESILIENCE AND ADAPTATION

Climate change extremes are here, and New Yorkers are feeling the effects. From heat waves to flooding, the City is experiencing record-breaking events every year that cost lives, jobs, and billions of dollars in critical infrastructure recovery. Heat waves are becoming more common and longer—and they affect the most vulnerable New Yorkers first and worst. The City saw 102 heat-related deaths among residents throughout the summer months from 2010 to 2019 (NYC Health, 2021). New York State is expected to see the number of dangerous heat days double by 2050 (States at Risk, n.d.). Extreme precipitation is also more pronounced than ever: between 2010 and 2020, New York experienced 31 extreme weather events totaling \$100 billion in damages (The White House, 2021). Hurricane Ida in 2021 set a rainfall record of more than 3.15 inches in a single hour—surpassing the previous one-hour record of 1.94 inches of rain from Hurricane Henri just 2 weeks before (Plumer, 2021).

New York's infrastructure was not built to handle these conditions. Aptly nicknamed a “concrete jungle,” NYC is mainly composed of heat-absorbing and impermeable materials such as asphalt, concrete, and roofing (NYC Department of Environmental Protection, 2020). Most buildings, transportation, and roads are aging and in need of repair. Critical infrastructure is located along the waterfront and is at particular risk of flooding and corrosion (NYC Emergency Management, 2014). Half of the City's electricity generation capacity and 88% of its steam generation capacity are within the 100-year floodplain.

IF THE WORLD DOES NOT DRASTICALLY REDUCE EMISSIONS, NEW YORK CITY COULD LOSE MUCH OF STATEN ISLAND, CONEY ISLAND, AND THE ROCKAWAYS TO PERMANENT SEA-LEVEL RISE.

(Gornitz et al., 2019)

Developing more resilient infrastructure presents a chance to create high-quality union jobs and a more equitable city. Aspects of resilience work are varied: painting cool roofs to reduce heat extremes; installing green roofs to reduce flooding; replacing concrete with permeable pavement and bioretention areas; applying anti-corrosion coatings to critical infrastructure; and installing a solar farm, a wastewater facility, a composting facility, and more at Rikers Island with local labor from frontline communities and pathways to union careers. New York City has an opportunity to create high-quality jobs, increase its resilience, and improve the welfare of every single resident. These recommendations outline a way forward.

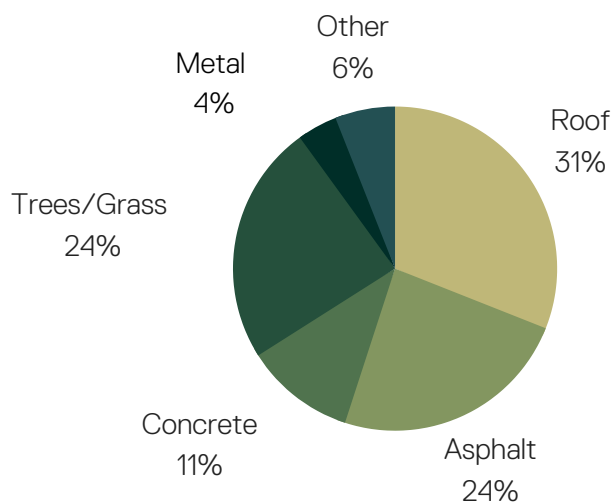
The background is a collage of various urban and community scenes. It includes images of people walking on a path, sitting at a table outdoors, a person holding a plant, a close-up of flowers, a person sitting on a bench, a person riding a bicycle, and various other scenes of people in different settings. The text is overlaid on this collage.

**DEVELOPING
MORE RESILIENT
INFRASTRUCTURE
PRESENTS A CHANCE TO
CREATE HIGH-QUALITY
COMMUNITY-SUSTAINING JOBS
AND A MORE EQUITABLE CITY**

MAKE EVERY NYC ROOF A COOL ROOF OR GREEN ROOF BY 2030

NYC workers should install green roofs—a vegetation layer designed to absorb excess precipitation and reduce energy needs—on all eligible roofs. All other roofs should be painted with an energy-saving reflective paint, otherwise known as “cool roofs.” All work should be completed under a Project Labor Agreement, Prevailing Wage, and Local Hire Requirements and should create a pathway for direct entry into union apprenticeship programs.

THE MAJORITY OF NYC LAND SURFACE IS ROOF



Most of NYC land area is roof, a surface that absorbs large amounts of heat and displaces water during heavy precipitation events. There is a huge opportunity to see roofs differently, as mechanisms to create nature-based job pathways, reduce building energy needs, reduce flooding, and lower costs. This can be achieved with green roof and cool roof installations.

GREEN ROOFS

A green roof is a layer of vegetation on top of a waterproof membrane that is installed on a flat roof. This material can absorb 50%—90% of stormwater runoff, save hundreds of dollars in heating and cooling costs for an average building, and enhance solar panel performance (Urban Green Council, 2019; Gregor, 2010).

NYC could create more than 179,760 jobs by installing green roofs. It is a multi-trade industry that involves roofers, engineers, laborers, and carpenters for design and installation. It also requires engineers and service workers for maintenance.

In 2014, NYC unions built the second largest green roof in the country on top of the Javits Convention Center. The 6.75 acre Green Roof and Pavilion has created 3,100 construction jobs, 4,000 full-time

PAINTING AND GREENING OUR SKYLINE

jobs and 2,000 part-time jobs (Velazquez, 2021). The Javits Center also absorbs nearly 7 million gallons of storm water per year, reduces energy consumption by 26% (Velazquez, 2021), and generates 40,000 pounds of vegetables per year.

The Laborers International Union of North America see green and cool roofs as an area of union job growth and are currently training their members to do this work.

To date, NYC Parks and Recreation manages only 250,000 square feet (5.7 acres) of green roofs (NYC Parks, n.d.) As of 2019, only 1 in 1,000 buildings in NYC had a green roof (Stern et al., 2019).

COOL ROOFS

Cool roofs are painted with a special reflective coating that enables these roofs to absorb less solar radiation than traditional roofs. On hot days, a cool roof can be more than 50 degrees Fahrenheit cooler than a typical roof (U.S. DOE, n.d.). Cool roofs can reduce building cooling needs by 10%–30% (Urban Green Council, 2019) and lower energy costs by increasing the efficiency of energy production by 5%–10% (Altan et al., 2019; Urban Green Council, 2019). A study of the urban heat island effect in NYC showed that 100% conversion to cool roofs in Mid-Manhattan could reduce surface temperatures in that area by 1.4 degrees (Rosenzweig et al., 2006).

ESTIMATED JOB CREATION:

If 25% of NYC roofs were green roofs and 75% of NYC roofs were cool roofs it could create 190,321 direct jobs over 8 years or 23,790 direct jobs per year. Additionally, installation of green roofs alone has the potential to create 32,702 maintenance jobs over 8 years or 4,087 jobs per year.

ENSURING HIGH-QUALITY JOBS:

The City should ensure that work is completed in line with Project Labor Agreements, Prevailing Wage, and Local Hiring Requirements and should prioritize targeted hiring in local communities. A pre-apprenticeship program should be developed, and a pathway should be constructed for direct entry into union apprenticeship programs.

CARBON EMISSIONS REDUCTION:

If 25% of NYC roofs were green roofs and 75% of NYC roofs were cool roofs it could reduce emissions by 1,919,747 metric tons of CO₂ by 2030. This is proportional to reducing NYC commercial and residential building emissions by over 7%.

CLIMATE RESILIENCE BENEFITS:

Converting 25% of City roof space into green roofs could prevent \$301 million in damages and service losses from precipitation through 2030 and an additional \$8.63 million each year after 2030.

ESTIMATED COST:

\$12.5 billion or \$1.56 billion per year for 8 years.



Green roof tip: When native vegetation or edible vegetation is used, as opposed to sedum, it creates a more livable ecosystem for pollinators, native bird species, and communities.

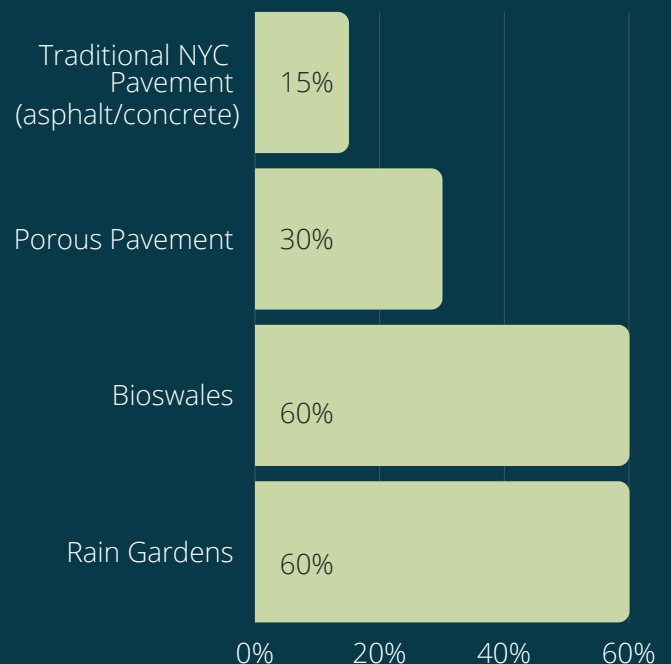
CREATE PERMEABLE, PERMANENT OPEN STREETS CENTERED AROUND EQUITY, RESILIENCE, AND HIGH-QUALITY JOBS BY 2030

Convert 10% of NYC to permeable Open Streets—the equivalent of building New Yorkers five new Central Parks—by increasing pervious surfaces with Prevailing Wage and Local Hiring Requirements. Invest in pre-apprenticeship training and direct entry into union apprenticeships, prioritizing targeted hiring in local communities.

NYC was not built to handle extreme precipitation. The majority of the city's land cover is impervious, constructed of materials through which water cannot easily pass. At the same time, the City sewer system can only handle 1.75 inches of rainfall per hour (Halverson & Samenow, 2021). When Hurricane Ida set a record of nearly twice this amount, or 3.15 inches of rainfall per hour, the flaws in the City's stormwater management system became evident. Akin to a clogged drain, rainwater gushed into basements, streets, and subway stations (Mckinley et al., 2021), drowning residents in their homes and cars (Intelligencer Staff, 2021) and causing up to \$100 million in damage to the transit system alone.

By installing green infrastructure that increases pervious area, NYC could create nature-based job pathways, improve residents' quality of life, strengthen ecosystems by planting native plants, and reduce costs associated with flooding.

PERCENT OF RAINFALL ABSORBED BY TYPES OF NYC LAND COVER



Most NYC streets are impervious surfaces which worsens flooding because they absorb little water and produce high amounts of water runoff.

(NYC Department of Environmental Protection. (2012)

PERMEABLE OPEN STREETS

Given that roofs are the most impervious land area (31%) followed by asphalt (24%) and concrete (11%), the City should prioritize high-impact solutions such as green roofs and porous pavement.

When NYC shut down from the COVID-19 pandemic in 2020, the City responded by launching an Open Streets program. The City made a public commitment of 100 miles of open streets for public use, including outdoor dining, retail, and recreation. The Open Street program was executed with significant flaws: only 20% of City residents had access to an open street, only a quarter of the 100 miles promised were actually in operation, and open streets in majority-White neighborhoods were four times more likely to be car-free than those in majority-Black neighborhoods (Transportation Alternatives, 2021). When restaurants expanded outdoor seating, a considerable accessibility problem arose for wheelchair users and others who required the sidewalk for mobility (Surico, 2021).

The Open Streets program was nevertheless considered a success: the 10,000 restaurants that expanded their dining areas saved 100,000 jobs (Hicks & Meyer, 2021). Meanwhile, 37% fewer cyclists, 25% fewer motorcyclists, and 4% fewer pedestrians were injured on open

streets compared with regular streets (Transportation Alternatives, 2021).

Converting 10% of car space to permeable open streets could support 150,000 small businesses

New Yorkers overwhelmingly support opening streets for public use. According to a 2020 DOT survey, 64% of all New Yorkers support using street space for outdoor dining. In a Siena College—Transportation Alternatives Survey, 63% of New York respondents supported open streets in their neighborhoods and 83% of voters supported adding more trees. Even more than half of car owners (57%) supported expanding open streets at the expense of parking spaces.

Making Open Streets permanent provides an opportunity to rethink streets with adaptation and resilience in mind. Up to 98% of stormwater cannot pass through asphalt and concrete; combined, these materials constitute one-third of NYC's land area (NYC Department of Environmental Protection, 2020). To reduce flooding and diminish the heat island effect, the City should replace 128 million square feet of existing asphalt and concrete in Open Streets with permeable pavement such as porous concrete. It should replace another 64 million square

PROCESS FOR CREATING PERMEABLE OPEN STREETS



PERMEABLE OPEN STREETS

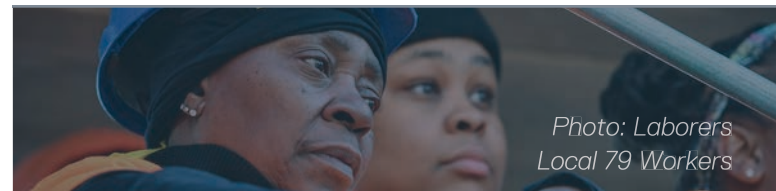
feet with bioretention areas like bioswales, rain gardens, tree pits, and canopy cover.

According to NYC's Department of Environmental Protection, this process involves removing asphalt (or concrete), digging up to two feet underground, filling the area with stone to allow filtration, and finally replacing the surface with porous concrete. The Laborers' International Union of North America is offering training courses on green construction to train workers in developing this critical stormwater infrastructure.

Training courses through the Laborers' International Union of North America include an introduction to green construction, heat fusion techniques for plastic pipes, trenchless technology for

pipe repair and installation, and green roof installation (Gordon et al., 2011). Courses under development include pervious concrete installation, irrigation system installation, and installation of retention/detention ponds and other methods of stormwater control (Gloudeman, 2014).

Open streets need to be centered around equity. Every New Yorker must be within close distance of an Open Street, and sidewalks must be wide enough for wheelchairs. Workers should be hired to work within their own communities whenever possible.



*Photo: Laborers
Local 79 Workers*

ESTIMATED JOB CREATION:

Installing pervious surfaces (permeable pavers, concrete, asphalt, tree pits, rain gardens, bioswales, canopies, and community gardens) on 10% of NYC streets could create 22,313 direct jobs over 8 years or 2,789 direct jobs per year.

ENSURING HIGH-QUALITY JOBS:

If NYC allocates 1% of the City's budget to parks, more staff can be hired instead of relying on seasonal workers (Khurshid, 2022). Requiring Prevailing Wage on all contracts for permeability and bioretention work would ensure that these jobs are well-paying. The City should also invest in pre-apprenticeship training and direct entry programs.

CARBON EMISSIONS REDUCTION:

Installing bioretention surfaces on one-third of permeable Open Streets could reduce emissions by 6,771 CO₂e from carbon sequestration, equivalent to taking about 1,460 cars off the road (U.S. Environmental Protection Agency, 2021).

CLIMATE RESILIENCE BENEFITS:

Avoided damages and service losses from pervious surface installation total \$17.3 million by 2030 and additional \$481,000 a year after 2030. It can reduce total water runoff on these streets by 25% compared to business as usual.

ESTIMATED COST:

\$1.92 billion or \$240 million per year for 8 years.

IMPLEMENT “RENEWABLE RIKERS,” CENTERING A JUST TRANSITION AND WORKERS’ RIGHTS

City agencies should implement A More Just NYC Renewable Rikers proposal through direct installation of a 90-megawatt solar farm, 300-megawatt battery storage, and construction of a wastewater resource recovery facility under a Project Labor Agreement on Rikers Island by 2035. To ensure a just transition and workers’ rights, the City should:

1

Require training and just transitions for existing workers

2

Require priority hiring, work hours, and new placement opportunities for justice-involved individuals and members of frontline communities

3

Set a 50% in-state manufacturing standard for procurement of materials needed for the installation of the solar farm and battery storage

NYC has a chance to reimagine Rikers Island. The second-largest jail complex in the United States is housed on this 432-acre island on the East River and is set to close by 2027 (Griffin, 2021). This circumstance presents a once-in-a-lifetime opportunity to use this space for the benefit of all—especially frontline

communities and workers most influenced by climate change, institutional racism, and underinvestment.

Rikers Island can be a force of resilience. New Yorkers recognize this, and organizations including the Urban Justice Center, New York City Environmental

RENEWABLE RIKERS

Alliance, New York Lawyers for the Public Interest, and the National Resources Defense Council have advocated for Rikers Island to be revitalized to create green jobs for communities most harmed by mass criminalization (Renewable Rikers, 2022).

With the passage of the 2021 Renewable Rikers Act, Rikers Island will be transferred to the Department of Citywide Administrative Services, and the City must conduct a feasibility study on renewable energy potential and battery storage (New York City Council, 2021).

Large-scale analyses of Rikers Island have already been conducted, including a 2017 study by an Independent Commission on NYC criminal justice and incarceration reform through A More Just NYC. Findings indicated that Rikers Island can host 90 megawatts of solar energy—enough to power 30,000 households—and 300 megawatts of battery storage (Lippman et al., 2017). The study also analyzed proposals for a potential wastewater treatment facility, an energy-to-waste facility, an academic research center, a memorial, and a public greenway. Further analyses should be performed to determine the space capacity for additional solar installations, such as on rooftops or a wastewater treatment facility.

The NYPA provides energy at a cost 25% less than that of local private utility companies and should build, own, and operate the 115-acre solar farm and promote the creation of affordable energy and high-quality jobs (NYCHA, 2020).

A collaboration between the Department of Citywide Administrative Services and NYPA can ensure that the solar work is done under a Project Labor Agreement and that resultant jobs are high-quality and family-sustaining for frontline communities.

A new wastewater treatment facility can be a source of permanent high-quality jobs. The City should invest in pre-apprenticeship and workforce transition training programs for existing workers that prioritize the skills necessary for 21st-century innovation in wastewater management, including new implementation and control technologies.

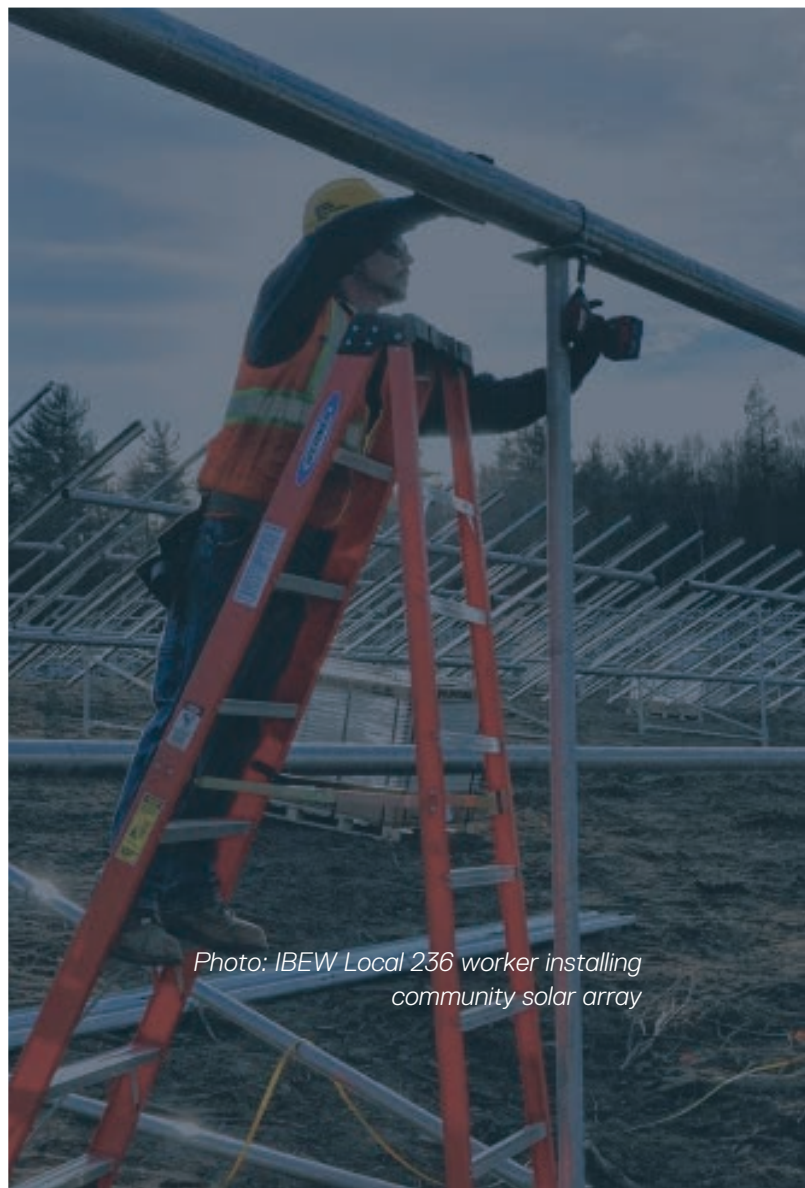


Photo: IBEW Local 236 worker installing community solar array

RENEWABLE RIKERS

ESTIMATED JOB CREATION:

Construction of a 90-megawatt solar farm and 300-megawatt utility battery storage on Rikers Island could create 1,819 direct jobs over 8 years or 227 direct jobs per year. Operations and maintenance of these projects could create 1,500 permanent jobs (Lippman et al., 2017).

ENSURING HIGH-QUALITY JOBS:

NYC can transform Rikers Island into a place of economic opportunity for workers most affected by the prison system and climate change by investing in pre-apprenticeship training and by prioritizing targeted hiring for justice-involved individuals and frontline community members. As NYC scales up its installation of solar and other clean energy products it should leverage these purchases to drive in-state manufacturing.

CARBON EMISSIONS REDUCTION:

Implementing this proposal could reduce emissions by 689,719 metric tons of CO₂ (Lippman et al., 2017)—the equivalent of taking 149,000 vehicles off the road (U.S. Environmental Protection Agency, 2021).

ESTIMATED COST:

\$507 million for solar and battery installation or \$63 million per year for 8 years. \$15 billion for the full proposal (Lippman et al., 2017) or \$1.86 billion per year for 8 years.

LOOKING AHEAD: CLIMATE-RELATED WORKER PROTECTIONS

An opportunity also exists to enact legislation that will protect workers from unsafe or unsuitable working conditions caused or exacerbated by climate extremes. NYC has hundreds of thousands of residents whose occupations directly expose them to extreme weather conditions. Such personnel include workers in the construction and specialty trades, utilities, transportation, emergency response, delivery and postal services, leisure and hospitality, and natural resources. Extreme weather also heavily affects residents who live or work indoors in old buildings with insufficient temperature regulation. NYC can show leadership by being the first city in the country to expand requirements for employers to provide shade or warmth, water, rest time, and paid leave for outdoor workers exposed to extreme high or low temperatures.

PREVENT CORROSION OF CRITICAL INFRASTRUCTURE

Require coating application and Protective Coating Inspection certifications for all critical infrastructure work in NYC: Coating Application Specialist, Certified Coating Applicator, Coating Inspector Certificate Program (CIP), and Protective Coatings Inspector.

Corrosion mitigation and prevention are essential to protecting NYC's infrastructure as climate change progresses. Saltwater is highly corrosive; flooding and sea-level rise each threaten to degrade telecommunications, power production equipment, subway and transit infrastructure, and buildings.

Hurricane Sandy demonstrated how poor corrosion mitigation can have enduring impacts on City infrastructure. Critical power equipment was drenched in saltwater and damaged by corrosion, causing up to two weeks of blackouts (Zimmerman et al., 2019). Millions of gallons of saltwater drowned the New York subway system and found its way into small pipes and cracks with wires and cables, requiring a full rebuild of certain system tunnels (Boesler, 2012). The MTA saw a 29% rise in delays in 2013 over the prior year due to track, switch, and mechanical issues caused by Hurricane Sandy (Miller et al., 2014). The F Line alone required "replacing 4,365 feet of track, [and] installing new signal equipment and power and communication cables" (Martinez, 2021).

Protective coatings are the main way to prevent corrosion of critical assets.

These coatings "block necessary elements from coming together to start the corrosion process, actively prevent the electrochemical reaction from occurring, or steer the corrosion process in a direction that will not harm the asset" (Association for Materials Protection and Performance, n.d.). Proper coating application can have considerable cost savings, reduce disruption, and protect people from the dangers of faulty infrastructure.

Coatings that have been improperly or irregularly applied can lead to infrastructure failures, threaten public safety, and increase costs for government authorities. Leaks from corroded natural gas pipes, half of which were installed before 1940, have caused a dozen explosions and killed or injured 25 people (McGeehan et al., 2014) in NYC over the past decade.

To ensure that the workers constructing or maintaining critical infrastructure are trained in corrosion prevention, all contractors and subcontractors should be either Coating Application Specialists or Certified Coating Applicators. Inspectors should be required to have completed either a Coating Inspector Certificate Program or to be certified Protective Coatings Inspectors.

WORKFORCE DEVELOPMENT AND QUALITY CAREERS

Healthy communities offer families the means to participate in essential civic and cultural activities and provide an environment for neighborhoods to grow and thrive. Holistic workforce development is conducive to developing such communities. These communities can build pathways to economic stability for disenfranchised New Yorkers and afford them the chance to meet their full potential.

Through investments in new green energy, public transportation infrastructure, deep retrofits on public and private buildings, solar installation, expanded broadband, and investments in resilience and adaptation, NYC can create millions of union jobs with family-sustaining wages geared towards the communities that need them most.

Low-income and frontline communities deserve collaborative, adaptive, and supportive workforce training programs that lead to both certifications and good union jobs. Leveraging investments in green jobs to create career opportunities for those who have historically borne the brunt of pollution, who are on the frontline of climate disasters, who have a history of justice involvement, and who have been historically excluded from economic opportunities should be a top priority for all New Yorkers. Direct Entry pre-apprenticeship and registered apprenticeship models provide these opportunities.

To effectively harness investments centered in equity and true economic mobility, the City should focus on the following recommendations: 1) expand the Office of Workforce Development and foster interagency cooperation; 2) allocate and increase funding for pre-apprenticeship and registered apprenticeship programs; and 3) encourage NY State community hiring legislation.



**COMMITMENT TO A
PIPELINE OF GOOD JOBS
ALLOWS FOR EXPANDED
OPPORTUNITIES FOR
RECRUITMENT OF NEW
WORKERS, TRAINING, AND
PLACEMENT**

EXPAND THE MAYOR'S OFFICE OF TALENT AND WORKFORCE DEVELOPMENT TO BUILD AN EQUITABLE, INCLUSIVE CLEAN ENERGY WORKFORCE

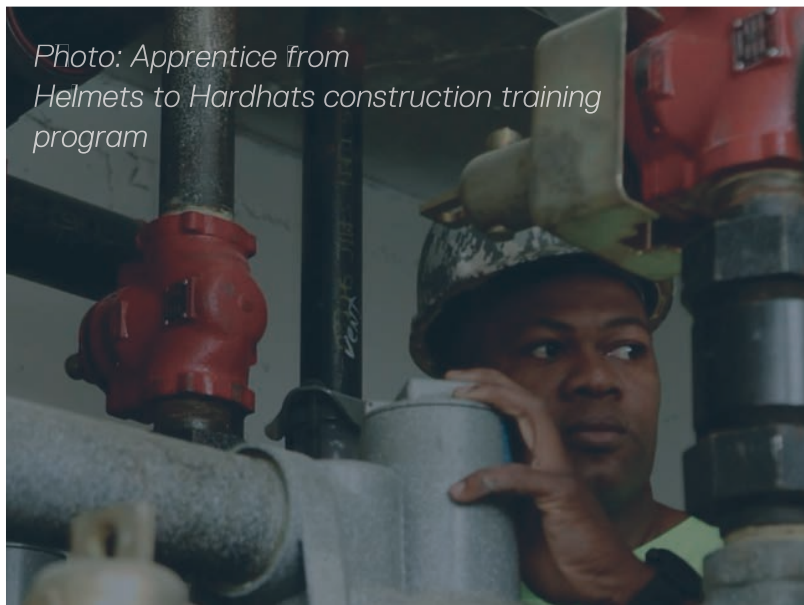
Prioritize spending to expand the Mayor's Office of Workforce Development to liaise directly with City agencies and develop a robust system of interagency cooperation to achieve workforce goals.

Investments in green energy go hand-in-hand with equitable workforce development. It is crucial that these investments produce high-quality union job opportunities for frontline communities and that the skills required for a just transition are readily accessible. The City must foster agency-wide commitments to such standards and facilitate the coordination of anticipated opportunities and skills needs with access to the necessary training and jobs. The Project Labor Agreements entered into between the City and the Building and Construction Trades Council of Greater New York, covering certain new construction and renovation projects, exemplify these aims. This commitment to a pipeline of good jobs allows for expanded opportunities to recruit, train, and place workers. These agreements contain workforce goals laid out in the City's most recent Project Labor Agreements that drive equity and career access for communities most in need by prioritizing

people in disadvantaged neighborhoods for job recruitment and referral.

This example of a joint effort between the City's Talent and Workforce Development Office and unions affiliated with the Building and Construction Trades Council of Greater New York can be expanded and used as a model for an inclusive clean energy workforce across the board given increased resources for the Office of Workforce Development.

Photo: Apprentice from Helmets to Hardhats construction training program



CITY WORKFORCE DEVELOPMENT

Expanding the Mayor's Office of Talent and Workforce Development can achieve these goals and allow the office to

- Develop tracking and outcomes measures to ensure successful implementation of the Project Labor Agreement's Community Hiring economic justice plan
- Work across city agencies to ensure that they are offering good job opportunities that can support increased demand for workers from target populations
- Coordinate directly with contractors/employers, Direct Entry training providers, unions working on Project Labor Agreement-covered City contracts and their apprenticeship programs, and community-based organizations to ensure that equity goals are being met and that best practices are being implemented.

Additionally, the City should increase its staff capacity at each agency (e.g., the Department of Design and Construction, the Department of Transportation, the Department of Environmental Protection, and the Department of Citywide Administrative Services) with a dedicated focus on contractor accountability and on coordinating the implementation and tracking of community hiring workforce goals.

To ensure that the transition to a new green energy economy increases the number of high-quality union jobs, expands career pathway access, and effectively protects existing workers, the City should establish a Just Transition Industry Partnership Committee within the Mayor's Office of Talent and Workforce Development.

This committee can support multi-agency responses to climate change and the transition to a decarbonized economy with the aim of protecting and training workers. NYC must confront the climate change crisis in a collaborative manner. Workers will be responsible for the installation and maintenance of new building technologies, electric vehicle chargers, solar panels, wind farms, battery storage, biogas-to-grid systems, green resilience infrastructure, and more. To ensure that the City is providing support for workers affected by this transition, the needs of the existing workforce must be addressed when planning and instituting a climate-focused agenda.

In her 2022 New York State of the State address, Governor Hochul announced a new statewide Office of Workforce Development and underscored the importance of a comprehensive and creative approach to addressing workforce needs. She also highlighted the need to expand apprenticeships and support Direct Entry pre-apprenticeship programs (Hochul, 2022). This recommendation will help the City coordinate effectively with state efforts coming through Regional Economic Development Councils. By expanding workforce development and facilitating coordination among agencies, the City can build on its collaborative efforts with stakeholders and cultivate conditions to further advance an equitable future for New Yorkers.



*Photo: NYC District Council of Carpenters
2012 Apprenticeship Contest*

INCREASE FUNDING FOR DIRECT ENTRY PRE-APPRENTICESHIP PROGRAMS

To meet the goals of the Federal Government's Justice 40 Initiatives and the hiring goals in NYC Project Labor Agreements—and to grow and support expanded career opportunities in the green energy economy for frontline communities and low-income New Yorkers—the City of New York should increase targeted spending for Direct Entry pre-apprenticeship programs and expand allowable indirect costs.

The passage of the federal infrastructure bill includes billions for projects that prioritize the transition to a clean energy economy. This pipeline of work is accompanied by heightened demand for skilled workers. To meet this need with equitable outcomes, the City should enlarge its investment in workforce development and focus on pathways to middle-class careers for frontline communities.

Recent Project Labor Agreements implemented between the City and the Building and Construction Trades Council of Greater New York, which cover certain construction and renovation projects, have ambitious community hiring goals. This partnership represents a mutual commitment to increased opportunities for frontline communities. The commitment to a pipeline of good union jobs allows for expanded worker recruitment, training, and placement that will drive equity and career access for the communities most in need.



Photo: Pathways to Apprenticeship's Coney Island Class with Assembly Member Mathylde Frontus

DIRECT ENTRY PRE-APPRENTICESHIP PROGRAMS

The Building and Construction Trades Council of Greater New York recently launched the Apprenticeship Readiness Collective, a groundbreaking initiative composed of model Direct Entry programs: The Edward J. Malloy Initiative for Construction Skills, Nontraditional Employment for Women, Pathways to Apprenticeship, and NY Helmets to Hardhats. The Collective harnesses diverse expertise to develop best practices and provide opportunities for New Yorkers most in need to enter union apprenticeship. Together, these groups have placed thousands of NYC residents into building and construction trades apprenticeships who have gone on to become journeyworkers, shop stewards, organizers, political directors, and union leaders. Members of the Apprenticeship Readiness Collective have been working with the City to enhance recruitment among NYCHA residents, in communities disproportionately affected by COVID-19, and where at least 15% of individuals or families fall below the poverty line. Members of the Collective also continue to pursue their discrete missions to serve justice-involved communities, women, high school students, and veterans.

Direct Entry pre-apprenticeships stand out from more general workforce development programs thanks to having unique relationships with registered apprenticeships. Beyond providing training for certificates or short-term jobs, program graduates are placed on career pathways featuring paid training, family sustaining wages, safer working conditions,

and benefits such as health care and a pension. Additionally, pre-apprenticeships foster commitments between employers and employees and address workplace diversity needs.

To promote successful outcomes in pre-apprenticeship and Direct Entry programs, dedicated funds should be increased to allow for wraparound support such as child care costs, transportation assistance, and stipends. The City should also expand the allowable indirect costs covered by allocated funds. Administrative salaries, rent, and other organizational costs are critical to a program's success and ability to track outcomes and provide ongoing support.

The City does not have to bear the cost of this work alone. For instance, part of the \$5.88 billion allocated for NYC from the Federal American Rescue Plan Act's State and Local Fiscal Recovery Funds could be directed to extending the city's existing workforce development infrastructure. The Green Economy Fund targets \$270 million in investments in education, job training, community health, and the environment. The City can also access grants from the United States Department of Labor Employment and Training Administration to support workforce outcomes and pre-apprenticeships.

By increasing funding directed to pre-apprenticeship programs, expanding the scope of allowable costs, and pursuing federal and state support, NYC can build a robust and exemplary workforce development system that continues to support quality pre-apprenticeship training to foster a carbon-free and healthy city.

DIRECT ENTRY PRE-APPRENTICESHIP PROGRAMS

Encourage the State Legislature to remove barriers to community hiring

The City of New York should encourage the State Legislature to pass community hiring legislation that will allow the City to use targeted hiring in its bid specification. This option will broaden the scope of NYC's local and targeted hiring policies, improve accountability, and bolster the impacts of projects involving City property or tax dollars.

The COVID-19 pandemic hit NYC hard and has illuminated existing inequities through its disproportionate effects on Black, Latino, immigrant, and low-income communities (NYC Health, 2020). By leveraging its vast purchasing power, the City has the opportunity to address historic inequalities and ensure family-sustaining career opportunities for heavily affected, economically disadvantaged communities. New legislation could allow the City to devise goals for contractors to employ NYCHA residents and people from low-income communities in building service and construction. The implementation of effective hiring policies targeted towards low-income and frontline communities is currently hampered by state law.

Passing state legislation will help to ensure that community hiring goals can be expanded and implemented effectively. The City will then be able to work with skills training programs, contractors/employers, Direct Entry pre-apprenticeship programs, union apprenticeship programs, and other community-based organizations to center equity in the green jobs economy.

Utilize Project Labor Agreements and Labor Peace Agreements and prioritize local hires in all renewable energy projects directly funded or leased via New York City Economic Development Corporation

To ensure that NYC's transition to a clean energy economy drives family- and community-sustaining jobs and benefits residents across the five boroughs—particularly in frontline communities—renewable energy projects and procurement must carry high-quality jobs standards. Successful workforce development outcomes are contingent on a steady work pipeline. The City can encourage this quality by remaining a market participant and by upholding labor standards. Additionally, where there are public/private partnerships, the City can leverage its proprietary interest to ensure that the principles of job quality and equity are not lost.

New York City Economic Development Corporation is a nonprofit organization that manages NYC Capital funds of \$1 billion for more than 150 projects (New York City Economic Development Corporation, n.d.). The Mayor directly appoints the Corporation's board, whose stated mission is “to foster inclusive economic development across all five boroughs by helping lay the foundations of growth, advancing quality jobs across sectors, and promoting access to opportunity” (Fuleihan & Thamkittikasem, 2021).

DIRECT ENTRY PRE-APPRENTICESHIP PROGRAMS

The Corporation manages the current leasing process of the South Brooklyn Marine Terminal for offshore wind. With a commitment for 40% of job and investment benefits to be directed towards women, minorities, and environmental justice communities, the Corporation has taken a vital step towards ensuring economic justice in green energy investments. In light of current commitments of \$191 million to offshore wind investments over the next 15 years, there is a tremendous opportunity for families to grow and thrive (New York City Economic Development Corporation, n.d.).

Given the Corporation's reliance on, and oversight of, massive public dollars and assets, the City should ensure that all renewable energy and resilience projects in New York City Economic Development Corporation's portfolio adhere to this mission by instituting labor standards, emphasizing community hiring goals, and encouraging Project Labor Agreements that can provide middle-class career opportunities for frontline communities.

APPRENTICESHIP READINESS COLLECTIVE (ARC) DIRECT ENTRY PRE-APPRENTICESHIP PROGRAMS

Construction Skills

<https://www.constructionskills.org/>

[Pathways to Apprenticeship](https://p2atrades.org/)

<https://p2atrades.org/>

[Nontraditional Employment for Women](https://www.new-nyc.org/)

<https://www.new-nyc.org/>

[Helmets to Hardhats](http://nyh2h.org/)

<http://nyh2h.org/>

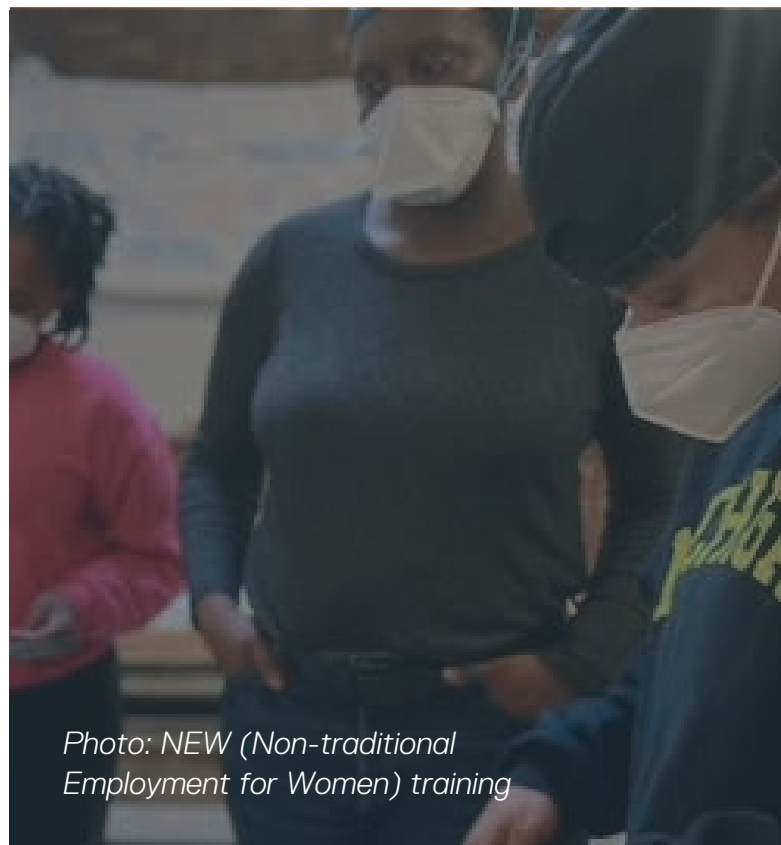


Photo: NEW (Non-traditional Employment for Women) training



MANDATE A LABOR VOICE IN ALL CLEAN ENERGY DEBATES AND FUND A CLIMATE JOBS INSTITUTE AT THE NEW YORK STATE SCHOOL OF INDUSTRIAL AND LABOR RELATIONS (ILR) AT CORNELL UNIVERSITY

Enact a statutory requirement to ensure that labor representatives are appointed to all key climate and energy decision-making boards. Fund an Institute at Cornell's ILR School to provide research, policy, and programming resources for NYC to navigate a just transition

Through the passage of the Climate Mobilization Act, NYC has made groundbreaking commitments to drastically reduce emissions, address climate change, and build an inclusive clean energy economy. Swift coordination is needed to manage associated impacts as the City strives to implement policies to decarbonize the economy and meet related goals. With thoughtful action, the City can maximize economic development and job creation related to offshore wind, solar installation, grid upgrades, green hydrogen, electric vehicles, building retrofits, and much more. These efforts can help to mitigate climate change, address historic inequities, and create high-quality jobs. Serious consequences could occur in the absence of a collaborative and careful transition—job

losses, tax revenue losses, and higher electricity and fuel prices that might erode public support for climate action.

According to Milkman and Luce (2020), union members compose more than one-fifth of all wage and salary workers who live in the five boroughs. Unions bring essential insight, industry expertise, and a collective voice that can ensure that the City effectively manages the clean energy transition. Decisions around climate and energy affect all New Yorkers; unions and frontline communities must have balanced representation in policy design and implementation. Failure to do so can lead to public distrust and occasionally dangerous and costly mistakes. The Mayor and the City Council should involve a labor voice on key boards and committees such

LABOR VOICE

as the NYC Economic Development Corporation, NYC Offshore Wind Advisory Council, and Committee on Resiliency and Waterfronts. Considering the enormous socio-economic impact of this transition, the City must ensure that labor is at the table of any energy and climate policy discussions.

Fund a Climate Jobs Institute at Cornell's ILR School

NYC has passed important climate and clean energy goals. Now the City must implement them and maximize opportunities to create high-quality union jobs for frontline communities, strengthen the economy, and lead an equitable and effective transition to a climate-friendly economy. These tasks represent a historic challenge. Policymakers, local communities, businesses, unions, environmental organizations, and others need high-quality, grounded information to guide this transition and ensure that the benefits and burdens are shared equitably.

A Climate Jobs Institute at Cornell's ILR School will provide the applied research, policy development, and educational programming that NYC needs to navigate this transition. The New York State Legislature established the ILR School in 1945 to ensure that employers, workers, and others had the necessary resources to meet the vision of the National Labor Relations Act and keep the state's economy strong. The current moment calls for similar action to establish a Climate Jobs Institute that provides the information required to meet New York's historic climate, equity, and jobs goals.

Cornell's ILR School, with 77 years of experience analyzing labor, employment, and clean energy issues, possesses the expertise to help NYC navigate this monumental transition, address historic inequities, and build an inclusive and diverse clean energy economy.

ESTIMATED COST:

\$10 million annual appropriation.



Photo: Cornell University's School of Industrial and Labor Relations offices located at 570 Lexington Avenue in NYC

CONCLUSION

With New York City on the frontlines of the climate crisis, it will take bold, ambitious action to combat climate change and reduce greenhouse gas emissions and pollution to the levels that science demands. Fortunately, tackling climate change is also an opportunity to address the other crises New York City is facing: racial discrimination and income inequality and pandemic recovery. As a leading climate-focused city, New York can be innovative and efficient, employing cutting-edge approaches to reverse climate change and inequality while recovering from the pandemic. New York City has the potential to invest in high-impact strategies that deliver deep cuts in emissions and pollution, high-quality union jobs for those who need them the most, and reduced energy costs. This would make New York's economy stronger, fairer, and more inclusive.

The "Climate Jobs" recommendations in this report show how New York City can move towards a path of building the equitable, climate-friendly economy that New Yorkers deserve.



APPENDIX

JOB CREATION SUMMARY

ANNUAL EMISSIONS REDUCTION SUMMARY

ESTIMATED COST SUMMARY

POTENTIAL FUNDING OPTIONS FOR NYC

KEY LOCAL REPORTS CITED

RECOMMENDATION METHODOLOGY

ACRONYMS

GLOSSARY

END NOTES

JOB CREATION SUMMARY

RECOMMENDATION	TOTAL DIRECT JOBS	YEARS OF INVESTMENT	JOBS PER YEAR
CARBON-FREE AND HEALTHY SCHOOLS	62,804	8	7,850
CARBON-FREE AND HEALTHY NYCHA	242,859	8	30,357
HIGH-EFFICIENCY AND HEALTHY HOSPITALS	16,722	8	2,090
OFFSHORE WIND AND GREEN HYDROGEN	220,158 85,617*	18	12,231 4,756*
GRID RELIABILITY AND ENERGY INDEPENDENCE	56,253	8	7,031
ORGANICS TO ENERGY	1,494	3	498
CONSTRUCT THE TRIBORO	55,680 3,600*	8	6,960 450*
GOLD-STANDARD BUS RAPID TRANSIT	5,760 372*	8	720 46*
MULTI-BOROUGH BUS RAPID TRANSIT EXPANSION	27,090 1,751*	13	2,083 134*

**Additional manufacturing jobs created*

JOB CREATION SUMMARY

RECOMMENDATION	TOTAL DIRECT JOBS	YEARS OF INVESTMENT	JOBS PER YEAR
INSTALL 500,000 ELECTRIC CHARGERS	1,496	8	187
MANUFACTURE 50% OF ELECTRIC SCHOOL BUSES	3,638	8	454
INSTALL 300 MILES OF BIKE LANES	2,088	3	696
CITIBIKE EXPANSION	5,800	3	1,933
INSTALL 150,000 BIKE SHELTERS	9,441	3	3,147
GREEN ROOFS ON 25% OF NYC ROOFS	179,760	8	22,470
COOL ROOFS ON 75% OF NYC ROOFS	10,561	8	1,320
PERMEABLE OPEN STREETS	22,313	8	2,789
RENEWABLE RIKERS SOLAR	559	8	69
RENEWABLE RIKERS BATTERY STORAGE	1,260	8	157

ANNUAL EMISSIONS REDUCTION SUMMARY

RECOMMENDATION	EMISSIONS POTENTIAL REDUCTION IN METRIC TONS OF CO ₂ /CO ₂ e (MTCO ₂)	CARS EQUIVALENT (PASSENGER VEHICLES DRIVEN IN A YEAR)	HOMES EQUIVALENT (ENERGY USE FOR ONE YEAR)
CARBON-FREE AND HEALTHY SCHOOLS	713,382	153,712	89,860
CARBON-FREE AND HEALTHY NYCHA	649,076	139,856	81,760
HIGH-EFFICIENCY AND HEALTHY HOSPITALS	269,304	58,027	33,922
OFFSHORE WIND AND GREEN HYDROGEN	26,520,900	5,714,438	3,340,652
GRID RELIABILITY AND ENERGY INDEPENDENCE	10,608,360	2,285,775	1,336,261
ORGANICS TO ENERGY	689,940	148,661	86,907
CONSTRUCT THE TRIBORO	2,064,164	444,764	260,008
GOLD-STANDARD BUS RAPID TRANSIT	12,256	2,641	1,544

ANNUAL EMISSIONS REDUCTION SUMMARY

RECOMMENDATION	EMISSIONS POTENTIAL REDUCTION IN METRIC TONS OF CO ₂ /CO ₂ e (MTCO ₂)	CARS EQUIVALENT (PASSENGER VEHICLES DRIVEN IN A YEAR)	HOMES EQUIVALENT (ENERGY USE FOR ONE YEAR)
MULTI-BOROUGH BUS RAPID TRANSIT EXPANSION	501,538	108,066	63,175
GREEN ROOFS ON 25% OF NYC ROOFS	1,577,712	339,948	198,733
COOL ROOFS ON 75% OF NYC ROOFS	342,035	73,698	43,084
PERMEABLE OPEN STREETS	6,771	1,459	853
RENEWABLE RIKERS	689,719	148,613	86,879

ESTIMATED COST SUMMARY

RECOMMENDATION	ESTIMATED COST	YEARS OF INVESTMENT	COST PER YEAR
CARBON-FREE AND HEALTHY SCHOOLS	\$14.5 billion	8	\$1.8 billion
CARBON-FREE AND HEALTHY NYCHA	\$52.8 billion	8	\$6.6 billion
HIGH-EFFICIENCY AND HEALTHY HOSPITALS	\$4.38 billion	8	\$547 million
OFFSHORE WIND AND GREEN HYDROGEN	\$61.2 billion	18	\$3.4 billion
GRID RELIABILITY AND ENERGY INDEPENDENCE	\$16.1 billion	8	\$2 billion
ORGANICS TO ENERGY	\$230 million	3	\$76.7 million
CONSTRUCT THE TRIBORO	\$4.8 billion	8	\$600 million
GOLD-STANDARD BUS RAPID TRANSIT	\$497 million	8	\$62.1 million
MULTI-BOROUGH BUS RAPID TRANSIT EXPANSION	\$2.34 billion	13	\$180 million

RECOMMENDATION	ESTIMATED COST	YEARS OF INVESTMENT	COST PER YEAR
INSTALL 50,000 ELECTRIC CHARGERS	\$272 million	8	\$34 million
MANUFACTURE 50% OF ELECTRIC SCHOOL BUSES	\$2.14 billion	8	\$267 million
IN-ROAD DYNAMIC WIRELESS CHARGING	\$1.04 million	1	\$1.04 million
INSTALL 300 MILES OF BIKE LANES	\$180 million	3	\$60 million
CITIBIKE EXPANSION	\$500 million	3	\$166 million
INSTALL 150,000 BIKE SHELTERS	\$814 million	3	\$271 million
GREEN ROOFS ON 25% OF NYC ROOFS	\$10.3 billion	8	\$1.28 billion
COOL ROOFS ON 75% OF NYC ROOFS	\$2.25 billion	8	\$281 million
RESILIENT OPEN STREETS	\$1.92 billion	8	\$240 million
RENEWABLE RIKERS	\$15 billion	8	\$1.88 billion

POTENTIAL FUNDING OPTIONS FOR NEW YORK CITY

Any funding mechanisms should be used for direct spending in the implementation of climate work or create grants or vouchers.

CITY LEVEL

1) Income Tax for Highest Earners - New York city could raise the city tax rate on the highest-earning individuals. The current New York City tax rate for income is between 3% and 4% based on income levels. Adding a new bracket for the highest earners could raise substantial revenue for climate projects.

2) Vacant Apartment Tax- New York City could impose a tax on the many unused or vacant apartments in the city. This would not only raise revenue, but also encourage landlords to rent out vacant apartments and address housing shortage within the city. The IBO estimates that a 5.0% surcharge on vacant properties would raise about \$29 million per year.” This tax should be increased each year an apartment remains vacant and could also apply to commercial buildings.

3) Short Term Rental Tax -New York could impose additional taxes on corporations such as Airbnb that have vastly expanded the short term rental market, which has decreased the supply of housing and harmed hotel workers’ livelihoods. The city currently collects a hotel room occupancy tax that applies to many short-term rentals, and could expand this tax to more directly target and increase rates on companies that transact short-term rentals, but do not manage rental property in the city.

4) Penny Park Tax - Organizations such as New Yorkers for Parks and the Play Fair coalitions’ have advocated instituting a penny tax to improve the condition of park’s in the city. One cent of every dollar spent by the city would have to be allocated to parks, amounting to 1% of the total budget or approximately \$1 billion. This money could also be used for climate resilience and further “greening” of the city.

5) Criminal Justice Investment Initiative - Each year money from international financial crime prosecutions, amounting to \$250 million, is utilized by the Manhattan’s District Attorney’s office to implement community programs such as career readiness for the survivors of domestic violence or youth opportunity hubs. A larger portion of this money, 10% or \$25 million, could be allocated toward connecting formerly incarcerated individuals to green jobs and union apprenticeship programs.

6) Direct Budget Participation - New York City residents should have absolute transparency when it comes to the use of the budget and could have more control over spending on certain items, such as redirecting current spending to certain items such as climate change programs. New York City could implement a more direct budget modification, where voters not only select their representatives, but indicate spending levels on certain larger items in the budget that expands the current participatory budgeting process of the city. This could direct more funding to climate policies that meet the needs of working people in the city.

7) Environmental Fees - Increasing certain fees that contribute to climate change and environmental degradation could raise revenue for the city while also discouraging harmful practices. Doubling the fees for illegal dumping, which causes damage to the city's environment, and idling, which generates carbon emissions, could increase funding for climate work.

8) Corporate Business Tax - New York City could expand the corporation tax to raise money from NYC's wealthiest businesses. The current tax rate sits between 4.4% and 9% for corporations in New York City, and implementing a higher tax rate on the wealthiest corporations, such as those who have a gross receipts of over \$10 million, could vastly increase revenue for the state.

9) Digital Billboard Tax - Digital billboards, such as those in Times Square, emit huge amounts of carbon emissions because of large energy use intensity, contributing to Manhattan's large energy consumption as compared to the rest of the city. A per KWh tax on these types of billboards could generate revenue for the state from infrastructure that contributes the most to climate change.

10) Crypto Carbon Taxes - Cryptocurrency, through mining and internet usage, produces large amounts of energy usage and carbon emissions, often in an unregulated market. New York City could implement a tax on the transactions of cryptocurrency with parties occurring in New York City and a tax on crypto mining in New York City proportional to their carbon emissions.

11) Salary Cap for High Level Executives - Executives in New York City can make immense salaries, hundreds of times that of their average employee. For example, the CEO of Spectrum makes \$38 million and the CEO of Con Edison earns \$15 million. In order to reduce inequality and raise revenue, New York City could implement a salary cap that charges a fee on all companies that pays employees more than a certain amount, such as \$1 million per year, based on the amount of compensation they earn.

12) Tax on Helicopter Rides - Across Manhattan, helicopters operate as a form of luxury transportation and tourism, with Newark airport alone having 4,391 flights in 2018. Yet helicopter flights contribute to climate change through producing carbon emissions and project noise pollution. New York City could implement a tax on the thousands of helicopter rides each year in order to raise revenue for climate programs and transportation projects

STATE LEVEL

1) Carbon Tax - In 2018, the EPA estimates that New York state released 172 million metric tons of CO₂ from fossil fuel combustion. A carbon tax of just \$15 per metric ton released would generate almost \$2.6 billion in funding for climate projects. Any carbon tax should be progressive, targeted at making polluters bare the majority of costs.

2) New York Green Bank - The New York Green Bank is a state funded institution that offers financing for renewable energy projects for private companies. The bank offers credit enhancement, term loans and investments and construction financing. Through March of 2021, the bank has committed to \$1.3 billion in funding across 88 transactions.

3) Increase State Income Tax for Highest Earners - Workers in New York pay income tax on their wages, raising the income tax on the highest earnings could generate significant revenue and help to reduce inequality across the state. A 5% increase in the tax liability paid by New Yorkers and directed at highest earners could generate \$2.7 billion each year.

4) Increase Corporate Tax on Large Businesses - Each year, taxes on business, corporations, banks, petroleum companies, and utilities raise significant revenue for the state. A 5% increase in the revenue from these taxes, directed at the largest of companies (with at least 150 employees) and the largest polluters and suppliers of petroleum could raise \$375 million per year.

5) Green Bonds - The state government of New York often capitalizes large infrastructure projects through the use of bonds. For example, in 2022, the legislature passed the Clean Water, Clean Air, and Green Jobs Environmental Bond Act of 2022, which provided \$4.2 billion in funding for green jobs projects. The state could utilize these types of bonds for expanding climate projects or pass new legislation to expand these bonds for more ambitious climate work.

REGIONAL LEVEL

1) Regional Greenhouse Gas Initiative - Greenhouse gas generating facilities auction for CO₂ allowances to emit. The proceeds that come from these allowances are reinvested in energy efficiency and renewable energy projects or greenhouse gas reduction programs.

FEDERAL

- 1) Build Back Better Bill and Infrastructure Bill: These pieces of legislation may provide funding for climate programs, transportation investments, building efficiency, and resiliency projects. As of the beginning of November 2021, their status is unknown.
- 2) Buses and Bus Facilities Program (FTA): Provides \$809 million in funding for improvements in buses and bus facilities. Many places have used money to purchase electric buses. Both a formula and a discretionary program.
- 3) Capital Investment Grants Program (FTA): This program funds \$2.3 billion in new heavy rail, commuter rail, light rail, streetcars, and bus rapid transit projects. Projects must have a budget of \$300 million or more and with a federal investment of at least \$100 million. This is a discretionary program.
- 4) Congestion Mitigation and Air Quality Improvement (CMAQ) Improvement Program (FTA): Provides \$2.5 billion in funding for states to reduce their transportation emissions. This is a formula program that may need to be spent on already federally funded programs.
- 5) Energy Efficiency and Renewable Energy Office (DOE): Provides numerous programs that allow local and state governments funding for renewable energy, energy efficiency, and transportation such as the Low Greenhouse Gas (GHG) Vehicle Technologies Research, Development, Demonstration and Deployment. These programs tend to be trials of new technologies.
- 6) EPA's Brownfield Program: This program works to clean-up America's brownfield for alternative usage and provides job-training grants, a revolving loan-program, assessment grants, and other types of funding. Some grants range up to \$2,000,000 for state assessments.
- 7) FEMA Hazard Mitigation: Grant that provides funding for the mitigation of extreme weather events, including long-term planning. Local governments can apply and grants can go to, among other uses, "stormwater, drainage and culvert improvements, flood control, property acquisition, slope stabilization, infrastructure protection, seismic and wind retrofits, and structure elevations."
- 8) State Energy Program (DOE): Provides \$55 million in total funding to states for reducing energy costs and improving resiliency. Each grant is usually around \$300,00-\$450,000, and has been used to seed green banks. This is a formula program.
- 9) State of Good Repair Grants (FTA): Provides \$2.7 billion for funding fixed guideway and high intensity motorbus systems in revenue service for at least seven year. Federal government provides 80% of the net capital cost. This is a formula program.

10) Surface Transportation Block Grant Program (STBG) (FTA): Provided 12.1 billion in funding for states to improve transportation infrastructure, usually related to highways or alternative transportation methods. This is a formula program.

11) Title 17 Innovative Energy Loan Guarantee Program (DOE): Provides up to \$4.5 billion in loan guarantees for innovative technological projects. Has been used to start large-scale renewable energy projects.

12) Urbanized Area Formula Program (FTA): Provides \$4.9 billion in funding for public transportation operations and capital assistance in urbanized areas (those with more than 50,000 people). This is a formula program.

The Infrastructure Investment and Jobs Act (IIJA) Funds for New York City



MORE FEDERAL FUNDS

- \$50 million a year increase in NYC's federal funding per year
- \$1 billion in total funds going to NYC DOT over the next five years.
- \$150 billion in national grants available to eligible NYC projects



PUBLIC TRANSPORTATION

- \$10.7 billion for MTA construction projects
- Investments in publicly-accessible direct current (fast) electric vehicle charging stations
- Expansion of greenway bicycle paths with a focus on better borough connections



BRIDGES AND TUNNELS

- \$2 billion to support restoration of up to 789 bridges across NYC
- \$8 billion to repair the Gateway Tunnel and for a proposed rail tunnel under the Hudson River



AIRPORTS

- \$295 million for John F. Kennedy Airport
- \$150 million for LaGuardia Airport



FERRY

- Upgrading the Staten Island Ferry, the most populous ferry service in the country with 70,000 daily passengers



RESILIENCE

- NYC DOT will use funds to protect streets and bridges from flooding

All construction workers on IIJA projects will be paid prevailing wages under the Davis-Bacon Act.

(NYC DOT, 2021; Schumer, 2021; Meyer, 2021; US DOL, 2021)

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RECOMMENDATION METHODOLOGY

CARBON-FREE AND HEALTHY SCHOOLS

Cost Calculation

The FY2020 DOE Office of Sustainability reports an average total school square footage of 160,958,666 from 2018-2020 (MOS, 2020). Calculation assumes deep retrofits and electrification cost a total of \$32/square foot (Carleton et al, 2019; Nagpal, 2019). Energy school usage used is the average MOS 2020 reported energy usage for years 2018-2020, excluding existing installed solar. Converted MBTU to KWH, and KWH to KW conversion for NYC uses 1KW:1400 KWH ratio (ECP, 2016). \$5/watt cost estimate for union rooftop solar installations provided by union report partners. Calculation assumes deep retrofits will result in at least a 50% energy reduction. For resilience efforts, assumes 3.3 gigawatts of battery storage will be needed for NYC schools where battery storage with up to 4 hours capacity is \$300/kWh or \$1200/KW for 4 hours (Wesley et al., 2021).

Job Creation

For deep retrofits: 4.7 direct jobs per million dollars invested. For solar installations: 3.8 direct jobs per million dollars invested (Pollin & Chakraborty, 2021). For battery storage: used SEIA assumptions that storage deployment can be completed on average in 25% of the time to install solar by a similar crew (The Solar Foundation, 2016).

Emissions Reduction

Under a net-zero scenario, emissions reductions are approximated as DOE building emissions (MOS, 2020) averaged over 2018-2020. Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

CARBON-FREE AND HEALTHY NYCHA

Cost Calculation

NYCHA buildings have a total square footage of 101,023,580 (NYCHA, 2021) where we estimate deep retrofits and electrification cost a total of \$32/square foot (Carleton et al, 2019; Nagpal, 2019). Assumes that NYCHA energy usage is 40% higher than 82.4 kBTU/square foot, which is the average energy use intensity of a multifamily building in NYC at 115.36 kBTU/square foot (U.S. Department of Energy, n.d.; Urban Green Council, 2020). MBTU to KW conversion for NYC using 1KW:1400 KWH ratio (ECP, 2016). \$5/watt cost estimate for union rooftop solar installations provided by union report partners. Calculation assumes deep retrofits will result in at least a 50% energy reduction. Assumes 1.2 gigawatts of battery storage needed for NYCHA and battery storage capacity up to 4 hours is \$300/kWh or \$1200/KW for 4 hours (Wesley et al., 2021). NYCHA has identified a need for \$40 billion for existing repairs (Braun, 2021; NYCHA, 2021). Suggests additional \$2 billion investment to hire full-time staff at NYC Parks Department for NYCHA green spaces.

Job Creation

The Green New Deal for Public Housing assumes 4.6 direct jobs per \$1 million invested (Pollin & Chakraborty, 2020).

Emissions Reduction

Estimates a greenhouse gas emissions intensity of 6.4 kilograms CO₂e/square foot based on the average of NYCHA buildings submitted to LL84 data set in 2021 (NYC Mayor's Office of Climate and Sustainability, 2021). Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

HIGH-EFFICIENCY AND HEALTHY HOSPITALS

Cost Calculation

H+H buildings have a total square footage of 20,951,232 (DCAS, 2016). Assumes a retrofit cost of \$4.59/ square foot for a 250,000/square foot cold climate hospital where total site retrofits costs were \$1,147,647(U.S. Department of Energy, 2013). Energy use intensity of H+H facilities estimated at 202.5 kBTU/square foot based on the average of H+H buildings submitted to LL84 dataset (NYC Mayor's Office of Climate and Sustainability, 2021). Converts MBTU to KWH, and KWH to KW for NYC using 1KW:1400 KWH ratio (ECP, 2016). \$5/watt cost estimate for union rooftop solar installations provided by union report partners. Calculation assumes energy needs under a 3.6% energy reduction, retrofit scenario accounting for existing solar installations on hospitals.

Job Creation

For retrofits: 4.7 direct jobs per million dollars invested. For solar installations: 3.8 direct jobs per million dollars invested (Pollin & Chakraborty, 2021).

Emissions Reduction

Estimated a greenhouse gas emissions intensity of 12.9 kilograms CO₂e/square foot based on the average of H+H buildings submitted to LL84 data set in 2021 (NYC Mayor's Office of Climate and Sustainability, 2021). Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

OFFSHORE WIND AND GREEN HYDROGEN

Cost Calculation

Cost of installation of an offshore wind generator in 2019 in the United States was \$4,077/kW (Stehly et al, 2020), and was used to get the total costs for a 15 gigawatt installation.

Job Creation

3.6 direct jobs per million dollars invested and a subset of 2.8 manufacturing jobs per million dollars invested (Pollin & Chakraborty, 2021).

Emissions Reduction

CO₂ emissions reductions were calculated using the EPA Avert Model. Assumes 884,030 tons CO₂ per 500 MW offshore wind installed in New York State (EPA, 2022). Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

GRID RELIABILITY AND ENERGY INDEPENDENCE

Cost Calculation

Assumes 6 gigawatt battery storage installation is equally spread over an 8-year time period with declining cost over time (NREL, 2021). Grid updates cost assumes transmission cost of \$955,556 per MW and remaining distribution costs of \$3.41 Million (Central Hudson Gas & Electric Corp et. al, 2020). Ratio applied for a scenario of 15 GW of Offshore Wind installation.

Job Creation

3.5 direct jobs per million dollars invested (Pollin & Chakraborty, 2021).

Emissions Reduction

CO2 emissions reductions were calculated using the EPA Avert Model (EPA, 2022). Assumes battery storage is connected to offshore wind production in New York State. Assumes a reduction of 884,030 tons CO2 per 500 megawatts of offshore wind installed. Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

ORGANICS TO ENERGY

Cost Calculation

Assumes cost of \$30 million for a capture and processing facility at Newtown Facility that can take up to 500 tons per day (\$600,000/ton) (NYC Independence Budget Office, 2018; Dahl, 2015). According to the NY City Council, 3% of NYC's daily food waste is 130 tons, so calculation assumes 100% of food waste is about 4,333 tons per day (New York City Council, 2020).

Job Creation

6.5 direct jobs per million dollars invested (Pollin & Chakraborty, 2021).

Emissions Reduction

500 tons of bioslurry per day can produce heat for 5,100 homes and lower the city's carbon footprint by 90,000 MT CO2 per year (Dahl, 2015). Assumed similar proportions to calculate emissions reduction for the remaining 3833 tons of city organic waste that exceeds Newtown's processing capacity. Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

TRIBORO

Cost Calculation

The cost of Portland's Orange Line – which is most comparable to the potential cost of the Triboro – was about \$200 million per mile (Levy, 2018). The expected length of the Triboro is 24 miles (Regional Planning Association, 2016).

Job Creation

11.6 direct jobs per million dollars invested and 1.5 manufacturing jobs per million dollars invested (Pollin et al., 2021)

Emissions

Calculated emissions utilizing the Regional Project Calculator (National Academies of Sciences, Engineering, and Medicine, 2015). Estimated a population of 2,475,346 people in neighborhood tabulation areas that border or intersect proposed area using the NYC Population Fact Finder (New York City Department of City Planning, n.d.). Assumes 5% of the population residing in surrounding areas of this transit line will use it for daily commuting resulting in a 5.4% reduction in vehicle miles traveled for the total regional population. Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

These calculations are not intended for use in place of projections created by transit agencies or transportation planners.

GOLD-STANDARD BUS RAPID TRANSIT ON UTICA AVENUE

Cost Calculation

Costs are estimated for an 8-mile Utica Avenue corridor (NYC Department of Transportation, n.d.). Costs modeled on the CTfastrak, a comparable Bus Rapid Transit Corridor that was \$567 million in current USD to construct 9.4 mile corridor including \$20.46 million of the total devoted to a fleet of nonelectric buses (Carrigan et al., 2019). CTfastrak cost per mile (excluding bus fleet) for design, utility upgrades, and infrastructure was \$58 million/mile (Carrigan et al., 2019). Assumption that NYC would purchase 30 BRT electric buses at a cost of \$1,049,607 each (MTA, 2021).

Job Creation

11.6 direct jobs per million dollars invested and 1.5 manufacturing jobs per million dollars invested (Pollin et al., 2021)

Emissions

Calculated emissions utilizing the Transit Corridor Project Calculator (National Academies of Sciences, Engineering, and Medicine, 2015). Estimated a population of 96,069 people in census tracts that border or intersect proposed corridor using the NYC Population Fact Finder (New York City Department of City Planning, n.d.). Assumes that 3% of the population residing in surrounding areas will switch from car to public transit for daily commuting, resulting in 10% reduction in vehicle miles traveled in the corridor. This is because many will likely switch from local bus to bus rapid transit. Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

These calculations are not intended for use in place of projections created by transit agencies or transportation planners.

BUS RAPID TRANSIT EXPANSION

Cost Calculation

Estimated cost for a total bus rapid transit extension of 37.62 miles (Flatbush Corridor: 9 miles; Fordham Road: 2.2 miles; Roosevelt: 3.72 miles; Hillside: 6.75 miles; Hylan: 13.74 miles; Narrows: 2.21 miles). Assuming similar cost to Utica Avenue BRT of \$62 million/mile including electric buses.

Job Creation

11.6 direct jobs and 1.5 manufacturing jobs per million dollars invested (Pollin et al., 2021)

Emissions

Calculated emissions utilizing the Regional Project Calculator (National Academies of Sciences, Engineering, and Medicine, 2015). Estimated a population of 1,516,626 people in neighborhood tabulations that border or intersect proposed corridors using the NYC Population Fact Finder (New York City Department of City Planning, n.d.). Assumes that 3% of the population residing in surrounding areas will switch from car to bus rapid transit for daily commuting, resulting in 16% reduction in vehicle miles traveled in the corridor. This is because many will likely switch from local bus to bus rapid transit. Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

These calculations are not intended for use in place of projections created by transit agencies or transportation planners.

PUBLIC CHARGING INFRASTRUCTURE

Cost Calculation

Calculation assumes installation of 50,000 public chargers by 2030. Charging infrastructure and associated costs for a Public L2 charger is \$5,440 (Nicholas, 2019).

Job Creation

5.5 direct jobs per million dollars invested (Pollin et al., 2021).

ELECTRIC VEHICLE TRANSPORTATION: IN-ROAD DYNAMIC WIRELESS ELECTRIC VEHICLE CHARGING

Cost Calculation

In-road dynamic wireless EV infrastructure is \$650,000 per kilometer of highway per Electreon (Hodari, 2021). One mile is approximately 1.6 kilometers.

ELECTRIC SCHOOL BUS MANUFACTURING

Cost Calculation

NYC has 10,700 school buses. Assumes 50% of buses and a cost of \$400,000 per electric school bus (New York City Council, 2021; Wachunas, 2022).

Job Creation

1.7 manufacturing jobs per million dollars invested (Pollin et al., 2021).

INSTALL 300 MILES OF PROTECTED BIKE LANES

Cost Calculation

Based on Regional Planning Authority's proposal to add 300 miles of protected bike lanes. The average protected bike lane in NYC costs \$600,000 per lane-mile (Hinds & Ibarra, 2016).

Job Creation

11.6 direct jobs per million dollars invested (Pollin et al., 2021).

EXPAND CITIBIKE TO ALL NEIGHBORHOODS IN THE FIVE BOROUGHES

Cost Calculation

Former DOT Commissioner Trottenberg estimated it would cost up to \$500 million to put Citibike stations throughout 302 miles of NYC (Guse, 2019)

Job Creation

11.6 direct jobs per million dollars invested (Pollin et al., 2021)

INSTALL 150,000 BIKE SHELTERS

Cost Calculation

The cost of a bike shelter that can secure 6 bicycles within the area of one parking space is €4,800 (Dublin City Council, 2017). Assumes 1 Euro = 1.1304 USD, or a cost of \$5,447 per bike shelter. Five percent of NYC's 3 million free street parking spaces would be 150,000 spaces that can be devoted to bike shelters. (Transportation Alternatives, 2021).

Job Creation

11.6 direct jobs per million dollars invested (Pollin et al., 2021)

GREEN ROOFS ON 25% OF NYC ROOFS

Cost Calculation

There is 2,010,821,594 square feet of roof space in NYC (DEP, 2020). Calculation assumes that at least 25% of NYC roofs are fit for installation as-is or with retrofits. 25% of NYC rooftop space is 502,705,398.5 square feet, and calculation subtracts 2,650,062 square feet (60.84 acres) of green roofs that currently exist (The Nature Conservancy, n.d.). Assumes cost of \$20.50 per square foot to construct a green roof (Rosenzweig et al., 2006).

Job Creation

Assumes a ratio of 1,199 construction jobs and 45 annual maintenance jobs per 3,112,818 square feet of green roof installed (Green Roofs for Healthy Cities, 2019).

Emissions Reduction

Calculation assuming green roofs installed would be native or edible and ranging from 3.13-9.82 of kg/m² of carbon sequestered (Shafique et al., 2020). Carbon sequestered was converted to CO₂ equivalency through the EPA equivalencies tool (U.S. Environmental Protection Agency, 2021). Assumes green roofs can reduce building energy and emissions by .7% (Environmental Protection Agency, n.d.).

Stormwater Savings

Assuming 25% of roof area is green roof and the benefit would save \$.113/square foot in avoided damages and service losses from precipitation (MOR, 2020). Assumes an equal number of square feet installed each year over the next 8 years.

COOL ROOFS ON 75% OF NYC ROOFS

Cost Calculation

There is 2,010,821,594 square feet of roof space in NYC (DEP, 2020) and 10 million square feet of cool roofs have already been installed (Poletto, 2021). All roofs can be cool roofs but this calculation assumes a goal of 75%. Assumes cost per square foot to install a cool roof is \$1.50 (U.S. EPA, 2017).

Job Creation

4.7 direct jobs per million dollars invested (Pollin et al., 2021)

Emissions Reduction

Cool roofs can reduce emissions at a rate of .5 lbs CO₂ reduced per square foot of rooftop painted (Cities of Service, n.d.). Emission equivalencies are approximated using EPA Greenhouse Gas Equivalencies calculator (U.S. Environmental Protection Agency, 2021).

PERMEABLE OPEN STREETS

Cost Calculation

68.82 square miles are currently devoted to cars today (Transportation Alternatives, 2021). 10% of roadway in NYC is 192 million square feet. This recommendation suggests conversion of two-thirds of this roadway into permeable pavers/concrete/asphalt and one-third into green infrastructure (bioswales, rain gardens, native trees and shrubs). This would require removal of 128,240,640 square feet of concrete and asphalt and replacing it with porous concrete and converting 64,120,320 square feet into green infrastructure. The cost of concrete removal is estimated at \$2 per square foot including labor and removal (Purnell, 2021). Estimated an average of \$10/square foot for permeable pavers, concrete, or asphalt including installation. Estimated installation cost for bioretention (bioswales, rain gardens, native trees and shrubs) is \$6/square foot. Environmental benefits bioretention and permeable pavers save \$.02/square foot/year (MOR, 2020). Open Streets benefits: .38% of space helped 5,700 restaurants during the pandemic; assuming similar rates, 10% of space could help 150,000 businesses.

Job Creation

11.6 direct jobs per million dollars invested (Pollin et al., 2021)

Emissions Reduction

Calculation assumes bioretention areas can sequester .31 kg/m² (Kavehei et al., 2029). Carbon sequestered was converted to CO₂ equivalency through the EPA equivalencies tool (U.S. Environmental Protection Agency, 2021).

RENEWABLE RIKERS

Cost Calculation

The cost of installation of a utility-scale solar generator in the Northeast in 2019 was \$1,635/KW (EIA, 2021), and used to get the total cost for a 90-megawatt Solar installation. The assumed Capital cost for battery storage up to 4 hours is \$300/kWh or \$1200/KW for 4 hours (Wesley et al., 2021). According to an analysis from the NYC Independent Commission on Criminal Justice and Incarceration Reform, this project would cost approximately \$15 Billion (Lippman, et al, 2017). Assumes construction begins in 2027 and ends by 2035.

Job Creation

Solar: 3.8 direct jobs per million dollars invested. Battery Storage: 3.5 direct jobs per million dollars invested (Pollin & Chakraborty, 2021). Note that this battery storage methodology is different from abridged report.

Emissions Reduction

Under the estimate that this plan would take 150,000 cars off the road (Lippman, et al, 2017), converted emissions with EPA Carbon Equivalency Calculator (EPA, 2021).

ACRONYMS

AFL-CIO	The American Federation of Labor and Congress of Industrial Organizations
AFSCME	American Federation of State County and Municipal Employees
ARC	Apprenticeship Readiness Collective
BCTC	Building & Construction Trades Council of Greater New York
BIPV	Building Integrated Photovoltaics
BOEM	Bureau of Ocean Energy Management
CFHS	Carbon-Free and Healthy Schools
CIP	Coating Inspector Certificate Program
CJNY	Climate Jobs New York
CMAQ	Congestion Mitigation and Air Quality
CO2/CO2Eq	Carbon Dioxide/Carbon Dioxide Equivalent
COVID-19	Coronavirus Disease 2019
CWA	Communications Workers of America
ECP	Enterprise Community Partners
ECRA	Economic and Climate Resilience Act
EJ	Environmental Justice
EV	Electric Vehicle
EVITP	Electric Vehicle Installation Training Program
GHG	Greenhouse Gas

MTA	Metropolitan Transit Authority
NPCC	New York City Panel on Climate Change
NSBCTC	Building & Transportation Trades Council of Nassau and Suffolk Counties
NYC DOE	New York City Department of Education
NYC DOT	New York City Department of Transportation
NYC EDC	New York City Economic Development Corporation
NYC H+H	New York City Health + Hospitals
NYC MOS	New York City Mayor's Office of Climate and Sustainability
NYCC	New York City Council
NYCCLC	New York City Central Labor Council, AFL-CIO
NYCHA	New York City Housing Authority
NYPA	New York Power Authority
NYSERDA	New York State Energy Research and Development Authority
NYSNA	New York State Nurses Association
PACT	Permanent Affordability Commitment Together
PLA	Project Labor Agreement
PSC	Public Service Commission
RFP	Request for Proposal
SEIU 32BJ	Service Employees International Union, Local 32BJ
TWU	Transport Workers Union of America
UA	United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada

GLOSSARY OF TERMS

Apprenticeship Program: According to the DOL, “paid on-the-job training and related classroom training under the guidance of experienced journey workers for workers learning a new trade.” (NY Department of Labor, n.d.)

BOEM (Bureau of Ocean Energy Management): Agency within the United States Department of Interior that deals with “managing development of U.S. Outer Continental Shelf energy and mineral resources.” They supervise the federal offshore wind lease process. (Bureau of Ocean Energy Management, 2022)

Brownfield: “A property which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.” (US Environmental Protection Agency, 2021)

Building Integrated Photovoltaics (BIPV): “integrated solar cells within the climate envelopes of buildings and utilizing solar radiation to produce electricity” (Jelle & Breivik, 2012).

Buy America Requirements: Regulations applied to purchases of iron, steel, and other manufactured products permanently incorporated into infrastructure project which must be undertaken by U.S. states and municipalities with funds issued by certain U.S. federal departments and agencies. (Trade Commissioner Service, 2021)

Carbon Dioxide (CO₂) Emissions: “emissions stemming from the burning of fossil fuels and the manufacture of cement; they include carbon dioxide produced during consumption of solid, liquid, and gas fuels as well as gas flaring.” (Eurostat, n.d.)

CO₂Eq (CO₂ Equivalent): Emissions of greenhouse gases are typically expressed in a common metric so that their impacts can be directly compared, as some gases are more or less potent (i.e., have a higher global warming potential) than others. The international standard practice is to express greenhouse gases in carbon dioxide equivalents (CO₂e). (US Environmental Protection Agency, 2013).

Cool Roof: “Roofs that stay cool in the sun by minimizing solar absorption and maximizing thermal emission” (Akbari & Levinson, 2008)

Corrosion: “a chemical or electrochemical reaction between a material, usually a metal, and its environment that produces a deterioration of the material and its properties” (Davis, 2000).

Cost-Burdened Household: A household “who pay more than 30% of their income for housing” and “may have difficulty affording necessities such as food, clothing, transportation, and medical care.” (US Department of Housing and Urban Development, n.d.)

Cryptocurrency: “A cryptocurrency is a digital or virtual currency that is secured by cryptography, which makes it nearly impossible to counterfeit or double-spend. Many cryptocurrencies are decentralized networks based on blockchain technology—a distributed ledger enforced by a disparate network of computers. A defining feature of cryptocurrencies is that they are generally not issued by any central authority, rendering them theoretically immune to government interference or manipulation.” (Frankenfield, Vera, & Velasquez, 2022)

Deep-Energy Retrofits/Deep Retrofits: “A whole-building analysis and construction process that achieves much larger energy cost savings—sometimes more than 50% reduction—than those of simpler energy retrofits and fundamentally enhances the building value.” (RMI, n.d.)

Direct Entry: Direct entry is a provision for individuals who successfully complete an apprenticeship program, and who meet the minimum requirements for a NYS Registered Apprenticeship program, with direct opportunity for an interview with the sponsor of a program. Direct Entry may be used by sponsors of Registered Apprenticeship programs as another way to bring apprentices into their programs. Direct Entry is a tool to help sponsors reach underrepresented populations and to meet their EEO goals. (New York State Department of Labor, n.d.)

Direct Jobs: “Jobs created to deliver a final project or product.” (McGlade, et al., n.d.)

Distributed Solar: “Distributed solar energy can be located on rooftops or ground-mounted, and is typically connected to the local utility distribution grid. There are a wide variety of policies at the federal, state and local level that impact distributed solar and its customers.” (Solar Energy Industries Association, 2022).

Energy Burden: “The percentage of gross household income spent on energy costs.” (Office of Energy Efficiency & Renewable Energy, n.d.)

Environmental Justice Area: The US Department of Environmental Protection defines an EJ Area as “any census tract where 20% or more individuals live at or below the federal poverty line, and/or 30% or more of the population identifies as a non-white minority, based on data from the U.S. Census.” (Pennsylvania Department of Environmental Protection, n.d.)

EVITP: The Electric Vehicle Infrastructure Training Program is a comprehensive program that trains workers to install electric vehicle supply equipment. (Electric Vehicle Infrastructure Training Program, n.d.)

Greenhouse Gas: “Gases that trap heat in the atmosphere.” (US Environmental Protection Agency, 2021)

Green Infrastructure: “The range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters.” (US Environmental Protection Agency, 2022).

Green Roof: “Rooftops planted with vegetation. Intensive green roofs have thick layers of soil (6 to 12 inches or more) that can support a broad variety of plant or even tree species. Extensive roofs are simpler green roofs with a soil layer of 6 inches or less to support turf, grass, or other ground cover.” (US Environmental Protection Agency, 2009)

Heat Pump: “Heat pumps offer an energy-efficient alternative to furnaces and air conditioners for all climates. Like your refrigerator, heat pumps use electricity to transfer heat from a cool space to a warm space, making the cool space cooler and the warm space warmer. During the heating season, heat pumps move heat from the cool outdoors into your warm house. During the cooling season, heat pumps move heat from your house into the outdoors. Because they transfer heat rather than generate heat, heat pumps can efficiently provide comfortable temperatures for your home.” (US Department of Energy, n.d.)

High-Speed Rail: Passenger train system that cruises at a higher velocity with some trains going as fast as 220 MPH (High Speed Rail Alliance, 2022)

Impervious Surface: “Impermeable surfaces that can not effectively infiltrate rainfall. This includes paved, concrete and gravel surfaces (i.e. parking lots, driveways, roads, runways and sidewalks); building rooftops and miscellaneous impermeable structures such as patios, pools, and sheds.” (New York State Department of Environmental Conservation, 2015)

Indirect Jobs: “Supply chain jobs created to provide inputs to a final project or product.” (McGlade, et al., 2020).

Induced Jobs: “Jobs created by wages earned from the projects and spent in other parts of the economy, thereby creating additional jobs.” (McGlade, et al., 2020)

Intergovernmental Panel on Climate Change (IPCC): “United Nations organization that releases scientific assessments on the worldwide impact of climate change and strategies for mitigation.” Thousands of scientists from around the world contribute to its findings. (The Intergovernmental Panel on Climate Change, 2022).

Labor Peace Agreement: An agreement entered into between an employer and a union where the employer agrees not to oppose unionization and the union agrees to not strike or otherwise stop work. (US Chamber of Commerce, 2016)

Low Income Home Energy Assistance Program (LIHEAP): Federal program operated by state authorities that “offers funding to pay utility bills of low-income customers and those in need of financial support.” (Benefits.gov, n.d.)

Median Household Income: A particular income amount of a region or population that divides it into two equal parts: those who make above this level and those who make below this level. (US Department of Education, 2021)

Megawatt: The standard term of measurement for bulk electricity. “One million watts of electricity.” (US Energy Information Administration, n.d.)

Megawatt-Hour: “One thousand kilowatt-hours or 1 million watt-hours.” A unit that is used to calculate electric output. (US Energy Information Administration, n.d.)

Net Zero Buildings/Schools: “Zero energy buildings combine energy efficiency and renewable energy generation to consume only as much energy as can be produced onsite through renewable resources over a specified time period.” (Office of ENergy Efficiency & Renewable Energy, n.d.)

New York City Housing Authority (NYCHA): “The New York City Housing Authority (NYCHA), the largest public housing authority in North America, was created in 1935 to provide decent, affordable housing for low- and moderate-income New Yorkers.” (NYCHA, n.d.)

NYC Health + Hospitals: It “is the largest public health care system in the United States” and it provides “essential inpatient, outpatient, and home-based services to more than one million New Yorkers every year in more than 70 locations across the city’s five boroughs”. (NYC Health + Hospitals, 2022).

Pervious Surface: “ Those surfaces in the urban landscape that cannot effectively infiltrate rainfall consisting of building rooftops, pavement, sidewalks, and driveways. Steep slopes and compact soils are not typically included as impervious surfaces ” (NYS Department of Environmental Conservation, 2010)

Pre-Apprenticeship Program: A “program or set of services designed to prepare individuals to enter and succeed in a Registered Apprenticeship program” by definition having “a documented partnership with at least one Registered Apprenticeship program.” (Employment & Training Administration, 2015)

Project Labor Agreement (PLA): “Collective bargaining agreements between building trade unions and contractors. They govern terms and conditions of employment for all craft workers—union and nonunion—on a construction project. They protect taxpayers by eliminating costly delays due to labor conflicts or shortages of skilled workers.” (AFL-CIO, n.d.)

Responsible Contractor Policy: “Policy that establishes a hiring preference for the selection of contractors who pay their workers a fair wage and provide employer-paid family health insurance, pension benefits and training opportunities.” (AFL-CIO Executive Council, 1997)

Request for Proposal (RFP): A request to offshore wind developers, which “specifies eligibility requirements, contract requirements, and evaluation criteria based upon the PSC Order and stakeholder input.” (NYSERDA, n.d.)

Runoff: “Overland flow and shallower interflow processes that transport water to the stream within the time scale of approximately a day or so” (Tarboton, 2003).

Storm Surge: “The rise in seawater level caused solely by a storm.” (National Ocean Service, 2021)

Stormwater Management: “A process employing various non-structural and structural measures to control stormwater runoff with respect to its quantity and quality.” (Marsalek & Chocat, 2002)

Urban Heat Island: ““Urban heat islands” occur when cities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat. This effect increases energy costs (e.g., for air conditioning), air pollution levels, and heat-related illness and mortality.” (US Environmental Protection Agency, 2021)

END NOTES

All end notes are listed in the order that they are cited within this report.

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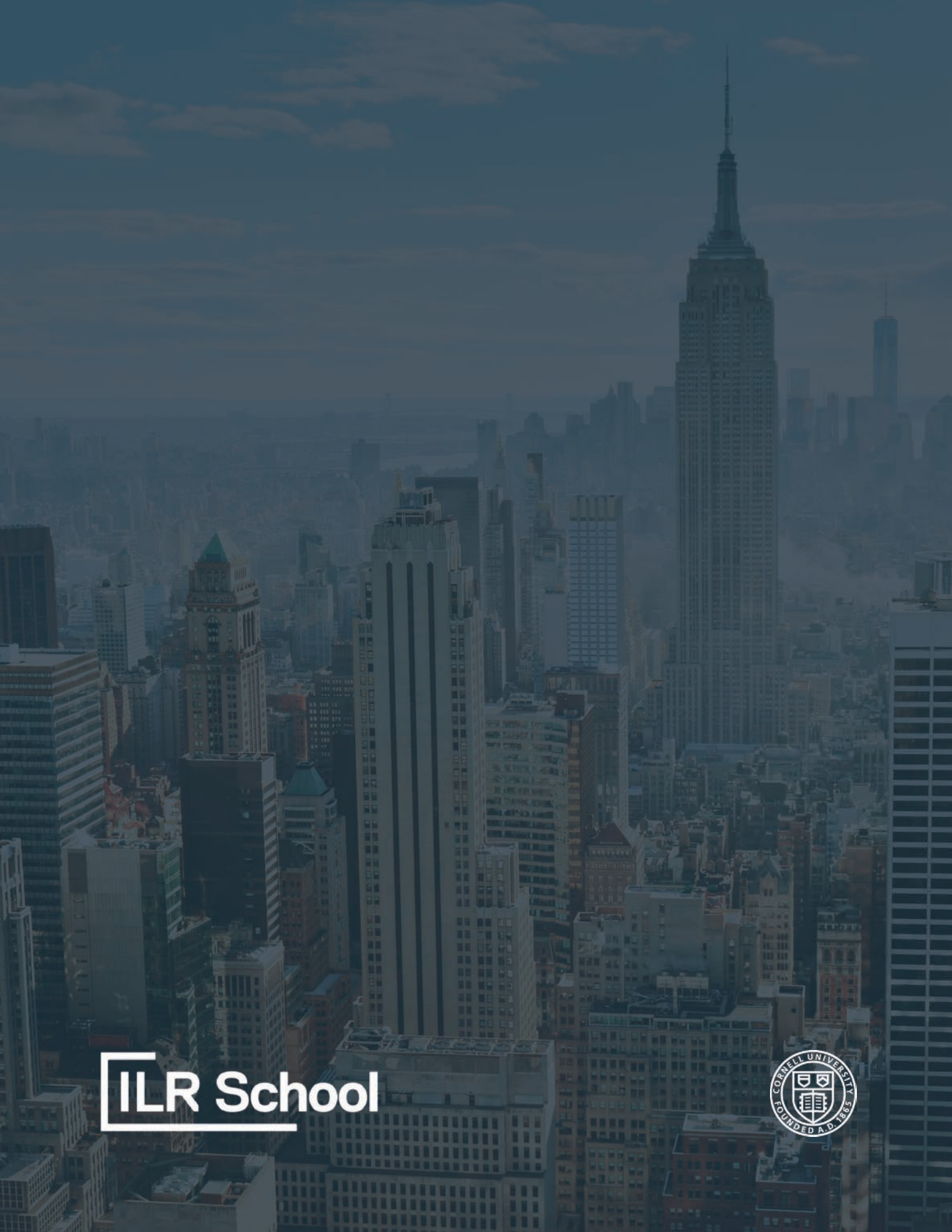
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