Climate Works for All

A Platform for Reducing Emissions, Protecting Our Communities, and Creating Good Jobs for New Yorkers

ABOUT THE AUTHORS

ALIGN: The Alliance for a Greater New York's mission is to create good jobs, vibrant communities, and an accountable democracy for all New Yorkers. Our work unites worker, community, and other allies to build a more just and sustainable New York. ALIGN is a local affiliate of the BlueGreen Apollo Alliance, Jobs with Justice and the Partnership for Working Families.

Founded in 1991, the **New York City Environmental Justice Alliance (NYC-EJA)** is a non-profit, 501(c)3 city-wide membership network linking grassroots organizations from low-income neighborhoods and communities of color in their struggle for environmental justice. NYC-EJA empowers its member organizations to advocate for improved environmental conditions and against inequitable environmental burdens by the coordination of campaigns designed to inform City and State policies. Through our efforts, member organizations coalesce around specific common issues that threaten the ability for low-income communities of color to thrive. NYC-EJA is led by the community-based organizations that it serves, with its board elected by its member groups, who set policy and guide program development.

The New York City Central Labor Council (NYCCLC) is a non-profit labor membership organization devoted to supporting, advancing and advocating for the working people of New York City. The NYCCLC brings together 300 local unions from every trade, occupation, public and private sector of the New York economy. We represent 1.3 million workers, including teachers, truck drivers, operating engineers, nurses, construction workers, electricians, firefighters, retail workers, janitors, train operators, bakers, and many more who are the face of today's workforce.

Today, the **BlueGreen Alliance** unites 15 of our country's largest unions and environmental organizations. Acting together, through nearly 16 million members and supporters, we are a powerful voice for building a cleaner, fairer and more competitive American economy.

The American Federation of Labor and the Congress of Industrial Organizations (AFL-CIO) is the umbrella federation for U.S. unions, with 56 unions representing 12.5 million working men and women. We work to ensure that all people who work receive the rewards of their work—decent paychecks and benefits, safe jobs, respect and fair treatment.

TABLE OF CONTENTS

Acknowledgments

Josh Kellermann from ALIGN is the lead author of this report. Roxanne Johnson from the BlueGreen Alliance provided invaluable research, writing, editing and all around brilliant support. Eddie Bautista, Natasha Dwyer and Juan Camilo Osorio from the New York City Environmental Justice Alliance developed key content areas of the report and provided essential editing support. Connie Raza from the Center for Popular Democracy brought her excellent copy editing skills to bear on this report. Alex Gleason from the NYC Central Labor Council supplied important edits to the report.

Many others provided feedback on this report, too numerous to name. Thank you!

Design by Winking Fish.

Errors remain the responsibility of the authors.

EXECUTIVE SUMMARY

Mayor Bill de Blasio's September 2014 commitment to reduce New York City's greenhouse gas emissions 80 percent by 2050 demonstrates the leadership New York City needs to decisively reduce our contribution to climate change. This 80x50 goal, coupled with City Council Speaker Melissa Mark-Viverito's legislative package to reduce emissions, has put New York City on track to show the world that reducing our carbon footprint while increasing our climate resiliency is not only possible, but can create good jobs for unemployed and disadvantaged residents and can lead to environmental justice and greater equity in one of the most unequal cities in the United States.

This report details a platform of 10 bold proposals for moving toward 80x50 that make our city more resilient, create nearly 40,000 good jobs each year, and cut our annual greenhouse gas emissions by nearly 12 million metric tons of carbon equivalent. New York City must reduce its emissions by 36 million metric tons by 2050. Our plan points the way to achieving one-third of this goal. Putting 40,000 people to work would reduce our unemployment rate by 14 percent and help struggling families to be more resilient in the face of climate change and its disrupting consequences.

Several of the proposals in this report overlap with measures proposed by Mayor de Blasio and the City Council, but others push the city to even stronger action on climate change and quality job creation. This report brings together some of the best thinking on climate policy and job creation from worker organizations, environmental justice advocates, environmentalists, and other stakeholders. Climate change will have severe and long-term effects on New York City residents. In the short-term, New Yorkers will see increased flooding and storm surges. The most severe long-term climate impact for New Yorkers will be rising sea levels. By the end of the century, sea level is likely to rise up to four feet, with a 1 in 100 chance that it will rise seven feet.[1] Given New York City's 520 miles of coastline and dense residential development on the waterfront, as well as significant commercial, industrial and energy infrastructure located at or near sea level, the danger of rising sea levels to people and the economy is clear. The intensity and reach of storm surges, like during Superstorm Sandy, will be expanded by these higher sea levels. In fact, the impact of Superstorm Sandy was exacerbated by higher sea levels that had already occurred over the last century.[2]

Heat waves are very likely to become more frequent, increasing the risk of heat-related death. By late century, we could experience nearly 60 days per year with temperatures over 90 degrees, whereas today we have about 18 such days per year.[3] This has direct implications for those vulnerable to heat, such as the elderly, young children, workers whose jobs are outside, low-income people who can't afford air conditioning, and those living in substandard housing. Extreme heat therefore has health and productivity implications for New York City residents. In addition, the spike in extremely hot days will increase the energy needs in the city to power air conditioning units. This will force New York City to invest in new and expanded energy sources and more resilient distribution networks, at a high cost to taxpayers.

Although most New Yorkers will suffer from some aspects of climate change, poor and low-income residents will be hardest hit. Low-income communities sit at a nexus of physical, political, and financial forces that leaves them most vulnerable to extreme weather events and other impacts of climate change. Nearly half of New Yorkers live at or near the poverty line. Fifty-five percent of Superstorm Sandy's storm surge victims in New York City were renters, with incomes averaging $18,000 a year. Sixty-four percent of homeowners impacted by Sandy earned less than $28,000 a year.[4] Nearly 20,000 undocumented immigrants lived in Sandy affected areas, yet they are excluded from most sources of relief.[5]

This is the challenge facing New York City. We have an unprecedented opportunity to simultaneously solve our jobs crisis, reduce greenhouse gas emissions and adapt to the impacts of climate change. New York City can unlock this potential—and set an example for other U.S. cities—by building physical, economic, and community infrastructure systems in a sustainable and equitable way.

The solutions that follow reflect the core values that we share:

- Climate change is a reality that must be addressed through government-led action that is accountable to communities and workers.
- Addressing climate change is not simply about reducing greenhouse gas emissions, but also about increasing the resiliency of those frontline communities most threatened by climate change, in addition to being disproportionately burdened by historic patterns of environmental, social and economic inequality.
- Physical and social resiliency refers both to the infrastructure that can protect these communities from extreme weather and also to the economic health that provides a financial buffer from destabilizing events like those caused by climate change.

It should be noted that some of the proposals in this report will require long-term commitments, while others can be completed in the next few years. Retrofitting all of New York City's large buildings will occur over the next 35 years, while replacing the New York City Housing Authority's (NYCHA) boilers damaged by Superstorm Sandy with combined heat and power units and placing solar on the rooftops of 100 schools should happen over the next few years.

It should also be noted that there is a significant cost to a "business as usual" approach to climate change. Superstorm Sandy caused $19 billion in damage and economic loss in New York City alone. Significant upfront public and private investments in emissions reductions and resiliency measures will pay significant dividends for decades to come, reduce the cost of future storms to the people and infrastructure of this city.

The 10 proposals in this report are not a complete inventory of possible climate protection activities. There are dozens of other valuable projects that will reduce emissions and increase resiliency. Many of these are already underway through PlaNYC, the city's sustainability plan, or through other resiliency initiatives. The proposals described in this report are complimentary to existing proposals, and are not exclusive of other ideas not yet on the table.

SUMMARY OF PROPOSALS

New York City can create tens of thousands of good, career-track jobs each year and reduce our annual greenhouse gas emissions by nearly 12 million metric tons by annually investing $2 billion in public and private funds in 10 key projects:

Mandate Energy Efficiency Retrofits in New York City's Largest Buildings

Investing $1 billion per year in retrofitting NYC's largest buildings for energy efficiency could create 16,000 jobs each year and reduce annual greenhouse gas emissions by 9.7 million metric tons of carbon dioxide equivalent. Mandating energy efficiency retrofits in privately-owned buildings will have, by far, the most significant impact on emissions and job creation in New York City.

Replace New York City Housing Authority (NYCHA) Boilers with Combined Heat and Power Systems

Replacing half of the 60 NYCHA boilers damaged during Superstorm Sandy with combined heat and power (CHP) systems over the next three years, at a cost of $132 million, would create 1,900 jobs in construction, installation and manufacturing and reduce greenhouse gas emissions by 40,000 metric tons of carbon equivalent per year. Energy savings from CHP can be reinvested in energy efficiency retrofits, deepening the energy savings for NYCHA.

Expand the Green Jobs - Green New York Program in New York City

Investing $50 million in a family home retrofit program in New York City would attract upwards of $500 million in private capital, lead to the retrofitting of 60,000 homes, and create over 9,000 good jobs over the next 10 years, while reducing annual greenhouse gas emissions by 134,000 metric tons of carbon dioxide equivalent. It would also save homeowners over $50 million in energy costs each year.

Install Solar Energy on Rooftops of New York City's 100 Largest Schools

Expanding the current commitment by the de Blasio administration by installing 50 megawatts (MW) of solar capacity on the 100 largest schools over the next five years would cost a total of $200 million, create more than 2,600 jobs, and reduce annual greenhouse gas emissions by 26,000 metric tons of carbon dioxide equivalent. The reduction in asthma-inducing pollution from oil boilers at these buildings would be significant for students.

Fix Leaking Natural Gas Lines

Repairing and replacing ConEdison's 1,340 miles of natural gas distribution pipeline made from leak-prone materials over the next 15 years will cost $1.65 billion, create more than 6,800 jobs, and reduce emissions by 42,000 tons of carbon dioxide equivalent annually. Accelerating the replacement of the more than 3,200 total miles of pipes made of leak-prone materials—such as cast iron and bare steel—in New York City has the potential to create an estimated additional 17,000 jobs and reduce annual emissions by an estimated 105,000 tons annually. This pipeline replacement also will increase the resiliency of New York City. It will provide a more reliable gas distribution infrastructure that will reduce the risk that residents who live in buildings with gas-fired boilers will lose their heat and hot water during storms. Most importantly, an updated gas infrastructure could save lives by preventing deadly explosions caused by leaking gas lines.

Upgrade New York City's Energy Distribution Systems by Investing in Microgrids

Investing $400 million over the next three years to pilot two microgrids powered by energy-efficient CHP systems or by solar or geothermal energy, could generate 104 MW of electricity in key New York City neighborhoods. This work would create 5,000 jobs and reduce greenhouse gas emissions by more than 543,000 metric tons of carbon dioxide equivalent per year. These microgrids would help to prevent widespread blackouts like the one following Superstorm Sandy and would promote energy self-reliance in climate-vulnerable communities.

Improve Flood Protection and Stormwater Management Infrastructure

Investing $200 million over the next two years to expand greenways and improve stormwater management systems throughout New York City will create 4,670 jobs and increase the resiliency of the City's climate-vulnerable communities. These greenways will reduce the stormwater runoff that causes sewage overflows nearly half the time it rains, while slowing down the speed of storm surges that directly threaten climate-vulnerable communities in New York City.

Increase Bus Rapid Transit and Restore Train Service Cuts

Investing $2.1 billion over the next 10 years in expanded Bus Rapid Transit (BRT) service in underserved neighborhoods in New York City, as well as restoring train service that has been cut, like the express Long Island Railroad Rockaway Line to JFK airport, would create more than 72,000 jobs. If 10 percent of the residents served by the proposed BRT system switch from driving cars to taking public transit for an average commute of eight miles, the result would be a savings of nearly 300,000 metric tons of carbon dioxide equivalent emissions each year. Increased public transit options would also decrease vehicle usage, traffic congestion, and increase job access and quality of life for outer-borough residents.

Invest in Public Hospital Resiliency Measures

Investing $1.6 billion over the next five years in increasing the resiliency of public hospitals would create over 32,000 jobs. This work would involve onsite energy generation, raising mechanical equipment above flood levels, and adequate funding for the provision of services and training of hospital staff. Adequately funded and resilient public hospitals insulate climate-vulnerable communities from the most acute impacts of severe weather events and ensure a safe environment for patients and a safe workplace for employees who must remain at work during natural disasters.

Increase Efficiency of Commercial Waste Hauling

Transforming the commercial waste hauling system through a more efficient system of waste collection zones would increase City revenue by almost $10 million, increase waste diversion rates through recycling by up to 200 percent, create more than 15,000 jobs over the next 10 years, and reduce greenhouse gas emissions by nearly one million metric tons per year. It would also improve quality of life for low-income communities and communities of color in New York City who are disproportionately impacted by truck and waste facility pollution under the current waste hauling system.

Other Initiatives Not Detailed in this Report

Build Offshore Wind: New York City should construct a large-scale wind farm in the Atlantic Ocean, off the shore of the Rockaways in Queens, hiring local residents under a Project Labor Agreement. The project could provide enough energy to power a half-million homes in New York City, significantly replacing current carbon-based fuels.

Develop Sustainable and Resilient Food Networks: New York City produces very little of its own food. Instead, the vast majority of our food is imported by truck. Increasing the amount of land cultivated within the city, supporting regional farmers, and expanding a low-carbon food distribution network will make New York City more resilient and sustainable.

Upgrade New York City's Roads, Bridges that Are Essential Evacuation Routes: During Superstorm Sandy, the rail and subway systems were shut down, leaving the bus system as the only viable evacuation option for residents who lack personal cars. All roads and bridges that are essential evacuation routes should be resilient to extreme weather events.

1. INTRODUCTION

NEW YORK CITY'S VISION FOR CLIMATE JOBS

Mayor Bill de Blasio's September 2014 commitment to reduce New York City's greenhouse gas emissions 80 percent by 2050 demonstrates the leadership we need to decisively reduce New York City's impact on climate change. This 80x50 goal, coupled with City Council Speaker Melissa Mark-Viverito's legislative package to reduce emissions, has put New York City on track to show the world that emissions reductions and climate resiliency not only are possible, but also can create good jobs for unemployed and disadvantaged residents and can lead to greater equity in one of the most unequal cities in the United States.

This report details a platform of 10 bold proposals for moving toward 80x50 that make our city more resilient, create nearly 40,000 good jobs each year, and cut our annual greenhouse gas emissions by nearly 12 million metric tons of carbon equivalent. New York City must reduce its emissions by 36 million metric tons by 2050. Our plan points the way to achieving one-third of this goal. Putting 40,000 people to work would reduce our unemployment rate by 14 percent and help struggling families to be more resilient in the face of climate change and its disrupting consequences.

Many of these proposals overlap with Mayor de Blasio's climate platform, but others push the city to even stronger action on climate and job creation. This report brings together some of the best thinking on climate policy from worker organizations, environmentalists, environmental justice advocates, and other stakeholders.

Climate change will have severe and long-term effects on New York City residents. From sea level rise, to more frequent extremely hot days, New Yorkers must become climate resilient. Climate resiliency means implementing measures that will help to protect vulnerable communities from the worst effects of storms and other extreme weather while also enabling the city to recover quickly from any damage. Examples include expanding greenways to reduce the impact of storm surges and installing microgrids that allow local communities to continue production of electricity even if there is a citywide black-out.

While implementing resiliency plans, however, we also must transition to a low-carbon economy as part of the global effort to prevent the worst-case climate change scenario. Examples include reducing energy use in buildings, shifting to carbon-free energy, and installing solar panels on schools throughout New York City.

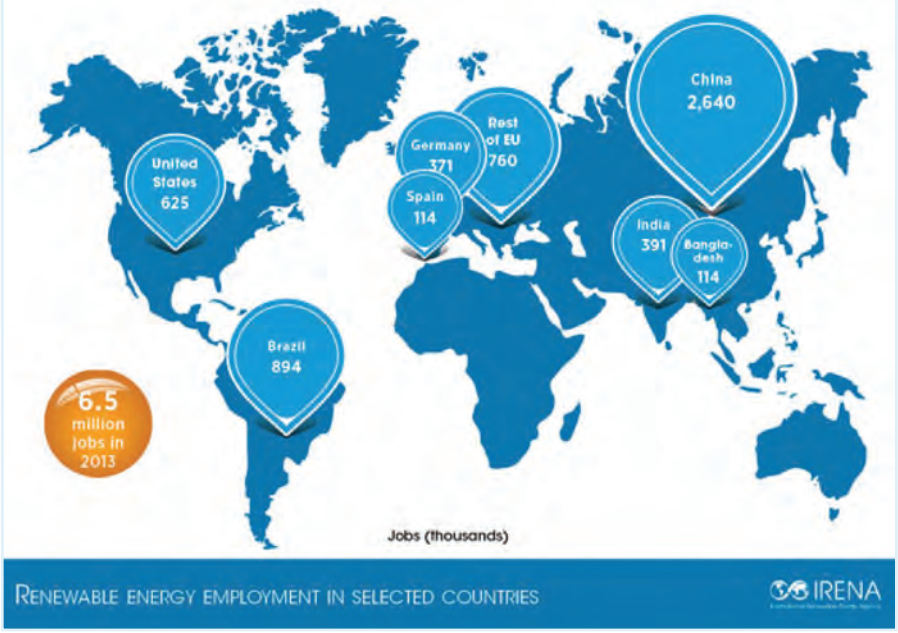
The challenge facing New York City is to build a resilient, low-carbon city that supports vulnerable communities and provides long-term, career-track job opportunities for workers. Worker organizations and community-based organizations have a key role to play to ensure that these projects are done safely, that workers make good wages, and that local and disadvantaged residents are prioritized for the work. For example, public sector unions can play an important role in disadvantaged communities by providing outreach and education on civil service exams in order to access new opportunities. They can also provide training for promotions once a worker is on the job, ensuring that career ladder opportunities are available for all workers. Construction unions can play an important role in hiring and training local and disadvantaged workers through offering quality apprenticeship programs that lead into career-track jobs and ensuring good, family-supporting wages and benefits for their members. Community-based organizations can link unemployed community members to these job opportunities, ensuring that workers are supported in their communities as well as on the job site.

We have an unprecedented opportunity to do right by our workers and communities most vulnerable to the impacts of climate change. New York City can unlock this potential—and set an example for other cities—by building physical, economic, and community infrastructure systems in a sustainable and equitable way.

Climate Jobs Are on the Rise

Jobs building the resilient, low-carbon future we need are on the rise globally. Currently, 6.5 million people worldwide are employed in the clean energy industry, with solar photovoltiac (PV) being the main renewable sector of employment.[6] Even though the United States does not yet have a comprehensive climate change policy, 23,682 new U.S. solar jobs were added in 2013, according to The Solar Foundation.[7]

FIGURE 1: Map Showing Global Renewable Energy Jobs in 2013[8]



As the appetite in the U.S. and in New York City increases for government-led initiatives to combat climate change, opportunities for employment in "climate jobs" will expand further. Climate jobs comprise a range of work in clean energy manufacturing and installation, public transit, green infrastructure, construction, weatherization, building management, recycling, education, finance, and other sectors. The International Trade Union Confederation (ITUC) conducted research showing that by mitigating climate change, 48 million new jobs could be created in just 12 countries.[9]

New York City is on the Right Path

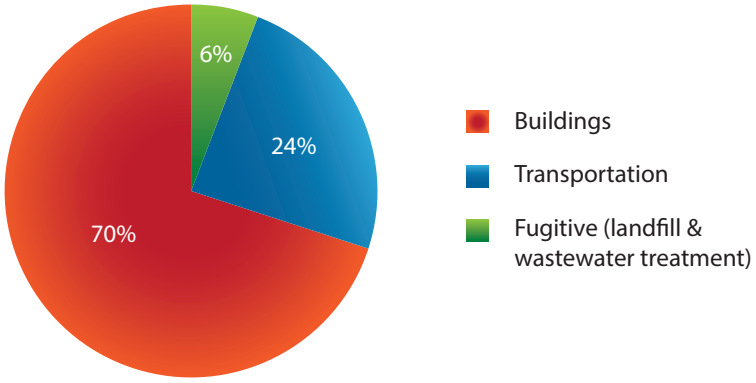
New York City's total annual GHG emissions are 48 million metric tons of carbon dioxide equivalent, greater than the emissions of 97 countries.[10] In September, Mayor de Blasio announced an aggressive, historic plan to reduce emissions 80 percent below 2005 levels by 2050. To date, New York City has reduced emissions 19 percent below 2005 levels, and is almost two-thirds of the way to meeting the interim goal of reducing emissions 30 percent by 2030.[11] Although milder weather patterns have contributed to reduced energy use, other factors include energy-efficiency improvements implemented by city government, reduced carbon intensity of the city's electricity supply, and reductions in energy use in privately-owned buildings.[12]

With over 70 percent of emissions in the city coming from buildings, Mayor de Blasio's commitment to retrofit each city building that uses significant amounts of energy (including schools, public housing, and hospitals) in the next 10 years is particularly important.[14] At the same time, retrofitting privately-owned commercial, residential and industrial buildings is also essential. Indeed, just two percent of these buildings in New York City use 45 percent of citywide energy.[15] The de Blasio plan includes voluntary measures—some of which may become mandatory, if necessary—to encourage property owners to retrofit their commercial and residential buildings to achieve significant carbon reductions in the next 10 years.[16]

Speaker Mark Viverito's plan incorporates important carbon reduction proposals such as requiring a reduction in fossil fuel purchases by city government, strengthening green building laws, and reducing waste. Finally, both the Mayor's and Speaker's plans seek to link city residents to new job opportunities through tailored job training programs. The Speaker's proposal includes legislation to ensure that building operators in large buildings throughout the City are certified in energy efficient building maintenance, which will help improve building energy performance.[17] The Mayor's plan supports this initiative and includes funding to train building operators.[18]

These are bold initiatives, but Superstorm Sandy clearly demonstrated that New York City cannot wait for another storm to reduce our contributions to climate change and protect our communities from its impacts.

FIGURE 2: Greenhouse Gas Emissions by Sector from the City of New York[13]



New York City can do much more to reduce GHG emissions and to increase the resiliency of its climate-vulnerable communities, while ensuring that quality jobs are created for its residents.

THE CRISIS

Cities across the country are facing a three-part crisis. First, they are still working to recover from the recession: high unemployment and underemployment, low revenues and stunted growth make it difficult to invest in public goods and programs. Second, cities are experiencing the increasing impacts of extreme weather events, putting pressure on their physical infrastructure which is already suffering from inadequate investment. Third, according to a recent Center for American Progress report, there has been an "historical trend of pushing external costs of economic development and infrastructure onto low-income neighborhoods."[19] Low-income communities sit at a nexus of physical, political, and financial forces that leaves them most vulnerable and hardest hit by extreme weather events and other impacts of climate change:

> *"The poorest communities in our cities have carried the brunt of the impacts of the financial collapse, crumbling infrastructure, and climatic turmoil. They live in the most inefficient buildings, spend the most proportionally on energy, and are most vulnerable to the health impacts of extreme temperatures. They have the least access to transit and walkable amenities, resulting in increased car-dependence and associated spending. Their properties are more vulnerable to flooding. City budgets that deal with increasingly frequent emergency needs divert resources first from the poor."*[20]

To address these disparities, infrastructure costs, investments and deployments need to be distributed fairly and climate-vulnerable communities need to be prioritized.[21]

New York City finds itself at the intersection of social, economic and environmental justice crises that are both local and global in nature. For decades, the city has implemented policies that have exacerbated economic inequality and placed disproportionate environmental burdens on low-income neighborhoods and communities of color to a degree that jeopardizes the common good. The city must now recognize that any solutions to climate change must meet the challenges of these intersecting crises.

Unemployed, Underemployed,and Impoverished Residents

As of August 2014, New York City had the highest unemployment rate in the state, at 6.9 percent,[22] and roughly 75 percent more workers are underemployed, despite wanting more work.[23] Unemployment is worse in some parts of the city, ranging from a low of 5.6 percent in Manhattan to a high of 9.8 percent in the Bronx.[24] In addition, 260,000 New York City residents are long-term unemployed or so discouraged they have dropped out of the labor force.[25]

In 2012, 21.4 percent of all New Yorkers and 25.4 percent of children in New York City lived in poverty, according to the city's Center for Economic Opportunity.[26] An additional 24.2 percent of New Yorkers are near poverty, with incomes between 101 percent and 149 percent of the poverty line.[27]

Inequality's rise corresponds to the fall in unionization in the United States.[28] While unionization rates in New York City remain strong compared to the rest of the country,[29] it is imperative that the interests of workers' organizations are central to the job creation strategies stemming from climate legislation. This means that emissions reductions strategies and resiliency infrastructure plans should be developed with good job creation and workforce development as central tenets. This will help to ensure that workers have safe jobs with family-sustaining wages, and that the benefits from addressing climate change are broadly shared.

Climate Change Pounds the Poor

New York City learned some very costly lessons when Superstorm Sandy hit our shoreline on October 29, 2012.

The storm was deadly. It killed 44 New York City residents.[30]

The storm was costly. It remains the second costliest hurricane in U.S. history behind Hurricane Katrina, causing around $65 billion in damage and economic loss in the region—including $19 billion in New York City alone.[31] Over 300,000 housing units were damaged or destroyed in New York City.[32]

And, the storm revealed deep fault lines caused by economic inequality in our city; low-income communities and residents were disproportionally affected by Superstorm Sandy.

- Forty-one percent of New York City housing units impacted were designated as low-income, subsidized, rent-stabilized or Mitchell-Lama housing.[33]
- Fifty-five percent of the storm surge victims in New York were very low-income renters, whose incomes are $18,000 a year on average.[34]
- Nearly 20,000 undocumented immigrants lived in Sandy-affected areas, yet they are still excluded from most sources of relief.[35]
- Over 400 New York City Housing Authority (NYCHA) buildings—housing about 80,000 residents—lost essential services, such as electricity, heat, hot water and use of elevators. Despite evacuation orders, most residents sheltered in place due to poor health, lack of mobility, fear, unclear evacuation plans, and lapses in communication from NYCHA.[36]
- Over 622,000 New Yorkers live in storm surge zones that are within a half-mile of the City's six Significant Maritime & Industrial Areas—430,000 of these residents are people of color.[37]

The low-income and unemployed New Yorkers living in areas of the city that were hit hard by Superstorm Sandy suffered disproportionately and were least able to recover due to a lack of financial resources. In fact, the Sandy Regional Assembly Recovery Agenda—prepared by nearly 200 participants from across the region in Sandy's wake—identified over $500 million in climate adaptation capital projects and dozens of policy recommendations to increase the resiliency of frontline communities.[38] While some of these recommendations were included in the Mayor's Special Initiative for Rebuilding and Resiliency report and the federal Hurricane Sandy Rebuilding Task Force Strategy, many were not.[39] Any future plan to address climate change in New York City must prioritize these climate-vulnerable communities.

More of the Same If We Don't Change Our Game

Average temperatures could rise significantly in New York City, threatening public health and straining our infrastructure. Because urban infrastructure absorbs and retains heat, known as the "urban heat island effect," temperatures in New York City are expected to be seven degrees Fahrenheit warmer than the surrounding region,[40] which will place the city's elderly, young children, those who work outdoors, and low-income residents in greater danger.

In addition, New York City has 520 miles of coastline. The risk of severe flooding and storm surges steadily increases due to sea-level rise and more intense storms. Sea levels have already risen a foot in the last 100 years and are projected to rise more rapidly—by up to 10 inches—in the next two decades.[41] As a result, areas of the city not affected by the storm surge during Superstorm Sandy because they are farther from the shoreline (or were at low-tide) will become increasingly vulnerable.

New York City must reduce its contribution to climate change by reducing greenhouse gas emissions and, at the same time, prepare for the inevitable effects of climate change by increasing the resiliency of climate-vulnerable communities. This will require us to take bold action and be proactive and smart when it comes to investing in our physical and social infrastructure. We need to protect our subways and coastline from flooding and storm surges. We need to make our homes, hospitals and schools able to withstand severe weather, so that flooding like we experienced during Superstorm Sandy does not leave families in danger and bring our city to a standstill.

A CLIMATE JOBS PLATFORM FOR NEW YORK CITY

New York City needs a comprehensive plan to address climate change and inequality. We need to leverage public investment for a resilient infrastructure and a low-carbon economy to create good jobs for local disadvantaged residents. By working with community-based organizations, labor unions, contractors, and business owners, the city should develop a climate-jobs program that requires contractors to hire locally and to hire disadvantaged residents,[42] to pay prevailing or living wages, and to use qualified apprenticeship programs where available. These programs should cover construction, manufacturing, retrofitting, and permanent jobs on worksites that have been publicly procured, or have received public investment such as grants, bond financing, tax exemptions and more.

PRINCIPLES FOR CLIMATE JOBS

- Prioritize climate-vulnerable communities
  - Low-income, climate-vulnerable communities should be prioritized for resiliency projects.
  - Develop community-based carbon-reduction infrastructure projects.
- Create good, local jobs
  - Prevailing wage standards for all construction and maintenance work.
  - Living wage standards for all permanent jobs.
- Establish strong workforce development and jobs pipelines
  - Create a centralized first-source hiring system for permanent jobs.
  - Expand training programs through qualified pre-apprenticeship and apprenticeship programs and other resources that emphasize formerly incarcerated, long-term unemployed, and members of communities with high unemployment and poverty rates.
- Ensure a just transition for existing workers
  - Workers employed in carbon-intensive industries should be guaranteed work in new industries and be provided strong social safety net benefits, including free re-training opportunities.
- Ensure community participation and oversight in decision making
  - Advisory committees for program design and implementation should ensure participation by community, labor, environmental justice, environmental, and other constituents.

STATEMENT ON METHODOLOGY

Project selection for this report is based on the following criteria:

1. Does it reduce greenhouse gas emissions?
2. Does the project increase the resiliency of climate-vulnerable and frontline communities?
3. Is there a significant jobs impact?

These criteria reflect the following core values that we share:

- Climate change is a reality that must be addressed through government-led action that is accountable to communities and workers.
- Addressing climate change is not simply about reducing greenhouse gas emissions, but also about increasing the resiliency of those frontline communities most threatened by climate change.
- Physical and social resiliency refers both to the infrastructure that can protect these communities from extreme weather and also to the economic health that provides a financial buffer from destabilizing events like those caused by climate change.

It should be noted that many of the proposed projects will require a long-term commitment. Retrofitting all of New York City's large privately-owned buildings will occur over the next 35 years, and building a citywide full-feature Bus Rapid Transit system will take decades. On the other hand, it should only take a few years to replace NYCHA's boilers that were damaged by Superstorm Sandy with combined heat and power units and to place solar on the rooftops of 100 schools. Alone, each of these projects is a worthwhile initiative and will have an impact on climate change and job creation. These projects—knit together with existing proposals—present a comprehensive solution to climate change and its impacts on New Yorkers.

The 10 proposals in this report are not a complete inventory of possible climate protection strategies. There are dozens of other valuable projects to reduce emissions and increase resiliency. Many of these are already underway through PlaNYC, the city's sustainability plan, or through other resiliency initiatives. The proposals that follow are complimentary to existing proposals, and are not exclusive of other proposals not yet on the table.

TABLE 1. Summary of Impacts of Proposals

Program	Annual Public and Private Investment	Annual Job Creation[43]	Annual Emissions Benefits at Project Completion (metric tons of CO2 equivalent avoided)
BUILDINGS			
Retrofit NYC's Largest Buildings	$1 billion	16,700	9.7 million
Replace NYCHA Boilers with Combined Heat and Power Systems	$44 million	600	40,000
Expand Green Jobs - Green NY Program for NYC	$55 million	900	134,000
ENERGY			
Solar on 100 Schools	$40 million	500	26,000
Fix Leak-Prone ConEd Natural Gas Distribution Lines	$110 million	450	42,000
Upgrade NYC's Energy Distribution Systems by Investing in Microgrids	$130 million	1,600	543,000
WATER SYSTEMS			
Improve Flood and Stormwater Infrastructure	$100 million	2,300	N/A
TRANSIT			
Increase Bus Rapid Transit and Restore Cut Train Service	$210 million	7,200	300,000
HEALTH CARE			
Invest in Public Hospital Resiliency Measures	$320 million	6,400	N/A
WASTE			
Increase Efficiency of Commercial Waste Hauling	N/A	1,500	One million
TOTAL	**$2 billion investment per year**	**38,000 jobs**	**11.8 million metric tons of CO_2 equivalent annually avoided**

2. LARGE-BUILDING ENERGY-EFFICIENCY RETROFITS

Investing $1 billion per year in retrofitting New York City's largest buildings for energy efficiency could create 16,700 jobs each year[44] and reduce annual greenhouse gas emissions by 9.7 million metric tons of carbon equivalent.[45]

THE PROBLEM:

Large buildings in New York City, defined as 50,000 square feet and above, make up only 2 percent of the City's building stock, but use 45 percent of citywide energy.[46] There are about 15,000 such properties in New York City.[47]

The city, under Mayor Bloomberg, adopted a concerted strategy to address emissions from these large buildings, with mixed results. New York City's Greener, Greater Buildings Plan established a series of laws in 2009 to address building emissions.[48] The Plan requires energy benchmarking and annual reporting. It also requires that significant renovations meet current energy codes, that buildings conduct energy audits and energy equipment tuning every 10 years, and undergo lighting upgrades and sub-metering of large, non-residential tenant spaces. Most new public buildings and substantial renovations of public buildings must achieve Leadership in Energy and Environmental Design (LEED) certification.[49] Despite the breadth of these laws, they fail to require energy efficiency retrofits in large privately-owned buildings.

Mayor de Blasio's proposed Large Building Retrofit Accelerator seeks to build on Greener, Greater Buildings by increasing outreach and assistance to buildings seeking energy efficiency retrofits.[50] The Speaker has a complimentary plan, requiring operators of large buildings to complete a training course in energy efficient building operations and to expand outreach and support to smaller buildings throughout the city.[51] Both the Mayor and Speaker propose much stronger action on municipal energy use, highlighting the important role the city can play to lead the way on energy efficiency. While these initiatives move the city in the right direction, they do not mandate retrofits of privately owned buildings.

The primary city and state programs that finance affordable housing preservation have started encouraging more integration of energy efficiency upgrades and green retrofit principles into all affordable housing preservation activities.[52] These programs have been effective, and should be expanded to ensure adequate financing for retrofitting all types of affordable housing.

Lastly, the non-profit New York City Energy Efficiency Corporation (NYCEEC) was created to assist the City in implementing its Greener, Greater Buildings Plan by creating an energy efficiency retrofit financing market for private building owners. NYCEEC partners with banks, community development financial institutions and energy services companies to provide financing for these projects. However, since inception in 2011, NYCEEC has only closed a total of eight financing transactions totaling $23.1 million.[53] The NY Greenbank is a new financing entity at the state level that could also play a role in financing building retrofits.[54]

These initiatives built a solid foundation for tackling GHG emissions in New York City. However, the impact of the Greener, Greater Buildings plan has been minimal. The annual GHG inventory shows that buildings emissions have been reduced 19 percent since 2005, although the majority of these reductions have come from utilities supplying cleaner fuels (the result of the mandatory cap-and-trade program known as the Regional Greenhouse Gas Initiative or RGGI) and buildings using cleaner heating fuels (the result of the mandatory Clean Heat Program).[55] This success demonstrates that mandatory programs indeed work and are a necessary ingredient for rapidly expanding citywide building retrofits.[56]

In the wake of Superstorm Sandy, it is clear that we cannot wait another four years to see if voluntary measures will bring large building retrofits to scale. A mandatory retrofit program is a necessary component of a viable plan to achieving climate sustainability in New York City.

THE SOLUTION:

New York City should pass legislation creating energy use performance targets, impaneling a Task Force that will determine how to achieve these targets, and ensuring that the jobs created to do this work pay good wages to local residents.

Energy Use Performance Targets

The City Council should pass legislation mandating energy use performance targets in existing buildings. The long-term target should require 60 percent energy use reductions below 2010 levels by 2050. Interim targets should require 20 percent energy use reductions by 2020 and 40 percent by 2035.

Short-term goals can be achieved through simple measures such as installing upgraded lighting and sensors, as well as retro-commissioning mechanical systems and ensuring improved operations and maintenance. Medium-term goals can be achieved with retrofits like new boilers, regenerative drive technology on elevators, new AC equipment, solid state lighting, air sealing, and energy recovery systems. Long-term goals can be achieved with a deep energy retrofit, like

reskinning, adding insulation, and changing energy distribution systems such as switching from steam to heat pumps.[57]

At the point of sale (when property is changing hands) buildings should be required to be brought up to the standards set by the next interim target (e.g., a property sold in 2018 should meet 2020 standards). This should also apply to any major renovation of a building.

There should be a financial hardship exemption that allows financially-struggling building owners to avoid or delay compliance with the mandates. This could be particularly important for manufacturers that form an integral part of the New York City economy but may lack access to capital to undergo retrofits, as well as some affordable housing buildings.[58]

Buildings that are already high-efficiency such as those certified LEEDv4 or above and those with an ENERGY STAR Score of 75 or higher should be exempt from the interim 20 percent by 2020 goal.[59] These buildings have already demonstrated efficient use of energy and should be recognized as leaders in the industry.

Retrofits that reduce energy consumption and lower fuel and utility costs are an integral component of preserving affordable housing. These upgrades offer opportunities to lower the ongoing costs of maintaining and operating affordable housing developments without cutting wages for workers or raising housing costs for tenants. Energy efficiency upgrades should not qualify as major capital improvements for the purpose of passing along the costs to tenants.[60] However, some affordable housing owners may have difficulty coming up with the upfront costs to finance retrofits. Therefore, a fund should be created to support these retrofits. Those affordable housing projects that receive public funding to undergo retrofits should be required to maintain affordability of their units. Further, a portion of the cost savings from retrofits should be shared with tenants.[61]

The city should leverage public funds for retrofits by bundling together buildings of similar types (high-rise curtain wall, high-rise masonry, etc.) and issuing requests for proposals (RFP) to conduct deep retrofit work throughout the city. This would allow the city to achieve an economy of scale in retrofits, which will enable bulk purchasing, block-by-block coordination, and large-scale financing.

Task Force, Monitoring and Enforcement

New building construction should steadily move toward reaching near-net-zero energy buildings.[62] The Speaker and Mayor should co-convene a Task Force and appoint technical advisors with demonstrated expertise in the field—as well as community, environmental justice, labor, and affordable housing representatives—with the mission of determining a set of policies to facilitate buildings achieving these targets and ensuring that the benefits of these improvements are broadly shared.

The Department of Buildings should fine non-compliant buildings based on the percent by which energy use exceeds the target. Funds collected could be used to support retrofits of affordable housing and buildings experiencing financial hardship.[63] NYCEEC should serve as the primary financing vehicle for this work through revolving loan funds and credit enhancements.

Workforce Development:

These large building retrofits and ongoing efficiency measures will create jobs in energy audits, construction, installation, and manufacturing of equipment and materials, as well as building operations. All publicly-funded construction for energy efficient retrofits should pay a prevailing wage to workers, utilize qualified apprenticeship programs where available, and hire local and disadvantaged residents. In addition, a portion of the project costs should be set aside to support jobs pipeline and workforce development programs.

Also, building owners should ensure that building operators are trained in energy-efficient operations. To this end, the City Council should pass Intro 13-2014, a bill that will require large buildings in New York City to have at least one building operator who is certified in energy efficient building maintenance.[64] If all New York City buildings over 50,000 square feet have one building operator trained in energy-efficient building operations, buildings can reduce citywide GHG emissions up to five percent.[65]

TABLE 2. Large Buildings in New York City by Borough (Private sector buildings 50,000 square feet and above, or multiple buildings on a single lot totaling more than 100,000 square feet)[66]

Borough	Number of Large Building Properties	Percent of Buildings that are Multifamily Housing
Manhattan	6,190	59%
Brooklyn	3,089	70%
Queens	2,691	64%
The Bronx	2,515	74%
Staten Island	292	34%
Totals	**14,777**	**64%**

3 REPLACE DAMAGED NYCHA BOILERS WITH COMBINED HEAT AND POWER UNITS AND RENEWABLE ENERGY SYSTEMS

Replacing half of the 60 New York City Housing Authority (NYCHA) boilers damaged during Superstorm Sandy with combined heat and power (CHP) systems, at a cost of $132 million,[67] would create 1,900 jobs in construction, installation, and manufacturing[68] and reduce greenhouse gas emissions by 40,000 metric tons of carbon equivalent per year.[69] Energy savings from CHP can be reinvested in energy efficiency retrofits, deepening the energy savings for NYCHA.

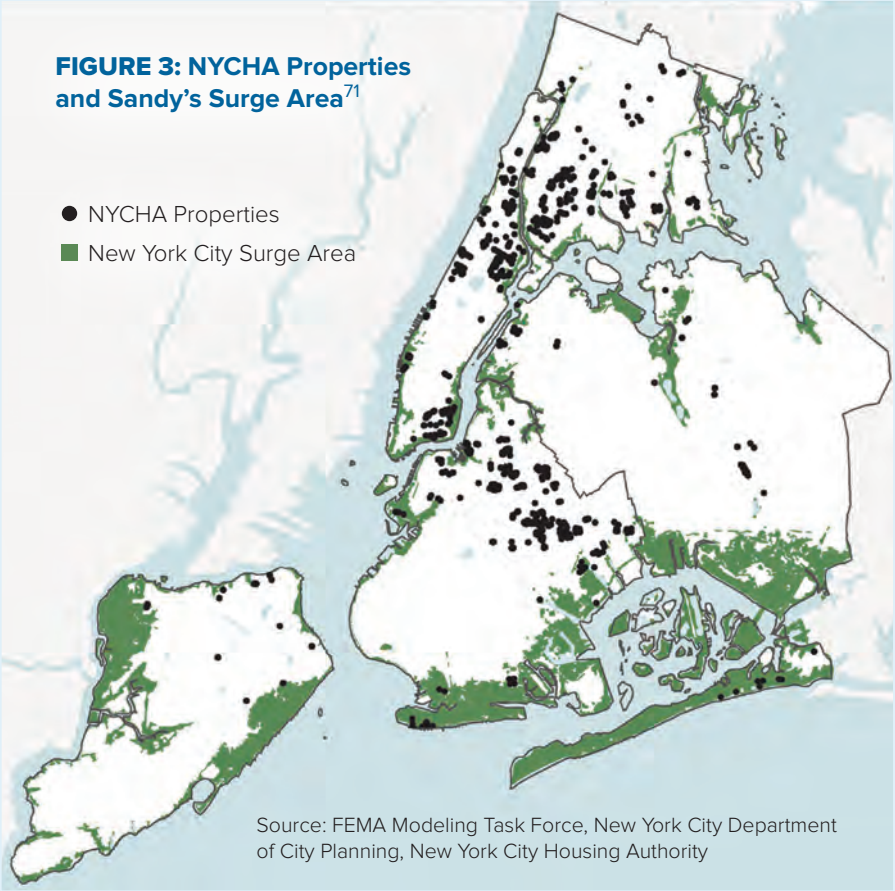


FIGURE 3: NYCHA Properties and Sandy's Surge Area[71]

Source: FEMA Modeling Task Force, New York City Department of City Planning, New York City Housing Authority

THE PROBLEM:

Superstorm Sandy damaged at least 60 boilers that serve 110 NYCHA buildings in New York City. These buildings are currently running off of temporary boilers at a cost of $3 million per month. NYCHA has indicated that the 60 damaged oil-burning boilers will be replaced with conventional natural gas boilers.[70] Additionally, many of these boilers will also need to be moved from flood-prone basements to elevated structures on NYCHA property.

NYCHA has an enormous debt load and backlog of capital improvements. Any energy system installed at NYCHA should maximize energy and cost savings, and take advantage of appropriate revenue-generation opportunities. Natural gas boilers, although less polluting than fuel oil boilers, are still only 40-50 percent energy efficient. CHP units, also known as co-generation systems, typically reach efficiency levels of 75 percent or more, generating both energy and cost savings.[72]

Funding for much of the boiler replacement will be reimbursed by insurance and the Federal Emergency Management Agency (FEMA); however, the scope of these reimbursements is subject to negotiation. It is unclear if FEMA will reimburse NYCHA for replacing oil burning boilers with CHP systems and the elevated structures to support them. Proper reimbursement is one essential component of building an efficient and resilient energy system for NYCHA, and NYCHA should be bold in demanding reimbursement for building a sustainable system that will not have to be replaced due to future storm damage.

Lastly, NYCHA does not provide training for the existing boiler room workers, represented by Teamsters Local 237. The union provides training to these workers when they start the job, but it is NYCHA's responsibility to continue to advance the training of these workers. The existing workforce must be trained in operating and maintaining the new energy systems to ensure quality service and good jobs for New Yorkers.

THE SOLUTION:

NYCHA should replace at least one-half of its damaged boilers with CHP systems. These units are highly energy efficient because they capture waste heat from the energy conversion process and use it to heat or cool the building.[73] Since most NYCHA buildings do not have central cooling systems, the CHP units would be used to provide heat and electricity. CHP units can be "grid-parallel," which means they can function during a city-wide blackout.[74] This will ensure reliable and affordable power for thousands of residents in NYCHA developments.

Because CHP systems are energy efficient, they can enable NYCHA to save money on its utility bill. NYCHA should work to restructure its reimbursement formula from the U.S. Department of Housing and Urban Development (HUD) to ensure those savings are recaptured by NYCHA and reinvested in energy efficiency and other capital improvements at NYCHA buildings.[75]

NYCHA currently has 509 boiler plants serving 181,000 apartments and facilities.[76] NYCHA's plan to replace its existing boilers at Sandy-damaged facilities will set the precedent for planned boiler replacement at NYCHA buildings around the city. Where feasible, NYCHA should also consider investing in solar, wind, and geothermal energy generation. NYCHA should also explore opportunities to connect to the microgrids being considered for New York City.

Financing is a challenge for any capital project at NYCHA. FEMA should guarantee the reimbursement of installing CHP units at Sandy-damaged buildings. Installation of CHP or other energy-efficient technology at all other NYCHA buildings should be supported by utility ratepayer funds or Regional Greenhouse Gas Initiative (RGGI) funds.[77] NYCHA should conduct a system-wide assessment of current energy efficiency opportunities and utilize bundled work and bulk purchasing to reduce costs.

NYCHA's boiler replacement should create good jobs for local New Yorkers. Any funding for this work should ensure workers are paid a prevailing wage, and should utilize public sector workers where appropriate and qualified apprenticeship programs where available. Current HUD Section 3 targeted hire requirements that attach to NYCHA projects have proven inadequate to address unemployment among NYCHA residents.[78] Any city policy should go above and beyond existing Section 3 requirements by prioritizing local workers and disadvantaged community members for jobs, developing a strong enforcement mechanism, and ensure that a percentage of the overall program funds are dedicated to strengthening workforce development and jobs pipelines.

Installation of CHP systems not only will save energy, reduce energy costs and overall GHG emissions, but also will create jobs in manufacturing, installation, operations and maintenance. CHP systems can be designed to contribute power to resilient microgrids and heat buildings directly, which reduces transmission losses and increases efficiency. Savings from these efficiency improvements can be reinvested in additional efficiency and resiliency improvements at NYCHA buildings throughout New York City.

4. EXPAND THE GREEN JOBS - GREEN NEW YORK PROGRAM FOR NYC

Investing $50 million in a family home retrofit program in New York City would attract almost $500 million in private capital, lead to the retrofitting of 60,000 homes, and create over 9,000 good jobs over the next 10 years,[79] while reducing annual greenhouse gas emissions by more than 134,000 metric tons of carbon equivalent per year.[80] It would also save homeowners over $50 million in energy costs each year.[81]

THE PROBLEM:

Green Jobs - Green New York is an innovative New York State program that provides loans to owners of homes with 1-4 units so they can retrofit their homes for energy efficiency. Unfortunately, the program has had little impact on New York City. As of October 2013, only 186 retrofits had occurred, out of 1.2 million 1-4-unit homes in New York City.[82]

There are several barriers to the successful implementation of this program in New York City. First and foremost is the upfront cost of a home retrofit, particularly for low and moderate income homeowners. Loans through New York State Energy Research and Development Authority's (NYSERDA) On-Bill Recovery Plan, which allows homeowners to pay off the loan on their utility bill, are approved based on the applicant's credit history. This presents a significant barrier for many low- and moderate-income city residents who have a higher rate of poor credit due to the high cost of living in New York City.[83]

In addition, few homeowners know of the program due to poor program marketing. Once homeowners do learn about it, the enrollment process is cumbersome and disjointed, leading to a high percentage of applicants losing interest in the process soon after it starts. Another barrier to program uptake is that there is a lack of upfront grants for low-income New Yorkers to pay for the work without having to take out loans. Lastly, there are no barriers to low-road contractors taking advantage of the program and of homeowners by producing a low-quality retrofit.[84]

THE SOLUTION:

Removing the key barriers in the Green Jobs - Green New York program can lead to the retrofitting of 60,000 homes in New York City. This represents five percent of small residential homes in New York City, and will likely generate enough momentum to significantly transform the home retrofit industry and create an economy of scale that will take on a life of its own. In order to achieve this goal there are several steps that need to be taken to reduce barriers to the program.

New York City should create its own on-bill recovery program that uses utility bill payment history to determine credit-worthiness, rather than full credit histories. Many low- and moderate-income New Yorkers maintain a good utility bill payment record despite economic hardships and, therefore, would be able to access the program. The New York City Energy Efficiency Corporation (NYCEEC) should be charged with developing this on-bill recovery product while leveraging a wide range of private capital (including Community Development Financial Institutions (CDFI) and credit unions) to help finance retrofits affordably. Superstorm Sandy funds could be used to provide upfront grants to low-income homeowners as well.

Additionally, marketing for the program should be expanded throughout the city and the city should partner with community based organizations to increase outreach and provide technical assistance to homeowners navigating the program. The enrollment process could be simplified and posted on a customer friendly website in multiple languages that allows a homeowner to track the progress they are making to complete their retrofit. New York City could decrease the paperwork and link program assistance to the city's 311 number. Free or low-cost audits based on a sliding income scale would increase accessibility to the program for low- and moderate-income residents.

FIGURE 4: Illustration of an Inefficient Home[85]

Utilizing the Green Jobs - Green New York program to its fullest extent would save New York residents money, improve homes and reduce greenhouse gas emissions by increasing energy efficiency. Increased utilization of the program can help to generate a small home retrofit industry in the city—increasing the capacity for additional retrofits and savings—while creating jobs in conducting audits, construction, installation, and manufacturing of equipment and materials.

Funding for family home retrofits should create good jobs for local New Yorkers. Any expansion of Green Jobs - Green New York in New York City should ensure workers are paid a prevailing wage, qualified apprenticeship programs are utilized, local workers and disadvantaged community members are prioritized for jobs, and that a percentage of the overall program funds are dedicated to strengthening workforce development and jobs pipelines. New York City should establish a list of approved contractors for the program, which could be based on considerations including whether the contractor pays a prevailing wage and hires from the local community.

5 INSTALL SOLAR ENERGY ON THE ROOFTOPS OF NYC'S 100 LARGEST SCHOOLS

Expanding the current commitment by the de Blasio administration by installing 50 megawatts (MW) of solar capacity on the 100 largest schools over the next five years would entail an investment of $200 million, would create more than 2,600 jobs[86] and reduce greenhouse gas emissions by 26,000 metric tons of carbon equivalent per year.[87] Additionally, these solar panels would reduce asthma-inducing pollution from oil boilers at these buildings.[88]

THE PROBLEM:

New York City's public school system of over 1,000 schools is the nation's largest. In 2012, the New York City Department of Citywide Administrative Services (DCAS) allocated $240 million, or almost 28 percent of the City's municipal electricity budget, to meet the demand for electricity in Department of Education (DOE) buildings.[89]

Public school buildings have relatively large footprints and expansive rooftops, which are suitable for solar. In addition to expanding and properly financing and staffing energy efficiency, recycling and composting programs, public schools should take advantage of their expansive and underutilized rooftops by installing solar panels.

Currently, New York City lacks significant energy generation from solar. There are 39 MW of installed solar capacity in New York City, both private and public.[90] In contrast, Los Angeles has 132 MW of installed solar power.[91] Increasing the solar energy capacity—particularly at New York City schools—would have benefits not only for the DOE's energy bill, but also for the health of our students. However, if schools save money on energy costs through solar installation, the savings flow to the DCAS, not to the DOE. Thus, schools will have little financial interest in solar installations unless they are allowed to keep a portion of savings.

City schools are currently converting their boilers from the most polluting oils (#6) to the less polluting #2 oil and to natural gas. These conversions have been spurred by the mandatory New York City Clean Heat Program and PlaNYC's 30 percent emissions reductions goals by 2017 for public buildings.[92] However, these cleaner boiler systems not only continue to generate carbon emissions but also expose students to other air pollutants, thereby posing a risk to all students, particularly those with asthma. Increasing solar power would decrease the need to burn fuel on site.

Further, as many schools serve as evacuation centers during disasters,[93] a truly resilient New York City needs these schools to be prepared to generate energy even if they citywide power grid is not functioning.

THE SOLUTION:

New York City should install solar on the rooftop of its public schools, beginning with the 100 largest schools that are scheduled for roof replacements in the near future.[94] These large schools not only have the most solar potential, but could more easily incorporate large solar installations into planned roof replacements. The first phase should focus on those schools located in areas that are environmentally overburdened frontline communities and also identify areas with existing incentive

programs, such as New Market Tax Credits. Schools that are already targeted for energy efficiency upgrades in their lighting systems through the Polychlorinated Biphenyl (PCB)-remediation program are also prime locations for developing renewable energy systems.[95] The city should conduct a system-wide solar feasibility study that identifies the top 100 schools for solar, but also sets a timeline and budget for installing solar throughout the remainder of the building portfolio.

The 100 largest public school roofs (those with the highest potential for solar energy) have the potential to install 50 MW of renewable electricity over some seven million square feet of roof space.[96] This would more than double the current total of installed solar energy in New York City. Investment in solar is also an investment in the long-term sustainability of school buildings. In addition, solar energy can improve the learning environment of schools in the short-term by reducing negative health effects of on-site emissions.

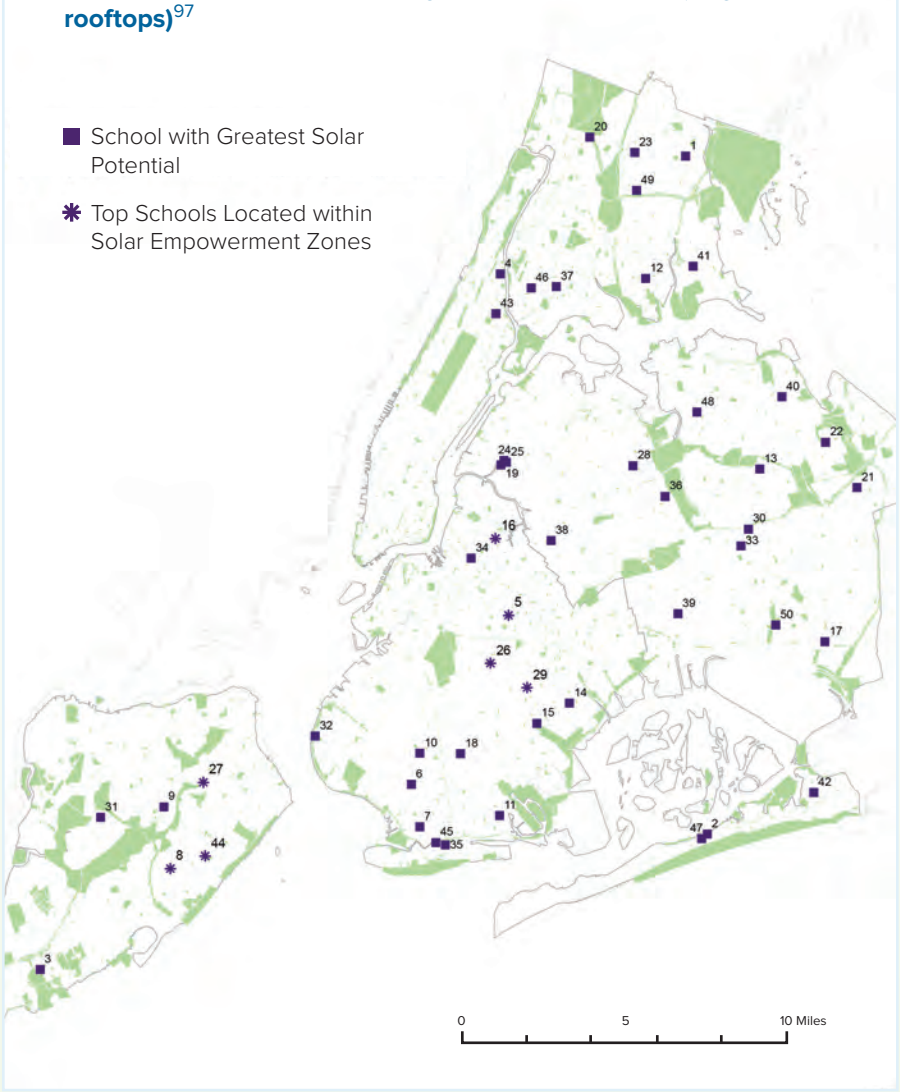
The city should first conduct a system-wide assessment of energy use in all school buildings. Even if a school is not ideal for rooftop solar, there are energy efficiency projects that should be identified. This study would then lead to a city-led scoping and design process that identifies the scale of the work across all 1,000 schools, prioritizes projects, and proposes project designs. Based on the results from the scoping and design process, the city can then bulk purchase the solar equipment, reducing costs.

Funding for this work could come from a combination of appropriations, bond sales, and the New York Power Authority (NYPA). We have estimated an installation cost of $4 per watt for New York City.[98] Each of the 100 largest schools would need to spend around $2 million to install on average 0.5 MW per roof.

Considerations of convenience and ease of implementation might lead certain schools to advocate for turnkey Power Purchase Agreements in which a third party conducts the scoping, purchase and financing of the work. However, the long-term benefits that result from city-led scoping, purchasing and financing significantly outweigh short-term benefits of convenience. These long-term benefits include maximizing savings through scale and bulk purchasing, low-interest financing through long-term lenders, and the ability to ensure that financial benefits accrue directly to each school.

Investing in solar energy reduces stress on the electricity grid, making it more resilient, particularly during peak use. Grid-tied solar energy could be a source of revenue for schools, and solar energy used in the building reduces energy bills and carbon emissions. Investments in solar create manufacturing, installation, and maintenance jobs, and solar energy systems can be used as learning tools by educators in their classrooms.

FIGURE 5: 50 Schools with Highest Solar Potential (largest rooftops)[97]



6. REPLACE LEAKING NATURAL GAS LINES THROUGHOUT NYC

Repairing and replacing ConEdison's 1,340 miles of natural gas distribution pipeline made from leak-prone materials over the next 15 years will cost $1.65 billion, create more than 6,800 jobs, and reduce emissions by 42,000 tons of carbon dioxide equivalent annually.[99] Accelerating the replacement of the more than 3,200 total miles of pipes made of leak-prone materials such as cast iron and bare steel in New York City has the potential to create an estimated additional 17,000 jobs and reduce annual emissions by an estimated 105,000 tons annually.[100] This pipeline replacement will increase the resiliency of New York City. It will provide a more reliable gas distribution infrastructure that will reduce the risk that residents who live in buildings with gas-fired boilers will lose their heat and hot water during storms.[101] Most importantly, an updated gas infrastructure could save lives by preventing deadly explosions caused by leaking gas lines.

THE PROBLEM:

There are over 6,000 miles of natural gas distribution pipeline in New York City; the average New York gas main is 56 years old and about half of the pipes are made of unprotected steel or cast iron, which are outmoded and leak-prone materials.[102] In 2012 alone, Con Edison and National Grid, which serve New York City and Westchester County, reported 9,906 leaks. More than half of these leaks were classified as dangerous. In fact, Con Edison has the highest leak rate in the country.[103]

Recent gas explosions that killed New Yorkers and power outages resulting from Superstorm Sandy are only the most extreme signs of our decaying and archaic energy infrastructure.[104]

Fugitive emissions, which are unintended or irregular releases of gas, represent five percent of all citywide emissions and are in part caused by these pipeline leaks.[106] Leaking methane (the primary component of natural gas) is one of the most potent greenhouse gases, with an impact at least 20 times more significant than carbon dioxide.[107] Therefore, tackling this pipeline replacement work should be an essential component of New York City's climate action plan.

THE SOLUTION:

Repairing and replacing more than 3,200 miles of New York City's natural gas distribution pipes made from leak-prone materials over the next 15 years could create over 17,000 jobs throughout the New York economy and avert an average of 105,000 tons of greenhouse gas emissions per year.

ConEdison has already started to take action, recently increasing its pipe-replacement commitment to 65 miles per year at a cost of $110 million per year.[108] However, at that rate, it would take the utility more than 35 years to

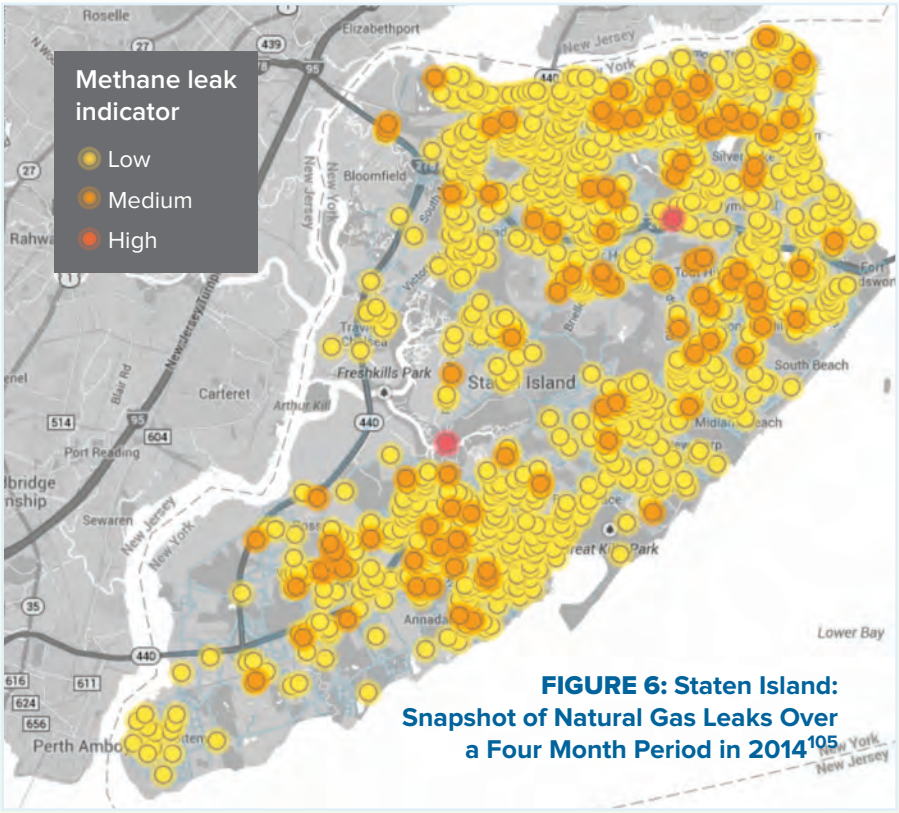


FIGURE 6: Staten Island: Snapshot of Natural Gas Leaks Over a Four Month Period in 2014[105]

replace all its cast iron gas mains in New York City. Doubling the funding would reduce the replacement timeframe in half, protecting New York City residents and reducing emissions.[109] Through additional financial contributions from the utilities and the state, doubling funding to $220 million per year would allow ConEd to replace its pipes made of leak-prone materials such as cast iron and bare steel within approximately 15 years.[110]

New York City should work with the New York State Public Service Commission to require an annual leak survey to identify and prioritize hazardous areas. This survey will allow the city and utilities to continually redirect resources to the most vulnerable areas. Ideally, while streets are torn up replacing gas lines, New York City and the utilities would also replace aging electrical infrastructure and water pipes and take steps to implement smart grids and microgrids.

Investing in repair and replacement of natural gas distribution lines made of leak-prone materials will reduce fugitive methane emissions that contribute to climate change, improve safety for workers and residents and create jobs for pipelayers and pipefitters, inspectors, and construction workers. All construction and maintenance of the natural gas distribution system should pay prevailing wages to workers, utilize public sector workers where appropriate and qualified apprenticeship programs where available, and hire local and disadvantaged residents. In addition, a portion of the project costs should be set aside to support workforce development programs.

7. UPGRADE NYC'S ENERGY DISTRIBUTION SYSTEMS BY INVESTING IN MICROGRIDS

Investing $400 million[111] over the next three years to pilot two microgrids powered by energy-efficient combined heat and power systems (CHPs) or by solar or geothermal energy, could generate 104 megawatts (MW) of electricity in key New York City neighborhoods. This work would create 5,000 jobs[112] and reduce greenhouse gas emissions by more than 543,000 metric tons of carbon dioxide equivalent per year.[113] These microgrids would help to prevent widespread blackouts like the one following Superstorm Sandy and would promote energy self-reliance in climate-vulnerable communities.

A microgrid is an energy system specifically designed to: (1) generate electricity, heating and/or cooling in the same community where the energy is consumed; (2) store and distribute the energy generated to the local community; and (3) manage energy consumption intelligently in real time.[114] This management of energy consumption relies on sophisticated technology that can automatically respond to increases and decreases in demand by allowing power to flow from the microgrid to the central grid or in the reverse direction.

THE PROBLEM:

New York City currently has an outdated grid that does not allow the two-way flow of energy that is essential for maximizing opportunities for local energy generation. The current system was designed for unidirectional electricity flow from utility substations to individual customers. Power generated by customer-sited installations and sent back into the grid, known as distributed generation, can disrupt the grid's protective mechanisms.[115]

Superstorm Sandy's impact on New York City's electrical grid highlighted the need for distributed generation and microgrids in climate-vulnerable communities. Vast areas of the city lost electricity for weeks. If climate-vulnerable communities had a properly designed, weather-resistant microgrid, they would have been more capable of weathering the storm.

After the storm, Governor Cuomo created a $40 million competition to build 10 "independent community-based electric distributions systems" statewide. Known as "NY Prize," the funding will help build community-scale power grids for areas with approximately 40,000 residents.[116] Proposals are not yet public and it is unclear whether they will take into account the communities that are in the most need of resilient and distributed energy generation, such as public housing residents.

THE SOLUTION:

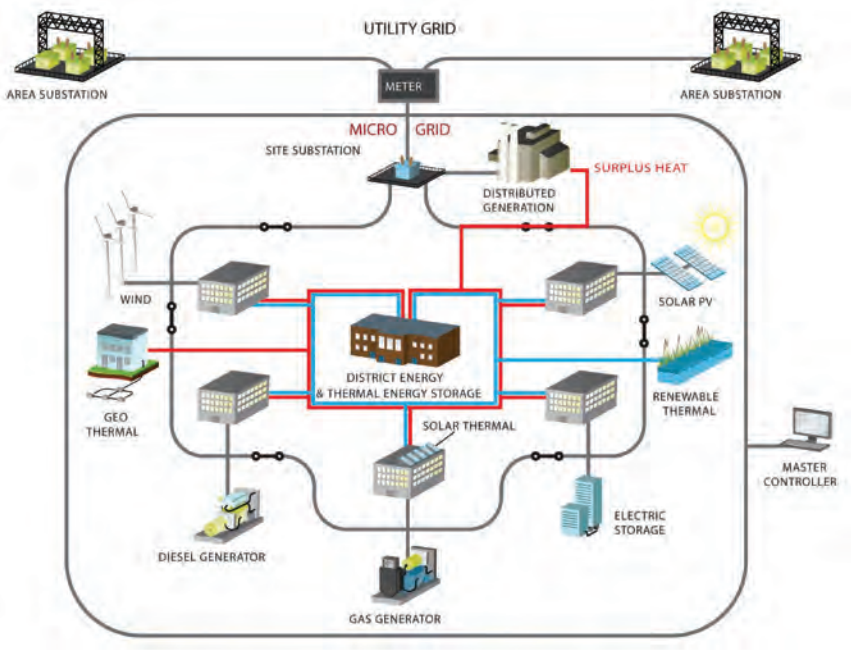
New York City should support the construction of microgrids that utilize clean energy throughout the city, focusing on areas with high peak energy loads, dense NYCHA populations, Sandy-impacted neighborhoods, and environmentally-overburdened frontline communities.[117] These microgrids would ensure that communities can generate their own clean energy for local use that can operate even when the rest of the grid is down.

Microgrids can use many types of energy generation for local distribution, including combined heat and power units (many of which rely on natural gas), solar photovoltaic, solar thermal, wind, hydro, geothermal, and biomass. A microgrid can rely on a large central generator usually anchored by an institution such as a hospital or school, or it can operate through hundreds of small-scale generators with solar on their roofs.[118]

Community microgrids are usually connected to the larger electric grid in the normal course of operation. The connection to the larger grid allows the microgrid to obtain energy that is not economical to generate within the microgrid system, or to meet peak demand that exceeds local supply. In addition, the linkage allows the larger grid to draw on excess power from the microgrid, which can generate revenue.[120] Microgrids can be designed to operate detached from the grid in "island mode." This enables a microgrid to function when the main grid is down during an emergency.

Because microgrids are built and operated on-site, local construction, maintenance, and operating staff will be needed, creating job opportunities in the local community. They also help keep energy dollars within the local community by reducing the money spent on imported energy. Utilities can also benefit if microgrid development reduces the demand on the central grid, enabling the utility to avoid costly investments to increase power supply.[121]

FIGURE 7: Sample Microgrid Design[119]



The design and implementation of a new microgrid should minimize emissions and adverse public health impacts on local residents; explore financing models with opportunities for community ownership of microgrids; and be coordinated with energy efficiency retrofits in the buildings located within the projected catchment area for the grid, to ensure that the system is no larger or more costly than necessary.

There is no question that constructing a microgrid is a complex and multi-step process involving many different constituencies and conflicting interests. In any given New York City neighborhood, the process ultimately should involve community members, businesses, local institutions, elected officials, the relevant utilities, and the state Public Service Commission (PSC).

ConEdison was recently required by the PSC to spend $1 billion for storm hardening in response to Superstorm Sandy. A significant part of storm hardening will involve identifying areas "where high-efficiency cogeneration systems and microgrids could be placed to reduce system load, isolate outages, and provide refuges of power islands."[122] This investment presents a unique opportunity for New York City to lead on piloting resilient and efficient microgrids.

Investing in microgrids increases the resilience of energy infrastructure in communities. Microgrid investment also creates jobs in construction, manufacturing of equipment and materials, operation and maintenance, and technology development. All construction and maintenance of the microgrid should pay prevailing wages to workers, utilize public sector workers where appropriate and qualified apprenticeship programs where available, and hire local and disadvantaged residents. In addition, a portion of the project costs should be set aside to support jobs pipeline and workforce development programs.

8 IMPROVE FLOOD PROTECTION AND STORMWATER MANAGEMENT INFRASTRUCTURE

Investing $200 million[123] to expand greenways and improve stormwater management systems throughout New York City will create 4,670 jobs and increase the resiliency of the city's climate-vulnerable communities.[124] These greenways will reduce the stormwater runoff that can lead to sewage overflows, while slowing down the speed of storm surges that directly threaten coastal communities in New York City.

THE PROBLEM:

Many coastal communities are largely unprotected from flooding and storm surges. During Superstorm Sandy, many coastal areas in New York City—particularly those that were also low- and moderate-income communities—were fully exposed to the unimpeded advance of the storm surge.

These coastal communities are also exposed to the health consequences of sewage overflows.[125] New York City has a "combined" sewer system, meaning that sewage from buildings flows through the same system as rain water or flood water. Thus, about half the time it rains the combined system is overwhelmed, causing raw sewage to overflow from our 14 waste-water treatment plants into our waterways. An estimated 27 billion gallons of raw sewage and polluted stormwater pour into New York's waterways every year.[126] Also, all 14 of these treatment plants are at some level of risk from climate change events such as storm surges and flooding due to their location along the waterfront.

Unfortunately, there is no simple or cheap solution to addressing this critical problem, given that all our wastewater treatment plants, 6,000 miles of sewers, 135,000 sewer catch basins, and 93 pump stations are all located in flood-prone areas."[127] At Brooklyn's Newtown Creek wastewater treatment plant, upgrades alone are estimated to cost $1 billion, and federal funding for sewage treatment has declined by 70 percent in the last 20 years.[128]

In September 2010, Mayor Bloomberg launched the NYC Green Infrastructure Plan, a 20-year effort to meet water quality standards, which will result in approximately 1.5 billion gallons of Combined Sewer Overflow (CSO) reductions annually by 2030. In addition, the New York State Development of Environmental Conservation (NYSDEC) and the New York City Department of Environmental Protection (NYCDEP) in 2012 agreed to fund $2.4 billion in green infrastructure and $1.4 billion in gray infrastructure projects to reduce sewage overflow.[129] These are very laudable plans, but do not go far enough. The conservative estimate from the EPA for upgrading New York City's sewer system is over $21 billion.[130]

THE SOLUTION:

Green infrastructure is one of the most simple and effective means of protecting coastal communities from future storm surges and flooding. Green infrastructure absorbs and holds water, slowing storm surges as well as slowing water's passage into New York City's combined sewer system and thus reducing the impact of storms on our wastewater treatment plants. While significant increases in green permeable surfaces in New York City are insufficient alone to address the problem of vulnerable coastal communities or sewage overflow, they will reduce the need for some of the more costly alternatives. These greenways also increase quality of life for residents by establishing open space and parkland, and reducing the urban heat island effect. Greenways also strengthen our ecological resources through wetland restoration initiatives, bioswale creation and more.

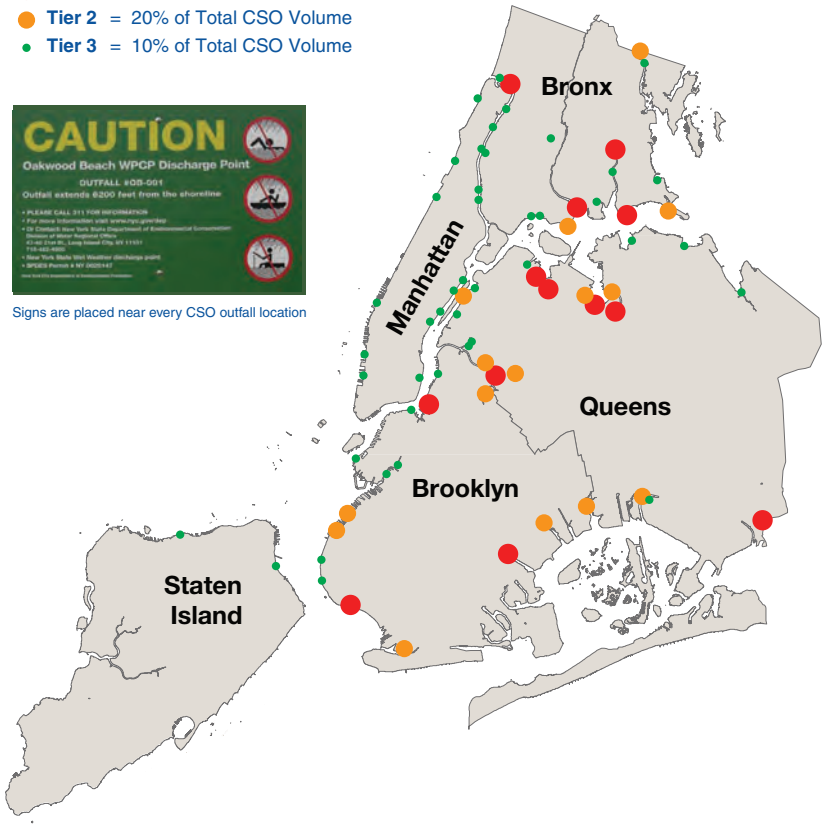
New York City should build on existing community-based plans that identify green infrastructure projects for flood protection and water quality, and the city should partner with community-based organizations for their design and implementation. According to these community-based plans, New York City should build greenways in Sunset Park, South Bronx, and along the Bronx River. New York City should also upgrade and develop parks in Bushwick Inlet Park and Bush Terminal Piers Park. These greenways will increase the vegetation and permeable surfaces in and around these at-risk neighborhoods to dampen the impacts of storm surges and flooding. Rain gardens and bioswales constructed throughout the city can also help to reduce runoff and flooding. These projects will likely cost a total of $200 million, much of which can come through Sandy recovery funds.[131] This should be viewed as only the beginning of an increased focus on reducing runoff into the sewer system and investing in green infrastructure in climate-vulnerable communities.

FIGURE 8: Sewage Overflow in New York City[132]

Combined Sewer Overflow (CSO) Volumes

- **Tier 1** = 50% of Total CSO Volume
- **Tier 2** = 20% of Total CSO Volume
- **Tier 3** = 10% of Total CSO Volume

Signs are placed near every CSO outfall location



New York City should also raise or flood-proof assets that are critical to the sewage treatment process. The City should construct barriers, improve waterfront infrastructure, and implement redundancy measures to avoid failure of these critical sewage treatment systems.

New York City should also change its building code to mandate that all new buildings incorporate rooftop rainwater catchment systems that filter and utilize the water for non-potable water systems. This will also help to keep stormwater from inundating the wastewater treatment system.

Building green infrastructure generates jobs in construction, operation and maintenance, and manufacturing of equipment and materials. The existing workforce should be offered training opportunities in any new technologies incorporated into green infrastructure. All construction and maintenance of greenways and stormwater management should pay family-sustaining wages to workers, utilize public sector workers where appropriate and qualified apprenticeship programs where available, and hire local and disadvantaged residents. In addition, a portion of the project costs should be set aside to support jobs pipeline and workforce development programs.

9 REDUCE TRANSPORTATION EMISSIONS BY INVESTING IN INCREASED BUS RAPID TRANSIT AND RESTORING CUT TRAIN LINES

Investing $2.1 billion in expanded Bus Rapid Transit (BRT) service in underserved neighborhoods in New York City, as well as restoring cut train lines like the express Long Island Railroad Rockaway Line to JFK airport, would create more than 72,000 jobs.[133] If 10 percent of the residents served by the proposed BRT system switch from driving cars to taking public transit for an average commute of 8 miles, the result would be nearly 300,000 tons of avoided CO2 emissions each year.[134] Increased public transit options would also decrease vehicle usage, traffic congestion, and increase the quality of life for outer-borough residents.

THE PROBLEM:

Outer-borough residents are underserved by New York City's subway and bus system. Many of these residents are low-income and spend over an hour commuting to work, lowering productivity. As housing costs have risen near transit corridors, low-income residents are pushed into transit deserts, furthering the challenges to access work. Compounding the poverty of low-income New Yorkers, 28 percent of NYCHA residents live more than one-half mile from the nearest subway station.[135]

There are currently no full-feature BRT systems in New York City. A typical BRT system includes dedicated bus lanes, off-board fare collection, platform level boarding, and signal coordination. It essentially operates like an above-ground subway but is less costly and quicker to build.[136] Select Bus Service (SBS), which currently is built-out on several bus lines in New York City, is similar to BRT but is not full-featured. It has dedicated bus lanes, but they are not separated by barriers, leading to frequent blockage by traffic. They also lack platform level boarding, extending wait times at platforms.[137] New York City should build on the success of SBS by establishing full-feature BRT lines throughout the city.

In addition, the loss of key train lines in New York City has contributed to increased car use and decreased the city's competitiveness as a global city. For example, there is currently no one-seat (no-transfer) connection between John F. Kennedy Airport (JFK) and Midtown Manhattan, despite the existence of deactivated tracks on that route.[138]

THE SOLUTION:

New York City should build BRT lines in outer-borough transit deserts, keeping with community priorities regarding transit needs, pollution reduction and with authentic community engagement. The four routes with the most potential (identified below), based on a study by the Pratt Center for Community Development, have the following three similarities: (1) they serve large numbers of low- and moderate-income residents, and link important employment and institutional destinations, (2) they can catalyze transformational change in the area because they are bordered by large areas of underutilized land, such as parking lots that offer new development opportunities that can avoid displacement of existing residents or businesses, and (3) have wide, multi-lane streets over most of the route, allowing for

FIGURE 9: An Example of Full Feature Bas Rapid Transit[139]

TABLE 3. Potential BRT Routes in New York City

Route	Neighborhoods Served	Borough	Corridor Length (50 miles total)	People living within ½ mile (1.5 million people total)
Bush Terminal to JFK via hospital cluster	Bush Terminal, Sunset Park, Flatbush, SUNY Downstate Medical Center, Brookdale Hospital, Brownsville, East New York, JFK	Brooklyn/ Queens	13.2 miles	514,942
LaGuardia/ Woodhaven/ Rockaway	Jackson Heights, Woodside, Elmhurst, Rego Park, Woodhaven, Ozone Park, Howard Beach, Broad Channel, Rockaway	Queens	13.5 miles	501,253
Hunts Point/ Flushing/ Jamaica	Hunts Point, Soundview, Castle Hill, Zerega Industrial Park, Flushing, Queens College, Kew Gardens, Jamaica	Bronx/ Queens	13.7 miles	397,204
North Shore Staten Island	West Shore Plaza, Arlington, Mariners Harbor, Port Richmond, New Brighton, St. George	Staten Island	9.5 miles	87,056

a full-featured BRT that would also make those streets safer for pedestrians, cyclists, transit users, and drivers.[140]

These four potential routes are a combined distance of about 50 miles. The total cost would be around $1.5 billion, based on a similar build-out in Cleveland.[141] The build-out of BRT should not be limited to these routes, as there are many other underserved areas of New York City, and should be planned and implemented in consultation with impacted communities.

Expanding transportation options to these transit deserts will make the transit system more resilient for all New York City residents. It will also increase mobility for residents and workers in the transit deserts, improve economic productivity of commuters, reduce fuel usage and carbon emissions, and create jobs.

New York City should also reactivate key train lines. The Long Island Railroad Rockaway Beach Line should be reactivated to create a transfer-free trip from the JFK airport to Grand Central Station in Midtown Manhattan. The $600 million project would reduce travel time by half, increase transit options for underserved communities along the route, as well as significantly reduce car traffic congestion along the route to JFK airport.[142] New York City should also reestablish express F subway service in Brooklyn, which would significantly reduce travel time to and from southern Brooklyn and require no new capital outlays.[143]

Investing in transit creates jobs in construction, manufacturing equipment and materials, operations and maintenance. All construction, maintenance and operations of a BRT system should pay family-sustaining wages to workers, utilize public sector workers where appropriate and qualified apprenticeship programs where available, and hire local and disadvantaged residents. In addition, a portion of the project costs should be set aside to support jobs-pipeline and workforce development programs.

10 IMPROVE NYC'S PUBLIC HEALTH SYSTEM BY INVESTING IN RESILIENT PUBLIC HOSPITALS

Investing $1.6 billion in public hospital resiliency projects over the next five years would create over 32,000 jobs.[144] This work would involve onsite energy generation, raising mechanical equipment above flood levels, and providing adequate funding for health services and training of hospital staff. Adequately funded and resilient public hospitals insulate climate-vulnerable communities from the most acute impacts of severe weather events and ensure a safe environment for patients and a safe workplace for employees who must remain at work during natural disasters.

THE PROBLEM:

The Health and Hospitals Corporation (HHC) operates 11 hospitals in New York City, as well as a variety of health clinics, school-based health centers, long-term care facilities, home-health care and mobile medical offices.[145] HHC is the only hospital network that provides full healthcare services to any person who seeks assistance, regardless of insurance coverage, ability to pay, income, or immigration status.[146]

The HHC system as a whole sees about 1.17 million patients annually in its emergency departments, of which 252,000 are seen by just three of the public hospitals that were closed or damaged by Superstorm Sandy: Bellevue, Metropolitan and Coney Island hospitals. The HHC system as a whole accounts for 37 percent of total city-wide in-patient admissions, 43 percent of total emergency department visits and 67 percent of total out-patient visits for uninsured city residents. In fact, 73 percent of emergency department visits at Coney Island Hospital are patients who are uninsured or on Medicaid.[147]

Providing health care services to the uninsured puts a financial strain on HHC. In 2014, HHC is expected to show operating losses of about $400 million, increasing to $1.4 billion by 2018.[148] According to HHC, it provides almost $700 million in uncompensated care annually, which accounts for the operating losses it will experience this year.[149] Financing from the state and federal governments has drastically declined for HHC. Since 2008, HHC has lost more than $540 million a year because of cuts to Medicaid reimbursement rates.[150]

The financial situation at HHC has only grown direr since Superstorm Sandy because federal reimbursements have not adequately addressed the immediate rebuilding and long-term resiliency needs after the storm. Four HHC hospitals in New York City were closed or damaged due to Superstorm Sandy. Bellevue Medical Center and Coney Island Hospitals, for example, were flooded and eventually shut down. Metropolitan and Coler hospitals managed to continue to operate, but suffered extensive damage. All of these hospitals require repair to damaged mechanical, electrical, research, and medical equipment, much of which was located on lower floors or below grade. Hospital infrastructure must be hardened and upgraded to adapt to the new reality of climate change and the threat of future catastrophic events that will follow in its wake.[151]

The four public hospitals damaged by Superstorm Sandy were recently granted $1.6 billion from the federal government for rebuilding and resiliency.[152] At the same time, a single hospital, NYU Langone Medical Center, which was badly damaged by Superstorm Sandy, will receive $1.13 billion in FEMA aid. This is the second-largest award for a single project in the history of FEMA.[153]

Patients were also evacuated from Bellevue Hospital after Superstorm Sandy flooded its mechanical room.[154]

Lastly, it should be noted that as temperatures increase due to climate change, the incidences of infectious disease transmission will most likely increase,[155] expanding the need for accessible public health systems.

THE SOLUTION:

New York City should invest in capital repair of critical health care infrastructure, particularly Bellevue Hospital (Manhattan), Metropolitan Hospital (Manhattan), and Coney Island Hospital (Brooklyn), all of which are located in floodplains. The $1.6 billion in costs includes $480 million in repair costs to Bellevue, Coney Island, Metropolitan and Coler hospitals, $679 million in mitigation costs for Coney Island, $284 million in mitigation costs for Bellevue, and $180 million in mitigation costs for Coler and Metropolitan.[156]

Given the critical role of HHC in our healthcare network and the serious underfunding it already faces in providing services to uninsured and underinsured New Yorkers, it is critical that HHC receive the additional support it needs to recover from and respond to the effects of climate change.

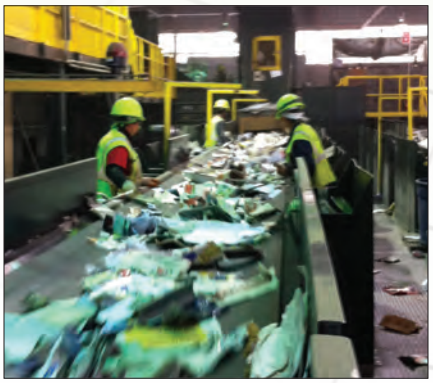
Proposals

- Prioritize funding to HHC from FEMA for the full cost of damage repairs and resiliency work to its infrastructure. Ensure adequate ongoing operations funding to maintain and expand its services and to ensure patient surge capacity to address future climate-related events.
- Install CHP systems to ensure the hospitals can operate during power outages. Link these systems to microgrids that supply power to the surrounding neighborhood, providing a potential source of income for HHC.
- Increase investments in training programs for nurses and doctors to respond to disasters.
- Increase investments in emergency planning to ensure that outpatient services for chronic conditions (like asthma or diabetes) are maintained during and after disasters.

Investing in public hospital infrastructure will ensure efficient, well-maintained, resilient facilities to serve New York City's communities, particularly those where many residents cannot afford other healthcare options. Bringing these facilities up to a state of good repair will also create local construction jobs. All construction, maintenance and operations of the HHC system should pay family-sustaining wages to workers, utilize public sector workers and qualified apprenticeship and training programs where available, and hire local and disadvantaged residents. In addition, a portion of the project costs should be set aside to support jobs pipeline and workforce development programs.

11 INCREASE THE EFFICIENCY OF COMMERCIAL WASTE HAULING AND INCREASE RECYCLING RATES

Transforming the commercial waste hauling system through a more efficient system of waste collection zones would increase City revenue by almost $10 million,[157] increase recycling rates by up to 200 percent, create more than 15,000 jobs,[158] and reduce greenhouse gas emissions by nearly one million metric tons per year.[159] It would also improve quality of life for low-income communities and communities of color in New York City who are disproportionately impacted by truck and waste facility pollution under the current waste hauling system.



Recycling Sorting Facility[168]

THE PROBLEM:

New York City's restaurants, offices, and businesses generate a staggering 5.5 million tons of solid waste each year, over 4 million tons of that waste is buried and burned in landfills and incinerators.[160] This commercial waste is collected by a highly dysfunctional and outsized private system. Excess garbage trucks on the road contribute to violations of clean air standards year after year, some of the worst smog in the country, and intense noise pollution.[161] Vast quantities of waste and inefficient collection have helped earn New York the dubious distinction of "America's Dirtiest City."[162]

Currently, over 230 companies deploy more than 4,000 trucks, most of them over a decade old and highly polluting, to service commercial customers along crisscrossing routes. These trucks drive over 65 million miles per year, needlessly wearing down city streets and emitting pollution that damages the health of truck drivers and residents. New Yorkers living in low-income communities and communities of color in the South Bronx, North Brooklyn, Sunset Park, and Southeast Queens—where the vast majority of solid waste transfer stations, recycling facilities, and commercial waste carter garages are located—experience the environmental and health impacts of commercial waste handling most acutely. These communities process over 75 percent of the entire City's waste and face the most direct exposure to truck traffic, diesel exhaust, and waste facility pollution, while suffering elevated rates of asthma.[163]

Working conditions in the commercial waste disposal industry are difficult and dangerous for many workers. Recycling sorter wages have remained below $25,000 during the last decade. Between 2006 and 2011, real wages fell in the commercial waste hauling industry for new hires in the Bronx, Brooklyn and Staten Island.[164] Furthermore, waste work has been ranked amongst the 10 deadliest occupations in the country for years. The fatal injury rate for waste work is eight times the rate for all occupations.[165]

Over 90 percent of commercial waste is recyclable or compostable, but only about 26 percent is recycled or composted.[166] The City is producing over 5.7 million metric tons of carbon dioxide equivalent greenhouse gases as a result of the current system.[167]

THE SOLUTION:

New York City should establish a more efficient system of commercial waste collection zones for waste hauling that ensures the efficient and cost-effective collection of commercial waste. In such a system, the City would select commercial haulers through a competitive bidding process to exclusively service designated collection zones across the city. In order to win a bid, companies would need to meet high-road labor and environmental standards, and would be required to meet a recycling target.

An efficient system of commercial waste collection zones would eliminate overlapping truck routes; reduce long-haul vehicle miles travelled by over 500 million miles;[169] raise worker wages and benefits; raise safety standards for workers and communities living near waste management infrastructure; increase recycling rates by up to 200 percent; and reduce waste flows through overburdened communities.[170]

If the City maximizes commercial recycling and facilitates the development of infrastructure to process it, over 5,000 jobs will be created in recycling processing and over 9,000 jobs created in recycling-reliant manufacturing. All jobs operating and maintaining these facilities should pay family-sustaining wages to workers, utilize qualified apprenticeship and training programs where available, and hire local and disadvantaged residents. In addition, a portion of the project costs should be set aside to support jobs pipeline and workforce development programs.

12. CONCLUSION

A just and sustainable New York City is a city with low-carbon infrastructure, climate resilient and environmentally just communities, and good jobs for all New Yorkers. With 10 bold initiatives, we can create tens of thousands of jobs each year and reduce annual greenhouse gas emissions by millions of tons. We can build a city that can thrive for generations to come. A New York City climate-jobs agenda does the following:

- Contributes to the global effort to slow climate change by dramatically reducing local carbon emissions.
- Minimizes energy use through efficiency measures while generating all the energy it needs from renewable resources.
- Protects its most vulnerable residents by ensuring an adequate supply of well-paying, career-track jobs. This also ensures that those who work to build a low-carbon, resilient and environmentally just New York City can also live in this city.
- Establishes a workforce development system that links disadvantaged residents to job opportunities and trains them to work safely on these projects.
- Increases the resiliency of the frontline neighborhoods most vulnerable to climate change through improvements in infrastructure as well as supporting community-based plans for climate adaptation and existing local networks that enable residents to assist each other in times of crisis.

This is a Climate that Works for All!

11. GLOSSARY

Climate Change means a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Climate Resilience means the capacity of an individual, community, institution and infrastructure to dynamically and effectively respond to shifting climate impacts while continuing to function at an acceptable level. Simply put, it is the ability to survive and recover from the effects of climate change.

Disadvantaged Worker means an individual who, prior to commencing work is domiciled in low-income neighborhood and faces one of the following barriers to employment: (1) being homeless; (2) being a custodial single parent; (3) receiving public assistance; (4) having a prior arrest or conviction; (5) suffering from Chronic Unemployment; (6) having been emancipated from the foster care system; or (7) being a veteran of the U.S. military.

Environmental Justice is the international movement of low income-communities and communities of color struggling against the disproportionate environmental burdens and lack of environmental amenities and equity confronting their communities. According to the U.S. Environmental Protection Agency (EPA), "Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work." Also, see also the 17 Principles of Environmental Justice: http://www.ejnet.org/ej/principles.html

Frontline Communities are the low-income communities, communities of color, and indigenous communities that are most vulnerable to the impacts of climate change, and the industrial extraction and exploitation of our natural resources. Frontline communities face challenges to long-term resiliency due to the disproportionate burdens of climate impacts as well as existing environmental, economic, and social disparities and injustices.

Local Worker means any person domiciled in New York City.

Worker Organizations mean an organization of workers formed for the purpose of advancing its members' interests in respect to wages, benefits, and working conditions. This includes labor unions, worker centers and other worker organizations created to advance the interests of workers.

ENDNOTES

1 The Risky Business Project, Risky Business: The Economic Risks of Climate Change in the United States, June 2014. http://riskybusiness.org/uploads/files/RiskyBusiness_Report_WEB_09_08_14.pdf

2 Ibid.

3 New York City Panel on Climate Change Climate Risk Information 2013 Observations, Climate Change Projections, and Maps, June 2013., http://ccrun.org/NPCC-2013

4 Furman Center, NYU, Sandy's Effects on Housing in New York City, Furman, March 2013. http://furmancenter.org/files/publications/SandysEffectsOnHousingInNYC.pdf

5 The Alliance for a Just Rebuilding, Weathering the Storm, March 2014. http://www.rebuildajustny.org/weathering-the-storm-rebuilding-a-more-resilient-nycha-post-sandy/

6 International Renewable Energy Agency, Renewable Energy Provides 6.5 Million Jobs Globally, May 11, 2014. http://www.irena.org/News/Description.aspx?NType=A&mnu=cat&PriMenuID=16&CatID=84&News_ID=360

7 The Solar Foundation, National Solar Jobs Census 2013, 2013. http://thesolarfoundation.org/research/national-solar-jobs-census-2013

8 International Renewable Energy Agency, Renewable Energy Provides 6.5 Million Jobs Globally, May 11, 2014. http://www.irena.org/News/Description.aspx?NType=A&mnu=cat&PriMenuID=16&CatID=84&News_ID=360

9 ITUC, Union leaders announce their commitments to the fight against climate change, May 21, 2014. http://www.ituc-csi.org/union-leaders-announce-their

10 World Resources Institute, CAIT 2.0 Climate Data Explorer, http://cait2.wri.org/wri

11 City of New York, PlaNYC Update, Full Report, and PlaNYC Progress Report 2014, April 2011. http://www.nyc.gov/html/planyc2030/html/publications/publications.shtml

12 City of New York, December, 2013. PlaNYC: Inventory of New York City Greenhouse Gas Emissions.

13 City of New York, September, 2014. PlaNYC: Inventory of New York City Greenhouse Gas Emissions.

14 City of New York ,"Mayor de Blasio Commits to 80 Percent Reduction of Greenhouse Gas Emissions by 2050, Starting with Sweeping Green Buildings Plan," September 21, 2014, http://www1.nyc.gov/office-of-the-mayor/news/451-14/mayor-de-blasio-commits-80-percent-reduction-greenhouse-gas-emissions-2050-starting-with#/0 (accessed September 28, 2014).

15 City of New York, PlaNYC: Inventory of New York City Greenhouse Gas Emissions, December 2013.

16 Wall Street Journal, Michael Howard Saul, "Mayor de Blasio Addresses United Nations Summit on Climate Change," September 23, 2014. http://blogs.wsj.com/metropolis/2014/09/23/mayor-de-blasio-addresses-united-nations-summit-on-climate-change/ (accessed September 28, 2014); City of New York, "Mayor de Blasio Commits to 80 Percent Reduction of Greenhouse Gas Emissions by 2050, Starting with Sweeping Green Buildings Plan" *Press Release*, September 21, 2014. http://www1.nyc.gov/office-of-the-mayor/news/451-14/mayor-de-blasio-commits-80-percent-reduction-greenhouse-gas-emissions-2050-starting-with#/0

17 New York City Council, Comprehensive Platform to Combat Climate Change, September 19, 2014. council.nyc.gov/html/pr/climateagenda.pdf

18 City of New York, "One City Built to Last," Mayor de Blasio, September 21, 2014. http://www.nyc.gov/html/builttolast/pages/home/home.shtml

19 Center for American Progress, Cities at Work: Progressive Local Policies to Rebuild the Middle Class (p. 49-51), February, 2014. http://www.americanprogressaction.org/issues/labor/report/2013/03/21/57375/states-at-work-progressive-state-policies-to-rebuild-the-middle-class/

20 Ibid. (p. 50).

21 Ibid. (p. 49, 51).

22 Seasonally adjusted, the rate is 7.3 percent, according to the New York State Department of Labor's "New York City, Smoothed Seasonally Adjusted" chart, available at the same website. For consistency with the county-level number, we have used the unadjusted rate. New York State Department of Labor, "Labor Market Regions Ranked by Unemployment Rate, August 2014," http://www.labor.ny.gov/stats/lslaus.shtm (accessed September 28, 2014).

23 Unofficial employment and underemployment rate is 14.6 percent. New York State Department of Labor, "Alternative Measures of Unemployment," http://www.labor.ny.gov/stats/nys/alternative_measures.shtm (accessed September 28, 2014).

24 *New York State Department of Labor*, "Counties Ranked by Unemployment Rate, August 2014." http://www.labor.ny.gov/stats/lslaus.shtm (accessed September 28, 2014).

25 Coalition for the Homeless,.State of the Homeless 2013, 2013. http://www.coalitionforthehomeless.org/pages/state-of-the-homeless-2013

26 The Official U.S. Poverty Rate, as calculated by Census Bureau, is 20 percent. For this report we have relied on the New York City government estimates. Center for Economic Opportunity, The CEO Poverty Measure, 2005-2012 – An Annual Report from the Office of the Mayor (p. 11, 25). http://www.nyc.gov/html/ceo/downloads/pdf/ceo_poverty_measure_2005_2012.pdf

27 Ibid. (p. 16)

28 Economic Policy Institute, Ross Eisenbrey and Colin Gordon, As Unions Decline, Inequality Rises, June 2012. http://www.epi.org/publication/unions-decline-inequality-rises/

29 New York City has nearly double the rate of unionized workers as the U.S. 22.4 percent of all wage and salaried workers residing in New York City were unionized, while workers in the U.S. averaged 11.3 percent. The Murphy Institute, CUNY Graduate Center, Ruth Milkman and Stephanie Luce, The State of the Unions 2013: A Profile of Organized Labor in New York City, New York State, and the United States, September, 2013. https://sps.cuny.edu/filestore/8/6/3_bc4b97196c5659e/863_916e1989d05f0e6.pdf

30 The Economist, Stronger than the Storm, October 2013. http://www.economist.com/news/united-states/21588125-recovery-has-been-remarkable-damage-persists-stronger-storm

31 U.S. Department of Housing and Urban Development,. Hurricane Sandy Rebuilding Strategy, August, 2013. http://portal.hud.gov/hudportal/HUD?src=%2Fpress%2Fpress_releases_media_advisories%2F2013%2FHUDNo.13-125

32 "Hurricane Sandy's Impact by the Numbers", Huffington Post, October 29, 2013. http://www.huffingtonpost.com/2013/10/29/hurricane-sandy-impact-infographic_n_4171243.html

33 Mitchell-Lama Housing is affordable rental or cooperative housing for moderate- and middle-income families.

34 Furman Center, NYU, Sandy's Effects on Housing in New York City, March 2013. http://furmancenter.org/files/publications/SandysEffectsOnHousingInNYC.pdf

35 The Alliance for a Just Rebuilding, Weathering the Storm, March 2014. http://www.rebuildajustny.org/weathering-the-storm-rebuilding-a-more-resilient-nycha-post-sandy/

36 The Alliance for a Just Rebuilding, Weathering the Storm, March 2014. http://www.rebuildajustny.org/weathering-the-storm-rebuilding-a-more-resilient-nycha-post-sandy/

37 New York City Environmental Justice Alliance (NYC-EJA) Waterfront Justice Project, Bautista, E. Hanhardt, E., Osorio, J.C.; Dwyer, N., Local Environment: The International Journal of Justice and Sustainability (article in press), 2014. http://www.tandfonline.com/doi/abs/10.1080/13549839.2014.949644

38 New York City Environmental Justice Alliance, Sandy Regional Assembly Recovery Agenda, http://nyc-eja.org/

39 New York City Environmental Justice Alliance, Sandy Regional Assembly SIRR Analysis, http://nyc-eja.org/

40 City of New York, PlaNYC Update, Full Report, April 2011. http://www.nyc.gov/html/planyc2030/html/publications/publications.shtml

41 Ibid.

42 We recommend full and authentic compliance with the HUD Section 3 Local Hire requirements, but also recognize that they do not go far enough to ensure the benefits of economic development are shared with low-income communities. Therefore, we urge New York City to create additional requirements for local and targeted hiring that go above and beyond HUD guidelines.

43 Most of the proposed projects will occur over multiple years. For annual job projections we assumed job creation would be equally distributed over each year of the project. For example, fixing leaking natural gas lines will take place over 15 years. We simply took the 15 year investment and job creation potential and divided it by 15 to obtain annual numbers. Many of these jobs will be in the construction sector, which are temporary positions. The job creation metrics we used for this report do not allow us to differentiate between permanent and temporary positions. We do know, however, that there will be increased opportunities for public sector workers to maintain and operate new project infrastructure, including parks jobs maintaining new greenways and bus operators driving the new Bus Rapid Transit routes. In addition, the building and construction trades will be put to work retrofitting thousands of our largest buildings, fixing leaking natural gas lines, and more. Also, property service workers will be employed and trained to maintain energy efficient buildings throughout the five boroughs. Job creation throughout these sectors will steadily boost employment over the next several decades, ensuring that these will not be short-term jobs for a few, but long-term jobs and career opportunities for many New Yorkers.

44 Jobs calculated using estimated 16.7 jobs/$1 million invested in building retrofits, also included cost of training one maintenance worker per building over 50,000 square feet. Number from CAP/PERI, The Economic Benefits of Investing in Clean Energy (p. 28-29), June 2009. http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF

45 Urban Green Council, 90 by 50: NYC Can Reduce its Carbon Footprint 90% by 2050, February, 2013. http://urbangreencouncil.org/content/projects/90-50

46 City of New York, PlaNYC: Inventory of New York City Greenhouse Gas Emissions, December, 2013. http://www.nyc.gov/html/dem/downloads/pdf/greenhousegas_2012.pdf

47 These 15,000 properties include more than 26,000 buildings.

48 City of New York, PlaNYC: Greener, Greater Buildings Plan, 2014. http://www.nyc.gov/html/gbee/html/plan/plan.shtml

49 Ibid.

50 City of New York, "Mayor de Blasio Commits to 80 Percent Reduction of Greenhouse Gas Emissions by 2050, Starting with Sweeping Green Buildings Plan," September 21, 2014. http://www1.nyc.gov/office-of-the-mayor/news/451-14/mayor-de-blasio-commits-80-percent-reduction-greenhouse-gas-emissions-2050-starting-with#/0 (accessed September 28, 2014).

51 New York City Council, Comprehensive Platform to Combat Climate Change, September 19, 2014. council.nyc.gov/html/pr/climateagenda.pdf

52 For example, HPD's Qualified Allocation Plan (QAP) for Low Income Housing Tax Credits (LIHTC) requires an applicant to meet Enterprise Green Communities Criteria to access the program. From NYC Housing Preservation and Development, Low Income Housing Tax Credits, HPD Green Threshold Requirements, http://www.nyc.gov/html/hpd/html/developers/low_income.shtml

53 "NYC Energy Efficiency Corporation." http://www.nyceec.com/mission/; see also NYC Energy Efficiency Corporation, Public Documents,NYCEEC 2013 Financial Statements, 2013. http://www.nyceec.com/public/

54 NY Greenbank, http://greenbank.ny.gov/. See also Environmental Defense Fund,"NYCEEC , NY State Green Bank Clear the Way for Clean Energy Financing of Retrofits." http://blogs.edf.org/energyexchange/2014/02/26/local-ny-green-banks-clear-the-way-for-clean-energy-financing-of-retrofits/

55 In 2011, the New York City Department of Environmental Conservation (DEC) passed regulations creating the Clean Heat program, requiring buildings 40,000 square feet and above to convert from heavy forms of heating oil to cleaner fuels. The City has made progress with this mandate. By June 2014, NYC Clean Heat resulted in 4,226 buildings' conversion to cleaner oil, natural gas or steam and these upgrades have reduced Particulate Matter pollution (PM 2.5) by 50 percent. Overall, about half of the buildings using the worst heating oils have made the switch, however there is still room for improvement. Many have simply switched to a marginally better fuel, rather than to the best available fuel. Additionally, some affordable housing owners have passed along the costs of these improvements to their low-income tenants. See City of New York, "NYC Clean Heat." https://www.nyccleanheat.org/content/what-nyc-clean-heat; See also NYC Clean Heat Progress Report, July 14, 2014. https://www.nyccleanheat.org/content/program-progress; See also New York Times, "Cost Among Hurdles Slowing New York City's Plan to Phase Out Dirty Heating Oil," April 6, 2014. http://www.nytimes.com/2014/04/07/nyregion/cost-among-hurdles-slowing-new-yorks-plan-to-phase-out-dirty-heating-oil.html?_r=0

56 City of New York, PlaNYC: Inventory of New York City Greenhouse Gas Emissions, December, 2013. http://www.nyc.gov/html/gbee/html/plan/ll84_scores.shtml

57 Rudin Management Co. obtained 8 percent savings just from improving control software in commercial buildings; The Empire State Building achieved 38 percent cut in its energy bill through reducing its building load through window replacement and sealing and thus purchasing smaller HVAC equipment.

58 LL87 of 2009 has a financial hardship clause. See law LL87, City of New York, Local Laws of the City of New York for 2009, 2009. http://www.nyc.gov/html/planyc2030/downloads/pdf/ll87of2009_audits_and_retro-commissioning.pdf

59 Currently, multi-family buildings do not have an ENERGY STAR score. However, these buildings will begin receiving an ENERGY Star score in September, 2015, in time for program implementation. U.S. Green Building Council, LEEDv4 Minimum Energy Standards, 2014. http://www.usgbc.org/node/2613421?return=/credits/existing-buildings/v4/energy-%26-atmosphere

60 Any change to the rules around Major Capital Investments (MCI) would need to be done at the state level.

61 Retrofits and energy efficiency upgrades can be used as an affordable housing preservation strategy, so it is essential that affordable housing not be left behind in this program. The Task Force should emphasize finding solutions to addressing both the affordable housing and energy crises.

62 There is currently no technology on the market that allows large buildings to produce as much energy as they consume. Near-net-zero means that new buildings should be as energy efficient as possible, so that when the technology becomes available, these buildings have the option to become net-zero energy users.

63 City of Seattle, Seattle Adoption and Amendment of the 2012 Edition of the International Energy Conservation Code, Commercial. City of Seattle, *Energy Code* (p. 45-46), 2012. http://www.seattle.gov/DPD/codesrules/codes/energy/overview/

64 The New York City Council, Int 0013-2014, Legislation, 2014. http://legistar.council.nyc.gov/LegislationDetail.aspx?ID=1655631&GUID=CBA48E2A-20C8-4F37-8A3F-A96DFF0DA096&Options=ID|Text|&Search=energy+efficiency

65 Steven Winters Associates, Measurement & Verification of the Green Supers Program, 2012; Assumptions: training cost: $2,000 per operator; operators to be trained: 13,500 (estimated from 2014 count of LL87 covered buildings); potential energy reduction: 5 – 20 percent from effective building operations (Green Supers Briefing Book, p. 9); building greenhouse gases: 12.5 Million Tons of carbon dioxide equivalent (2013 LL84 Benchmarking Report, p. 23); NYC greenhouse gases: 47.9 Million Tons of carbon dioxide Equivalent. City of New York, 2013 NYC Inventory of Greenhouse Gas Emissions (p. 8), 2013. http://www.nyc.gov/html/dem/downloads/pdf/greenhousegas_2012.pdf

66 City of New York, *PlaNYC: Green Buildings and Energy Efficiency, Benchmarking Data Disclosure and Reports*, 2013. http://www.nyc.gov/html/gbee/html/plan/ll84_scores.shtml

67 Author's calculation: CHP systems vary in cost from around $3,000 kW to $7,000 kW, before incentives, depending on design, fuel and offset electricity costs, and more. The author has assumed an average cost of $5,000 kW. Boiler sizes will likely vary from 200 kW to 1.4 MW, depending on several factors including whether it will be used as the sole source of power for the building, and whether planned energy efficiency retrofits will decrease the overall building's energy demands. The author assumes an average size of 800 kW for CHP system. Lastly, we assume that not all NYCHA boilers damaged by Superstorm Sandy will be replaced by CHP units. The author assumes a 50 percent uptake. Thus, 30 - 800 kW boilers at $5,000 kW would cost $132 million in total, or $4.4 million per boiler. See U.S. EPA, "Combined Heat and Power Partnership: Economic Benefits," 2013. http://www.epa.gov/chp/basic/economics.html.

68 Calculated using estimated 14.4 total construction, installation, and manufacturing jobs per $1 million invested in CHP, from BlueGreen Alliance,. Combined Heat and Power: An Opportunity for U.S. Workers (unpublished paper), 2014.

69 800kW residual oil boiler replaced by an 800kW natural gas CHP unit for heating and electricity only. U.S. EPA, "CHP Emissions Calculator," http://www.epa.gov/chp/basic/calculator.html. 800kW residual oil boiler replaced by an 800kW natural gas CHP unit for heating and electricity only.

70 Testimony from NYCHA Executive Vice President for Capital Projects Raymond Ribeiro (p. 5), February 27, 2014. http://www.nyc.gov/html/nycha/downloads/pdf/sandy-boilers-testimony-20140227.pdf; Office of Senator Schumer, Press Release, http://www.schumer.senate.gov/Newsroom/record.cfm?id=350553

71 Furman Center for Real Estate and Urban Policy, NYU, Sandy's Effects on Housing in New York City, march 2013. http://furmancenter.org/files/publications/SandysEffectsOnHousingInNYC.pdf

72 U.S. EPA, "Combined Heat and Power Partnership: Methods for Calculating Efficiency." http://www.epa.gov/chp/basic/methods.html

73 Fuel cells use a chemical conversion process to turn fuel into energy. There is no combustion engine in a fuel cell. Fuel cell technology is still relative new and should be approached cautiously. See Energy Solutions Center website, Understanding CHP, Chapter 4.4: Fuel Cells. http://www.understandingchp.com/appguide/Chapters/Chap4/4-4_Fuel_Cells.htm

74 NYSERDA , "Combined Heat and Power: Public Policy Issues," 2014. https://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/CHP/Public-Policy-Issues.aspx

75 Navigant Consulting and DNV KEMA, Process Evaluation Report for Con Edison's Multi-Family Low-Income Program, 2013. http://www.coned.com/energyefficiency/PDF/Multi-Family%20Low-Income%20Process%20Evaluation%20Report.pdf

76 City of New York, NYCHA's Heating Systems. http://www.nyc.gov/html/nycha/downloads/pdf/heating.pdf

77 World Bank Group PPPIRC, "Power Purchase Agreements (PPAs) and Energy Purchase Agreements (EPAs)." http://ppp.worldbank.org/public-private-partnership/sector/energy/energy-power-agreements/power-purchase-agreements

78 Community Voices Heard, Bad Arithmetic: The Failure of New York City Housing Authority (NYCHA) Recovery Funds to Create Jobs for Local Residents, October 2010. http://www.cvhaction.org/BadArithmetic

79 Calculated using estimated 16.7 jobs/$1 million invested in building retrofits. Number from CAP/PERI, The Economic Benefits of Investing in Clean Energy (p. 28-29), June 2009. http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF

80 U.S. EPA, Household Carbon Footprint Calculator. http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html; U.S. EPA, Greenhouse Gas Equivalencies Calculator. http://www.epa.gov/cleanenergy/energy-resources/calculator.html

81 Center for Working Families, Green Jobs/Green Homes New York: Expanding home energy efficiency and creating good jobs in a clean energy economy, May, 2009. http://thecenterforworkingfamilies.org/issues/green-economy/gjgny/

82 U.S. Census Bureau, 2010-2012 American Community Survey, 3-Year Estimates, 2012.

83 Center for Working Families, "Watt's New: The Green Jobs/Green NY Progress Report," April 18, 2013. http://thecenterforworkingfamilies.org/wattsnew15/

84 Ibid.

85 Green jobs - Green New York. http://gjgny.ccext.net/portal/SouthernTier.

86 Calculated using estimated 13.3 jobs/$1 million invested in solar. Number from CAP/PERI, The Economic Benefits of Investing in Clean Energy (p. 28-29), June 2009. http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF

87 Office of the Manhattan Borough President, Scott Stringer, Rooftop Revolution, How Solar Panels on Public Schools Can Jumpstart the Local Green Collar Economy and Dramatically Expand Renewable Energy in NYC, January 2012. http://blogs.villagevoice.com/runninscared/2012/01/scott_stringer_1.php

88 Office of the Manhattan Borough President, Scott M. Stringer, Rooftop Revolution, How Solar Panels on Public Schools Can Jumpstart the Local Green Collar Economy and Dramatically Expand Renewable Energy in NYC, January 2012. http://www.libertycontrol.net/uploads/mbp/RooftopRevolutionFINAL.pdf

89 DCAS, NYC Energy Use. http://www.nyc.gov/html/dem/html/stat/stat.shtml#EnergyUse See also: Rooftop Revolution, above

90 Sustainable CUNY. NYC Solar Map, http://www.nycsolarmap.com/

91 Environment California Research and Policy Center,. Shining Cities: At the Forefront of America's Solar Energy Revolution, , April 2014. http://www.environmentcaliforniacenter.org/reports/cae/shining-cities. Note: This report lists NYC's solar capacity at 33 MW. Instead, we rely on the NYC Solar Map for NYC's most up to date solar data.

92 NYCDOE, 2012. New York City Department of Education 2011-2012 Annual Sustainability Report, http://schools.nyc.gov/community/facilities/sustainability/about/energy.htm

93 New York Times, "New York City Hurricane Evacuation Zones", New York Times, October 28, 2012. http://www.nytimes.com/interactive/2012/10/28/nyregion/hurricane-evacuation-zones.html?_r=0

94 City building roof warranties should be made publicly available for the purpose of indicating to the public those buildings that are ripe for solar installations.

95 Center for an Urban Future, Caution Ahead: Overdue Investments for New York's Aging Infrastructure, March 2014. http://nycfuture.org/research/publications/caution-ahead. Also see: Rooftop Revolution, note 76.

96 Office of the Manhattan Borough President, Scott M. Stringer, Rooftop Revolution, How Solar Panels on Public Schools Can Jumpstart the Local Green Collar Economy and Dramatically Expand Renewable Energy in NYC, January 2012. http://www.libertycontrol.net/uploads/mbp/RooftopRevolutionFINAL.pdf

97 Office of the Manhattan Borough President, Scott M. Stringer, Rooftop Revolution, How Solar Panels on Public Schools Can Jumpstart the Local Green Collar Economy and Dramatically Expand Renewable Energy in NYC (p. 9), January 2012. http://www.libertycontrol.net/uploads/mbp/RooftopRevolutionFINAL.pdf

98 Conversations with solar installation companies. See also NYSERDA, New York Solar Study: An Analysis Of The Benefits And Costs Of Increasing Generation From Photovoltaic Devices In New York, January 2012. https://www.nyserda.ny.gov/Publications/Program-Planning-Status-and-Evaluation-Reports/Solar-Study.aspx

99 Mileage number from Center for an Urban Future, Caution Ahead: Overdue Investments for New York's Aging Infrastructure, p. 23-24 March 2014.. http://nycfuture.org/research/publications/caution-ahead. Cost number from CNN, "New York explosion exposes nation's aging and dangerous gas mains", March 17, 2014,. http://www.cnn.com/2014/03/15/us/aging-gas-infrastructure/. Economic and carbon models calculated using Con Edison's proportion of total leak prone pipelines and totals calculated (see notes 108, 109) using BlueGreen Alliance, *Interconnected: The Economic and Climate Change Benefits of Accelerating Repair and Replacement of America's Natural Gas Distribution Pipelines*, July 2014. http://www.bluegreenalliance.org/news/publications/document/Interconnected-Report-vFINAL.pdf.

100 Con Edison leak-prone mileage number (1,340) comes from Center for an Urban Future, Caution Ahead: Overdue Investments for New York's Aging Infrastructure (p. 23-24), March 2014. http://nycfuture.org/research/publications/caution-ahead. Jobs number (17,000 jobs created) and carbon equivalent number (105,000 million metric tons of carbon dioxide equivalent reduced annually) was calculated using data and modeling from BlueGreen Alliance, *Interconnected: The Economic and Climate Change Benefits of Accelerating Repair and Replacement of America's Natural Gas Distributions Pipelines.* July 2014. http://www.bluegreenalliance.org/news/publications/interconnected. Con Edison portion of those numbers were calculated using the percentage of total leak-prone pipeline mileage that is ConEdision (40 percent). Cost was estimated using Con Edison's estimates as cited in CNN, "New York explosion exposes nation's aging and dangerous gas mains", March 17, 2014. http://www.cnn.com/2014/03/15/us/aging-gas-infrastructure/.

101 SmartGrid Consortium, Strategic Smart Grid Vision and Technical Plan Report: Leading the Way to New York's Future, 2009. https://www.smartgrid.gov/sites/default/files/doc/files/Strategic_Smart_Grid_Vision_Technical_Plan_Report_200906.pdf

102 Center for an Urban Future, Caution Ahead: Overdue Investments for New York's Infrastructure, 2014. http://nycfuture.org/pdf/Caution-Ahead-Info.pdf; see also New York Times, "Beneath Cities, a Decaying Tangle of Gas Lines," March 23, 2014. http://nyti.ms/1rleacD

103 New York Times, "Beneath Cities, a Decaying Tangle of Gas Lines," March 23, 2014. http://www.nytimes.com/2014/03/24/nyregion/beneath-cities-a-decaying-tangle-of-gas-pipes.html

104 CNN, "New York explosion exposes nation's aging and dangerous gas mains,", March 17, 2014. http://www.cnn.com/2014/03/15/us/aging-gas-infrastructure/

105 Environmental Defense Fund, Natural Gas: Local Leaks Impact Global Climate. http://www.edf.org/climate/methanemaps

106 City of New York, PlaNYC: Inventory of New York City Greenhouse Gas Emissions, December, 2013. http://www.nyc.gov/html/gbee/html/plan/ll84_scores.shtml. Leaking natural gas lines account for 9 percent of NYC's fugitive emissions, and .05 percent of citywide emissions.

107 U.S. EPA, Overview of Greenhouse Gases, http://epa.gov/climatechange/ghgemissions/gases/ch4.html

108 CNN, "New York explosion exposes nation's aging and dangerous gas mains,", March 17, 2014. http://www.cnn.com/2014/03/15/us/aging-gas-infrastructure/

109 New York Times, "Beneath Cities, a Decaying Tangle of Gas Lines," March 23, 2014. http://www.nytimes.com/2014/03/24/nyregion/beneath-cities-a-decaying-tangle-of-gas-pipes.html

110 Center for an Urban Future, Caution Ahead: Overdue Investments for New York's Aging Infrastructure, p. 23-24 March 2014. http://nycfuture.org/research/publications/caution-ahead

111 Cost of Brownsville micro-grid and energy demand reduction: $200 million. Transmission Hub, "Con Edison seeks approval for demand management program in Brooklyn, Queens," July 18, 2014. http://www.transmissionhub.com/articles/2014/07/con-edison-seeks-approval-for-demand-management-program-in-brooklyn-queens.html.

112 Calculated using an estimate of 12.5 jobs/$1 million invested in smart grid. Number from CAP/PERI, The Economic Benefits of Investing in Clean Energy (p. 28-29), June 2009. http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF

113 Assumes same CO2 savings per MW installed capacity as New York University (NYU) Washington Square Campus Cogeneration Microgrid, which achieves an estimated reduction of up to 70,000 tons of CO2 per year with 13.4MW of capacity; as cited in NYSERDA, Microgrids: An Assessment of the Value, Opportunities and Barriers to Deployment in New York State (p. A31-A44), 2010. http://nyssmartgrid.com/wp-content/uploads/2013/03/NYSERDA-microgrid-report.pdf

114 PACE Energy and Climate Center. Community Microgrids: Smarter, Cleaner, Greener, http://energy.pace.edu/publications/community-microgrids-smarter-cleaner-greener; Greg Morris, Chad Abbey, Geza Joos, Chris A Marnay, 2011. Framework for the Evaluation of the Cost and Benefits of Microgrids, http://der.lbl.gov/publications/framework-evaluation-cost-benefits-microgrids

115 National Renewable Energy Laboratory, Interconnecting PV on New York City's Secondary Network Distribution System, November 2009. http://www.nycedc.com/resource/analysis-solar-photovoltaic-grid-interconnection

116 Office of Governor Cuomo, "Governor Cuomo Announces Broad Series of Innovative Protections; Vice President Biden Credits Governor Cuomo's Storm Plan as A Model for Future Recovery Efforts," January 7, 2014. http://www.governor.ny.gov/press/01072013-cuomo-biden-future-recovery-efforts

117 Brownsville and the Rockaways are two ideal locations for microgrids. Brownsville is located in a load pocket where energy demand is higher than the substation capacity during peak energy use. The Rockaways' energy system was exposed by Superstorm Sandy, resulting in significant and prolonged energy loss.

118 Berkeley Lab,About Microgrids. http://building-microgrid.lbl.gov/about-microgrids; See also How Stuff Works, "How a Microgrid Works." http://science.howstuffworks.com/environmental/energy/microgrid.htm

119 Pace Energy and Climate Center, Tom Bourgeois, Preliminary Microgrid Study Findings, June 2013. http://energy.pace.edu/presentations/bourgeois-preliminary-microgrid-study-findings

120 Berkeley Lab,About Microgrids. http://building-microgrid.lbl.gov/about-microgrids; See also How Stuff Works, "How a Microgrid Works." http://science.howstuffworks.com/environmental/energy/microgrid.htm

121 Ibid.

122 "Con Edison to take new measures to protect against the effects of climate change", Environmental Defense Fund website, February 20, 2014, http://www.edf.org/media/con-edison-take-new-measures-protect-against-effects-climate-change

123 Sandy Regional Assembly, Sandy Regional Assembly Recovery Agenda, April 2013. http://bit.ly/1ssbLNL; See also City of New York, Special Initiative Recovery and Resiliency – SIRR - Report, Water and Wastewater, 2013. http://www.nyc.gov/html/sirr/html/report/report.shtml; See also Rebuild by Design program, http://www.rebuildbydesign.org

124 Calculated using estimate of 23.3 jobs/$ 1 million invested in water and wastewater infrastructure from Clean Water Council, Sudden Impact: An Assessment of Short-Term Economic Impacts of Water and Wastewater Construction Projects in the United States (p. 1-6), 2009. http://trenchlessonline.com/pdfs/webinar-sudden-impact.pdf

125 New York Times, "Sewage Flows After Storm Expose Flaws in System," November 29, 2012. http://www.nytimes.com/2012/11/30/nyregion/sewage-flows-after-hurricane-sandy-exposing-flaws-in-system.html?pagewanted=all&_r=0

126 Center for an Urban Future, Caution Ahead: Overdue Investments for New York's Infrastructure, 2014. http://nycfuture.org/pdf/Caution-Ahead-Info.pdf

127 NY Department of Environmental Conservation, Wastewater Infrastructure Needs of New York, March 2008. http://www.dec.ny.gov/chemical/42383.html

128 Capital New York, "Gray and Green: The story of a big-city sewer system that worked too well," May 15, 2012. http://www.capitalnewyork.com/article/politics/2012/05/5610263/gray-and-green-story-big-city-sewer-system-worked-too-well?page=all

129 NYCDEP, "DEC and DEP Announce Groundbreaking Agreement To Reduce Combined Sewer Overflows Using Green Infrastructure in New York City," March 13, 2012. http://www.nyc.gov/html/dep/html/press_releases/12-17pr.shtml#.U_Y_62MkWfs

130 Lohud, Costly Repair Bills for State Sewers Database. http://data.lohud.com/watchdog/sewer_costs.php; Capital New York, "Gray and Green: The story of a big-city sewer system that worked too well," May 15, 2012. http://www.capitalnewyork.com/article/politics/2012/05/5610263/gray-and-green-story-big-city-sewer-system-worked-too-well?page=all

131 Sandy Regional Assembly, Sandy Regional Assembly Recovery Agenda, April 2013. http://bit.ly/1ssbLNL; See also City of New York, Special Initiative Recovery and Resiliency – SIRR - Report, Water and Wastewater, 2013. http://www.nyc.gov/html/sirr/html/report/report.shtml; See also City of New York, Special Initiative Recovery and Resiliency – SIRR - Report, Water and Wastewater, 2013. http://www.nyc.gov/html/sirr/html/report/report.shtml; Special Initiative for Rebuilding and Resiliency (SIRR), A Stronger, More Resilient New York, http://www.nyc.gov/html/sirr/html/report/report.shtml; See also Rebuild by Design program. http://www.rebuildbydesign.org

132 New York City Department of Environmental Protection, What is a Combined Sewer Overflow. http://www.nyc.gov/html/dep/pdf/cso_long_term_control_plan/ltcp_disp_nyc_cso_program.pdf

133 Calculated using estimate of 36.1 jobs/$1 million invested in public transportation. Number from American Public Transit Association (APTA), Economic Impact of Public Transportation Investment (p. 28), October 2009. http://www.apta.com/resources/reportsandpublications/Documents/economic_impact_of_public_transportation_investment.pdf

134 Calculated using populations of areas served and assuming the sample trip listed as their commutes; as listed in Pratt Center, Mobility and Equity for New York's Transit-Starved Neighborhoods: The Case for Full-Featured Bus Rapid Transit, 2013. http://prattcenter.net/research/mobility-and-equity-new-york%E2%80%99s-transit-starved-neighborhoods-case-full-featured-bus-rapid; carbon reductions of 20 mile round trip commute switch from car to transit for one individual reduces CO2 4,800 lbs/year from APTA, Public Transportation Benefits, http://www.apta.com/mediacenter/ptbenefits/Pages/default.aspx

135 Pratt Center for Community Development, Mobility and Equity for New York's Transit-Starved Neighborhoods: The Case for Full-Featured Bus Rapid Transit, 2013. http://prattcenter.net/research/mobility-and-equity-new-york%E2%80%99s-transit-starved-neighborhoods-case-full-featured-bus-rapid

136 The Institute for Transportation and Development Policy, "The Bus Rapid Transit Standard, What Is BRT?", https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/what-is-brt/

137 Capital New York, "Why New York Has a Second-Tier Bus System", November 20, 2012. http://www.capitalnewyork.com/article/politics/2012/11/6620008/why-new-york-city-has-second-tier-bus-system?page=all

138 Institute for Rational Urban Mobility, Inc.,, JFK Airport Express: Building World Class Airport Ground Access for New York City, 2013. http://www.irum.org/QTA-Capstone-Final-Report-v2.pdf

139 The Institute for Transportation and Development Policy, "The Bus Rapid Transit Standard, What Is BRT?", https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/what-is-brt/

140 Pratt Center for Community Development, Mobility and Equity for New York's Transit-Starved Neighborhoods: The Case for Full-Featured Bus Rapid Transit, 2013. http://prattcenter.net/research/mobility-and-equity-new-york%E2%80%99s-transit-starved-neighborhoods-case-full-featured-bus-rapid

141 Cleveland implemented a 6.8 mile BRT system for less than $30 million per mile. Also see Pratt Center, above.

142 Institute for Rational Urban Mobility, Inc.,, JFK Airport Express: Building World Class Airport Ground Access for New York City, 2013. http://www.irum.org/QTA-Capstone-Final-Report-v2.pdf

143 New York City Transit, Review of F Line Operations, Ridership, and Infrastructure, 2009. http://www.irum.org/QTA-Capstone-Final-Report-v2.pdf

144 Calculated using labor intensity of the construction sector, 20.3 jobs/$1 million invested. From MIG 2011 and ACEEE, Understanding the True Benefits of Both Energy Efficiency and Job Creation (p. 5), 2011. http://www.frbsf.org/community-development/files/cdir_vol10issue1-Understanding-the-True-Benefits-of-Energy-Efficiency-and-Job-Creation.pdf

145 NYCHHC, NYC Health and Hospitals Corporation: Our Hospitals and Services. http://www.nyc.gov/html/hhc/html/about/About-HospServices.shtml

146 NYCHHC, NYC Health and Hospitals Corporation: Mission and Values. http://www.nyc.gov/html/hhc/html/about/About-MissionVisionValues.shtml

147 NYCHHC, "013 Community Health Needs Assessment and Implementation Strategy. http://www.nyc.gov/html/hhc/html/about/About-PublicInfo-CHNA.shtml

148 NYCHHC, HHC, Public Authorities Reporting Information System – Budget and Financial Plan, 2013-2018. http://www.nyc.gov/html/hhc/html/about/About-PublicInfo-Financial.shtml

149 Capital New York, "City's public hospitals facing billion-dollar deficits," February 24, 2014. http://www.capitalnewyork.com/article/city-hall/2014/02/8540802/citys-public-hospitals-facing-billion-dollar-deficits

150 Bloomberg News, "NYC Hospital Agency Deficit to More than Triple to $1.4 Billion,", February 24, 2014. http://www.bloomberg.com/news/2014-02-24/nyc-hospital-agency-deficit-to-more-than-triple-to-1-4-billion.html

151 Hurricane Sandy Rebuilding Taskforce, 2013. Hurricane Sandy Rebuilding Strategy. http://portal.hud.gov/hudportal/documents/huddoc?id=hsrebuildingstrategy.pdf

152 Crain's, "$1.6 Billion in Federal Aid for Public Hospital System," November 6, 2014. http://www.crainsnewyork.com/article/20141106/HEALTH_CARE/141109915/-1-6b-in-federal-aid-for-public-hospital-system#utm_source=Rebuilding%20NY%20Alert&utm_medium=alert-html&utm_campaign=Newsletters

153 New York Times, "NYU Langone Medical Center to Get $1.13 Billion in Storm Aid," July 29, 2014. http://www.nytimes.com/2014/07/30/nyregion/30nyu.html

154 Pro Publica, "In Hurricane's Wake, Decisions Not to Evacuate Hospitals Raise Questions," November 1, 2012. http://www.propublica.org/article/in-hurricanes-wake-decisions-not-to-evacuate-hospitals-raise-questions

155 World Health Organization "Climate Change and Human Health: Risks and Responses." http://www.who.int/globalchange/summary/en/index5.html

156 Capital New York, "N.Y.U. Langone receives $1.13B from FEMA,", July 30, 2014. http://www.capitalnewyork.com/article/city-hall/2014/07/8549892/nyu-langone-receives-113b-fema

157 Note: we are unable to calculate the cost of this program largely because there is no significant cost (aside from administrative costs) to implement the collection zone system. However, there would be significant investment by private entities to capture the stream of recycled material for sorting and manufacturing enterprises. The degree to which existing businesses could expand their capacity or new businesses would need to be created to handle the stream of recycled material is beyond the scope of this report. Therefore, job numbers are based on waste tonnage, rather than cost per million dollars.

158 The Tellus Institute devised metrics for estimating job creation based on waste tonnage. See Tellus Institute, More Jobs, Less Pollution: Growing the Recycling Economy in the U.S., 2011. http://www.tellus.org/publications/files/More_Jobs_Less_Pollution.pdf

159 Based on a 70 percent diversion rate, 200 percent of the current rate. The 2014 NYC GHG Inventory lists emissions from solid waste export, landfills and transport as 2.2 million metric tons of CO2 equivalent per year (Table 3). A 70 percent diversion rate above the current 26 percent diversion rate would reduce emissions by 44 percent, resulting in an annual decrease of 968,000 metric tons. See New York City, NYC Greenhouse Gas Inventory (Table 3), 2014. http://www.nyc.gov/html/planyc/html/publications/publications.shtml. See also Halcrow Engineers, PC, New York City Comprehensive Commercial Waste System Analysis and Study, 2012. See also Tellus Institute, More Jobs, Less Pollution: Growing the Recycling Economy in the U.S. (p. 46); 2011. See also ALIGN, Transform Don't Trash NYC: How to Increase Good Jobs, Recycling, and Justice in the Commercial Waste Industry, October 2, 2013. http://www.alignny.org/posts/resource/2013/10/transform-dont-trash-nyc/

160 Halcrow Engineers, PC.New York City Comprehensive Commercial Waste System Analysis and Study. Aug 2012.

161 Environment New York, "New Report: New York City and Long Island Rank in the Top Twenty Smoggiest Large Metropolitan Areas in the Country," September 21, 2011. See also WNYC, "NYC Region Exceeds Smog Standards: EPA," May 2, 2012. See also The Atlantic Cities, "Yo, I'm Trying to Sleep Here! New York's Wonderful Map of Noise,", April 15, 2013.

162 Travel and Leisure, "America's Dirtiest Cities," July 2012.

163 New York City Environmental Justice Alliance. http://nyc-eja.org/?page_id=315; See also Furman Center for Real Estate and Urban Policy, NYU, State of New York City's Housing and Neighborhoods 2012, 2013. http://furmancenter.org/research/sonychan

164 "Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates, New York-Northern New Jersey-Long Island, NY-NJ-PA." Bureau of Labor Statistics. 2002- 2012. See median annual hourly wage for 53-7062; annual wage = median hourly wage * 2,000 hours; Quarterly Workforce Indicators, U.S. Census Bureau.

165 Waste and Recycling News, "Trash, recyclable collector deaths spike in 2011," September 20, 2012. See also U.S. Bureau of Labor Statistics, U.S. Department of Labor, "National Census of Fatal Occupational Injuries in 2012 (Preliminary Results)," August 22, 2013. http://www.bls.gov/news.release/pdf/cfoi.pdf.

166 Halcrow Engineers, PC. New York City Comprehensive Commercial Waste System Analysis and Study, Aug 2012. Also see Volume II – Appendix B: Employment-Based Estimate of Putrescible Waste Generation Year 2002. Available at (p7 of Volume II – Appendix B is p87 of the 220-page pdf): http://www.nyc.gov/html/dsny/downloads/pdf/swmp/swmp/cwms/cwms-ces/v2-cwgp.pdf

167 Assumes 70 percent recycling, 4 million tons. Halcrow Engineers, PC., Commercial Waste Characterization, August 2012. U.S. EPA< Comprehensive Commercial Waste System Analysis and Study, Technical Memo 1c: Waste Generation Modeling, Diversion and Aggregate Tonnages, Aug 2012; GHG calculated using EPA WARM Calculator. http://epa.gov/epawaste/conserve/tools/warm/Warm_Form.html.

168 ALIGN, Transform Don't Trash NYC: How to Increase Good Jobs, Recycling, and Justice in the Commercial Waste Industry, October 2013. http://www.alignny.org/posts/resource/2013/10/transform-dont-trash-nyc/

169 Halcrow Engineers, PC. and NYC Department of Sanitation, New York City Comprehensive Commercial Waste System Analysis and Study; "Solid Waste Management Plant Technical Revie, August 2012. http://www.nyc.gov/html/dsny/downloads/pdf/swmp/swmp/technical/Review.pdf p227. Commercial Waste Long Haul Transport VMT/ton = 211.5. Current Currently landfilled/incinerated waste= 4.1 million tons. At 70 percent diversion, landfilled/disposed waste = 1.6 M tons. (4.1M T*211.5 mi/T) – (1.6M T*211.5 miles/T) = 529M miles.

170 ALIGN, Transform Don't Trash NYC: How to Increase Good Jobs, Recycling, and Justice in the Commercial Waste Industry, October 2013. http://www.alignny.org/posts/resource/2013/10/transform-dont-trash-nyc/