I/ CITY DESCRIPTION

New York City comprises five boroughs, each of which is coextensive with a county: The Bronx, Brooklyn, Manhattan, Queens, and Staten Island. With over 8.2 million residents within an area of 322 square miles (830 km²), New York City is the most densely populated major city in the United States. According to Census Bureau population estimates, New York City’s population increased from 8,008,278 in April 2000 to 8,104,079 in July 2004.

II/ PRIORITY HAZARDS/VULNERABILITIES

New York City has one of the most urbanized coastlines in the United States making it particularly vulnerable to rises in sea level that are expected to accompany increases in temperature. The vulnerabilities of this highly populated coastline city include the following:

- Along much of the New York coast, sea level could rise significantly: estimates range from 11.8 to 37.5 inches in the 2080s (see figure 1). Such a rise in sea level can lead to flooding and complete inundation of low-lying areas, loss of coastal wetlands, erosion of beaches, and saltwater intrusion into lakes and rivers, and will likely increase the vulnerability of coastal areas to storms and other severe weather patterns;
- Flooding could become more frequent and severe as the century progresses. According to one estimate (see figure 1), the probability of a “100-year flood” may increase from once in 80 years (where it is today) to once in 43 years by the 2020s and up to once in 19 years by the 2050s; and
- Low-lying and waterfront infrastructure could experience flooding.

Energy reduction programs, street tree-planting programs, conversion of streetlights to more efficient technologies, landfill methane recovery, use of alternative fuel vehicles, and solid waste recycling.
New York City has combined its adaptation and mitigation programs through PlaNYC.

**New York City Planning (PlaNYC)**

PlaNYC was launched in April 2007 and contains many objectives, goals, and programs to be reached by 2030. Developed by the Mayor’s office in partnership with external experts and institutions, PlaNYC covers both mitigation and adaptation measures.

PlaNYC’s main goal is to reduce greenhouse gas (GHG) emissions by 30 percent by 2030. The plan to reduce GHG is of course part of the mitigation effort (figure 2). The mitigation plan to reach the emissions reduction goal is based on four initiatives:

1. **Avoided sprawl.** Attract 900,000 new residents by 2030 to achieve an avoided 15.6 million metric tons of GHG.
   - Develop sustainable, affordable housing;
   - Expand and improve mass transit;
   - Reclaim contaminated land;
   - Open waterways for recreation;
   - Ensure energy supply; and
   - Plant trees and provide more parks in the city area.

2. **Clean power.** Improve New York City’s electricity supply to save 10.6 million metric tons of GHG.
   - Replace inefficient power plants;
   - Expand “Clean Distributed Generation”; and
   - Promote renewable power.

3. **Efficient buildings.** Reduce energy consumption in buildings by 16.4 million metric tons of GHG.
   - Improve the efficiency of existing buildings;
   - Require efficient new buildings;
   - Develop and apply green energy codes;
   - Increase the efficiency of appliances; and
   - Increase energy awareness through education and training.

4. **Sustainable transportation.** Enhance New York City’s transportation system to save 6.1 million metric tons of GHG.
   - Improve public transit;
   - Improve the efficiency of private vehicles and taxis; and
   - Decrease CO₂ intensity of fuels.

The adaptation plan is based on three initiatives:

- Create an intergovernmental task force to protect all NYC’s vital infrastructure, with the aim of expanding adaptation strategies beyond the protection of water supply, sewer, and wastewater treatment systems to include all essential city infrastructure;
- Work with vulnerable neighborhoods to develop...
area-specific strategies, with the aim of creating a community planning process to engage all stakeholders in specific climate adaptation strategies; and

- Launch a citywide strategic planning process for climate change adaptation.

**Development and Management of PlaNYC**

To define the climate change action plan, both for mitigation and adaptation, many stakeholders were interviewed. Private sector and civil society, including environmental NGOs, were not included in the initial round of interviews but will be included in the next. The stakeholders interviewed were:

- Environmental Protection Agency Region II
- Federal Emergency Management Agency Region II
- US Army Corps of Engineers NY District
- National Park Service, Gateway National Recreation Area
- Port Authority of New York and New Jersey
- New York State (NYS) Department of Environmental Conservation
- NYS Energy Research and Development Authority
- NYC Department of Environmental Protection
- NYC Department of Health
- NYC Department of City Planning
- NYC Department of Design and Construction
- NYC Department of Parks and Recreation
- NYC Mayor’s Office of Long-Term Planning and Sustainability
- Con Edison – electric company in NYC
- Metropolitan Transit Authority
- Regional Plan Association

The PlaNYC mitigation and adaptation measures have been selected through the following process cycle:

- Inventory of greenhouse gas for mitigation and of risks for adaptation,
- Assess options,
- Decide,
- Monitor, and
- Reassess.

The inventory of GHG has been done through traditional techniques. The inventory of risks has been done on the basis of scientific models (Global Climate Models and Emissions Scenarios), regional climate scenarios for key variables, forecasts on extreme events, and high-impact scenarios (ice melting) (Rosenzweig et al., 2006).

To assess the adaptation options, specific guidelines for climate change adaptation measures have been developed:
Audit existing infrastructure, lifetimes, rehabilitation cycles;  
Compare with regional climate change forecasts;  
Determine thresholds and ranges of forecast sea level, temperature, hydrology;  
Evaluate potential adaptations policy through cost-benefit analysis and environmental impact assessment;  
Define timeline: short, medium and long term; and  
Monitor and review climate indicators and projections (~every three–five years).

On the basis of the assessment, recommendations will be defined on adaptation pathways, encouraging mitigation and adaptation synergies, etc.

Rosenzweig et al. from NASA and Columbia University presented observations on NYC Department of Environmental Protection Climate Adaptation Assessment. They found that to develop a successful plan on climate change, the following are needed: 

- Excellent local leadership;  
- Peer-reviewed science;  
- Collaboration with university centers and Federal agencies with strength in climate change;  
- Regular technical and policy meetings;  
- Education and training: climate change workshops for all staff; and  
- Important but precisely defined roles for research and consultants.

**NYC Disaster Planning**

On the basis of a 1995 study by the U.S. Army Corps of Engineers and more recent studies by Columbia University and NASA, NYC prepared an emergency response plan in 2006. Among the findings, the studies concluded that a Category 3 hurricane could hit New York City, creating tremendous damages and requiring the evacuation of as many as 3 million people.

If a disaster hit, a team of more than 34,000 city employees would lead the mobilization effort, bringing residents to evacuation shelters throughout the city. The Fire Department would assist in evacuating the elderly and infirm from hospitals and nursing homes. Mass transit would also be used in the evacuation process, with fares and tolls waived.

**Mitigation: GHG Inventory and Plans**

The inventory of NYC GHG emissions forewarned that while there were steps that New York City could take to adapt to warmer temperatures, the greatest urgency was to prevent further climate change by reducing the emission of greenhouse gases. New York City plans to do the following:

- Reduce its GHG emissions, which are currently as much as Ireland or Portugal emissions;  
- Prepare for growth, because the average New Yorker has a much lower GHG footprint than the average American (a more dense New York City is itself an emission reduction strategy); and  
- Learn by doing and promote the most effective model to other cities in the world.

The operation of New York City’s homes, buildings, transportation systems, and vehicles, together with decomposition of solid waste, resulted in the net emission of approximately 58.3 million metric tons of greenhouse gases in 2005. Figures 3 and 4 give a breakdown of NYC’s emissions by sector and source.

**FIGURE 3. NYC CO₂ Emissions by Sector, 2005**

According to the inventory, in 2005 New York City's total GHG emissions were 58.3 million metric tons of carbon dioxide equivalent (CO$_2$-e). Of these, 79 percent were caused by the consumption of energy by buildings in the city, in contrast to the national average of 34 percent.\(^8\)

By 2030, in a business-as-usual scenario, citywide CO$_2$-e emissions are projected to increase by 27 percent to approximately 74 million metric tons per year (figure 5).

**IV/ OUTCOME/IMPACTS**

**Reduction Measures to Date**

New York City has already begun implementing measures that contribute to reducing the City Government's GHG emissions. These measures include energy reduction programs, street tree-planting programs, conversion of streetlights to more efficient technologies, landfill methane recovery, use of alternative fuel vehicles, and solid waste recycling. Figure 6 illustrates each measure's contribution to the total annual avoidance of 446,000 metric tons of CO$_2$-e emissions. These measures demonstrate the progressive policies of the past 10 years and point toward the fact that with more concentrated effort New York will be able to achieve even more substantial reductions in the future.

**Future Planned Reduction Measures**

Measures to be implemented between 2006 and 2017 are projected to result in the avoided emission or reduction of 404,000 metric tons of CO$_2$-e each year by 2017. By 2017, these measures are expected to result in only a small reduction of CO$_2$-e levels below 2006 of 0.3 percent. Without these measures emissions would have...
increased by almost 10 percent. Figure 7 illustrates the projected reductions by share.

**FIGURE 7.** Projected CO$_2$-e Reduction Measures by Share, 2017

Data from the U.S. Census Bureau, 2004.

Mayor’s Office of Operation with several consultants, i.e., ICLEI, Columbia University, the Clinton Climate Initiative.


Global Climate Models characterize climate uncertainty (IPCC, 2007) and GHG emission scenarios span a range of development futures population, gross domestic product, and technology (IPCC, 2000).


Rosenzweig and Gornitz’s two-year study used the Goddard Institute’s Atmosphere-Ocean Model, a computer program that simulates the Earth’s climate. Based on previous research by Columbia University scientists for the U.S. Global Change Research Program in 2001 and the Intergovernmental Panel on Climate Change, this model projects a sea-level rise of 15 to 19 inches by the 2050s in New York City.


New York’s citywide CO$_2$-e total figures exclude emissions from aviation and marine freight shipping, as these two sources are not routinely included in city emissions inventories. However, because these sources represent significant CO$_2$-e emissions, and because New York serves as a major regional air travel and marine freight hub, emissions from these two sources have been included in the GHG inventory report: from 1995 to 2005, CO$_2$-e emissions increased by a total of 8.5 percent.