

# Climate Change





# Together we can

Reduce and track greenhouse gas emissions

Assess vulnerabilities and risks from climate change

Increase the resilience of the city's built and natural environments

Protect public health from the effects of climate change

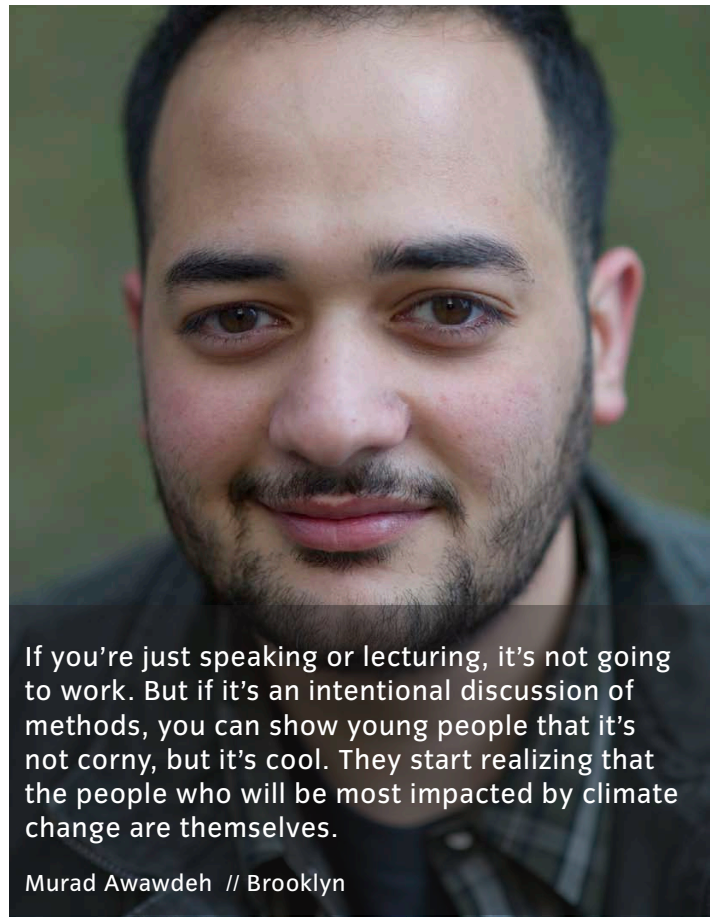
Increase the city's preparedness for extreme climate events

Create resilient communities through public information and outreach



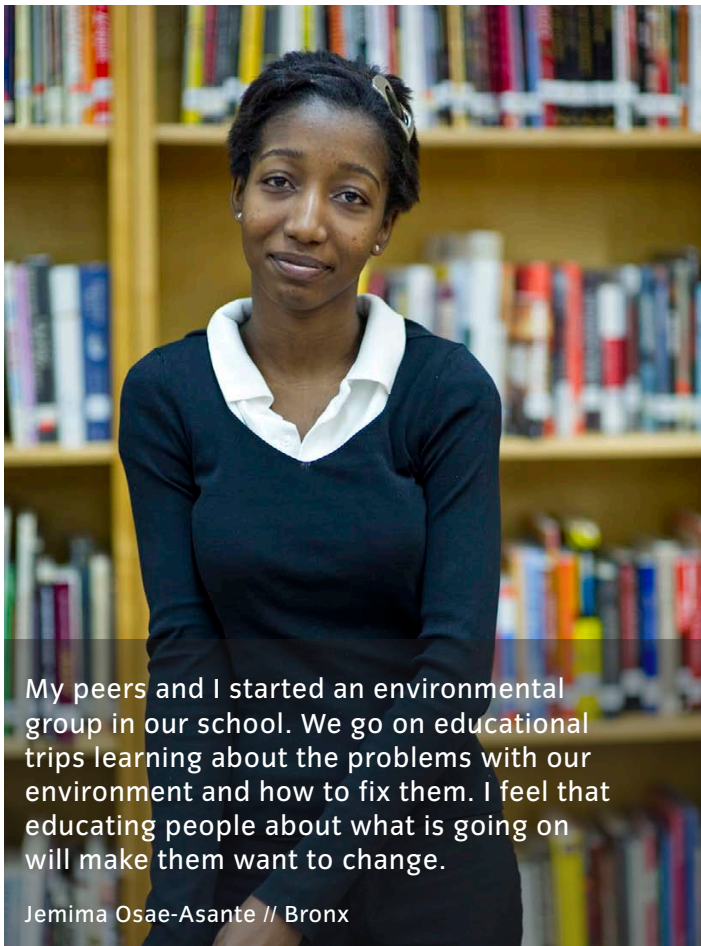
Cities are not constrained by the politics of an international agenda. Cities are able to act. A lot of the breakthroughs happening in climate change adaptation are coming from cities around the world.

Robert Pollard // Manhattan



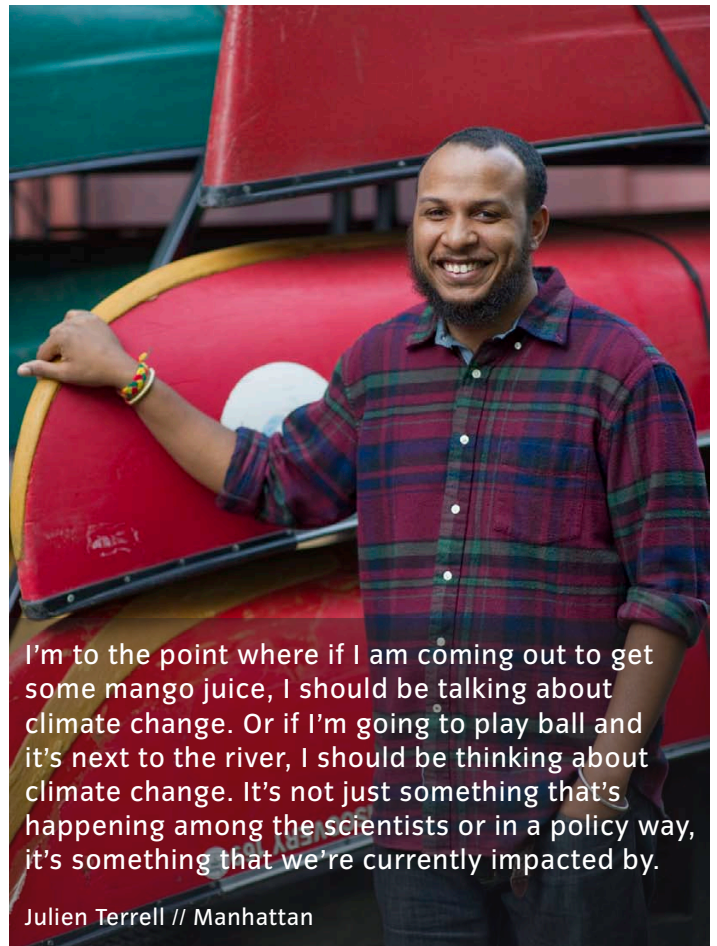
If you're just speaking or lecturing, it's not going to work. But if it's an intentional discussion of methods, you can show young people that it's not corny, but it's cool. They start realizing that the people who will be most impacted by climate change are themselves.

Murad Awawdeh // Brooklyn



My peers and I started an environmental group in our school. We go on educational trips learning about the problems with our environment and how to fix them. I feel that educating people about what is going on will make them want to change.

Jemima Osae-Asante // Bronx



I'm to the point where if I am coming out to get some mango juice, I should be talking about climate change. Or if I'm going to play ball and it's next to the river, I should be thinking about climate change. It's not just something that's happening among the scientists or in a policy way, it's something that we're currently impacted by.

Julien Terrell // Manhattan



# Climate Change

**Reduce greenhouse gas emissions by more than 30%**

**Increase the resilience of our communities, natural systems, and infrastructure to climate risks**

Cities are at the forefront of both the causes and effects of climate change. Urban areas are estimated to be the source of approximately 80% of global greenhouse gas (GHG) emissions. At the same time, urban areas located on a coast like New York City face increased climate risks. Accordingly, cities have a responsibility to deal with both the causes and effects of climate change.

New York City has always faced climate risks, including heat waves, snow storms, high winds, tropical storms, storm surges, lightning, and torrential downpours. These events affect every New Yorker, and as our climate changes, they will become more frequent and severe.

In addressing climate change, we must be guided by the best available science. In 2008, we convened the New York City Panel on Climate Change (NPCC) to advise the City on climate change. The NPCC projects that by mid-century, New York City's average temperatures will rise by three to five degrees Fahrenheit, and sea levels could rise by more than two feet. By the end of the century, the city's climate may be more similar to North Carolina than present-day New York City. While New Yorkers currently experience an average of 14 days a year with temperatures over 90 degrees Fahrenheit, by the 2080s it could be more than 60 days.

We can reduce our local contributions to climate change by reducing our GHG emissions, which today account for about one-sixth of one percent of global emissions annually—roughly the same amount as Switzerland. While New Yorkers already have one of the lowest per capita carbon footprints among major global cities, we are taking aggressive action to reduce citywide GHG emissions further. A significant reduction in the carbon intensity of our electricity supply—driven by a shift in the fuels used to generate our electricity—has been chiefly responsible for a 13% drop in emissions from 2005 levels. Achieving our target of a 30% reduction in GHG emissions from 2005 levels by 2030, however, will require considerable effort in the coming years.

Reducing our emissions and slowing climate change will yield tremendous environmental and economic benefits, but even if global GHG emissions are reduced, some climate change is inevitable. The scientific evidence is irrefutable; GHG mitigation efforts can reduce the severity of climate change, but they cannot completely prevent it from happening. As a result, not only must GHG emissions be curbed, but we must increase the city's climate resilience—our ability to withstand and recover from extreme events and environmental changes.

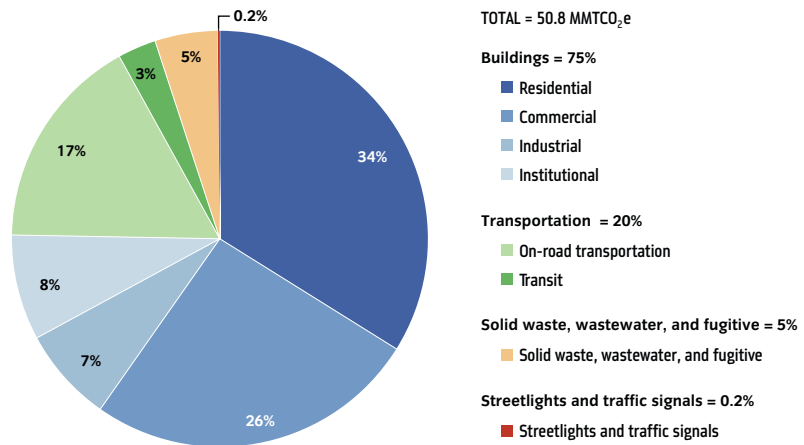
Even as our understanding of climate change and its impacts evolves, we have already taken several actions to increase our resilience. We have identified likely impacts to the city's critical infrastructure. We are reducing buildings' contribution to high summer temperatures. We are preparing vulnerable populations for coastal storms and heat waves. And we are working with cities around the globe that recognize the importance of national and international leadership on climate change. As the Chair of the C40 Cities Climate Leadership Group, which brings together the leading largest cities in the world to work collectively to reduce GHG emissions, Mayor Bloomberg is shaping the global dialogue and action on climate change in cities.

## Our Plan

No single action can achieve our GHG reduction goal or prevent climate change from impacting the city. We must make a number of strategic investments in our infrastructure and operations to reduce our contribution to global GHG emissions and our exposure to climate risks. This Plan provides details about our strategies for mitigating our GHG emissions and increasing our climate resilience.

In our Housing and Neighborhoods plan, we are directing new development to areas well-served by transit, reducing reliance on cars. We are

## 2009 Citywide GHG Emissions by Sector



Source: NYC Mayor's Office

providing homeowners and developers with information on how they can reduce their energy consumption. We are also incorporating energy efficiency standards into specifications for our City-financed rehabilitation and construction projects.

In our Parks and Public Space plan, we are planting one million trees and creating a network of green corridors. Greening the city will reduce GHG emissions, help combat the urban heat island effect, and enhance stormwater management.

In our Waterways plan, we are increasing our ability to capture and retain stormwater. Our Green Infrastructure Plan, capital investments in our wastewater treatment plants and sewer system, and modifications to codes and standards will all allow us to better cope with intense downpours. We are also protecting existing wetlands, as well as creating new areas that could serve as natural barriers for coastal storms.

In our Transportation plan, we are providing New Yorkers with more sustainable transportation options. These include improved and expanded bus, subway, and commuter rail service, expanded ferry service, and enhanced bicycle and pedestrian safety, as well as convenience. These will all reduce GHG emissions related to transportation. In our Air Quality plan, we are switching to less-polluting, more efficient fuels, and reducing emissions from taxis, black cars, and for-hire vehicles.

In our Energy plan, we are reducing energy consumption in buildings and investing in our energy infrastructure to lessen our dependence on fossil fuels. The City government will also continue to lead by example by modifying operations and investing in cost-effective retrofits and upgrades. Through these efforts and others, we will reduce our GHG emissions from government operations by more than 30% below Fiscal Year (FY) 2006 levels by 2017.

In our Solid Waste plan, we are reducing the amount of garbage we export to landfills, where it decomposes and emits methane, a harmful GHG. We are also making our solid waste management system more efficient. Together these measures will reduce GHG emissions by 2%.

Through all these efforts, we will reduce citywide GHG emissions by more than 30% below 2005 levels by 2030. We will increase our climate resilience. And we will enhance our city's quality of life, save New Yorkers money, and create economic opportunities.

These efforts alone, however, are not enough. We must continue to measure and track our progress toward our carbon reduction goal, even as we begin to chart a course to an 80% reduction in GHG emissions by 2050.

To increase our resilience even further, we will build upon many of the planning efforts already underway. This will ensure that the knowledge we have gained is put to use on the most cost-effective risk reductions. We will create a climate risk assessment tool to prioritize our actions and evaluate the effectiveness of our decisions.

Building on our existing knowledge, we will update critical planning tools and regulations to increase the resilience of our buildings, infrastructure, and natural assets. To expand our understanding of resilience, we will identify potential measures to protect coastal areas from storm surges. We will complete a comprehensive

## Our plan for climate change:

### Reduce and track greenhouse gas emissions

- 1 Release an annual inventory of greenhouse gas emissions
- 2 Assess opportunities to further reduce greenhouse gas emissions by 80% by 2050

### Assess vulnerabilities and risks from climate change

- 3 Regularly assess climate change projections
- 4 Partner with the Federal Emergency Management Agency (FEMA) to update Flood Insurance Rate Maps
- 5 Develop tools to measure the city's current and future climate exposure

### Increase the resilience of the city's built and natural environments

- 6 Update regulations to increase the resilience of buildings
- 7 Work with the insurance industry to develop strategies to encourage the use of flood protections in buildings
- 8 Protect New York City's critical infrastructure
- 9 Identify and evaluate citywide coastal protective measures

### Protect public health from the effects of climate change

- 10 Mitigate the urban heat island effect
- 11 Enhance our understanding of the impacts of climate change on public health

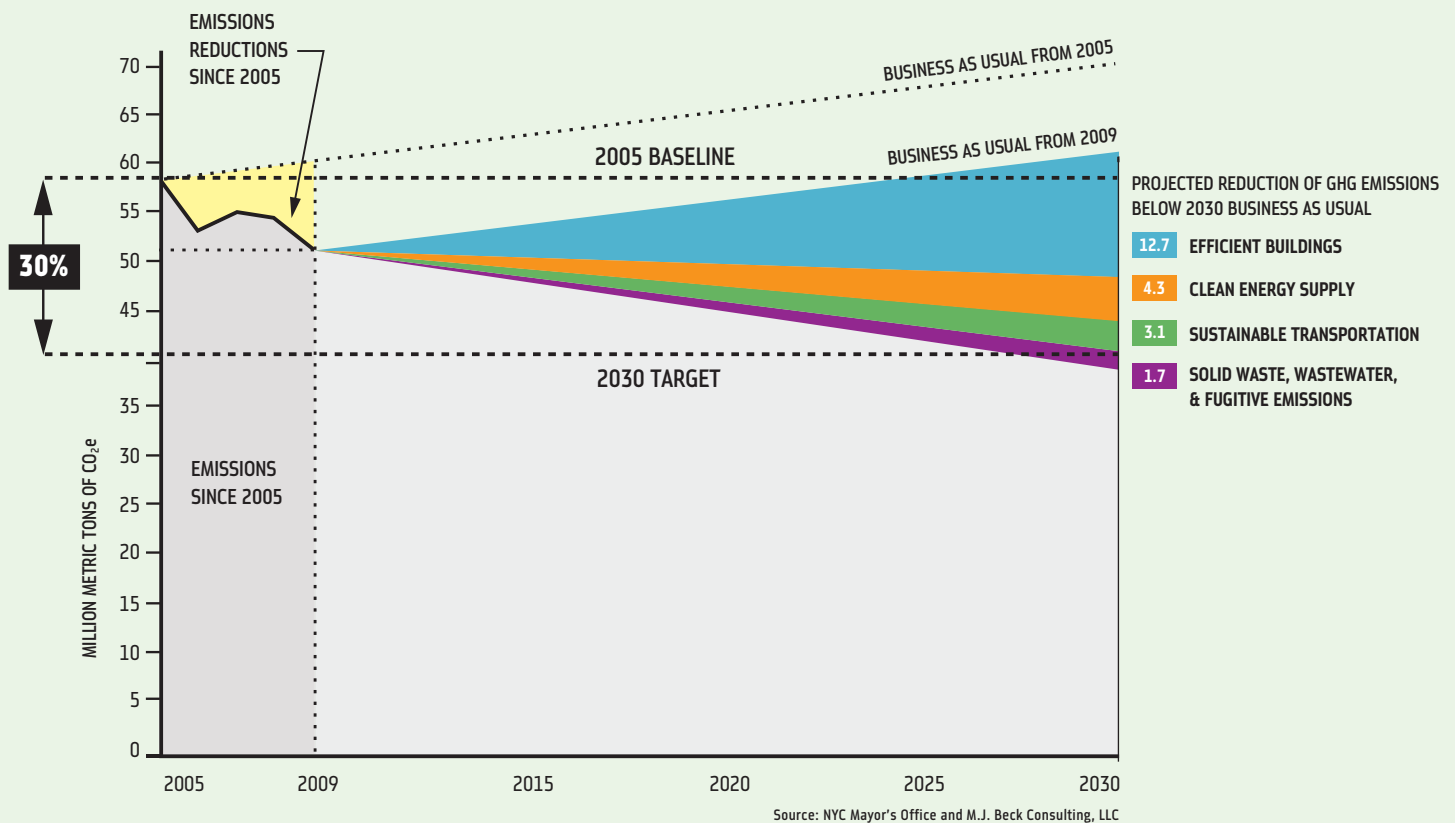
### Increase the city's preparedness for extreme climate events

- 12 Integrate climate change projections into emergency management and preparedness

### Create resilient communities through public information and outreach

- 13 Work with communities to increase their climate resilience

# Projected Impacts of Our Greenhouse Gas Reduction Strategies



## EFFICIENT BUILDINGS

- Foster the creation of Greener, Greater Communities
- Increase the sustainability of City-financed and public housing
- Implement the Greener, Greater Buildings Plan
- Improve our codes and regulations to increase the sustainability of our buildings
- Improve compliance with the energy code and track green building improvements citywide
- Improve energy efficiency in smaller buildings
- Improve energy efficiency in historic buildings
- Provide energy efficiency financing and information
- Provide energy efficiency leadership in City government buildings and operations
- Expand the Mayor's Carbon Challenge to new sectors

## CLEAN ENERGY SUPPLY

- Increase planning and coordination to promote clean, reliable, and affordable energy
- Support cost-effective repowering or replacement of our most inefficient and costly in-city power plants
- Encourage the development of clean distributed generation
- Foster the market for renewable energy in New York City
- Develop a smarter and cleaner electric utility grid for New York City
- Promote the use of cleaner-burning heating fuels

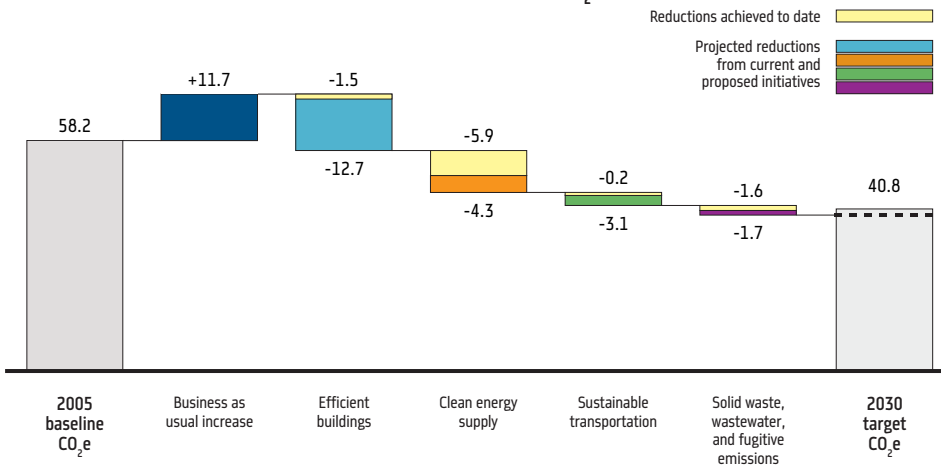
## SUSTAINABLE TRANSPORTATION

- Continue transit-oriented rezonings
- Promote walkable destinations for retail and other services
- Improve and expand bus service throughout the city
- Improve and expand subway and other commuter rail
- Promote car sharing
- Expand and improve ferry service
- Make bicycling safer and more convenient
- Enhance pedestrian access and safety
- Reduce, replace, retrofit, and refuel vehicles
- Facilitate the adoption of electric vehicles
- Reduce emissions from taxis, black cars, and for-hire vehicles
- Work with the Port Authority to implement the Clean Air Strategy for the Port of New York and New Jersey

## SOLID WASTE, WASTEWATER, & FUGITIVE EMISSIONS

- Promote waste prevention opportunities
- Increase the reuse of materials
- Incentivize recycling
- Improve the convenience and ease of recycling
- Revise City codes and regulations to reduce construction and demolition waste
- Create additional opportunities to recover organic material
- Identify additional markets for recycled materials
- Pilot conversion technologies
- Improve the City government's diversion rate

## Achieved and Projected GHG Emissions Reductions (MMT<sub>CO<sub>2</sub>e</sub>)



Source: NYC Mayor's Office

study on the health impacts of all climate-related events. We will also continue to keep New Yorkers safe through our extensive emergency preparedness and response programs and active engagement with vulnerable communities.

## Reduce and track greenhouse gas emissions

New York City's GHG emissions are largely the result of fossil fuel energy consumed by buildings and transportation. Roughly 75% of our GHG emissions are related to heating, cooling, powering, and lighting buildings. 20% of our GHG emissions are related to transportation.

In 2009, New York City emitted 50.8 million metric tons of carbon dioxide equivalent, a 13% reduction from 2005 levels. This drop is attributed to less carbon-intensive and more efficient electricity generation, reduced per capita energy consumption, and reduced emissions of sulfur hexafluoride, a potent GHG. While this puts us on track to meet our goal of a 30% reduction in emissions by 2030, we must do more, as we cannot ensure the same annual reduction due to uncertain factors we do not control, such as weather.

Regular, accurate GHG emissions inventories allow us to focus our policy initiatives—such as improving the energy efficiency of existing large buildings through landmark green buildings legislation. These updates ensure that we are implementing the most effective GHG mitigation strategies. They also provide transparent data for New Yorkers to use in holding us accountable.

### INITIATIVE 1

## Release an annual inventory of greenhouse gas emissions

We are already seeing significant reductions in our GHG emissions. These are mostly due to a reduction in the carbon intensity of our electricity supply and other factors beyond the City's direct control. To meet our ambitious goals, we need accurate data to measure our progress. Annual inventory updates provide valuable information on emissions trends in New York City, as well as the impacts that weather, population, infrastructure investments, policy decisions, and consumer behavior have on GHG emissions levels.

Our initiatives to reduce energy demand and the carbon intensity of our electricity supply, to increase opportunities for more sustainable transportation, and to improve solid waste management will all contribute toward achieving our GHG reduction goal. We will continue to measure and report GHG emissions annually from both City government operations and from the city as a whole to ensure we remain on track toward achieving our reduction goals for each of these sectors. We will also expand our GHG inventory to include neighborhood-level emissions. This will help us better understand the energy intensity of our neighborhoods, target policies to carbon-intensive areas, and provide communities with critical information to help them reduce their emissions.

While extending our practice of GHG measurement to the neighborhood level, we will also collaborate with other cities to refine the methods of GHG measurement and reporting. The science of estimating GHG emissions is an evolving one, with a variety of models and practices in use around the globe. New York City will remain at the forefront of that discipline, learning from practitioners in other cities while also sharing our own expertise.

## CASE STUDY Greenhouse Gas Mitigation

New York City is already one of the most energy efficient cities in the U.S. Each New Yorker is responsible for the emission of a third of the GHG generated by the average American. Our energy efficiency is due to both the high density of our built environment and our extensive public transit network. Despite this, we have the opportunity and responsibility to further reduce our energy consumption and GHG emissions.

In 2007, we set the goal of reducing the city's GHG emissions by 30% below 2005 levels by 2030. Our annual GHG inventory demonstrates that we are currently on-track to achieve that goal, having reduced citywide GHG emissions by 13% below 2005 levels in just four years.

Much of the reduction in our GHG emissions can be attributed to external effects. The carbon intensity of our electricity supply has decreased 26% since 2005. This decrease is due to new, more efficient power plants and an increase in the importation of renewable power made possible by a new electricity transmission line. Together, these changes to our electricity supply system are responsible for reducing our annual GHG emissions by 10%. Significant investment by Con Edison to reduce leaks of fugitive sulfur hexafluoride in its electricity transmission and distribution system has also lowered our emissions by 3%.

While external effects have been responsible for most of our GHG reductions to date, we also have seen that per capita electricity and heating fuel consumption have decreased. This means that New Yorkers are becoming more energy-efficient. However, to remain on track to achieve our GHG reduction goal, we must continue making significant reductions in per capita energy use. We cannot meet our goals by relying on the continued benefit of external effects such as weather or the carbon intensity of our electricity supply.

Our GHG mitigation strategies include measures to further reduce emissions from our energy supply, including fuel switching and increased use of renewables and cogeneration. Continued reduction of energy demand, reductions from new solid waste management strategies, and more sustainable transportation will ensure we meet our 30% reduction goal and continue on a path toward additional future reductions.



# Climate Change Projections for New York City<sup>1</sup>

|  | BASELINE<br>1971-2000   | 2020s                        | 2050s                        | 2080s                        |
|--|-------------------------|------------------------------|------------------------------|------------------------------|
| Air Temperature <sup>2</sup>                               | 55°F                    | + 1.5 to 3°F                 | + 3 to 5°F                   | + 4 to 7.5°F                 |
| Precipitation <sup>2</sup>                                 | 46.5 in                 | + 0 to 5%                    | + 0 to 10%                   | + 5 to 10%                   |
| Sea Level Rise <sup>2,3</sup>                              | NA                      | + 2 to 5 in                  | + 7 to 12 in                 | + 12 to 23 in                |
| Rapid Ice-Melt<br>Sea Level Rise <sup>4</sup>              | NA                      | + 5 to 10 in                 | + 19 to 29 in                | + 41 to 55 in                |
| Number of Days Per Year<br>With Temperature Over 90°F      | 14                      | 23 to 29                     | 29 to 45                     | 37 to 64                     |
| 1-in-100 Year Flood to<br>Reoccur, On Average <sup>5</sup> | once every<br>100 years | once every<br>65 to 85 years | once every<br>35 to 55 years | once every<br>15 to 35 years |

1 Based on 16 Global Climate Models (GCMs) (7 GCMs for Sea Level Rise) and three emissions scenarios. Baseline is 1971-2000 for temperature and precipitation and 2000-2004 for sea level rise. Data from National Weather Service (NWS) and National Oceanic and Atmospheric Administration (NOAA). Temperature data are from Central Park; precipitation data are the mean of the Central Park and La Guardia Airport values; and sea level data is from the Battery at the southern tip of Manhattan (the only location in NYC for which comprehensive historic sea level rise data are available).

2 Projections represent the middle 67% of values from model-based probabilities; temperatures ranges are rounded to the nearest half-degree, precipitation to the nearest 5%, and sea level rise to the nearest inch.

3 The model-based sea level rise projections may represent the range of possible outcomes less completely than the temperature and precipitation projections.

4 Rapid ice-melt scenario is based on acceleration of recent rates of ice melt in the Greenland and West Antarctic Ice sheets and paleoclimate studies.

5 Does not include the rapid ice-melt scenario.

Source: New York City Panel on Climate Change

## Other Initiatives That Will Increase Our Climate Resilience

### HOUSING AND NEIGHBORHOODS

- Foster the creation of Greener, Greater Communities
- Increase the sustainability of City-financed and public housing

### PARKS AND PUBLIC SPACE

- Create a network of green corridors
- Plant one million trees
- Support ecological connectivity
- Incorporate sustainability through the design and maintenance of all public space

### WATERWAYS

- Complete cost-effective grey infrastructure projects to reduce CSOs and improve water quality
- Expand the sewer network
- Optimize the existing sewer system
- Expand the Bluebelt program
- Build public green infrastructure projects
- Engage and enlist communities in sustainable stormwater management
- Provide incentives for green infrastructure
- Enhance wetlands protection
- Restore and create wetlands

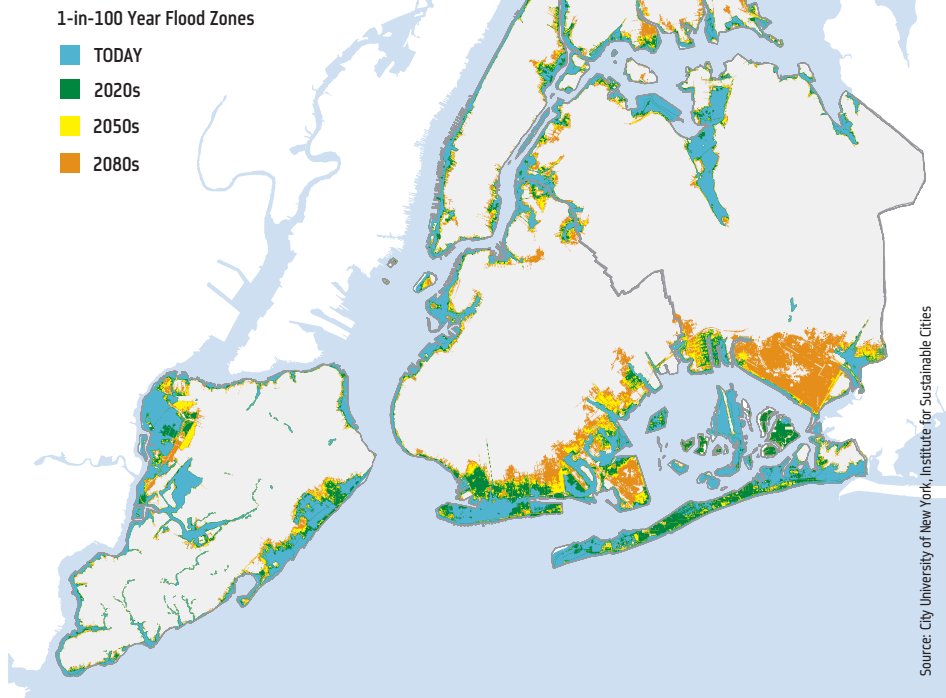
### WATER SUPPLY

- Maintain and upgrade dams
- Increase operational efficiency with new technology
- Increase water conservation

### ENERGY

- Implement the Greener, Greater Buildings Plan
- Improve our codes and regulations to increase the sustainability of our buildings
- Improve compliance with the energy code and track green building improvements citywide
- Improve energy efficiency in smaller buildings
- Improve energy efficiency in historic buildings
- Provide energy efficiency financing and information
- Support cost-effective repowering or replacement of our most inefficient and costly in-city power plants
- Encourage the development of clean distributed generation
- Foster the market for renewable energy in New York City
- Ensure the reliability of New York City power delivery
- Develop a smarter and cleaner electric utility grid for New York City

## Potential Future 1-in-100 Year Flood Zones: Rapid Ice-Melt Sea Level Rise Projections



### INITIATIVE 2

#### Assess opportunities to further reduce greenhouse gas emissions by 80% by 2050

Our GHG reduction goal is ambitious, but it can be achieved using existing technology. The Intergovernmental Panel on Climate Change (IPCC) has determined that global GHG emissions need to be reduced by 60 to 80% below 1990 levels by 2050 to avoid the catastrophic effects of climate change. New York City can lead by example and demonstrate how to achieve this goal. That is why we will complete a study to determine potential strategies to reduce citywide GHG emissions by 80% below 2005 levels by 2050.

#### Assess vulnerabilities and risks from climate change

Even without longer-term climate change, New York City faces climate-related risks today. As currently mapped, more than 200,000 New Yorkers live within the Federal Emergency Management Agency (FEMA)-designated 1-in-100 year flood zone. Almost half a million New Yorkers live within the 1-in-500 year flood zone. These zones contain vibrant neighborhoods, critical infrastructure, natural resources, historical and cultural landmarks, and nearly 300,000 jobs.

Heat waves also have an impact on public health. People who are older, have heart or lung disease, and who are unable to escape the heat are at an increased risk of death during prolonged periods of hot and humid weather. We must act now to reduce the risks we face today and increase our resilience to climate change.

To do so, we must have a full understanding of the risks we face and the costs and benefits associated with efforts to build resilience. This will allow us to pursue and implement the most effective initiatives to protect our city, and ensure we remain able to prepare for, withstand, and respond to climate events and long-term changes. The information generated by this regular process will also allow us to monitor the effectiveness of our resilience strategies.

### INITIATIVE 3

#### Regularly assess climate change projections

In 2008, we convened the New York City Panel on Climate Change (NPCC) to ensure that our climate resilience efforts were based on state-of-the-science information. Modeled on the IPCC, the NPCC consists of leading climate and impact scientists, academics, economists, and risk management, insurance, and legal experts.

The NPCC developed the first official climate change projections for New York City. A host of City, state, and federal agencies, public authorities, and private companies have adopted these projections to inform operations and infrastructure investments. The panel also developed recommendations on how to foster an effective, ongoing, and iterative climate resilience program. As our climate and the state of climate science continue to evolve, it is essential to re-evaluate our projections. We will institutionalize the NPCC and establish a process to regularly update its climate projections.

### INITIATIVE 4

#### Partner with the Federal Emergency Management Agency (FEMA) to update Flood Insurance Rate Maps

FEMA's Flood Insurance Rate Maps (FIRMs) determine which properties participate in the National Flood Insurance Program (NFIP) and where new buildings must comply with floodproofing standards. These flood maps have not been significantly revised since 1983. We need to develop flood maps that better represent our current climate exposure to improve the risk management available through the NFIP. To support this need and other planning efforts, we acquired the most detailed three-dimensional elevation data ever gathered for New York City, known as LiDAR (light detection and ranging) data. We will work with FEMA to update our Digital Flood Insurance Rate Maps (DFIRMs) using these LiDAR data. The updated maps will reflect changes to our shoreline, built environment, and sea levels—which have already risen three inches since 1983.

### INITIATIVE 5

#### Develop tools to measure the city's current and future climate exposure

We need to better evaluate the scope and scale of the risks we face, and measure the cost-effectiveness of various options for improving our resilience. We will create a climate risk assessment tool that quantifies our exposure and vulnerability to climate risks today and over time to prioritize investments, develop cost-benefit estimates for impacts and actions, and track our progress.

Just as our mitigation efforts to reduce our contribution to global GHG levels are driven by our GHG inventory, our resilience efforts to reduce our vulnerability to climate change will be driven by an assessment tool that allows us to take an informed, risk-based approach.

## CASE STUDY Governors Island

Situated in the heart of New York Harbor, Governors Island stood guard over New York City for almost 200 years. But this 172-acre island that has served as a fort and former U.S. Coast Guard base will need a new type of protection, not from hostile invaders but from a changing climate. The Trust for Governors Island (TGI) has developed and adopted a multi-phase, mixed-use development strategy to reactivate the island with the creation of a new 87-acre park and improved public spaces. These spaces have been designed specifically to increase the island's resilience to climate change.

The key challenge for TGI and the design team was addressing existing site conditions to ensure that the new green spaces could thrive for generations. Much of the site is flat landfill and lies below the elevation of where the NPCC projects the 1-in-100-year flood level could be in 2100.

Rising sea levels, along with intensified coastal storms, are expected to cause more severe and more frequent flooding. This poses a particular threat to the trees on Governors Island that depend on salt-free groundwater. The design addresses this danger by raising the root levels of the island's new trees above projected flood zones using both subtle and dramatic changes in topography. A significant portion of the new parkland will be raised and shaped around the elevation of the projected 1-in-100-year flood.

Areas of the new parkland left at-grade in the projected flood zone will feature plants that can thrive on brackish groundwater, and more than 1,300 new trees will be planted. Plant and tree selection will focus on both native and locally adapted species expected to thrive as temperature ranges in the region rise.

Replacing more than 19 acres of impervious paved surface with lawn, plantings, and permeable paving will improve stormwater management on the site. The reduction of asphalt area and the substantial planting of trees will also help decrease the city's urban heat island effect.

Visitors to Governors Island will experience this integrated design in a park enhanced with harbor views, shade, and natural habitat that will ensure its longevity.



The development of models and flood maps that reflect likely sea level rise scenarios will be a key step in this effort. We will develop an updated digital elevation model using our new LiDAR data to promote more accurate sea level rise modeling. We will also launch an effort to develop publicly-available projected flood maps that incorporate sea level rise projections for planning purposes. These maps will help government agencies, private companies, and communities begin planning for sea level rise.

## Increase the resilience of the city's built and natural environments

New York City faces real and significant risks from climate change. As a city with more than 520 miles of coastline—the most of any city in America—the potential for more frequent and intense coastal storms with increased impacts due to a rise in sea level is a serious threat to New York City. This threat, in various forms, touches every part of the city, not just waterfront areas.

Our population density can often amplify the impacts of climate events, such as flooding and heat waves. Our extensive physical infrastructure—including more than 700 miles of subways, 90,000 miles of underground power cables, 14 wastewater treatment plants, and 2,000 bridges and tunnels—is aging. It is often immovable and was built for different environmental conditions than it is likely to face in the future.

Our natural systems, including the 5.2 million trees and more than 6,000 acres of wetlands in the city, are already stressed from being in an urban environment. They will be further strained by rising temperatures, precipitation changes, and rising sea levels.

By updating our codes and standards, working with regional infrastructure operators to implement resilience strategies, and partnering with the insurance industry to promote flood protection, we can create a more resilient city.

## INITIATIVE 6

### Update regulations to increase the resilience of buildings

Our existing building stock was not built to standards that anticipated changes to our climate. However, as new buildings are constructed, we can ensure that they are able to better withstand flooding, temperature extremes, and other conditions by updating local laws and zoning regulations.

Our current building code requires that new buildings in the FEMA 1-in-100-year flood zone elevate occupied space above the FEMA-designated flood level (the base flood elevation). Significantly lower federal flood insurance rates are available to buildings that further raise this space by one or two feet—an approach known as “freeboard.” We currently require freeboard for critical buildings in flood zones such as hospitals, utility facilities, public safety facilities, and schools. For other types of buildings, use of freeboard is voluntary, though in some locations zoning height limits can restrict a building from providing freeboard.

More extensive use of freeboard can help property owners manage risk, but may also change the character of buildings and the streetscape. We will conduct a study of the urban design and streetscape implications of freeboard to ensure we can maintain the city's active street life and vibrant character while enhancing our resilience.

On the basis of this analysis, we will explore amendments to the Zoning Resolution. We will also pursue amendments to the Building Code to require freeboard for a wider range of buildings to reduce risks associated with sea level rise and more intense coastal storms.

New York City's Waterfront Revitalization Program (WRP) establishes policies for the development and use of the city's waterfront. It provides a framework for evaluating whether certain

## CASE STUDY DEP's Climate Change Program

Climate change may have an impact on our water supply and treatment systems as more frequent and intense storms may increase the amount of sediment that washes into our unfiltered water supply and place additional burdens on our drainage and wastewater treatment systems. Warmer weather could affect the amount of snowpack and timing of snowmelt, which could change the flow of water into our reservoirs.

Today, the Department of Environmental Protection (DEP) is actively implementing its Climate Change Program Assessment and Action Plan, assessing the potential impact of climate change on our water infrastructure and identifying areas that need further study. The projections developed by the NPCC are being used to formulate climate change impact scenarios that can help agencies like DEP determine which parts of the system will be most impacted.

Some of the investments DEP is making now—such as the Croton Water Filtration Plant—will filter the sediments that enter our water supply after storms. Other projects—such as the repair of the Delaware Aqueduct—will increase system redundancy and operational flexibility.



DEP is also improving the efficiency of the sewer system, especially in areas prone to flooding, sewer backups, and combined sewer overflows. The agency is developing a stormwater drainage strategy to ensure that design criteria and infrastructure investments minimize the risks associated with population growth and increased rainfall intensity. This study will consider impacts at wastewater treatment plants and strategies to make our infrastructure more resilient to climate

change, such as raising elevations of equipment above projected flood heights.

The initiatives DEP is pursuing maximize synergies and minimize tradeoffs among energy, air, water, land, and climate policies. As such, infrastructure investments and programs that achieve multiple benefits—including climate resilience—have become central to DEP's decision-making process.

actions in the coastal zone, the area between the shoreline and approximately 500 feet inland, are consistent with City policies. To ensure that such actions are consistent with our resilience efforts, we will incorporate consideration of climate change within the policies of the WRP.

The projected effects of sea level rise and coastal flooding demand concerted attention. However, our buildings are also at risk from many other climate change effects. To increase our resilience to climate change effects other than coastal flooding, we will launch a study of the effects of rising water tables, inland flooding, wind, and extreme heat events on buildings.

### INITIATIVE 7 Work with the insurance industry to develop strategies to encourage the use of flood protections in buildings

Developing new FEMA flood insurance maps will allow us to provide the most current, accurate assessments of properties in New York City that are at risk of flooding. However, climate change projections indicate that future flood risks may extend well beyond FEMA's flood zones. To increase our resilience to current and future flood risks, we will work with the insurance industry to explore measures to promote flood protection in areas that may be subject to flooding based on climate forecasts. An important focus of this

effort will be to understand the current state of flood insurance protection in the city, both within and outside current flood zones.

### INITIATIVE 8 Protect New York City's critical infrastructure

The city's infrastructure systems—the transportation of people and goods, the delivery of energy and water, the handling of wastewater and solid waste—are vast and complex. They are critical to our ability to function effectively, and they require constant investment to maintain as the city grows and undertakes new development projects.

In 2008, we launched the New York City Climate Change Adaptation Task Force (Task Force), which is composed of 40 public and private entities that operate or regulate critical infrastructure in the city. The Task Force's mission is to assess how climate change could impact our infrastructure and to develop measures to increase the city's climate resilience.

The Task Force identified more than 100 types of transportation, energy, water and sewer, solid waste, telecommunications, and natural infrastructure that climate change could impact. The Task Force will use this initial assessment to develop coordinated strategies to increase the

resilience of the region's infrastructure. These strategies include changes to standard capital and maintenance processes.

We will work with the Task Force to complete its assessment and begin to implement its recommendations. As our understanding of climate change and its impacts is always evolving, we will expand the focus of the Task Force to include public health and safety services and periodically reassess our inventory of at-risk infrastructure and resilience strategies.

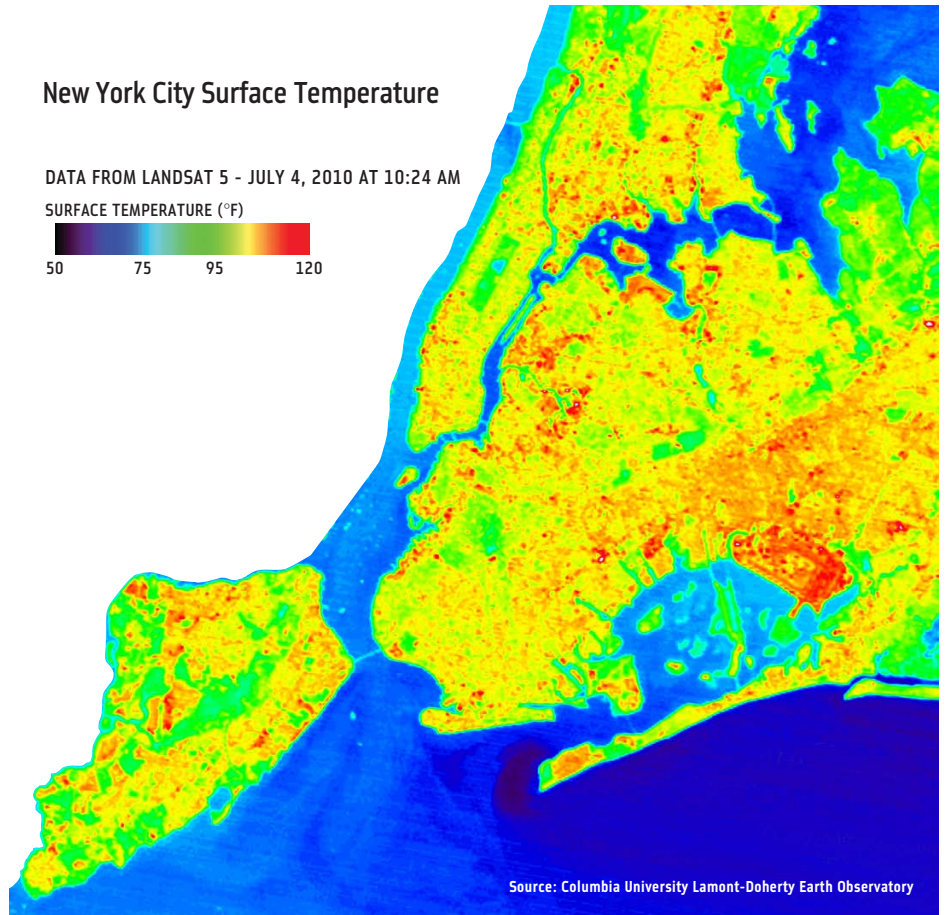
In addition, changes to the design specifications and standards that govern our infrastructure will ensure that all elements of these systems are built to be as climate-resilient as possible. As a first step in this process, we will assess the opportunities for the incorporation of climate change projections into design specifications and standards for critical infrastructure.

### INITIATIVE 9 Identify and evaluate citywide coastal protective measures

As a city with a high density of population living in coastal areas, we must reduce our exposure to coastal storms and flooding. Many possible solutions exist to increase our resilience.

## New York City Surface Temperature

DATA FROM LANDSAT 5 - JULY 4, 2010 AT 10:24 AM  
SURFACE TEMPERATURE (°F)  
50 75 95 120



Both structural and non-structural measures protect buildings or shorelines from erosion, prevent flooding, or reduce wave and tidal action. In the Netherlands, Rotterdam has built a system of massive sea walls and storm surge barriers that work in conjunction with a network of dykes, levees, pumping facilities, and building-scale measures to protect the city from flooding. In Germany, Hamburg has developed HafenCity, a neighborhood that is designed to flood periodically to accommodate rising water without causing substantial damage or inconvenience. The approaches used in different cities address both their specific vulnerabilities and the specific opportunities available to them.

Increasing our climate resilience in coastal areas will require us to consider both traditional and new, more creative solutions. One example is the *On the Water: Palisade Bay* project by Guy Nordenson, Catherine Seavitt, and Adam Yarinsky, which examined options for storm surge attenuation in Upper New York Harbor using soft infrastructure such as constructed wetlands. We will create an inventory of strategies, from wave attenuators to soft edges, to enhance climate resilience on New York City's extensive and varied waterfront. We will work with academic institutions, scientists, engineers, and designers to develop pilot projects and evaluate their potential costs and benefits.

## Protect public health from the effects of climate change

Increasing the resilience of our built and natural environments will help protect New Yorkers, but climate change poses risks beyond our infrastructure and buildings. Warmer temperatures, more frequent and intense heat waves, intense precipitation, and coastal flooding all have significant impacts on public health. This is particularly true for populations with pre-existing health conditions. We must better understand the health risks posed by climate change for New Yorkers and take steps to mitigate these risks.

### INITIATIVE 10 Mitigate the urban heat island effect

In densely built cities such as New York City, pavement and the surfaces of buildings produce what is known as the urban heat island effect. Both store and radiate the sun's heat energy, leading to conditions in which air temperatures are often several degrees warmer in cities than in the surrounding suburbs. In some instances,

New York City's air temperature can be more than seven degrees Fahrenheit warmer than in neighboring counties.

We are already taking many steps to cool New York City. We are increasing our vegetated surface area through planting one million more trees, constructing green infrastructure to manage stormwater, and incentivizing the installation of green roofs.

A contributing factor to the urban heat island effect is the city's many dark-colored roofs, which absorb the sun's heat. A white or "cool" roof reflects much of the sun's energy, reducing air temperatures and the energy required to air condition the building. Cool roofs can lower air pollution and GHG emissions by reducing electricity demand, and often save building owners and tenants money through reduced energy bills. They also prolong the life expectancy of the building's roof and cooling equipment.

Through the NYC °CoolRoofs program, we have already coated more than one million square feet of roofs white, largely through the efforts of NYC Service volunteers. We will expand this effort to coat an additional two million square feet of roofs with cool coating by 2013, further mitigating the urban heat island effect. We will also pursue a cool roof requirement for existing buildings, resulting in all flat roofs in the city having a cool coating by 2030.

The urban heat island effect is not uniform throughout the city. Models using remote sensing technology data have demonstrated that air temperatures in areas with a higher percentage of paved surfaces, such as airports, can be almost nine degrees Fahrenheit warmer than areas with greater vegetated cover, such as parks. Because some communities are more affected by the urban heat island effect than others, we will work with neighborhoods most impacted to develop and implement community-specific strategies. Similar to our Trees for Public Health program, which focuses tree planting efforts on neighborhoods with low tree cover and high asthma rates, this approach will ensure that our efforts target communities most in need.

### INITIATIVE 11 Enhance our understanding of the impacts of climate change on public health

The effects of climate change—including rising temperatures and declining air quality—have the potential to significantly affect New Yorkers' health. Recognizing this, we launched a program in 2010 funded by the United States Centers for Disease Control and Prevention (CDC) to assess the impacts of climate change on public health, including impacts to our public health system infrastructure.



Mayor Bloomberg and NYC Service volunteers applying a cool roof coating

Through this program, we will evaluate the public health impacts of climate-related events. We will identify opportunities and gaps in adapting to a changing climate, outline strategies for fostering climate resilience (particularly among vulnerable New Yorkers), and devise outreach strategies to protect communities from the public health impacts of climate change.

## Increase the city's preparedness for extreme climate events

Many effects of climate change may be gradual and occur over the long-term. However, the NPCC projects that extreme events are likely to become more frequent and intense in the near future. Within the next 20 years, we could face twice as many heat waves as we do now, and the current 1-in-100 year flood could reoccur on average once every 65 to 80 years.

New York City already has one of the world's leading local emergency management departments, capable of planning for and responding to climate-related events. Ensuring the continued ability to plan for and respond to these emergencies requires that climate change be considered in all relevant emergency management planning decisions.

### INITIATIVE 12 Integrate climate change projections into emergency management and preparedness

Recognizing that New York City faces climate-related risks today that are likely to get worse, we have already developed a number of plans to prepare for and respond to extreme climate events, including our Natural Hazard Mitigation Plan, Coastal Storm Plan, Heat Emergency Plan,

Debris Management Plan, Power Disruption Plan, Winter Weather Emergency Plan, and Flash Flood Emergency Plan. To continue to prepare for and respond to climate-related emergencies as effectively as possible, we will integrate climate change projections into our emergency management and preparedness plans and procedures as they are regularly updated. We will also launch a process to include climate change as a hazard assessed under the Natural Hazard Mitigation Plan, which will be updated in 2014.

## Create resilient communities through public information and outreach

New York City is a large, complex city that has demonstrated its ability to remain strong in the face of adversity. The effects of climate change will bring new challenges to our city in coming decades and require that our communities are well-informed and prepared to accommodate and respond to climate change effects. To accomplish this, we will develop and implement a public information and outreach program.

### INITIATIVE 13 Work with communities to increase their climate resilience

Increasing the climate resilience of our communities requires developing information and making it publicly available. We can both communicate the risks communities face and inform them of opportunities to reduce their risk exposure.

We will increase climate resilience by ensuring that current outreach efforts target appropriate communities and provide up-to-date climate risk information. In fact, Ready New York is a program that already provides information to residents at more than 500 events per year, and Notify NYC, a

public warning system, sends emergency alerts directly to residents by email, text message, or telephone. We are helping people prepare for and respond to emergencies, including coastal storms, flash flooding, and extreme heat. We will incorporate the risks posed by climate change into these efforts and continue to engage New Yorkers to enhance their resilience to extreme events. We will also create an online portal and other materials that will include the latest NPCC climate projections, projected flood maps, and tools to increase the climate resilience of homes and businesses.

Flooding from coastal storms presents many risks, including structural damage to buildings and infrastructure. This damage can be made worse if structures containing hazardous materials are breached by floodwaters. To better enable community resilience planning, we will improve access to publicly available data on the locations of hazardous material storage in flood zones throughout the city.

## Conclusion

New York City is one of the most energy-efficient cities in the world. We have made significant progress toward increasing this energy efficiency and further reducing our GHG emissions. We have also begun preparing our city for the serious consequences of climate change.

The promise of a greener, greater New York will only be met if we recognize the seriousness of the challenges before us and our responsibility to meet them. A comprehensive climate change strategy requires equal attention to both mitigating GHG emissions and building climate resilience. Together, our efforts to address climate change on both fronts will allow us to remain strong for many years to come.

Reducing the risks posed by climate change will not be achieved through a single plan or action—it must be achieved through an ongoing planning process that is responsive to the latest scientific information and a thorough understanding of the potential costs and benefits of our actions. Our strategy will remain flexible so it can be adapted to changing needs, but we are taking steps now that have tangible benefits today and will have even greater benefits as the climate changes.