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**A Climate Adaptation and Mitigation Strategy for New York City Public  
Housing Authority Properties**

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# I. Introduction

## 1.1 Climate change events present challenges to NYCHA developments

Climate change has presented many challenges to modern cities, especially those located near large bodies of water such as New York City. As hurricanes become more severe and intense, it is important that cities prepare their buildings to sustain themselves under the onslaught of increasingly and more frequent severe weather events. Buildings must be retrofitted to be prepared for the potential flooding and wind damage associated with climate change. This is especially important for low-income properties and residents as they are the most vulnerable to climate change. Low-income properties tend to be in the lowest lying areas and tend to not have enough resources to prepare themselves for a disaster. Developing strategies for climate change for low-income properties and low-income residents can therefore prove to be very challenging. This puts the New York City Housing Authority, as the largest manager of low-income properties in North America, in a particularly difficult position. The New York City Housing Authority (NYCHA) is the largest landlord in the City of New York and the largest public housing authority in North America. NYCHA provides affordable housing for low and moderate-income residents in all five boroughs. The average yearly income for residents of NYCHA properties is \$21,520 (NYCHA Fact Sheet).<sup>1</sup> Currently, there are 176,327 families residing in NYCHA's 2,602 residential buildings, 345 of which are public housing units. As such, NYCHA finds itself in a unique position to be responsible for financing the retrofitting of a number of properties all at once to ensure the safety of its residents and long term sustainability of its' properties. NYCHA normally preserves its' facilities through regular maintenance and modernization efforts, but this has become difficult to do under the constraints of the current economy.

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<sup>1</sup> <http://www.nyc.gov/html/nycha/html/about/factsheet.shtml>

<b>NYCHA Statistics</b>	
Number of families	176,327
Number of buildings	2,602 (345 Public Housing)
Average rent	\$320
Average resident income	\$21,520

The research that will be presented in this paper will be based on scientific data generated by leading researchers on the topic of climate change. I will tie the projections that they make for the Northeast region to the necessary adjustments that NYCHA will need to make as an institution to prepare themselves for climate change. I will follow up with sources and uses for funding for this under taking. Though NYCHA is currently experiencing severe financial issues, strategic use of public-private partnerships and tax credits can create methods for them to navigate their way through difficult times. I will focus on one property in particular located in a low-lying area in Far Rockaway, Queens called the Beach 41 Property. I will look specifically at the financial and infrastructure issues surrounding the redevelopment of this property and do an assessment of measures that can be taken to prepare this community specifically for climate change. I will then present case studies on notable projects that have implemented similar redevelopment strategies. The goal of this research paper is to offer the New York City Housing Authority strategies for best practices on how to prepare their low-income properties for the effects of climate change through effective retrofitting strategies.

**1.2 The New York City Housing Authority faces financial problems**

NYCHA has been experiencing regular annual budget short falls and a severe lack of capital resources for some time. NYCHA’s annual budget has been running at a deficit since 2002. Currently, there is a \$13 billion gap between what NYCHA will receive in capital funding and what its buildings and infrastructure needs are through 2015. Over the course of 10 years, NYCHA has been deprived of \$714 million in operating subsidy. The Fiscal 2011 expense budget totals \$3.059 billion,

which is approximately \$274 million greater than the 2010 expense budget. With such a large budget increase, it is no surprise that funding gaps are widening so much. The largest portion of the budget that year went to employees, which accounted for nearly 38% or \$1.17 billion of it. The second largest component of the budget was Section 8 payments to landlords, which accounted for 33% or \$969 million of the budget. The third largest portion of the budget was utility costs. This accounted for \$530.9 million or 17% of the budget that year. Other expenses included insurance, supplies, leases, payments in lieu of taxes (PILOT), debt services, and replacement services<sup>2</sup>. NYCHA's largest sources of revenue in 2011 included subsidies from HUD to operate the Section 8/Housing Voucher program in the amount of \$996 billion, federal operating subsidies from HUD in the amount of \$915 million, and rental income from NYCHA tenants in the amount of \$866 million. Other revenue sources include interest on investments, rental income from commercial tenants, revenue from operations, categorical grants, and funding transferred from the capital budget to the operating budget. These revenue sources total \$199 million in funding. As is evident by these figures, NYCHA relies heavily on HUD funding. That is why it was so severely affected when it was deprived of approximately \$700 million in operating subsidies due to partial funding by Congress<sup>3</sup>.

NYCHA residents are dependent on a wide range of NYCHA community and social programs. Each year more than \$75 million of NYCHA's budget goes to support programs, services, and outreach initiatives. Only \$12 million of this is covered by grants. The rest is funded from NYCHA's operating budget<sup>4</sup>. In 2006, NYCHA assessed its maintenance and repair needs and estimated that it needed to invest \$25 billion over the next 15 years. NYCHA invested approximately \$2 billion between 2006 and 2010, leaving an estimated \$5.5 billion in unmet need through the end of 2010. For 2011 through 2015, NYCHA anticipates investing another \$1.5

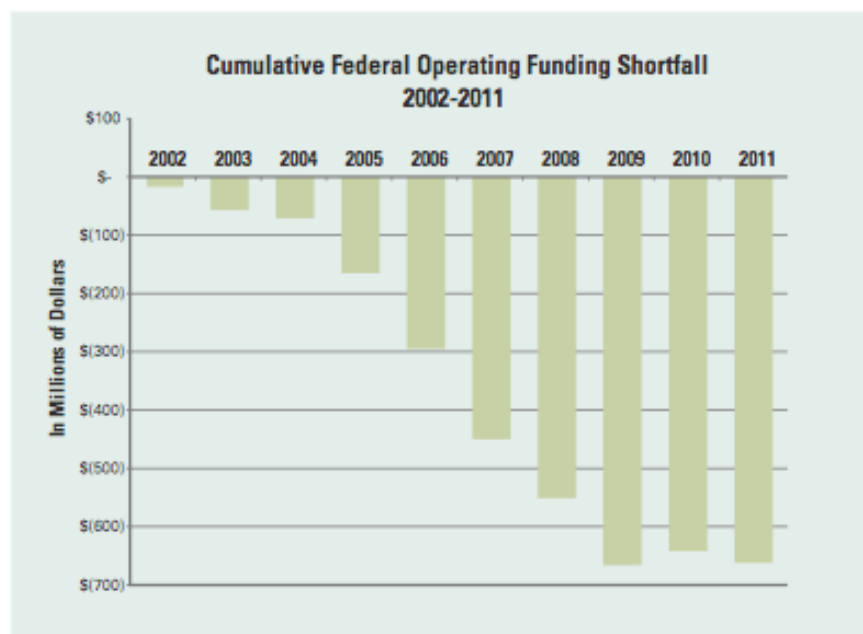
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<sup>2</sup> City Council Hearing on the Mayor's Fiscal 2012 Executive Budget- New York City Housing Authority; June 2, 2011

<sup>3</sup> NYCHA 2011 Fiscal Budget

<sup>4</sup> PLAN NYCHA, A Roadmap for Preservation; December 2011; page 9

billion against an estimated \$9 billion needed. Creative financing methods and more public private partnerships are needed to keep these shortfalls from exacerbating over time.



“Almost two-thirds of NYCHA's current \$150 million deficit- approximately \$90 million- is due to meeting the unsubsidized needs of the State and City developments on a yearly basis. NYCHA can no longer afford to divert federal subsidies from the federal developments” –New York City Housing Authority Chair John Rea<sup>5</sup>.

### 1.3 Stakeholder involvement in the adaptation and mitigation process

Every city will be affected by climate change differently. Knowing the appropriate parties to bring to the table during the adaptation and mitigation process is key. All climate mitigation strategies must address the need of particular communities, focusing on the vulnerable areas of that region. It is essential to know what appropriate public and private partners exist to address each issue that arises. 45% of NYCHA’s developments are in FEMA designated low-lying Hurricane

<sup>5</sup> [http://www.nyc.gov/html/nycha/html/about/mixed\\_financefaq.shtml#q1](http://www.nyc.gov/html/nycha/html/about/mixed_financefaq.shtml#q1)

Evacuation Zones<sup>6</sup>, making them all vulnerable to climate change related flooding. This fact prompted NYCHA to partner with New York City's Office of Emergency Management to launch a pilot program in the six Far Rockaway, Queens Developments: Hammel Houses, Redfern, Ocean Bay Bayside, Ocean Bay Oceanside, Beach 41<sup>st</sup> Street and Carlton Manor<sup>7</sup>. The low-lying areas in each borough of New York have distinct issues associated with each of them.

The Federal Emergency Management Administration organizes hazard mitigation strategies and is a key go to entity during the time of a disaster. FEMA dollars are often times what communities end up leaning on after a disaster. The Long Term Community Recovery program through FEMA is a key source of funds that are deployed immediately following a disaster. Additional funding comes from sources such as disaster recovery central development block grants and other sources of funding which will be discussed later in this paper. The important thing is to spend those investment dollars strategically and seek private sector investment dollars to match these federal dollars and push projects forward. FEMA separates hazard mitigation strategies into six broad categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. My research will track these stages and align it with my recommendations.

#### **1.4 Worst case scenario for climate change: The City of New Orleans' adaptation and mitigation strategy**

The City of New Orleans has become a poster child for the affects of climate change. While none of the properties that NYCHA handles will be as low on FEMA's flood plane registry as most of the properties in New Orleans, there is a lot that NYCHA can learn from the NOLA's post Katrina recovery efforts. The City of New Orleans' disaster recovery is an example of the worst-case scenario and what to do

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<sup>6</sup> Greening Public Housing: New York City Housing Authority; Spring 2011

<sup>7</sup> <http://www.nyc.gov/html/nycha/html/news/emergency-readiness-rockaways.shtml>

under extreme circumstances. In order to decrease the levels of green house gas emissions, the local New Orleans City government and various community and non-profit groups undertook several initiatives, including a comprehensive, environmentally-focused rebuilding plan called GreenNOLA, a revised Master Plan for the City- which pays special attention to lowering emissions, the creation of a Green Council through the office of the Mayor, a Green Building Ordinance, Green Jobs Training, and a Sewerage and Water Board wetlands assimilation project to increase carbon sequestration. In addition, the City became a Solar America City, ramping up its commitment to clean, reusable energy sources. Numerous nonprofits became engaged in sustainable residential building projects, while others made sure that citizens of all income levels had access to ecologically friendly materials, household appliances and tools that help them save energy<sup>8</sup>. Additionally, the New Orleans Public have adopted the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Silver standard as a baseline for the construction of all schools citywide. These efforts have brought sustainable rebuilding practices to a citywide impact.

## II. Current Climate Adaptation Strategies Used in NYC

### 2.1 New York City's Panel on Climate Change

The City of New York has initiated several projects that are geared towards mitigating the affects of climate change and can be utilized by NYCHA in their planning efforts. The City established the New York City Panel on Climate Change (NPCC) in August of 2008, modeling it off of the United Nations Intergovernmental Panel on Climate Change. This was an effective way to set priorities for mitigation and adaption goals for the City of New York. The panel consisted of representatives from NASA, the City University of New York, Accenture, Rutgers University, Wesleyan, New York University, and the Mayor's Office. These representatives act as an advisory body for the Mayor and the New York City Climate Change Adaptation

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<sup>8</sup> City of New Orleans Carbon Footprint Report; July 2009



task force. The panel projected that potential future extreme events such as heat waves, intense precipitation events, storm related coastal flooding, and droughts could pose a serious risk to New York. These disasters have the potential to have severe impact on the infrastructure of New York, including increased summertime strain on materials, increased peak electricity loads, increased flooding, reduction of water quality, inundation of low lying areas, and reduction of water quality. Low-lying properties such as the developments in Rockaway, Queens will need to take these issues into consideration when planning their adaptation strategies. The challenge for NYCHA will be making sure these properties and their residents are safe in the event of a large scale, climate change related disaster.

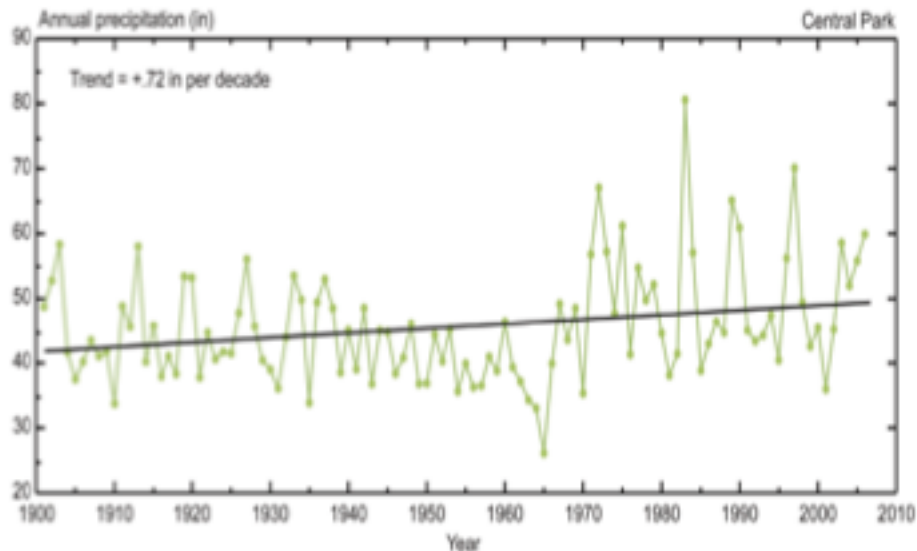
The extreme events threatening the New York area, as described by the NPCC, are divided into three categories: temperature, precipitation, and sea level rise<sup>9</sup>. Extreme temperatures are described as either individual days with maximum temperatures above 90 degrees, days with maximum temperatures above 100 degrees, or three consecutive days with temperatures above 90 degrees. During the 1971-2000 period, the City of New York averaged 14 days per year over 90 degrees, 0.4 days over 100 degrees, and two heat waves per year. In July of 2011, a 104 degree temperature day produced the largest power demand in City history<sup>10</sup>. Con Edison reported a peak load of 13, 182 megawatts, which surpassed its previous record of 13,141 set in August of 2006. Energy demand surged as residents of the City attempted to keep their homes cool. A major priority of climate adaptation strategies is coming up with ways to address energy distribution and energy supply under this type of scenario. Low-income residents, as the largest users of energy, are adversely affected under this scenario. A natural inclination of most cities is to rely on solar energy and other alternative sources of energy as a power supply back up, but it is also important to focus on energy use reduction measures for buildings through what is known as demand side management. This should be coupled with

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<sup>9</sup> "Climate Change Risk Information: New York City Panel on climate Change"; February 17, 2009

<sup>10</sup> [http://articles.nydailynews.com/2011-07-22/local/29822337\\_1\\_air-conditioners-con-ed-heat-wave](http://articles.nydailynews.com/2011-07-22/local/29822337_1_air-conditioners-con-ed-heat-wave)

user education so that citizens are informed of their options when it comes to controlling their comfort levels in their homes.



Extreme precipitation is another major threat to the New York area, according to the NPCC. A report issued by the commission states that between 1971 and 2000 New York City averaged 13 days per year with 1 inch or more of rain fall, 3 days per year with 2 or more inches of rain, and 0.3 days per year with more than 4 inches of rain. The three years with the most occurrences of more than 2 inches of rain have all occurred during the last three decades. This past year, precipitation levels reached above 4 inches four months in a row. While these statistics do not seem to reflect a long-term trend, they are certainly a cause for concern. Severe rain events compounded by rising sea levels can present a scenario that can become a more serious threat over time.

Added to these concerns are potential threats from coastal storms. While it was an isolated incident, Hurricane Irene threatened New York with Category 1 winds in August of 2011. This event presents itself as a “worst case scenario” that City agencies must prepare themselves for. By engaging in responses to these worse case scenarios, NYCHA can be a step ahead of the game. NPCC used IPCC based methods to generate modeled projections for temperature, precipitation and sea level rise over the course of the next 70 years. These models, as reflected in the

below graph, project that sea level may rise by 2 to 5 inches in the 2020's, 7 to 12 inches in the 2050's, and 12 to 23 inches in the 2080's. These are represented as the mean average of three potential scenarios that were run through the simulation. The scenarios projected the future of New York under severe rain, sea level rise, and heat wave events. The data that was compiled from this study may prove to be very useful for future planning efforts for NYCHA and several other City departments.

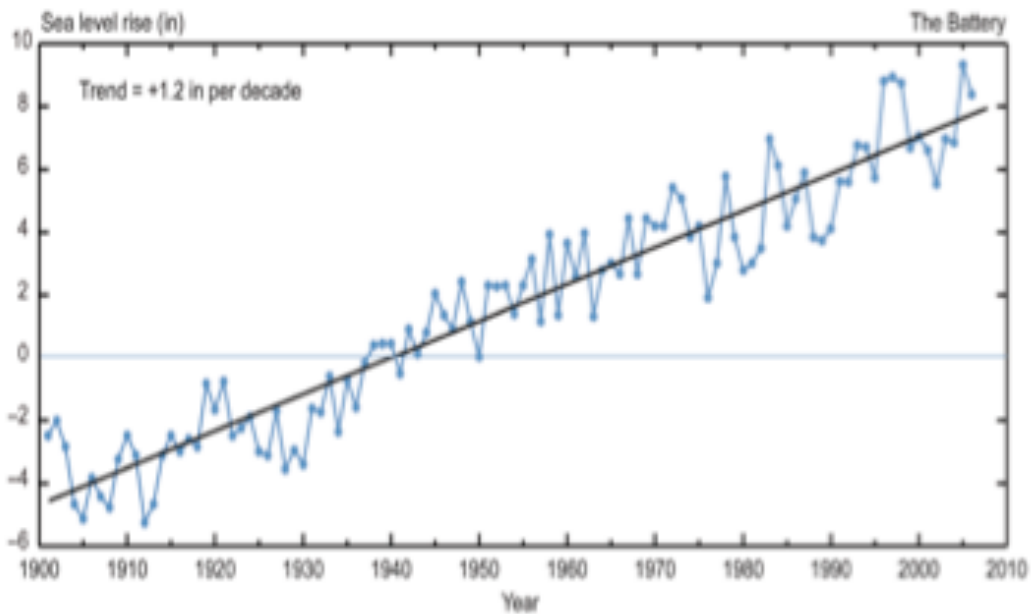


Figure 2: Graph from NPCC study of sea level rise projections in New York

## 2.2 New York City Housing Authority's current hazard mitigation strategy

New York City's current Hazard Mitigation plan is a coordinated effort between 39 New York City agencies. The strategy is a unified effort between 39 offices to jointly address issues dealing with sea level rising and responses to severe weather events in New York. The panel's suggestions can be very impactful to NYCHA's strategies for retrofitting their properties going forward. It is important that all efforts are coordinated in this manner, so as to prevent overlapping and duplication of efforts going forward. The most difficult process of implementing climate adaptation strategies is the cooperation between so many entities that it

requires. In developing a funding strategy for the Public Housing Authority, it is imperative that these impediments be averted to ensure the success of the program in the long run. Communication between departments is crucial to the success of the program.

There have already been major strides made on the issue of intergovernmental relations with regards to implementing the Hazard Mitigation Strategy through the formation of the Mitigation Planning Council. The meeting of this council on a regular basis is essential to the success of the strategies that will be discussed in this research paper. The council identified a number of natural hazards in the Risk Assessment Section of their report that can potentially affect the New York area. The committee identified coastal erosion, coastal storms, drought, earthquakes, extreme temperatures, flooding, windstorms and tornadoes, and winter storms as priorities for the Hazard Mitigation strategy. These disasters will have the most severe impact on low income residents and residents of low-lying properties. As a manager of low-income properties, NYCHA's hazard mitigation strategy must specifically highlight these properties and the mitigation strategy must take this especially into consideration.

### **2.3 Community engagement in adaptation and mitigation strategies**

Organizing residents is a crucial part of a disaster response strategy. The New York City Housing Authority has already made great strides in that endeavor through their "Ready New York" campaign. This strategy was developed by NYCHA to get community members more engaged in the efforts of the Office of Emergency Management to do outreach to community members in lieu of a natural disaster<sup>11</sup>. As was highlighted in the City's Hazard Mitigation Strategy, public education and awareness is a key component of the mitigation strategy. As such, the "Ready New York" campaign is vital to the success of the project. This was evident in the City of New Orleans following Hurricane Katrina when many residents found themselves stranded and without a plan for evacuation.

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<sup>11</sup> [http://www.nyc.gov/html/oem/html/get\\_prepared/ready.shtml](http://www.nyc.gov/html/oem/html/get_prepared/ready.shtml)

Though the City of New Orleans, prior to Hurricane Katrina, had an effective disaster response strategy in place, many of the City's low-income residents still were not able to get out of the City during the storm. The City was not fully evacuated, as was evident by the number of low-income residents that were in the Superdome following the storm. These low-income residents represented roughly 20% of the population that did not have a way to evacuate following the storm. In developing a strategy for these residents for future responses, the New York City Housing Authority needs to take several factors into account. One of the most major factors that were addressed was the capacity of the highways to deal with traffic. The American Highway Users Alliance reports that New Orleans' roads have an exiting capacity of 67%. This means that roughly two thirds of the population at any given moment can access roads leaving New Orleans in the event of a disaster. One method of improving the exiting capacity of New Orleans is to widen the roads and make more access points to prevent bottlenecking on major highways<sup>12</sup>. In planning for the expansion of road ways, it is important to take into account the delay time of traffic during an evacuation. According to the American Highway Users Alliance, New Orleans' average travel delay time was about 19%, while the internal traffic flow rating was measured at 81%. This means that it takes 19% more time to travel from one part of town to another when there is an evacuation going on. Another major factor in determining the evacuation capacity of a city is the percent of people that have access to a car, either by owning one or through a friend or relative. The American Highway Users Alliance determined that 91% of the population has access to a car to get out of the City. This same study averaged all of these factors together to determine an average evacuation capacity and derived a 67.3% evacuation capacity for New Orleans. These statistics are vital when developing the strategy for evacuation for future storms. Evacuation of citizens is the priority when responding to threats from an incoming storm. Citizens must be informed of their options when it comes to evacuation routes so that they can plan accordingly. Local municipalities

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<sup>12</sup> <http://web.mit.edu/12.000/www/m2010/finalwebsite/katrina/evacuationplan.html>

must also be able to predict traffic flows to better prepare police and first responders.

Seven months after Hurricane Irene and Tropical Storm Lee struck New York, the Federal Emergency Management Agency (FEMA), its New York State partners, and other stakeholders focused on the long-term community recovery needs of the hardest-hit areas of the state. FEMA's Long-Term Community Recovery (LTCR) teams were active in six New York counties -- Broome, Delaware, Greene, Schenectady, Schoharie and Tioga<sup>13</sup>. Following Hurricane Irene, immediate steps were taken to implement a mitigation strategy through the Office of Homeland Security. The office utilizes the National Response Framework (NRF) to implement its strategies<sup>14</sup>. The NRF is a guide that details how the Nation conducts all hazard responses. The framework describes how communities, States, Federal Governments and private sector and non-governmental partners apply the NRF principles in a coordinated manner. It also describes special circumstances where the Federal Government exercises larger roles. One of the Office of Homeland Security's key methods for coordinating a response between several offices of government and the private sector is the use of the National Incident Monitoring System (NIMS).

The same 2006 Evacuation Study by the American Highway Users Alliance graded the City of New York's exit capacity and evacuation capacity with an F. The automobile access strategy received a B and is seen as a redeeming quality of the evacuation strategy. Outreach to community members is crucial for the success of any evacuation strategy. The report makes four key recommendations for improving urban evacuation plans: implementing a national standards and reporting system, expanding the capacity of roadways, expanding citizens access to automobile transportation as much as possible, and establishing a comprehensive urban area evacuation plan. The report states that "the New York urban area has nearly double the number of auto-less households as the next most transit

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<sup>13</sup> <http://www.newschannel34.com/mostpopular/story/FEMA-Focusing-on-Long-Term-Community-Recovery/71Z0iPF-N0Wn5CRxyJpCXg.csp>

<sup>14</sup> <http://www.fema.gov/emergency/nrf/aboutNRF.htm>

dependent urban area, New Orleans”<sup>15</sup>. This is likely due to the abundance of availability of mass transit in New York and the amount of low-income residents in the New York area. The report highlights the fact that 80% of the auto-less households live in the City of New York where mass transit is available in abundance. It is suggested that residents make use of the city’s subway system to provide transportation to commuter rail stations where people can transfer to trains that take them to areas outside of the urban area.

#### **2.4 PlaNYC ‘s Climate Change Task Force**

The New York City panel on climate change has a broad reaching strategy to address the affects of climate change. Similar to the Hazard Mitigation Strategy, the Climate Action Plan addresses several areas that require action in preparation for climate change. These categories were Housing and Neighborhoods, Parks and Public Space, Waterways, Transportation, Energy, and Solid Waste. The plan projects that the average temperature in New York will rise 3 degrees, the number of days with the temperature over 90 degrees, and the sea level will rise 2 to 5 inches degrees all in the next 10 years. Additionally, flood events are projected to occur every 65 to 85 years as opposed to every 100. With these sorts of statistics being prevalent, it is imperative that an action plan for low-income residents that will be most adversely affected by these hazards have a plan of action.

New York City’s Panel on Climate Change established several efforts to mitigate change that align with NYCHA’s goals:<sup>16</sup>

- Release an annual inventory of greenhouse gas emissions
- Assess opportunities to further reduce greenhouse gas emissions by 80% by 2050
- Regularly assess climate change projections
- Partner with FEMA to update flood insurance rate maps

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<sup>15</sup> “Emergency Evacuation Report Card 2006: 25 Urban Areas Could Face Greater Challenges than New Orleans Experienced After Hurricane Katrina” - American Highway Users; page 27

<sup>16</sup> NYC panel on climate change report

- Develop tools to measure the City's current and future climate exposure
- Update regulations to increase the resilience of buildings
- Work with the Insurance industry to develop strategies to encourage the use of flood protection in buildings
- Protect New York City's critical infrastructure
- Identify and evaluate coastal and protective measures
- Mitigate the urban heat island effect
- Enhance our understanding of the impacts of climate change on public health
- Integrate climate change projections into emergency management and preparedness
- Work with communities to increase their climate resilience

Each of these action items creates an opportunity for NYCHA to coordinate with this team and create a strong long term community action strategy.

## **2.5 Flood Resilient Waterfront Development in New York City**

Following major disasters it is common for the insurance industry to become wary about paying too many claims in the affected area. Insurance companies immediately are naturally nervous about lending in flood prone areas already, so it is not a surprise that when their fears are realized, they make every attempt to not have to pay more than they have to. This must be kept in consideration when working with insurance companies during the rebuilding process. Updating building codes is also an important part of that process as well to boost the lenders confidence. At times it is a sufficient response to simply adopt updated building codes, but occasionally it is necessary to write and adopt more stringent ones. It is up to the local municipality to decide which is most appropriate. FEMA regulations can be incorporated easily into zoning documents. It is important that NYCHA take note of the local flood zone maps available on the FEMA website (<https://msc.fema.gov>) and be sure that new zoning restrictions align with these restrictions.



### III. Analysis of Retrofitting Benefits and Potential Solutions

#### **3.1 Recommendations for Retrofit Priorities and Structural Changes**

The conundrum that many cities have found themselves in as they attempt to address the needs of their low-income population is the issue of funding. For profit developers and lending institutions grapple with this topic daily regarding private sector development. The issues become compounded when you begin to look at subsidized low income housing where there are no additional investment dollars that can fill gaps and holes in funding required upgrades for properties. The New York City Public Housing Authority's issues with retrofitting their building stock are the same that every housing authority across the nation are experiencing. The issue is coming up with financing strategies to retrofit properties that are experiencing deferred maintenance and are already dilapidated. The major source of funding for this work will have to come from government subsidies. Following Hurricane Katrina, the City of New Orleans was successful in securing a significant amount of FEMA funding, which allowed the local public housing authority to work in tandem with large scale developers on building entirely new, mixed use developments in the place of the formerly dilapidating public housing units. The housing developments- B.W. Cooper, C.J. Peete, Lafitte, and St. Bernard- have all been rebuilt and redesigned to meet modern codes, and even attain LEED certification in one instance. The "big four" housing units, as they were commonly referred to, have become models of sustainable development that are garnering attention and praise from both the government and the private sector development market.

While this scenario is not possible for NYCHA, it is possible to work with the Office of Emergency Management on a more effective strategy for the use of FEMA dollars. New York has received \$151,579,096 in funding from the Office of Homeland Security annually for the past two years. These invested dollars must be spent strategically to ensure that they protect the most vulnerable population of New York, low-income residents of NYCHA properties. Another source of grant

funds are dollars available through the New York State Energy Research and Development Authority to assist in energy efficiency retrofits. If New York does become the victim of a major disaster, disaster dollars from HUD<sup>17</sup> will also be made available as they were after the 9-11 tragedy. Disaster-CDBG played a crucial roll in post Katrina recovery and propped up several programs that helped the city to get back on its feet after the storm.

The International Panel on Climate Change identified in its' 2007 report<sup>18</sup> several key areas that should be focused on in mitigating commercial and residential propertied for climate change. The designing strategies that they suggest include reducing heating and cooling loads, selecting systems that make the most cost effective use of its' energy systems, strategic use of insulation, and using equipment that has effective control strategies in place. Additionally, they encourage using passive heating and cooling methods through the use of passive solar design. The energy use of a building however depends largely on the building's occupants and the behavior of the user. These issues must be addressed during the early design stages by the architect and the planner. The building's proximity to surrounding buildings, the insulation levels of the thermal envelope, and issues such as thermal bridging which can cause moisture build up are all issues that must be addressed during the design phase. The choice of insulation must maximize the long-term thermal performance of the building. Window placement is a big priority during the design phase. Windows must be properly placed and contain multiple glazing layers in order to be most effective at deterring heat gain. Any heat that can be deterred will reduce the work that the installed systems will have to do. Reducing heating and cooling loads depends a lot on the building's shape and orientation. Another important factor is the choice of the building materials that are used for construction.

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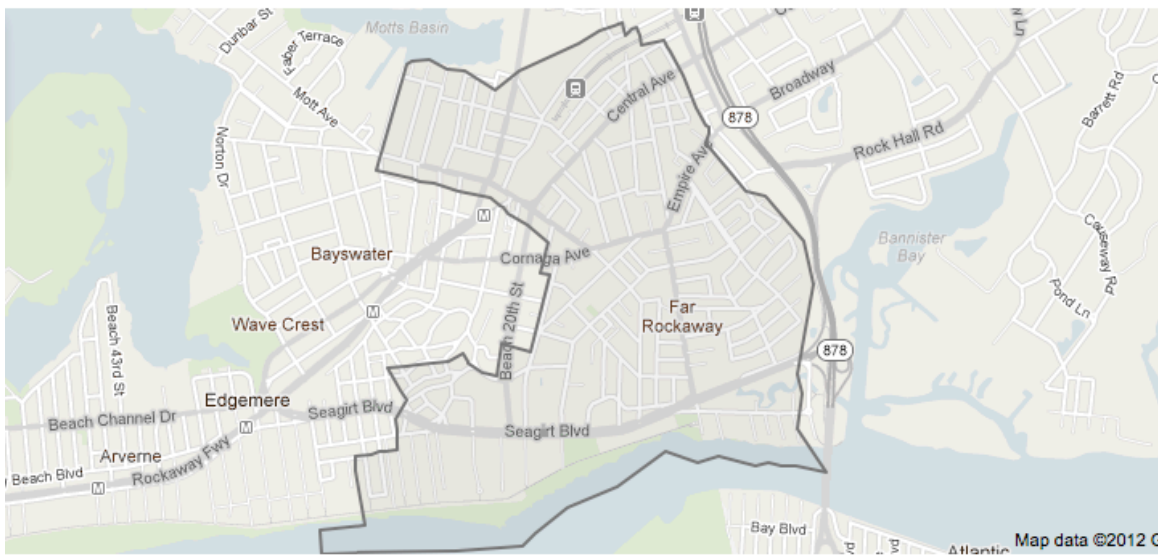
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[http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_wg3\\_report\\_mitigation\\_of\\_climate\\_change.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg3_report_mitigation_of_climate_change.htm)

### 3.2 The Case of Beach 41 Street Development

To bring the theories of this research into a more tangible strategy, I will focus on a specific development project of the New York City Housing Authority. The Beach 41 Street property is one of six housing projects of NYCHA that exists on the peninsula of Rockaway, Queens. This property is currently being considered for redevelopment. The project site contains four 13 story buildings that exist on a 13.31 acre site with 712 apartments housing approximately 1,733 people. The project was developed in November of 1973. Given the age of the facility, it is obvious that the facility is in a state of disrepair and needs significant upgrades. The property is currently valued at \$312,791, so simply selling it would not make enough of a profit to really justify it. Improvements will be performed on both the garage property as well as the main facility.



In analyzing the Beach 41 St. property market, the most important factors to take into account are the trends impacting the market, the available affordable housing, employment rates, and the rents of adjacent communities. Since the New York Housing Authority provides public housing for low-income residents, it is not necessary to look at the rental market in a competitive manner, but rather as a means of determining the level of need in the community<sup>19</sup>. It is important to determine what the rents of other units that are considered as affordable are in the

<sup>19</sup> <http://newyork.hometownlocator.com/ny/queens/far-rockaway.cfm>

area to determine what the definition of low-income in the community is. Property listings from local sites show that the average rent for affordable units in this area are between \$600 and \$800. With this being the average, it can be reasonably inferred that the rents charged by NYCHA will serve what will be considered a low income population for this neighborhood as its population grows. As of 2011, the population of the community of Far Rockaway was 59,542 people<sup>20</sup>. Since 2000 it has had a growth of 7.38 percent. Compared to the rest of the country, Far Rockaway's cost of living is 58.6% higher than the national average. The unemployment rate in Far Rockaway is 8.4%, which is less than the national average of 9.1%. The national commute time for residents to their jobs is 50 minutes. This is significantly more than the national average of 28 minutes.

Far Rockaway, Queens neighborhood has seen many changes in the sales<sup>21</sup> prices in its' community over the course of the past year. As highlighted in appendix C, the median sales price for homes in Far Rockaway for Jan 12 to Mar 12 was \$499,778. This represents an increase of 24.9%, or \$99,778, compared to the prior quarter and an increase of 87.6% compared to the prior year. Sales prices have depreciated 24.1% over the last 5 years in Far Rockaway, Queens. The median sales price of \$499,778 for Far Rockaway is 2.96% lower than the median sales price for Queens NY. As is also shown in appendix C, the average price per square foot for homes in Far Rockaway was \$274 in the most recent quarter, which is 61.18% higher than the average price per square foot for homes in Queens<sup>22</sup>. A survey conducted by the organization Nabe Wise shows that the Far Rockaway community does not rank high in terms of shopping options, dining, or nightlife. It is also not viewed as a very safe community.

Employment figures show that in 2010 Queens had a per capita personal income (PCPI) of \$40,285. This PCPI ranked 14th in the state and was 83 percent of the state average, \$48,596, and 101 percent of the national average,

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<sup>20</sup> <http://newyork.hometownlocator.com/ny/queens/far-rockaway.cfm>

<sup>21</sup> <http://www.propertyshark.com/mason/text/infopages/Far-Rockaway.html>

<sup>22</sup> [http://www.trulia.com/real\\_estate/Far\\_Rockaway-Queens/5099/market-trends/](http://www.trulia.com/real_estate/Far_Rockaway-Queens/5099/market-trends/)

\$39,937. The 2010 PCPI reflected an increase of 3.4 percent from 2009. The 2009-2010 state change was 3.8 percent and the national change was 2.8 percent.<sup>23</sup> In 2000 the PCPI of Queens was \$27,894 and ranked 17th in the state. The 2000-2010 average annual growth rate of PCPI was 3.7 percent. The average annual growth rate for the state was 3.4 percent and for the nation was 2.8 percent. In 2010 Queens had a total personal income (TPI) of \$89,991,968<sup>24</sup>. This TPI ranked 3rd in the state and accounted for 9.5 percent of the state total. In 2000 the TPI of Queens was \$62,218,522 and ranked 3rd in the state. Total personal income includes net earnings by place of residence, dividends, interest, and rent, and personal current transfer receipts received by the residents of Queens. It is home to 461 businesses. These businesses employ roughly 8,894 employees. Retail and health care related businesses represent a little under half of that with 226 being represented by those fields. The majority of the rest of the businesses are made up of food services, real estate, financial related businesses, trade, technology, waste management, and construction.

The features that have been identified for investment by the development team are the electrical system, the plumbing system, and cathodic protection. When severe flooding occurs, electrical systems are all destroyed and made unusable. Piping systems are either crushed from standing water or break due to high storm surges that they are not able to handle. Pipes that have been worn down over time due to corrosion and over use are especially vulnerable to damage from flooding. A solution to the electrical issue is to keep all mechanical and electrical systems above the FEMA designated flood plane levels. Protecting wiring with insulation and blocking can also protect them against flood waters. Submerged pipes are often much more difficult to address. In the days following hurricane Katrina, The City of New Orleans received significant funding from the "Submerged Road Program". This program was developed by the Louisiana Department of Transportation and Development and was funded by post Katrina disaster recovery funds from the Emergency Relief Program of the Federal Highway Administration. These funds

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<sup>23</sup> [http://www.trulia.com/real\\_estate/Queens-New\\_York/community-info/](http://www.trulia.com/real_estate/Queens-New_York/community-info/)

<sup>24</sup> <http://www.bea.gov/regional/bearfacts/action.cfm?fips=36081>

were used to both repair pipes and fix damaged roads and streets. In the event of a major disaster, NYCHA may consider replicating this initiative to create sources of funding for plumbing and street scape improvements. The use of cathodic protection is also a strategic investment that will produce long term saving on the Rockaway properties. This process uses various elements to enhance the durability of pipes and keep them from corroding over time. This will certainly increase the durability of pipes on the Rockaway site and decrease costs for future repairs.

### **3.3 Funding Sources for redevelopment of properties**

There are several sources of redevelopment funds that can prove to be a strategic leveraging point for the New York City Housing Authority. In the event of a climate change related disaster, hazard mitigation funds are another key source of revenue that may be tapped in the event of a disaster. The City of New Orleans' Hazard Mitigation Strategy is a model of measures that may be taken by a City facing the affects of climate change. While hazard mitigation grant funding is only available to cities that are declared as a natural disaster, the City of New York may still have a few pointers that they can take from this retrofitting strategy. The Hazard Mitigation program is a FEMA approved effort that assisted the City of New Orleans in recovering from the affects of Hurricane Katrina. As such, any other City that goes through similar circumstances may find this strategy useful. The hazard mitigation program is specifically for the purposes of elevating flood prone structures, demolition of structures, or reconstruction of an improved and elevated structure on a demolished site. The New York City Housing Authority could utilize these in the event of a natural disaster hitting the peninsula of Queens. Following a large enough rain or storm event, NYCHA may find it to be a better economic decision to demolish the properties at Rockaway rather than retrofitting them. If this is the case, knowing the how to strategically apply the FEMA hazard mitigation to a recover effort would be a helpful. FEMA's hazard mitigation program has five different programs: the Hazard Mitigation Grant Program, the Pre-Disaster Mitigation Program, the Flood Mitigation Assistance Program, the Repetitive Flood Claims Program, and the Severe

Repetitive Loss Program<sup>25</sup>. Knowing which one of these programs to deploy under given circumstances is key to developing an effective mitigation strategy.

The amount of Hazard Mitigation funding that is available to a City is decided entirely by FEMA, following that City's declaration as a disaster zone. The Pre-Disaster Mitigation program is designed to help local governments and states implement sustained hazard mitigation strategies, the Flood Mitigation Assistance Program has the purpose of reducing claims under the National Flood Insurance Program, the Repetitive Flood Claims Program

The Low Income Housing Tax Credit (LIHTC) program provides tax credits that can be easily integrated into the redevelopment budget for New York City Housing Authority properties. Eligible uses of these funds include acquisition, construction or rehabilitation of affordable housing. The LIHTC program is the largest source of funds for the preservation and development of affordable housing nation wide. These tax credits are allocated and administered by state housing agencies. Development capital is made available by syndicating the tax credits to an investor or group of investors. To take advantage of the credit, a developer must apply through the state, comply with the rules and regulations of the program, and have a developer in place that will receive the credits on behalf of the project.

### **3.4 FEMA methods for tracking success**

Recently, the University of Michigan teamed up with the USGBC, ICLEI, and FEMA to issue a report on the importance of climate change mitigation and adaptation strategies<sup>26</sup>. This report highlights the likely impacts of climate change on a regional, neighborhood, and site or building level. The report gives strategies on how to enhance the resilience of a site by making adjustments to six categories: 1) the building envelope, 2) siting and landscape, 3) heating, cooling and lighting, 4) water and waste; 5) equipment, and 6) process and operation. These strategies are split into "no regrets" strategies and resilient strategies. No regrets strategies are

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<sup>25</sup> <http://www.fema.gov/library/viewRecord.do?id=4225>

<sup>26</sup> "Understanding Impacts and Preparing for Changing Conditions" University of Michigan in partnership with USGBC

described as strategies that will produce social and economic benefits whether or not climate change occurs. A resilient strategy is described as something that will allow a system to absorb disturbances such as increased precipitation or flooding. The infusion of these strategies with local zoning and building code regulations is essential to expand the cause of climate change adaptation nationally. Many local jurisdictions and regions have been slow to adopt these strategies. Others who have adopted the ideology of climate change have not effectively infused policy with practice. Getting affective climate change strategies implemented will require local jurisdictions to understand the dangers that they face from climate change and for affective strategies of mitigation to be developed to address those dangers.

In the built environment, an important first step to mitigation is to evaluate the building's operation and maintenance practices, and to conduct a scenario analysis that will show how buildings will respond to projected climate impacts. Knowing the potential affects of climate change on individual building sites is key to inform all decisions that will be made with regards to mitigation in the future. If the area that you live in has major flood risks due to climate change, location of the electrical systems and heating and ventilation systems is important to consider when either building or renovating a building in this type of area. FEMA plays a key roll in this effort, as their flood plane maps can inform you of whether or not your development is at a high risk of flooding. Wild fires due to high temperatures affects other regions and may be more of a concern to certain developments. In this case, knowing local fire codes and designing accordingly is essential to the long term sustainability of your site. Fires can spread easily if not planned for during construction. The use of non-combustible materials is a good mitigation tactic in this instance. It is also important to install an effective sprinkler system and to properly shield all floors, hallways and elevator shafts to present the rapid spread of a fire in the event that one occurs. FEMA addresses fire issues via their hazard mitigation strategies as well. Having a firm grasp of their recommended mitigation strategies is very important prior to construction.

After addressing individual building performance, it is important take a neighborhood scale view to your projects. A key impact on the development of



communities is urban heat island effect. Densely populated urban areas can trap heat easily and cause heat levels in communities to reach unsafe levels. Utilizing proper shading and installing highly reflective roofing can significantly reduce this affect. These strategies are mentioned in LEED criteria and points are given in every version of LEED for actions that are taken to reduce heat island effects. Another strategy that has the dual benefit of reducing heat island effect while mitigating carbon is the strategic planting of trees through a method commonly referred to as evapotranspiration. Increasing trees and shrubbery on site has many benefits including increasing soil stability and reduced run off, allowing for ground water recharge, and maintaining humidity in the air in dry regions. These strategies can be effective for both hazard mitigation and climate change. They are “no regrets” measures that make sense whether or not the New York area falls victim to climate change or not.

Integrated Rapid Visual Screening (IRVS) of Buildings using FEMA software is a good tool for measuring and tracking the success of FEMA funded properties. The Integrated Rapid Visual Screening is a quick and simple tool designed to determine initial or relative risk and resilience for buildings based on visual inspection only. The IRVS for Buildings categorizes 15 building types and addresses 20 hazardous events: internal (intrusion, blast and CBR); external blast and external chemical, biological, and radiological releases from 100, 300 and 1,000 feet; earthquakes (ground shaking and ground failure); floods (still water and velocity surge); wind (hurricane, tornado, and other wind events); landslide (rainfall and earthquakes); and fire (resulting from earthquakes, blast, or arson. The knowledge for calculating both risk and resilience is embedded in the tool. Major tool interactions are automatically calculated by pre-assigned weights, interaction logic, and context-based algorithms based on knowledge and tool validations. Risk is based primarily in target attractiveness (for manmade hazards)<sup>27</sup>.

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<sup>27</sup> <http://ciasce.asce.org/news-article/bips-04-integrated-rapid-visual-screening-series-irvs-buildings>

## IV Relevant Case Studies

### 4.1 Case Study#1: NYCHA's federalization of 21 properties

The strategy that NYCHA came up with in response to its' loss of HUD related funding in March of 2010 laid out a framework for success that can be replicated by the organization to survive future funding dilemmas<sup>28</sup>. In order to qualify for ongoing federal subsidies through a mixed finance modernization plan, NYCHA separated 21 properties that had been federalized into two portfolios. They sold 13 developments to NYCHA Housing Preservation I, LLC, a limited liability company comprised of NYCHA I HDFC, a wholly owned subsidiary of NYCHA and Citibank. They then sold the remaining 8 to NYCHA Housing Preservation II LLC, a limited liability company comprised of NYCHA II HDFC and NY Housing Partnership, a non-profit entity. Citibank's involvement in this partnership helped them to take advantage of the low-income housing tax credit program, as they claimed tax credits for all properties that they co-own as members of the partnership. NYCHA also used the funds that Citibank invested to fund necessary improvements to other facilities. This type of strategic financing and public private partnering is what is needed to keep NYCHA afloat during such financially difficult times.

As a result of the transaction, NYCHA<sup>29</sup>:

- Will receive more than \$400 million in public and private funding, the majority of which will go to capital improvements that began immediately and will continue through 2012.
- Has begun apartment inspections and interior repairs on some of the 21 developments. So far NYCHA has started work at Rutgers and Amsterdam addition in Manhattan, and Castle Hill and Marble Hill in the Bronx
- Has started Capital improvement work at all of the 21 developments. Including brick work, façade and roof repairs, elevator replacement, front and rear entrance renovations and heating upgrades.

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<sup>28</sup> "Testimony for NYCHA DGM for Operations Carlos G. Laboy-Diaz", Federalization, City Council Committee on Public Housing, April 29, 2011

<sup>29</sup> [http://www.nyc.gov/html/nycha/html/about/mixedfinance\\_modernization.shtml](http://www.nyc.gov/html/nycha/html/about/mixedfinance_modernization.shtml)

As a result of this transaction, NYCHA leases were changed to reflect the new ownership structure. The owner and the landlord listed on the lease for the 21 developments were changed from simply NYCHA to the “NYCHA Public Housing Preservation I or II, LLC. In the new leases, NYCHA is named as the managing agent and the partnership is named as the landlord. NYCHA I HDFC is the managing member of NYCHA Public Housing Preservation I, LLC. And NYCHA II HDFC is the managing member of NYCHA Public Housing Preservation II, LLC. In the partnership structure, NYCHA continues to own the land that the development is located on and continues to operate the community facilities and commercial spaces. NYCHA acts as the managing agent for both LLC’s manages the properties in the same way that it has in the past. Secretary Shaun Donovan stated at a NYCHA Press conference that this partnership would “ensures that the operating costs of these homes won’t come at the expense of the 180,000 affordable homes already in NYCHA’s portfolio -- preserving affordable housing in New York City and putting NYCHA on a stronger foundation for years to come”<sup>30</sup>. This shows the importance of executing a project such as this given the economic climate.

This process was made possible by one time grant dollars that were made available by the American Recovery and Reinvestment Act, which made swift action on the behalf of NYCHA a necessity. All paper work and compliance documents had to be taken care of by March of 2010. As a part of the Mixed-Finance Modernization Plan, NYCHA provided a ground-lease of the land to the LLC partnership. By using private funding to finance these properties, the sentiment of NYCHA is that this will lead to further financial resources over time. These resources can be used to hire more staff and fund more upgrades on buildings. As a result of this investment, NYCHA is projected to make an investment of more than \$200 million over the course of the next two years. These land leases are in place for fifteen years. At the end of the fifteen year period, Citibank will receive the benefits from having been a part of this partnership and NYCHA will have the right to acquire the buildings.

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<sup>30</sup> [http://portal.hud.gov/hudportal/HUD?src=/press/speeches\\_remarks\\_statements/2010/Speech\\_03015010](http://portal.hud.gov/hudportal/HUD?src=/press/speeches_remarks_statements/2010/Speech_03015010)

NYCHA will continue to receive the operating and capital funding at the end of the minimum 15 year period. Given the increased funding opportunities for low-income housing that were created during the Obama administration, NYCHA feels there may be future opportunities for funding if this administration stays in office.

#### **4.2 Case Study #2: The City of New Orleans redevelopment of Hope 6 Project Units**

Following Hurricane Katrina, the City of New Orleans found themselves in the position to have to demolish four of their big public housing developments- B.W. Cooper, C.J. Peete, Lafitte and St. Bernard. The demolition of these properties happened amidst a lot of controversy. Sentiments concerning the property's demolition were mixed as some felt that the buildings were deplorable and the poverty needed to be de-concentrated while others invoked right to return laws, stating that former residents were forced out and were not given any way to return. In the event of a major disaster, NYCHA may find themselves in a similar predicament and will therefore have a good bit that they can learn from the City of New Orleans' experience.

Funding for the redevelopment of "the big four" came from a variety of sources. The Housing Authority of New Orleans (HANO) was a major funding source in the redevelopment process. HUD Section 901 dollars were used, as were funding dollars from a Capital Housing Fund. The Lafitte project had a unique funding arrangement. Enterprise Community Partners, acting as the developer, worked with the Housing Authority of New Orleans to execute the project. A payment in lieu of taxes (PILOT) was arranged to cover a portion of the dollars. The PILOT was then covered by a bond that was issued by the housing authority. The bond was necessary to help the housing authority avoid taxes on their invested dollars. Additional sources of funding for the Lafitte project redevelopment came from Low Income Housing Tax Credits, Central Development Block Grants, and HANO loans. The LIHTC's were allocated to Enterprise through the Louisiana Housing Finance Authority (LHFA). The City of New Orleans received a larger than normal allocation due to hurricane Katrina, so Enterprise was able to benefit from that. Enterprises

has a department that specifically focuses on tax credit syndication, which was engaged as a partner on this project. Adding them to the deal added additional equity to the project. The Lafitte project has been completed and residents are actively moving in.

#### **4.3 Case Study #3: The Seattle Housing Authority's Implementation of the mixed finance modernization plan**

The Seattle Housing Authority (SHA) owns and operates 5,443 conventional public housing units subsidized by the U.S. Department of Housing and Urban Development and nearly 1,000 additional units for seniors and people with disabilities as part of the Seattle Senior Housing Program. These properties are widely scattered throughout the city in strategically well-placed locations in garden apartment and townhouse communities, as well as 28 high-rise structures. SHA provides affordable housing to more than 27,000 low-income individuals in Seattle. Of these residents, approximately 23,500 have incomes below 30 percent of the Area Median Income (AMI) and the remaining 3,500 residents have incomes between 30 and 80 percent of the AMI. Many residents of SHA housing are elderly or disabled. In 1999 HUD recognized SHA's accomplishments by approving the authority's request to be designated as one of 30 Moving to Work (MTW) Authorities. The authority's MTW status has provided the flexibility needed for SHA leadership to implement significant operational changes that have further improved operating efficiency, the quality of residents' lives, and the livability of public housing.

As a result of a thorough and rigorous 30-year Physical Needs Assessment, the Seattle Housing Authority determined that 21 of the authority's 28 high-rise buildings were in need of significant capital repairs. Most of these buildings were constructed between 1967 and 1971 and in total required \$70 million in repairs to windows, façades, and essential building systems. SHA quickly recognized that the size of the investment needed would require use of a Mixed-Finance Modernization approach that included Low Income Housing Tax Credits. Since the 4% LIHTC allocation associated with private activity bonds would only provide half of the

required investment, additional bonds authorized under HUD's Capital Fund Financing Program, in addition to other smaller grants and loans, were needed to close the funding gap. This Mixed-Finance Modernization program was then named homeWorks<sup>31</sup>.

SHA realized that because of the scope of the work, and the need to meet the "placed- in-service" requirements of the LIHTC program, the work would have to be completed in three phases. Recognizing the immediate needs of Phase 1, SHA obtained HUD approval for its Mixed-Finance Modernization program and a Capital Fund Finance Program bond issuance of \$12 million. The CFFP bond is payable over 20 years, with a fixed interest rate of 4.86% and a level of debt service that represents approximately 9.5% of SHA's estimated adjusted annual capital grant. Phase 1 of the project concept consisted of eight high-rise sites, which were identified as needing immediate repairs to their water distribution systems. Architectural and engineering firms were then procured to perform comprehensive evaluations of all of the building systems. The eight sites selected for Phase I of homeWorks contain a total of 809 units, of which only 704 benefit from CFFP financing. The eight sites include: Olive Ridge<sup>1</sup>; Harvard Court; Ballard House, Green Lake Plaza; Capitol Park; Lictonwood; Beacon Tower; and International Terrace. The scope of work on the eight properties included a replacement of domestic water supply lines, a replacement of hot water boilers, upgrades to the building's common rooms, repairs to the building's shell, elevator upgrades, and a new security system. The individual units received upgrades to their closets, showers and kitchens.

The Seattle Housing Authority formed an affiliated Limited Partnership, High Rise Rehabilitation Phase I Limited Partnership, with the Authority acting as the General Partner. This Partnership then acquired a leasehold interest in the eight scattered-site multi-family locations containing 704 units that make up the Seattle homeWorks Apartments. The regulatory requirements of this transaction required SHA to obtain a Demolition/Disposition approval from HUD in order to permit the lease/purchase of the former public housing sites to an affiliated Limited

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<sup>31</sup> <http://www.seattlehousing.org/redevelopment/homeworks/>

Partnership. The Partnership, on behalf of its investors, will then rehabilitate, own and operate these units. The parties have also entered into a Regulatory and Operating Agreement that will make the modernized units available to SHA during the lease period as public housing units, in return for a portion of the authority's HUD operating subsidy. Similar to NYCHA's arrangement, SHA retains the option to buy back the property at the end of the 15-year tax credit holding period, at Fair Market Value. Other repurchase options include an early buy-back option if the General Partner's capital account is reduced to a negative value and a Right of First Refusal to purchase the property based upon an offer by an unrelated third party non-profit entity<sup>32</sup>.

This partnership raised \$11,693,117 in investment capital from two funds managed by Boston Capital, based upon the anticipated LIHTC return to the investors. Since this tax credit equity will be paid in over four years, the authority used its independent bonding authority to issue \$10.8 million in bonds to serve as a bridge loan, not secured by public housing assets. This bridge loan is secured by a pledge of the LIHTC equity as it is paid into the authority's general fund pursuant to the lease/purchase agreement. This arrangement is typical of a 4% LIHTC transaction and allows the partnership to benefit from the authority's lower cost of borrowing. SHA then raised \$12 million from the sale of the CFFP bond that will be loaned to the partnership to fund the rehabilitation costs. A second \$10.8 million bond issue, secured by SHA's non-ACC assets, provides long-term financing while an additional \$150,000 in MTW Block Grant funds, \$100,000 in Energy Rebates, and \$127,000 in interest income related to the CFFP bond issue brings the total project funding to \$36,070,117.

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<sup>32</sup> HUD Case Study document; Ann-Marie Lindboe Housing Finance and Asset Manager Seattle Housing Authority

## V Conclusions

While it is difficult for municipalities to finance and execute retrofitting and redevelopment projects in their cities, it is important that in age of widening wealth gaps and decreasing standards of living that public housing authorities find ways to rebrand themselves and promote mixed use and affordable housing projects that deconcentrate poverty and create more healthy life styles and buildings for low income residents. Creative finance structures such as the mixed finance modernization plan are needed in a dire economic climate such as the one that we exist in today. In the aftermath of the recession of 2008, public housing entities such as NYCHA find themselves in the unique position to have to scramble for funding from both public and private sources to not only maintain their existing properties but to prepare them for the potential affects of climate change in the future. This case study offers some potential strategies for accomplishing that goal while offering up lessons learned from the rebuilding process of the City of New Orleans following Hurricane Katrina.



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## Appendix A

### **A Report on Responding to Climate Change in NYC: The ClimeAid Integrated Assessment for Effective Climate Change Adaptation, New York Academy of Science**

The ClimAid Integrated Assessment for Effective Climate Change Adaptation gives pertinent statistics regarding advancement in energy policy. One of the most important conversations with regards to long-term sustainability in the face of climate change is the topic of energy. The establishment of the Integrated Assessment for Effective Climate Change Adaptation Strategies (ClimAID) by the New York State Energy Research and Development Authority (NYSERDA) through its Environmental Monitoring, Evaluation, and Protection Program (EMEP) is vital in that regard. The City must especially show leadership on the topic of energy. In the aftermath of any major natural disaster, access to energy for the communities is essential to their survival. Renewable energy sources can turn out to be the only sustainable forms of energy that you have when the entire grid goes down. As such, the findings on energy in chapter 8 of this research paper are of particular importance to the ongoing dialogue. Actions must be taken that are in direct proportion to the increases in heating degree-days that are projected to occur. The paper begins with innovating ideas for more strategic energy management such as “dispatch rules to de-emphasize the use of vulnerable systems assets, establishment of larger incentives to promote energy efficiency in order to reduce energy demand during extreme heat events and associated peak load demands, strategies to promote the more rapid deployment of distributed generation technologies, including solar, on-site combined heat and power technology, etc.) to reduce demand on the grid and reduce site specific system vulnerabilities”. These goals are attainable if proper planning begins now.

The topic of “site specific system vulnerabilities most specifically highlights properties such as the Beach 41 Street Development. These low lying and low-income properties are most vulnerable and lack the necessary financial support to ready themselves against a natural disaster. The report breaks down the distribution of energy coming to New York as having 49% of the electricity coming

from fossil fuels, 30% comes from nuclear, and 21% comes from renewable energy sources. These energy sources and the process by which these energy sources distribute energy are key when thinking through ways to keep NYCHA properties energized. The New York Independent System Operator as the regulating entity for energy supply has the task of regulating the supply of power to all of the various boroughs.

## Appendix B

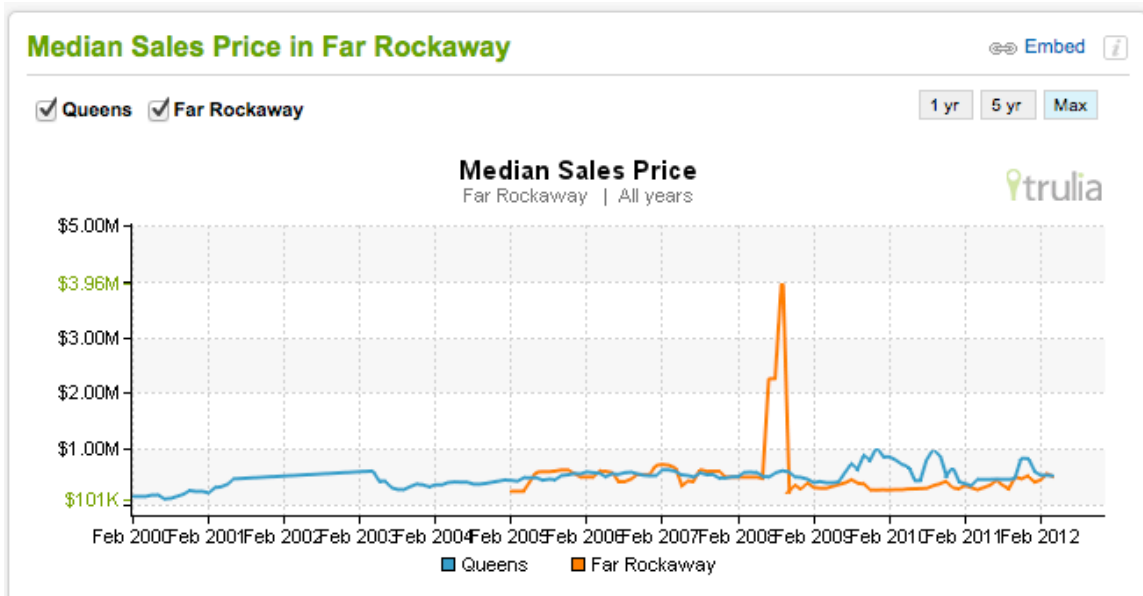
### **CUNY Report on Integration of Solar Energy in Emergency Planning**

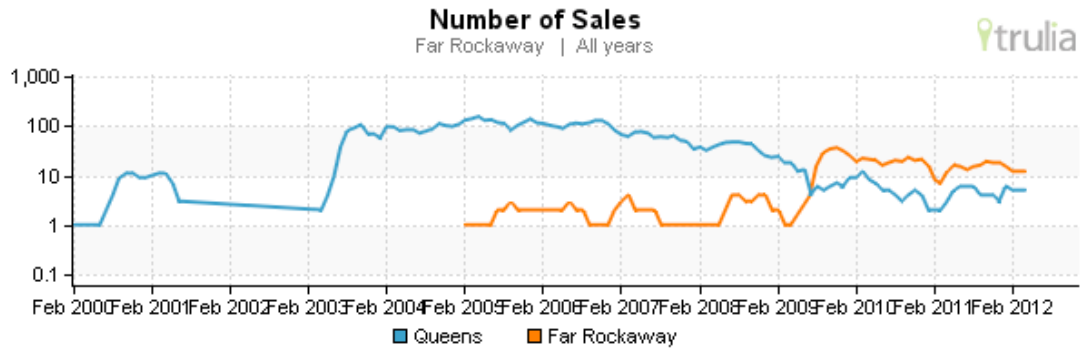
The City University of New York prepared a report on the integration of solar energy into the future of planning efforts in New York. This report highlighted many of the recent successes in the solar industry and highlighted how these efforts could be utilized in the hazard mitigation plans of New York. As one of the thirteen inaugural Solar Cities under the US Department of Energy's (DOE) Solar America Cities Initiative and in support of PlaNYC's long-term sustainability goals, the City of New York seeks to create and implement a strategy supporting large-scale solar energy market growth. This report represents the 2011 update to previous solar market assessments and strategies. In particular, it bridges past solar programs and policies with on-going solar initiatives, describing the current state of New York City's solar market, the future market outlook, and recommendations for accelerating solar market growth.

Over the past five years, solar PV capacity has more than tripled in the City, from 1.47 megawatts (MW) to 5.65 MW. While still relatively small, New York City's solar market has grown exponentially and is poised for continued growth. The success of New York City's solar market is due in large part to the work of NYC Solar America City Initiative (NYC SAC) partners in breaking down barriers, which are reviewed in detail in this report. Of note is the collaboration between New York City leaders, Con Edison, and the National Renewable Energy Lab (NREL) in clarifying, simplifying, and (as a result) largely eliminating the technical uncertainty of solar PV's

interaction with the network grid. Additionally, the City has worked with state leaders to develop new and lucrative incentives, like the property tax abatement and the Regional Program funding initiative. The former provides a tax abatement that offsets up to 20% of the installed cost of a solar system for property owners. The latter provides \$25 million annually to New York City and Westchester County to support large- scale solar PV installations through 2015. Additionally, NYC SAC recently created Solar Empowerment Zones, which are geographic areas in New York City that have been prioritized for solar energy development because they maximize benefits for end-users, grid management, and the environment. By concentrating solar development efforts in such high-value areas, the City aims to better integrate solar PV into utility planning, deploy PV more strategically across the city and the grid, and focus PV outreach and funding efforts.

## Appendix C





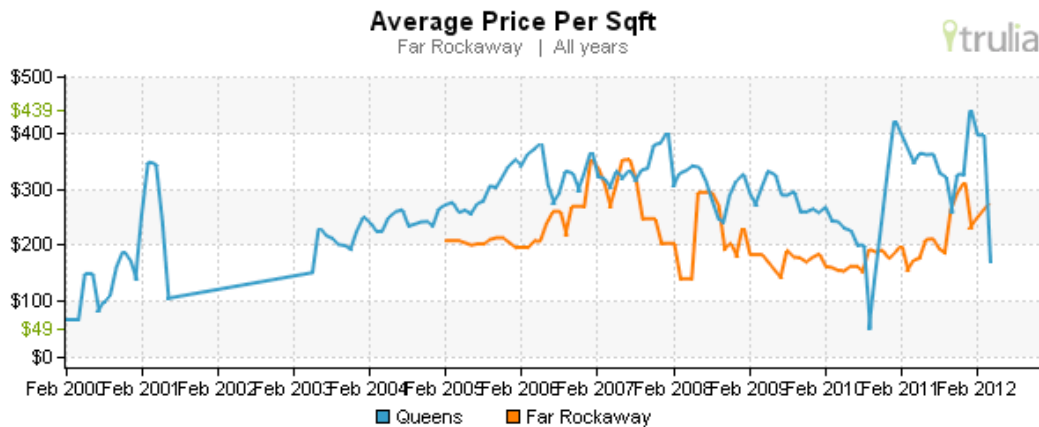
Neighborhood	Jan - Mar '12	y-o-y	3 months prior	1 year prior	5 years prior
Far Rockaway	\$499,778	+87.6%	\$400,000	\$266,350	\$658,402
Queens	\$515,000	+14.4%	\$592,500	\$450,249	\$597,000

### Average Price Per Sqft for Homes in Far Rockaway

[Embed](#) [i](#)

Queens  Far Rockaway

1 yr 5 yr Max



## Appendix D

### Maximizing Leveraging - Mixed Finance Modernization CFFP/MF Modernization Transactions

To date, nine housing authorities have utilized Mixed Finance Modernization in conjunction with CFFP. The authorities realized that their capital improvement needs exceed their available resources. The way they bridged the funding gap was to

obtain either 4% or 9% tax credits. Below is a summary chart of those housing authorities and the amount of funds they were able to leverage:

	State	CFP/CFPP Proceeds	Additional Funds Leveraged	Leverage Ratio	Type of Tax Credits
Seattle I	WA	\$12,277,000	\$23,107,573	1.88	4%
Seattle I	WA	\$16,365,729	\$16,296,968	1.00	4%
Seattle II	WA	\$12,150,756	\$21,012,149	1.73	4%
Seattle Total		\$40,793,485	\$60,416,690	1.48	
<hr/>					
Albany	NY	\$8,272,000	\$7,135,561	0.86	4%
Jackson	TN	\$4,702,249	\$8,380,375	1.78	4%
Denver	CO	\$16,936,202	\$37,097,759	2.19	4%
King County	WA	\$9,150,000	\$63,617,979	6.95	4%
St. Louis	MO	\$5,448,828	\$7,558,554	1.39	4%
Stevens Point	WI	\$907,093	\$6,666,030	7.35	9%
Washburn	WI	\$265,000	\$1,743,818	6.58	9%
Clinton	MO	\$675,000	\$2,362,349	3.50	4%
Puerto Rico	PR	\$378,765,000	\$235,000,000	0.62	4%
<hr/>					
<b>Overall Total</b>		<b>\$457,642,857</b>	<b>\$422,843,554</b>	<b>0.92</b>	