

# One City Built to Last



The City of New York  
Mayor Bill de Blasio

Mayor's Office of Long-Term Planning and Sustainability  
Anthony Shorris, First Deputy Mayor

# Transforming New York City's Buildings for a Low-Carbon Future

# Table of Contents

## Letter from the Mayor 5

## Executive Summary 6

## Overview 20

- 21 Introduction
- 26 Background
- 35 Transforming our Buildings for 2050
- 39 A Roadmap for New York City’s Buildings
- 40 Work We Will Begin Today
- 42 Guiding Strategies

## Public Buildings as Models for Sustainability 46

- 48 Invest in High Value Projects in All City-Owned Buildings
- 50 Expand Solar Power on City Rooftops
- 51 Implement Deep Retrofits in Key City Facilities
- 53 Improve Operations and Maintenance in City Buildings
- 55 Pilot New Clean Energy Technology in City Buildings
- 56 Improve the Efficiency and Quality of New York City’s Public Housing

## A Thriving Market for Energy Efficiency and Renewable Energy 58

- 60 Launch an Energy and Water Retrofit Accelerator
- 64 Engage Communities in Creating Energy Efficient and Resilient Neighborhoods
- 66 Expand Access to Information for Mid-Sized Buildings
- 71 Provide Financing Options for Energy Efficiency and Clean Energy

- 74 Improve Energy and Water Efficiency in Affordable Housing
- 76 Bring Solar Power to New Neighborhoods Across New York City
- 77 Coordinate with the State to Streamline Financing and Incentive Programs
- 78 Collaborate with Local Utilities to Promote Energy Efficiency
- 80 Expand the Goals and Reach of the NYC Carbon Challenge
- 82 Train the Next Generation of Building Operators
- 84 Expand NYC CoolRoofs
- 85 Help New Yorkers Reduce Energy Use at Home

## World Class Green Building and Energy Codes 86

- 88 Raise the Standards for our Building and Energy Codes
- 89 Enhance Energy Code Enforcement

## A Global Hub for Clean Energy Technology and Innovation 90

- 92 Explore Innovative Technologies for NYC Buildings
- 93 Support Emerging Entrepreneurs in Clean Energy and Energy Efficiency

## Summary of Impacts 96

## Appendices 102

- 103 Footnotes
- 105 Glossary
- 111 Acknowledgments

# Letter from the Mayor



Friends,

Global climate change is the challenge of our generation. New Yorkers are facing the risks of rising sea levels, increased temperatures and heat waves, and increasing frequency of intense storms. The damage caused by Hurricane Sandy in 2012 provided tragic evidence of these risks. Almost two years later, we are still recovering. Globally, rising sea levels will flood coastlines, droughts will disrupt livelihoods, and storms and other extreme weather will threaten lives and economic development. We are faced with an existential threat, and inaction is not an option.

New Yorkers will rise to the challenge. We will build on progress we have made to become more resilient to a changing climate and to mitigate the harmful greenhouse gas emissions that contribute to climate change. We are committing to reduce our emissions by 80 percent below 2005 levels by 2050, making us the largest city in the world to commit to this goal.

In New York City, our buildings are responsible for the overwhelming share of our emissions. The energy we use in our homes, schools, workplaces, stores, and public facilities accounts for nearly three-quarters of our contribution to climate change. But we can upgrade our buildings to make them more energy efficient and reduce these emissions. With this work, we can make our homes more affordable, improve the quality of our air, and create a thriving market for energy efficiency and renewable energy—with new jobs and new businesses.

With this ten-year plan, we are making a commitment to achieve the greenhouse gas emissions reductions needed from our buildings to put us on the path to meet our ambitious climate goal.

Realizing this vision will not be easy. The change will come building by building, block by block, and neighborhood by neighborhood. It will require new technologies and innovative thinking. But New Yorkers are the world's most skilled architects, engineers, real estate developers, academics, construction workers, and building operators. The solutions we develop together will change our city, and they can change cities across the world.

Our work begins today, and working together, we can truly become One City: Built to Last.

A handwritten signature in black ink that reads "Bill de Blasio". The signature is fluid and cursive.

Mayor Bill de Blasio

# Executive Summary

# Executive Summary

What does it mean for a city to be built to last?

In a city that is built to last, our homes and workplaces will require less energy for heating, cooling, and power. The energy those buildings will need comes from renewable sources that do not pollute our air and water or dangerously increase global temperatures. Residents of a city built to last are protected from rising sea levels and extreme weather.

Global climate change is the challenge of our generation. The stakes are high—for New Yorkers and for the world. In the coming years, New York City will face rising sea levels, increased temperatures and heat waves, and an increasing frequency of the most intense storms. These risks are not remote or distant. They are here today. The damage caused by Hurricane Sandy in 2012 provided vivid evidence of these risks. Almost two years later, we are still recovering. Globally, climate change is having a devastating impact on people's lives as rising sea levels flood coastlines, droughts disrupt livelihoods, and storms, hurricanes, and other extreme weather events threaten security and economic development.

For this reason, New York City is committed to reducing its greenhouse gas (GHG) emissions by 80 percent by 2050—the level the United Nations projects is needed to avoid the most dangerous impacts of climate change—and will chart a long-term course for a total transition away from fossil fuels to renewable sources of energy.

In New York City, our buildings are responsible for the overwhelming share of our GHG emissions, accounting for nearly three-quarters of our contribution to climate change. We can upgrade our buildings to become more energy efficient and power them with renewable sources of energy, reducing our GHG emissions while also helping to make our homes more affordable and creating new jobs and businesses.

Realizing this vision will require engaged communities, energized leadership, and creative solutions. New Yorkers will rise to the challenge. New York City is one of the world's leaders in real estate development, architecture and engineering firms, skilled labor unions, financial institutions, and research universities. We are uniquely poised to develop the solutions needed to transform our city, and will share these solutions with the world.

We have the power to begin transforming our buildings for a low-carbon future and the complete transition away from fossil fuels—and we will begin today.

## The Global Context

Human activities are increasing fossil fuel combustion and changing land use patterns, which leads to GHG emissions that change the chemical composition of the atmosphere.<sup>1</sup> This is having a direct and measurable impact on human populations and natural ecosystems.

The United Nations Framework Convention on Climate Change (UNFCCC) projects that by 2050, global GHG emissions must be reduced by 50 percent below 1990 levels to avoid the most dangerous impacts of climate change. Developed countries must reduce their emissions even more aggressively—by up to 80 percent by 2050—to account for their greater contribution to global emissions to date and their higher average per-capita emissions. If we fail, the impacts of climate change will be far-reaching and felt by all, but with the worst consequences for the world’s poorest and most vulnerable populations.

Cities must play a leading role in addressing the problem. More than half the world’s population now lives in urban areas, which are responsible for the vast majority of global GHG emissions. Cities on coastlines and in other vulnerable locations face the greatest risks from the impacts of climate change. But cities also have the resources, the commitment, and the ingenuity to prepare for a changing climate and to take bold action to reduce the harmful emissions that are the cause of climate change.

### **New York City’s Role**

New Yorkers will continue to lead the way. With our significant public infrastructure, a world class mass transit system, dense living patterns, and capacity for civic innovation, we are uniquely positioned to become the most sustainable big city in the world.

New York City has demonstrated its commitment to adapt to climate change. Mayor de Blasio created the Office of Recovery and Resiliency (ORR) in March 2014, the first City agency in the country dedicated solely to resiliency. ORR is implementing the strategies laid out in *PlaNYC: A Stronger, More Resilient New York*, which includes 257 initiatives to make the city, its communities, and its infrastructure more resilient.

We are also committed to reducing the GHG emissions that are causing the problem. In line with the UN target, we will put New York City on a pathway to achieve an 80 percent reduction in GHG emissions from 2005 levels by 2050.

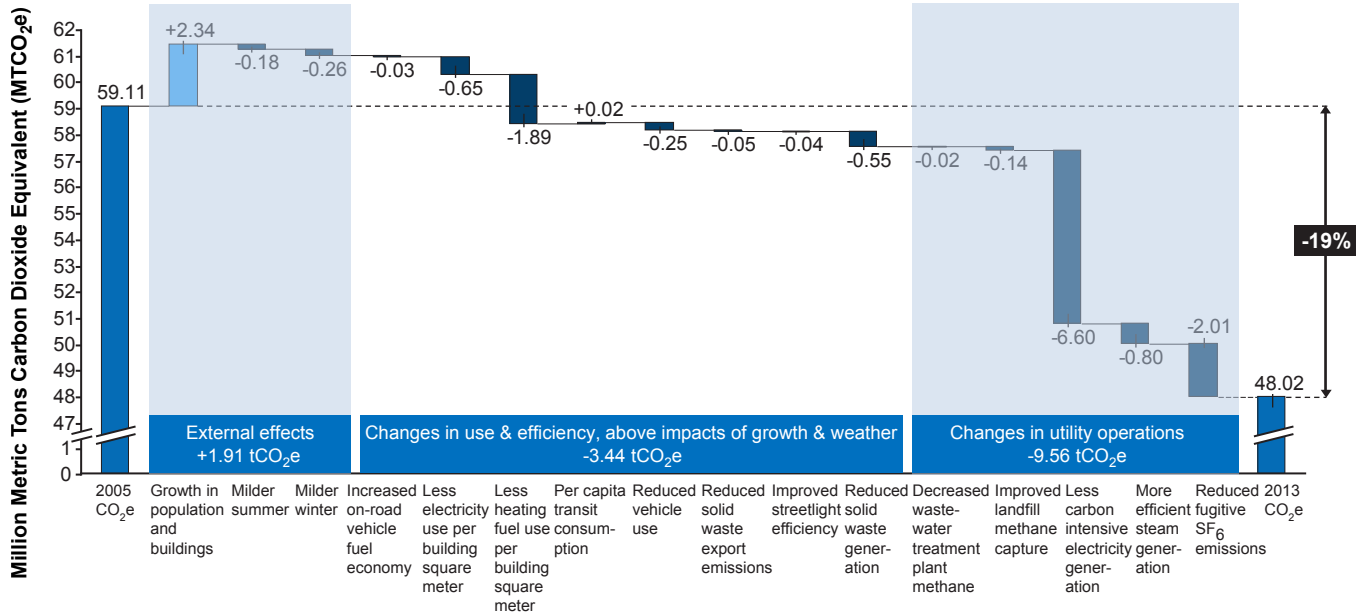
New Yorkers have the tools and resources to mitigate our GHG emissions. In fact, New York City has already reduced citywide emissions by 19 percent from 2005 levels.

We made this progress by measuring and reporting our annual GHG emissions and efforts to make investments to clean our electric grid, expand sustainable transportation options, reduce our solid waste, and enact policies to reduce emissions from the energy used in our buildings.

But the majority of the reductions we have achieved so far were the result of switching from coal and oil to natural gas to generate electricity and other improvements to utility operations. Together, these account for more than 80 percent of the reductions. These strategies cannot be replicated, and future reductions will be much more difficult to achieve.



## New York City's Greenhouse Gas Emissions Drivers of Change, 2005-2013



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

To reach 80 by 50, further GHG reductions will need to come from cleaner power generation, more sustainable modes of transportation, and better management of our solid waste. But the biggest untapped opportunity is to improve the energy efficiency of the city's one million buildings.

The energy used in our buildings contributes nearly three-quarters of all citywide emissions. Because our buildings are expected to last well beyond 2050, increasing the energy efficiency of our existing buildings, in addition to new construction, is the most important step we can take to make deep reductions in our carbon emissions.

Reducing energy use in our buildings can also help address our affordable housing crisis. Increasing utility costs are one of the primary contributors to the growing share of New Yorkers who are becoming rent-burdened.<sup>2</sup> Improving efficiency in our residential buildings can help mitigate rising housing costs. In addition, our public housing has significant untapped energy-saving potential. Investments in efficiency in these buildings would help improve the quality of our public housing stock.

Investments in energy efficiency will also help stimulate economic activity that will create new jobs and opportunities for career advancement for thousands of New Yorkers, and will create a healthier and more sustainable place for all.

## **Opportunities to Reduce Greenhouse Gas Emissions from Buildings**

There are three distinct ways to reduce GHG emissions from the energy used in our buildings. The first is by improving the energy efficiency of building systems and operations and investing in cleaner on-site power generation. These are improvements that building owners and managers can directly control.

The second is by reducing the energy consumption of a building's tenants and occupants, which can account for anywhere between 40–60 percent of a building's energy use. Tenants can directly lower their energy use, but building owners typically have limited control over this.

The third opportunity is by reducing emissions from the city's power supply. This requires power suppliers to switch to cleaner energy sources and fuel distributors to offer lower-carbon fuels. Building owners and managers do not have direct influence over the power supply, although they can help grow the market for renewables through power purchase agreements and other mechanisms to buy cleaner energy that is generated off-site.

This plan focuses on the opportunities to improve the efficiency of building systems, equipment, and operations and dramatically expand on-site renewable energy generation. We will call on building owners and managers to make these investments, but also provide the resources they need to do so. We will also create tools to empower New Yorkers to reduce their own energy use and programs to mobilize communities in this effort. With this plan, we can improve the quality of our built environment, create good jobs, and help protect families from rising housing costs.

## **Current Sustainable Building and Energy Efficiency Policies**

The City has already laid the foundation for improving the efficiency of both our public and private buildings.

For our public buildings, we have undertaken major energy efficiency retrofits, invested in clean energy sources, and piloted leading edge technologies across the City's portfolio of roughly 4,000 buildings.

For our privately-owned buildings, the City has focused on providing information to building decision-makers—which include building owners, managers, superintendents, board members, buyers, sellers, and residents—to help them prioritize investments in energy efficiency. The City requires owners of large buildings over 50,000 square feet in floor area to measure and publicly disclose their energy and water use annually through a process called “benchmarking,” conduct energy audits and retro-commissioning once every ten years, install energy sub-meters for large commercial tenants, and upgrade lighting in non-residential buildings.

More than 2.1 billion square feet of floor area in New York City buildings has been benchmarked since 2010, and the City has released three reports analyzing this data. The reports found that multifamily residential buildings present the greatest energy-saving opportunity due to their relative size and distribution of energy use, and that there is significant variation in energy use among similar types of buildings—presenting enormous opportunities for energy efficiency and GHG reductions.

The City also enacted laws to phase out the use of heavy fuel oils in buildings, which contributed more soot pollution in New York City than all of our cars and trucks combined. To complement the laws, the City launched the NYC Clean Heat program to provide technical assistance to help accelerate the pace of fuel oil conversions. Mayor de Blasio extended this program, and more than 3,500 fuel oil conversions have now been completed. Last year the City’s air quality was the cleanest it has been in more than 50 years, due in large part to the success of the program, and as a result, an estimated 800 lives are saved each year.

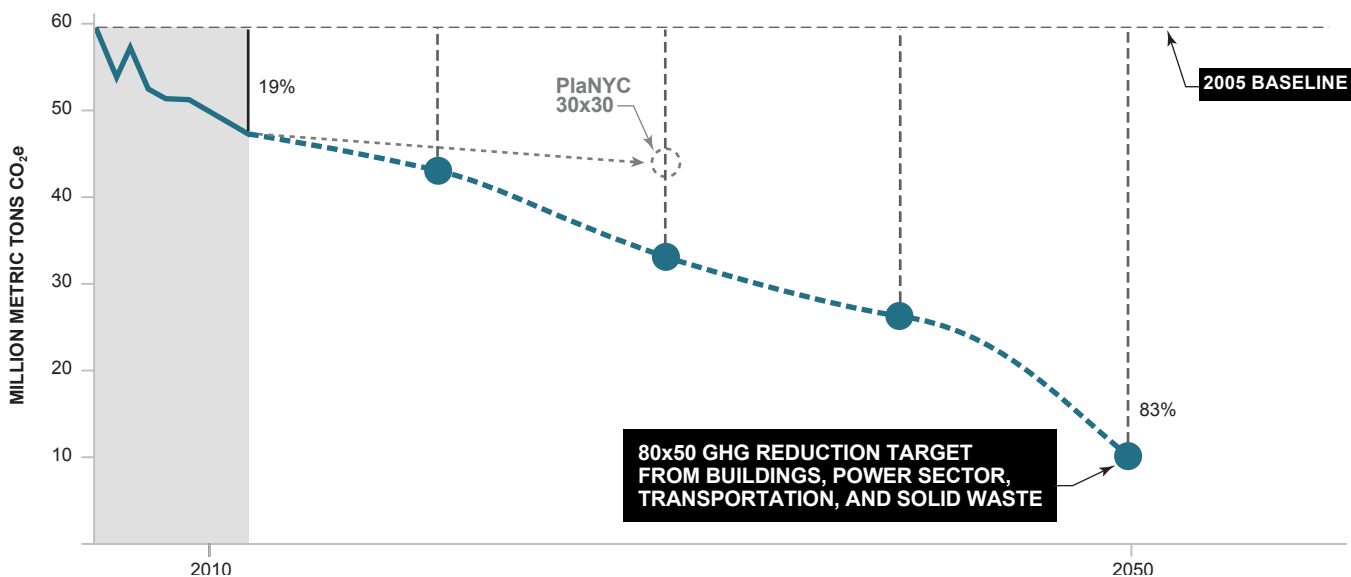
The City has created additional resources to help building owners comply with its local laws and make their buildings more energy efficient. These include the New York City Energy Efficiency Corporation (NYCEEC), a not-for-profit financial services firm that has developed innovative energy efficiency and clean energy financing products, and Green Light New York, an educational resource center to provide trainings, demonstrations, and events on emerging technologies and strategies.

Working with stakeholders, the City also launched a the NYC Carbon Challenge as a voluntary program to encourage deep energy retrofits, incorporated energy efficiency and green building principles into the building codes, and changed zoning laws to encourage sustainable building practices.

### Charting a Path to 80 by 50

The Bloomberg administration put the City on track to achieve a 30 percent reduction in GHG emissions by 2030—but it is increasingly clear that this is not enough. To achieve an 80 percent reduction in emissions by 2050 (“80 by 50”), the City must be on a much more ambitious pathway toward deep carbon reductions.

#### Pathways for Reductions in City-wide Greenhouse Gas Emissions



Source: New York City Mayor’s Office of Long-Term Planning and Sustainability

In 2013 the City studied opportunities to achieve an 80 by 50 reduction based on current technologies. The study found that nearly two-thirds of the GHG reductions that are needed must come from more efficient buildings. More than 80 percent of the building-based measures would also be cost-effective from a societal standpoint, but there are major obstacles to scaling up these investments and transitioning to a low-carbon future.

Nothing short of a dramatic transformation in the way energy is used in buildings is necessary to achieve 80 by 50. By 2050, our buildings will need to become high-performance structures powered by low-carbon energy sources. Walls and windows must be insulated, building equipment must become more efficient and intelligent, and building systems must be made ready for renewable energy sources to eventually replace fossil fuels for heating, hot water, and cooking. Residents would need to conscientiously conserve energy and water, and building operators will need to become skilled in the latest energy efficiency technologies. Moreover, achieving 80 by 50 would require the deployment of new and promising—but largely unproven—technologies and strategies.

Despite these challenges, the City can focus on efforts in the short- and medium-term to put our buildings on the right trajectory. The City has the tools, expertise, and committed leadership to accelerate carbon reductions and place the city on a pathway to 80 by 50. This plan is the first step.

## **A Roadmap for New York City's Buildings**

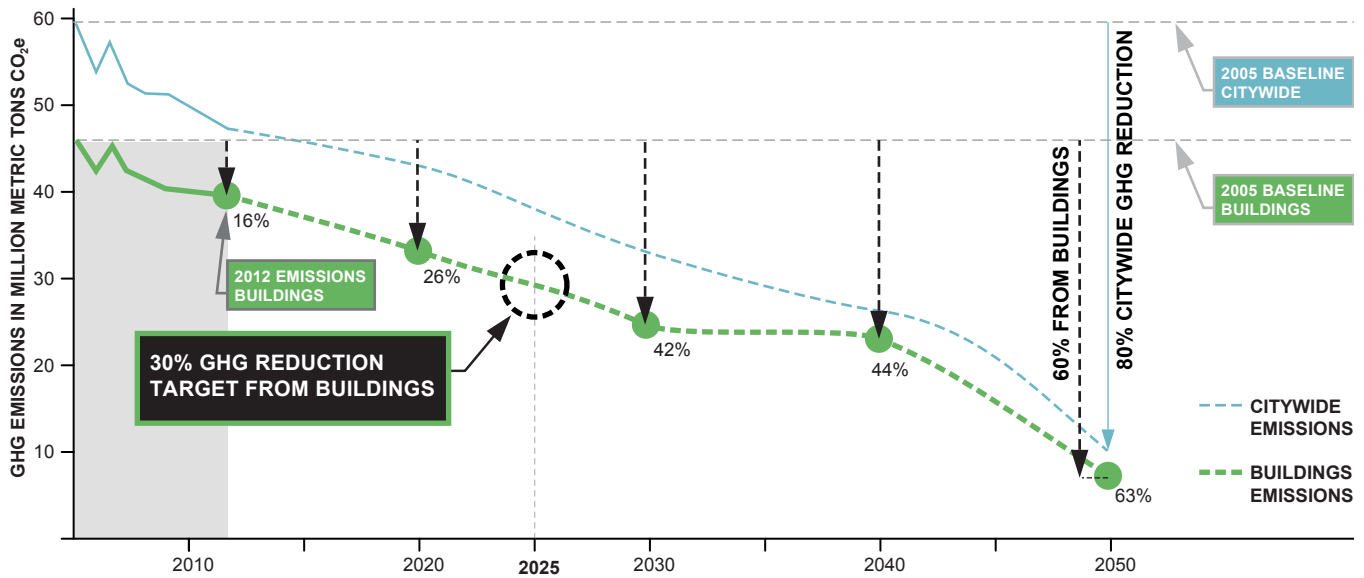
To be on a pathway to 80 by 50, we will need to reduce GHG emissions from the energy used to heat, cool, and power our buildings by 30 percent from 2005 levels over the next decade. City government can lead the way, and will commit to achieving a 35 percent reduction in emissions in the next ten years.

To achieve these goals, by 2025 we will:

- Complete efficiency improvements in every City-owned building that has significant energy use and install 100 MW of onsite renewable power.
- Implement leading edge performance standards for new construction that cost effectively achieve highly efficient buildings, looking to Passive House, carbon neutral, or “zero net energy” strategies to inform the standards.
- Develop interim energy performance targets for existing buildings to be met through both voluntary reductions and new regulations, such as performance standards and measure-based mandates, which would be triggered if adequate reductions are not achieved.

These goals set a high bar for what we will expect from our buildings in the future. Ambitious as they are, however, they are also designed to be flexible. To rise to this challenge, ensure our measures are technically sound, and determine the ideal process of implementation, we will work closely with New York City's world class

## Pathways for Reductions in Greenhouse Gas Emissions from Buildings



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

real estate industry, architects, engineers, labor unions, affordable housing experts, environmental justice leaders, and academics. The City will convene a task force of these stakeholders and conduct a robust technical analysis that will be used to create programs, policies, and regulations that transition our buildings to a low-carbon future.

There are also initiatives that we will begin right away. We will invest in our public buildings to make them models for sustainability. We will improve energy efficiency in affordable housing. We will catalyze a thriving market for energy efficiency and renewable energy generation. We will continue to improve construction standards to make our new buildings the greenest in the world. We will mobilize business sectors, communities, and neighborhoods across the city to improve energy efficiency and reduce GHG emissions. We will provide new opportunities for skills development in energy services and create jobs. And we will invest in and inspire the next generation of clean tech and energy efficiency innovations right here in New York City.

All together, the initiatives outlined in this plan are expected to reduce GHG emissions from the energy we use to heat, cool, and power our buildings by roughly 3.4 million metric tons of carbon dioxide equivalent by 2025. These initiatives will also create an estimated 3,500 construction-related jobs, provide training for more than 7,000 building operators and staff, and generate \$1.4 billion in annual cost savings for New Yorkers.

## Creating Efficient Buildings for All New Yorkers

What we are outlining today is not just a carbon mitigation plan: it is also an affordability plan, an economic development plan, and a public health plan.

By lowering building energy use, we will make it easier for people to afford to live in New York City. Energy efficiency measures can reduce the energy bills for tenants who pay their utilities directly, and can free up additional funding that owners could invest in other capital upgrades to improve the quality of our housing stock. For the City, the money saved by reducing operating costs can be redirected to other vital investments.

Stimulating new investments in improving the efficiency of our buildings will create broader economic benefits. Boosting the demand for energy efficiency services and contractors will create new jobs and for New Yorkers, growth opportunities for local businesses, and training opportunities for building staff to advance their careers and enhance their earning potential.

This plan will also improve the health of all New Yorkers. Reducing GHG emissions often has the added benefit of reducing air pollutants, which lowers health risks such as asthma, heart disease, and premature death. Reducing GHG emissions also helps to protect vulnerable populations from the increased frequency of heat waves that will be brought on by rising global temperatures.

At every step of the way, we are committed to ensuring that all residents in each and every borough have equal access to the benefits that come from retrofitting our buildings, reducing our GHG emissions, and building a more sustainable and resilient place to live.

This is our plan to create One City: Built to Last.

## Guiding Strategies

The City adhered to five guiding strategies for the proposals outlined in this plan.

- 1 Lead by example.** The City will pave the way by implementing innovative technologies and strategies in City-owned buildings that will set the example for achieving deep carbon reductions. This also means working with the federal government on new strategies to reduce energy use in public housing and mobilizing business leaders and communities in our effort to tackle climate change.
- 2 Empower New Yorkers to take action.** The City will create programs and policies to reduce the risks and complexities of retrofitting buildings and empower New Yorkers to act. This includes providing educational resources and expanding financial resources to help cover the costs of projects. The City can also research local applicability of emerging technologies and help bring them to market, particularly where they promote deep energy retrofit projects.

- 3** **Hold New York City's buildings to the highest energy performance standards.** The City will ensure our buildings meet the highest standards. This includes improving compliance with existing laws, raising standards for energy performance on new construction and renovations, and promoting resiliency improvements during efficiency upgrades.
- 4** **Ensure benefits are shared by New Yorkers in every neighborhood.** The City will promote energy efficiency and renewable energy across more communities and building sectors, including affordable housing and small and mid-sized buildings. The City will also create new programs so local workers benefit from the job growth and economic activity that result from efficiency investments.
- 5** **Use data, analysis, and stakeholder feedback to drive the approach.** As initiatives are implemented, the City will take a data-driven approach based on energy use information, real estate market data, engineering analysis, and other sources. We will collaborate with stakeholders along the way, particularly when shaping the approach for specific building sectors and communities. We will hold ourselves accountable by closely tracking and reporting our progress to the public.

## Key Policies and Programs

The guiding strategies outlined above provide the policy framework for the initiatives we will begin today.

### **We will make our public buildings models for sustainability.**

**Invest in high value projects in all City-owned buildings.** The City's Department of Citywide Administrative Services (DCAS) will fund high value efficiency projects identified by City agencies through a competitive selection process. The City will also expand the funding program to reach many more agencies, support new and innovative projects, and provide the incremental cost of efficiency measures in planned capital construction projects.

**Expand solar power on City rooftops.** Solar photovoltaic (PV) installations offset electric grid use with a clean and renewable energy source, and when combined with battery storage, can also provide backup power during extended blackouts. The City will install 100 megawatts (MW) of solar capacity on more than 300 City-owned rooftops over the next ten years, starting with 24 newly re-roofed schools. The City will also prioritize installations paired with battery storage on the City's emergency shelters to improve the city's emergency preparedness.

**Implement deep retrofits in key City facilities.** The City will enhance its implementation of comprehensive retrofits in City buildings using new, more streamlined contracts that facilitate deep energy retrofits. The City will also expand implementation of combined heat and power (CHP) projects to generate energy more efficiently and reliably.

**Improve building operations and maintenance.** The City will improve the operations and maintenance (O&M) of City-owned buildings by expanding its preventative maintenance programs, which includes hiring more staff and enhancing training for the city's building operators. The City will also expand its Expenses for Conservation & Efficiency Leadership (ExCEL) Program, a competitive program to award resources for agency-identified O&M measures such as training, tools, and other energy-saving projects.

**Pilot new clean energy technology in City buildings.** The City will engage companies with emerging energy technologies to pilot their solutions in City-owned facilities. The expanded program will test performance of technologies in more facilities, identify opportunities for larger-scale deployment in public buildings, and provide case studies to increase market adoption of promising technologies.

**Improve the efficiency and quality of New York City's public housing.** NYCHA will undertake a partnership with the U.S. Department of Housing and Urban Development (HUD) and private lenders to develop a multiphase, large-scale Energy Performance Contract (EPC). NYCHA will work with HUD to streamline the EPC process and explore the opportunity to leverage financial incentives from third parties as part of the EPC.

## **We will create a thriving market for energy efficiency and renewable energy.**

**Launch an Energy and Water Retrofit Accelerator.** The City will create a coordinated outreach and technical assistance program to accelerate energy and water retrofits in privately-owned buildings. The "Retrofit Accelerator" will use data-driven direct marketing to identify and assist buildings to undertake efficiency upgrades and complete heavy heating oil conversions to cleaner fuels. The program will also provide streamlined information about available financing and incentives and connect local job-seekers and firms to increased demand for services.

**Engage communities in creating energy efficient and resilient neighborhoods.** To complement the Retrofit Accelerator, the City will launch a program to engage local communities to promote energy efficiency retrofits, with



a focus on helping key neighborhoods that are facing pressures on housing affordability. The program will also complement new financing programs currently under development by the City's Department of Housing Preservation and Development (HPD) and will train and employ local residents in order to provide new opportunities for career advancement.

**Expand access to information for mid-sized buildings.** The Mayor's Office will work with City Council to expand the City's Greener, Greater Buildings Plan to include all buildings over 25,000 square feet in floor area, lowering the square footage cut off from 50,000 square feet. This will bring an additional 11,400 properties (16,800 buildings) under the law, providing more building decision-makers with energy use information and creating new opportunities for savings. Expanding the laws will also increase the number of buildings that can be assisted by the Retrofit Accelerator.

**Provide financing options for energy efficiency and clean energy.** The New York City Energy Efficiency Corporation (NYCEEC) has developed innovative financing options for energy efficiency and resiliency measures that are ready to be scaled up, including green mortgages and direct lending products that underwrite energy savings into the loan. The City will also explore modifications to the J-51 housing tax credit and the use of Qualified Energy Conservation Bonds (QECBs) to encourage additional investments in efficiency measures.

**Improve energy and water efficiency in affordable housing.** HPD and HDC will begin requiring a "green" capital needs assessment for all moderate rehabilitation projects that are financed by the City to ensure that opportunities to save energy and water are included within the scope of work. HPD will also develop a grant and loan program to assist owners of small- to mid-sized multifamily properties undertake efficiency improvements in exchange for entering into an affordable housing regulatory agreement. The program will be paired with a robust outreach and technical assistance effort that engages local partners, and will also create opportunities for workforce development and career advancement.

**Bring solar power to new neighborhoods across New York City.** Solar energy complements energy efficiency by providing a renewable energy source to power building systems and reducing grid dependency. The City's goal is to increase our solar power capacity by 250 MW over the next ten years on privately-owned properties. Expanding the NYC Solar Partnership provides a platform to coordinate solar programs and streamline processes to sustain the local solar industry's growth, expand equitable access to solar power, and promote community-shared and group purchasing of solar power.

**Coordinate with the State to streamline financing and incentive programs.** The City will work with NYSERDA and the NY Green Bank to coordinate programs in order to provide a more streamlined customer experience, build the local workforce, and provide appropriate financing options for the affordable multi-family sector. The City will also continue advocating for an equitable allocation of State funding to the downstate region.

**Collaborate with local utilities to promote energy efficiency.** The City will work with local utilities including Consolidated Edison (Con Ed), National Grid, PSEG Long Island, and the New York Power Authority (NYPA) to improve the quality of and access to customer utility data, support the development of renewable sources of energy, manage citywide load growth, and reduce load growth in priority areas. This includes efforts to collaborate within the Northern Brooklyn-Southern Queens load pocket, where energy efficiency retrofits can help manage stresses on utility infrastructure and mitigate rising housing costs brought on by neighborhood growth.

**Expand the goals and reach of the NYC Carbon Challenge.** Expanding the City's voluntary carbon reduction program by adding new sectors and participants will allow the City to partner with private sector leaders and identify best practices for deep carbon reductions. The City will also challenge existing participants to increase their carbon reduction goals to lead the way on the citywide pathway towards 80 by 50.

**Train the next generation of building operators.** The City will help improve the efficiency and lifespan of their equipment and upgrade the skills of building staff by offering low- to no-cost training in energy efficiency best practices. These expanded trainings will reach new constituencies, including building superintendents and operators who speak English as a second language.

**Expand NYC CoolRoofs.** The City will continue the current mission of the CoolRoofs program to coat one million square feet of rooftops white each year, which reduces building energy use and helps mitigate urban heat. The City will also expand the program's mission to focus on small- and mid-sized multifamily buildings and will enhance opportunities for green workforce training.

**Help New Yorkers reduce energy use at home.** New Yorkers can take simple steps in their own homes to reduce energy use that can lower their energy bills. GreeNYC is the City's public education program that engages New Yorkers to take actions to live more sustainably. Through GreeNYC, the City will empower New Yorkers to take simple energy-saving measures in their own lives such as switching to more efficient light bulbs, adjusting thermostats, unplugging chargers, and using appliances more efficiently.

## **We will develop world class green building and energy codes.**

**Raise the standards for our building and energy codes.** Working together with industry leaders and City Council, the City will continue to improve standards for energy performance and sustainable building practices in new construction. Standards will be implemented that raise the bar towards better construction practices, higher efficiency equipment, and improved operations and maintenance to improve the quality of our building stock and lower energy costs for residents.

**Enhance Energy Code enforcement.** Energy performance standards need strong enforcement and education to ensure existing and new standards are met. Additional resources must be allocated to City agencies that will ensure that these requirements are fulfilled in both the design phase and during construction.

## **We will become a global hub for clean energy technology and innovation.**

**Explore innovative technologies for New York City buildings.** Reaching 80 by 50 will depend in part on identifying and scaling up new clean energy technologies and strategies for efficiency. The City will study promising new solutions to explore their adaptability to the New York City market and develop best practice guidelines for implementation.

**Support emerging entrepreneurs in clean energy and energy efficiency.** The City will expand clean technology incubator programs in the city to support entrepreneurs and promote local company growth, including “step-out” and prototyping space that will allow emerging companies to stay in New York City as they grow.

# Overview

# Introduction

## Climate Change and Its Impacts

Global climate change is the challenge of this century, and the stakes are high. Increasing fossil fuel combustion and changing land use patterns emit carbon dioxide, methane, nitrous oxide, and other greenhouse gas (GHG) emissions that are changing the chemical composition of the global atmosphere.<sup>3</sup> These changes are having a direct and measurable impact on human populations and natural ecosystems.



In New York City, we are experiencing the impacts of climate change firsthand. Sea levels are rising. Temperatures are increasing. Heavy rain and other extreme weather events are occurring more often. Heat waves are becoming more frequent and intense.

Several weather-related events in recent years have highlighted our vulnerability to the risks of climate change. Hurricane Sandy was a devastating snapshot of these

risks. Sandy caused destruction across dozens of neighborhoods in South Queens, Southern Brooklyn, the East and South Shores of Staten Island, and Lower Manhattan. The storm also disrupted power for almost two million people, flooded nearly 90,000 buildings, disrupted food networks and fuel supplies, forced businesses large and small to shut down, caused 44 deaths, and resulted in \$19 billion in economic damage in New York City alone. Two years later, many of our neighborhoods are still in the process of recovering.

Globally, climate change will have impacts that threaten to disrupt livelihoods and exacerbate issues of resource inequality. Rising sea levels will increase flooding in coastal areas, causing the displacement of populations. Droughts will continue to devastate ecosystems and agricultural production. Storms, hurricanes, and other extreme weather events will pose risks to people and businesses.

Climate change is projected to accelerate unless global efforts are taken to dramatically reduce GHG emissions. The New York City Panel on Climate Change (NPCC) projects an increase of average annual temperatures in New York City by 2° to 3°F by the 2020s and 4° to 6.5°F by the 2050s. Sea levels are projected to rise from 4–10 inches by the 2020s and 11–30 inches by the 2050s.<sup>4</sup>

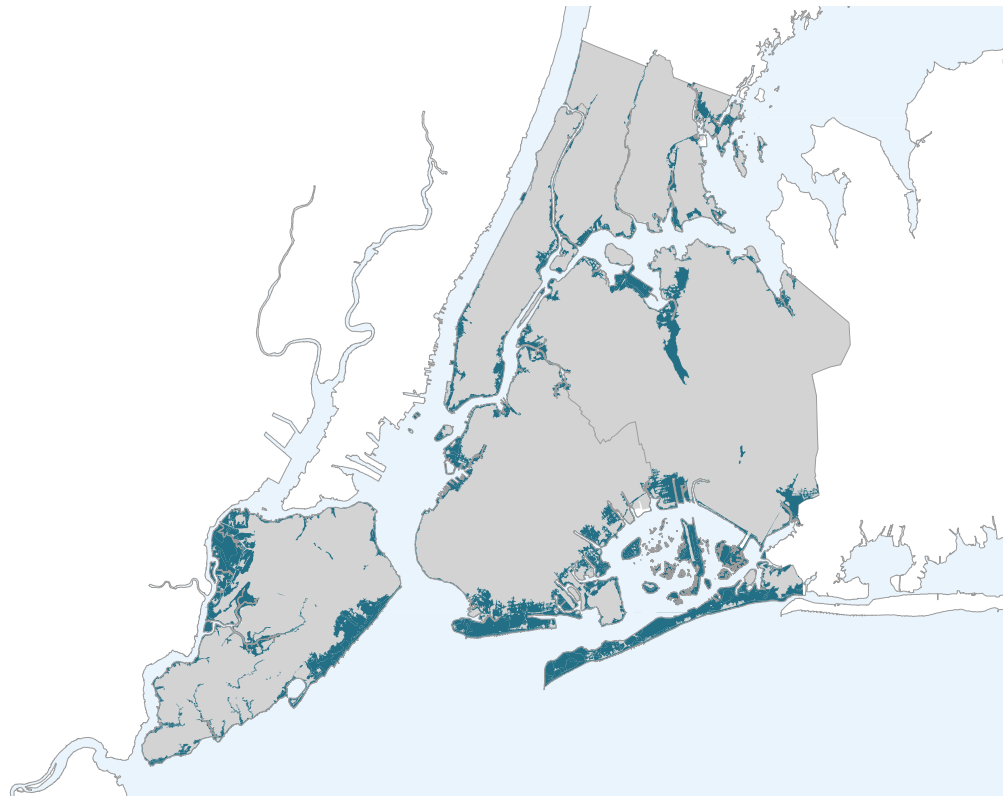
## Flood Insurance Rate Maps (FIRMs)

In 2013, the Federal Emergency Management Agency (FEMA) released the Preliminary Flood Insurance Rate Map (FIRM), which indicates all areas of New York City located within the 100-year and 500-year floodplains. Areas in the 100-year floodplain have a one percent chance of flooding every year, translating to a 26 percent chance of flooding over 30 years, while areas in the 500-year flood plain have a 0.2 percent chance of flooding each year.

FEMA requires owners of all properties located in the 100-year flood plain to carry flood insurance if they have a mortgage from a federally-backed lender. The updated maps nearly doubled the number of buildings located in the city's 100 year floodplain, bringing the total to more than 70,000 buildings. The floodplain includes the homes of roughly 400,000 New Yorkers, who must now face the reality of rising flood insurance rates.

In 2014, the City adopted the Preliminary FIRM for its new construction standards, the most significant update to the flood zone map in over 30 years. The City is not required to use the Preliminary FIRM for construction standards, but did so to better protect its buildings from future floods, taking into account rising sea levels and increasing intensity of storms resulting from climate change.

## FEMA Preliminary FIRMs 100-Year Floodplain



Source: New York City Mayor's Office of Recovery and Resiliency

These projected impacts have brought a spotlight onto our city's resiliency, defined as our capacity to survive, adapt, and grow in the face of stress and shocks. Resiliency to climate change refers to our ability to prepare for and respond to future climate-related events. Becoming a more resilient city will require defending our coastlines, transforming our built environment, protecting our critical infrastructure and services, and strengthening our communities so that we can meet the challenges of climate change while continuing to grow and thrive.

Climate change can also exacerbate conditions of inequality in New York City. Individuals and communities who are most vulnerable due to poverty, poor health, crime, and/or food insecurity will suffer disproportionately from the impacts. Some of the neighborhoods worst hit by Hurricane Sandy were located in underserved areas that faced an array of other challenges well before Sandy hit. Many lower-income residents in these communities were largely unprepared for such a ferocious storm, and could not afford the costly maintenance and upgrades that would have better protected their homes and businesses.

As sea levels rise, so will flood insurance rates, placing another disproportionate burden on low-income New Yorkers—many of who are already struggling with rising housing costs. In addition, deaths and hospitalizations from heat waves in New York City are 50 percent more likely in high poverty neighborhoods than in low-poverty neighborhoods.<sup>5</sup>

Climate change will have an impact on all of us in how we live, work, and play. It will affect our ability to enjoy our environment and surroundings, on the life we imagine for future generations. It will affect our city's growth and continued economic development, and it will affect our ability to create a more equitable and resilient city.

## **New York and the Role of Cities**

Globally, cities can play a leading role in addressing the problem. More than half the world's population now lives in cities, which are responsible for the vast majority of global GHG emissions. Cities located on coastlines and in other vulnerable locations are also on the frontlines of climate change and will bear the brunt of its impacts. But cities also have the tools, the drive, and the ingenuity to both adapt to climate change and take bold action to reduce their emissions.

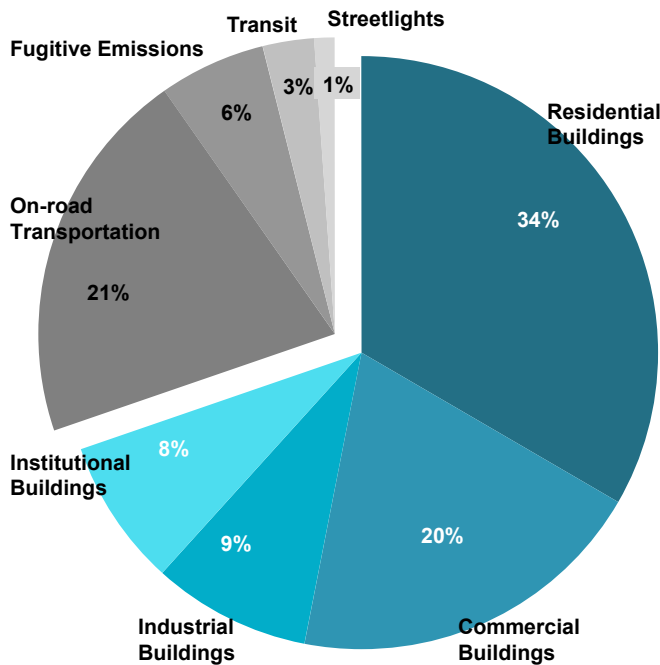
New York City has demonstrated its commitment to adapt to climate change in its response to Hurricane Sandy. Mayor Bill de Blasio established the Office of Recovery and Resiliency (ORR) in March 2014 to oversee the City's efforts to recover and rebuild following Hurricane Sandy and to prepare for our longer-term risks. ORR is implementing the strategies laid out in *PlaNYC: A Stronger, More Resilient New York*, which includes 257 initiatives to strengthen coastal defenses, make our buildings more resilient, harden city infrastructure, protect critical services, and make our neighborhoods safer and more vibrant. Since the plan's release, ORR, City agencies, and stakeholder groups have worked diligently to accomplish this goal, and 90 percent of the report's initiatives are now in progress or complete.

New York City also has an obligation to mitigate its GHG emissions. The United Nations Framework Convention on Climate Change (UNFCCC) projects that global emissions must drop by at least 50 percent below 1990 levels by 2050 to limit the increase in average global temperatures to 2 degrees and avoid the most dangerous impacts of climate change. Because developed countries have contributed to a greater share of the global emissions to date and have higher per-capita emissions rates compared to the global average, they must reduce their emissions even more aggressively to achieve that goal. In fact, the reduction in emissions that the UN projects are needed from developed countries such as the United States is actually closer to 80 percent by 2050—"80 by 50."

In response, the European Union and several U.S. states, including California and New York, have set goals to cut their emissions by 80 percent by 2050. At the national level, the President has committed to reduce GHG emissions from federally-owned and operated sources by 28 percent below 2008 levels and will aim to supply 20 percent of its electricity from renewable sources by 2020.

New York City has already taken the lead. In 2007, we set the goal to reduce city-wide GHG emissions 30 percent by 2030, and since then we have made considerable progress—achieving a 19 percent reduction from our 2005 baseline. Yet as global GHG emissions continue to rise, placing further strains on our city, we must become ever more ambitious with our goals.

## New York City 2013 Greenhouse Gas Emissions by Sector



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

The 30 by 30 goal is not enough. New York City is committed to being on a pathway to 80 by 50 and will chart a long-term course for a total transition away from fossil fuels.

Because our buildings contribute nearly three-quarters of citywide GHG emissions, a large part of our strategy must focus on increasing the efficiency of our buildings and moving them to cleaner energy sources.

### Our Plan

We must act now to improve the efficiency of our buildings and transition them to cleaner energy sources in order to be on a pathway towards 80 by 50.

But this plan is not just a carbon mitigation plan—it is also an affordability plan. By reducing energy use and emissions from our buildings, we will also protect New Yorkers from rising energy costs. This can reduce the energy bills for tenants who pay their utilities directly, and can free up additional funding that owners could invest in other capital upgrades to improve the quality of our housing stock. For the City, reducing op-

erating costs allows funding and resources to be directed towards improving public housing, schools, libraries, and city services.

This plan is also an economic development plan. By stimulating new investments in efficiency, we will create new jobs and opportunities for career advancement for New Yorkers and opportunities for business growth for local firms. We can also train building operators to enhance their earning potential and open new doors for good, stable work in construction, building operations, and building sciences. By making workforce development an essential component of this plan—and by mobilizing communities and empowering residents to take ownership of this transition—we will be better able to take advantage of the benefits as we transition to a low-carbon future.

Finally, this is a public health plan. Reducing GHG emissions often has the benefit of reducing air pollutants at the same time. Air pollution causes asthma, increased risks of heart disease, and premature death, which disproportionately impact low-income New Yorkers and vulnerable populations. Increasing the efficiency of our buildings can also significantly improve indoor air quality—an issue we plan to study in greater detail. Moreover, efforts to mitigate climate change will reduce climate-related health risks, from increased temperatures and heat waves, which can have dangerous impacts on the elderly and disabled. Reducing GHG emissions and increasing the efficiency of our buildings will make New York City a healthier and more sustainable place for all.



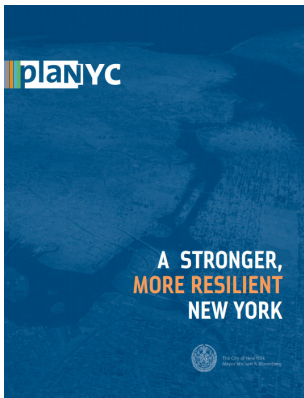
At every step of the way, we will ensure that all these benefits accrue equitably across the city. All residents of New York City have equal claims to housing that is affordable, air that is breathable, and a city that is sustainable. Simply reducing our GHG emissions is not enough. We will make sure that the residents of every borough have access to the same opportunities and benefits of our programs. In this way, we can improve the quality of life for all New Yorkers, now and in the future, and ensure that New York City truly is One City, Built to Last.



## Background

New York City has long demonstrated leadership in urban sustainability and climate change mitigation. There is more work to be done, however, to address the challenges that arise from our aging infrastructure, fast-changing economy, and the critical need to protect our environment in order to put us on the pathway to 80 by 50.

We have the tools and the commitment to address these challenges. With our durable communities, extensive public-sector capacity, access to private capital, strong labor unions, and world-class science and technology resources, we can be the most sustainable and resilient city in the world.

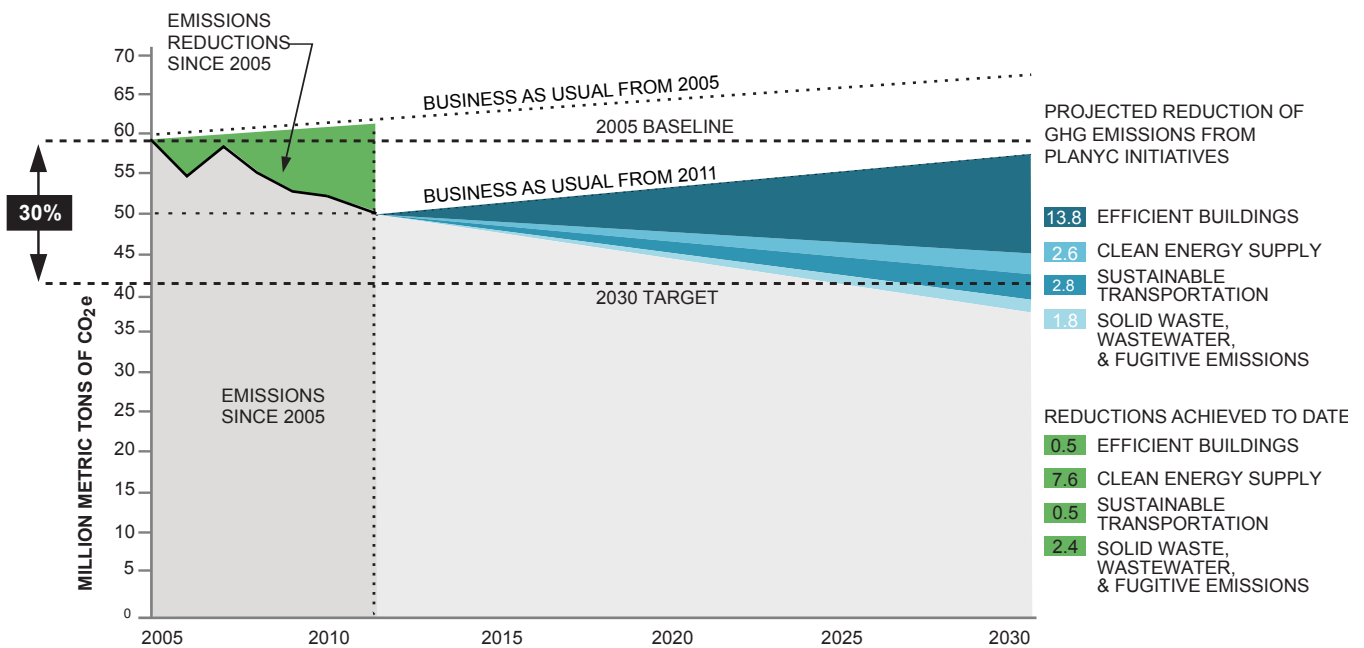


### PlaNYC

In 2007, the City released its comprehensive sustainability agenda, *PlaNYC*, which set the goal to reduce citywide GHG emissions by 30 percent from 2005 levels by 2030. Following Hurricane Sandy, the City released *PlaNYC: A Stronger, More Resilient New York*, a complementary plan to rebuild post-Sandy and improve citywide resiliency.

To reduce our GHG emissions, New York City must focus on improving the efficiency of our buildings. Nearly 75 percent of New York City’s emissions come from the energy used in buildings. Our buildings also last longer than the national aver-

### Projected Impacts of New York City’s Greenhouse Gas Reduction Strategies



Source: New York City Mayor’s Office of Long-Term Planning and Sustainability

age: 85 percent of the buildings that are here today will still be here in 2030. This means we must increase the energy efficiency of our existing buildings, in addition to new construction, to achieve deep reductions in our carbon emissions.

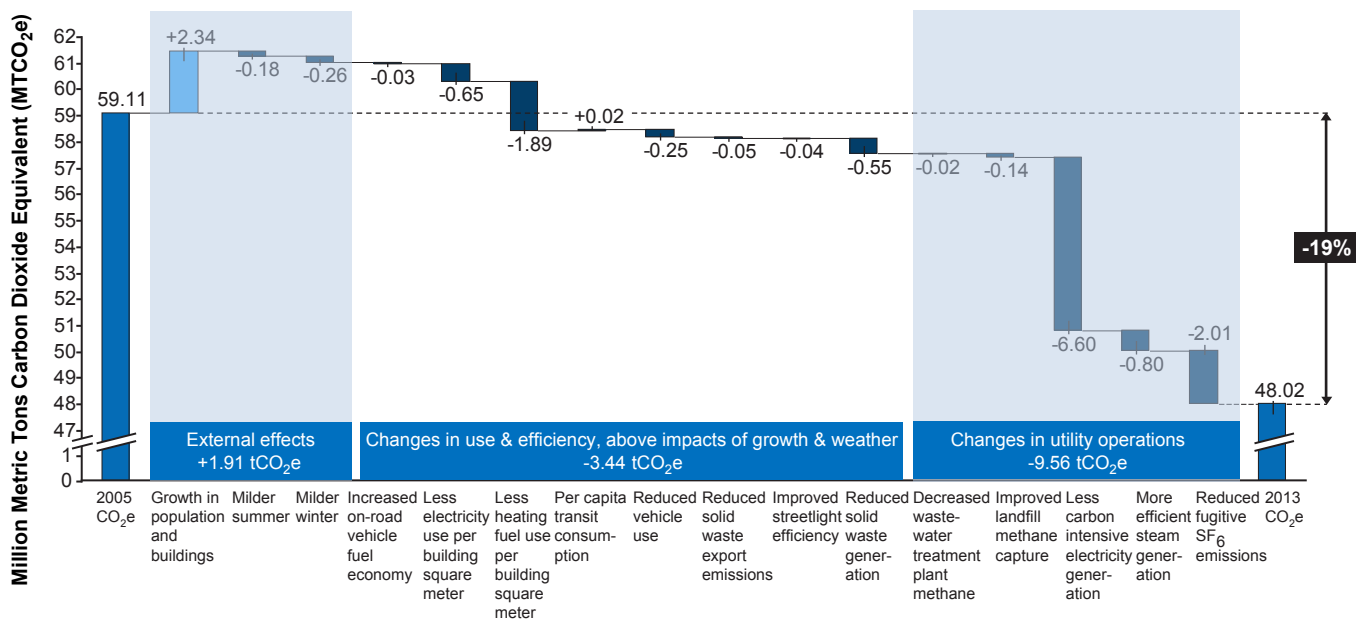
As of 2013, New Yorkers have reduced their GHG emissions by 19 percent from 2005 levels. We made this progress by making investments to clean the electric grid and enacting programs to measure and report our annual emissions, improve sustainable transportation options, reduce solid waste, lower energy use in our buildings, and convert heavy fuel oil to cleaner-burning sources of energy.

Mayor de Blasio has committed to expanding these efforts. Since taking office, the Mayor announced the most sweeping update to New York City’s Air Pollution Control Code since 1975, increased municipal organics recycling, expanded bike lanes across the city, scaled up green infrastructure investments, and made environmental sustainability a key component of *Housing New York*, the City’s ten-year affordable housing plan.

But our next set of GHG reductions will be more difficult to achieve than the first. More than 80 percent of our reductions to date were due to a switch from coal and oil electricity generation to cleaner-burning natural gas and additional improvements to utility operations. These reductions cannot be replicated. The largest remaining portion of our goal must come from reducing energy use in buildings. Moreover, the 19 percent reduction we achieved in 2013 actually held constant from 2012—further highlighting our need for action.

There is ample opportunity to increase the energy efficiency of the one million buildings in New York City, and many of these measures would also result in cost

### New York City’s Greenhouse Gas Emissions Drivers of Change, 2005-2013



Source: New York City Mayor’s Office of Long-Term Planning and Sustainability

savings for building owners and tenants. However, even when energy efficiency measures make economic sense, undertaking these improvements can be complex, may require capital that is difficult to finance, and can disrupt occupants’ work and lives.

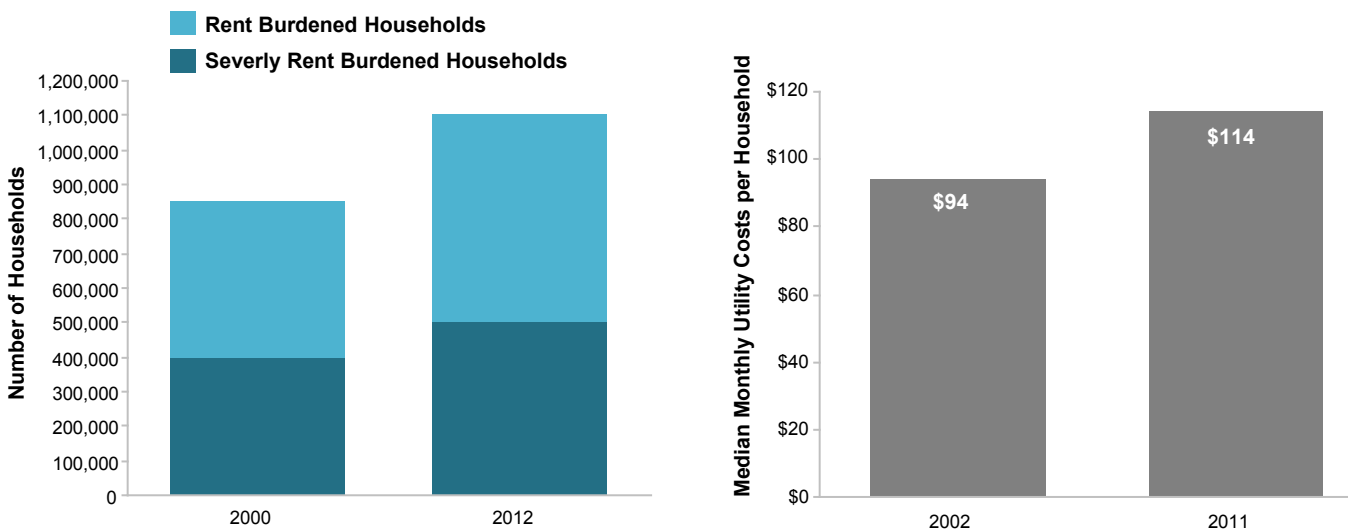
Achieving significant reductions in the GHG emissions from the energy we use to heat, cool, and power our buildings is possible, but the City will need to provide private building decision-makers—including owners, managers, superintendents, board members, buyers, sellers, and residents—with the technical assistance, financing, education, and motivation they need to make these efficiency improvements.

### Housing New York

In May 2014, Mayor de Blasio released *Housing New York – A Five Borough, Ten Year Plan* to address New York City’s affordable housing crisis. As of 2012, almost 55 percent of all households were rent-burdened, defined as paying more than 30 percent of annual income on gross housing costs—an 11 percent increase since 2000.<sup>6</sup> Rising utility costs are one of the primary contributors to this problem. New York City tenants have experienced an increase in utility costs of 20 percent since 2002, while fuel oil costs more than doubled in the same period.<sup>7</sup>

These costs disproportionately impact low-income residents, who typically pay a higher proportion of their rent on energy and utilities. Tenants paying for utilities face the risk of becoming rent-burdened as their gross housing costs rise. Property owners must pay for the increases out of their bottom line by deferring maintenance and capital needs or by raising rents. Higher utility costs also decrease the amount of conventional debt that affordable housing projects can support.

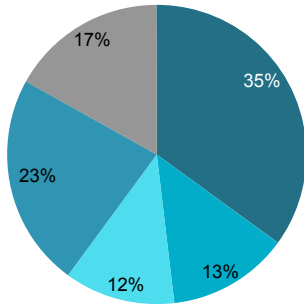
**Number of Rent-Burdened Households; Median Monthly Utility Costs**



Sources: U.S. Census (2000) PUMS data; American Community Survey (2012) PUMS data; Housing and Vacancy Survey (U.S. Census), 2002 and 2011

## Energy Use in New York City, 2011

- Small Buildings (< 50k sf)
- Large Buildings Appliances, Cooling, & 'Other'
- Large Buildings Lighting
- Large Buildings Heating & Hot Water
- Transportation



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

Providing assistance to undertake energy and water efficiency projects is one of the most effective ways the City can protect families from rising utility costs and help building owners control operating expenses. Because residential buildings account for the largest single source of citywide emissions (roughly 37 percent), this will also have a large impact on our efforts to mitigate our GHG emissions.

The capital costs of such improvements can be difficult for owners of low- to moderate-income buildings to finance. For this reason, the New York City Energy Efficiency Corporation (NYCEEC) and the NYC Housing Development Corporation (HDC) have developed innovative new financing products for the affordable multifamily sector, and the NYC Department of Housing Preservation and Development (HPD) is developing a new program to assist small and mid-sized buildings in reducing their utility costs.

### Opportunities for Green Buildings and Energy Efficiency

There are three distinct opportunities to reduce GHG emissions from the energy used in our buildings.

The first is by improving the energy efficiency of building systems and operations and investing in clean and renewable on-site power generation. These are improvements that building owners and managers can directly control.

The second is by reducing the energy consumption of a building's occupants, including commercial tenants, retailers, and residents. Occupants can account for anywhere between 40–60 percent of a building's energy use, depending on the activities that take place in the building. Tenants can directly lower their energy use, but building owners typically have limited control over this.

The third opportunity is by reducing emissions from the city's power supply. This requires suppliers to switch to clean and renewable energy sources to power the city's electric grid and steam distribution system and requires fuel distributors to offer lower-carbon fuels. Building owners and managers do not have direct influence over the power supply, although they can help grow the market for renewables through power purchase agreements and other mechanisms to buy cleaner energy that is generated off-site.

The focus of this plan is to help building owners and managers undertake efficiency measures and expand on-site renewable energy generation to reduce GHG emissions from the building systems they directly control. This includes improving the efficiency of building equipment and systems; insulating the building windows, roof, and walls; investing in clean and renewable on-site energy sources, such as solar power generation and combined heat and power (CHP) systems; and improving operations and maintenance so building systems operate more efficiently.

The City will provide resources building owners and decision-makers need to make these investments, including information, education, technical assistance, financing, and public recognition for their achievements. The City will also lead the way by retrofitting City-owned buildings and deploying innovative technologies and renewable energy sources in our public schools, libraries, fire houses, and offices.

## Current Sustainable Building and Energy Efficiency Policies

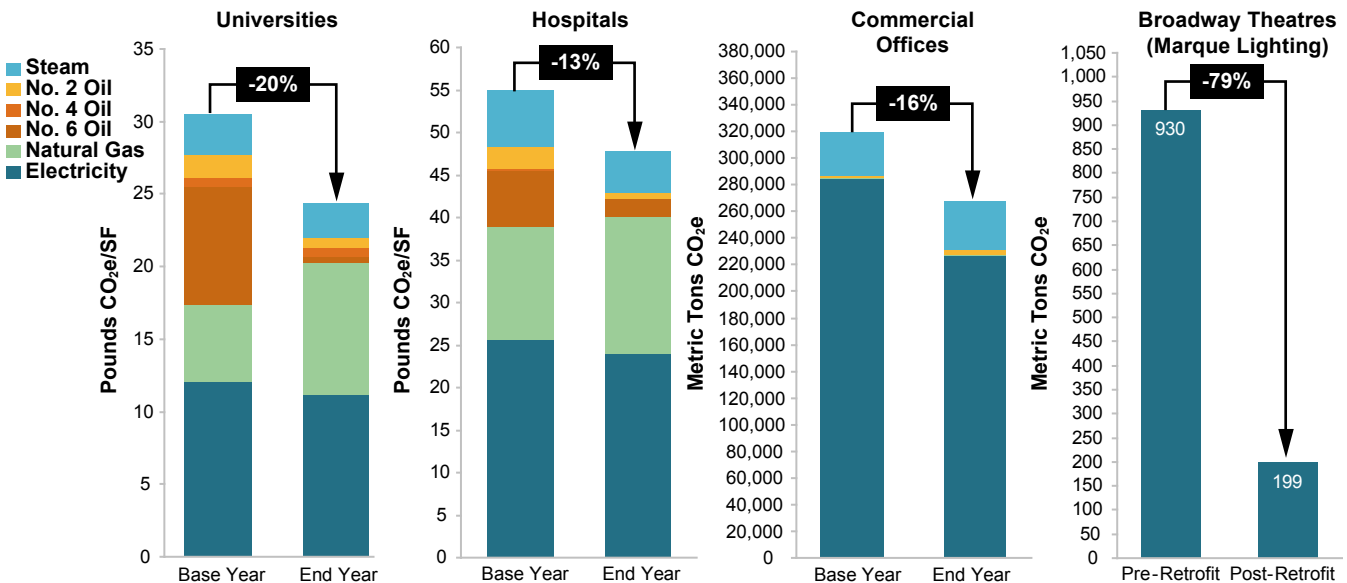
The City has laid the foundation for improving the efficiency of both our public and private buildings by creating some of the most innovative programs and laws in the nation.

For our public buildings, the City has enacted a comprehensive energy management strategy across the City’s portfolio of roughly 4,000 buildings. This includes conducting energy audits of nearly 300 buildings, performing retro-commissioning studies on 250 buildings, and undertaking energy efficiency upgrades in more than 200 buildings. In addition, the City has invested in renewable energy sources such as solar power, piloted leading edge technologies across its portfolio, and trained nearly 2,000 building operators in efficient operations.

The City launched the NYC Carbon Challenge as a voluntary program for leaders in the private and institutional sectors to follow City government’s lead in achieving ambitious GHG reduction goals. More than 50 participants including the city’s universities, hospitals, commercial firms, and residential property management companies have signed up to reduce their emissions by 30 percent or more in ten years, and Broadway theatres are also engaged with a range of sustainability projects. Together, the City and the NYC Carbon Challenge participants are paving the way towards deeper carbon reductions through innovative strategies and cost-effective technologies that can be replicated across the city.

The City also set out to green its building and energy codes. In 2008, the City convened the Green Codes Task Force, in conjunction with the Urban Green Council (the local chapter of the U.S. Green Building Council), followed by the Building Re-

### Emissions Reductions by NYC Carbon Challenge Participants



Source: New York City Mayor’s Office of Long-Term Planning and Sustainability

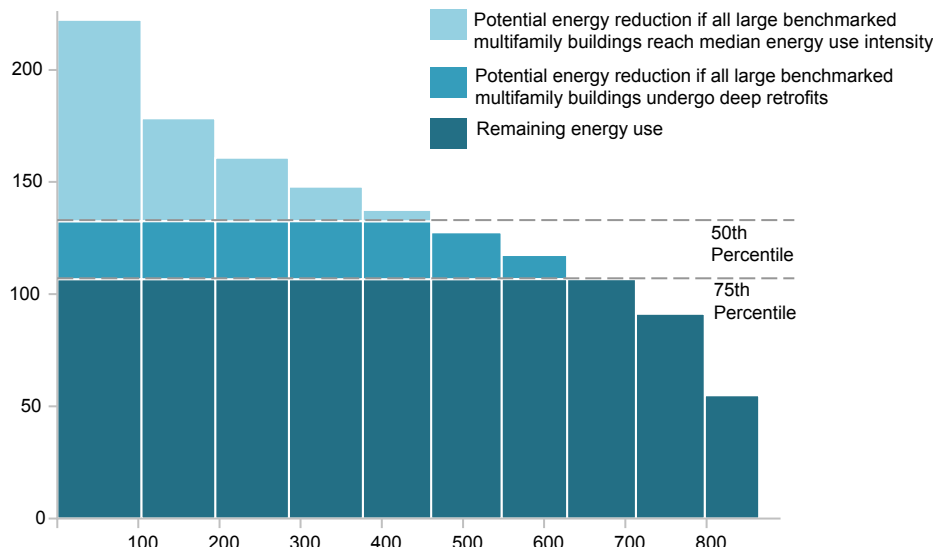
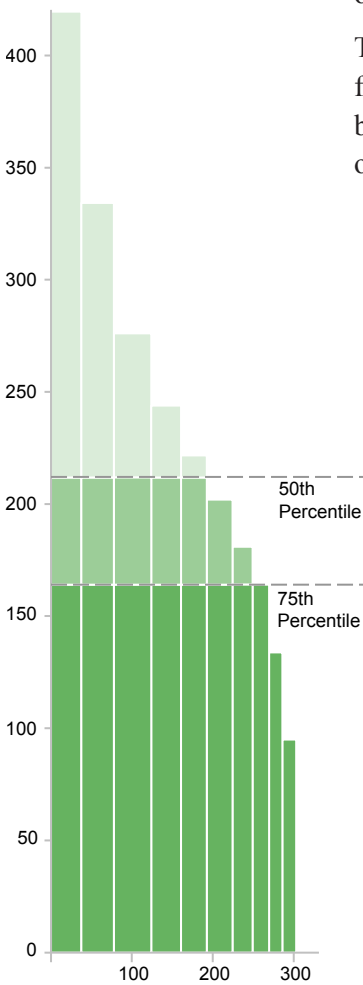
siliency Task Force in 2013. These task forces resulted in 111 green code proposals and 33 proposals to improve building resiliency and better prepare our buildings for extreme weather events. Of those, 50 green codes and 16 resiliency proposals have now been enacted. The City simultaneously launched Zone Green, a Department of City Planning (DCP) initiative that amends zoning regulations to help property owners install a wide range of energy efficiency and renewable energy features in new and existing buildings.

The City has also passed the most comprehensive set of private building efficiency laws in the nation. In 2009, the City enacted the Greener, Greater Buildings Plan (GGBP), a set of four laws that address the City’s largest buildings over 50,000 square feet in area, or multiple buildings on a lot that together make up 100,000 square feet. These buildings make up just two percent of the City’s building stock, but account for nearly half of the built square footage and 45 percent of total city-wide energy use.

The GGBP laws focus on creating transparency and providing information about energy use in the City’s large existing buildings. The full implementation of the laws is projected to reduce citywide emissions by nearly five percent and create thousands of local jobs in construction and energy services.

The City began benchmarking its public buildings in 2010. Private building owners followed in 2011. All together, more than 2.1 billion square feet of space has now been benchmarked—more square footage than all other cities with benchmarking ordinances in the U.S. combined. Since then, the City has released three reports ana-

- Potential energy reduction if all large benchmarked commercial buildings reach median energy use intensity
- Potential energy reduction if all large benchmarked commercial buildings undergo deep retrofits
- Remaining energy use



Source: New York City Mayor’s Office of Long-Term Planning and Sustainability and New York University

The Greener Greater Buildings Plan includes the following:

- Local Law 84 of 2009 (LL84): Requires owners of large buildings to benchmark and publicly disclose energy and water consumption annually
- Local Law 85 of 2009 (LL85): Creates the NYC Energy Conservation Code (NYCECC) and removes an exemption for most renovations from being required to meet code
- Local Law 87 of 2009 (LL87): Requires owners of large buildings to conduct energy audits and retro-commissioning once every 10 years to assess the performance of existing energy systems, recommend energy conservation measures, and require building owners to tune up their systems to operate as originally intended
- Local Law 88 of 2009 (LL88): Requires owners of large buildings to upgrade lighting in non-residential space to meet code and provide large commercial tenants with sub-meters by 2025

lyzing private energy and water use data, becoming the first municipality to publish benchmarking data over multiple years.

The reports show that the multifamily sector represents the greatest potential opportunity for citywide GHG reductions, due to its relative size and distribution of energy use. There is also significant variation in energy use intensity per square foot between buildings, even within the same sector. If all buildings were brought to the median level of energy performance in their category, it would reduce energy consumption from large buildings by 18 percent and GHG emissions from these buildings by 20 percent. In addition, an analysis conducted recently by NYCEEC showed that just 30 percent of the buildings benchmarked under LL84 would achieve 70 percent of the total potential energy efficiency cost savings, not including additional savings from fuel oil conversions.<sup>8</sup>

In 2013, building owners submitted the first set of LL87 energy audit and retro-commissioning reports, which are required on a rolling basis once every ten years. These audits are now in the process of being analyzed, which can help the City identify the key strategies and opportunities for energy efficiency across New York City's building stock. In particular, the City is identifying the most common recommendations and analyzing the highest-impact, lowest-cost measures that could be implemented at scale.

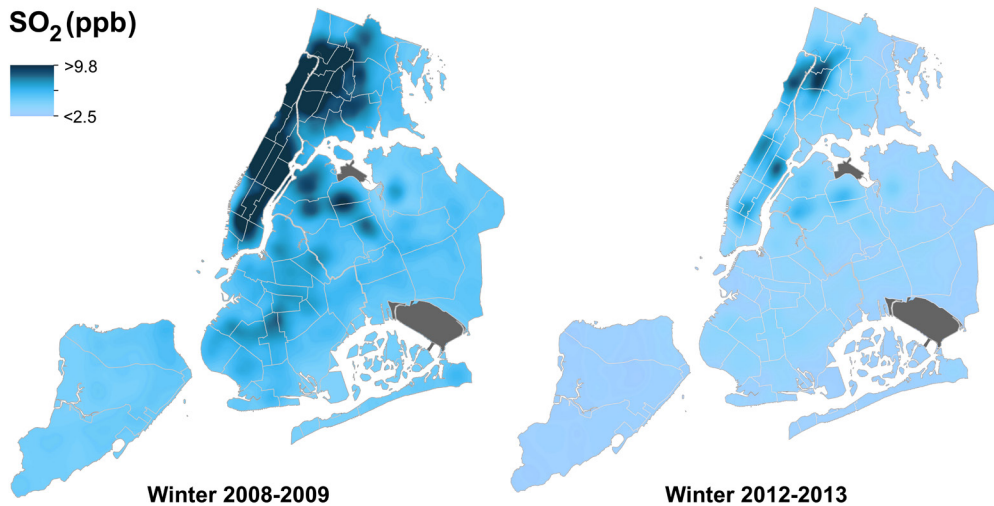
The City also enacted laws to phase out the use of No. 6 heavy heating fuel oil in buildings by 2015 and No. 4 fuel oil by 2030. The City established the NYC Clean Heat program to assist building owners in complying with the law and to accelerate fuel oil conversions to the cleanest fuels (biodiesel, ultra-low sulfur No. 2 oil, and natural gas), with the goal of reducing fine particulate matter (PM<sub>2.5</sub>) emissions from buildings by 50 percent. PM<sub>2.5</sub> emissions can aggravate respiratory diseases such as asthma and cause heart attacks or other cardiovascular episodes. Phasing out heavy fuel oil is expected to reduce citywide GHG emissions by almost one million metric tons of carbon.

Under Mayor de Blasio, the City has committed to eliminating all permitted primary use of No. 6 oil and will facilitate 1,000 additional conversions from No. 4 and No. 6 fuel oils to the cleanest available fuels by June 2015. At least half of these fuel oil conversions will be completed in affordable housing or in the highest emitting neighborhoods, specifically the Upper East Side, Upper West Side, Northern Manhattan, and South Bronx.

As a result of NYC Clean Heat and other programs, the City now has the cleanest air in 50 years. Since 2008, the levels of sulfur dioxide (SO<sub>x</sub>) in the air have dropped by 69 percent, and since 2007 the level of soot pollution (PM<sub>2.5</sub>) has dropped by 23 percent. The cleaner air enjoyed by New Yorkers today is preventing 800 deaths and 2,000 emergency room visits annually. Building on this progress, on Earth Day 2014, Mayor de Blasio announced the most sweeping update to New York City's Air Pollution Control Code since 1975 to update emission standards for sources including commercial char broilers, fireplaces, food trucks and refrigeration vehicles.



## Air Particulate Matter, 2008 - 2012



Source: New York City Community Air Survey, New York City Department of Health and Mental Hygiene

The City has created programs to finance energy efficiency and clean energy projects and to provide educational resources. The City created NYCEEC in 2009 to develop and scale up innovative financing products. The City also created Green Light New York the same year to provide energy efficiency trainings, demonstrations, and events that New Yorkers can access through its physical learning center.

In addition, the City partnered with Service Employees International Union (SEIU) local 32BJ to launch the 1,000 Green Supers program to train building operators and superintendents in energy efficiency best practices. More than 2,000 green supers have been trained through the program to date, and are now working to make buildings systems operate more efficiently.

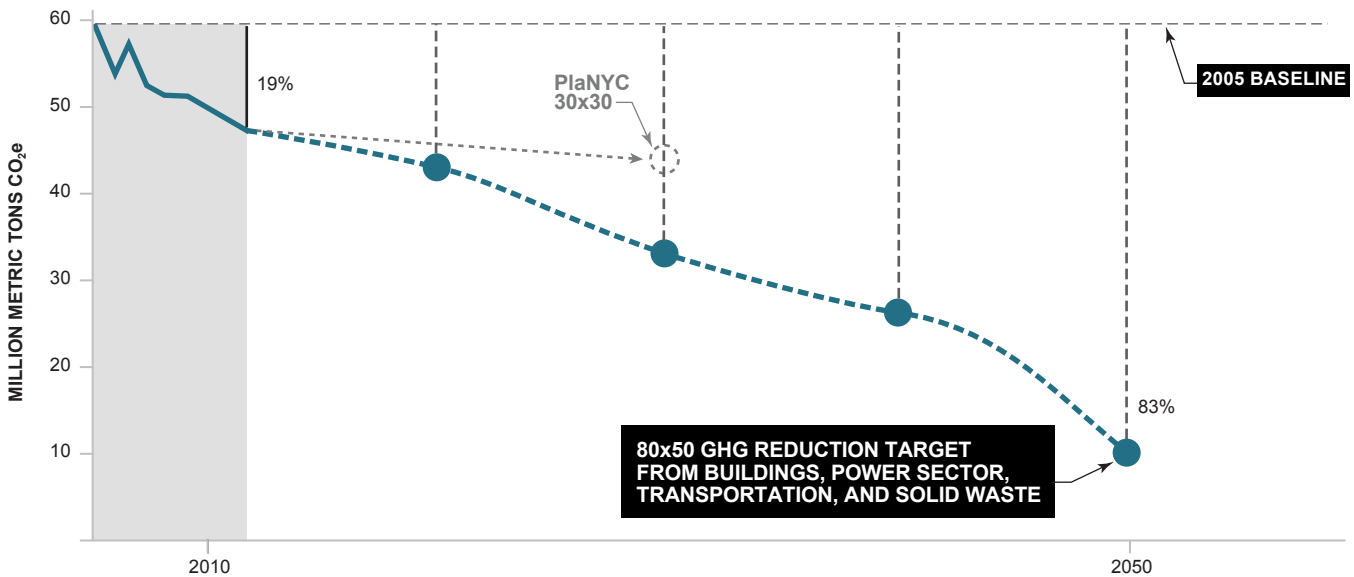
As a result of these and other efforts, New Yorkers have made significant progress towards reducing GHG emissions by 30 percent by 2030. As of 2013, we have achieved a 19 percent reduction in our emissions—bringing us nearly two-thirds of the way to our goal.

However, 30 by 30 is not enough to put us on a pathway toward an 80 percent reduction in GHG emissions by 2050. We will need to accelerate our pace of reductions to reach this goal.

### **New York City's Pathways to Deep Carbon Reductions**

The City has completed a comprehensive study of the technical potential to further reduce GHG emissions and put the city on a pathway toward 80 by 50. The findings were released in *New York City's Pathways to Deep Carbon Reductions*. The study evaluates the potential for achieving deep long-term carbon reductions, taking into account the complexity and uniqueness of New York City's built environment

## Pathways for Reductions in City-Wide Greenhouse Gas Emissions

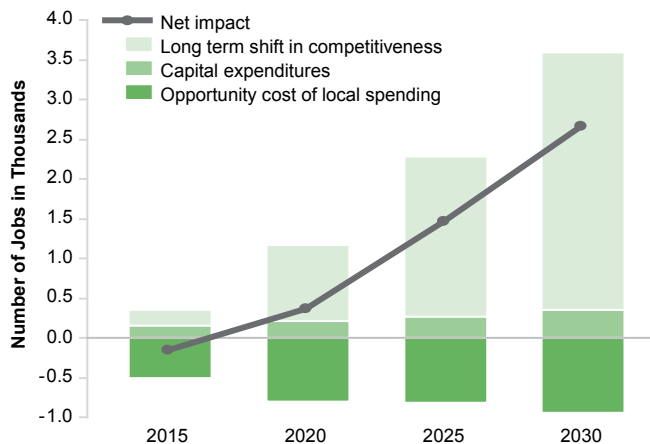


Source: New York City Mayor's Office of Long-Term Planning and Sustainability

and infrastructure. The study examines the feasibility of achieving 80 by 50 based on current technologies and identifies the lowest-cost pathways and highest-priority near-term actions needed to reach this goal.

The study found that 62 percent of the GHG reductions needed must come from more efficient buildings, for a total reduction of 24.7 million metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) from 2011 levels. An additional 18 percent of the reduction (9.3 million MTCO<sub>2</sub>e) would need to come from GHG reductions in the power sector by interconnecting large-scale renewable energy resources to the grid

## Employment Impacts of GHG Reduction Strategies in Buildings



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

and allowing for greater distributed generation. Transportation can contribute to 12 percent of the reduction (7.5 million MTCO<sub>2</sub>e) by almost entirely shifting automobiles powered by fossil fuels to other less polluting technologies and modes of transportation. Reductions in solid waste can contribute eight percent of the total GHG reduction needed (3.5 million MT CO<sub>2</sub>e) by significantly increasing recycling rates and waste reduction efforts, as well as diverting the majority of organic waste from landfills and converting waste into energy at state of the art facilities.

The study also analyzed the economic impacts of more than 70 potential GHG reduction measures. Overall, roughly two-thirds of the studied measures would be cost-effective from a societal standpoint, meaning that economy-wide benefits would outweigh the costs. From the buildings sector, more than 85 percent of the measures would be cost-effective. These investments would yield up to 18,000 new jobs and \$1.9 billion of economic activity a year by 2030.

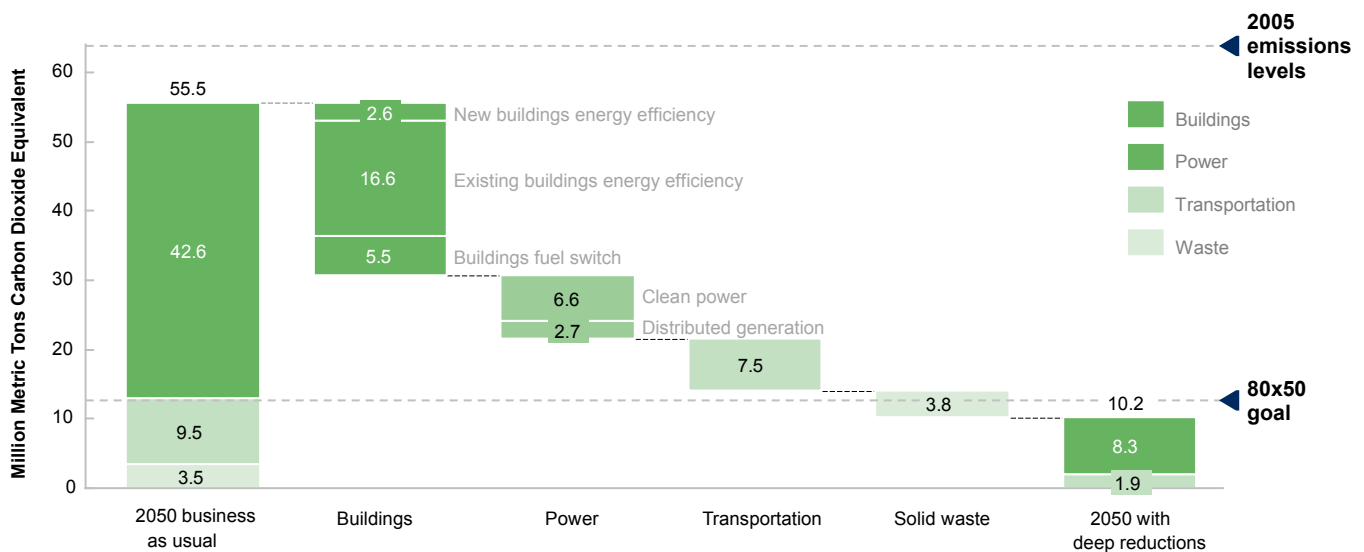
Achieving 80 by 50 is possible, but will be difficult and requires change at an unprecedented scale. Federal, state, and/or regional action will also be important to level the playing field and send a price signal to the marketplace. Key challenges to implementation include market barriers that prevent residents and businesses from retrofitting their buildings, even when it is in their economic interests; the need to coordinate multiple parties with different priorities; and uncertainty about technological possibilities in 2050.

New Yorkers are already relatively efficient, due to our world-class mass transit system and dense living patterns. We also have the tools, momentum, and committed leadership to accelerate carbon reductions from our buildings today that will put the city on a pathway to 80 by 50—showing the way for urban centers around the world. The benefits would be significant, creating thousands of local jobs, stimulating investments in communities, reducing air pollution, and making the city more competitive, livable, and resilient.

## Transforming our Buildings for 2050

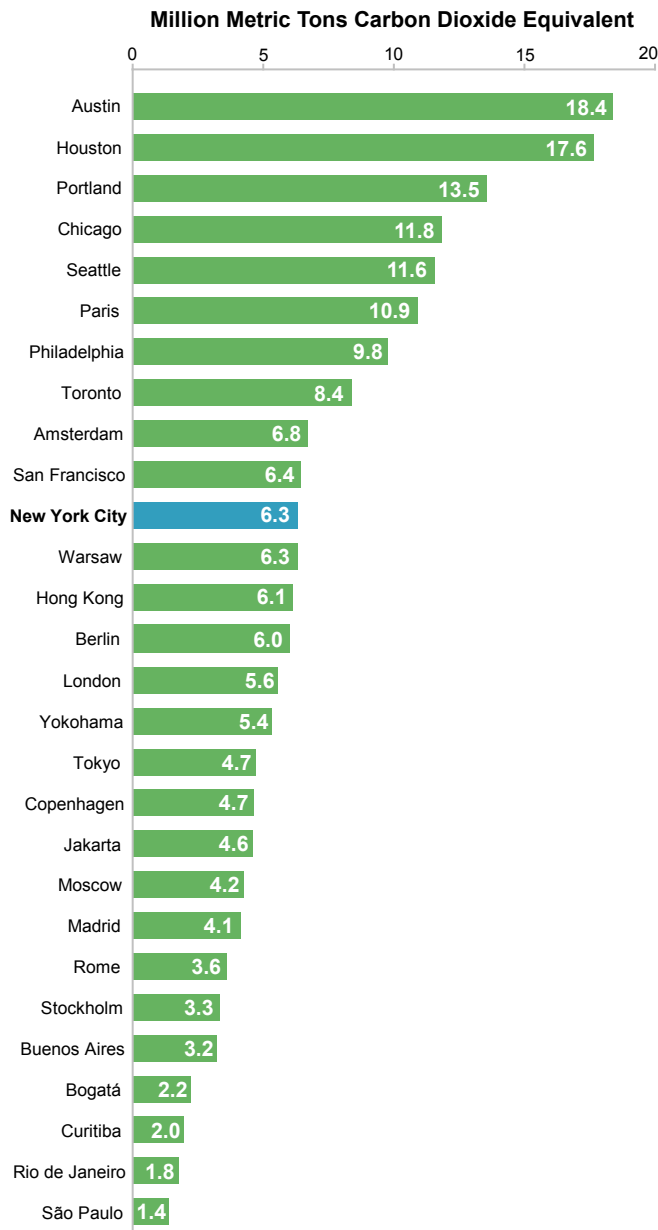
The transition will not be easy. Achieving an 80 by 50 target will require nothing short of a dramatic transformation in the way energy is used in our buildings. Overall, the City must cut energy use across all building sectors on average by at least 60 percent from 2005 levels and switch to renewable fuel sources to be on target for 80 by 50. The remaining reductions would be achieved by reducing our emissions from transportation and waste and cleaning our power supply.

### New York City 2050 GHG Reduction Potential by Sector



Source: New York City Mayor’s Office of Long-Term Planning and Sustainability

## Per Capita Greenhouse Gas Emissions for Selected U.S. and Global Cities



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

Under an 80 by 50 scenario, our aging buildings will need to be transformed into highly energy efficient structures and powered by renewable sources of energy, and new buildings will need to meet the highest possible energy performance standards. All buildings would need to significantly increase the insulation of their exterior walls, roofs, and windows. Buildings would also need correctly-sized and energy efficient heating and cooling systems, and must install high efficiency lighting and appliances. Heating and cooling equipment must also be operated by personnel trained in energy efficiency best practices, and residents would need to make changes to their everyday behavior to conscientiously conserve energy. Eventually, all buildings would also need to move towards low carbon and renewable sources of energy and advanced energy recovery systems.

These improvements, along with additional on-site renewable generation, could reduce New York City's building-based emissions by 60 percent by 2050. Along with reductions from other sectors, this would allow us to achieve 80 by 50.

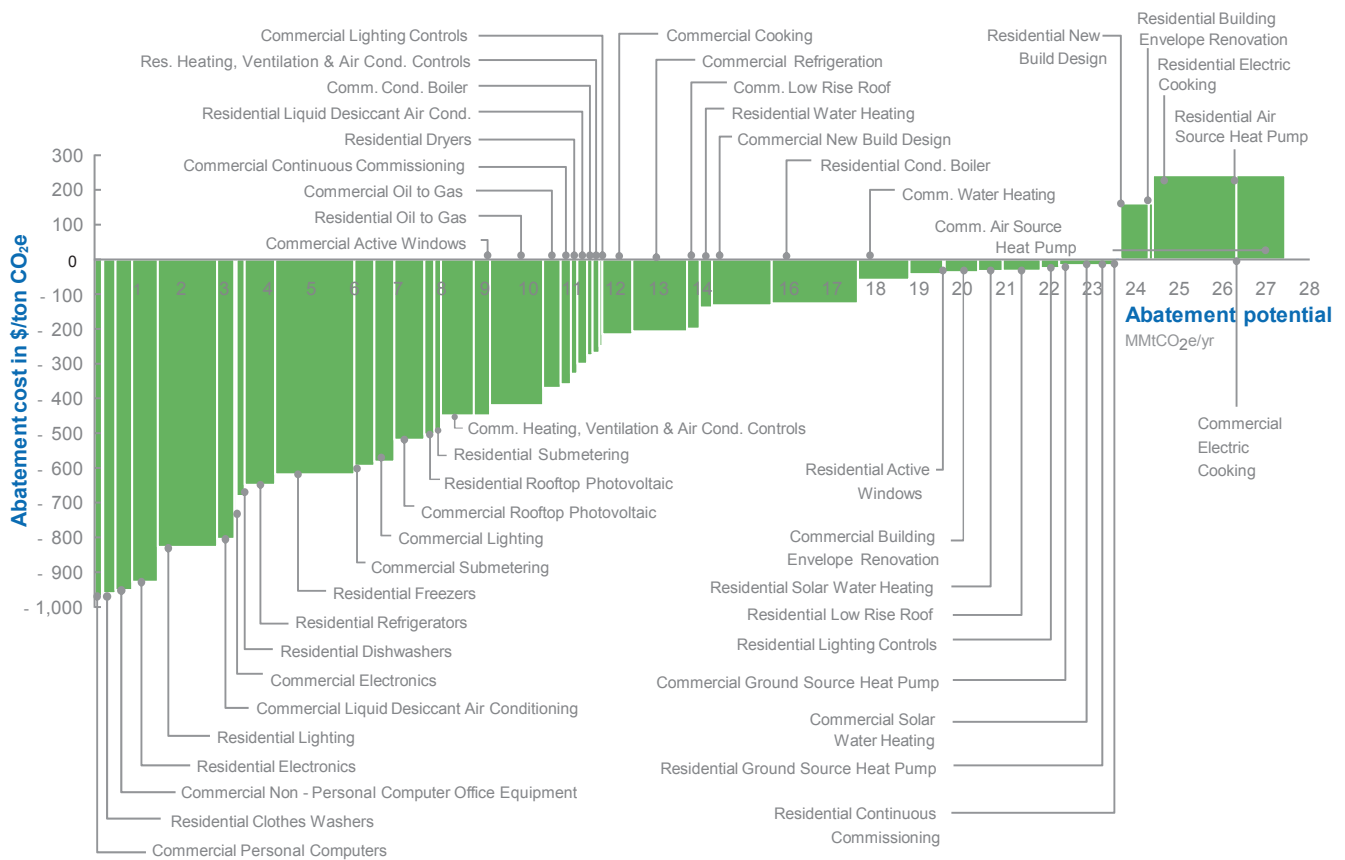
Given current technology, the returns in energy savings for most measures would also justify the expense in the long run. For measures that are not yet cost effective, the City will need to look to new technologies that have not yet been scaled to market. These could include ground source heat pumps, air source heat pumps, biogas, biomass, and advanced biodiesel. If implemented at scale, these systems could allow the City reach 80 by 50 cost effectively.

In the years leading up to 2050, we can focus our efforts on creating policies to accelerate the changes we must make to the way we use energy in our buildings.

We will begin by focusing on measures that are cost effective today that will enhance the efficiency of our building systems, improve operations, and increase insulation. We will look to our public buildings to lead the way, making investments in deep carbon reductions and scaling up innovative technologies across our portfolio of 4,000 City-owned properties.

We must also hold our new construction to ever-higher energy performance standards. The costs associated with meeting these standards are often absorbed during the design phase, and case studies of “Passive House” and other high performance buildings show that construction of these buildings can occur without cost premiums (see following page). To change the way we build, we must also implement extensive education and training across the entire industry spectrum of owners, architects, engineers, and construction workers.

### 2050 Marginal Abatement Cost Curve for New York City Buildings Sector



Source: New York City Mayor’s Office of Long-Term Planning and Sustainability

## What is Passive House?

A building constructed to “Passive House” standards must meet strict energy efficiency criteria for its insulation, space heating and cooling, and primary energy demand within the building. These standards require minimizing heating and cooling loads through substantial insulation; the “passive” use of solar heat and internal heating sources, such as people and electrical equipment, to heat the building; solar shading to cool the building; and heat recovery systems for space heating that is required. Because the building is essentially airtight, a continuous supply of low volume filtered fresh air must also be supplied to living and working spaces, and stale air regularly exhausted from spaces with high-efficiency heat exchange to minimize heating losses.

Passive House standards can be applied to both new construction and renovations. For the renovation of existing buildings, the performance standard is slightly more lenient, but still results in a roughly 90 percent reduction in average heating and cooling energy usage and up to a 75 percent reduction in primary energy usage. A Passive House building can also be any type of building, including an apartment building, a school, an office building, a factory, a supermarket, or a single-family house.

## Case Study: Knickerbocker Commons Affordable Housing

803 Knickerbocker Avenue, Brooklyn  
Architect: Chris Benedict, R.A.  
Owner: Ridgewood Bushwick Senior Citizen’s Council  
General Contractor: Galaxy Construction  
Construction Cost: \$180/square foot  
No. of Units: 24



### Knickerbocker Commons, the first mid-sized apartment building designed to Passive House standards in the United States

Knickerbocker Commons, a six-story residential building containing 24 units of affordable housing, is the country’s first mid-sized apartment building to conform to Passive House design standards. To achieve the strict Passive House standards, each rental unit in Knickerbocker Commons has its own ventilation system and small radiators for heating and airtight window air conditioning units for cooling. In addition, the building features triple-paned windows and a sculpted exterior that shade windows from the sun in the summer and maximize exposure in the winter. According to the project’s architect, Chris Benedict, the building will use 85 percent less energy than is typically required to heat a New York City apartment building in the winter.

The apartment is located in the Bushwick neighborhood of Brooklyn and was developed through HPD’s Low Income Rental Program. Of the 24 units, six units will be rented to households earning up to 30 percent of Area Median Income (AMI), five units will be rented to households earning up to 50 percent of AMI, 12 units will be rented to households earning up to 60 percent of AMI, and one unit will be set aside for a building superintendent. In addition to the residential units, the project includes almost 5,000 square feet of community facility space.

# A Roadmap for New York City's Buildings

To be on a pathway to 80 by 50, we will need to reduce GHG emissions from the energy used to heat, cool, and power our buildings by 30 percent over the next decade. City government can lead the way, and will commit to achieving a 35 percent reduction in emissions in the next ten years.

To achieve these goals, by 2025 we will:

- Complete efficiency improvements in every City-owned building with significant energy use and install 100 MW of on-site renewable power.
- Implement leading edge performance standards for new construction that cost effectively achieve highly efficient buildings, looking to Passive House, carbon neutral, or “zero net energy” strategies to inform the standards.
- Develop interim targets for existing buildings, to be met through voluntary reductions and new regulations, such as performance standards and measure-based mandates, which would be triggered if adequate reductions are not achieved.

We must act now to begin the transformation of our buildings for a low-carbon future. Our public buildings will continue leading the charge by meeting the highest standards, undertaking deep energy retrofits, and installing clean energy generation—and doing so cost-effectively. We know we must also raise the bar for energy efficiency in new construction and substantial renovations.

But we won't stop there. We will also demand better performance from our one million existing buildings. Our buildings must reduce energy use, phase out their worst-performing systems, and phase in systems needed for 21<sup>st</sup> century performance. We will provide tools to help building owners along the way.

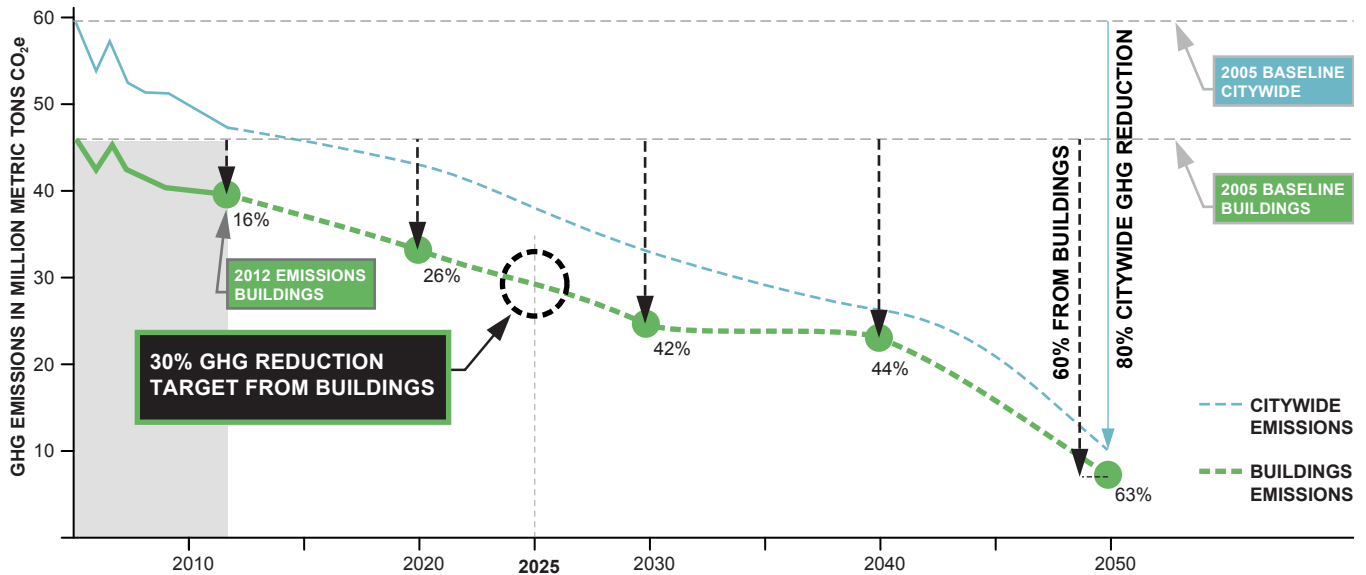
## Setting the Interim Goals

The City must take bold action to transform its building stock, but will do so in a way that is informed by data and supported by stakeholders. Ambitious as these goals are, they are designed to be flexible, with many details to be filled in based on technical analysis and stakeholder collaboration.

To undertake this process, the City will launch a task force and technical study to assess the specific needs of our building stock in the next decade to be on a pathway to 80 by 50.

The study will include collecting and analyzing data on existing energy use across multiple sectors and classes of buildings to better understand energy use patterns. This analysis will then be used to create programs, policies, and potential mandates that reduce buildings' energy use and transition us to a low-carbon future.

## Pathways for Reductions in Greenhouse Gas Emissions from Buildings



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

The City will also convene stakeholders at the request of the Mayor, including leaders in real estate, architecture, engineering, construction, finance, economics, affordable housing, and environmental justice. These stakeholders will help the City develop the scope of the study and determine the appropriate direction of policies.

With the findings from the task force, the City will develop specific energy performance standards for new construction and substantially renovated buildings, along with a plan to phase in higher standards over time. The City will also develop energy performance targets for our public and private buildings that will set them on a trajectory towards 80 by 50, and will define triggers that will be used to track this progress. Finally, the City will begin phasing out the use or installation of the worst-performing systems within existing buildings and phasing in the installation of smarter systems and controls.

The City will continue to track and inventory citywide GHG emissions through the next decade and will establish milestones for future years. If progress does not materialize, the City will enact performance mandates for existing buildings and require GHG reductions as local law to set our buildings on a path towards 80 by 50.



## Work We Will Begin Today

The goals we have laid out for our buildings for the next ten years will guide New York City's progress in reducing GHG emissions. Over the next year, we will work with the task force to develop the right mix of policies, programs, and mandates to achieve the reductions we need from our buildings to put us on a pathway to 80 by 50. But there are also initiatives that we can and will begin today.

The City has already enacted the most robust package of laws in the country to improve the efficiency of its largest buildings and convert to cleaner energy sources. These laws—which include the Greener, Greater Buildings Plan (GGBP), enacted Green Codes, and Clean Heat regulations—are transforming the private building industry. Within the City-owned portfolio of buildings, the laws have also led to efficiency upgrades in more than 200 buildings, including dozens of schools, and new investments in clean and renewable energy generation.

But we can do much more. The GGBP provides private building decision-makers with critical information to understand opportunities to invest in energy and water efficiency, but the law does not require them to act on this information. Major barriers exist that prevent private building owners and decision-makers from making efficiency upgrades at the scale needed to achieve the 80 by 50 goal. It is estimated that just 5–10 percent of buildings that completed an energy audit to comply with LL87 in 2013 have gone on to invest in an energy efficiency upgrade.<sup>9</sup>

Key barriers include limited awareness of the benefits of energy efficiency and difficulty navigating the available financial incentives for retrofits. The opportunity costs of undertaking retrofit projects are high due to limited time and capital to undertake projects. Many building owners are risk averse, and innovative technologies are slow to come to market. And despite recent efforts, newly developed financing options that recognize the value of energy savings have not been scaled up.

As a result of these barriers, New Yorkers are missing out on roughly \$3 billion in energy savings each year that would result from energy efficiency and clean energy improvements.<sup>10</sup> Residents could use the savings to lower their gross housing costs. Owners could reinvest the savings in projects to improve the quality of their buildings or to reinvest back into the economy. This would also lead to job growth and new businesses. The City can and will do more to break down these barriers to catalyze a thriving market for energy efficiency and renewable energy and realize these benefits for New Yorkers.

In our public buildings, we will lead by example by investing in energy efficiency and streamlining programs to best utilize public funding for this goal. We will advance programs that invest in high value projects and perform energy efficiency upgrades in 150–200 City buildings per year for the next ten years.

For our privately-owned building stock, we will focus on catalyzing a self-sustaining market for energy efficiency and renewable energy. We will do this by empowering decision-makers to take action and access the financing and incentive programs

that are available to help cover the costs. We will also continue to improve building standards, support our emerging clean technology entrepreneurs, and partner with private sector leaders to identify innovative technologies and strategies that will enable deeper carbon reductions.

By undertaking these efforts, we will achieve environmental benefits by reducing local air pollution and mitigating rising temperatures, while doing our part to mitigate climate change. All together, the initiatives we have outlined in this plan are expected to reduce GHG emissions from the energy we use to heat, cool, and power our buildings by roughly 3.4 million metric tons of carbon dioxide equivalent—a 10 percent decrease in our current building-based emissions, on top of the 19 percent we have already achieved. This gets us close to our 30 percent goal over the next ten years—but “business as usual” growth and other drivers in emissions increases will need to be offset at the same time.

We will also achieve economic benefits. The retrofits that our public and private buildings undertake are expected to create an estimated 3,500 construction-related jobs and hundreds of other industry jobs. We will also train more than 7,500 building operators and residents in energy efficiency best practices, creating new opportunities for career growth.

And we will advance our affordable housing goals. The efficiency improvements resulting from the initiatives in this plan are also expected to generate \$1.4 billion in annual cost savings for New Yorkers, which can lower housing costs for tenants who pay their utility bills directly and free up capital that owners can reinvest. Over ten years, we expect to help New Yorkers save \$8.5 billion in cumulative utility cost savings—which are funds that can be reinvested in other building upgrades that improve the quality of our building stock, as well as the broader economy.

As a result of this plan, we will accelerate progress towards a more energy efficient, resilient, and sustainable built environment that improves the lives of all New Yorkers.

# Guiding Strategies

There are several guiding strategies that have informed our plan. Employing these cross-cutting strategies will ensure that we achieve the greatest benefits from our efforts.

## 1 Lead by example

The City will pave the way in making our buildings more energy efficient and encourage early adopters to do the same. Specifically, the City will:

- **Set the example with City-owned buildings.** We will implement energy efficiency and clean energy projects public building with significant energy use and make them models for sustainability. The City will act as first adopters to help raise the bar and set the stage for others in the private sector to follow.
- **Lead the effort to improve the efficiency of public housing.** The City will undertake a partnership with the US Department of Housing and Urban Development (HUD) to scale up investments in energy efficiency and improve the quality of New York City's public housing stock.
- **Work with industry leaders.** The City can partner with New York City's building owners, managers, real estate developers, and other industry leaders who are already undertaking innovative projects to improve energy efficiency and work to reach new and underserved communities.

## 2 Empower New Yorkers to take action

To realize the benefits of a more energy efficient building stock, private building owners must be empowered to act. Even for efficiency measures that are cost-effective, there are barriers that prevent building owners from making investments. The City can help overcome these barriers. Key components of this strategy include:

- **Reduce the risks and complexity of undertaking building retrofits.** This includes improving data quality and making information more readily available, streamlining the process of undertaking a retrofit, working together with the industry to enhance the quality of energy services, and improving operations and maintenance.
- **Empower building decision-makers to undertake energy efficiency projects.** To help building owners and stakeholders to understand their options, the City must work to create new approaches to increasing awareness of the benefits, drive demand for retrofits, and build institutional capacity for energy management.
- **Scale up financing options.** NYCEEC and others have created innovative and promising options to finance energy efficiency retrofits that need to be scaled up. There are currently at least \$250 million in financial incentives from NYSERDA and the local utilities through the end of 2015. The City must enable building owners and decision-makers to use these incentives before the programs expire in 2016.

- **Support market adoption of innovative strategies and technologies.** New technologies and strategies are needed to put our buildings on the trajectory towards 80 by 50. The City must ensure that the most promising technologies are able to come to market and can be scaled up citywide.
- **Promote deep retrofit projects.** We know that deep retrofits will be necessary in many buildings to transform our building stock for a low carbon future. The City can lead by example in its own portfolio and work with early adopters to ensure they have access to the proper technical assistance, financing, and trainings.

### 3 Hold New York City's buildings to the highest energy performance standards

Codes set the standard for what we require of our buildings, and must be properly enforced to be effective. To improve our standards, we will:

- **Improve compliance with existing laws.** Laws that are meant to help building owners reduce their energy use and emissions are not helpful if they do not comply. This requires education to ensure that decision-makers understand the requirements for compliance, as well as enforcement when necessary to ensure that the laws are upheld.
- **Raise the bar for energy performance on new construction and renovations.** The City can exercise a great deal of control over the performance of its newly constructed buildings through its building and energy codes. The City will continue to strengthen these codes to ensure that they keep pace with changing technologies and strategies.
- **Ensure that energy efficiency upgrades incorporate resiliency, and vice versa.** The link between sustainability and resiliency is clear, and implementing strategies for both at the same time is often more effective. The City will work to make sure building owners have the technical assistance and financing options they need and ensure that programs are streamlined to incorporate both.

### 4 Ensure benefits are shared by New Yorkers in every neighborhood

We are committed to ensuring that all the benefits of energy efficiency accrue to residents of each and every borough and in every building type. In order to ensure this, the City will:

- **Promote energy efficiency in small and mid-sized buildings.** Many current policies focus solely on assisting our largest buildings over 50,000 square feet in area. Going forward, we will provide more assistance to help small- and mid-sized buildings in neighborhoods across New York City become more efficient.
- **Promote energy efficiency investments in affordable housing.** Our affordable housing sector includes some of our oldest and most vulnerable housing. Address-

ing it will require specialized financing and technical assistance, but will help us mitigate rising housing costs and enhance the quality of our affordable housing stock.

- **Ensure the local workforce benefits.** Increasing the demand for energy services will create new jobs and career opportunities for New Yorkers, but will also require new skills. Training programs must be prioritized for New Yorkers in underserved communities, and local firms must have access to business development services so they can compete with non-NYC firms.

## 5 Use data, analysis, and stakeholder feedback to drive the approach

The City has bold goals for its buildings, and the City is committed to using data, analysis, and stakeholder collaboration to inform its approach. In particular, the City will:

- **Make use of the growing trove of energy use data about our buildings.** The Greener, Greater Buildings Plan has shed more light on buildings' energy use than ever before. The City will continue to use this data to inform its policies, and will combine it with other data sources covering resiliency, real estate markets, jobs, and socio-economic conditions to create holistic, data-driven policies. The City will also work with the local utilities and energy services providers to improve the quality of and access to buildings' energy use data.
- **Conduct engineering and other technical analyses where information is missing.** Buildings are complex, and the industry has more to learn about how to improve energy performance. The City will contribute to this effort by supporting engineering and technical analysis to fill in the missing pieces and move the industry towards higher levels of energy performance.
- **Enlist stakeholders for collaboration.** Close collaboration with New York City's real estate, building management, labor, architecture, and engineering experts is crucial to shaping policies and addressing the needs of highly specific building sectors and communities.
- **Closely track our own progress.** We will create a Compstat-like portal at the Office of Long-Term Planning and Sustainability, in partnership with Mayor's Office of Operations and DCAS, to track the progress towards our goals and provide a report of our progress each year.

Chapter 2

# Public Buildings as Models for Sustainability

# Making Our Public Buildings Models for Sustainability



New York City’s public buildings include an awe-inspiring array of symbols from our City’s past, present, and future. With more than 4,000 buildings in the City’s portfolio—including public schools, libraries, courthouses, wastewater treatment facilities, firehouses, and offices—the opportunities and challenges for making these buildings more efficient and sustainable are enormous.

City government has been leading the charge toward a low-carbon future. When the City set the goal to reduce GHG emissions by 30 percent by 2030, City government committed to achieve this reduction from municipal buildings on an accelerated timeframe.

The City enacted a comprehensive energy management strategy for its portfolio of buildings. The City began benchmarking public buildings for energy performance in 2010, a year ahead of the private sector, and included all buildings greater than 10,000 square feet in floor area. The City has also conducted energy assessments for nearly 300 public buildings, performed retro-commissioning studies on 250 buildings, and implemented energy efficiency upgrades and renewable energy projects in more than 200 buildings.

In executing this ambitious plan, the City has learned that multiple strategies and pathways are needed to cost-effectively achieve the greatest results. We will expand on our achievements to fully realize the tremendous reduction potential across the municipal portfolio. Our proposals will promote deep energy retrofits, scale up renewable energy generation, and pilot new technologies on City-owned properties. We will also invest in training opportunities for our workforce and explore new opportunities to improve the efficiency and quality of our public housing.

With these proposals, the City will accelerate the pace of its energy efficiency and renewable energy projects on its own properties. The benefits will accrue to all New Yorkers in the form of good jobs, new economic development, energy cost savings, improved resiliency, energy reliability, and reduced GHG emissions that will help put us on a pathway to 80 by 50.

## Invest in High Value Projects in All City-Owned Buildings

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**270,000**

MtCO<sub>2</sub>e reduced

**\$105 million**

Annual Cost Savings

**470**

Jobs Created

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The City launched the Accelerated Conservation & Efficiency (ACE) program in June 2013 to deliver quick, cost-effective energy-reducing projects that target the individual needs of City agencies. Through a competitive solicitation process managed by the City's Department of Citywide Administrative Services (DCAS), ACE provides funding to otherwise un-funded high value capital projects that reduce energy costs and GHG emissions and can be implemented by agencies. The program leverages agencies' energy expertise and existing contract capacity to deliver quick and creative energy savings and building improvements. ACE prioritizes projects with a low cost per ton of GHG emissions reduced, high energy cost and operational savings, public health and resiliency benefits, and a quick installation timeline.

The success of ACE has been impressive. Agencies requested over \$350 million in the last year for a wide range of energy-saving projects, clean-technology pilots, and efficiency measures in capital improvements. DCAS awarded nearly \$150 million for projects across the City, which are expected to result in a reduction of over 54,000 metric tons of carbon dioxide equivalent. The projects include LED lighting retrofits at firehouses, indoor pool cover installations at public recreation centers, and steam system optimization at schools.

Now, the City will expand the ACE program to reach more agencies, including Department of Homeless Services, Administration for Children's Services, Department for the Aging, and City libraries. DCAS will also provide additional support and guidance to assist these agencies in developing high-value projects for upcoming funding rounds. That support will include help identifying high value projects and ensuring that appropriate contracts are available as a vehicle for projects.

DCAS will also collaborate with agencies that have capital improvement projects already underway to incorporate in-scope energy efficiency measures. This includes funding the incremental cost of the measures in order to maximize the energy efficiency gains. For example, an agency planning to install an Energy Code-compliant boiler could apply for ACE funding to cover the incremental cost of a premium efficiency boiler and high efficiency motor replacements. To identify projects, DCAS will partner with the Department of Design and Construction (DDC) and the School Construction Authority (SCA) to advance efficiency opportunities across the existing pipeline of capital improvement and equipment replacement projects.

### Expected Outcomes

Expanding the ACE program will lead to an estimated additional 270,000 metric tons of GHG reductions annually by 2025, on top of the 54,000 metric tons already reduced through the first rounds. The program is also expected to generate over \$105 million in annual energy cost savings for the City and will create an estimated 470 direct jobs.



## Case Study: Accelerated Conservation & Efficiency Projects at FDNY and Parks Department



The ACE program is already having an impact on reducing citywide GHG emissions and lowering the city's energy bills. The Fire Department of New York (FDNY) was awarded ACE funding to replace older inefficient lighting fixtures with LED lighting fixtures at 37 firehouses and offices. In addition to reducing electric demand by providing brighter light at a lower wattage, LED lamps last longer which means that FDNY will also save on maintenance costs. Using a lighting planning software, FDNY was able to reassess the layout of lighting fixtures in their spaces to deliver more light with fewer fixtures. The FDNY replaced T12 fixtures and lamps with LED fixtures and lamps, for a direct savings of over 50 Watts per lamp – a benefit that is especially important at firehouses which operates 24/7.

The City is expected to widely deploy LED lighting in municipal buildings, and FDNY's venture into LED lighting will provide critical data to inform further investments. The combined benefits of this LED project at FDNY include savings of over



520 metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e), and energy bill cost reductions to the City of over \$420,000 per year.

In another project, the Department of Parks and Recreation (Parks) was awarded ACE funding for the installation of pool covers at seven recreation centers. Pool covers improve heat retention, saving on heating from gas and oil, and also reduce evaporation, which saves electricity by reducing the need for dehumidification.

This ACE-funded project is expected to save the City \$76,000 in energy costs including 200,000 kWh of electricity, nearly 50,000 therms of natural gas and reduce fuel oil consumption by 15,000 gallons annually. The total projected savings of 478 metric tons of GHG emissions is equivalent to the benefits of planting 12,250 trees. Results of the project will be measured and verified by Parks and third-party consultants to guide future investments in pool covers around the city.

## Expand Solar Power on City Rooftops

**35,000**  
MtCO<sub>2</sub>e reduced

**\$8 million**  
Annual Cost Savings

**160**  
Jobs Created

### Port Richmond Wastewater Treatment Plant



The City has been leading the charge to expand renewable energy generation in New York City. So far, the City has installed roughly 0.7 Megawatts (MW) of solar power on City-owned rooftops, and has another 1.9 MW underway at buildings including schools, a garage, and a wastewater treatment plant.

In the coming years, the City will significantly increase its renewable energy resources, which will have a significant impact on reducing GHG emissions and catalyzing job creation.

The City will expand solar photovoltaic (PV) on the rooftops of public buildings—in particular, at schools—to 100 MW of solar capacity. The City will develop cost-effective projects by maximizing all available solar incentives available through NYSERDA and the local utilities.

The City will also lay the foundation for the installation of solar power systems with energy storage capacity. Solar PV paired with battery storage can significantly lower operating costs by providing an alternative source of electricity during peak demand, when electricity is most expensive. Reducing electric demand also has the potential to offset grid constraints and help avoid power outages. Deploying solar power systems with battery storage will provide the opportunity to reduce energy use in grid-

constrained areas during times of peak demand, which will lower utility bills and can offer reliable alternative power for New Yorkers during extended outages.

The City will also install solar power on emergency shelters as a source of back-up power that will increase our resilience—a need that was made clear during Hurricane Sandy. Solar arrays installed on the City's emergency shelters, paired with battery storage could supply some or all of the power needs during blackouts and help conserve fuel at large shelters.

DCAS has applied for NYSERDA solar incentives to co-fund the installation of 6.25 MW of solar at 24 recently re-roofed schools. The City will ensure the installation of solar panels at these school sites become environmental educational opportunities for students, creating an opportunity to engage the next generation in our sustainability goals.

Over the next ten years, the City will deploy 100 MW of solar power on City-owned roofs. These installations will relieve constrained areas of the electric grid, increase resiliency, provide long-term and carbon-free electricity to City buildings. The installations are expected to reduce annual GHG emissions by an estimated 35,000 metric tons of carbon dioxide equivalent, save the City \$8 million in annual energy cost savings, and create 160 construction-related jobs by 2025.

## Implement Deep Retrofits in Key City Facilities

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**100,000**

MtCO<sub>2</sub>e reduced

**\$55 million**

Annual Cost Savings

**420**

Jobs Created

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With more than 4,000 buildings in its portfolio across a variety of building types—including schools, public hospitals, police precincts, courthouses, office buildings and park recreation centers—the City has abundant opportunities to reduce GHG emissions through deep energy retrofits and energy efficiency upgrades. The City’s building retrofit program has had considerable success in reducing energy use and GHG emissions, completing over 190 comprehensive building energy efficiency retrofit projects to date, with annual energy cost reductions of nearly \$10.5 million.

To measure the energy performance of its portfolio and identify opportunities for retrofits, the City benchmarks all City-owned buildings over 10,000 square feet and conducts energy audits and retro-commissioning studies. The City then prioritizes buildings with the greatest opportunity for energy savings through a comprehensive retrofit and implements projects based on the studies’ recommendations.

The City will expand the types of projects implemented and increase the overall number of energy efficiency retrofits in City buildings. To streamline the process, the City will procure new types of contracts to perform deep retrofits, targeting City buildings with the largest energy demands and most complex energy consuming systems.

The City will also increase its investments in clean distributed generation, such as combined heat and power (CHP) and renewable generation like solar energy. This will not only support the City’s efforts to reduce GHG emissions, but also increase the resiliency of our buildings and electric grid. The City has already installed 1.4 MW of clean distributed generation since 2010, with another 27 MW underway, including a 15 MW CHP plant at the Riker’s Island correctional facility. CHP plants provide efficient and reliable alternative sources of power, and are a particularly good fit for the City’s public hospitals and wastewater treatment plants.

### Expected Outcomes

By increasing the City’s investments in comprehensive retrofits of its own facilities, the City government will be able to significantly decrease its carbon footprint and develop case studies of deep energy improvements. Overall, the program is expected to reduce citywide GHG emissions by roughly 100,000 metric tons of carbon dioxide equivalent, generate \$55 million in annual energy cost savings, and create 420 construction-related jobs by 2025.

## Case Study: Combined Heat and Power at Rikers Island

New York City's Department of Correction (DOC) is one of the largest municipal correctional systems in the United States. DOC currently operates ten facilities on Rikers Island, which require reliable electricity 24 hours a day, 7 days a week, 365 days a year. Rikers Island has a continuous thermal load for heating and hot water for showers as well as laundry, kitchens, and a bakery. The nature of the operations and energy load at Rikers made it a great technical fit for CHP.

CHP uses waste heat from the electricity-generating process to produce steam for heating, which makes such systems more efficient than boilers. The new CHP facility underway at Rikers Island will include two 7.5 megawatt (MW) combustion turbines with heat recovery steam generators, for a total of 15 MW installed capacity. The facility will generate nearly all of the electricity and steam needed to serve Rikers Island, and is projected to save the City nearly \$7 million annually.



The facilities on Rikers Island draw power from the Queens electrical

grid, which can be overburdened at periods of peak demand, especially during the summer months. The electricity reduction projected from the Rikers Island facility is equivalent to taking roughly 15,000 single family homes off the grid, which will support the reliability of electrical service for all New Yorkers in this service area. The plant will also provide a reliable energy source to Rikers, ensuring resilient operations in the event of a power outage. The CHP plant is expected to come online at the end of 2014.

## Improve Building Operations and Maintenance

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**175,000**

MtCO<sub>2</sub>e reduced

**\$12 million**

Annual Cost Savings

**550**

Jobs Created

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Keeping complex mechanical and electrical systems in a state of good repair is essential to maintaining an energy efficient building. Instituting operations and maintenance best practices ensures that controls, equipment, and other building systems are operating as originally designed and reduces the effects of wear and tear that can lead to energy waste. Enhancing operations and maintenance practices across our 4,000 City-owned facilities is a cost-effective opportunity to maximize city investments and reduce GHG emissions.

The City will expand two key initiatives that improve operations and maintenance in City-owned buildings: the Preventative Maintenance Collaborative and the Expenses for Conservation and Efficiency Leadership (ExCEL) program.

The Preventative Maintenance Collaborative funds skilled staff, tools, and materials necessary to properly manage and maintain municipal buildings—particularly as building systems become increasingly complex and digitized. The program leverages the City’s existing energy training and educational courses to teach operations and maintenance best practices and help City employees master new building system technologies. The program also ensures that each agency has the appropriate staffing levels to maintain a safe, efficient, and comfortable environment in our public buildings and will provide support to help agencies develop a coordinated strategy and ensure that best practices are shared across the City.

The Expenses for Conservation and Efficiency Leadership (ExCEL) program provides City agencies with an additional opportunity to apply for funding to further support operations and maintenance improvements. These projects can include maintenance and repair upgrades, basic energy-saving retrofits, diagnostic tool purchases, and specialized training. This allows DCAS to allocate funds on a competitive basis, prioritizing investments that focus on innovation and have the greatest anticipated energy savings. Past projects include LED lighting upgrades, battery storage systems; boiler testing and tune ups; installation of digital controls; and heating, ventilation, and air conditioning (HVAC) system optimization.

### Expected Outcomes

Together, these two programs improve the way City-owned properties are operated and maintained and will help extend the useful life of our building systems. City employees hired through the Preventative Maintenance Collaborative will use their skills to help the City reduce emissions by an estimated 130,000 metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) and save \$10 million in lower energy costs annually by 2025. The ExCEL program is expected to reduce GHG emissions by an additional 45,000 MTCO<sub>2</sub>e and save \$1–2 million in annual energy costs by 2025. All together, the programs are also expected to reduce 175,000 MTCO<sub>2</sub>e, annually save \$12 million, and create 550 new construction-related jobs.

## Case Study: Energy Management Institute

Developing the energy efficiency skills of building staff through training and education is critical for any successful energy management program. In 2009 the City created the Energy Management Institute in partnership with the City University of New York (CUNY) Building Performance Lab to offer a broad range of trainings, certifications, and other technical support needed to bring our municipal employees to the forefront of energy management best practices. The Institute developed a comprehensive training curriculum to teach municipal building operators how to optimize building systems, use new technologies, and extend the operational life of building equipment. Courses include the Building Operator's Certification (BOC), professional certification exam preparation courses, such as the Certified Energy Manager (CEM) course, and trade-specific energy management trainings. As preventative maintenance efforts continue to grow and City facility staff is introduced to new technologies, the Energy Management Institute will be expanded with new classes and specialized programs to meet the expanding needs of the municipal workforce.

Since 2009, with more than 2,000 City employees have attended classes and 1,000 certifications have been awarded. Increasing this investment in our municipal workforce will ensure that staff have the knowledge and skills that will help us realize our low carbon future.



## Case Study: Bringing City Buildings into a State of Good Repair

In 2013, the Department of Parks and Recreation (DPR) developed a model program to enhance energy efficient building operations and to keep park facilities and recreation centers in a state of good repair. With this program, DPR was able to repair equipment that was scheduled for replacement by hiring and training a team of skilled staff and implementing industry best practices in building maintenance, deferring over \$3.2 million in capital costs. Optimizing building systems is expected to save the agency an additional \$700,000 in energy costs per year across their 50 largest buildings and will reduce annual GHG emissions by an estimated 2,500 metric tons.

Recognizing the success of this model, the City is expanding this program to other agencies to ensure that controls and equipment are operating as specified—a simple, cost-effective solution for energy efficiency that will be institutionalized across the City portfolio.



## Pilot New Clean Energy Technology in City Buildings (IDEA)

New technologies that are under development or have yet to be developed could offer unforeseen opportunities for energy savings and reductions in GHG emissions. A new municipal program managed by DCAS called Innovative Demonstrations for Energy Adaptability (IDEA) will capitalize on these opportunities.

The IDEA program will identify emerging energy technologies and evaluate their potential for installation across the City's portfolio. Launched in January 2014, IDEA engages vendors of emerging and underutilized energy technologies to test these solutions in City buildings. IDEA helps streamline vendor engagement, pilots new technologies that can advance our broader carbon reduction goals, and can lead to smart, targeted City procurements for citywide deployment of proven solutions.

The pilot of IDEA, which focused on building controls, led to agreements with 12 vendors for demonstrations of new technologies in 23 buildings across eight City agencies. Building on the success of the pilot phase, the City will begin launching two phases annually and increase collaboration with local cleantech startups and incubators, such as the Urban Future Lab. The program will use energy performance data from demonstration projects to evaluate and share results from the new technologies.

As IDEA expands, new phases will target specific topics that have been identified by City agencies' energy and facility management staff. Demonstrations will be prioritized based on the potential for energy cost savings, GHG reductions, resiliency benefits, and job creation potential. Following the completion of each IDEA phase, DCAS will assess performance data from demonstrations and choose solutions to be replicated in other City buildings, which could eventually lead to larger-scale procurements. DCAS will then share success stories with the private sector through a central clearinghouse of case studies, performance data, and analysis. The City will also partner with stakeholders and educational resource centers, such as Green Light New York, to share this information through conferences, breakout sessions, panels, and cleantech consortia events.

The IDEA program also creates an opportunity to deepen municipal workforce training and provide employees with new skills. DCAS will partner with stakeholders to develop technology-focused trainings for City facilities and energy management staff that work in the City's wide array of building types. Through this program, the City can both scale up innovative new technologies and help create our 21<sup>st</sup> century municipal workforce.

## Improve the Efficiency and Quality of New York City's Public Housing

The New York City Housing Authority (NYCHA)—which houses more than 400,000 New Yorkers in 334 public housing developments around the five boroughs—has already made a concerted effort to reduce its energy and water consumption through upgrading building systems and improving regular operations and maintenance. However, rising utility costs are placing a significant strain on NYCHA's operating budget. In its FY2015 operating budget, NYCHA allocated \$589 million—or 18 percent of total spending—for utilities, nearly double from a decade ago. This is due to higher energy and water costs as well as aging and inefficient plants and infrastructure. The federal government reimburses NYCHA for the majority of this bill, but payments have not kept pace with escalating utility costs.

NYCHA can achieve three critical objectives through scaling up its energy and water efficiency efforts. First, by reducing consumption, NYCHA can mitigate the impact of ever-rising utility costs on its operating budget. Second, NYCHA can preserve its limited capital budget for vital repairs and building upgrades, while leveraging private sources to finance energy and water upgrades through capturing the savings. Finally, NYCHA can make a significant contribution to the City's greenhouse gas reduction progress.

To realize this opportunity, NYCHA and the City will undertake a partnership with the US Department of Housing and Urban Development (HUD) and private lenders to develop a multiphase, large-scale Energy Performance Contract (EPC) that will enable NYCHA to finance energy and water efficiency measures through capturing the savings that will accrue over time. An EPC could include the installation of high-efficiency lighting in common areas and apartments, boilers, controls, and other measures across many of its developments. NYCHA and the City will partner with HUD to streamline the EPC process and explore the opportunity to leverage financial incentives from third parties as part of the EPC.

Efficiency measures that NYCHA could pursue include lighting retrofits in apartments and common areas are highly cost-effective. Roughly half of NYCHA's developments have yet to undergo comprehensive upgrades. Implementing lighting retrofits across the portfolio could create an opportunity to cross-subsidize the installation of more costly measures such as exterior lighting or boilers.

Wireless thermostats and building management systems present another opportunity. NYCHA has installed automated heating controls at its largest heating plants, but these systems lack thermostats within apartments. This decreases the efficiency of the heating controls and can lead to comfort issues, such as over-heating. Installing wireless thermostats in approximately 25% percent of applicable apartments to continuously monitor indoor apartment temperatures and communicate with a centralized building management system could achieve an estimated 10 percent reduction in its annual heating fuel usage.



Additional energy and water efficiency measures to consider include improving motors and house pumps to handle distribution of water to the roof top tanks; installing water savings devices for showers, faucets and toilets; upgrades to exterior landscape lighting; providing air conditioner covers to prevent winter drafts through existing air conditioners; and upgrading elevators and boilers.

## Chapter 3

# A Thriving Market for Energy Efficiency and Renewable Energy

# Create a Thriving Market for Energy Efficiency and Renewable Energy

A thriving, self-sustaining market for energy efficiency upgrades and renewable energy generation is necessary to reach our GHG reduction goals and to be on a pathway towards 80 by 50. However, there are significant market barriers that prevent building owners and decision-makers from taking actions to improve building efficiency and invest in clean energy, even when it is in their economic interest.

The City can play a role in creating a thriving market for energy efficiency and renewable energy by reducing or removing these barriers. The comprehensive proposals we outline below will help building owners and managers access more information about energy use and enable them to undertake building upgrades. The City will focus on providing information and assistance to reach the widest possible audience, engaging communities and empowering individuals in the effort to become more energy efficient and resilient, promoting deep retrofit projects and investments in renewable energy, providing financial resources to cover the costs of undertaking projects, and collaborating with key stakeholders such as the State and the local utilities. The City will also ensure that our affordable housing stock is a key focus across all of our programs and that the local workforce is well positioned to tap into the new jobs and economic opportunities that will result from the growing market.

Together, our proposals will remove major barriers that are preventing New Yorkers across all neighborhoods from participating in citywide efforts to lower carbon emissions, and will foster a more dynamic and self-sustaining market for energy efficiency and renewable energy. This market is the foundation for our vision of a sustainable and resilient city where the benefits are equitably shared.



# Launch an Energy and Water Retrofit Accelerator

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**940,000**  
MtCO<sub>2</sub>e reduced

**\$360 million**  
Annual Cost Savings

**430**  
Jobs Created

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Private building owners and managers are in a unique position to help reduce city-wide GHG emissions, lower energy costs, and improve resiliency through investments in energy and water efficiency. With the implementation of the Greener, Greater Buildings Plan, the owners and decision-makers of the City’s largest buildings now have more information than ever before to understand their energy and water consumption and prioritize their investments in new equipment and maintenance.

Many building owners are undertaking efficiency measures as a result of this information. Forward-looking property owners and managers, including those participating in the City’s voluntary NYC Carbon Challenge, have already recognized the importance of making smart investments to improve their buildings and save on energy. But many decision-makers still face a range of obstacles to pursuing building upgrades, including limited financial and human capital, difficulty navigating available financing and incentive programs, and the complexities of undertaking energy and water efficiency upgrades.

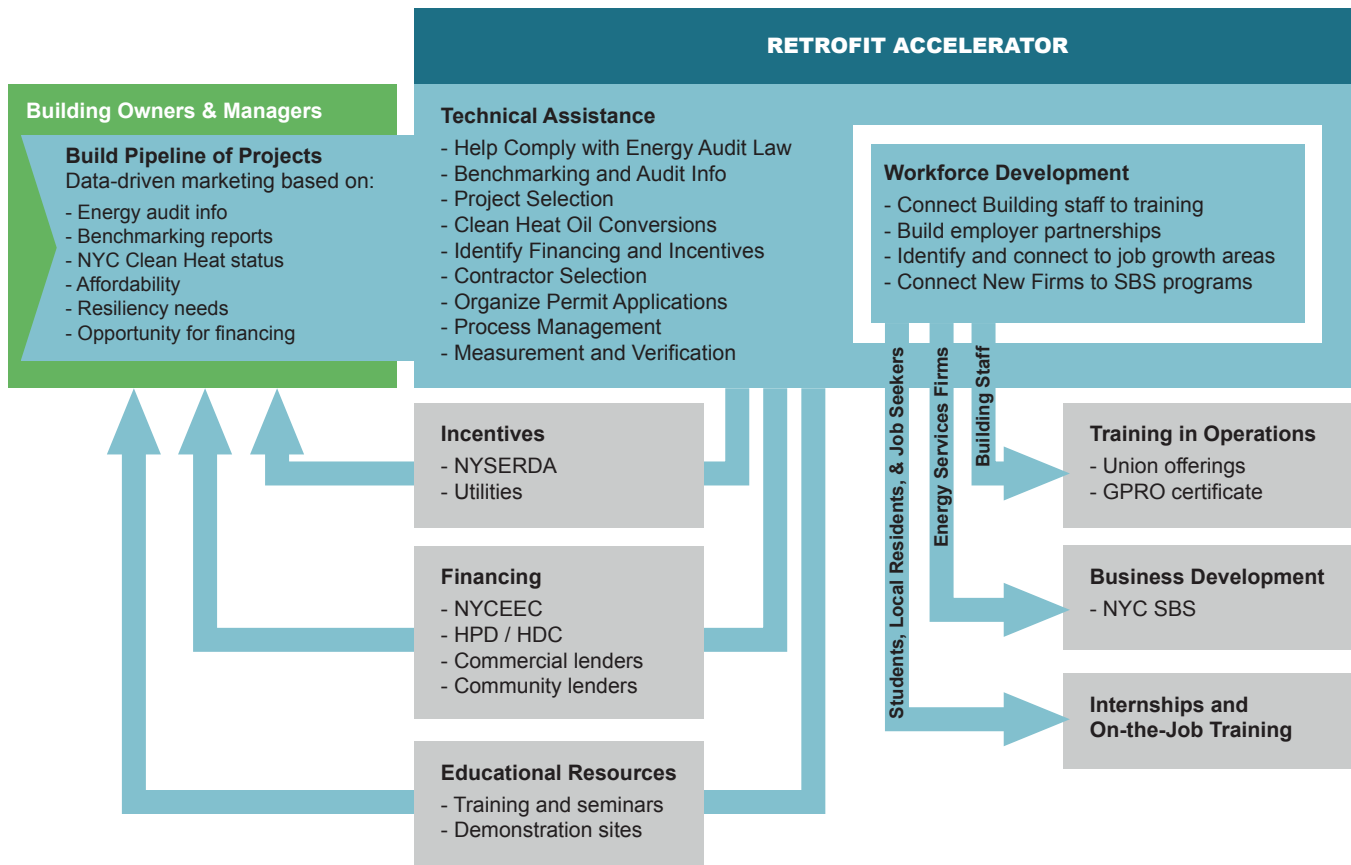
These barriers have prevented efficiency investments from being scaled up to reach their full potential. New Yorkers are missing out on \$3 billion or more in savings on their utility bills each year that would be achieved if they reduced building energy use by an average of 15 percent, as well as the full range of environmental and health benefits that would result from making energy efficiency and clean energy investments in their buildings.

## **The Retrofit Accelerator**

The City can help overcome these barriers. The City will launch a coordinated outreach and assistance program to help private building owners and decision-makers accelerate efficiency retrofits and clean energy investments. This “Retrofit Accelerator” will include a team of customer service and building experts who will provide technical assistance to help remove the complexities of undertaking projects, using the recommendations from buildings’ LL84 benchmarking, LL87 energy assessments, and other data sources as the basis of the assistance.

The Retrofit Accelerator will build on the successful model of the NYC Clean Heat program to accelerate heavy heating fuel oil conversions to cleaner fuels in buildings. The assistance provided will include support to interpret energy use information from LL84 and LL87 and help in selecting the right projects to pursue. The Retrofit Accelerator team can then help decision-makers select contractors, explain the necessary permits, and navigate the existing financing and incentive programs to help cover costs. Building maintenance staff will also be given access to trainings and education to help improve the quality of operations and maintenance. As a result, the program will bring experience in energy management and project planning to building owners, managers, tenants, and staff that will help them continue to undertake projects in future years.

## Accelerator Program Technical Assistance and Outreach Process



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

The Retrofit Accelerator will seek to complement, as opposed to replicate, existing financing, incentive, and assistance programs available in New York City. The Retrofit Accelerator team will direct new customers to existing programs offered by NYSERDA, NYCEEC, and the local utilities, as well as to water conservation programs such as the NYC Department of Environmental Protection's toilet replacement program and educational programs through organizations such as Green Light New York.

### Using Data to Drive our Approach

One of the keys to the success of the Retrofit Accelerator will be the use of energy and water data from buildings to help decision-makers identify and prioritize the right projects. Under the Greener, Greater Building Plan, the largest buildings in the City must measure their energy use annually (LL84) and undertake a detailed assessment of building systems and equipment once every ten years (LL87), which includes a list of opportunities for efficiency upgrades along with the costs and potential savings from implementing these projects. The Retrofit Accelerator can pair this data with heating fuel oil conversion status, affordability status, resiliency needs, and other factors to identify and assist buildings with the greatest opportunity and need for assistance. As a result, we will accelerate investments that have the greatest impacts in improving environmental quality and mitigating rising housing costs.

## Integrating Efficiency and Resiliency

The Retrofit Accelerator will help building owners and decision makers coordinate both efficiency and resiliency investments. Because the scope of most efficiency improvements does not trigger compliance with flood resistance regulations, buildings may miss the opportunity to protect new equipment against flooding or other extreme weather events. For buildings located in the 100-year floodplain, for example, the Retrofit Accelerator will help owners and tenants determine how to flood-protect the building and its electrical and heating systems. For buildings across the City, the Retrofit Accelerator will also help owners consider redundancy to systems to ensure reliability during blackouts. Assistance will also be prioritized for buildings providing a critical function, such as medical and emergency services, and where vulnerable populations are at risk.

## Addressing Affordable Housing

The Retrofit Accelerator supports the City's commitment to solving the affordable housing crisis and improving the quality of the city's affordable housing stock. Roughly half of the properties assisted through the platform of the Retrofit Accelerator are expected to be government-assisted affordable properties or at least 50 percent rent-regulated or rent-stabilized. Several members of the program team will work directly with the City's Department of Housing Preservation and Development (HPD) and Housing Development Corporation (HDC) to identify and assist buildings in their portfolios, particularly when it aligns with capital planning cycles. The Retrofit Accelerator will also connect buildings with existing financial products that have been created for the affordable housing stock, such as the joint NYCEEC-HDC Program for Energy Retrofit Loans (PERL).

## Preparing the Workforce

As building owners begin energy efficiency projects, demand will grow for skilled workers in energy services, engineering, and building trades, leading to hundreds of new jobs and opportunities for new business model innovations. The Retrofit Accelerator will have a dedicated workforce coordinator who will build partnerships with potential employers and connect New Yorkers to training programs and placement services to ensure that the local workforce benefits. In addition, the City's Department of Small Business Services (SBS) will offer business development services for local firms to help them grow their businesses, creating new opportunities for economic development.

## Expected Outcomes

The Retrofit Accelerator is expected to stimulate energy and water efficiency retrofits and clean energy investments in more than 20,000 buildings (7,500 properties) over the course of ten years. The program is expected to touch more than 700 million square feet of built space and 400,000 residential units, representing almost 15 percent of the City's total built square footage and 10 percent of residential units.

In total, the retrofits these buildings undertake are expected to reduce citywide emissions by 940,000 metric tons of carbon dioxide equivalent annually by 2025. The program will also reduce annual water consumption by an estimated 600,000 gallons. This is expected stimulate roughly \$100 million in annual construction activity, creating more than 400 construction-related jobs. They will also generate an estimated \$360 million in average annual cost savings by 2025.

## Energy Efficiency Financing and Incentives

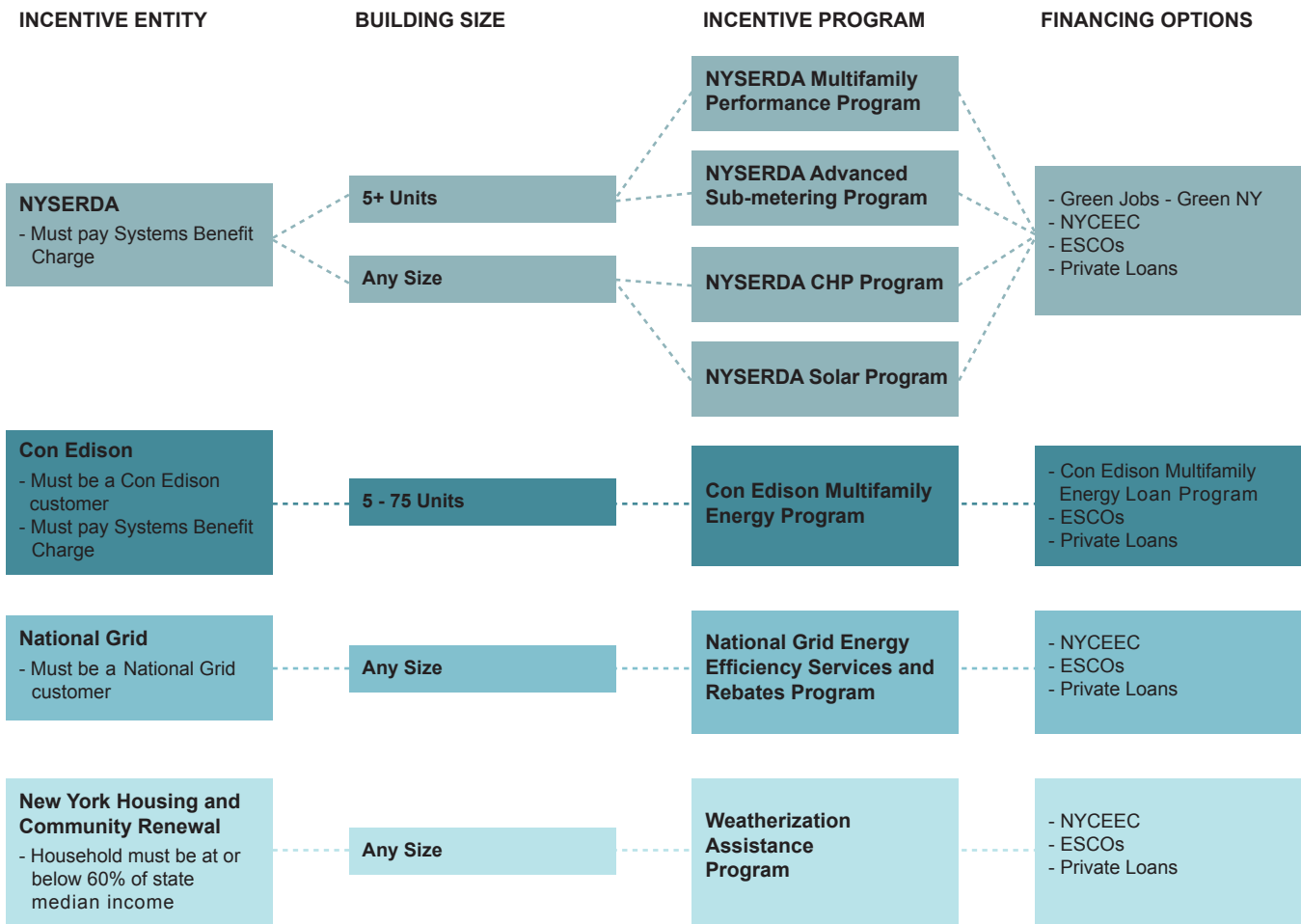
There are ample financing and incentive options in New York City to help building owners cover the cost of undertaking an efficiency retrofit or investing in clean energy. NYSERDA, a State-run authority, and the local utilities including Con Edison, National Grid, and PSEG Long Island offer a suite of incentives for all building types, including commercial, multifamily, institutional, and industrial buildings as well as single-family homes. These incentives have historically been underutilized both in the city and across the state, in part because building owners are unaware that they exist or are unsure how to navigate their options. At least \$250 million in financial incentives from NYSERDA and the City's local utilities are still available for New York City's buildings through the end of 2015.

Innovative new financing options are also available for building owners through NYCEEC, which has developed a suite of new products including green mortgage products, energy service agreements, and

direct loans. These products include attractive options for affordable multifamily buildings, which often face financing constraints due to limited reserves or lack of credit. In addition, HPD is developing a new program to help fund investments in energy and water efficiency projects for some of the oldest and most vulnerable housing stock. In addition, there are also commercial lenders and energy services companies (ESCOs) offer products that buildings can use to finance the cost of equipment.

The Retrofit Accelerator will provide the platform New Yorkers need to take better advantage of these and other programs and navigate their options as they consider making efficiency and clean energy investments.

## Multifamily Financing and Incentive Options in New York City



Source: New York City Mayor's Office of Long-Term Planning and Sustainability

# Engage Communities in Creating Energy Efficient and Resilient Neighborhoods

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**9,000**  
MtCO<sub>2</sub>e reduced

**\$5 million**  
Annual Cost Savings

**50**  
Jobs Created

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The Retrofit Accelerator will primarily assist large buildings over 50,000 square feet in floor area. These buildings make up just two percent of New York City’s buildings, but nearly half of citywide energy use—meaning they represent the greatest potential for reducing the city’s GHG emissions and improving environmental quality for all New Yorkers.

However, the vast majority of New York City’s buildings are small- and mid-sized buildings that are less than 50,000 square feet. Residential buildings of this size serve as the backbone of many of New York City’s neighborhoods and face growing threats to affordability due to rising operating costs and changing market conditions that place upward pressure on rents.

One way to help these small- and mid-sized residential buildings preserve their affordability is through energy and water efficiency retrofits. Similar to their larger counterparts, however, building owners face many barriers to undertaking these upgrades, including the complexity of undertaking projects and financing constraints. However, unlike their larger counterparts, small- and mid-sized buildings are not required to benchmark their energy use or conduct energy assessments under the City’s local laws. The owners and residents of these buildings may be unaware of the energy and water savings available and as a result, will need an additional level of assistance to invest in cost-saving upgrades.

## **The Neighborhood Accelerator for Small- and Mid-Sized Buildings**

To help address the needs of our small- and mid-sized building stock, the City will partner with our strong network of community-based organizations to launch a community-driven education, outreach, and assistance program to accelerate retrofits in these buildings. The program will focus initially on neighborhoods where there are overlapping issues of housing affordability and grid reliability, in partnership with the local utilities. The program will also complement a utility cost reduction program currently under development by HPD to help fund retrofits in small- and mid-sized residential buildings where rising utility costs threaten affordability.

Assistance provided through the neighborhood-based program will include simple and low- or no-cost measures that residents can take in their own homes, as well as more comprehensive retrofits of residential buildings and key neighborhood cultural and institutional buildings that can be highlighted within the community. Building owners and residents will receive free or reduced cost audits to understand their efficiency opportunities, as well as assistance with project selection, permitting,



contracting, and financing. They will also be connected to financing and incentive programs through NYSERDA and the local utilities, including new programs that Con Edison is rolling out in neighborhoods in Northern Brooklyn and Southern Queens that are facing issues of grid reliability.

The program will also feature a strong workforce development component to ensure that local residents benefit directly from new job and career advancement opportunities. The program administrators will seek local residents for program positions and provide training in energy efficiency best practices, marketing, and community organizing. Program staff will also partner with local employers to identify skills and training requirements and place program graduates into related jobs, for example with local utilities, community-based organizations, private energy consulting firms, and others. This will ensure that local job-seekers gain access to career opportunities and will empower residents to increase sustainability and energy efficiency within their local communities.

### Expected Outcomes

The neighborhood-based outreach and assistance program will result in significant energy and cost savings for targeted neighborhoods, with the potential to scale these benefits citywide. In addition, the program will identify local leaders who can promote efficiency in their neighborhoods, provide new opportunities for career growth for local residents, and create greater ownership of outcomes within communities.

Over the course of the 3-year initial phase, the program is expected to result in efficiency retrofits in up to 1,000 small and mid-sized multifamily buildings and cultural institutions. This is expected to reduce GHG emissions by roughly 9,000 metric tons of carbon dioxide equivalent, with potentially significant positive impacts on local air quality within each neighborhood. The program will also generate an estimated \$5 million in annual energy cost savings for residents and create 50 programmatic and construction-related local jobs within the communities.

## Expand Access to Information for Mid-Sized Buildings

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**270,000**  
MtCO<sub>2</sub>e reduced

**\$110 million**  
Annual Cost Savings

**130**  
Jobs Created

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The existing Greener, Greater Buildings Plan (GGBP) laws focus on creating transparency about energy and water use in the City's large existing buildings and providing information to building owners and other decision-makers. The laws are meant to help owners and decision-makers prioritize investments reduce their energy and water consumption and save money. These laws will also be critical to the success of the Retrofit Accelerator by providing information about where efficiency and clean energy investments will have the greatest opportunities for cost savings and GHG reductions.

The GGBP currently requires all buildings in the City over 50,000 square feet in floor area (or multiple buildings on a single lot that are collectively over 100,000 square feet in area) to measure their energy use annually and undertake a more detailed assessment of building systems and equipment once every ten years. Expanding the GGBP to cover mid-sized buildings over 25,000 square feet in area would allow City to deliver the benefits of energy upgrades to a greater number of buildings.

### Require Benchmarking in Mid-Sized Buildings

Annual benchmarking of building energy use allows owners and decision-makers to consistently measure their efficiency, track energy and water performance, and create a baseline for recommending improvements. Owners of large buildings over 50,000 square feet in New York City are required to benchmark their buildings annually using a free online tool from the U.S. Environmental Protection Agency (EPA) called Portfolio Manager under Local Law 84 (LL84). Portfolio Manager also provides eligible buildings with an ENERGY STAR score, which indicates their energy performance relative to similar buildings across the country, taking into account variations in weather and certain building characteristics.

Benchmarking data can be the starting point to identify opportunities for investing in cost-effective retrofits and reducing energy costs overall. In addition, public disclosure of this information helps renters and the public make informed decisions when choosing to buy or rent properties and demand greater efficiency from their homes and businesses. The data collected through benchmarking also allows stakeholders including building owners, utilities, City agencies, and nonprofit organizations to better understand citywide energy use patterns and opportunities for efficiency. The City has aided in this effort by releasing annual benchmarking reports that analyze this energy and water use data and make recommendations for next steps. As of 2014, the City has released three of these reports, becoming the first city in the country to release reports on multiple years' worth of benchmarking data.

Working with City Council, the City will expand LL84 to bring mid-sized buildings over 25,000 square feet under the law. The cost of benchmarking is low, and therefore should not present a financial burden to these buildings. The City will also work to

### ENERGY STAR Score for Multifamily Buildings

An ENERGY STAR score indicates how well a building performs compared to other similar buildings and can be obtained by benchmarking energy use through EPA's free Portfolio Manager tool. Currently, the scores are only available for certain building types. In September 2014, EPA will launch its highly anticipated ENERGY STAR Score for multifamily buildings, which will for the first time allow the largest portion of New York City's housing stock to compare their energy performance to similar buildings nationwide.

ensure that these buildings gain access to the tools and resources they need to conduct benchmarking, which includes funding a Benchmarking Help Center and providing regular updates to the City's Green Buildings & Energy Efficiency website, located at [www.nyc.gov/gbee](http://www.nyc.gov/gbee).

The City will also explore other opportunities to measure buildings' energy performance, for example at the time of sale of a property. Improvements are often made to homes and properties when they are sold, which is an ideal time to include energy- and water-saving measures. Prospective buyers and renters should have access to information about how much it will cost to live and work in their new spaces. The City will therefore begin engaging stakeholders to explore opportunities to require benchmarking and disclosure at the time of sale. The City will also examine ways to process this information so buyers and sellers understand the improvements they can make to reduce their energy and water costs

### Expected Outcomes

Expanding LL84 to include mid-sized buildings will add up to 16,800 buildings (11,400 properties) covered by the law. These properties will include at least 300,000 residential units and more than 400,000 square feet of space.

## Case Study: 1440 Broadway Benchmarking Leads to Efficiency Upgrades in a Major Commercial Property

1440 Broadway, Manhattan  
Building Manager: CBRE  
Energy Services Firm: CodeGreen Solutions  
Square Feet: 751,615  
Cost Savings: \$300,000

1440 Broadway is a roughly 752,000 square foot commercial office building in Midtown Manhattan that was built in 1924. In 2011, the building's management team benchmarked 1440 Broadway through the EPA's Portfolio Manager tool to comply with LL84. The building received an ENERGY STAR score of 63, meaning that the building performs better than 63 percent of similar buildings in terms of its energy consumption.

In order to better understand the building's energy use patterns, improve energy efficiency, and raise its ENERGY STAR score, the building's management engaged a sustainability and energy management firm based in New York City. The firm began an energy analysis process that included an energy audit and retro-commissioning of the building's systems, which fulfilled the requirements of Local Law 87.

Based on the results, the building's management implemented many of the recommended measures, including optimization of water temperatures in the building's chiller system, installation of economizer cycles for air handling units, and establishing set points to limit heating when parts of the building are unoccupied.

As a result of these measures, 1440 Broadway's ENERGY STAR score reached 74 in 2013, which helped the building achieve LEED for Existing Buildings Gold certification in operations & maintenance (LEED-EBOM®). To maintain this high energy performance, the building's management has implemented ongoing commissioning services. As of August 2014, the building's ENERGY STAR score rose to 78, achieving an ENERGY STAR certification. As a result of these measures, the building has also saved \$300,000 from lower energy bills since 2011.

## **Require Energy Assessments and Retro-Commissioning for Mid-Sized Buildings**

Energy assessments, or “audits,” provide detailed information about how equipment in a building uses energy and identifies opportunities to reduce energy use. The City’s Local Law 87 of 2009 (LL87) requires owners of eligible large buildings over 50,000 square feet to conduct a detailed energy assessment and retro-commission, or tune up, their building systems once every ten years, beginning in 2013. Owners must also submit a report to the City including this information and verifying that the required work has been completed.

The energy assessment required by LL87 provides private building owners with a roadmap for improving their buildings’ energy efficiency through recommended energy conservation measures (ECMs), which include information about costs, potential savings, and return on investment. However, building owners are not required to act on any of the recommendations outlined in their energy assessment.

The retro-commissioning component of LL87 requires that building owners make certain adjustments to building systems and equipment to ensure optimal performance and maintenance. This will help ensure building systems and equipment operate as originally intended and can also help prolong the life of equipment.

Moreover, the data collected through the LL87 reports will help the City better understand energy and water use patterns across its private building stock and formulate programs and policies. For example, the LL87 data will be used by the Retrofit Accelerator team to assist the owners of buildings with the greatest energy-saving opportunities make the necessary investments in energy retrofits to realize these savings.

The City will expand LL87 to include mid-sized buildings over 25,000 square feet. Working with City Council, the City will require energy assessments with an appropriate scope for a mid-sized building. These buildings tend to have less complex systems and equipment than their larger counterparts, so the law will require the assessments to be less detailed in scope and less costly on a per square foot basis. The requirements could also include certain approved types of “virtual audits.” The City will also require mid-sized buildings to retro-commission their systems once every ten years, but again at a lower level of specificity and cost than their larger counterparts.

### **Expected Outcomes**

Expanding LL87 to include mid-sized buildings will add up to 16,800 buildings (11,400 properties) covered by the law. The additional buildings that are required to complete retro-commissioning are expected to stimulate \$25 million in economic activity, reduce GHG emissions by an estimated 35,000 metric tons of carbon dioxide equivalent, and realize \$10 million in energy cost savings annually by 2025.

In addition to these direct impacts of LL87, expanding the law to mid-sized buildings will also create new opportunities for these buildings to be assisted by the

Retrofit Accelerator. Using the data generated from their energy assessments, the expanded Retrofit Accelerator would lead to efficiency retrofits and clean energy investments in an estimated 4,000 additional buildings (2,700 properties), touching almost 100 million square feet and 75,000 residential units. This is expected to generate \$65 million in annual energy cost savings, and stimulate an estimated \$200 million in economic activity, which will create 80 construction-related jobs. It will also reduce citywide GHG emissions by 175,000 metric tons of carbon dioxide equivalent.

### Case Study: 12 East 97th Street

12 East 97th Street is an 11-story co-op that was built almost 100 years ago. By 2010, its base systems were outdated and still burning heavy fuel oil in its boiler. The building was required to convert its fuel oil under the City's Clean Heat regulations and would eventually need to perform an energy audit and retro-commissioning to comply with LL87. Recognizing the advantages of combining the work, 12 East 97th Street acted quickly to convert its fuel oil and to comply early with LL87, an option that was available in 2013 only.

The board hired consultants to analyze the building's energy use, who recommended improvements that could begin saving energy almost immediately. The board also added energy efficiency measures to its boiler conversion that included upgrading the boiler control system and replacing all radiator steam traps, as well as other efficiency measures including replacing its lighting fixtures, installing occupancy sensors in the basement, and insulating steam and hot water pipes. After making an investment of over \$500,000—a portion of which was covered by NYSERDA incentives—the building has reduced its energy use by 18 percent, reduced its GHG emissions by 40 percent, and is expected to save more than \$100,000 annually in operating costs.



## **Require Lighting and Sub-Metering Upgrades for Mid-Sized Buildings**

Lighting accounts for roughly a quarter of the energy used in New York City's buildings. Improvements in lighting technologies over the past two decades have made upgrading a building's lighting system a cost-effective way to increase efficiency, often with fast payback periods. In addition, generous incentives and rebates for lighting projects through NYSERDA and local utilities mean lighting upgrades can be enticing investments for building owners.

In addition, many buildings still bill tenants for electricity use on a standard rate regardless of their consumption because they rely on a single meter to monitor electricity usage. Individual tenants would likely reduce their energy consumption if energy use information were made available to them regularly and billed for it accordingly.

Local Law 88 (LL88) currently requires owners of non-residential buildings over 50,000 square feet to upgrade their lighting to meet current code requirements and install sub-meters in non-residential tenant space by 2025. Public buildings are also undergoing lighting retrofits, despite being exempt from this law.

The City will expand LL88 to require all owners of mid-sized non-residential buildings over 25,000 square feet to certify that lighting is compliant with current energy codes and install sub-meters in non-residential tenant spaces by 2025. Setting the compliance date to 2025 ensures that building owners have sufficient time to upgrade lighting and install sub-meters at the time of lease turnover.

### **Expected Outcomes**

Expanding LL88 to include non-residential mid-sized buildings will add up to 5,500 mid-sized buildings (3,770 properties) required to comply with the law. This is expected to stimulate nearly \$100 million in economic activity, which will create 40 construction-related jobs. It will also reduce annual GHG emissions by about 60,000 metric tons of carbon dioxide equivalent and generate roughly \$35 million in annual energy cost savings.

# Provide Financing Options for Energy Efficiency and Clean Energy

For many building owners and decision-makers, particularly in the affordable multifamily sector, financing is a major barrier to undertaking energy efficiency and renewable energy investments. Buildings may lack the capital reserves or credit-worthiness to access commercial financing options. Lending for these projects can also require specialized technical analysis and credit expertise, which conventional lenders often lack, and traditional loan products do not recognize energy savings in the underwriting process. In addition, current regulations that govern rent increases and define scopes of work as major capital improvements pose barriers to integrating energy efficiency and resiliency measures into capital projects in the affordable housing sector.

Innovative new financial products are available or under development through the New York City Energy Efficiency Corporation (NYCEEC), the NYC Housing Development Corporation (HDC), and the City's Department of Housing Preservation and Development (HPD). The City will help scale up these products through its outreach and assistance platforms, including the Retrofit Accelerator, the neighborhood-based energy efficiency accelerator program, and other platforms. The City will also explore strategies to reform regulations to allow building owners to take advantage of these products while maintaining affordable rents.

## **The New York City Energy Efficiency Corporation (NYCEEC)**

Created by the City in 2011, NYCEEC is an independent, financial services non-profit that provides financing solutions and technical expertise to help building owners invest in energy efficiency and renewable energy projects. Since it began lending in 2012, NYCEEC has financed over \$28 million dollars of energy- and cost savings projects across 3.4 million square feet of New York City property.

NYCEEC currently offers three distinct financing products to serve the needs of a diverse range of building types and owners:

- **Green mortgages.** Green mortgages incorporate energy efficiency financing into standard mortgage lending practices. This product is an innovative and scalable approach that provides borrowers with low-cost, long-term financing. NYCEEC has developed two green mortgage programs so far with Fannie Mae and the NYC Housing Development Corporation (HDC).
- **Energy Service Agreements.** Building owners can use an Energy Service Agreement (ESA) to finance projects. ESAs are well suited for larger, more complex projects. Benefits to the building owner include no upfront cost to the project and third-party management and construction.
- **Direct lending.** NYCEEC can lend directly to building owners to finance energy efficient equipment and distributed generation projects. The benefit of this product is minimal contractual complexities, which improves access to financing for smaller buildings, particularly in the affordable multifamily sector.

### **Modify J-51 tax incentives**

New York City launched the J-51 program in 1955 to encourage landlords to install heat and hot-water systems in cold-water flats. The City later expanded the program to provide a combination of real property tax benefits for investments in critical building systems. Owners receive a tax exemption and/or abatement in exchange for rehabilitating existing buildings or converting certain nonresidential buildings to residential buildings, which is based on the type of improvement provided and other factors.

To receive a J-51 abatement, building owners with rent-stabilized units must itemize the cost of each improvement they make. The value of the abatement is determined in part by the Certified Reasonable Cost (CRC) schedule, which lists the allowable costs for each item. Increasing the CRC and the categories of rehabilitation work would allow owners to recoup more of their investments, and could potentially encourage more owners to participate in the program.

The J-51 program was overhauled in 2012-2013, resulting in marginal cost savings and increased efficiencies. Moving forward, the City will create a task force to explore additional reforms that encourage proper maintenance and upkeep of buildings and lower operating costs, including through energy and water efficiency improvements. Broader participation would help increase the quality of the housing stock and could reduce the need for enforcement actions, retain low-cost housing through investment in rent-regulated units, and help to bring energy efficiency investments to scale. The task force will consider increasing the incentive for improvements to buildings systems, aligning the list of items eligible for J-51 benefits with New York State's Department of Homes and Community Renewal (HCR) useful life schedule for major capital improvements, and providing incentives that increase uptake of sustainability projects, including energy and water efficiency retrofits and fuel oil conversion projects.

### **Explore the Use of Qualified Energy Conservation Bonds (QECCBs)**

Qualified Energy Conservation Bonds (QECCBs) are federally subsidized debt instruments that enable local government issuers to borrow money to finance eligible energy conservation projects. New York State was allocated the first tranche of these bonds under the federal Energy Improvement and Extension Act (2008), later expanded by the American Recovery and Reinvestment Act (2009), for a total of \$202 million, of which New York City is expected to have access to at least \$80 million.

QECCB loans receive a coupon payment subsidy, which effectively brings interest rates to below-market levels. This improves access to inexpensive capital, which could potentially spur greater uptake of energy efficiency investments. The City will explore opportunities for a clean energy and retrofit loan fund for efficiency measures in public buildings and the multifamily sector, with a focus on affordable multifamily buildings and buildings serving low- to moderate-income populations.



## Case Study: Roosevelt Landing

Roosevelt Landings is a mixed-income, multifamily housing complex built in 1969. The management company for the complex, which includes nine buildings and over 1,000 units, wanted to install a high-efficiency CHP system and undertake a range of other efficiency measures that included whole building air sealing, floor slab insulation, networked programmable thermostats, and high-efficiency boilers. However, similar to many multifamily buildings serving low and moderate populations in New York City, the building had limited funds to cover upfront and capital costs. Moreover, standard commercial loans were not available because of the technical complexity and extended payback period for the project, and the complex's primary lender had the right to approve additional secured lending arrangements.

NYCEEC structured a financing strategy for Roosevelt Landings that provided debt financing of \$4.5 million, which combined an energy services agreement (ESA) to fund the efficiency measures and a power purchase agreement (PPA) for the CHP project. Third-party investors, including an owner affiliate, invested equity in the project at a market rate of return, and NYSERDA and Con Edison incentives completed the funding for the project.



The upgraded and retrofitted energy systems are projected to provide annual costs savings of \$818,000. Moreover, the financial innovation of using an ESA for a multifamily building represents a milestone in unlocking energy efficiency potential, and provides a model for future financing in the multifamily sector.

## Improve Energy and Water Efficiency in Affordable Housing

Our affordable housing stock represents one of the most significant opportunities to improve energy and water efficiency and housing quality. These buildings make up some of our oldest and most vulnerable housing stock, including small- and mid-sized tenement buildings.

Utilities are one of the fastest rising costs of housing in New York City. The effect is increasing the rent-burden for tenants and eroding bottom lines for property owners, which can lead to deferral of maintenance and major upgrades. Undertaking energy and water efficiency retrofits can help building owners control operating expenses and maintain affordability, but many buildings have not undergone even low-cost measures due to limited capital resources or reserves, small net operating incomes, or lack of technical understanding. Controlling operating expenses is therefore a critical aspect of ensuring the long-term viability of low- and moderate-income multifamily properties and preserving their affordability.

The Retrofit Accelerator and neighborhood-based energy efficiency programs outlined above will help mitigate rising housing costs and improve energy and water efficiency in our affordable housing stock. The City's Department of Housing Preservation and Development (HPD) and Housing Development Corporation (HDC) will be integral to the success of these programs. In addition, HPD and HDC will launch two new initiatives.

First, HPD and HDC will integrate cost-effective energy and water improvements to moderate rehabilitation projects financed by the City. Currently, buildings undergoing a substantial rehabilitation or being financed by Low Income Housing Tax Credits are required to meet Enterprise Green Communities requirements, meaning that they are already required to integrate basic energy and water efficiency measures into the rehabilitation. However, the hundreds of moderate rehabilitation projects financed by HPD and HDC each year in multifamily buildings of all sizes do not currently need to meet similar standards.

The City will begin requiring a "green" capital needs assessment for moderate rehabilitation projects, so that opportunities to improve energy and water usage are included within the building's capital needs. This will allow cost-effective energy and water efficiency improvements to be integrated into the scope of the rehabilitation work, which could reduce energy use by as much as 10–20 percent.

Second, HPD will develop an affordable housing loan program that assists owners of small- to mid-sized multifamily properties with reducing utility costs through financing energy and water efficiency improvements, in exchange for entering into an affordable housing regulatory agreement. This program will target properties with low- and moderate income households that have above-average energy and water consumption and that may also have rehabilitation needs, particularly where there is danger of losing affordability due to upward market pressures and rising utility costs.

The loan program will finance eligible energy and water efficiency measures with low-interest loans or an alternative city source for items that are not capital-eligible. The program can leverage existing private financing sources such as the NYCEEC-HDC PERL program, NYCEEC's direct loan program, NYSERDA Multifamily Performance Program, and the New York State Weatherization Assistance Program. New projects receiving financial assistance will enter into a regulatory agreement with the City, which includes rent stabilization, income limitations, and maximum rent charged. The program will be paired with a robust outreach and technical assistance component that will proactively identify affordable housing that is in danger of becoming unaffordable and will guide building owners through the process of assessing project needs, developing the scope of work, preparing bid materials, ensuring quality construction, and monitoring performance after completion.

To ensure that the local workforce benefits from the new job opportunities resulting from this program, the City will collaborate with contractors to better understand their hiring needs and require these contractors to share job orders with the City's Workforce1 Career Centers prior to hiring new staff. The City will also explore the option to create a "job shadowing" program for high school students in the NYC Department of Education's career and technical education programs.

# Bring Solar Power to New Neighborhoods Across New York City

**105,000**  
MtCO<sub>2</sub>e reduced

**\$70 million**  
Annual Cost Savings

**460**  
Jobs Created

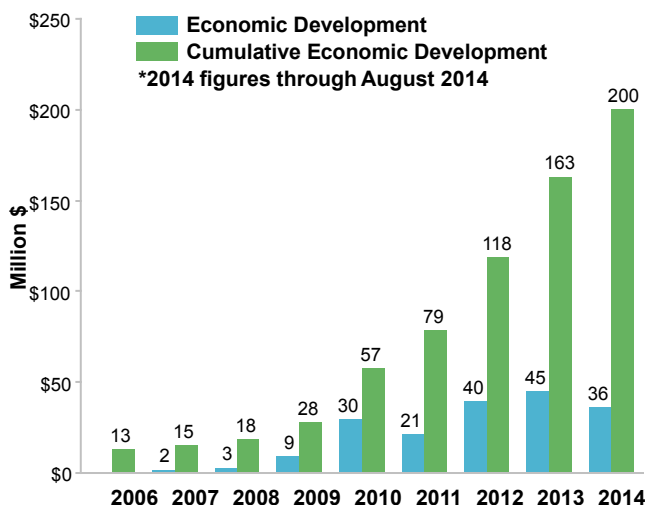
New York’s solar energy market is growing. Solar generating capacity has increased from less than one megawatt (MW) in 2006 to over 30 MW today. Numerous solar installation companies have also set up shop in the city, creating hundreds of jobs and attracting investments of \$200 million in the industry. Since 2006, the New York City Solar Partnership led by the City University of New York (CUNY) has provided critical support for this industry development.

Over the next decade, the City will aim to increase the development of more than 250 MW of solar energy on rooftops and in communities across New York City.

The City will fund the NYC Solar Partnership to continue their work to reduce market barriers for investing in solar power, attracting solar energy companies to the city, and increasing solar energy production capacity. This includes providing assistance with permitting for solar installations, coordinating solar projects between City-owned properties and other entities, connecting installers and their customers to financing and incentive opportunities, and providing installers, businesses, and residents with educational resources to help accelerate investments in solar power.

In addition to these services, the expanded Solar Partnership will focus on increasing the resiliency of communities by identifying and coordinating opportunities for targeted installations of solar power with battery backup storage. The Solar Partnership will also expand solar access to ensure it is more equitably distributed by targeting additional assistance for communities that have historically had limited access due to financial hardship, technical constraints, or other reasons. This includes scaling up innovative solar programs, including community-based group purchasing and shared solar programs, which would provide more New Yorkers with the opportunity to benefit from this renewable energy source.

## Solar Economic Development in New York City



Source: City University of New York

## Expected Outcomes

As a result of these initiatives, the City expects to continue the exponential market growth of solar installations in New York City. Over ten years, the Solar Partnership will help the City achieve its goal to install 250 MW of solar power in ten years, across an estimated 30 million square feet of roof space in the city. By 2025, the installed capacity is expected to reduce annual GHG emissions by more than 105,000 metric tons of carbon dioxide equivalent, generate \$70 million in annual energy cost savings, and create 460 construction-related and solar industry jobs.

## Coordinate with the State to Streamline Financing and Incentive Programs

Over the past decade, the State of New York has acted as a domestic leader in addressing climate change. The State has set a goal to reduce statewide GHG emissions 80 percent below 1990 levels by 2050 and to improve the resilience of all the state's communities to withstand the effects of climate change.

Over the past decade, the New York State Energy Research and Development Authority (NYSERDA) has been tasked to scale up investments in energy efficiency and clean and renewable energy. To do so, NYSERDA has largely focused on developing and distributing financial incentives to help offset the costs of undertaking investments and funded research and development for innovative efficiency and clean energy technologies. To further the State's goals, in 2013 Governor Cuomo created the NY Green Bank to finance energy efficiency and clean energy investments, with a projected capitalization of \$1 billion.

The New York State Public Service Commission (PSC) is responsible for regulating the state's utilities, including Con Edison and National Grid, and overseeing NYSERDA's energy efficiency and renewable energy programs. Earlier this year, the PSC began an ambitious proceeding to revise the manner in which electric service is provided to customers throughout the State—the Reforming Energy Vision (REV) proceeding. Through the REV and other proceedings, the PSC is also reviewing and possibly revising the manner in which energy efficiency and renewable energy projects are funded and administered. Most of the existing funding will be combined into a new Clean Energy Fund (CEF), incentives will be modified and possibly increased, and administration of the programs may largely switch from NYSERDA to the utilities.

The City will continue to work with State agencies throughout this process to achieve their shared goals of expanding clean and renewable energy generation, catalyzing widespread energy retrofits, and creating a low-carbon, energy efficient future. This includes working together to deploy the roughly \$250 million in incentives that are available in New York City through NYSERDA and the local utilities through the end of 2015. The City will also work to ensure that there continues to be a strong focus on addressing energy efficiency needs of the affordable multifamily sector. The City and NYCEEC will work with the Green Bank to develop financing mechanisms that are tailored to the specialized needs of this sector.

One of the other goals of the REV, CEF, and related proceedings is to become more customer-centric and make the energy efficiency, demand response, and renewables programs less complicated. The City supports this set of goals, and will work with the PSC, NYSERDA, Con Edison, and others to expand and streamline customer opportunities and access to funding. This can be accomplished in part through the many of the City's new programs, such as the Retrofit Accelerator.

Additionally, the City will work with the State to ensure that the workforce development efforts of the State and the City are complementary. The City will collaborate with the State to develop trainings that prepare local workers for careers in energy services, focusing on those that are dependent on new technologies in the public and private sectors.

Finally, the City will continue to work to ensure an equitable distribution of funding to downstate regions. New York City accounts for almost half of the state population, and there is significant untapped potential for energy efficiency measures throughout the metropolitan area. Sufficient access to programs, incentives, low-cost loans, and other funding sources is needed to exploit that potential. Because New York City customers contribute a substantial portion of the funding for the State-wide programs and initiatives, the City will continue to advocate for an equitable level of funding for opportunities and programs for New York City residents and businesses.

## Collaborate with Local Utilities to Promote Energy Efficiency

Multiple utilities serve New York City, including Con Edison, National Grid, PSEG Long Island, and the New York Power Authority, which supplies electricity to governmental entities. Together, the utilities deliver reliable power to New Yorkers from one of the cleanest and most dependable generation and delivery systems in the world. The utilities also offer financial incentives and assistance programs to increase energy efficiency through equipment replacement and deep retrofits. Additionally, since 2010, they have provided customers with whole-building energy use data to benchmark energy usage under LL84.

The City will continue to coordinate with the utilities to provide their customers with easy access to utility data, better manage citywide energy use, and address peak load reductions in key geographic areas.

To help make benchmarking easier, the City will continue to work with Con Edison, National Grid, PSEG Long Island, and the state regulators to streamline processes for whole building energy data reporting and reduce the costs of reporting for property owners. The City and National Grid are participating in the Better Buildings Energy Data Accelerator, a White House-led initiative where New York City's experience will inform best-practice approaches for other cities and their utilities.

Through the Retrofit Accelerator and other platforms, the City will continue to work with the utilities to deploy incentives that are available in New York City to help cover the costs of efficiency upgrades. To ensure the greatest potential impact, the City will work with the utilities to coordinate messaging and connect customers to the right programs.

## Combined Heat and Power (CHP)

Combined heat and power (CHP) units generate electricity using fossil fuels or biofuels and recover waste heat for on-site heating and cooling needs. CHP plants are highly efficient and less carbon intensive than traditional power plants, achieving up to 70–80 percent efficiency, compared to just 30 percent efficiency for typical single-cycle units. CHP units also provide resiliency benefits because they reduce strain on the grid and allow facilities to continue operating during grid-level power outages.

Over the past few years, the utilities have worked with the City and the State to increase investments in CHP. One major achievement was Con Edison's adoption of the CHP "offset tariff," allowing larger systems serving multiple buildings and campuses to more easily interconnect. This led to additional private investments in CHP systems across numerous multi-facility campuses in the city, including NYU Langone Medical Center, Columbia University, and several hotels, residential buildings, and commercial buildings. While prices have come down and smaller CHP installations are becoming more cost-effective, the high capital costs and the need for relatively large and consistent thermal loads still limit potential application for certain buildings.

The City will also work with the State and the utilities to ensure that State regulations allow building owners and developers to scale up innovative technologies and strategies. For example, the City will work with the utilities on customer-sited distributed generation such as combined heat and power (CHP), fuel cells, and microgrid installations; installation of advanced battery storage technologies to supplement both demand response and intermittent local generation resources, such as solar photovoltaic arrays; and other innovative customer-side demand management and energy efficiency strategies.

The City will continue to support the goals of the State's REV initiative and work to support the development of renewable sources of energy. The City also supports the objectives of Con Edison's Utility of the Future to empower customers and to compensate them for investments in generation, transmission, distribution, demand-side resources, information technology, and communication infrastructure that serve the utility system. These objectives actively promote energy efficiency and renewable generation to further reduce GHG emissions.

Finally, the City will work with the utilities to reduce peak energy use in load pockets that are straining the grid, while also ensuring that proper investments are being made to the grid's infrastructure. For example, the City plans to partner with Con Edison to reduce peak use in the Northern Brooklyn-Southern Queens network and leverage the utility's planned investments in non-traditional, customer-sited demand management strategies. This will not only improve power quality and reliability through the network, but also generate energy cost savings and clean energy investments for residents in neighborhoods that have been traditionally underserved by these opportunities.

## Expand the Goals and Reach of the NYC Carbon Challenge

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**510,000**  
MtCO<sub>2</sub>e reduced

**\$290 million**  
Annual Cost Savings

**540**  
Jobs Created

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The NYC Carbon Challenge is a voluntary leadership program that engages private and institutional organizations to reduce GHG emissions by 30 percent in just ten years. Current participants, which include more than 50 universities, hospitals, commercial firms, and residential management companies (all together accounting for 220 million square feet of space), have moved aggressively to cut their annual emissions to meet the Carbon Challenge goal. In addition, Broadway theatres are engaged with a range of sustainability projects through the Broadway Green Alliance. To date, these participants have reduced their GHG emissions by almost 200,000 metric tons of carbon dioxide equivalent, saving an estimated \$170 million annually in lower energy costs as a result. In addition, six participants have already achieved the Carbon Challenge goal—reducing their emissions intensity by 30 percent in less than half the time allotted for the Challenge.

Under Mayor de Blasio, the City has aggressively expanded the Carbon Challenge for multifamily buildings, adding nearly 300 multifamily buildings (accounting for more than 60 million square feet of space) to the program, including at least 150 buildings serving low- to moderate-income populations. Board members and residents of these buildings will work with their residential property managers to implement energy- and cost-saving measures that will make significant cuts in their GHG emissions. The Carbon Challenge also serves as a platform for exchanging and spreading ideas and information about efficiency retrofits and carbon reduction strategies, and provides simple tools for participants to track their progress. Participants are also connected to financing and incentive options to facilitate deep energy retrofits that will help them achieve their GHG reduction goals.

Building on this success, the City will expand the NYC Carbon Challenge program by increasing the number of participants in the existing sectors; expanding the program to include new sectors, such as hotels, restaurants, and/or retail; and challenging participants to reach an even higher goal of a 50 percent reduction in GHG emissions.

### Expected Outcomes

Expanding the NYC Carbon Challenge has the potential to drive deep energy retrofits across hundreds of millions of square feet of space. The full expansion outlined above would reduce emissions by as much as 510,000 metric tons of carbon dioxide equivalent, on top of the 175,000 metric tons that current participants have already reduced.

The expansion of Carbon Challenge also has the potential to stimulate \$170 million in economic activity annually, for a cumulative total of \$1.5 billion in activity over ten years, leading to an estimated 540 construction-related jobs. The energy efficiency and clean energy projects are anticipated to generate \$290 million in annual energy cost savings. The innovative new technologies and strategies that the Carbon Challenge participants undertake will also shed light on the most cost-effective opportunities for deep carbon reductions—showing the way for others to follow.



## Case Study: Park City Estates



Park City Estates is a 1,049-unit co-op in Queens managed by FirstService Residential, a participant in the NYC Carbon Challenge. The co-op had been experiencing double-digit maintenance charge increases for five years when FirstService took over management in 2010. At the time, residents of Park City Estates had a relatively common problem for apartment-dwellers in New York City: because each of the complex's five buildings were master metered, it was impossible to bill residents individually and they all paid the same electricity bill, regardless of whether they conserved energy.

To lower maintenance costs and reduce building-wide energy use, Park City Estates upgraded to electric sub-meters, giving residents direct control over their electricity use. The co-op began installation of the sub-meters in 2011 and converted nearly all of the units in just five months. The co-op also took advantage of more than a quarter million dollars in incentives from NYSERDA, cutting the cost nearly in half.

Today, Park City Estates residents pay only for the electricity they actually consume. In combination with other energy-saving measures, the building's maintenance costs decreased by 15 percent and property values are rising. In 2012, Park City Estates upgraded to more energy efficient LED lighting, which further reduced its operating costs and GHG emissions.

Encouraged by the benefits that energy efficiency has brought to the complex, the co-op board is now pursuing another NYSERDA incentive program to reduce whole-building energy consumption by 15 percent and is participating in the Carbon Challenge to reduce GHG emissions by 30 percent in ten years. To reach these goals, the co-op board plans to replace both of its boiler plants to further increase efficiency and reduce operating costs.

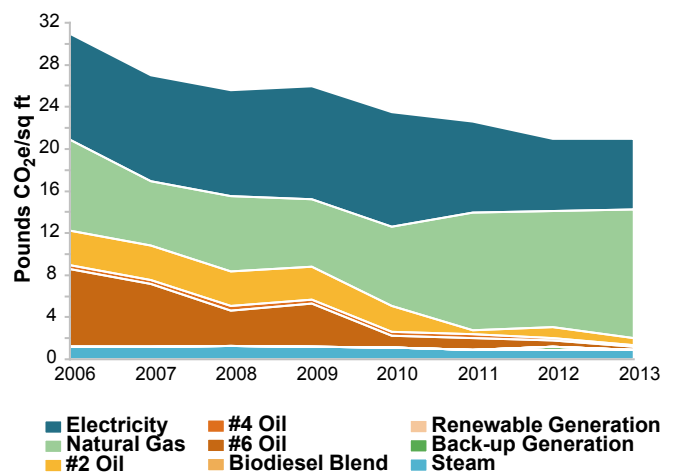
## Case Study: New York University

New York University (NYU) accepted the NYC Carbon Challenge in 2007. In just five years, the university reduced its emissions intensity by 30 percent from 2006 levels—four years ahead of schedule. Now, NYU has set out to cut its emissions in half by the end of the Challenge in 2017.

NYU achieved its 30 percent goal through a comprehensive approach to energy savings, which included both physical plant upgrades and a systematic focus on personnel training and education. In addition, NYU completed a cutting edge, high-efficiency CHP plant in 2011. At a cost of \$125 million, it was the largest capital investment in the university's history. The plant produces heating, cooling, and electricity for 40 NYU buildings, providing half the campus with more efficient energy. The plant cut NYU's GHG emissions by more than 20 percent and air pollutants by 68 percent while also generating cost savings of between \$16 million and \$22 million per year. The cogenerated power also takes pressure off the city's strained electrical grid and increases NYU's resiliency by providing reliable backup power during blackouts and other emergencies, such as the one that occurred during Hurricane Sandy.

In 2013, NYU became the first university in the Carbon Challenge to commit to a target of a 50 percent reduction in emissions by 2017. NYU plans on achieving this target by focusing on building-level strategies, which include reducing electrical demand and increasing efficiency of equipment, as well as campus-wide strategies, such as raising efficiency standards for existing buildings and new construction and exploring alternative energy sources.

### NYU Carbon Intensity by Fuel Type



Source: New York University and New York City Mayor's Office of Long-Term Planning and Sustainability

# Train the Next Generation of Building Operators

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**285,000**  
MtCO<sub>2</sub>e reduced

**\$100 million**  
Annual Cost Savings

**3,300**  
Operators Trained

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Even with the best equipment in a building, energy efficiency is not guaranteed without proper training for building staff. Currently, it is not required for building operators to be trained in sustainable building operations, energy efficiency, or associated monitoring—and yet, research shows that this training can result in energy savings of 5–20 percent, without requiring any major capital expenditures.

The City can help building residents save energy and help building staff upgrade their skills by providing low- or no-cost training for building operators in energy efficiency best practices. Operators will receive an overview of critical building systems, with an emphasis on preventative maintenance, and learn how to bring interdependent building systems to their optimal efficiency levels. Whether dealing with new or existing equipment, this training will help ensure proper use and maintenance, which will reduce energy costs and extend the useful life of the equipment. By offering expanded trainings as well as “English as a Second Language” (ESL) courses, the City can train the next generation of building operators and help build a 21st century workforce.

## Expected Outcomes

The potential impact of training building operators is significant, both in terms of opportunities for career advancement and GHG reductions. Providing training for every building operator in buildings over 50,000 square feet is expected to increase the number of trained operators by at least 3,300. The energy efficiency skills and best practices provided to these operators is estimated to reduce citywide GHG emissions by 285,000 metric tons of carbon dioxide equivalent and could lead to as much as \$100 million in annual energy cost savings per year by 2025, on top of additional savings that can be achieved by extending the life of building equipment.

## Green Codes Task Force Proposal: Mandating building operator training for large buildings

The City is poised to enact legislation requiring the base building systems of large buildings (greater than 50,000 square feet in area) to be operated by building staff that has been trained in energy efficiency best practices. If passed, the legislation will reduce energy use in large buildings by ensuring that staff is trained in energy efficient operation of the building’s critical energy-using systems, including the envelope, heating, ventilation, and air conditioning (HVAC), domestic hot water, electrical and lighting systems. The building staff with primary on-site responsibility for supervising the energy consuming systems would need to be trained, and the building owner would certify that the necessary staff have received the training.

## Case Study: 32BJ Green Supers Training

Energy efficiency training for building operators can improve the careers of building operators and superintendents as well as the energy performance of a building. A recent study of the Green Supers Program, run by the SEIU local 32BJ, found that 95 percent of the superintendents surveyed had successfully implemented energy efficiency measures within a year of graduation of the program, and energy audits of their buildings showed energy savings of 5–20 percent.

Victor Nazario and Marat Olfir are two building operators with “green super” credentials who are now helping to reduce their buildings’ carbon footprint and share their knowledge with other superintendents.

Nazario, a superintendent of The Whitney at 311 East 38th Street, was in the first Green Supers pilot class in 2009. He had worked in the industry for decades, but says the program taught him new ways to think about the building and its connected systems. According to Nazario, “It was no longer just a job but part of an overarching goal to make things better and part of my personal legacy.”

Olfir received a Green Building Diploma through the 32BJ Training Fund and is now using his practical skills to implement numerous green strategies at his building, The Future Condominiums at 200 East 32nd Street. These include upgrading lighting, insulating steam pipes, and creating a steam trap maintenance program. Olfir was also able to provide the building’s board and his managers with detailed calculations about the impact of these measures to determine which were worth the investment. The training helped Olfir advance his career. According to Olfir, “Being a Green Super helped me get better jobs in good buildings.”



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**3,500**  
MtCO<sub>2</sub>e reduced

**\$1 million**  
Annual Cost Savings

**500**  
Personnel Trained

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## The Urban Heat Island Effect

Urban areas such as New York City experience the “urban heat island effect” due to the replacement of permeable surfaces with buildings, roads, and other infrastructure that are impermeable and dry. This results in the creation of an “island” of higher temperatures in urban areas, which can be anywhere from 2–22 degrees higher than surrounding rural areas.<sup>18</sup> The urban heat island effect can exacerbate projected climate change impacts, such as increased heat and heat waves, and places additional strain on the electrical grid by increasing energy use that can threaten grid reliability during peak hours.

## Expand NYC CoolRoofs

Applying a reflective white coating to a building’s roof is an easy and inexpensive way to reduce energy use and cooling costs, preserve and extend roof life, and reduce the urban heat island effect. The City’s NYC CoolRoofs program, launched in 2009, encourages and assists building owners to undertake simple white roof coating projects, which can produce annual cost savings of \$0.10 per square foot. To date, nearly 6 million square feet of roof space has been coated through NYC CoolRoofs.

The City will continue the NYC CoolRoofs program over the coming years to enable at least one million square feet of rooftop to continue to be coated annually. The expanded program will also incorporate a more robust green workforce-training and jobs platform. Through this platform, an administrative partner will provide 50 job-training participants per year with on-the-job training in building efficiency practices and project management, as well as additional certifications and competencies needed to enter the green jobs market.

Public education will also remain a key focus of the NYC CoolRoofs program by providing a platform to educate building residents and community members about concepts such as energy efficiency and resiliency to urban heat (see sidebar) in a hands-on setting. In addition, the expanded program will use a data-driven targeting strategy to focus on assisting small- and mid-sized buildings which might not otherwise take advantage of this energy-saving opportunity.

## Expected Outcomes

Over a period of 10 years, the NYC Cool Roofs program will help thousands of New Yorkers reduce their energy use and will help address the City’s urban heat island effect by coating up to 10 million square feet of roof area. By 2025, this is expected to reduce citywide GHG emissions by 3,500 metric tons of carbon dioxide equivalent, generate \$1 million in annual energy cost savings, and train 500 New Yorkers who will be prepared for jobs promoting energy efficiency in buildings.

## Case Study: NYC CoolRoofs and Workforce Development

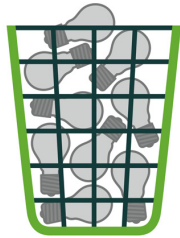
NYC CoolRoofs has a strong track record preparing unemployed and under-employed residents for jobs in energy services and other “green” sectors. Jeremy Bair, a 2013 NYC CoolRoofs crew member, can vouch for the opportunities that this program can provide. A graduate of Sustainable South Bronx’s Bronx Environmental Stewardship Training (BEST) Academy, an official NYC CoolRoofs partner from 2012 through 2014, Jeremy was able to bolster his work experience through his service with NYC CoolRoofs. This helped lead to full-time employment for Jeremy as a lighting technician.

According to Jeremy, “NYC CoolRoofs helped me learn how to work in a team and I now understand how different buildings present different challenges. I also saw that if we put in a little effort, a lot of energy can be saved.”

## Help New Yorkers Reduce Energy Use at Home



**SWITCH  
TO CFLs &  
SAVE ENERGY.**



There are simple changes that residents can make in their own homes that will have a meaningful impact on reducing GHG emissions beyond the larger investments they can make to their building systems and envelopes. The decisions New Yorkers make about how they use appliances, the light bulbs they purchase, and the temperature at which they keep their thermostats can add up to significant energy savings. Through strategic marketing efforts, the City can empower residents to make smart decisions that will achieve meaningful impacts in a short timeframe.

New Yorkers understand that they can take responsibility to improve our city, and want to act. GreeNYC is the City's public education program that empowers New Yorkers to take actions to live more sustainably.

GreeNYC promotes actions that will have the greatest impact—saving residents money, improving personal comfort, and helping the City's overall GHG reduction goals.

The GreeNYC brand is recognized by more than 40 percent of New Yorkers and has a proven track record of connecting with the City's residents. GreeNYC uses a data-driven approach to identify target audiences, create messaging and artwork, design media plans, develop partnerships, and measure results. Future GreeNYC campaigns will encourage New Yorkers to undertake energy-saving measures, such as switching to more efficient light bulbs, adjusting their thermostats, unplugging their chargers and electronics when not in use, and purchasing more energy efficient appliances.

### GreeNYC Market Research

GreeNYC has conducted market research to determine which energy-saving measures New Yorkers are most likely to undertake and the messages that will resonate most. One key takeaway from this research shows New Yorkers are willing to take action in their own lives. When asked in a survey to identify who has the most potential for improving the city's environment, the top two responses were "local government" and "people like me / ordinary residents." By providing New Yorkers with simple steps they need to lead more sustainable, energy efficient lives, GreeNYC is empowering New Yorkers to become part of the solution to climate change in their everyday actions.

Chapter 4

# World Class Green Building and Energy Codes

## Develop World Class Green Building and Energy Codes

New York City's one million buildings include a diverse range of building types, architectural styles, and uses. They include some of the most iconic buildings in the world—including skyscrapers, pre-war apartments, classic brownstones, television studios, warehouses, hospitals, and factories. For hundreds of years, New Yorkers have been leading the world in architecture. We will continue to do so.

A growing number of our buildings are now more sustainable and energy efficient than ever, as the City continues to raise construction code standards and owners recognize the benefits to their bottom line. Over the next ten years, we will expand our effort to raise standards and enhance our enforcement of the City's Energy Code. These proposals will ensure that newly constructed and substantially renovated buildings meet leading edge performance standards and that those standards are enforced. As a result, New York City will continue to lead the way in creating outstanding, energy efficient buildings that help reduce GHG emissions and improve sustainability citywide.



# Raise the Standards for our Building and Energy Codes

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**650,000**  
MtCO<sub>2e</sub> reduced

**\$270 million**  
Cost Savings

**240**  
Jobs Created

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Construction code standards for energy performance and system resilience ensure that the most energy efficient and resilient buildings are constructed. New York City created its own local energy code in 2009, which provides the City flexibility in improving the standards for energy performance.

The City currently revises its Energy Conservation Code on a three-year basis, which is in line with the International Code Council's code revision process. By participating in this process, the City has enacted local standards that have raised the bar for quality construction and improved energy efficiency in construction practices.

But the City did not stop there. The City, in conjunction with Urban Green Council (the local chapter of the U.S. Green Building Council), convened the Green Codes Task Force in 2008 to develop proposals to further ensure that sustainability is embodied in design and construction practices, equipment standards, and operations and maintenance.

To date, 51 of the 111 recommendations included in the Green Code Task Force report have been incorporated into laws and practices, and many more are in the pipeline. By 2030, the measures already implemented will reduce citywide carbon emissions by almost five percent.

Following Hurricane Sandy in 2012, the City convened the Building Resiliency Task Force, which recommended 33 changes to the codes to better prepare our buildings for the impacts of climate change and extreme weather events. Since then, 16 of the recommendations have been implemented to help prepare our buildings for coastal floods and extended power outages.

The City will enact the remaining proposals from the Green Codes Task Force that have a GHG emissions impact. These include proposals that will minimize the energy used to heat and cool buildings, ensure that systems are commissioned to function at optimum levels, and require building staff in large buildings to be trained in energy efficiency best practices. In addition to reducing GHG emissions, the proposals will also improve thermal comfort, enhance indoor air quality, and reduce toxic substances in the environment.

## Expected Outcomes

The remaining codes that the City plans to enact will deliver substantial cost savings for building owners and occupants and GHG reductions for the city. In total, they are projected to reduce citywide emissions by more than 650,000 metric tons of carbon dioxide equivalent and generate \$270 million in annual energy cost savings by 2025. In addition, the marginal increase in construction spending is anticipated to create 240 new construction-related jobs.



## Enhance Energy Code Enforcement

Enforcement of New York City’s local Energy Code is a critical component in citywide efforts to reduce energy use and GHG emissions. Enforcement ensures that newly constructed and renovated buildings meet the building codes that require them to be more energy efficient and resilient.

The Department of Buildings (DOB) launched its enforcement program for New York City’s Energy Code in 2013. This enforcement program, however, was limited in scope and lacked appropriate staffing levels to fully enforce compliance for new buildings and a portion of major alteration applications.

Under the current enforcement program for new building construction, Energy Code compliance deficiencies have been identified at 20 percent of project sites. Furthermore, renovations are not all fully plan-examined by DOB staff for Energy Code compliance, relying instead on certification by design industry professionals. To date, nearly every renovation project that has been audited has been out of compliance—indicating that better enforcement is needed to ensure renovations are meeting the proper standards.

The City will expand DOB’s Energy Code enforcement capacity to include the review and inspection of renovations. The program will result in better energy performance from retrofits and renovations of existing buildings. Building owners and occupants will save money on energy costs, and will be ensured higher quality construction and better-informed design and construction services.

### New York City’s Existing Building Code

As first proposed in *Housing New York*, the City will initiate the process of adopting a new building code for existing buildings.

Since 2008 there have been significant revisions to New York City’s construction codes, but the current scheme remains complex and time-consuming. Renovation and rehabilitation of existing buildings are subject to a strict regulatory structure that includes regulations set by state law, the applicable provisions of the building code, and interpretive regulations and guidelines. Most renovations are allowed to comply with the legacy code under which the building was first constructed, but these legacy codes do not always align with the current Energy Code that is subject to a three-year revision cycle.

The housing plan tasked the City to establish an Existing Buildings Code Revision Committee, consisting of relevant experts and stakeholders, to propose a comprehensive Existing Building Code based on the International Existing Building Code (IEBC), as has been enacted in the rest of New York State. Adopting a separate code for existing buildings will streamline permitting and simplify regulations governing building upgrades and energy efficiency improvements for buildings constructed prior to 2008, which accounts for the vast majority of buildings. Once the code is adopted, the City will also establish and maintain industry-wide training programs for the new code.

## Chapter 5

# A Global Hub for Clean Energy Technology and Innovation

## Create a Global Hub for Clean Energy Technology and Innovation

Over the past several years, New York City has positioned itself as a growing technology hub. As a result, the City began to attract many startups and growth-stage companies that are exploring new and innovative clean energy technologies. As a global center of finance and with some of the best research institutions and universities in the world, it is no wonder that these companies are choosing to call New York City home.

Clean energy technology startups and other emerging companies create local jobs and generate new economic activity. We want to encourage these companies and entrepreneurs to come to New York and use the city as a base to develop, prototype, and test new technologies. The City will support growth-stage companies and ensure they can remain in New York City by addressing their specific requirements for incubator spaces and large, flexible, and affordable facilities. To help prove the viability of promising new technologies, we will also study these emerging technologies and how they be implemented and scaled in New York City's unique built environment.

New York will solidify its position as a global hub for clean energy technology and innovation. As a result, all New Yorkers will benefit from the economic activity and the opportunities these technologies offer to help us meet our energy efficiency and GHG reduction goals for our low-carbon future.

## Ground Source Heat Pumps

Ground source heat pumps use electricity to cycle fluid between a building and underground wells to transfer heat. The ground beneath New York City maintains a stable temperature of 55 degrees year round, making it possible to use as a heat source in the winter and a heat sink during the summer. Several types of systems are available and applicable in New York City based on certain geological conditions, but actual penetration is limited by the high cost of drilling wells under existing buildings, space requirements, and the complexities of integrating these systems into a building's existing heating and cooling systems. The City's Department of Design and Construction (DDC) will soon release a full study of geothermal heat pumps in New York City, which will shed more light on potential applications in New York City.

## Explore Innovative Technologies for New York City Buildings

New York City plans to accelerate improvements in building efficiency and reductions in its GHG emissions using many of the currently available building system technologies in order to continue on the pathway toward 80 by 50. However, to cost-effectively reach that target, it will also be necessary to explore new and innovative technologies and study how they can be implemented in New York City's unique built environment. This is important for building owners that may be reluctant to adopt new technologies without a track record of successful implementation in similar building types.

To help prove the viability of promising technologies, the City will undertake or fund in-depth technical studies of emerging energy efficiency and clean energy technologies. One study already underway will examine ground source heat pumps and their applicability to New York City, which are proven at several City-owned buildings, but are still difficult to implement and expensive to site.<sup>19</sup> Another technology that City will research is liquid desiccant air conditioning, which dehumidifies and cools simultaneously—cutting conditioning loads by half or more—but is still in the early stages of commercialization. Other potential opportunities for studies include solar and wind energy generation technologies, battery storage, microgrids, and smaller-scale CHP.

## Support Emerging Entrepreneurs in Clean Energy and Energy Efficiency

A growing number of startups and growth-stage companies based in New York City are pursuing emerging technologies in the clean technology sector. These companies require dedicated and flexible workspaces as well as specialized services, equipment and community support to continue their work in New York City. In particular, these companies need large, affordable spaces for operational activities such as warehousing of inventory, testing and prototyping, and light manufacturing. Because existing incubators and shared workspaces can only accommodate between ten to fifteen people, companies seeking new growth-stage resources are at risk of leaving the city.

Expanding the City's clean technology incubator programs will address the needs of startups and growth-stage companies. Providing these resources allows a higher rate of success and ensures that local companies meet the growing demand for clean energy products and services, while also accelerating local job creation and economic growth. For example, the Urban Future Lab in Downtown Brooklyn opened in March 2014 with 10,000 square feet of incubator, educational, and demonstration space. As of July 2014 the Lab supported 17 portfolio companies, several of which are nearing their capacity limitations.

The programs will also provide real estate to address the requirements of startups and growth-stage companies and to solidify New York City's position as home to these companies. The "step-out space" concept, piloted by New York City's Economic Development Corporation (EDC), will create a 75,000 square foot facility that can be leased on a flexible basis for companies with between 15 and 20 people, helping these companies better manage their space needs over time.

The step-out space will be located in proximity to the Urban Future Lab, fostering the growing cleantech cluster in the "Tech Triangle," which includes Downtown Brooklyn, DUMBO and the Brooklyn Navy Yard, and creating a sense of community and collaboration and allowing shared-resources.

The potential impact of this initiative could create as many as 8,500 new jobs, with an economic impact of \$483 million.

## Case Study: Emerging Technology REGEN Energy

REGEN Energy is an emerging clean technology company with incubator space at Urban Future Lab that has developed a wireless energy management system as an inexpensive solution for building operators to optimize energy performance. REGEN's "Swarm Energy Management" solution is less expensive to install than traditional building management systems, and generates real-time data, allowing building owners and operators to better manage their peak electricity demand and consumption.

REGEN Energy pioneered this innovative and sophisticated take on energy efficiency. Based on biomimicry and inspired by the communication patterns of honeybees, their system employs a logic that allows electrical equipment in buildings to communicate with each other and reduce peak electrical demand by up to 30 percent.

A national big box retailer with multiple store locations used this technology to reduce its average monthly electricity demand by 18 percent, saving the company \$989,000 since 2012. The data generated by the REGEN Energy system allowed the retailer to quickly make changes to calibrate building systems and reduce peak electrical demand when electricity prices are highest.

The Urban Future Lab helped REGEN Energy remain in New York City to develop, prototype, and test its wireless management systems by providing a collaborative space for innovation.

## Case Study: Business Development Bright Power, Inc.

Bright Power, Inc. was founded in 2004 as an energy management company dedicated to assisting multifamily apartment buildings. Bright Power helps its clients reduce their energy use, saving clients energy, money, and time. When New York City passed the Greener, Greater Buildings Plan in 2009, Bright Power recognized a business growth opportunity and moved quickly to capitalize on a growing market for energy auditors and commissioners. To invest in training for its staff needed to meet the new demand for these services, Bright Power was awarded a Training Grant through NYC Department of Small Business Services (SBS). The Training Grant funded specialized Energy Sales Professional training, Energy Modeling training, and Advanced Multifamily Building Auditing training for Bright Power's staff. The grant allowed the firm to increase the skill set of its existing engineering staff, enabling the firm to hire from within for higher-level positions and increase productivity.

The Training Grant helped Bright Power add an additional three percent to its market share—roughly a 40 percent increase over the previous year. In total, more than 30 staff were trained, 24 of which were covered under the grant, leading to better skills and higher wages. In addition, Bright Power was able to hire three new employees to the engineering team.



Chapter 6

# Summary of Impacts



## Summary of Impacts

We have laid out a bold vision to transform our buildings for a low-carbon future. Within the next decade, we will have reduced building-based emissions to levels that will put the city on a path towards an 80 by 50 reduction citywide, with our public buildings leading the way.

Our ten-year goals in this plan address our public buildings, new construction, and privately-owned existing buildings. Partnering with real estate and industry leaders, we will transform the way we construct and run our buildings to ensure that New York City is built to last.

The initiatives that we will begin today will build momentum on the progress we have made to date. Our initiatives will also begin realizing benefits that improve environmental quality, mitigate New Yorkers' rising housing costs, enhance the quality of our buildings, and create new jobs and opportunities for career advancement.

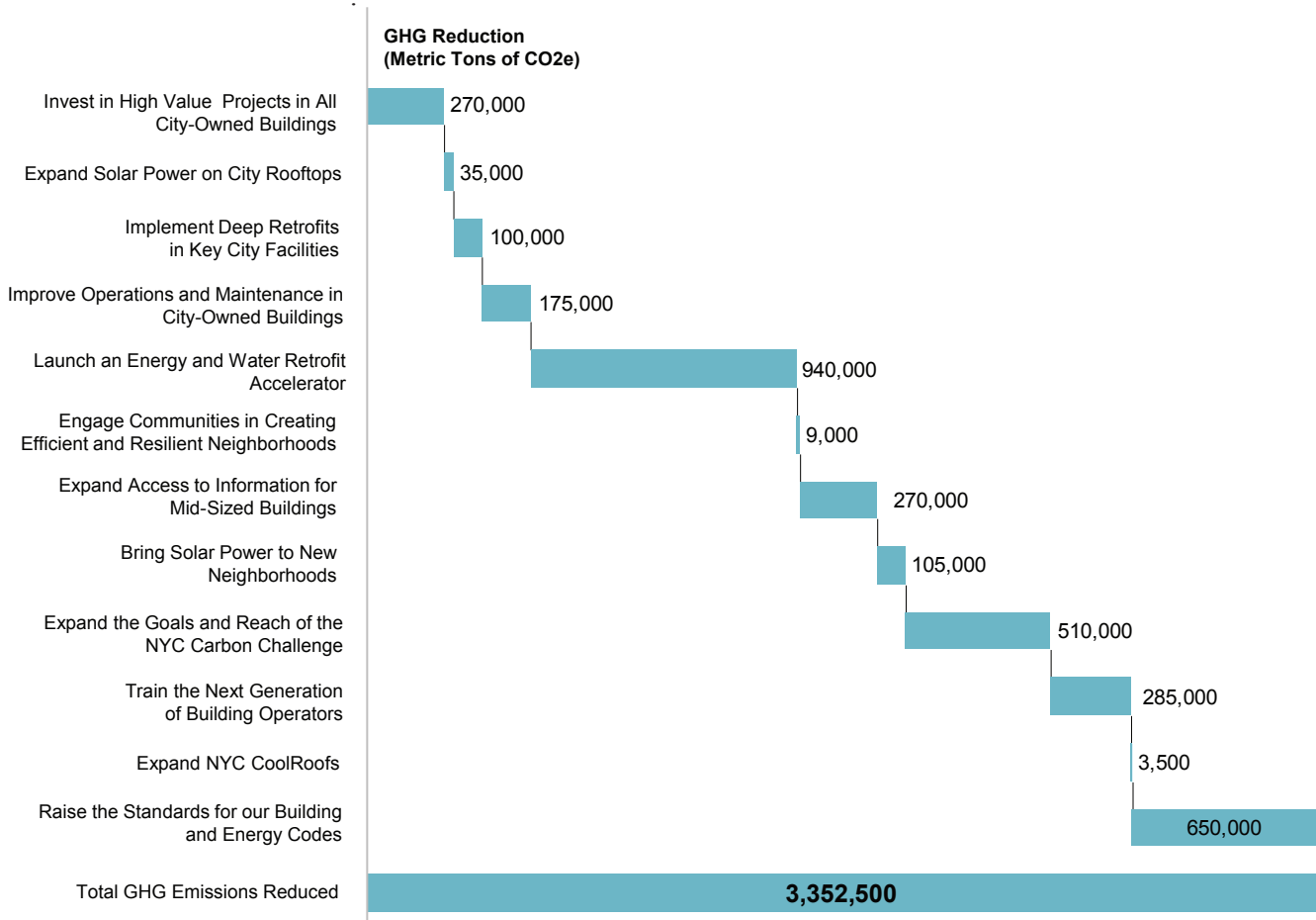
All together, the initiatives we have outlined in this plan are expected to reduce the GHG emissions from the energy we use to heat, cool, and power our buildings by roughly 3.4 million metric tons of carbon dioxide equivalent—an additional 10 percent decrease in our current building-based emissions levels on top of what we have already achieved. The retrofits that our public and private buildings undertake will generate an estimated \$750 million in construction spending every year over the next ten years, generating an estimated 3,500 construction-related jobs and hundreds of additional administrative and programmatic jobs. The efficiency improvements resulting from this plan are expected to generate \$1.4 billion in cost-savings for New Yorkers annually, and nearly \$8.5 billion in cumulative cost-savings over the course of ten years.

These initiatives will realize unprecedented reductions in GHG emissions from the energy used in our buildings—but we know we must do more. These reductions will be affected by growth in our economy, population, and built area. We will look to partners in our task force to help shape new policies and programs to help us achieve our goals, and we will track and report our progress to the public each year.

This plan lays out the first of many steps towards realizing our sustainability goals. By working together with our stakeholders and industry partners, we will continue to develop innovative ways to transform our building stock, fulfill our obligation to tackle global climate change, and make New York City a more sustainable, resilient, and energy efficient place for all.

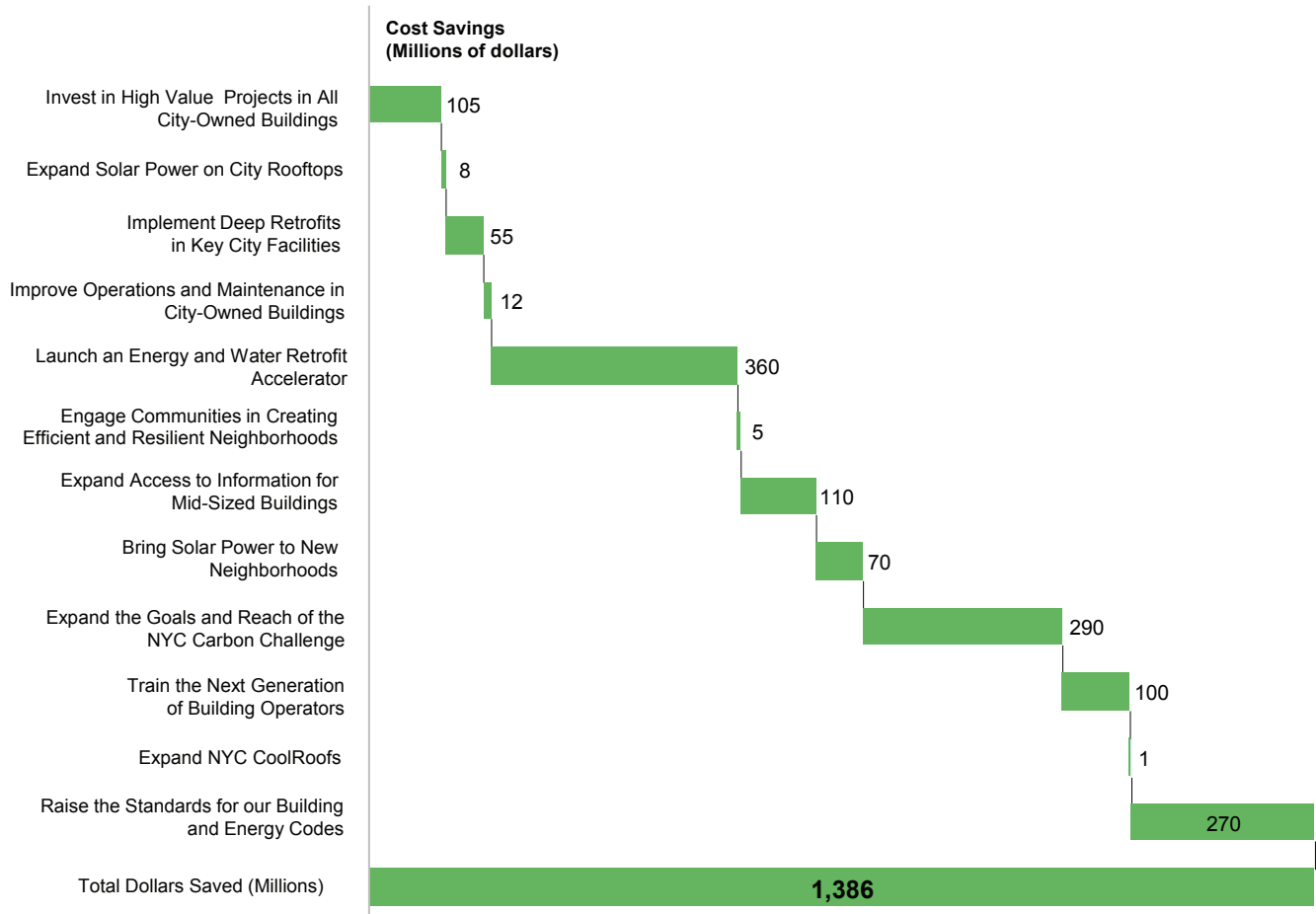
# GHG Emissions

The proposals in our plan are expected to reduce GHG emissions by nearly 3.4 million metric tons of carbon dioxide equivalent.



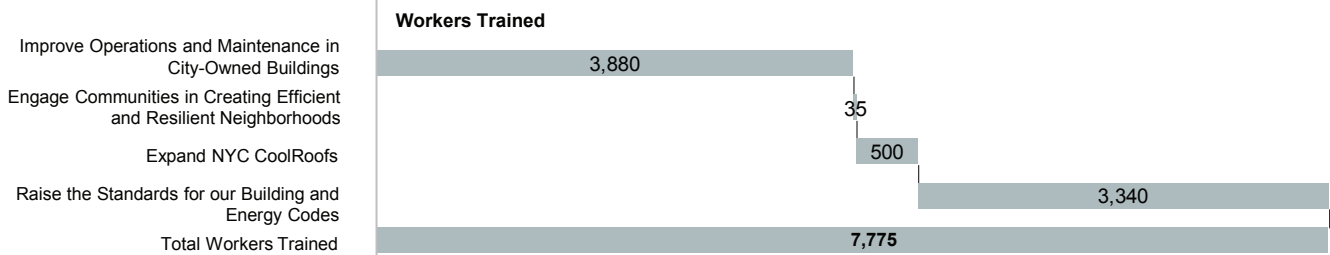
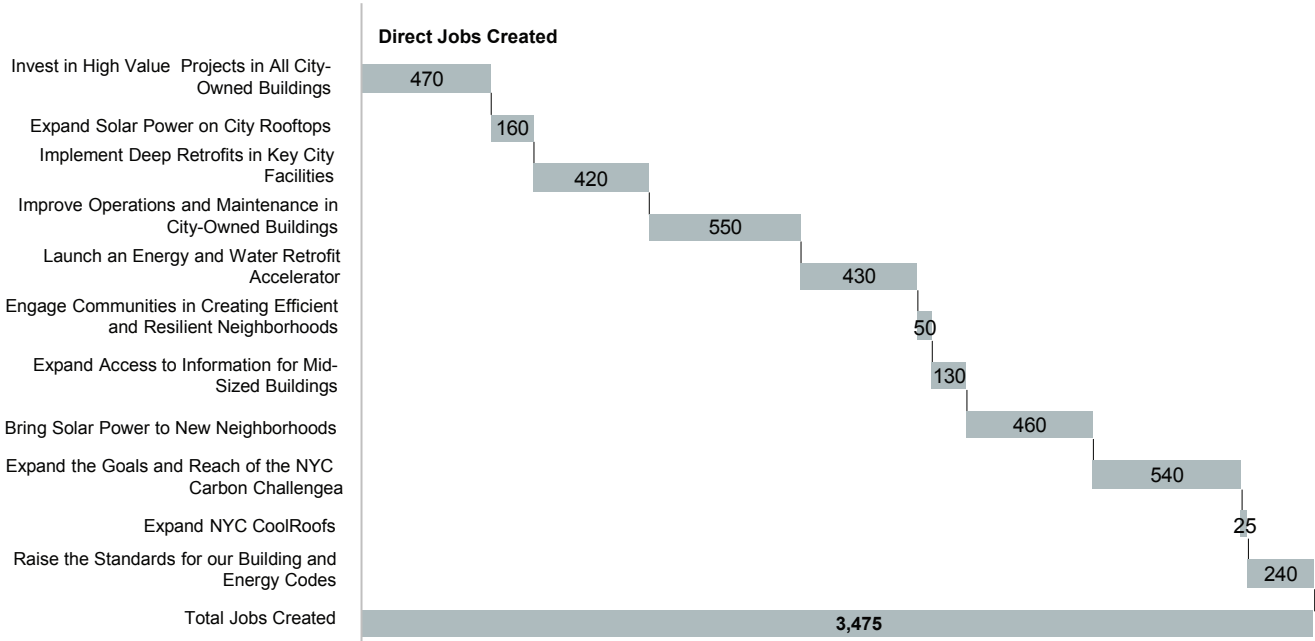
# Cost Savings

By 2025, the proposals are expected to save New Yorkers nearly \$1.4 billion annually on their utility bills, and \$8.5 billion cumulatively over ten years.



# Job Creation

The proposals in our plan are expected to create 3,475 direct jobs in construction and related industries and will train an estimated 7,775 workers to upgrade skills.





Chapter 7

# Appendices

# Footnotes

## Executive Summary

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15. Ground source heat pumps (GSHP) use electricity to cycle fluid between a building and underground wells to transfer heat. The ground maintains a stable temperature year round, which makes it possible to use as a heat source (in the winter) or a heat sink (in the summer) transferring heat from the ground to the building or vice-versa.



## Glossary

**Affordable Housing Preservation** This refers to the preservation of the affordability of the existing housing stock. Current affordable housing may be unregulated privately owned property, regulated privately owned property, or publicly-owned property. The City, in coordination with Federal, State, private, and non-profit partners, preserves affordability by offering building owners low cost loans for capital needs or refinancing and/or tax incentives for operations in exchange for regulatory agreements limiting rents to affordable levels.

**Air Pollutants** Air pollutants are particulates, biological molecules, or other harmful materials that have been introduced into the Earth's atmosphere that can cause serious health effects or even death to humans and other living organisms.

**Air Source Heat Pump** An air source heat pump (ASHP) is a system which transfers heat from outside to inside a building, or vice versa. An ASHP uses a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another. They can be used as a space heater or cooler, and are sometimes called "reverse-cycle air conditioners."

**Battery Storage System** A battery storage system is a method of storing electricity on site for use as an alternative to electricity supplied from the electrical grid. They can be used during periods of high demand on the electrical grid or during emergencies as backup power.

**Biodiesel** Biodiesel is a renewable alternative to petroleum diesel fuel (petrodiesel). It does not contain petroleum, but it can be blended at any level with petroleum diesel to reduce emissions and improve lubricity. The main sources for biodiesel are agricultural products such as soybeans and grapeseed (virgin oils), or waste products such as used cooking oil and unwanted animal fats (nonvirgin oils). Biodiesel is used as heating fuel and in standard diesel engines, unlike vegetable and waste oils used to fuel converted diesel engines. Biodiesel can be used alone, or blended with petrodiesel in various proportions such as a ratio of 20% biodiesel to 80% petrodiesel.

**Biogas** Biogas is a source of renewable energy, specifically methane, that is derived from the process of bacterial decomposition of sewage, manure, garbage, plant crops, or other organic waste products.

**Biomass** Biomass is any plant-derived organic matter available on a renewable basis, including agricultural and feed crops, agricultural crop wastes and residues, wood wastes and residues, aquatic plants, animal wastes, municipal wastes, and other waste materials. As an energy source, biomass can either be used directly via combustion to produce heat, or be converted into to various forms of biofuel.

**Building Retrofit** A building retrofit means making changes to the systems inside the building or even the structure itself at some point after its initial construction and occupation. Typically this is done with the expectation of improving ame-

**Department of Homeless Services (DHS)** The New York City Department of Homeless Services works to prevent homelessness by providing short-term emergency shelter and re-housing support in partnership with its clients, public agencies, and the business and nonprofit communities.

**Department of Housing Preservation and Development (HPD)** Using a variety of preservation, development and enforcement strategies, the Department of Housing Preservation and Development strives to improve the availability, affordability, and quality of housing in New York City, and to create and sustain viable neighborhoods for New Yorkers.

**Department of Small Business Services (SBS)** The Department of Small Business Services makes it easier for businesses in New York City to start, operate and expand by providing direct assistance to business owners, fostering neighborhood development in commercial districts, and linking employers to a skilled and qualified workforce.

**Energy Audit** Energy audit is an assessment of the energy consumption of a building, process or system to identify cost-effective energy improvements and operational changes that will result in energy savings.

**Energy Benchmarking** Energy benchmarking is a survey and analysis of the energy use of a building or group of buildings in comparison with other similar structures. Energy benchmarking also looks at how energy use for a particular building varies over time from a baseline measurement of energy use.

**Energy Efficiency** Energy efficiency is a means of managing and restraining the growth in energy consumption. A building, machine, or other energy consuming object is more energy efficient if it delivers more functions or services for the same energy input, or the same function or service for less energy input.

**Energy Use Intensity (EUI)** Energy Use Intensity (EUI) expresses a building's energy use as a function of its size or other characteristics. EUI is expressed as energy per square foot per year, and is calculated by dividing the total energy consumed by the building in one year (typically measured in kBtu) by the total gross floor area of the building.

**Federal Emergency Management Agency (FEMA)** The Federal Emergency Management Agency (FEMA) supports communities and first responders in efforts to build, sustain and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards.

**Flood Insurance Rate Maps (FIRMs)** FEMA produces Flood Insurance Rate Maps (FIRMs) which identify areas that are at risk of flooding. Areas are assigned different zones depending on the level of flood risk.

**Greenhouse Gas (GHG) Emissions** A greenhouse gas (GHG) absorbs and emits solar radiation within the atmosphere. Concentrations of these gases in the Earth's atmosphere is the main cause of the greenhouse effect, a process by which thermal radiation from the Earth's surface is absorbed by GHGs and is re-radiated in

nities for the building's occupants and/or improving the performance of the building. The development of new technologies mean that building retrofits can allow for significant reductions in energy and water usage.

**Carbon Dioxide Equivalent** Carbon dioxide equivalent or CO<sub>2</sub>e is a measure for describing how much global warming a given type and amount of greenhouse gas may cause, using the equivalent amount or concentration of carbon dioxide (CO<sub>2</sub>) as a reference. Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents, abbreviated as MTCO<sub>2</sub>e.

**Carbon Neutral** A building that is carbon neutral does not use fossil fuels, creates no direct greenhouse gas emissions, and, as a result, does not contribute to global warming. The energy it uses may be produced on site or may be drawn from a utility grid but it must be "clean," produced by wind turbines, photovoltaics, or other renewable energy system.

**Certified Reasonable Cost (CRC)** By law, J-51 tax abatement benefits are capped at a maximum annual and maximum aggregate represented as a percentage of the CRC, which are the costs of the alterations or improvements schedule identified in a schedule promulgated by agency rules attributing a maximum value to each renovation item.

**Clean or Renewable Energy** Clean or renewable energy is generally defined as energy that comes from naturally replenishing resources, such as sunlight, wind, rain, tides, waves and geothermal heat.

**Climate Change** Climate change is a change to global or regional climate patterns that occurs when the atmosphere is altered due to the release of greenhouse gas emissions from increased fossil fuel combustion and changing land use patterns.

**Combined Heat and Power (CHP)** Combined heat and power (CHP), also known as cogeneration, is the simultaneous production of two or more useful forms of energy from a single device, typically electricity and useful heat. A CHP system will take fuel, most commonly natural gas, to generate electricity. Excess heat from this process is then used to provide space or hot water heating to buildings, or process heat for manufacturing.

**Department of City Planning (DCP)** The New York City Department of City Planning oversees the City's zoning and land use processes. It works to promote strategic growth and development in the City, in part, by initiating planning and zoning changes for individual neighborhoods and business districts.

**Department of Citywide Administrative Services (DCAS)** The City of New York Department of Citywide Administrative Services ("DCAS") ensures that City agencies have the critical resources and support needed to carry out their missions and to provide the best possible services to the public. Specifically, through its Division of Energy Management (DEM), DCAS establishes, audits and pays utility accounts that serve more than 4,000 buildings; and implements energy efficiency programs and clean resource projects throughout City facilities.

all directions. Since part of this re-radiation is back towards the surface, it results in an increase in average surface temperature. The main GHGs are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

**Geothermal / Ground Source Heat Pumps** Geothermal heat pumps, also known as ground source heat pumps, tap into the constant temperature of the earth beneath a building to provide efficient heating and cooling. These systems operate by exchanging heat energy between the building and the ground, providing heating in the winter and cooling in the summer.

**Global Warming** Global warming is the increase of the Earth’s surface temperature due to increased concentrations of greenhouse gas emissions in the atmosphere.

**Heavy Heating Fuel Oil** There are three grades of heating oil burned in New York City, No. 6, 4, and ultra-low sulfur 2 (ULS 2). The heaviest grade, No. 6 oil, resembles tar or asphalt. It is often referred to as residual oil because it literally comes from “the bottom of the barrel” of the petroleum refinement process. Because of its high sulfur content, burning No. 6 oil releases significant quantities of fine particulate matter (PM<sub>2.5</sub>) in chimney exhaust. When PM<sub>2.5</sub> becomes embedded in people’s lungs it can aggravate existing respiratory diseases such as asthma and cause heart attacks or other cardiovascular episodes. Emissions of the heavy metal nickel are also a major concern, as it can increase the risk of heart disease and other ailments when ingested.

**Infrastructure** Infrastructure is the set of interconnected structural elements that provide a framework supporting an entire structure of development.

**International Existing Building Code (IEBC)** The International Existing Building Code (IEBC) is a model code developed by the International Code Council establishes minimum regulations for existing buildings intended to encourage the use and reuse of existing buildings while requiring reasonable upgrades and improvements.

**J-51 Tax Exemption and Abatement program** J-51 is an as-of-right tax exemption and abatement for residential rehabilitation or conversion to multiple dwellings. Eligible projects include HPD-financed or privately financed moderate and gut rehabilitation of multiple dwellings, privately financed and government–assisted major capital improvements to multiple dwellings, or conversions of lofts and other non-residential buildings into multiple dwellings.

**Light-emitting Diode (LED)** Light-emitting diode (LED) lighting produces light efficiently by passing electrical currents through semiconductor material. LED light bulbs emit more visible light using less electrical power and have a notably longer lifespan than traditional incandescent light bulbs or compact fluorescent lamps.

**New York City Economic Development Corporation (EDC)** New York City Economic Development Corporation is the City’s primary vehicle for promoting economic growth in each of the five boroughs. NYCEDC’s mission is

to stimulate growth through expansion and redevelopment programs that encourage investment, generate prosperity and strengthen the City's competitive position. NYCEDC also helps create affordable housing, new parks, shopping areas, community centers, and cultural centers.

**New York City Housing Authority (NYCHA)** NYCHA's 334 public housing developments house more than 400,000 New Yorkers across the five boroughs, and another 235,000 receive subsidized rental assistance in private homes through the NYCHA-administered Section 8 Program. HPD, in collaboration with NYCHA, rehabilitates NYCHA housing stock and constructs low- and moderate-income units on vacant NYCHA property.

**New York City Housing Development Corporation (HDC)** The New York City Housing Development Corporation provides a variety of financing programs for the creation and preservation of multifamily affordable housing throughout the five boroughs of New York City. HDC programs are designed to meet the wide range of affordable housing needs of the city's economically diverse population.

**New York State Energy Research and Development Authority (NYSERDA)** The New York State Energy Research and Development Authority is a public benefit corporation created in 1975 tasked with helping New York meet its energy goals: reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment.

**Office of Long Term Planning and Sustainability (OLTPS)** New York City's Office of Long-Term Planning and Sustainability coordinates with all other City agencies to develop, implement, and track the progress of PlaNYC and other issues of infrastructure and the environment which cut across multiple City departments. In addition to producing PlaNYC, the Office of Long-Term Planning and Sustainability promotes the integration of sustainability goals and practices into the work of City agencies and the lives of New Yorkers.

**Onsite Renewable Power** On-site Renewable Power are generation technologies derived from sun, wind, water, or the Earth's core that can produce some or all of the energy a building consumes, and are typically cleaner or more efficient than the energy supplied by a traditional power utility. Many of these technologies require a large upfront investment, but they will typically provide operational savings and provide numerous environmental benefits.

**Particulate Matter** Particulate matter, also known as particle pollution or PM, is a mixture of particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

**Passive House** Passive house refers to a rigorous, voluntary standard for energy efficiency in a building. A building constructed using passive house principles is very well insulated, virtually air-tight and primarily heated externally via solar energy and internally from building occupants, electrical equipment, etc. Energy

losses are minimized. Any remaining heating or cooling demand is provided by an extremely small source, and balanced fresh air is constantly supplied. This standard saves up to 90% of space heating and cooling costs, and provides very high indoor air quality.

**Performance Mandate** A performance mandate is legislation that requires a target level of performance to be met with flexibility in the means of achieving the target. For buildings, a performance mandate is legislation that requires the energy use within a building to meet a targeted level of consumption.

**Power Purchase Agreement** A Power Purchase Agreement (PPA) is a contract between a seller who generates electricity and a buyer looking to purchase electricity. The PPA defines all of the terms for the sale of electricity between the two parties, including when the project will begin operation, schedule for delivery of electricity, penalties, payment terms, and termination.

**Retro-commissioning** Retro-commissioning is the testing and tune-up of existing building systems to confirm they are operating as designed and as efficiently as possible. Retro-commissioning commonly identifies maintenance, calibration, and operations errors that are easily corrected and, when implemented, save energy and improve equipment reliability.

**Solar Photovoltaic (PV)** Solar Photovoltaic (PV) systems, also known as Solar Electric systems or solar panels, convert sunlight into electricity. Installing solar PV can help save energy costs by reducing the need to purchase electricity from a utility. Moreover, any excess electricity produced that a building does not use is sold to the utility in a process called net-metering.

**U.S. Department of Housing and Urban Development (HUD)** The U.S. Department of Housing and Urban Development is the nation's federal housing agency. HUD provides funding and programmatic support to sustain homeownership, create affordable housing opportunities for low-income Americans, and support the homeless, elderly, people with disabilities and people living with AIDS. HUD also promotes economic and community development and enforces the nation's fair housing laws.

**Zero Net Energy** Zero net energy refers to a state of zero net energy consumption. A building is a zero net energy building when the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site.

**Zoning Laws** Zoning laws or zoning ordinance are techniques or legal instruments of land-use planning used by local governments to establish criteria for permissible uses, sizes and configurations of structures, requirements for open space, parking, and other provisions within a community.

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