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TITLE OF THE RESEARCH : CLIMATE CHANGE AND URBANIZATION IN NEW YORK CITY: EFFECTS AND IMPLICATIONS

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GENERAL INFORMATION

RESEARCH TITLE	CLIMATE CHANGE AND URBANIZATION IN NEW YORK CITY: EFFECTS AND IMPLICATIONS	
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1. Introduction

Today, more than before, the changing global climate is defined as a new, direct and multifaceted issue threatening national security all over the world. Considering the effects of climate change, especially through extreme weather events, the situation seems quite serious. The future of humankind and our planet may be in jeopardy due to it. Storms, droughts, forest fires and floods have caused environmental impairments and longer-lasting drought not recycled and this situation has adversely affected the food, water and sanitation security of millions of people and mass migration has happened for more than a decade. The most devastating effects of these problems are those affecting developing countries which have scarce natural resources and limited facilities to adapt to these challenges caused by climate change. They are state's most costly and destructive natural disaster. Conversely, it is possible that the problems created by climate change can lead to conflicts and tensions among the states and communities, especially in the world's most unstable regions, as well as threatening economic and political stability, peace and tranquility.

When the U.N. report[1] explains that the world population has passed about 7 billion and that more than half of this population lives in cities, it highlights changes and trends about threats we will face. Cities have responsibility for 75 percent of the total global energy consumption and that is, for 80 percent of the world's greenhouse gas ("GHG") emissions[2]. Moreover, the world population is expected to reach 10 billion of this by 2100, an increase of nearly 50 percent from today's population of 7 billion[3]. GHG effect is felt rather in cities and has turned to be an environmental problem as a result of human activities. Because of this pollution, especially in these cities, urban heat islands occur as a result of the effect of inversion. These heat islands occur since cities get warmer than the rural areas as a result of unplanned and distorted urbanization, and it becomes a source of environmental problems from which many environmental consequences emerge.

Thus, cities and local governments that are directly affected by this process are required to cope with the natural disasters such as thirst and sudden floods – for example the European heatwave of 2003 caused 35,000 deaths, Hurricane Katrina in the U.S. in August 2005,

[1] United Nations, Department of Economic and Social Affairs, *World Urbanization Prospects, the 2011 Revision*, (http://esa.un.org/unup/CD-ROM/Urban-Agglomerations.htm), (last visited June 13, 2013)

[2] David Dodman, *Paper 1: Urban Density and Climate Change*, Revisited Draft- April 2, 2009 (Analytical Review of the Interaction between Urban Growth Trends and Environmental Changes), United Nations Population Fund, p. 6

[3] United Nations Press Release, *World Population to reach 10 billion by 2100 if Fertility in all Countries Converges to Replacement Level*, (http://www.pdfdownload.org/pdf2html/pdf2html.php?url=http%3A%2F%2Fesa.un.org%2Funpd%2Fwpp%2Fother-information%2Fpress_release_wpp2010.pdf&images=yes), (last visited June 13, 2013)

Myanmar' Cyclone Nargis disaster in May 2008[4], the 2010 heavy floods in Pakistan[5], and long-term droughts in the Amazon Basin, Australia and East Africa.[6] Given that this process is so rapid in cities like Istanbul, Ankara, and Bursa that grows rapidly the inventory of GHG in the cities in Turkey must be documented as soon as possible and the re-creation of energy, agriculture and water resources must be realized, and management and planning of reduction targets should be specified and monitored. With urban infrastructure regulations created in this framework, sustainable and livable cities can be created. Sustainable cities are the locations that make socio-economic benefits available to citizens in accordance with environmental and energy concerns in order to ensure the sustainability of the rural change and development. Developments in these cities are planned to parallel sustainable social development. Accordingly, necessary measures to be taken regarding reduction and restriction of carbon emission rate used in the prevention of climate change are important in the process of creating a sustainable city.

One of New York City's ("NYC") best practices for tackling climate change and the creating sustainable city is the NYC administration and its applications. The Administration comes forward particularly in this regard to commissioning expert scientific advice, formulating policy goals, setting standards and developing new institutions for environmental governance and sustainability[7], although the City faces as a result of more frequent heavy precipitation, sea level rise and rising temperatures which are climate change-related challenges. Hurricane Sandy, which occurred in October of 2012, can be an important touchstone for that and also, is a clear example for need to tackle climate change. Because this Hurricane struck and swept through the Caribbean and up the East Coast of the nation, it was the deadliest and most destructive hurricane of the 2012 Atlantic hurricane season, besides the second-costliest hurricane in the nation history. It affected 24 states, including the entire eastern seaboard from Florida to Maine and west across the Appalachian Mountains to Michigan and Wisconsin, with especially severe damage in New Jersey and New York, and caused the death of hundreds of people. Its storm surge hit NYC, flooding streets, tunnels and subway lines and cutting power in and around the city. In affected region, over 7,000 transformers and 15,200 poles were damaged and fuel pumps at gas stations did not work due to power outages and lack of back-up generation[8]. It caused large financial losses; over $50 billion in damage in the nation, total surpassed only by Hurricane Katrina. Hurricane Sandy is the nation's most expensive storm since Hurricane Katrina, which caused $128 billion in damage, according to the 2013 data[9], and this mainly will be paid by federal funds, but many

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[4] "Cyclone Nargis struck Myanmar on 2 and 3 May 2008, devastating the Irrawaddy Delta, affecting 2.4 million people and leaving an estimated 130,000 people dead or missing…"; Rebecca Barber, "The Responsibility to Protect the Survivors of Natural Disaster: Cyclone Nargis, a Case Study", *Journal of Conflict & Security Law*, Vol. 14, No. 1, 2009, p. 3

[5] According to a report released in August 2013, In 2012, the destructive floods of Pakistan affected about 3 million people, damaged thousands hectares of agricultural crops, and claimed approximately 450 lives.; American Meteorological Society, *State of the Climate in 2012* (edits. Jessica Blunden and Derek S. Arndt), Special Supplement to the Bulletin of the American Meteorological Society, Vol. 94, No. 8, August 2013, p. 190

[6] "The period 2001-2010 was the warmest decade on record since modern meteorological records began around the year 1850"; World Meteorological Organization, *The Global Climate 2001-2010: A Decade of Climate Extremes Summary Report*, Geneva, 2013, p. 3

[7] Jason Corburn, "Cities, Climate Change and Urban Heat Island Mitigation: Localising Global Environmental Science", *Urban Studies*, 46(2), 2009, p. 413

[8] U.S. Department of Energy, *U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather (DOE/PI-0013)*, July 2013, p. 6; "The biggest blackout since '03 was during superstorm Sandy, when hundreds of thousands of people lost electricity amid downed power lines and flooded transformers."; Ivan Pereira, "10 years after blackout, officials say NYC has better grip on power", *amNewYork: Manhattan's Highest Daily Circulation Newspaper*, August 12, 2013, p. 6. See also; Marge Winski, "Superstorm Sandy", *The Beacon*, Montauk Historical Society, No. 27, 2013, p. 15

[9] Wikipedia, *Hurricane Sandy*, (http://en.wikipedia.org/wiki/Hurricane_Sandy), (last visited June 12, 2013); DoSomething.Org, *11 Facts About Hurricane Sandy*, (http://www.dosomething.org/tipsandtools/11-facts-about-hurricane-sandy), (last visited June 12, 2013). See for more detailed information; National Climatic Data Center, *Billion-Dollar Weather/Climate Disasters*, (http://www.ncdc.noaa.gov/billions/events), (last visited July 2, 2013)

other tax bills will reflect to the public[10]. Despite all this, the author believes the NYC Administration was protected from the possible more adverse results because of the measures taken to increase the NYC's resilience to extreme weathers.

Our study examines policies and programs related to GHG emissions arising in NYC within the scope of the efforts local governments to ensure urban sustainability against the climate change. This study shows how the NYC's climate policy developed in the context of a comprehensive long-term sustainability plan and model, which is PlaNYC, since 2002. The NYC Administration stands out in challenging climate change, and its initiatives are the examples of best practices at the municipal level. In this framework, our study consists of three sections. The first section discusses NYC's administrative structure in the light of current studies. This section also provides climate change projections for NYC and identifies some of the potential risks to the city's critical infrastructure posed by climate change. In the second section, NYC's policies and measures for the realization of goals set for its GHG emissions reduction are analyzed. In the third and final section, local legal documents determining the City's climate policy and offering significant opportunities for implementation is examined.

2. Studies in report terms

I. Term: Evaluation in the light of Current Studies related to Effects of Climate Change at the City of New York

In the first term, the City's government policies based on greenhouse gas emissions inventory to determine of the carbon footprint related to the City generally were evaluated. The effects of climate change at New York City with interpretation of available data were exposed. It was exposed why this City especially tend to this problem.

II. Term: National and International Legal Documents

After the studies related to greenhouse gas emissions inventory were examined, national and international legal documents providing implementation of these politics. They, at these documents which arising from demand of creating some common rules and standards, are included in detailed information about at energy, transportation, housing, public health etc. Thus, it is be becoming important if they are included in these studies.

III. Term: Adopt Measures Taken in the Direction of Mitigation Target

In this term, politics and measures determined at the City level in order to achieving the targets mentioned were analyzed. Here is to find answers to questions related to what can be done, and what measures can be applied for greenhouse gas emissions reduction in New York City. In this context, it was included in executed strategies and policies and measures related to sustainable energy politics, transportation, housing, urban planning and land use, waste management, sustainable use of water resources and forests as a whole. In other words, it was exposed what is done issues such as dissemination of clean and renewable energy, encouragement for abandonment of fossil fuel consumption, dissemination and increasing the use of photovoltaic systems in buildings, give place to more green space with new land use planning, afforestation and increasing the reafforestation, prevention of deforestation, more efficient public transportation by new transportation planning and regulation of infrastructure for pedestrian and bicycle transportation, development and dissemination of hybrid electric vehicles, recycling and reuse of solid waste to man-made emission mitigation and reproduction and strengthening of carbon holder medium (sinks). And then, the results of the implementation process were also included because of emerge from to what extent can be accessed at determinated targets for greenhouse gas emissions targets.

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[10] Michael Freedman-Schnapp, "A Sustainable City for All", *Toward a 21st Century City for All: Progressive Policies for New York City in 2013 and Beyond*, (http://21c4all.org/sites/default/files/pdf/21cforall_sustainability.pdf), (last visited August 16, 2013), p. 1

IV. Term: Final Report Writing

In the fourth term, generally New York City's climate policy was evaluated, analyzed and interpreted in city-wide, and the final report was written.

3. Research results

1 Addressing climate change of the New York City administration

To begin dealing with risks posed by changing climate, NYC administration[11], or rather the Bloomberg administration has needed to take concrete steps to protect the City's vulnerability to climate change since 2002. The NYC administration with regard to climate change and adaptation[12] has focused on managing and reducing effectively the City's emissions. Till today, the NYC administration has actively applied and pursued programs, and legal and policy measures to reduce emissions of GHG emissions, with mostly 30 percent below current levels by 2030. But the administrations who served in the previous terms[13] had taken no action on this issue[14], despite their acceptance of the existence of climate change as a problem. For example, the Giuliani administration (1994-2001) opposed clearly mandatory limits on GHG emissions[15]. Thus, this study discusses only the policies and practices covering the period of Mayor Michael Bloomberg (2002-Incumbent), who was positioning the city to be a leader and a driving force in addressing climate change and sustainability planning.

1.1 Background: About New York City's territory and population…

Located in the northeastern United States (U.S.) in the Middle Atlantic Census Division, the U.S. state of New York is bounded west and north by Canada with Lake Erie, Lake Ontario and the St Lawrence River forming the boundary; east by Vermont, Massachusetts and Connecticut, southeast by the Atlantic, south by New Jersey and Pennsylvania. The State covers a land area of 47,126 square miles (122,057 km²) and ranks as the 27th largest state by size.[16] Its census population in 2012 was 19.570.261 million, about 7 percent of national population.[17] NYC is its largest city. With more than 8 million people[18] as of 2012, constituting

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[11] NYC is administered by a mayor who holds considerable power but is constantly involved in legislative battles with the 51 members of the City Council, who are elected to four-year terms; Encyclopedia Britannica, *New York City*, (http://www.britannica.com/EBchecked/topic/412352/New-York-City), (last visited June 18, 2013) "…New York City has been a metropolitan municipality with a mayor-council form of government since its consolidation in 1898. The government of New York is more centralized than that of most other U.S. cities…"; Wikipedia, *New York City*, (http://en.wikipedia.org/wiki/New_York_City), (last visited June 12, 2013)

[12] For this, for example, convened by Mayor Michael Bloomberg in August 2008, NPCC advises the Mayor on these issues. Modeling on the Intergovernmental Panel on Climate Change (IPCC), NPCC is studying to develop climate change projections for NYC, and also to create a set of workbooks to assist the City's Climate Change Adaptation Task Force, and draft a technical report on the localized effects of climate change on NYC; NYC. Gov, *Climate Risk Information: New York City Panel on Climate Change*, (http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf), (last visited June 13, 2013)

[13] See for the NYC's mayors; NYC.gov, *Green Book - Mayors of the City of New York*, (http://www.nyc.gov/html/dcas/html/about/greenbook_mayors.shtml), (last visited July 12, 2013).

[14] Michael B. Gerrard, *Personal Interview*, July 12, 2013 (at 10:30 a.m.)

[15] Grist, *A look at Rudy Giuliani's environmental platform and record*, (http://grist.org/article/giuliani/full/), (last visited July 12, 2013); Council on Foreign Relations, *Rudy Giuliani*, (http://www.cfr.org/experts/world/rudy-giuliani/b10534#16), (last visited July 12, 2013); Marianne Lavelle and Matthew Lewis, *Climate Change Lobbying Dominated by 10 Firms*, (http://www.politico.com/news/stories/0509/22723.html), (last visited July 12, 2013)

[16] Barry Turner (Edited by), *The Statesman's Yearbook: The Politics, Cultures and Economies of the World*, Palgrave Macmillan, New York, 2012, p. 1424

[17] United States Census Bureau, *New York (city), New York*, (http://quickfacts.census.gov/qfd/states/36/3651000.html), (last visited June 17, 2013); Clark H. Bensen, *Demographic Guide to New York: Towns, Cities and Places, 2000 Census Edition*, Polidata, New York, 2003, p. 3.1

about 84 percent of the total state population, NYC is one of the most populous cities in the nation; with a population notably greater than the combined totals of Los Angeles and Chicago, and higher than the San Francisco Bay Area's metropolitan total[19]. It is referred to as "New York City" or "the City of New York" to distinguish it from the U.S. state of New York, of which it is a part, located at the center of the New York Metropolitan Area. Also, located on one of the world's largest natural harbors, NYC is the gateway to the North American continent, as well as the preferred exit to the oceans of the globe[20].

On the other hand, NYC has an area of 302.64 square miles (783.8 km^2), consists of five boroughs[21]—The Bronx, Brooklyn, Manhattan, Queens, and Staten Island—, each of which is a county of the State of New York.[22] The Bronx (Bronx County), the NYC's northernmost borough, is separated from Manhattan (to the south and west) by the narrow Harlem River and is further bordered by Westchester County (north), Hudson River (west), the East River (south), and Long Island Sound (east)[23]. Brooklyn (Kings County), southeastern New York, is the city's most populous borough and is known for its cultural diversity, an independent art scene, distinct neighborhoods and unique architectural heritage. It is separated from Manhattan by the East River and is bordered by the Upper and Lower New York bays (west), the Atlantic Ocean (south), and the borough of Queens (north and east).[24] Brooklyn on its own would be the 4th largest city in the U.S.[25]. The other borough is Manhattan (New York County) in southeastern the State of New York. Considered one of the world's foremost administrative, business, financial, and cultural centers, Manhattan is bounded by the Hudson River (west), Harlem River and Spuyten Duyvil Creek (northeast), East River (east), and Upper New York Bay (south)[26]. Queens (Queens County) is southeastern New York and lies on Long Island east of Brooklyn and extends across the width of the island from the junction of the East River and Long Island Sound to the Atlantic Ocean[27]. Staten Island (Richmond County) lies in New York Harbor south of Manhattan and between New Jersey and Brooklyn[28]. It is the least populated of the five boroughs with 470,728 people in 2012[29], but is the third borough spreads over 30,734 acres[30] in NYC.

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[18] United States Census Bureau, *State & County Quick Facts: New York (city), New York*, (http://quickfacts.census.gov/qfd/states/36/3651000.html), (last visited June 12, 2013). The population of New York City, by boroughs, census of April 2012 was: Manhattan, 1,619,090; Bronx, 1,408,473; Brooklyn, 2,565,635; Queens, 2,272,771; Staten Island, 470,728; total 8,336,697; New York City Department of City Planning, *Population (Current Population Estimates)*, (http://www.nyc.gov/html/dcp/html/census/popcur.shtml), (last visited June 12, 2013)

[19] New York City Department of City Planning, *Population (Current Population Estimates)*, *ibid.*

[20] Encyclopedia Britannica, *New York City*, *ibid.*

[21] "…Each borough has the same boundaries as a county of the state. The county governments were dissolved when the city consolidated in 1898, along with all city, town, and village governments within each county… The term *borough* was adopted to describe a unique form of governmental administration for each of the five fundamental constituent parts of the newly consolidated city. Technically, under New York State Law, a "borough" is a municipal corporation that is created when a county is merged with populated areas within it…The borough of Bronx was originally the parts of New York County that had previously been ceded by Westchester County, until Bronx County was created in 1914…The borough of Queens originally consisted of only the western part of a larger Queens County, until Nassau County was created by the secession from Queens County of the three eastern towns in 1899. The borough of Staten Island was officially the borough of Richmond until the name was changed in 1975 to reflect its common appellation…"; Wikipedia, *Borough (New York City)*, (https://en.wikipedia.org/wiki/Borough_(New_York_City)), (last visited June 12, 2013)

[22] Wikipedia, *New York City*, *ibid.*

[23] Encyclopedia Britannica, *Bronx*, (http://www.britannica.com/EBchecked/topic/80989/Bronx), (last visited June 17, 2013)

[24] Encyclopedia Britannica, *Brooklyn*, (http://www.britannica.com/EBchecked/topic/81247/Brooklyn), (last visited June 17, 2013)

[25] New York City Department of City Planning, *Population (Population Facts)*, (http://www.nyc.gov/html/dcp/html/census/pop_facts.shtml), (last visited June 17, 2013)

[26] Encyclopedia Britannica, *Manhattan*, (http://www.britannica.com/EBchecked/topic/362078/Manhattan), (last visited June 17, 2013).

[27] Encyclopedia Britannica, *Oueens*, (http://www.britannica.com/EBchecked/topic/486891/Queens), (last visited June 17, 2013).

[28] Encyclopedia Britannica, *Staten Island*, (http://www.britannica.com/EBchecked/topic/564014/Staten-Island), (last visited June 17, 2013)

1.2 Observed trends for temperature, precipitation sea level rise and extreme events in New York City

NYC has a temperate and continental climate, along with hot and humid summers and cold winters. An annual average air temperature from 1971 to 2000 was approximately 55 degrees Fahrenheit, according to the records. Its climate is depicted by substantial precipitation amounts range between approximately 43 and 50 inches in all months of the year.[31] However the trends in temperature, precipitation and sea levels have risen overall throughout the century, despite of interannual and decadal variations. Observational records show that spring is arriving sooner, summers are growing hotter, and winters are becoming warmer and less snowy. NYC's mean annual temperature and precipitation increased, respectively, 4.4 °F and 7.7 inches from 1900 to 2011. Moreover, a long and intense heat wave during the summer of 2006 caused 40 heat stroke deaths, most of them elderly, in NYC, according to a report[32]. NPCC2' 2013 report update finds that mean annual temperatures and precipitation are, in turn, projected by global climate models to increase by 2.0 – 3.0°F and 0 – 10 percent by next seven year[33]. Sea level in a large fraction of NYC and the surrounding region has also risen 1.1 feet due to land subsidence, with the remaining sea level rise driven by climate-related factors since 1900 and infrastructure in these areas is vulnerable to coastal flooding during major storm events from inland flooding and coastal storm surges[34]. It is not definite due to high natural variability and limited record length[35], but this sea level rise occurring over time increased the extent and the magnitude of coastal flooding during storms. Several previous studies[36] have also confirmed the claim that sea levels continue to rise globally, along with higher local rates of rise in the Northeast U.S. during this century and therefore, NYC can expect dramatic changes in climate over the course of this century, with significant impacts on the NYC's economy, environment and quality of life. All observed climate information and trends poses significant risks to NYC's communities and infrastructure.

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[29] For 2010 Census Bureau population estimates; New York City Department of City Planning, *Population (Current Population Estimates)*, *ibid.*

[30] NYCEDC, *Borough Updates*, (http://www.nycedc.com/economic-data/borough-updates), (last visited June 17, 2013)

[31] NYC.gov, *Climate Risk Information: New York City Panel on Climate Change (February 17, 2009)*, (http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf), (last visited June 13, 2013)

[32] NYC Health, *NYC Vital Signs Investigation Reports: Deaths Associated with Heat Waves in 2006 (November 2006, Special Report)*, (http://www.nyc.gov/html/doh/downloads/pdf/survey/survey-2006heatdeaths.pdf), (last visited July 1, 2013)

[33] New York City Panel on Climate Change (NPCC2), Climate Risk Information 2013: Observations, Climate Change Projections, and Maps (edits. C. Rosenzweig and W. Solecki), Prepared for use by the City of New York Special Initiative on Rebuilding and Resiliency, New York, June 2013, p. 4

[34] NYC. Gov, *Climate Risk Information: New York City Panel on Climate Change (February 17, 2009)*, *ibid.*. "… assuming historical forces continue, a 2-foot rise in global sea level … by the end of this century would result in a relative sea-level rise of 2.3 feet at New York City…"; Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (edits.), *Global Climate Change Impacts in the United States: A State of Knowledge Report from the U.S. Global Change Research Program*, Cambridge University Press, 2009, p. 37

[35] Radley M. Horton, Vivien Gornitz, Daniel A. Bader, Alex C. Ruane, Richard Goldberg, Cynthia Rosenzweig, "Climate Hazard Assessment for Stakeholder Adaptation Planning in New York City", *Journal of Applied Meteorology Climatol*, Vol: 50, 2011, p. 2252

[36] U.S. Department of Energy, *ibid.*; National Climate Assessment and Development Advisory Committee (NCADAC), *National Climate Assessment*, U.S. Global Change Research Program Public Review Version, January 2013; Intergovernmental Panel on Climate Change, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (edits. C. B. Field, V. Barros, T. F. Stocker and D. Qin), Cambridge University Press, Cambridge, UK and New York, NY, USA; National Oceanic and Atmospheric Administration, Global Sea Level Rise Scenarios for the United States National Climate Assessment, NOAA Technical Report OAR CPO-1, December 6, 2012; Asbury H. Sallenger Jr, Kara S. Doran, Peter A. Howd, "Hotspot of accelerated sea-level rise on the Atlantic coast of North America", *Nature Climate Change*, Vol. 2, 2012, pp. 884-888; Adam B. Smith, Richard W. Katz, "US billion-dollar weather and climate disasters: data sources, trends, accuracy and biases", *Natural Hazards*, Volume 67, Issue 2, June 2013, pp. 387-410

Hurricanes and tropical storms are rare in NYC, but they are always possible and do in fact occur with long-term frequency. This is because the history of hurricanes in NYC is a very old and hurricanes have affected NYC since the 17th century. The greatest and deadliest storm, known as the Long Island Express, was the 1938 New England Hurricane, which struck over Long Island and into New England as a Category 3 hurricane, killing nearly 200 people. This storm led to millions of dollars in damage, and its floods knocked out electrical power in all areas above 59th Street in Manhattan and in all of the Bronx, the new IND subway line lost power, and 100 large trees in Central Park were destroyed. The other major storms in the past are 1821 Hurricane which was one of the only hurricanes believed to have passed directly over parts of modern NYC; Hurricane Carol in 1954 which was the destructive hurricane that hit the Northeast coast as a Category 3 hurricane over Long Island, New York and Connecticut on the 31st of August; Hurricane Agnes in June 1972 which was responsible for 122 deaths and $2.1 billion in damage in the U.S.; Hurricane Gloria in September 1985 resulted in extensive damage; Hurricane Floyd in September 1999 which caused the majority of the $3 to 6 billion in damage; Hurricane Irene in August 2011 led to the major damage was caused by flooding the City's upstate water supply system; and Hurricane Sandy in late October 2012.[37] By now it is clear that these hurricanes hit NYC very infrequently and high-intensity, mostly between July and October. But NYC is also vulnerable to sea level rise, which may lead to a marked increase in extreme flood levels in the long-term.[38] Therefore, especially Hurricane Sandy has taken attention on the effects that such extreme climate events have on NYC, reminding and showing New Yorkers that the city is vulnerable to be a range of uncertain and potentially climate hazards today and in the future. Moreover, a new report which released in July 2013[39] explains that a coastal flooding resulting from accelerating sea level rise and storm surge is projected to occur 10 times as often by 2100. By 2050, these effects on NYC could be even more severe than previously thought, putting more people at risk from increasingly frequent, intense, and longer heat waves in duration and coastal floods in frequency, extent, and height as a result of increased sea levels due to extreme events[40], and approximately 43 miles of NYC's coastline which stretches a total of 520 miles – 8 percent of the city's total excluding beaches and wetlands – could be at risk daily or weekly tidal inundation during non-storm conditions[41].

1.3 Climate change adaptation as a challenge and opportunity for New York City

New York City's Office of Long-Term Planning and Sustainability (OLTPS) formed as part of the Mayor's Office by the Bloomberg administration in 2006[42]. The Office, as a comprehensive and important step toward climate change adaptation, launched a report titled PlaNYC[43] after one year. PlaNYC was a comprehensive and long-term sustainability plan comprised of 127 initiatives in the key areas of land, water, transportation, energy, air and climate change. Since then, the plan was updated in 2011 and has been expanded to 132 initiatives and more than 400 specific milestones to prepare the city for one million more residents, strengthen the economy, combat climate change, and enhance the quality of life

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[37] NYC.gov, *NYC Hazards: NYC Hurricane History*, (http://www.nyc.gov/html/oem/html/hazards/storms_hurricanehistory.shtml), (last visited June 20, 2013)

[38] N. Lin, K. A. Emanuel, J. A. Smith and E. Vanmarcke, "Risk assessment of hurricane storm surge for New York City", *Journal of Geophysical Research-Atmospheres*, Vol: 115, D18121, 2010

[39] U.S. Department of Energy, *ibid.*, p. A-10

[40] New York City Panel on Climate Change (NPCC2), *ibid.*

[41] PlaNYC, *A Stronger, More Resilient New York (June 11, 2013)*, (http://nytelecom.vo.llnwd.net/o15/agencies/sirr/SIRR_spreads_Hi_Res.pdf), (last visited July 15, 2013), p. 46

[42] NYC.gov, *Who We Are*, (http://www.nyc.gov/html/planyc2030/html/about/who-we-are.shtml), (last visited July 5, 2013)

[43] NYC.gov, *PlaNYC: A Greener, Greater New York*, (http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/full_report_2007.pdf), (last visited July 3, 2013)

for all New Yorkers for December 2013.[44] The Office has accepted that the challenges related to climate change are a part of sustainable development goals.

Under the umbrella of NYC's sustainability plan, PlaNYC, the Bloomberg administration has carried out a wide range of innovative initiatives[45], including the Greener Greater Buildings Plan, Clean Heat Program, Climate Resilience Initiatives, Million Trees program, Green Infrastructure Plan, and the others to increase NYC's resilience to the effects of climate change during the this time, as shown in Appendix Table 1. NYC is becoming more energy efficient with these initiatives. For example, only as more buildings comply with the GGBP and as the code proposals of the NYC Green Codes Task Force are fully enacted, it is expected that these efficiency gains would increase, and could yield more than a 10 percent GHG emissions reduction by 2030. This success has largely based on improvements in the NYC' energy supply changes. According to 2013 data, NYC's annual GHG emissions over 2005 emissions have dropped 16 percent - more than halfway to its goal of a 30 percent reduction by 2030. For this, the Bloomberg administration has spent 10 percent of their annual energy budget - approximately $80 million - on funding energy efficiency measures in city government buildings so far.[46] A recent proposal from the Bloomberg administration for NYC alone is priced at $20 billion[47].

A The Greener, Greater Buildings Plan

NYC's buildings account for about 75 percent of carbon emissions. They are the largest single source of energy use and emissions[48], and this leads to $15 million per year in energy costs. The city has 22,000 buildings, which are mostly concentrated in Manhattan, over 50,000 square feet, according to the records. To reduce energy consumption and make the energy systems of the city cleaner and more reliable, NYC enacted the Greener, Greater Buildings Plan (GGBP) legislative package in December 2009[49].

GGBP is comprised of four local laws[50] supplemented by job training opportunities and financing entity called the New York City Energy Efficiency Corporation (NYCEEC). The regulations consist of Local Law 85 (NYC Energy Conservation Code), Local Law 84 (Energy

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[44] NYC.gov, *PlaNYC Progress Report 2013: A Greener, Greater New York*, (http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_progress_report_2013.pdf), (last visited July 3, 2013)

[45] Therefore, the Bloomberg administration received the Environmental Law Institute's 2012 Award for Achievement in Environmental Law, Policy and Management for both bringing together business and environmental leaders and showing the way to a sustainable future for megacities in the world.; Environmental Law Institute, *2012 Annual Report: Making the Law Work for People, Places and the Planet*, Washington, D.C., 2012

[46] NYC.gov, *PlaNYC Progress Report 2013: A Greener, Greater New York*, *ibid.*

[47] New York Times, *Bloomberg Outlines $20 Billion Storm Protection Plan*, (http://www.nytimes.com/2013/06/12/nyregion/bloomberg-outlines-20-billion-plan-to-protect-city-from-future-storms.html?pagewanted=all&_r=0), (last visited July 3, 2013)

[48] Kim Brokhof, Brian Holland and Ryan Foshee, *Case Study: New York City's Greener, Greater Buildings Plan*, ICLEI-Local Governments for Sustainability USA & the Institute for Market Transformation, November 2011, p. 20

[49] Naomi Millan, *NYC's Greener, Greater Buildings Plan*, (http://www.facilitiesnet.com/energyefficiency/article/NYCs-Greener-Greater-Buildings-Plan--11548), (last visited July 9, 2013)

[50] As a concept, "local laws that conflict with state statutes are expressly not authorized under the home rule powers of local government. Further, local laws that are authorized under the home rule powers may nevertheless be preempted if the state legislature chooses to occupy that particular field of regulation."; Edna Sussman, David C. Major, Rachel Deming, Pamela R. Esterman, Adeeb Fadil, Amy Fisher, Fred Fucci, Roberta Gordon, Caroline Harris, J. Kevin Healy, Cullen Howe, Kathy Robb, Jeff Smith, "Climate Change Adaptation: Fostering Progress Through Law and Regulation", *New York University Law School Environmental Law Journal*, Vol. 18, No. 55, 2010, p. 132. "… PlaNYC is enshrined in local law (although its content and policies largely are not) and the framework will need to be reexamined in 2015…"; Freedman-Schnapp, Michael, "A Sustainable City for All", *Toward a 21st Century City for All: Progressive Policies for New York City in 2013 and Beyond*, (http://21c4all.org/sites/default/files/pdf/21cforall_sustainability.pdf), (last visited August 16, 2013), p. 2

and Water Benchmarking), Local Law 87 (Energy Audits and Retro-commissioning) and Local Law 88 (Lighting Upgrades and Sub-metering). Based on the New York State Energy Code, Local Law 85 is the City's local energy code and its provisions apply to all renovations and repairs since its adoption in 2009. Its goal is to ensure that NYC's building stock provides the benefits of energy efficiency during the natural cycles of building upgrades. Local Law 84 is the annual requirement to benchmark energy and water consumption and requires owners of large buildings to do this. About 3,000 buildings including libraries, police stations, firehouses, schools, courthouses, health, community and family centers, and government offices have been benchmarked by the NYC Department of Citywide Administrative Services, with 28 agencies, since 2009[51]. Local Law 87 requires energy audits and retro-commissioning for large buildings which must be fulfilled for all the base building systems, consisting of HVAC, electrical and lighting, conveying systems, domestic hot water, and building envelope. Local Law 88 requires the lighting in the non-residential space be upgraded to meet code and large commercial tenants be provided with sub-meters by 2025.[52]

By 2030, this comprehensive plan to improve energy-efficiency in existing buildings is estimated to reduce citywide GHG emissions from new and existing buildings by at least 5.3 percent[53], have a net savings of $7 billion, and create roughly 17,800 construction-related jobs over 10 years[54]. GGBP was developed together with PlaNYC[55], and has been implemented successfully. This is because, by August 2011, almost two-thirds of covered buildings had complied in the framework GGBP[56]. For this, NYC is also applied to use $16 million of the $80 million in Federal stimulus funding allocated to the city under the program of Energy Efficiency and Conservation Block Grant for this direct lending program[57]. Lastly, the NYC Building Resiliency Task Force released the report which has a wide range of proposals for making NYC buildings and residents safer and better prepared for the next extreme weather event on June 27, 2013[58].

B NYC Clean Heat Program

NYC Clean Heat Program provides free resources to help buildings with technical assistance[59] and financing options convert to the cleanest heating fuels – including natural gas and biodiesel[60] – from heavy heating no. 6 and no. 4 oil more quickly, beginning in July 2012. NYC Department of Environmental Protection passed the relevant regulations in April 2011. PlaNYC's goal is to reduce 2 percent of NYC's emissions, about 1.3 million metric

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[51] NYC Department of Citywide Administrative Services, *Energy Benchmarking Report for New York City Municipal Buildings*, November 2011, p. 8; NYC Department of Citywide Administrative Services, *New York City Government Building Energy Benchmarking Results: 2010 and 2011*, (http://www.nyc.gov/html/gbee/downloads/pdf/benchmark_results_2011.pdf), (last visited July 10, 2013)

[52] NYC.gov, *Greener, Greater Buildings Plan*, (http://www.nyc.gov/html/gbee/html/plan/plan.shtml), (last visited July 8, 2013); Kim Brokhof, Brian Holland and Ryan Foshee, *ibid.*, p. 6-7

[53] Urban Green, *Advocacy in Action: Urban Green Council and the Greener, Greater Buldings Plan*, (http://www.urbangreencouncil.org/GGBP), (last visited July 5, 2013)

[54] NYC.gov, *Greener, Greater Buildings Plan*, (http://www.nyc.gov/html/gbee/html/plan/plan.shtml), (last visited July 8, 2013)

[55] Kim Brokhof, Brian Holland and Ryan Foshee, *ibid.*, p. 5

[56] *ibid.*, p. 15

[57] The Sallan Foundation, *Greener, Greater Buildings Plan*, (http://sallan.org/pdf-docs/Greener_Greater_workforce_and_financing.pdf), (last visited July 5, 2013)

[58] Urban Green Council, *Building Resiliency Task Force: Full Proposals (Report to Mayor Michael R. Bloomberg & Speaker Christine C. Quinn)*, New York, June 2013

[59] As technical assistance, this program helps to determine fuel choices for buildings, perform a simple payback analysis, recommend energy efficiency opportunities to explore, coordinate with natural gas utilities to reduce connection costs, and find qualified contractors, engineers and energy-efficiency specialists.; NYC Clean Heat, *Technical Assistance*, (http://www.nyccleanheat.org/content/technical-assistance), (last visited July 10, 2013)

[60] See for the alternatives fuels; NYC.gov, *NYC Clean Heat: Alternatives*, (http://nyccleanheat.org/content/alternatives), (last visited August 22, 2013)

tons, by the end of 2013 through this Program [61]. Achieving this goal will also help to improve air quality and save lives. NYC's air pollution leads to nearly 6 percent of annual deaths each year[62]. For this program, NYC launched more than $100 million in financing to encourage buildings to convert to cleaner heating fuel in June 2012[63].

C Climate Resilience Initiatives

Since 2007, the Bloomberg administration has notably taken actions to increase its resilience due to NYC's vulnerable structure which is surrounded by 520 miles of coastline, more than Miami, Boston, Los Angeles and San Francisco combined[64], against climate events. All these initiatives and preventions for rebuilding and fortifying made NYC better informed and prepared for Hurricane Sandy, but also revealed the extent of its vulnerabilities[65], as mentioned previously.

Before taking action, the Bloomberg Administration convened the New York City Panel on Climate Change (NPCC1). The Panel consists of leading climate change scientist, academics, and insurance, risk management and legal experts, with funding from the Rockefeller Foundation, in August of 2008. The main purpose of NPCC1 as the technical advisory body is to develop a clear scientific understanding of the risks-based response to climate change and possible impacts to the city's infrastructure, built environment, and population. Overseen by the Mayor's Office of Long Term Planning and Sustainability, the panel's analyses are key part of challenging climate change for the success of new initiatives from policy development to implementation, and provide facts on these issues. The NPCC1 found that NYC could encounter up to 2.5 feet of sea-level rise, almost as many 90 degree days and double to triple the probability of 100-year flood of today[66]. In February of 2009, the Panel released the most detailed climate risk information for the city at the NPCC1 Report published in the Annals of the New York Academy of Sciences. To ensure long-term sustainability, *ad hoc* adaptation to extreme climate events are not enough, and both public and private sectors should make investments to minimize these risks mentioned.[67] And then, the administration convened over 40 public and private infrastructure operators as part of a climate change adaptation task force, the NYC's Climate Change Adaptation Task Force (CCATF)[68], to develop an inventory of risks to the NYC's critical systems, which it completed

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[61] NYC.gov, *PlaNYC Progress Report 2013: A Greener, Greater New York*, *ibid.* See for detailed information; NYC Clean Heat, *Welcome to NYC Clean Heat*, (http://www.nyccleanheat.org/), (last visited July 8, 2013)

[62] New York City Department of Health and Mental Hygiene, *Air Pollution and the Health of New Yorkers: The Impact of Fine Particles and Ozone (Edit. Lise Millay Stevens)*, (http://www.nyc.gov/html/doh/downloads/pdf/eode/eode-air-quality-impact.pdf), (last visited July 10, 2013). The neighborhoods in the Northern Manhattan and South Bronx have the highest asthma hospitalization rates citywide; Iyad Kheirbek, Katherine Wheeler, Sarah Walters, Daniel Kass and Thomas Matte, "PM2.5 and ozone health impacts and disparities in New York City: sensitivity to spatial and temporal resolution", *Air Quality*, *Atmosphere* & *Health*, Vol. 6, 2013, p. 477-479. Moreover, it is claimed that medical services in these neighborhoods are so inadequate.; Alec Pruchnicki, "East vs. West, One More Imbalance", *WestView News*, Vol. 9, No. 8, August 2013, p.5

[63] NYC.gov, *News from the Blue Room: For Immediate Release, PR-212-12, June 13, 2012*, (http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2012a%2Fpr212-12.html&cc=unused1978&rc=1194&ndi=1), (last visited July 10, 2013)

[64] Hilary Russ, *NYC Lays Out $20 Billion Plan to Adapt to Climate Change*, (http://www.reuters.com/article/2013/06/11/us-climate-newyork-plan-idUSBRE95A10120130611), (last visited June 12, 2013)

[65] NYC.gov, *PlaNYC Progress Report 2013: A Greener, Greater New York*, *ibid.*

[66] *ibid.*

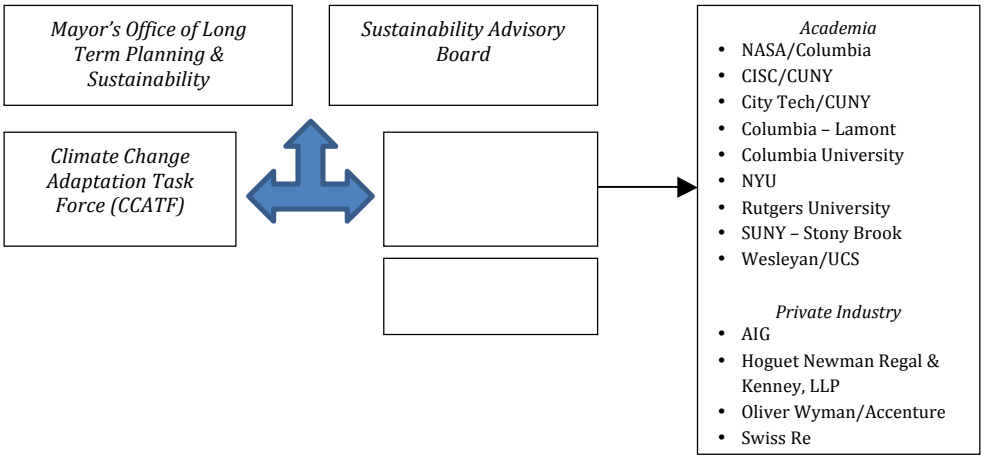
[67] See for detailed information; New York City Panel on Climate Change, *Climate Change Adaptation in New York City: Building a Risk Management Response (edits. C. Rosenzweig and W.D. Solecki)*, New York City Panel on Climate Change 2010 Report, In Annals of the New York Academy of Sciences, 2010, New York, pp. 1-354

[68] In August 2008, Mayor Michael Bloomberg launched the Climate Change Adaptation Task Force to develop adaptation strategies to secure the City's infrastructure from the effects of climate change.; NYC.gov, *Mayor Bloomberg Launches Task Force to Adapt Critical Infrastructure to Environmental Effects of Climate Change*, (http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor

next year, to begin addressing the risks mentioned at the report, and to coordinate between the various regional, state, and federal agencies.[69]

In September 2012, NYC enacted Local Law 42 that established the NPCC1 as an ongoing body which meets at least twice a year, advises the NYC and the CCATF on the latest scientific developments and updates climate projections at least every three years, starting from March 2013. Following the Hurricane Sandy in October 2012, the administration reconvened secondly the New York City Panel on Climate Change (NPCC2) in January 2013 to provide current and future information and analyses concerning climate risks facing NYC for use in the Special Initiative for Rebuilding and Resiliency (SIRR), and to begin work on a new assessment. The NPCC2 which follows the risk management approach[70] developed in NPCC1 released the NPCC Climate Risk Information report update published in June 2013. Using the latest climate models, recent observations about climate trends, and new information about GHG emissions, the NPCC2 now projects that by 2050s, sea level rises of up to 11 to 24 inches are projected.[71]

Figure 1: Organizational structure for quantify the impacts of climate change



Source: Adam Freed, *Building Climate Resiliency in New York City*, (http://www.ucar.edu/governance/meetings/oct09/followup/freed.pdf), (last visited July 12, 2013)

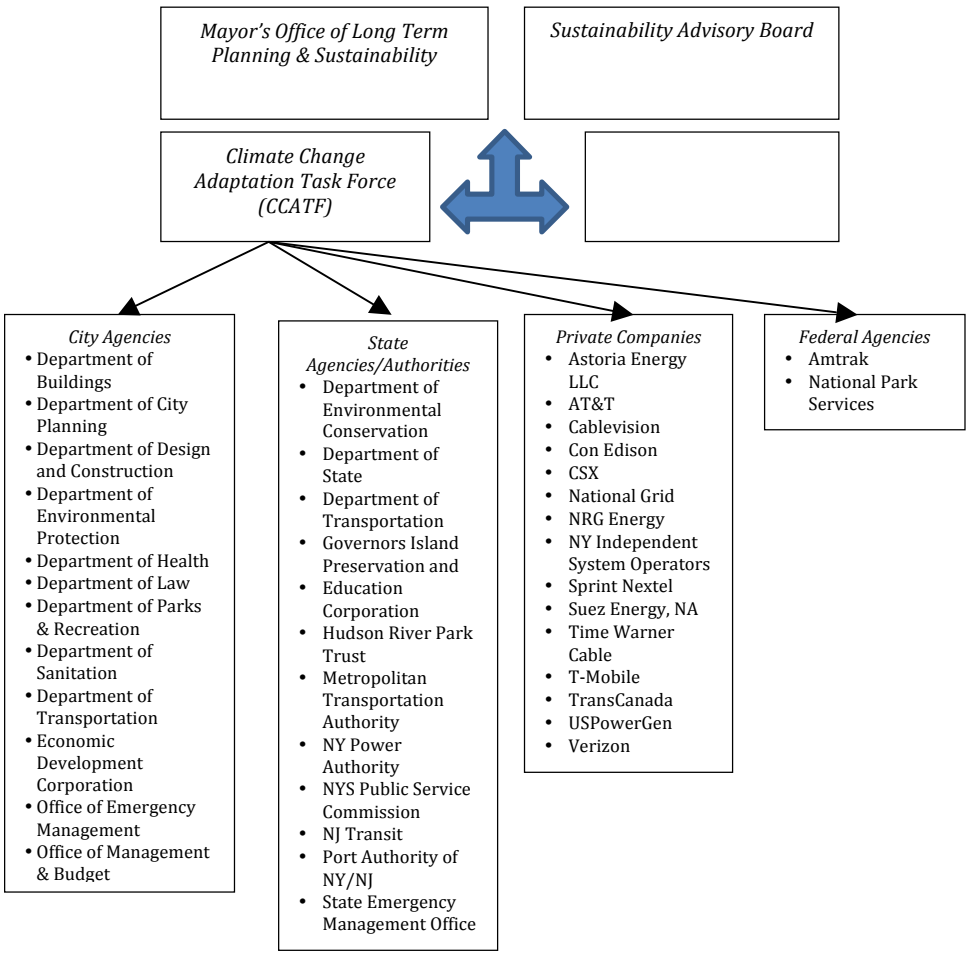
_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2008b%2Fpr308-08.html&cc=unused1978&rc=1194&ndi=1), (last visited August 13, 2013)

[69] NYC.gov, *PlaNYC Progress Report 2013: A Greener, Greater New York*, *ibid.*

[70] The NPCC1 "suggests adopting a multidimensional risk management framework based on up-to-date information about climate science, impacts, and adaptive strategies…"; New York City Panel on Climate Change, *Climate Change Adaptation in New York City: ...*, *ibid.*, p. 14

[71] New York City Panel on Climate Change (NPCC2), *ibid.*, p. 4, 7; PlaNYC, *A Stronger, More Resilient New York (June 11, 2013)*, *ibid.*, p. 28

Figure 2: Organizational structure for quantify the impacts of climate change



Source: Adam Freed, *Building Climate Resiliency in New York City*, (http://www.ucar.edu/governance/meetings/oct09/followup/freed.pdf), (last visited July 12, 2013)

Afterwards, the administration launched a number of initiatives to fortify the resilience of built environment, in accordance with the results and analyses. NYC created a $2.4 billion Green Infrastructure Plan[72] to better manage rainfall and prevent the impacts of combined sewer overflows. The administration required that all projects undertaking environmental review deal with future sea level rise and coastal risks in their drafts to protect new waterfront development. Another initiative is NYC Cool Roofs Program[73] to help cool the city and reduce cooling costs, cut energy usage and lower GHG emissions by reducing the amount of heat absorbed by buildings[74]. This program encourages building owners to cool their rooftops by

[72] See for detailed information on NYC Green Infrastructure Plan released in September 2010; New York City Department of Environmental Protection, *NYC Green Infrastructure Plan: A Sustainable Strategy for Clean Waterways*, September 2010

[73] See for detailed information on NYC Cool Roofs Program; NYC.gov, *Welcome to NYC Cool Roofs*, (http://www.nyc.gov/html/coolroofs/html/home/home.shtml), (July 17, 2013)

[74] J. Cullen Howe, "Chapter 7: Buildings", *The Law of Adaptation to Climate Change: U.S. and International Aspects (Edits. Michael B. Gerrard and Katrina Fischer Kuh)*, American Bar Association, Chicago, 2012, p. 219

applying a reflective white coating.[75] In NYC, the total cooled roofs are nearly 3.7 million square feet in size, according to 2012 Annual Report of the NYC Department of Buildings[76].

Lastly, the measures were taken before, during and after the Hurricane Sandy. One of them that are the Bloomberg administration in 2010 began working together the Federal Emergency Management Agency (FEMA) to update NYC's flood maps – Flood Insurance Rate Maps –, a comprehensive program to retrofit existing buildings in coastal areas. To help communities understand their coastal flood risks and determine whether buildings must obtain flood insurance and meet flood protection standards in the NYC's Building Code, the maps[77] were already in the process of being updated when the hurricane struck. Also, another initiative of the administration is a comprehensive coastal protection study, officially known as the North Atlantic Coast Comprehensive Study, with the U.S. Army Corps of Engineers (USACE). Released on May 28, 2013, the USACE's this study which was authorized for up to $20 million by Congress, and determines and evaluates how best to reduce flood and storm damage risks for vulnerable coastal people and communities in areas affected by Hurricane Sandy.[78]

For this, in December 2012, the Bloomberg administration also convened the Special Initiative on Rebuilding and Resiliency (SIRR) as an effort to rebuild communities that were hit hardest by Hurricane Sandy and fortify the resilience of the built environment and critical infrastructure to the effects of changing climate. In the aftermath of Hurricane Sandy, SIRR announced a report which is the latest report under PlaNYC, recommending how to rebuild communities' post-Sandy and boost infrastructural resiliency citywide, on June 11, 2013. The plan is estimated to cost nearly $20 billion, includes over 250 specific initiatives for preparing the NYC in the face of climate change and severe storms.[79] In general, these initiatives consist of building a huge levee to protect Lower Manhattan, forming wetlands along the East River and installing floodgates along Staten Island.[80]

D MillionTreesNYC: A plaNYC initiative with NYC parks and New York restoration project

Citywide, NYC's tree inventory includes over 590,000 publicly managed street trees, which are distributed amongst the five boroughs – Brooklyn, 24 percent, Bronx, 10 percent, Manhattan, 8 percent, Queens, 41 percent, and Staten Island, 17 percent –. But this is not enough; there is a requirement to increase tree planting to maintain the flow of benefits provided by the urban forest currently, as explained clearly in the NYC Municipal Forest Resource Analysis 2007 report. NYC's street trees intercept 1432 gallons of stormwater annually, and are valued at $61 per tree. Rainfall interception by trees as mini-reservoirs,

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[75] NYC.gov, *PlaNYC Progress Report 2013: A Greener, Greater New York*, *ibid.*

[76] NYC Buildings, *2012 Annual Report (in April 2013)*, (http://issuu.com/nycbuildingsannualreport2012/docs/3652_nycbuildings_annualreport2012?e=8027266/2240144), (last visited August 5, 2013), p. 28

[77] See for the Flood Insurance Rate Maps; Federal Emergency Management Agency, *Flood Insurance Rate Map (FIRM): National Flood Insurance Program (NFIP) Policy Index*, (http://www.fema.gov/floodplain-management/flood-insurance-rate-map-firm), (last visited July 18, 2013). "...However, the City also recognized that even updated FEMA flood maps, because they are based on historic data, will not provide information about the changes that are likely to threaten New York in the future...To ensure that the City would always have access to the latest information about future climate risks, in September 2012 New York City formally codified the NPCC and the Climate Change Adaptation Task Force..."; PlaNYC, *A Stronger, More Resilient New York (June 11, 2013)*, *ibid.*, p. 27-28

[78] See for the information on the North Atlantic Coast Comprehensive Study; U.S. Army Corps of Engineers, *Evaluating North Atlantic Coastal Risks: North Atlantic Coast Comprehensive Study*, (http://www.nad.usace.army.mil/Missions/CivilWorks/HurricaneSandyCoastalRecovery/NorthAtlanticComprehensiveStudy.aspx), (last visited July 19, 2013); U.S. Army Corps of Engineers (New York District Times), *Army Corps Responds to Hurricane Sandy*, New York, January Edition 2013, pp. 1-16

[79] PlaNYC, *A Stronger, More Resilient New York (June 11, 2013)*, *ibid.*, p. 50

[80] Wilder Fleming, "Has Anything Changed? A Year After Sandy, Are We Ready for the Next Big Storm?", *City & State*, Vol. 2, No. 16, August 2013, p. 31

controlling runoff at the source, reduces the magnitude of floods during large storms.[81] Also, these trees affect air quality, are temperature reduction and other microclimatic effects; removal of air pollutants; emission of volatile organic compounds and tree maintenance emissions; and energy conservation in buildings and consequent power plant emissions[82]. Therefore, under the PlaNYC 2030, MillionTreesNYC is implemented since 2007.

MillionTreesNYC is a public – private initiative to plant one million trees by 2017, legislation requiring the city to formulate a plan to reduce sewage overflow, and an $80 million commitment to energy efficiency programs for city government. According to this, NYC will plant 70 percent of the trees in parks and other public spaces, while the other 30 percent will come from private organizations, homeowners, and community organizations.[83] Founded in 1995, New York Restoration Project (NYRP) which is a non-profit organization dedicated to transforming open space in underserved communities to create a greener, more sustainable NYC, is leading this initiative in partnership with the Bloomberg administration. Also the NYC Department of Parks & Recreation (Parks), which is responsible for greening and maintaining the city's open spaces, is another partner of this project, along with the Home Depot Foundation as a financial supporter. NYC has planted more than 750,000 trees[84] across the five boroughs so far.

E Citi Bike initiative

Citi Bike is a privately owned, for-profit public bicycle sharing system which serves NYC's residents and also, the biggest system in the nation. Initially, this system was selected in September 2011 to develop and operate the system using Bixi Technology[85] which is a public bicycle sharing system launched in May 2009 in the city of Montreal, and was comprised of 10,000 bikes and 600 portable, solar-powered docking stations[86]. But the implementation of this system did not start in July 2012 planned, and was delayed because of first software glitches[87] in contractor Alta's operating system and later Hurricane Sandy, which damaged bicycles in storage at Brooklyn Navy Yard[88].

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[81] Paula J. Peper, E. Gregory McPherson, James R. Simpson, Shelley L. Gardner, Kelaine E. Vargas and Qingfu Xiao, *New York City, New York Municipal Forest Resource Analysis (Technical Report)*, Center for Urban Forest Research, U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, March 2007

[82] David J. Nowak, Robert E. Hoehn III, Daniel E. Crane, Jack C. Stevens and Jeffrey T. Walton, *Assessing Urban Forest Effects and Values: New York City's Urban Forest*, U.S. Department of Agriculture, Forest Service, Northern Research Station Resource Bulletin NRS-9, Newtown Square, 2007, p. 13

[83] MillionTreesNYC, *About Million Trees NYC*, (http://www.milliontreesnyc.org/html/about/about.shtml), (last visited July 15, 2013)

[84] MillionTreesNYC, *I'm available*, (http://www.milliontreesnyc.org/html/home/home.shtml), (last visited July 15, 2013)

[85] See for detailed information of Montreal's Bixi System; Bixi Toronto, *Ride with Bixi*, (https://toronto.bixi.com/ride-with-bixi/station/design-innovation-technology), (last visited July 17, 2013)

[86] Richard Matthews, *BIXI Bikes Takes a Bite of the Big Apple (September 15, 2011)*, (http://www.greenconduct.com/news/2011/09/15/bixi-bikes-takes-a-bite-of-the-big-apple/), (last visited July 17, 2013)

[87] Cody Lyon, *The Drama behind the Bike Share Delay (August 22, 2013)*, (http://www.gothamgazette.com/index.php/topics/transportation/1435-why-the-bike-share-software-doesnt-work), (last visited July 17, 2013); Channtal Fleischfresser, *New York City bike sharing delayed till next spring (August 20, 2012)*, (http://www.smartplanet.com/blog/transportation/new-york-city-bike-sharing-delayed-till-next-spring/1768), (last visited July 17, 2013)

[88] Alex Davies, *NYC Delays Launching Its Bike Share Program, Again (December 10, 2012)*, (http://www.businessinsider.com/nyc-citi-bike-share-delayed-by-sandy-2012-12), (last visited July 17, 2013); Cody Lyon, *Why the Latest Delay to the Bike Share Program may not be the Last (December 9, 2012)*, (http://www.gothamgazette.com/index.php/transportation/2348-why-the-latest-delay-to-the-bike-share-program-may-not-be-the-last), (last visited July 17, 2013)

Citi Bike is a part of a $41 million sponsorship deal with Citigroup Inc. for five-years[89]. It finally began operations in May 2013, with 330 docking stations in Manhattan south of 59th Street[90] and in Brooklyn north of Atlantic Avenue and west of Nostrand Avenue[91]. The system has started with 6,000 bikes at these stations, but its goal is to expand the city's network of bike lanes to 10,000 bikes and 600 stations[92], and to the Bronx, Queens and other parts of the City. Today it has more than 113,000 subscriptions, and it is growing. The system helps reduce injuries by upwards of 40 percent for everyone including pedestrians and motorists and nearly 75 percent in risk, according to Sadik-Khan, Commissioner of NYC Department of Transportation.[93] As a means of urban transportation, Citi Bike is important because of its contribution to NYC's sustainability, with regard to reducing carbon emissions of NYC in particular, despite delays and problems[94] with its implementation. Also the pros and cons of Citi Bike will occur over time.

1.4 The network of C40 Cities Climate Leadership Group

Convened in October 2005, the C40 Cities Climate Leadership Group (hereafter "C40") is a collaboration of megacities from around the world to address climate risks. This Group brings together a unique set of assets and creates a shared sense of purpose, in aligned partnership with the Clinton Climate Initiative which focuses on helping large cities reduce their GHG emissions[95] since 2006, and also works to empower these cities to connect with each other and share technical expertise on best practices.[96] It also has initiatives with Bloomberg Philanthropies, World Bank, ICLEI - Local Governments for Sustainability, the Carbon Disclosure Project (CDP) and Arup.

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[89] Fried, Ben and Noah Kazis, *Citigroup to Sponsor NYC Bike-Share at $41 Million Over Five Years (May 7, 2012)*, (http://www.streetsblog.org/2012/05/07/citigroup-to-sponsor-nyc-bike-share-at-41-million-over-five-years/), (last visited July 17, 2013)

[90] Roger Clark, Citi Bike Share Program Launches for Riders With Annual Memberships, (http://www.ny1.com/content/transit/182753/citi-bike-share-program-launches-for-riders-with-annual-memberships), (last visited July 17, 2013)

[91] Stephen Miller, Updated Bike-Share Map Appears to Show Phased Rollout Plan (March 28, 2013), (http://www.streetsblog.org/2013/03/28/new-map-shows-initial-bike-share-spring-rollout-to-skip-parts-of-brooklyn/), (last visited July 17, 2013)

[92] Andrew Meggison, *No Helmet? No Problem, Says NYC Bike Share Program (July 9, 2013)*, (http://gas2.org/2013/07/09/no-helmet-no-problem-says-nyc-bike-share-program/), (last visited July 17, 2013)

[93] *City & State*, "Scorecard: Mass Transportation", Vol. 2, No. 15, August 5, 2013, p. 30, 32

[94] "…the Bloomberg administration has refused to quantify, or even elaborate on, the rash of problems plaguing its system, which has had technical errors of a magnitude never experienced by bike-share programs in other major American cities…"; Matt Flegenheimer, *Bike-Share Effort Draws Riders and Hits Snags (June 11, 2013)*, (http://www.nytimes.com/2013/06/12/nyregion/two-weeks-in-riders-and-errors-for-bike-share-effort.html?_r=1), (last visited July 17, 2013); "... bikers who long dreamed of having their own superhighways now find their trips impeded by construction workers guiding overburdened hand trucks, workers rolling clothing racks, people pushing shopping carts and trailing suitcases and of course, oddles of purposefully striding pedestrians seeking their own obstacle-free commuting lanes...While vehicles are the No. 1 obstacle for cyclists, pedestrians using the bike lanes are an increasing source of cyclist irritation... The bike lanes have become highways for pedestrians, especially in mid-town... The infrastructure we have is not sufficient for both pedestrians and cyclists... No one appears to collect data about injuries in bike lanes or elsewhere..."; Shelia Anne Feeney, "A Tight Fit in Bike Lanes", *amNewYork*, August 16-18, 2013, p. 3. See also for another comments; Sommer Mathis, *Deconstructing New York's Bike-Share Freak Out (May 7, 2013)*, (http://www.theatlanticcities.com/commute/2013/05/deconstructing-new-yorks-bike-share-freak-out/5506/), (last visited July 20, 2013); Felix Salmon, *New York's expensive bikeshare (May 7, 2012)*, (http://blogs.reuters.com/felix-salmon/2012/05/07/new-yorks-expensive-bikeshare/), (last visited July 20, 2013); Matt Flegenheimer, *Out for a First Spin: City's Bike Share Program Begins (May 27, 2013)*, (http://www.nytimes.com/2013/05/28/nyregion/bike-share-program-opens-in-new-york-city-after-long-delay.html?pagewanted=all&_r=0), (last visited July 20, 2013); Ivan Pentchoukov, "As Bike Share Thrives, Demand for Rentals Dwindles", *Epoch Times*, July 25-31, 2013, pp. A1, A4

[95] See for detailed information on Clinton Climate Initiative; Clinton Foundation, *Clinton Climate Initiative*, (http://www.clintonfoundation.org/main/our-work/by-initiative/clinton-climate-initiative/about.html), (last visited July 22, 2013)

[96] C40 Cities, *C40 Cities Climate Leadership Group*, (http://www.c40cities.org/), (last visited July 22, 2013)

Along with the ten-member steering committee of other C40 mayors and the executive leadership team, the current chairperson of the C40 is NYC Mayor Michael Bloomberg who began in November 2010. The C40 convenes city networks to work together on seven key areas - energy efficiency, finance & economic development, measurement & planning, sustainable communities, transportation, solid waste management, water and adaptation and to hold workshops and seminars to exchange best practice. For example, energy efficiency retrofit programs - installing energy efficient light bulbs, other smart lighting mechanisms - has been implemented for existing buildings in 20 cities. Also, 10 Cities have delivered bus rapid transit (BRT) systems. Of the 16 mayors with direct power over 1.4 million taxis, 4 mayors are piloting electric taxis, while 5 mayors are taking policy measures to introduce hybrid taxis. 22 mayors have taken action to improve the cycling infrastructure.[97] Through all these networks, the C40 aims to reduce GHG emissions significantly and to provide proven models that other cities and national governments can adopt[98].

A total of 59 global cities[99] which represent 297 million people and generate 18 percent of global GDP and 10 percent of carbon emissions, are members of the C40. Collectively, these cities account for 4,734 actions to combat climate change, but approximately 74 percent of them have been implemented to date, according to a report[100] released in June 2011.

Table 2: The actions implemented and planned by C40 cities

Sector	*Implemented*	*Planned Expansion*	*Planned New*
Transport	919	470	248
Existing buildings	1,343	688	372
Waste management	783	412	272
Water	192	66	76
Energy supply	268	147	178
Outdoor lighting	121	73	33
Planning and urban agriculture	388	201	67
Food and urban agriculture	97	64	10
Information &Communication Technology	105	65	47
Finance and economy	66	34	43
Climate adaptation	452	275	119
Total	4,734	2,495	1,465

Source: Rohit T. Aggarwala, Rishi Desai, Benson Choy, Andrea Fernandez, Paula Kirk, Alina Lazar, Tania Smith, Mark Watts, Anson Yan, *Climate Action in Megacities: C40 Cities Baseline and Opportunities*, Version 1.0, ARUP & C40 Cities Climate Leadership Group, June 2011, p. 11

[97] Rio+20 United Nations Conference on Sustainable Development, *An 'Alternative Approach for Cities': C40 Cities Climate Leadership Group Submission to Rio+20*, (http://www.uncsd2012.org/content/documents/244C40%20Submission%20to%20Rio20.pdf), (last visited July 22, 2013)

[98] C40 Cities Climate Leadership Group, *A Global Opportunity for Cities to Lead*, (http://c40.org/whycities), (last visited July 23, 2013)

[99] C40 is comprised of the these cities: Addis Ababa, Athens, Bangkok, Beijing, Berlin, Bogotá, Buenos Aires, Cairo, Caracas, Chicago, Delhi, Dhaka, Hanoi, Hong Kong, Houston, Istanbul, Jakarta, Johannesburg, Karachi, Lagos, Lima, London, Los Angeles, Madrid, Melbourne, Mexico City, Moscow, Mumbai, New York City, Paris, Philadelphia, Rio de Janeiro, Rome, São Paulo, Seoul, Shanghai, Sydney, Toronto, Tokyo, and Warsaw. The C40 also has 19 affiliate cities: Amsterdam, Austin, Barcelona, Basel, Changwon, Copenhagen, Curitiba, Heidelberg, Ho Chi Mon inh City, Milan, New Orleans, Portland, Rotterdam, Salt Lake City, San Francisco, Santiago de Chile, Seattle, Stockholm, and Yokohama.; GoGreen: An Ecotribe Initiative, *Green Stories: C40 Cities – Climate Leadership Group*, (http://www.go-green.ae/greenstory_view.php?storyid=1375), (last visited July 22, 2013)

[100] Rohit T. Aggarwala, Rishi Desai, Benson Choy, Andrea Fernandez, Paula Kirk, Alina Lazar, Tania Smith, Mark Watts, Anson Yan, *Climate Action in Megacities: C40 Cities Baseline and Opportunities*, Version 1.0, ARUP & C40 Cities Climate Leadership Group, June 2011.

Launched within same year, another report provides and analyzes the information on current situation of their GHG emissions, adaptation and strategy. It explains that 58 percent of the 42 reporting cities are adopting citywide GHG reduction targets, and 62 percent have established action plans to address climate change. But over 90 percent of C40 cities identified themselves as being at risk due to climate change. Also, there exists an overarching need for developing a standardized way cities can publicly communicate their carbon emissions and risk profiles, according to this report.[101] The reports released during the last two years have demonstrated the results from second and third year of annual reporting from cities in C40. The first report shows a rise in C40 cities setting emissions reduction targets from 62 percent in 2011 to 71 percent, as well as the measurement and reporting of citywide emissions is a growing trend among the C40 cities. These cities report emissions totaling nearly 1 billion tons of carbon emissions, which represents an increase of 43 percent from levels reported last year.[102] Launched this year, the final report is based on data disclosed by 110 cities and shows how climate change actions are helping cities reduce carbon emissions and analyzes the current situation of these cities. According to the report findings, the cities are cutting their carbon footprint, reporting annual energy savings of up to $13 million, and their residents are benefitting from healthier living and better business environments. Also these cities report about $40 million in savings per year from their emissions reduction activities.[103]

Hosted by the city of Copenhagen in cooperation with the C40 cities and ICLEI, the Climate Summit of Mayors was held in December 2009 in conjunction with the 15th Conference of the Parties (COP 15) of the United Nations Framework Convention on Climate Change (UNFCC). The goal of the Summit was to emphasize the significant role that cities play in replying to climate change in regard to both mitigation and adaptation.[104] To achieve this, and create new partnerships and move forward with cutting-edge research findings, two years later, more than 30 mayors convened at the C40 Cities Mayors Summit in Sao Paulo, Brazil. ICLEI and C40 cities launched the development of a new global standard for reporting GHG emissions, as well as shared the best practices and innovation by mayors and experts from around the world.[105] The next C40 Mayors Summit will be held on February 4-6, 2014.

1.5 The Mayors Climate Protection Agreement and the greenhouse gas reduction commitment of New York City

Another municipal network on climate change was the U.S. Conference[106] of Mayors Climate Protection Agreement (the "Agreement"), in which cities pledged to meet or exceed the targets as set forth in the Kyoto Protocol to the United Nations Framework Convention on Climate Change[107], which is an international treaty that sets binding obligations on

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[101] Carbon Disclosure Project (CDP), *CDP Cities 2011, Global Report on C40 Cities (Report written by KPMG)*, C40 Cities Climate Leadership Group, 2011

[102] Carbon Disclosure Project (CDP), *Measurement for Management, CDP Cities 2012 Global Report: Including special report on C40 Cities*, C40 Cities Climate Leadership Group, 2012

[103] Connor Riffle, Kyra Appleby and Pauline Martin, *Wealthier, Healthier Cities: How climate change action is giving us wealthier, healthier cities, based on the CDP responses from 110 global cities*, Carbon Disclosure Project (CDP) & C40 Cities Climate Leadership Group, 2013

[104] New York City Panel on Climate Change, *Climate Change Adaptation in New York City: ...*, *ibid.*,, pp. 26-27

[105] C40 Cities Climate Leadership Group, *C40 Blog: Building on a legacy of action: Looking ahead to Johannesburg 2014*, (http://c40.org/c40blog/building-on-a-legacy-of-action-looking-ahead-to-johannesburg-2014), (last visited July 27, 2013)

[106] "The U.S. Conference of Mayors (USCM) operates as an independently coordinated group of political representatives and is the official nonpartisan organization of cities with populations of 30,000 or more."; Cinnamon Pinon Carlarne, *Climate Change Law and Policy: EU and US Approaches*, Oxford University Press, New York, 2010, p. 90

[107] "…The USA has ratified the United Nations Framework on Climate Change. On the eve of the 1997 Conference of the Parties in Kyoto, the US Senate, by a vote of 95–0, adopted a resolution opposing ratification of any climate treaty that did not impose binding obligations on the rapidly developing economies comparable to those to be imposed on the USA. Though President William Clinton and Vice President Albert Gore supported the Kyoto Protocol and the USA became a signatory before the Clinton Administration left office, they did not submit it

industrialized countries to reduce GHG emissions, in their own communities. Adopted in June 2005, the Agreement encourages the U.S. municipalities to take action to reduce GHG emissions and aims basically reducing the nation's dependence on fossil fuels and also expediting the development of clean, economical energy resources and fuel-efficient technologies. Signatories of the Agreement are represented in the Conference by its chief elected officials, the mayors[108]. As of August 8, 2013, the mayors of 1060 from the 50 States, the District of Columbia and Puerto Rico, representing a total population of over 89 million citizens, have signed and joined the Agreement[109]. Today, the total 47 cities including NYC from the state of New York have signed it[110], and formally adopted and actively promoted policy positions on these issues. These cities are instituting programs to reduce GHG emissions by installing energy-efficient lighting, developing and enforcing building codes incorporating energy-efficient designs, investing in mass transit, carpooling and bicycle commuting programs, and switching over to solid waste management programs that use less energy and recovering landfill gases, as well as creating an emission inventory and developing an effective action plan to fight climate change.[111] The NYC administration's actions at the municipal level have substantially been generated under the PlaNYC, which aims to reduce GHG emissions by 30 percent citywide, and begun implementing over 90 percent of the 127 initiatives[112] such as enacting a local regulation requiring the NYC's yellow cab fleet to drive only hybrid cars by 2012[113], and launching a campaign to plant one-million trees, with 30,800 trees planted since 2007, as mentioned previously.

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to Senate for ratification, knowing that it would be defeated. When George W. Bush became President in January 2001, he explicitly repudiated the Kyoto Protocol. His successor, Barack Obama, who was inaugurated in January 2009, supports US participation in international climate negotiations, but he has presented no climate treaty to the Senate for ratification... President Obama is a Democrat, as is a majority of the Senate. The House of Representatives was controlled by the Democrats until January 2011. The House passed a comprehensive climate bill in June 2009 based on an economy-wide cap-and-trade system, but the Bill died in the Senate, whose current rules require affirmative votes of sixty of its one hundred members to enact legislation. The Republicans took controlof the House in January 2011, and their leadership is strongly opposed to climate regulation and is attempting to block President Obama's efforts…"; Michael B. Gerrard and Gregory E. Wannier, "United States of America", *Climate Change Liability: Transnational Law and Practice* (edits. Richard Lord, Silke Goldberg, Lavanya Rajamani and Jutta Brunnee), Cambridge University Press, Cambridge, 2012, p. 557-559

[108] Carlarne, *ibid.*, p. 91

[109] Mayors Climate Protection Center, *Map of Participating Mayors*, (http://www.usmayors.org/climateprotection/map.asp), (last visited August 8, 2013). The main reason of high number of signatories to this agreement is a wish that local governments are today taking part as new players in world affairs. According to Blank, localities have come forward by doing their part to further disaggregate the waning Westphalian concepts of the unitary state. Therefore, they are among such initiatives or entities, and being taken place of new legal meaning in order to implement their new function and define localities' new place in the emerging global order.; Yishai Blank, "Localism in the New Global Legal Order", *Harvard International Law Journal*, Vol. 47, No. 1, 2006, p. 265-266. Also see; Katherine Trisolini and Jonathan Zasloff, "Cities, Land Use, and the Global Commons: Genesis and the Urban Politics of Climate Change", *Adjudicating Climate Change: State, National, and International Approaches* (edits. William C.G. Burns and Hari M. Osofsky), Cambridge University Press, New York, 2011, pp. 72-98

[110] Mayors Climate Protection Center, *Cities That Have Signed On*, (http://www.usmayors.org/climateprotection/cities.asp?state=NY), (last visited August 8, 2013)

[111] Mayors Climate Protection Center, The U.S. Mayors Climate Protection Agreement (As endorsed by the 73rd Annual U.S. Conference of Mayors meeting, Chicago, 2005), (http://www.usmayors.org/climateprotection/documents/mcpAgreement.pdf), (last visited August 8, 2013); Kirsten H. Engel and Barak Orbach, "Micro-Motives for State and Local Climate Change Initiatives", *Harvard Law & Policy Review*, Vol. 2, 2008, p. 122-123

[112] The United States Conference of Mayors, *Climate Protection Featuring 2008 Mayors' Climate Protection Award Winning Entries*, Mayors Climate Protection Center, Washington, D.C., June 2008, p. 11; The United States Conference of Mayors and the City of Seattle, *Climate Protection Strategies and Best Practices Guide: 2007 Mayors Climate Protection Summit Edition (November 1-2, Seattle)*, Mayors Climate Protection Center, Washington, D.C., November 2007, p. 16-17

[113] NYC.gov, *Mayor Bloomberg Announces Taxi Fleet to Be Fully Hybrid by 2012 (May 22, 2007)*, (http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2007a%2Fpr156-07.html&cc=unused1978&rc=1194&ndi=1), (last visited August 9, 2013)

1.6 Regulatory background

PlaNYC has the binding commitments to provide the sustainability programs of NYC. As a part of these commitments to reduce the effects of changing climate, the some of PlaNYC's initiatives, as mentioned above, converted into legally binding requirements in city laws and regulations.[114] The administration aims to ensure local climate change initiatives by building codes, standards and regulations, even if the other administrations, who have a political vision that does not adopt the idea of same adaptation and mitigation, come to power. This will surely not be enough; however this strategy at the local level needs to be transferred to the national level. There has been above-party political interest, and also this reflects as the success of administration[115]. In this section, we address only many relevant legal regulations, standards, and policies to promote adaptation to climate change under the PlaNYC, although there are thousands of them[116].

A The New York City Climate Protection Act

Enacted as Local Law 22 of 2008, the New York City Climate Protection Act (the "Act") establishes the NYC's Climate Action Plan. The Act is a local law to amend the administrative code of the City about reducing GHG emissions and repeal of the Local Law 55 for the year 2007. Under the Act, NYC commits to a 30 percent of the municipal GHG emissions reductions below 2005 by 2030, and a 30 percent in City government emissions below fiscal year 2006 levels by 2017, as well as a requirement that the City produces an annual assessment and analysis of citywide GHG emissions. The Act explains also these reductions would be achieved through the policies, programs, and actions of the PlaNYC 2030.[117]

B Department of Environmental Protection Rules Regarding the Use of #4 and #6 Fuel Oil in Heat and Hot Water Boilers & Burners

NYC uses 1 billion gallons of heating oil annually, more than any other city of the U.S., accounting for nearly 14 percent of the City's total PM2.5 emissions of the citywide average. The City's air quality, thus, threatens public health, contributing to approximately 6% of annual deaths; particularly among vulnerable populations such as children.[118] For this, in

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[114] Rebecca Bratspies, *Sustainability (Draft for July 24, 2013)*, The CUNY School of Law Writing Workshop, New York City, New York, on July 24, 2013, p. 20.

[115] However, "Such legislative efforts have been largely unsuccessful in creating law, though restrictions on the ability of the National Oceanic and Atmospheric Administration (NOAA) to create a 'climate service' were incorporated into an appropriations bill that was enacted…In contrast, those who supports federal action on adaptation generally do not advocate it to the total exclusion of state and local efforts. Because climate change impacts of experienced at local levels, and because traditional authorities and responsibilities of state and local government govern many affected areas (land use and planning, water resources, … etc.), it is both unlikely and undesirable for federal policy to fully displace or preempt important state and local roles and activities. This reality underscores the need to improve vertical cooperation throughout all levels of government (federal, state, and local) as well as to improve horizontal cooperation across agencies and sectors at the same level of government in order to plan for and support adaptation…"; Vicki Arroyo and Terri Cruce, "Chapter 16: State and Local Adaptation", The Law of Adaptation to Climate Change: U.S. and International Aspects (edits. Michael B. Gerrard and Katrina Fischer Kuh), American Bar Association Publishing, Chicago, 2012, p. 570

[116] For example, the NYC has only implemented more than 25 construction safety laws which have been passed since 2008, affecting construction sites citywide.; NYC Buildings, *Press Releases: Buildings Commissioner Robert Limandri and Investigation Commissioner Rose Gill Hearn Announce Revocation of William Rapetti's Rigger and Crane Operator Licenses (For Immediate Release July 20, 2011)*, (http://www.nyc.gov/html/dob/html/news/pr_revocation_072011.shtml), (last visited August 8, 2013)

[117] The New York City Council, *Local Laws of the City of New York for the Year 2008, No. 22*, (http://legistar.council.nyc.gov/LegislationDetail.aspx?ID=448283&GUID=E252FFD9-2B6E-4D93-865C-96ABDD0D357A&Options=ID|Text|&Search=), (last visited July 29, 2013), pp.1-5

[118] NYC.gov, *PlaNYC Update April 2011: A Greener, Greater New York*, (http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_2011_planyc_full_report.pdf), (last visited August 1, 2013), p. 122-123

January 2011, the NYC Department of Environmental Protection promulgated the Fuel Oil Rules; the amendments to Chapter 2 of Title 15 of the Rules of the City of New York regarding emissions from the use of grade numbers 4 and 6 fuel oil in heat and hot water boilers and burners[119]. The Rules which set the standards for all existing and new boilers in NYC, aim to phase out highly polluting heating oils in favor of less polluting alternatives[120] by 2030.

One of the proposed requirements of the Rules that the boilers must use either #2 or #4 fuel oil[121] or natural gas in order to receive a Certificate of Operation for owners with an existing Work Permit. Boilers using #6 fuel oil will not receive a renewed Certificate of Operation, unless emissions are less than #4 fuel oil on an annual basis. Thus, #6 fuel oil can no longer be used. Also, for new installations, applications for a Work Permit must specify that the equipment will use either fuel oil #2 and/or natural gas, unless emissions are less than fuel oil #2 on an annual basis. For example, #4 fuel oil can no longer be used. Finally, as of January 1, 2030 boilers are required to use either #2 fuel oil or natural gas in order to receive a new or renewed Certificate of Operation, unless emissions are less than #2 fuel oil on an annual basis. This schedule will provide owners with time to convert to #2 fuel oil, or its equivalent, or natural gas, while ensuring more rapid transition from the most polluting fuel oil.[122] All these reductions are crucial to protect the health of New Yorkers in particular; a report issued by the New York City Department of Health and Mental Hygiene in 2011 projected that even a reduction of 10 percent could prevent more than 80 premature deaths, 180 hospital admissions and 950 emergency department visits[123]. The NYC Bar Committee on Environmental Law recommends also that the NYC administration work together the related groups including the Rent Stabilization Association, the coop groups, and the New York Oil Heating Association, to create incentives to shift to cleaner fuels and to upgrade boilers for cleaner and more efficient burning[124].

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[119] NYC.gov, *Department of Environmental Protection Promulgation of Amendments to Chapter 2 of Title 15 of the Rules of the City of New York Rules Governing the Emissions from the Use of #4 and #6 Fuel Oil in Heat and Hot Water Boilers and Burners*, (http://www.nyc.gov/html/dep/pdf/air/heating_oil_rule.pdf), (last visited July 30, 2013)

[120] Bratspies, *ibid.*, p. 20.

[121] "…Heating oil is a type of fuel refined from crude petroleum and which is used for space heating purposes. Depending on the degree of refinement and processing, heating oil is classified as either "distillate" or "residual." Distillate fuels include Number 2 heating oil and highway diesel fuel, the latter of which is used in transportation… Residual fuels include Number 6 heating oil, which unlike Number 2 oil, is the heavy fuel sludge that remains from the petroleum refining process after all distilled products are extracted….Residual fuel oil's use for apartment building space heating is now confined largely to older buildings in New York City, and its use in electric generation is limited largely to a few utilities in Florida and the Northeast."… Number 4 heating oil is the mixture that results from blending Number 6 heating oil, a residual fuel, with Number 2 heating oil, a distillate fuel. It is often used in boilers that are not equipped with preheating equipment for residential and industrial uses…Number 6 and Number 4 heating oils are more polluting than distillate heating oil, which is a lower-sulfur, more refined product. Buildings can also use natural gas as a heating fuel, which is less polluting than any heating oil…"; Kizzy M. Charles-Guzman, *Air Pollution Control Strategies in New York City: A Case Study of the Role of Environmental Monitoring, Data Analysis, and Stakeholder Networks in Comprehensive Government Policy Development*, A practicum submitted in partial fulfillment of the requirements for the degree of Master of Science School of Natural Resources and Environment University of Michigan, December 2012, p. 6-7

[122] AKRF Leaders in Environmental, Planning & Engineering Consulting, Proposed Fuel Usage Requirements in New York City, (http://www.akrf.com/files/Spotlight/NYC%20Regulations.pdf), (last visited July 30, 2013)

[123] New York City Department of Health and Mental Hygiene, *Air Pollution and the Health of New Yorkers: The Impact of Fine Particles and Ozone (Edit. Lise Millay Stevens)*, *ibid.*, p. 25

[124] Kathy Robb and Andrew E. Skroback, *PlaNYC 2030 Update: 2011, Proposed Initiatives for Consideration, Prepared by the New York City Bar Committee on Environmental Law*, the Association of the Bar of the City of New York, New York City, January 5, 2011, p. 16-17. See also the Climate Change Mitigation and Adaptation Principles of NYC Bar Association; New York City Bar, *New York City Bar Association Climate Change Mitigation and Adaptation Principles (December 1, 2009)*, (http://www.nycbar.org/pdf/report/uploads/20071828-ClimateChangeMitigationandAdaptationPrinciples.pdf), (last visited August 6, 2013)

C New York City's local energy performance laws

As noted previously, the NYC administration signed four local laws as a part of the City's Greener, Greater Buildings Plan which is the most comprehensive program in the country to reduce GHG emissions from existing and new buildings, in December 2009. Enacted to improve the energy efficiency of existing buildings, these laws apply to all NYC properties 50,000 gross square feet or larger in size, and thus, are expected to reduce GHG emissions citywide by nearly 5 percent, result in a net savings of $7 billion, and create almost 17,800 construction-related jobs by 2030.[125] Briefly, these address a different side of improving energy efficiency in the NYC's buildings, as shown in Table 3 below, and aim at promoting energy conservation in NYC.

Table 3: New York City' Greener Greater Buildings Legislation

Law	*Jurisdiction*	*Requirements*	*Benefits*	*Timeline*
Energy & Water Benchmarking: Local Law 84 of 2009	All buildings in the New York City	Closure of the 50percent loophole. Renovations of less than half the gross square footage of a structure must comply with energy code.	New lighting, HVAC, and building operations technologies can develop much faster, and renovated buildings will see significant energy savings.	July 1, 2010
New York City Energy Conservation Code: Local Law 85 of 2009	All buildings in the New York City over 50,000 square feet	Requires annual tracking of water and energy use through the U.S. EPA's Energy Star Portfolio Manager.	An energy star rating allows building managers to compare their energy efficiency to similar buildings.	Reporting required in May 2011 (May 2010 for city buildings); collection of 2010 water and energy data required.
Audits & Retro-commissioning: Local Law 87 of 2009	All buildings in the New York City over 50,000 square feet	Energy Audit (meeting standards of ASHRAE Level II) and retro-commissioning required. Identify capital projects with "reasonable" pay back periods. Implementation is not required.	Quantifying the payback period for energy efficiency improvements justifies retrofitting projects to management teams. Projects are eligible for points towards their LEED certification.	Energy efficiency reports are due between 2013 and 2020 in accordance with the building's tax block number.
Lighting Upgrades & Sub-metering: Local Law 88 of 2009	All buildings in the New York City over 50,000 square feet	1. Major tenants with over 10,000 square feet must be sub-metered for electricity.	Sub-metering allows tenants to track their individual electricity consumption.	Sub-metering must be implemented by January 1, 2025.
		2. All non-compliant lighting systems must be upgraded to meet the New York City Energy Conservation Code.	Lighting accounts for 18% of energy use in buildings. Reducing the lighting load is an inexpensive and easy way to see immediate reductions in electricity costs and carbon emissions.	All lighting systems are required to meet section 805 of the New York City Energy Conservation Code by January 1, 2025.

Source: Bonded Building & Engineering, *Environmental Laws Applying to New York City Buildings: A Timeline*, (http://www.bondedbuilding.com/Bonded-NYC%20Green%20Building%20Timeline%20copy.pdf), (last visited August 3, 2013)

One of these laws, Local Law 84 of 2009 (Benchmarking Energy & Water Usage), requires that buildings submit an annual analysis of their energy usage using an online benchmarking tool (known as the "Portfolio Manager") created by the U.S. Environmental Protection

[125] Urban Green, *Advocacy in Action: Urban Green Council and the Greener, Greater Buildings Plan*, (http://www.urbangreencouncil.org/GGBP), (last visited August 1, 2013); NYC.gov, *New York City Local Law 84 Benchmarking Report: A Greener, Greater New York (August 2012)*, (http://www.nyc.gov/html/gbee/downloads/pdf/nyc_ll84_benchmarking_report_2012.pdf), (last visited August 1, 2013), p. 7

Agency. This benchmarking system enables the NYC' building owners to better understand their performance.[126] Accordingly, by starting May 1, 2011, they are required to submit their usage for the electricity, gas, fuel oil or steam, and water utilities for the previous calendar year to the U.S. Department of Finance, or if not, these owners will be fined $500 per quarter, up to $2,000 per year[127]. Subsequent reports are due each year on May 1st [128].

In August 2012, the New York City Local Law 84 Benchmarking Report was released as the first analysis of NYC benchmarking data collected pursuant to Local Law 84. This report provides the current state of energy consumption and performance in large buildings citywide. NYC's 2,065 buildings, constituting 2.6 billion square feet in size, accordingly, benchmarked their energy for 2011, an approximately 75 percent compliance rate. One of the key findings of the report is that on average, NYC's buildings have a median Energy Star score of 64 (out of 100), which is in line with other buildings in the Northeast but better than the national average for buildings of 59. Newer office buildings tend to use more energy per square foot than older ones, which seems surprising at first blush. However, older buildings tend to have less extensive ventilation systems, better thermal envelopes, and less dense or energy intensive tenant occupations. Also larger office buildings tend to be more energy intensive than smaller ones, but smaller multifamily buildings tend to be more energy intensive than larger ones. In addition to, bringing large buildings up to the median EUI in their building type category could reduce total NYC building energy consumption by roughly 18 percent and GHG emissions by 20 percent.[129]

New York City's energy code, or NYC Energy Conservation Code (known as "Local Law 85"), is the second law in the Greener, Greater Buildings legislation. Setting standards for the energy performance of buildings citywide[130], the Code is based largely upon the 2010 Energy Conservation Construction Code of New York State (ECCCNYS), Local Law 48 of 2010 and Local Law 1 of 2011.[131] The Code requires that renovations of existing buildings meet at least energy conservation standards applied to all new construction projects that submit construction approval documents to the U.S. Department of Buildings on or after July 1, 2010, and building alterations resulting in the replacement of minimum 50 percent or more of buildings systems[132].

Local Law 87 of the NYC's Greener, Greater Buildings Plan requires energy audits and retro-commissioning of base building systems of certain buildings and retro-fitting of certain all city-owned buildings over 50,000 square feet in size, as listed by the Department of Finance, once every ten years, beginning in 2013. Also, this law requires an American Society of Heating, Refrigeration and Air-Conditioning Engineers Inc. level II Energy Audit and a retro-commissioning study of base building systems in order to increase the energy efficiency of the largest NYC buildings. Accordingly, the energy audits must encompass all base building

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[126] RAND, *DOB Benchmarking Law (Local Law 84/09) Requires Owners to Submit Energy and Water Usage by May 1, 2011*, (http://randpc.com/green/LL84-09_benchmarking.php), (last visited August 1, 2013). See for detailed information; NYC.gov, *Local Laws of the City of New York (No. 84)*, (http://www.nyc.gov/html/planyc2030/downloads/pdf/ll84of2009_benchmarking.pdf), (last visited August 1, 2013)

[127] NYC Benchmark, *NYC Local Law 84 Violations & Fines*, (http://www.nycbenchmark.com/local-law-84-violation), (last visited August 1, 2013)

[128] NYC Benchmark, *About NYC Local Law 84 - Greener, Greater Buildings Plan*, (http://www.nycbenchmark.com/nyclocallaw84), (last visited August 1, 2013)

[129] NYC.gov, *New York City Local Law 84 Benchmarking Report: A Greener, Greater New York (August 2012)*, *ibid.*

[130] NYC.gov, *Local Laws of the City of New York for the Year 2009 (No. 85)*, (http://www.nyc.gov/html/dob/downloads/pdf/ll85of2009.pdf), (last visited August 2, 2013)

[131] NYC.gov, LL85: NYC Energy Conservation Code (NYCECC), (http://www.nyc.gov/html/gbee/html/plan/ll85.shtml), (last visited August 2, 2013)

[132] DSIRE (Database of State Incentives for Renewable & Efficiency), *New York City - Energy Conservation Requirements for Existing Buildings*, (http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY16R), (last visited August 1, 2013)

systems, defined to include the building envelope, HVAC systems, conveying systems, domestic hot water systems, and electrical and lighting systems that will save energy, but also must identify all reasonable measures and capital improvements that would result in energy use or cost reductions, the associated savings, cost of implementation, and simple payback period. Building owners, afterwards, must ensure that retro-commissioning is completed by a retro-commissioning agent for the required base systems, which must comprise an analysis of operating protocols, calibration and sequencing, cleaning and repairs, and training and documentation. Building owners also are required to submit energy efficiency reports to the Department of Buildings that include both an energy audit report and a retro-commissioning report. But Leadership in Energy and Environmental Design ("LEED")[133]-certified Existing Buildings already as being highly energy efficient are exempt from the requirements under certain circumstances.[134]

In NYC non-residential lighting accounts for almost 18 percent of the energy use in its buildings and roughly 18% of carbon emissions from its buildings. Rapid improvements in lighting technology over past two decades have made it feasible to notably reduce energy consumption by installing more efficient lighting systems, and any investments made to install such systems will typically be paid for through operational savings. Also, many buildings depend on a single meter to monitor electricity consumption. Individual tenants would likely reduce their energy consumption if energy use information were made available to them regularly. Local Law 88 of 2009, another component of the Greener, Greater Buildings Plan developed by the PlaNYC, requires upgrading of lighting systems and the installation of sub-meters providing to achieve significantly energy savings in larger buildings to comply with the NYC Energy Conservation Code standards, which include lighting controls (interior lighting controls, light reduction controls and automatic lighting shutoff), tandem wiring, exit signs, interior lighting power requirements and exterior lighting. By January 1st, 2025 with the NYC Department of Buildings, reports documenting the lighting upgrades, installation and use of electrical sub-meters must be completed.[135]

D Building energy efficiency legislation

The NYC Council enacted four law to increase the City's energy efficiency as part of the PlaNYC. Passed on October 6, 2010, these local laws intend to take away inefficient construction code requirements and support the use of new environmentally-friendly technologies[136] which aim to improve lighting system energy efficiency. Local Law 47 of 2010 which took effect January 1, 2010, alters building code requirements for egress lights in

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[133] See for the U.S. Green Building Council's LEED rating system; Geoffrey M. White, Joshua Nichols and Jeff York, "Chapter Two: Green Building Rating Systems and Green Leases", *The Law of Green Buildings: Regulatory and Legal Issues in Design, Construction, Operations, and Financing* (edits. J. Cullen Howe and Michael B. Gerrard), American Bar Association Publishing, Chicago, 2010, pp. 15-34. See also City University of New York (CUNY) which has this system as an example university; CUNY/The City Universiy of New York, *CUNY Sustainability Project*, (http://www.cuny.edu/about/resources/sustainability/about-us/project.html), (last visited September 11, 2013); CUNY/The City Universiy of New York, *Lehman College Science Hall – So Green It's Platinum*, (http://www1.cuny.edu/mu/forum/2013/08/27/lehman-college-science-hall-so-green-its-platinum/), (last visited September 11, 2013)

[134] NYC.gov, *Local Laws of the City of New York for the Year 2009 (No. 87)*, (http://www.nyc.gov/html/planyc2030/downloads/pdf/ll87of2009_audits_and_retro-commissioning.pdf), (last visited August 3, 2013); New York County NYCLA Lawyers' Association, *Energy Audits & Retro-Commissioning (Local Law 87) Summary*, (http://www.nycla.org/PDF/Regulations%20to%20be%20posted%20online.pdf), (last visited August 1, 2013)

[135] NYC.gov, *Local Laws of the City of New York for the Year 2009 (No. 88)*, (http://www.nyc.gov/html/planyc2030/downloads/pdf/ll88of2009_lighting_upgrades_and_sub-meters.pdf), (last visited August 5, 2013)

[136] Zara F. Fernandes, Christopher Rizzo and Christine A. Fazio, *New York City Adopts New Laws Aimed at Increasing Energy and Water Efficiency*, (http://www.clm.com/publication.cfm?ID=314), (last visited August 12, 2013)

lobbies and hallways[137]. To address energy efficiency in commercial buildings, Local Law 48 of 2010 requires the use of vacancy sensors. This local law allows the city to amend the Energy Code to reduce energy consumption beyond the state code, in relation to establishing reporting requirements for the department of citywide administrative services on the status of city-owned real property. Effective as of December 28, 2010, this local law also adds a requirement that sensors and controls (including occupant sensors) in classrooms, conference rooms, employee lunch and break rooms and offices smaller than 200 square feet; only enable lights to be turned on manually, automatically shut lights off within 30 minutes of all occupants leaving the space, and enable lights to be turned off manually.[138] Another is Local Law 51 of 2010 took effect July 1, 2011, which improved the efficiency of high lighting at temporary walkways, foot bridges and sidewalk sheds at construction sites. This local law also allows the use of photo sensors to control this lighting.[139] Finally, effective as of January 1, 2011, Local Law 52 of 2010 amends housing maintenance code provisions related to lighting in corridors. Also this law allows the use of photo sensors to control this lighting.[140]

2 New York City climate change adaptation after Bloomberg…

The incumbent and ongoing NYC administration is term-limited and therefore, unable to seek re-election to a fourth term in office. The 2013 NYC mayoral election[141] is scheduled to occur on November 5, 2013 and a new mayor will be elected for the first time since 2001. It has been seen that the NYC has largely changed in accordance with climate change adaptation and mitigation in the last 12 years. However, the related administrative consistency and will should be ensured by the next NYC administration; these cooperative and collaborative policies, as it is now, will provide some benefits[142] to the NYC sustainability. Aggressive administrative efforts have achieved great success.

To this end, a 23-page report, by the New York City Bar Association released in May of 2013, contains a wide range of policy recommendations on infrastructure, the environment and emergency preparedness, including climate change, renewable energy, post-Sandy recommendations and transportation, for NYC's next mayor. In general the Report highlights the continuity of successful environmental planning and accountability structures established by the NYC's outgoing administration, such as PlaNYC 2030, which is the administration's road map for a 'Greener, Greater New York', and also, of substantial climate initiatives and efforts which are already underway for climate change mitigation and adaptation. Briefly, the City Bar's report focuses on two main themes. The next mayor should not only build upon the successful environmental planning and accountability structures figured out by the current

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[137] NYC.gov, *Local Laws of the City of New York for the Year 2010 (No. 47)*, (http://www.nyc.gov/html/dob/downloads/pdf/ll47of2010.pdf), (last visited August 12, 2013)

[138] NYC.gov, *Local Laws of the City of New York for the Year 2010 (No. 48)*, (http://www.nyc.gov/html/dob/downloads/pdf/ll48of2010.pdf), (last visited August 12, 2013); Fernandes, Rizzo and Fazio, *ibid.*

[139] NYC.gov, *Local Laws of the City of New York for the Year 2010 (No. 51)*, (http://www.nyc.gov/html/dob/downloads/pdf/ll51of2010.pdf), (last visited August 12, 2013)

[140] NYC.gov, *Local Laws of the City of New York for the Year 2010 (No. 52)*, (http://www.nyc.gov/html/gbee/downloads/pdf/ll52-2010.pdf), (last visited August 12, 2013)

[141] See for all Republican and Democratic mayoral candidates; Decide NYC, *Race Overview: Mayor*, (http://www.decidenyc.com/mayor/), (last visited August 16, 2013); Tim Herrera, "amNY Voter's Guide", *amNewYork: Manhattan's Highest Daily Circulation Newspaper*, September 9, 2013, pp. 1-5; Matthew Chayes, "GOP voters high on Lhota", *amNewYork: Manhattan's Highest Daily Circulation Newspaper*, September 3, 2013, p. 8; Ivan Pereira, "When disaster strikes", *amNewYork: Manhattan's Highest Daily Circulation Newspaper*, September 3, 2013, p. 7

[142] For example, these policies facilitate policymaking that is effective in addressing the leading motives and specific manifestations of changing climate at the local level. Also, they offer models for structuring policies at the state and national level, as well as promote public awareness and participation that, respectively, contributes to the grassroots political movement within the nation through environmental policies.; Carlarne, *ibid.*, p. 89

Administration, but also should do more to reduce GHG emissions and to prepare for and protect the City from the foreseeable impacts of changing climate.[143]

Generally, the successful initiatives for tackling climate change of NYC administration have been supported by mayoral candidates.[144] But the next NYC administration will have to decide which ongoing projects and policies it is supportive of and, if possible, should determine and rearrange its own projects and policies, which offer recommendations for strengthening the city's infrastructure in the face of climate change and future natural disasters, as a part and continuation of PlaNYC and its vision. Moreover, NYC' next mayor will have inevitably to address and tackle the complex and crucial problems and its impacts facing the city post-Sandy, and other climate change threats in the future.

One of these problems is, for example, related to South Street Sea Port area with its cobblestone streets and 19th century building stock which represents a number of different styles of mercantile architecture, including Georgian, Federal and Greek revival. Hurricane Sandy flooded many sea port buildings, and a number of ground-floor restaurants and stores have yet to recover business. For this historic district, the current NYC administration presented a proposal which is part of their long-term plan, "A Stronger, More Resilient New York". But this proposal could take decades to be completed. Also, this proposal has not been factored into the mayor's storm recovery budget. Also only $15 billion of the $20 billion in projected spending has been accounted for, leaving a $5 billion gap.[145] For the foregoing reasons, the next mayor will face and also, measures like these[146] would take years to implement.

4. Conclusion and Comments

The catastrophic effects of global warming can be seen in NYC today. As of now, the NYC as a coastal city has faced different climate risks such as heat waves and storm surges, which affect everyday life citywide, and, if current trends continue, they will become more frequent and severe. Hurricane Sandy which has devastated the East Coast is just the latest example.

Being aware of these consequences, the NYC administration has taken measures both to resolve the crisis arising climate change – environmental, social and technological –, to turn to opportunities since 2002. Under PlaNYC, which could be called "ambitious", the Administration has carried out successfully initiatives such as the Greener, Greater Buildings Plan and the Million Trees Program to tackle climate change through reducing GHG

[143] The Association of the Bar of the City of New York, *Policy Recommendations for New York City's Next Mayor*, New York, 2013. See also for a report prepared by the NYC Democratic mayoral candidate Bill de Blasio, Public Advocate for the City of New York, in 2013, contains suggestions and recommendations for best practices which highlights the importance of collaboration, communication and coordination; Office of Bill de Blasio Public Advocate for the City of New York, *Supporting Community-Based Disaster Response Lessons Learned from Hurricane Sandy*, New York, June 2013

[144] For example see for the views of candidates running for mayor; Dan Rivoli, "How They Fare on Transit? Mayoral Candidates Outline the Ways They Would Improve the Lives of Commuters", *amNewYork: Manhattan's Highest Daily Circulation Newspaper*, August 29, 2013, pp. 6-7

[145] Gabby Warshawer, "Seaport District Moves to Regain Footing", *The Wall Street Journal*, August 17-18, 2013, p. A18; Grace Kelly, "On the Waterfront: Pros and Cons of Bloomberg's Seaport City proposal", *City & State*, Vol. 2, No. 14, July 22, 2013, p. 11

[146] See for Rebuilding Task Force's strategy released a rebuilding strategy to continue helping the Sandy-affected region rebuild; Hurricane Sandy Rebuilding Task Force, *Hurricane Sandy Rebuilding Strategy: Stronger Communities, A Resilient Region*, New York, August 2013, pp. 1-198. Also see; Linda I. Gibbs and Caswell F. Holloway, *NYC Hurricane Sandy After Action: Report and Recommendations to Mayor Michael R. Bloomberg*, May 2013, pp. 1-37; NYC Buildings, Information about Rebuilding after Hurricane Sandy, (http://www.nyc.gov/html/dob/html/rebuilding_after_sandy/storm_update.shtml), (last visited August 22, 2013); Kia Gregory, "Mayor Signs 9 Bills to Improve Disaster Planning", *The New York Times*, August 13, 2013, p. A19; Anna Sanders, "Council Pushes Forward Storm Bills", *Metro: New York City's Daily Newspaper*, July 25-28, 2013, p. 6

emissions, with mostly 30 percent below current levels by 2030. These initiatives, which providing the examples of best practices at the local level, help to create a more resilient the NYC, with a long-term focus on preparing for the impacts of climate change. However the weakest side of these, maybe, is that the NYC has limited financial resources. This can turn a disadvantage because of other pressing needs and tight budgets.

Additionally, this strategy of the NYC administration at the local level should be transferred to the national level, and also adopted as above-party political interest, as mentioned frequently in our study. Achieving this challenge will require integration with the national preparedness system across adaptation and mitigation. In June 2013, the U.S. Government released a rebuilding strategy to strengthen all communities in the U.S. at risk from extreme weather and promised to help local governments strengthen their infrastructure[147]. Thereby, this is important in terms of additional support and guidance from the federal government. Moreover, the local government elections in NYC will soon take place; it will be determined whether or not the next mayor has same policies. In addition, the NYC may need many more strategies in adapting citywide to a changing climate, as well as current politics. To ensure that the NYC is resilient to existing and future climate risks, the next mayor must take further action.

The NYC administration is a good municipal example for the cities in Turkey, especially for its coastal cities such as Istanbul and Izmir that are vulnerable to climate change effects. This is worth considering not only in terms of best practices, but also an evidence of fulfillment the administrative success in a short period of time. In fact, NYC is late relatively to address climate change, when compared to other cities such as Los Angeles, Seattle and Denver in the nation. For example, as one of the C40 cities[148], Istanbul, located in northwestern Turkey, is in a similar situation now, and needs to a comprehensive program which are preparing risk assessments, setting GHG emission reduction targets and pledging to act, just as the PlaNYC. The effort of NYC's administration may be able to provide lessons to our cities as they plan adaptation strategies.

5. Outputs (Publications, presentations, etc.)

This study will provide various opportunities. Because I can make sustainability measurements which achieving a balance among economic development, environment and quality of life, and providing an opportunity to see sustainable development, related to climate change in the major cities of Turkey, especially İstanbul, Erzurum, Trabzon and İzmir, with this study experience in CUNY School of Law. Also, this study will be useful for both Public Administration especially in the context of local governments, and Turkish Environmental Law.

I presented this study at the CUNY School of Law Faculty Forum on September 12, 2013.
Also I would like to publish as a full paper in an academic journal.

[147] Executive Office of the President, *The President's Climate Action Plan*, June 2013; Ernest J. Moniz's speech, *Policy Adress by Ernest J. Moniz, U.S. Secretary of Energy*, Center on Global Energy Policy, Columbia University, New York City, August 26, 2013.

[148] Istanbul is a part of the network of C40 Cities Climate Leadership Group. But there has not been any climate change data. Therefore we could not make a comparison with the other C40 cities in our study.; C40 Cities Climate Leadership Group, *Istanbul, Turkey*, (http://www.c40cities.org/c40cities/istanbul), (last visited July 25, 2013)

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