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Innovative Policies to Address Climate Change and Improve Real Estate Values

"We cannot solve our problems with the same thinking we used when we created them."
-- Albert Einstein

"What's the use of a fine house if you haven't got a tolerable planet to put it on."
-- Henry David Thoreau

Climate change is one of the most critical long-term issues facing our planet. Over the next fifty years, climate change will have a profound impact on how cities are organized and how real estate will be valued. It is commonly said that the three largest factors determining the value of real estate are "Location, Location, Location". However, what makes a desirable location is likely to dramatically change over the next several decades as cities react to climate-related issues such as:

- Rising sea levels will re-define the risk of owning waterfront property
- New transportation networks will be created in response to the move away from fossil fuels
- Government and private market Incentives will make energy efficient buildings more desirable
- Increased spending on city infrastructure will create new parks and "green" areas and urban agriculture will start to change the food supply chain

New York is among the cities most impacted by climate change. The city is surrounded by water and impacted by hurricanes. It has a transportation network clogged by polluting cars and trucks. It is filled with inefficient buildings which utilize carbon-powered energy. Fortunately, New York has been a leading city in developing policies to address climate change.

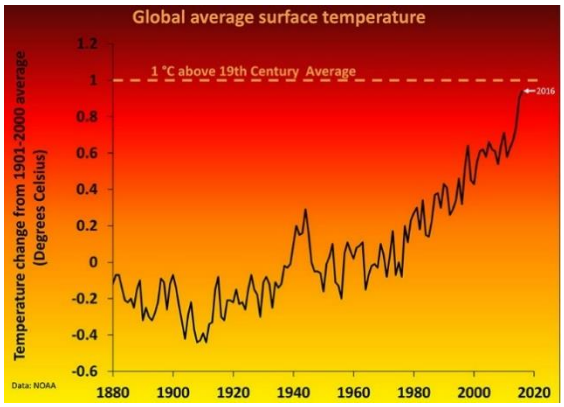
In the course of my research I reviewed dozens of scientific studies and public policy articles. I read several books describing climate change and how cities will evolve. I attended the Climate Strike to understand first-hand how passionate this topic is to millions of people. I visited several neighborhoods across New York City to better understand how they are organized and what environmental features they possess. I interviewed building management at some of New York's most innovative buildings to understand what makes them unique. I also analyzed rents in different New York neighborhoods to determine how adopting environmental features can result in higher rents.

All of this research allowed me to develop a series of policies that I believe will both improve New York's carbon footprint as well as make the city more livable and improve real estate values. There are many innovative solutions that New York could adopt to accelerate its plans to address climate change. New technologies are available today, but often take time to work their way into public policy. New York needs to continue to evaluate new policies and technologies which will continue to make it desirable for both residents and commercial tenants.

The research is organized into four sections which will explore (1) the definition and causes of climate change; (2) the impact that climate change is having on cities; (3) how New York is transforming its neighborhoods to respond to the changing environment and (4) a recommendation of specific policies which should be implemented to reduce carbon emissions and make New York a more livable city with improved real estate values.

Section 1: What is Climate Change?

"We are the first generation to be able to end poverty, and the last generation that can take steps to avoid the worst impacts of climate change. Future generations will judge us harshly if we fail to uphold our moral and historical responsibilities"
Ban Ki-Moon, Secretary-General of the United Nations



The science behind defining and documenting climate change in recent decades has become increasingly strong. There are numerous examples every day showing the impact that climate is having on cities. National Geographic defines climate change as "the long-term alteration of temperature and normal weather patterns". It is important to note that the term "climate change" has been gradually replacing "global warming" in most literature over the past decade. Temperatures are gradually increasing globally (see graph), primarily due to aggressive land-use such as deforestation and the burning of fossil fuels and which releases greenhouse gases such

as carbon dioxide which become trapped in the Earth's atmosphere. Another major impact of climate change is the resulting unpredictability of weather in the short term.

The United States Geological Society cites a number of disturbing signs of climate change. These include rising world-wide temperature levels, longer and more extreme droughts, more severe tropic storms due to warmer ocean water temperatures, melting glaciers, and rising sea levels which threaten coastal communities and marine ecosystems. The compounding impact of these signs creates a crisis to which many cities will have to urgently respond.

One of the biggest concerns about climate change is an increase the number of extreme weather events. The combination of global warming and rising sea temperatures is a recipe for stronger hurricanes. Warmer air holds most moistures that feeds hurricanes. Global warming also stalls weather patterns which slows the speed of hurricanes, so they remain in place longer. One study by MIT predicts that by 2035, there will be 32 super-extreme storms with winds above 190 miles per hour. Because of their unbridled strength, scientists may reclassify these storms into a new category: Category 6.

A quick read of the daily newspaper of almost any city in the world is likely to include a story on the changing climate. Record heat, abnormal precipitation, severe weather events, rising water levels are all direct results of climate changes. Some recent events covered by the media include:

- *July 2019 was the hottest month ever.* The National Oceanic and Atmospheric Administration recently reported that July 2019 was the hottest month since record keeping began almost 150 years ago. This was a global phenomenon with the vast majority of the globe having above average temperatures. In the Artic, the warm temperatures caused a record 40,000 square miles of ice to melt every day.

- *World's Largest Forest Fire.* The World's largest forest in Siberia experienced its worst fires on record during the summer of 2019. Russia declared a state of emergency covering a land area the size of India. Since the beginning of 2019, fires have consumed more than 13 million hectares—an area larger than Greece (Bloomberg). According to National Geographic, forest fires in Brazil's Amazon during the Summer of 2019 were visible from space and were up 80% from the previous year.

- *Rising Sea Levels.* The rate at which the global sea level has been rising has been steadily increasing and is now at record levels (National Ocean Service). In Europe, 70% of the largest cities have areas at risk from rising sea levels. China alone is believed to have 78 million people living in low elevation areas close to the sea (World Bank).

- *More Severe Hurricanes.* Although the frequency of hurricanes hasn't changed significantly in recent decades, the number of Category 4 and 5 (the most severe) has

seen a marked increase. Some models by the Center for Climate and Energy Solutions project a 45-87% increase in the frequency of these most severe hurricanes.

Media and public attention around the topic of climate change have dramatically increased in recent years. The recent Climate Strike prompted by a 15-year environmental activist from Sweden named Greta Thunberg shone a spotlight on how important this topic is to younger generations across the globe. Greta's passion inspired 2,500 events across 150 countries this August. Greta used this spotlight to deliver many powerful messages:

- "You say that you love your children above all else, and yet you are stealing their future in front of their very eyes"

- "Our leadership has failed us. Young people must hold older generations accountable for the mess they have created. We need to get angry and transform that anger into action"

- "Right now, we are ignoring natural climate solutions. We spend 1,000 times more on global fossil fuel subsidies than on nature-based solutions. This is your money, it is your taxes, and your savings."

Even presidential candidates in the United States are passionate about the issue. Bernie Sanders said, "Climate change is real, is caused by human activity and is one of the great environmental crises facing our planet…We must transform our energy system away from fossil fuels and move aggressively to energy efficiency and sustainable energy." Elizabeth Warren has articulated the upside of addressing the challenge of climate change: "Tackling our climate challenges will provide us with the opportunity to grow our economy, protect public health, and propel the United States to become the world leader in green innovation in the 21st century. We can address climate change and strengthen our economy by making major upgrades to our crumbling infrastructure, building more resiliency along our coasts and rivers, constructing more renewable energy, and promoting policies that will spur new, innovative research."

Despite this public and political outcry and strong evidence from the scientific community about the causes of climate change, there is a vocal group of people that are skeptical of the causes of global warming. The most common argument is that climate change is a natural or normal phenomenon that has occurred at other points in the Earth's history. Their argument is that man-made causes like burning fossil fuels aren't hurting the climate and therefore no changes to human behavior are required. However, scientific evidence shows an overwhelming link between man-made causes of carbon dioxide increases and the resulting impact on the climate. This impact is gradual over many decades though and that fact causes many people not to worry as major problems won't occur until future generations.

Section 2: The Impact of Climate Change on Cities

"I don't want your hope. I don't want you to be hopeful. I want you to panic … and act as if the house is on fire"

- Greta Thunberg, Climate Activist

Much of the research on climate change has been done at a national or even global level. However, it is equally important to look at the impact at a local level to understand what solutions have been attempted and what are under development. This section will evaluate the impact of climate change on two locations and assess some of the early responses that they have initiated to deal with these effects. To examine the global impact of climate change two geographically different locations were selected: New York City and Ukraine.

Climate Change in New York City

As the most populous city in the United States (2019 World Population Review) and surrounded by water, New York will be forced to overcome enormous political, structural, and societal obstacles over the next several decades. Through its response to 9/11 and Hurricane Sandy in the recent past, New York has proven its ability to respond to short-term crises but facing the longer-term challenge of climate change will test New York in new and different ways.

One of the most disastrous climate events faced by New York City was Hurricane Sandy which hit New York in October 2012. The storm killed 53 people in New York and caused an estimated damage of $19 billion. The effects of Sandy were wide ranging and severe. Much of the damage was caused by flooding as waves in Battery Park reached 14 feet in height. Con Ed (the electric utility company) said it received the worst damage to its system ever and 780,000 homes were without power, including all of Lower Manhattan. All major New York transportation hubs were closed for 1-3 days: Grand Central Station, Brooklyn Bridge, Central Park, PATH trains, Port Authority Buses, and all three major airports (LaGuardia, JFK and Newark). The New York Stock exchange was closed for two days – the first two-day weather closure since a blizzard in 1888. Even all Starbucks were in New York City and Long Island were officially closed for a day and a half!

New York has been pro-active in trying to address climate change. New York Governor Andrew Cuomo said "I want New York to have the most aggressive climate change program in the United States of America. Climate change is the issue of our lifetime". In 2008, Mayor Bloomberg created the New York Panel on Climate Change (NPCC) to begin long-term planning for the impact of climate change. The Panel was most concerned with the projected increase in the frequency and intensity of extreme events including extreme heat and humidity, heavy downpours, droughts, extreme winds, and cold snaps, as well as sea level rise and coastal flooding. This group has subsequently issued four reports (most recently in 2019) which

provide statistical analysis of these extreme weather events. Some of the findings from the NPCC 2015 Report (which was re-validated in the 2019 report) include:

- Mean annual temperature is projected to rise by 4.1 to 6.6°F by the 2050s, and by 5.3 to 10.3°F by the 2080s
- Frequency of heat waves is projected to triple by the 2050s to 5 to 7 heat waves per year and 5 to 8 heat waves per year by the 2080s
- Mean annual precipitation is projected to increase between 4 to 13% by the 2050s, and by 5 to 19% by the 2080s
- Sea level is expected to keep rising by 11 to 21 inches by the 2050s, and by 18 to 39 inches by the 2080s

While the NPCC is an excellent forum to bring together scientists to evaluate the impact of climate change, it falls short of recommending bold actions to remedy these likely changes. However, recent actions by the New York legislature provide some hope that the Panel's efforts will be converted into actions.

In June 2019, New York state passed the "Climate and Community Protection Act" to became only the second state to design a law that would create a carbon-neutral economy. The objective of the bill is to reduce greenhouse gases in the State of New York to zero by 2050. California recently passed a bill with an objective of being carbon neutral by 2045.

The bill would achieve this objective by requiring drastic actions to reduce carbon-dioxide emissions. Gasoline-powered automobiles and oil-burning furnaces would be eliminated, and wetlands would be restored and new trees would be planted to further remove carbon dioxide from the air.

Many critics argue that those objectives are unreasonable, but the passing of this law as a step in the right direction. Bold steps are required in order to address these challenges and setting ambitious goals is a logical first step to meet this crisis. The government alone though can't develop all the answers. Events like Climate Week NYC, run by an international non-profit organization in conjunction with the United Nations, are equally important. This event brings together businesses, government, academic institutions, and individuals to discuss a number of critical climate change issues. Key topics this year included energy transition, clean transportation and buildings, sustainable travel, national government policy, and food and agriculture.

Climate Change in Ukraine

Ukraine is a nation of over 40 million people and is geographically the largest country located entirely within Europe. The blue and gold flag of Ukraine symbolizes its bright blue skies and many acres of golden grain. Ukraine is often considered the "bread basket" of Europe and is

one of the largest exporters of grain in the world. Roughly 16 million Ukrainians (one in three people) subsist on working the land. Given the country's reliance on agriculture as a staple of its economy, Ukraine is very sensitive to significant changes in the weather.

Unfortunately, that change in weather has started to happen. Globally, the average temperature since 1961 has increased by 0.8 degrees Celsius. In Ukraine, the impact has been much more marked with temperatures increasing 1.1 degrees. The average temperature has risen from 7.8 degrees to approximately 9 degrees, an increase of over 15%. Also, the number of extreme temperature days has increased over time. Historically, the Kyiv region had 10 "heat waves" a year (days of over 30 degrees Celsius). The past decade there have been 20-30 days a year with high temperatures. These hot temperatures over time will make the soil more arid and lessen the efficiency of rainfall which will dramatically impact the productivity of agricultural harvests.

The projected future weather trends look equally bleak. The United States Agency for International Development (USAID) projects further temperature increases by 2050, increased precipitation in the winter and significantly decreased precipitation in the summer, shifts in the onset and duration of seasons, and more frequent flash floods resulting from extreme weather events. Any one of these trends would have a significant impact on the country, but the cumulative effect could prove to be disastrous.

Ukraine also suffers from an inefficient energy sector and is among the highest greenhouse gas emitters in the world. Ukraine's high CO_2 emissions are related to its exorbitant energy intensity, which is more than three times higher than the European Union average. These energy demands are primarily from the industrial and agriculture sectors. About a third of Ukraine's energy comes from coal, 30% from natural gas and 20% from nuclear. Only 2% comes from renewable sources. The energy sector has had a major adverse impact on the environment in the Ukraine both from its reliance on coal as well as the remnants of the nuclear disaster at Chernobyl in northern Ukraine in 1986.

The facts about Ukraine's carbon emissions and energy usage, combined with the headwinds from the global changes in climate pose an enormous threat to the country. Fortunately, the government has acknowledged that changes need to be made. By 2020, Ukraine committed to reduce its greenhouse gas emissions by 20 percent below 1990 levels. In addition, Ukraine developed and adopted the 2020 National Renewable Energy Action Plan (NREAP) in 2014, which sets a target to increase Ukraine's share of renewables to 11 percent of total final energy consumption by 2020.

Ukraine is a party to the Paris Agreement and has made certain longer-term commitments as part of that Agreement. Specifically, the target is to reach 40% below 1990 levels by 2030 and 50% below by 2050. In July 2018 Ukraine published the 2050 Low Emission Development Strategy which describes the planned policies required to meet their longer-term targets.

The government is taking steps to reach these targets. In 2018 it passed an increase in the carbon tax that is places on industrial, power, and buildings sectors. Although the increase was significant in nature, Ukraine still has among the lowest taxes of all countries. In 2017 it passed the Electricity Market Law which aims to deregulate the industry and separate generation and transmission capabilities to be more inline with other European nations.

There are also exciting initiatives going on the municipal level. Several cities, including the large city of Lviv in Western Ukraine have committed to having 100% renewable energy by 2050. The 250,000 person town of Zhytomyr in north-western Ukraine has set ambitious goals to reduce energy consumption by 20%. To achieve this, they are retrofitting heating systems in schools and municipal buildings, installing LED bulbs in streetlights, installing an electric trolley system and launching a program to fund energy-efficient insulation in housing associations.

Despite this progress, Ukraine will face enormous challenges in the coming decades to weather the storm of climate change. With an economy based on industrial production and agriculture, Ukraine is extremely susceptible to changes in the weather and the cost and source of its energy. The government has responded to these threats by implementing targets and a set of policies aimed to curb its energy usage and shifts its energy source to more renewable methods. While some cities seem to be taking an innovative approach to meeting these targets, these are the exceptions, and are not representative of the majority of the country. There needs to be greater urgency by the national government which is focused on action.

Section 3: How is New York Transforming its Neighborhoods?

"We're in a race against time with climate change, and yet there is virtually no hope of bold federal action on this issue…Mother Nature is not waiting on our political calendar, and neither can we."
-- Former New York Mayor Michael Bloomberg

New York is a city of neighborhoods, each with its own history, character, and architecture. New York's neighborhoods have all evolved in response to the emerging climate change crisis. A growing number of neighborhoods and buildings in New York are embracing the "green" movement by using innovative thinking and technologies. 40% of global greenhouse gas emissions come from buildings and many new structures are taking radical approaches to reduce their emissions.

Older neighborhoods like Rockefeller Center and Battery Park City have been reinventing themselves to be more environmentally sustainable. Even more exciting, there are new neighborhoods being developed which are designed from the ground up to reduce their carbon footprint. Data indicates that these new neighborhoods which make environmental sustainability as a cornerstone of their development are being rewarded with higher consumer demand and market rents. I visited two of the most high-profile locations in New York City to

better understand how they have been built to incorporate best practices in environmental design. Hudson Yards on the west side of Manhattan and Cornell's Tech campus on Roosevelt Island are two excellent examples of this.

Key questions I wanted to understand in my interviews were:

- What amenities are being demanded by corporate and residential tenants?
- What steps are being taken to use renewable energy?
- How do they think about environmental certifications like LEED, Energy Star, and Passive House?

To me, these four neighborhoods are a critical part of what makes Manhattan great. Rockefeller Center is a centrally located office park with nearly 100 years of history. Battery Park offers waterfront living with lots of open space and many environmental friendly residential and commercial buildings. Hudson Yards is a true neighborhood where people can choose to live, work, and shop. Cornell's tech campus embraces many new technologies to be one of the most energy efficient buildings in Manhattan. The architecture and design of the four different complexes reflect their different purposes and the era in which they were designed. Looking at each in more detail can provide insight into how Manhattan will continue to evolve in the future.

Rockefeller Center

The New York Times Architecture critic Michael Kimmelman recently called Rockefeller Center "an object lesson in urban design and a landmark of modern art and architecture". Initially designed and built during the 1930's, the complex currently consists of 19 buildings across 22 acres. Over time, this neighborhood has become a critical part of Manhattan's culture, including the annual Christmas Tree lighting, skating rink, Radio City Music Hall and home to several media companies including NBC.

The urban design was almost solely focused on building a complex of commercial office buildings. In the 1930s, there was a clear demarcation between "commercial" areas and "residential" areas. Located in the heart of the midtown's commercial district, Rockefeller Center was built solely to be a commercial and cultural complex. The logical and clean design makes it easy to identify buildings and navigate the area with the centrally located ice rink/plaza. The symmetry of buildings and common architecture is possible because all of the buildings serve a similar purpose.

Based on modern demands, there are several downsides to the design of Rockefeller. The retail space is limited and poorly organized – it is hard to "window shop" from store to store as they aren't interconnected. Many of the environmental demands of today's workers (large windows

to allow light, open common spaces, advanced air filtration systems, etc.) are difficult to retrofit into Rockefeller's buildings.

However, in 2007 Rockefeller underwent a major overhaul to address its aging infrastructure. Highlights included the installation of solar panels which became the largest private solar panel roof at the time. The annual Christmas Tree was installed with 30,000 LED lights and is now recycled each year to provide lumber to the Habitat for Humanity charity. A "green roof" was installed on top of Radio City Music Hall which used desert plantings to save over 500,000 gallons of water. Finally, an ice making and storage plant was created which creates ice at night and then uses it provide air conditioning during the day. The combined effect of these actions was to keep nearly 100,000 pounds of carbon dioxide out of the atmosphere each year and make Rockefeller Center a more attractive location for their commercial tenants.

Battery Park City

Battery Park City is a 92 acre community on the west side of the southern tip of Manhattan. The neighborhood was built primary on landfill and the site of dilapidated piers. One of the things that made the plan for Battery Park City unique was how it integrated commercial, residential, and open space at a scale that hadn't been seen before in Manhattan. Battery Park City would eventually contain the private development of 9.3 million square feet of commercial space, 7.2 million square feet of residential space, and nearly 36 acres of open space in lower Manhattan, becoming a model for successful large-scale planning efforts and marking a positive shift away from the urban renewal mindset of the time.

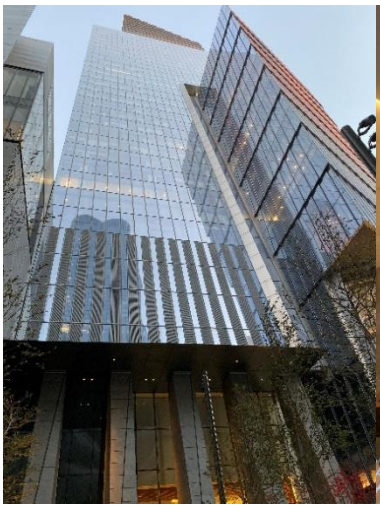
Although designed before environmental certifications existed, Battery Park City was an early home to buildings who adopted sustainable technologies. In 2011, only a few years after LEED certifications were designed, Battery Park City was home to 5 of the 23 certified buildings in Manhattan. One early example was One Rockefeller Plaza, a 32-story, 258 unit condominium which obtained LEED Gold certification. Residents enjoy twice filtered air, filtered water, non-toxic materials and lower energy costs. Another building, the Versidian, in 2008 became the first apartment building in the US to receive LEED Platinum status. Russell Unger, an executive director at the organization that makes LEED certifications (The US Green Building Council), claimed "Battery Park City really helped train a generation of designers and contractors how to do it".

Hudson Yards

Hudson Yards is the most significant new development in Manhattan in over a generation. The desires of residential and commercial tenants have changed dramatically over the past hundred years since Rockefeller Center was developed. More modern neighborhoods like Columbus Circle, Brookfield Place, and Hudson Yards feature a blend of office space, hotels, high end

residential apartments, affordable housing, open parks, and tourist attractions. Modern generations want the convenience of having everything in one place. This is a significant change from prior generations of urban planning in which there were distinctly separate zones for commercial vs. residential areas.

In October, the entire neighborhood was granted a LEED Gold rating for the first time ever in New York. A key feature of the 28-acre Hudson Yards neighborhood is its commitment to the environment. Unlike Battery Park City where several buildings have unique environmental features, in Hudson Yards, there are shares features for the entire neighborhood. There are two cogeneration power plants to generate electricity and are efficient enough to save the equivalent of emissions from 5,100 cars a year. Storm water is collected for use in irrigation and mechanical systems to reduce stress on the sewage system. Waste collection has been organized to optimize treatment of organic and recyclable trash. A 15-acre park and improved public transportation system provides significant benefits to the local community. The developers have also committed to add or preserve 1,000 units of affordable housing in the community. All of these important features demand that certain sacrifices me made in the design of new structures.



I visited 10 Hudson Yards which was the first building in New York to achieve a Platinum LEED designation. I spoke with the leasing agent and she indicated that environmental factors were huge considerations for tenants evaluating working or living in Hudson Yards. In particular she said, “the quality of air and water filtration systems” were among the top concerns. Hudson Yards has been hugely successful in attracting tenants – 30 and 55 Hudson Yards are completely leased, and 50 Hudson Yards which will not finish construction until 2022 is already 75 percent leased. In fact, Facebook recently signed to take 1.5 million square feet of space, the majority of which will be in 50 Hudson yards.

I personally find Hudson Yards a little challenging to navigate because of all the different buildings. The lack of “grid” design at first makes the neighborhood appear more chaotic to me than the cleanly organized Rockefeller Center. This unique design though artfully blends open

spaces, with tourist attractions like the Vessel, with restaurants and office buildings. Part of the fun of Hudson Yards is allowing yourself to get lost and explore these new places.

Using data from StreetEasy, I conducted an analysis of residential sales metrics between Battery Park City and Hudson Yards. The summary of the analysis below (more details are also available in the Appendix) highlights how desirable Hudson Yards is to Manahttan's residents. The price/square foot for one, two and three bedroom apartments is over twice that of Battery Party City. This premium for Hudson Yards is reflective of the significant investments that have been made in environmental sustainability and is evidence that consumers are willing to pay a higher price to live in a neighborhood that offers those amenities.

COMPARABLES SALES: BATTERY PARK AND HUDSON YARDS CONDOS IN THE LAST 90 DAYS

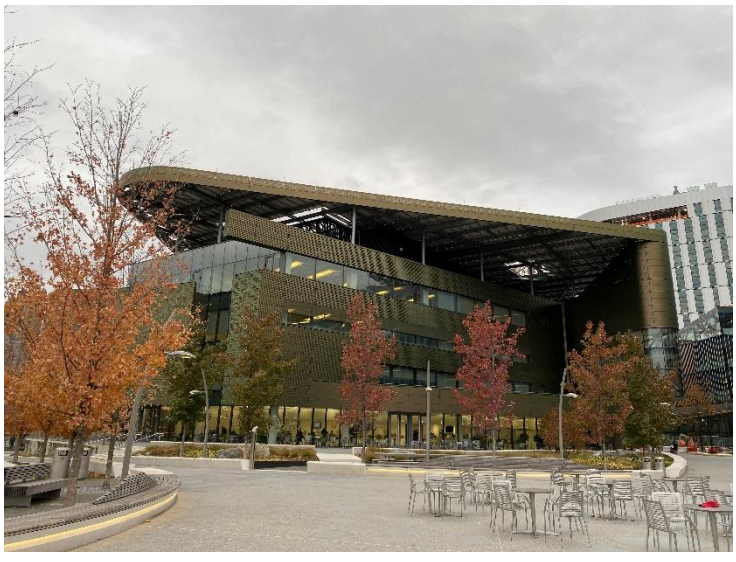
BATTERY PARK CITY

Type	Average price	Average $ per SF	Numbers of properties
One Bedroom	$935,430	$1,162	21
Two Bedroom	$1,505,413	$1,383	15
Three Bedroom	$1,733,836	$1,674	12

HUDSON YARDS

Type	Average price	Average $ per SF	Numbers of properties
One Bedroom	$2,810,528	$2,443	1
Two Bedroom	$5,427,747	$2,741	31
Three Bedroom	$5,711,460	$3,571	27

Cornell Tech's Campus (The Passive House)



Passive House is an international building efficiency standard with very strict energy conservation standards required for certification. Key measurement criteria include the (1) use of energy per square foot; (2) external air and fresh air ventilation must be balanced with energy recovery and (3) air tightness, as measured by the number of air changes per hour throughout the building. The objective is to save 90% of energy required for heating and cooling and 75% of overall energy usage including electricity. Because of the strict criteria, Passive House construction is more expensive than traditional methods, however, lower ongoing maintenance costs can often offset these upfront costs over a short number of years.

In November 2017, the 26-story residential building at Cornell Tech's campus on Roosevelt island was certified as the tallest Passive House building in the world. The building contains 352 apartments for students and faculty. The residential House is part of a 12-acre campus which also includes the Bloomberg Center, a four-story academic building with 1,464 solar panels and 80 geothermal wells, and the Bridge, an LEED Silver building with a rooftop solar photovoltaic canopy.

My visit and interviews with building management highlighted a number of important features both of Cornell's campus as well as Passive Houses in general. I met with Brandon Ramroop, the Resident Manager for The Related Companies which is the developer of Cornell's campus. Mr. Ramroop referenced a number of innovative technologies used in the buildings including fresh filtered air delivered to each room. The feature of which he seemed most proud was recycling. "Even if students don't separate out recyclables, our system will separate everything out to maximize the amount of recycled material." The building's developers have also committed to give back to the community and are donating old furniture to local non-profit organizations.

Section 4: What Additional Strategies Should New York Consider?

"Every day we are paying more for energy than we should due to poor insulation, inefficient lights, appliances, and heating and cooling equipment - money we could save by investing in energy efficiency."

- Bernie Sanders, US Senator

"In order to create a sustainable world, we need to:
1) Educate people.
2) Educate people.
3) Educate people.

- A. Togay Koralturk, Author of "LEED Complete Study Guide Series"

Cities occupy only 2% of the world's land mass but they account for 70% of global carbon emissions. Environmental activists, Climate Strike participants, scientists, and non-profit organizations are all vocal about the need to reduce greenhouse gases and fervent in their demands that politicians take immediate action. However, a common theme across many of these outspoken advocates for change is that they don't address what exactly needs to be done to improve the environment. There has been lots written about what cities of the future will look like, but cities have been slow to adopt new policies (as evidenced by the frustration of Greta Thunberg and the many participants in her climate strike). Almost everyone agrees on the problem; there is no consensus on the solution.

There are seven initiatives that I believe New York should implement to both reduce carbon emissions and improve the livability of the City. These recommendations are based on technologies that exist today and on expanding programs and which have been proven to be successful.

(1) Improve education through a building rating system
(2) Revitalize historic neighborhoods through environmental programs
(3) Create incentives to make affordable housing more environmental
(4) Install higher standards for energy efficiency
(5) Demand increased use of renewable energy
(6) Mandate decreased use of gasoline-powered cars within cities
(7) Create new incentives for urban agriculture

The combined effect of these actions would radically reduce greenhouse emissions and make cities more livable and sustainable. The polices would result in less traffic and air pollution, improved quality and cost of housing, and a more educated consumer that would demand continued improvement in environmental sustainability.

Improve Education Through a Building Rating System

One of the most important ways to drive change is through educating people by creating transparency and accountability. In the 1990s many restaurants in Los Angeles were suffering food quality issues. Consumers were concerned about how to assess the safety of their favorite dining establishments. To resolve this issue, the city designed a grading system which would be assigned by inspectors and the results placed in restaurant windows. Consumers would see an "A", "B" or "C" rating and this would help inform their choice on where to eat. The program proved to be very successful and was adopted by New York City in 2010 and many other cities around the globe over the past decade.

I believe a similar system should be put in place to assess the "health" of New York City's buildings from an environmental perspective. Today, it is extremely challenging for corporate tenants or residents of a building to evaluate the carbon footprint of their place of work or

residence. How much of the energy being used comes from renewable sources? What is the quality of the construction? How is air quality measured? Providing a standardized metric would allow consumers to make better informed choices about where to live and work.

Some certification systems have been developed and proven successful. Perhaps the most well-known is LEED (Leadership in Energy and Environmental Design) developed by the non-profit US Green Building Council (USBGC). The LEED point system was designed to measure how energy efficient and "green" a building is. The USBGC claims that LEED-certified buildings are 25-30% more efficient than non-LEED buildings. The system takes into account a number of factors including:

- Sustainable Sites – Is the building located close to public transportation? Is there storage for bikes?
- Water efficiency – Is grey water re-used? Are toilets water efficient?
- Energy and Atmosphere – What is the overall energy efficiency of the building? What are the sources of power (i.e. from renewable sources)?
- Materials and Resources – How are building materials selected, disposed of, and reduced?
- Indoor Environmental Quality – What is the quality and energy efficiency of lighting, temperature and ventilation? How is indoor pollution addressed? How much natural daylight is allowed into the building?
- Innovation in Design – Are there any innovate strategies being used that aren't covered by the other categories?

Since its development in the late 1990's, LEED has become a well-respected system and the green building market is anticipated to be among the fastest growing industries worldwide. The number of LEED-certified projects in the United States rose from 296 certifications in 2006 up to over 67,200 in 2018. Every day, another 2.2 million square feet of real estate is certified, the equivalent of a 65-story skyscraper.

However, the system does have critics. It is expensive with costs sometimes running over $100,000 for a large building to become certified. The certification is often based on computer models and it is unclear whether these models accurately reflect the reality of the operations of these buildings. Some studies have argued that the methodology of the LEED point system is flawed and many LEED buildings are actually less efficient than their peers. LEED certifications are often given out when a building is built or renovated but there is no system to ensure that these standards are maintained.

New York has already taken steps to implement a city-wide grading system. Known as "Local Law 33 of 2018", the law mandates that all buildings are assigned an energy efficiency grade. The grade is based on an Energy Star rating which is performance-based and looks at actual utility bills and energy usage (versus LEED which is design-based and often calculated using theoretical computer models). Los Angeles and San Francisco have already enacted similar

legislation requiring commercial and multi-family housing to report their annual energy usage. Energy Star ratings have the downside though of only looking at existing utility usage and not rewarding buildings for investing in innovative new technologies which could have other benefits – for example improving air quality.

As in many areas of environment policy, the European Union is several steps ahead of the United States. In 2010, the EU enacted disclosure laws requiring that all advertisements offering buildings for sale or rent include an energy performance grade. As this program has proven successful, they have broadened the number and type of buildings that are required to comply with these laws. Not surprisingly, recent studies looking at property markets where these laws are in effect are finding that buildings with higher grades are commanding premium prices. This is exactly the incentive that should be provided to investors – a demonstration that investing in energy efficient technologies is not only environmentally correct, but will result in an appreciation in the value of their property.

I believe that installing a comprehensive rating system for New York's buildings is excellent public policy. It will create a clear scorecard for investors and property owners to evaluate their properties. Most importantly, it will provide a system for consumers to decide the type of building in which they want to live and work. I believe there are several ways the existing policies can be improved:

1. More transparent. Building ratings should be posted in readily observable locations on buildings. Current policy guidelines just call for the information to be available online. I believe that these ratings need to be displayed in obvious locations in order to have the most impact. I also think that providing the ratings in building advertisements, as required in the EU, is necessary.

2. More understandable. Energy Star uses a 100 point scale to evaluate buildings. I think that the letter grading of A, B, C used by restaurants is a more intuitive framework for consumers to comprehend. While the framework used to determine the grades needs to be rigorous and advanced, the actual rating/grade needs to be easy for consumers to understand.

3. More innovative. Perhaps most importantly, the criteria to determine these grades needs to be thoughtfully developed. Unlike Energy Star, it needs to provide incentives for property owners to invest in new technologies. Unlike LEED, it needs to be based in the reality of how the building operates and not on theoretical models. The grading system needs to evolve over time to reflect the available of new sources of energy and advanced technologies.

Implementing a system like this will have some risks. There are over 1 million buildings in New York and the cost to evaluate, maintain, and enforce ratings is not insubstantial. Much of the cost could be borne by a "green tax" placed on new buildings that are seeking permits for

construction. However, if the tax is too high, it could provide a disincentive for new construction. The process of establishing the rating system will also be very politicized. Many existing property owners will fight for easier standards and a system with "grade inflation" to avoid the negative connotation associated with a bad grade. Even if the standards are more lax than many environment activists would like, having a system in place will have tremendous long-term benefits and the standards can evolve over time.

Revitalize Historic Neighborhoods through Environmental Programs

In recent years, there have been many excellent examples of how to renew historical neighborhoods while taking into consideration the impact on the environment. The High Line in New York has become a global benchmark for how to turn an aspect of historic urban blight into a tourist attraction with sustainable environmental value.

Most major cities in the United States experienced rapid population growth in the late 1800s when rail transportation was the predominant means of transportation. Railway tracks, usually elevated above roads which carried pedestrians and horses, crisscrossed urban areas allowing people and goods to move quickly from place to place. Over time, automobiles displaced trains as primary method of transport and these train tracks became abandoned in the mid-20th Century. In many cities, they remain an unsightly and unsafe feature on the urban landscape.

In the early 2000's, with active support from Mayor Blomberg, a private foundation in New York developed the idea of turning an elevated set of tracks running through Chelsea and the Meatpacking district on the west side of Manhattan into a park. First opened in 2009, the park is now a 1.5 mile green way featuring over 500 species of plants and trees.

A study in 2016 conducts by the University of Hartford in Connecticut validated many of the High Line's benefits. They found that noise and air pollution on the elevated parkway were 37% less than on the ground below. The researchers concluded that the High Line "has had a positive environmental impact for its users in terms of reduced pedestrian exposure to both noise and air pollution."

Importantly, there is also a "halo effect" which benefits residential buildings located near to the High Line. A 2016 analysis by StreetEasy found that residences located within two blocks of the High Line had 20% higher prices than those located further away. It is not surprising that people want to live closer to an urban park and that desire results in higher real estate valuations.

I validated this effect myself, walking from 14th street all the way to Hudson Yards. I walked through gardens, was surrounded by tall grasses, saw people lounging on the lawn, and gained a perspective on the west side of Manhattan that I would never have at street level. I saw a vast number of high-end residences dotting the path on either side of the walkway. The

experience was pleasurable and relaxing, especially compared to the stop-and-go walking along 10th Avenue.

The use of elevated walkways has been effectively used in many Asian cities, especially Hong Kong, as a way to improve traffic flows and pedestrian movements across busy city streets. The High Line's combination of an elevated walkway with sustainable environmental features is a brilliant way to both improve an existing infrastructure as well as provide a public good. Other cities have been quick to copy this format and we are experiencing a renaissance of old infrastructure being converted to public spaces in Chicago, Atlanta, Dallas, Washington DC and elsewhere.

While potentially cost prohibitive, I would love to see Manhattan attempt to create a more modest version of the High Line in midtown. New Buildings should be required to think creatively about how to alleviate pedestrian traffic and more effectively enable people to move around the neighborhood. Getting pedestrians off the streets will create more room for bike and other forms of transportation which are more convenient and environmentally friendly.

Create Incentives to Make Affordable Housing More Environmental

One of the most challenging topics at the intersection of climate change and real estate is how to handle affordable housing. New York is full of buildings and structures built decades or even centuries ago which have significant cultural value. However, many of these buildings lack both modern amenities and often have outdated technologies which contribute to global warming. There have been vast improvements in affordable housing in the past decade and many new exciting proposals for how to continue this trend of building public housing using environment technologies.

Affordable housing is a critical part of any city's infrastructure. Providing housing to meet the needs of the less fortunate is important public policy. In the past, many of these affordable housing units were poorly built and gave no consideration to features which could be used to mitigate their carbon footprint.

Affordable housing is always a contentious topic among investors, politicians, local neighbors, and non-profit groups. Everyone agrees on the need for affordable housing in a community but there are many views on how best to deliver these services. There is increasingly broad agreement though that climate change is having an impact on affordable housing. The impact is both negative and positive.

The negative impact of climate change on affordable housing has been well documented in recent years. The increasing rate of natural disasters is having a disproportionate impact on affordable housing, often because of their location and sub-standard quality of construction. The increased volatility in temperature (colder winters and warmer summers) also has a big

impact on public housing which often has inadequate heating and cooling capabilities. Even those who don't live in public housing are affected. The poor quality of public housing means that the cost to maintain these units extraordinarily high which is borne by the taxpayers and the poor environmental construction contributes to overall carbon emissions in a community.

This topic has come front-and-center in recent political discussions. In November, New York Representative Alexandria Ocasio-Cortez and Vermont Senator Bernie Sanders introduced a new bill that would dedicate billions of dollars in improve the energy efficiency of America's dilapidated public housing stock. Diane Yentel, president and CEO of the National Low Income Housing Coalition, said "We must build the political will to combat both the affordable housing and climate crises."

Local communities in New York are taking notice and there is increasingly evidence that new affordable housing units are being built with much higher environmental standards. Via Verde in the Bronx at Brook Avenue and East 156th is one example. The building was designed to maximize natural light, including a large central courtyard. Ceiling fans are included in every room to reduce the need to utilize air conditioning. The roof contains 40,000 square feet of trees and garden space, including room for tenants to grow their own gardens.

Buildings like Via Verde and AOC's New Green Deal legislation are excellent steps toward reducing the carbon footprint of affordable housing. Much more needs to be done though. Via Verde has 71 co-ops and received 800 applications from hopefully tenants. This highlights that the need for new housing is massive and will take decades to fulfill.

Install Higher Standards for Energy Efficiency

Next to emissions from automobiles, the energy required to heat and cool buildings in a city is one of the largest causes of greenhouse gas emissions. Because cities use so much energy, there is great potential to reduce carbon emissions by making buildings more energy efficient. There are many new technologies which can dramatically impact the efficiency of a building's HVAC capabilities. These technologies are often expensive, especially to retrofit older buildings, and require a significant upfront investment. There is a key role that government can play in incentivizing developers to incorporate these modern technologies into both existing and new buildings.

Academic research has supported the fact that buildings with environmental certifications command higher lease rates. This has not gone unnoticed by developers as they aggressively work to retrofit older buildings and ensure that new buildings are environmentally friendly. A study in 2017 found that in the 30 largest commercial real estate markets in the United States, the percentage of space that is environmentally certified increased from 5% in 2005 to 39% in 2014. That is a massive increase in only a decade's time and highlights the power of environmental certification. There are dozens of unique and innovative buildings in New York

and it is helpful to review a few in detail to understand what steps they are taking to become more energy efficient.

- New Construction Case Study: One Bryant Park. One good example in New York City is One Bryant Park (also known as the Bank of America Tower). This building was the first commercial high rise to earn LEED Platinum status. Built in 2010, the building has over 51 occupied floors totaling over 2.3 million square feet. The vision for the building was to emphasize daylight, fresh air, and a connection with the outdoors. 65% of the building's energy is generated by an on-site cogeneration power plant. The building uses a number of innovative concepts like producing ice at night when temperatures are cooler and then melting the ice during the day to provide cooling. Rainwater and melting snow are also captured to serve as "grey water" for the toilets and cooling system. These strategies save 7.7 million gallons of water a year. Air quality is also a superior to most buildings. 95% of the air is filtered and 9.5 foot ceilings allow for lots of natural light.

- Retro-fit Case Study: Empire State Building. The Empire State Building has significantly upgraded its energy efficiency. Perhaps the most iconic building in the world, The Empire State Building is the tallest and most well-known building to achieve LEED Gold-certification. Some of the steps that led to the certification include the installation of ultra-low-flow fixtures in restrooms throughout the building, the use of recycled carpets, green cleaning supplies, eco-friendly pest control, low off-gassing wall coverings, and recycled paper products. The building also recycles tenant waste and construction debris.

There are many commercially available technologies available to make buildings more energy efficient. These technologies include building automation, green roofs, insulation, LED lighting, and smart glass. Building automation technologies increasingly use sensors to more optimally determine how to utilize heating and cooling processes. Green roofs and smart glass can be made from materials which reflect solar radiation and therefore require less energy to manage the temperature inside the building. New insulation also plays an important role in maintaining the temperatures to reduce energy requirements.

Energy efficient buildings will be more desirable to corporate and residential tenets. They save energy, use less water, generate less construction waste, and provide healthier and more comfortable indoor environments. Even today, buildings are frequently marketing themselves according to their LEED certification or other environmental attributes. Studies show that working in a green building increases productivity and reduces absenteeism. Green buildings provide tenants the opportunity to promote their healthy workspace to enhance their business brand and attract quality personnel. Most importantly, these buildings will be able to consistently generate higher lease rates in the decades to come as consumers demand buildings to be environmentally sustainable.

While many critics cite the significant cost of these actions, it has been demonstrated that these investments will pay off over the long-term. The risk of not making these investments is that businesses and consumers will leave for other cities which are becoming more innovative. For New York or other large cities to maintain their status as global leaders they must be at the forefront of being environmentally sustainable. This can be achieved through setting high environmental standards for new buildings and establishing a timetable for older buildings to meet certain minimum requirements.

Demand Increased Use of Renewable Energy

Experts have urgently argued that to slow or stop the unnatural warming of the planet, people must reduce burning fossil fuels and shift to renewable, carbon-free energy. Many cities and nations are increasingly making public commitments to become carbon neutral over the next 20-30 years. The success or failure in meeting these commitments will most likely be determined by how quickly renewable energy can be implemented. Electric power generation is one of the largest contributors to a large carbon footprint. The use of hydro, wind, solar, and biomass technologies are all radically reducing the use of fossil uses. Historically these methods were called “alternative” energy but they are rapidly becoming mainstream. This transition will take decades of investment and the creation of many new technologies to make renewable energy both cost efficient and effective.

In New York State, nearly 26% of electric power comes from renewable sources. While there remains a large gap to meet longer-term objectives (a recent law declares that the State must get to 70% by 2030), New York has a good starting point. The State produces more hydro-electric power than any state east of the Rocky Mountains, primarily from a very large hydro plant located close to Niagara Falls.

Wind power technology has been one of the fastest growing sources of renewable energy and exhibits one of the lowest cost structures. Existing wind farms are all located on-shore, but coastal sites are being evaluated to create off-shore wind farms as well. In July 2019, New York Governor Andrew Cuomo made a groundbreaking announcement which awarded 1,700 MW of offshore wind to two companies, putting New York State on a pathway to becoming a global hub for the emerging offshore wind industry. New Jersey also recently announced a 1,110 MW contract for a wind farm to be built off the coast of Atlantic City. While much of this investment will be made by large global companies like GE, Siemens, and Mitsubishi, there are many innovative companies that are creating new technologies to leverage wind power.

For wind power, there have been a lot of new companies created to improve the design of the traditional wind turbine which resembles an old-fashioned windmill with a large turning blade. In Japan, a company has designed a turbine capable of harnessing wind power from a typhoon where wind often blows extremely fast from multiple directions. In Iceland, a company has designed a turbine shaped like a conch shell which is able to operate in a very low wind

environment – an historical problem for wind turbines. In Spain, they have designed a bladeless wind turbine which costs 50% less than traditional model and runs silently so as not to upset wildlife. All of these examples highlight the dramatic changes that are likely to happen in the wind industry over the next decades as these technologies get adopted.

However, much work is required to make wind power cost effective in the near term. While most people agree on the environmental advantages of wind power, the costs of this renewable energy source have been prohibitive. The pathway to cost effectiveness is complex requiring large capital investments, an improved ports infrastructure, new grid connections, community engagement on building the projects and building and deploying a skilled workforce.

In addition to cost, skeptics of wind power have cited several other concerns. Fluctuations in wind make it an unstable power source. Traditional wind turbines are loud and have often posed a threat to wildlife. They are often argued to create "visual pollution" as idyllic fields are deformed with dozens of unattractive windmills. While these have historically all been valid concerns, the newer technologies mentioned above are actively working on addressed and rectifying these issues. New York must take the lead in adopting these new forms of technology to reduce its reliance on fossil fuel.

Mandate Decreased Use of Gasoline-Powered Cars with Cities

Automobiles are responsible for nearly 20% of carbon emissions. Many cities, especially in Europe, are starting to implement policies that limit the use of cars within cities. Madrid, Paris, and Oslo have all experimented with policies aimed at removing cars and traffic from city centers. Hanne Marcussen, Oslo's Vice Mayor of urban development said, "A couple of decades ago, it was perfectly normal to smoke cigarettes inside. Today, very few would do that. I think it's the same with cars in the city center: One day we will look back and ask ourselves why we ever thought that was a good idea."

Most large cities have evolved over the past century to be designed around cars. Wide streets, parking lots, and traffic lights are the cornerstone of most urban environments. Cars create air pollution, noise pollution, ground vibration, and pedestrian deaths. There are a billion parking spots in the United States – one for every four cars in existence. It is estimated that many downtowns have 50-60% of their space devoted to servicing automobiles. Removing cars alleviates these negative factors and creates free space which can be used build more houses, stores or parks.

The city of Oslo has done an excellent job in the transition to limited automobile use. Parking spots on the side of streets have been converted to bike lanes. New public transportation routes have been added and the prices have been reduced. A bike-sharing system was set up which now does 3 million rides a year. Grants are given to citizens to purchase electric bikes.

These changes have resulted in creating a more vibrant downtown area. Pedestrian traffic is estimated to have increased by 10%.

Another way cities can reduce emissions and energy use is by implementing a thoughtful transportation policy. Most large cities own massive fleets of government vehicles and public transportation systems. Switching government fleets to electric cars or vehicles that use alternative fuels would make a big impact on a city's carbon emissions. Cities can also encourage citizens and businesses to do the same through enacting tax rebates or other incentives.

The City of New York has designed a plan to increase its use of clean vehicles. New York currently manages a fleet of over 27,000 full-burning vehicles which consume over 29 million gallons of gas a year. In 2015, New York committed to reduce greenhouse gas emissions by 80% by the year 2050. Part of that commitment involves purchasing 2,000 electric vehicles (EVs) by 2025. This would give New York the largest fleet of EV's of any United States city. The City will also focus on reducing the size of the overall fleet through better utilization of their existing cars. Currently 600 cars are enrolled in ZipCar's FastFleet car-sharing network to improve utilization. This number can be significantly increased over time. 60% of the fleet uses traditional diesel gas today. Moving to biodiesel or other renewable diesel technologies will have a large impact on carbon emissions.

Adopting policies to reduce the carbon footprint of their fleet of municipal vehicles is something that every city can control. The reduced carbon footprint and improved air quality will make cities that act aggressively be more livable and desirable to residents and businesses. The design and development of neighborhoods in Manhattan has changed dramatically over the past hundred years. Each generation designs neighborhoods to reflect the architecture and required functionality of society at that point in time. Comparing Rockefeller Center (designed 100 years ago), Battery Park City (designed 50 years ago), and Hudson Yards (currently being designed) provides some insight into how views have changed over the past century. Each of these projects was massive in scale and resulted in a dramatic change in Manhattan's real estate market. It is also evident that climate change and environmental factors weren't a consideration 50-100 years ago, but today they are often the driving force behind the design of new neighborhoods.

Create New Incentives for Urban Agriculture

Modern agriculture, food production and distribution are major contributors of greenhouse gases. These processes are directly responsible for 14 per cent of total greenhouse gas emissions, and broader rural land use decisions have an even larger impact. Also, the increasing trend toward urbanization is causing cities to rethink the supply chain that delivers their food. Antonio Roman-Alcala, a farmer in San Francisco recently claimed, "It takes a lot of

skill to be able to grow food sustainably. It's an art form. We need to raise agriculture up to another different level like they do in Europe where farmers are on the same level as engineers and doctors… because the food that we eat is the most important thing in our lives."

Urban farming is one idea that will transform agriculture. Where in densely populated cities is agriculture taking place? On rooftops. "In terms of rooftop commercial agriculture, New York is definitely a leader at this moment," said Joe Nasr, co-author of "Carrot City: Creating Places for Urban Agriculture". Moving agriculture to the sky has multiple benefits. Urban agriculture uses storm water which keeps water from overloading a city's sewer system. It also makes transportation of food to consumers much easier and keeps trucks off the roads which helps with air pollution.

One company that is having great success with urban farming is Brooklyn Grange. Founded in 2010, Brooklyn Grange is now spread across 5.5 acres of space in Brooklyn and Queens and has sold 400,000 pounds of vegetables to restaurants and directly to the public. Gotham Greens is another pioneer of urban agriculture. With over 170,000 square feet of technologically advanced urban rooftops across four facilities in New York and Chicago. The company's flagship farm is located on the roof of Whole Foods in Brooklyn. Both of these companies have proven that successful businesses can be created while providing a service that improves the environment.

Urban agriculture is not a panacea and does have issues which limit its feasibility. Within cities there is a chance of severe winds on rooftops. This is often created by wind whipping around the sides of and in between buildings. Lack of light can also be a problem depending on the density and height of nearby buildings. Not all roofs are able to support the weight of a farm on the roof, structural engineering may be required in order to bolster the strength of an existing roof, especially if the building is older. All of these issues can be overcome by a thoughtful design, but resolving the issues could impact the viability of the farm from a cost perspective.

Summary

Climate change is a huge problem that demands multiple creative and innovative solutions. Some of the best talent in the world is actively focused on how to solve the problems posed by our changing environment. Actions must be taken at an individual, corporate and governmental level in order to be successful. Individuals must be educated to about the risks of climate change and how their choices can impact the environment for better or worse. Corporations must take more responsibility for their actions and take steps to reduce their carbon footprint. Governments must be bold and implement hard solutions that may take a decade to result in meaningful improvements.

If New York City wants to meet its goal of reducing greenhouse gases by 80% by 2050, building neighborhoods like Hudson Yards and Cornell's Tech campus will need to be replicated on a

larger scale. Because projects like the Passive House require lower ongoing operational costs, they are ideal for public housing. There are several Passive House projects underway including one in East Harlem and a 24-story building in the Bronx which will be dedicated to affordable houses. Careful attention needs to be paid to these early projects to ensure they are successful and then significant efforts will be required to massively scale them across the city.

There are many creative policies that can be implemented by cities to address climate change. Creating no-car zones, building green elevated walkways, improving energy efficiency standards for buildings, using more renewable energy sources, and promoting urban agriculture are just several policies that could be implemented by any city looking to reduce their carbon footprint. Businesses and consumers will demand these changes over time, and cities that are slow to respond will likely see a decline in population and real estate valuations. Conversely, cities who are early adopters will likely reap significant benefits including higher real estate valuations.

The attention that climate change has received over the past decade has not gone unnoticed by smart entrepreneurs. There have been a number of very innovative companies that have been created to develop technologies and services to improve the environment. There will be many billion-dollar businesses built in order to tackle the challenges imposed by climate change. As these new ideas and companies become successful, it will dramatically improve the feasibility of implementing new sustainable technologies to improve the environment.

Over the next several decades real estate values will be significantly impacted by climate change. More specifically, valuations will be changed by the policies implemented by governments and the actions that people take (or choose not to take) regarding the environment. Cities and developers who take positive actions to address climate change and adopt environmentally responsible policies will be rewarded with higher demand and rents over time.

Appendix: COMPARABLES SALES: BATTREY PARK AND HUDSON YARDS CONDOS IN THE LAST 90 DAYS

BATTERY PARK CITY- 1 BEDROOM

Summary	Type	Average price	Average $ per SF	Numbers of properties
Active listings	One Bedroom	$782,821	$1,109	46
In-contract listings	One Bedroom	$755,778	$1,104	9
Record sales	One Bedroom	$935,430	$1,162	21

BATTERY PARK CITY - 2 BEDROOM

Summary	Type	Average price	Average $ per SF	Numbers of properties
Active listings	Two Bedroom	$1,979,557	$1,499	44
In-contract listings	Two Bedroom	$1,775,083	$1,460	12
Record sales	Two Bedroom	$1,505,413	$1,383	15

BATTERY PARK CITY - 3 BEDROOM

Summary	Type	Average price	Average $ per SF	Numbers of properties
Active listings	Three Bedroom	$2,814,364	$1,657	11
In-contract listings	Three Bedroom	$3,174,750	$1,856	4
Record sales	Three Bedroom	$1,733,836	$1,674	12

HUDSON YARDS - 1 BEDROOM

Summary	Type	Average price	Average $ per SF	Numbers of properties
Active listings	One Bedroom	$3,000,000	$2,785	2
In-contract listings	One Bedroom	$1,447,500	$828	2
Record sales	One Bedroom	$2,810,528	$2,443	1

HUDSON YARDS – 2 BEDROOM

Summary	Type	Average price	Average $ per SF	Numbers of properties
Active listings	Two Bedroom	$4,884,231	$2,789	13
In-contract listings	Two Bedroom	$1,795,000	$1,095	1
Record sales	Two Bedroom	$5,427,747	$2,741	31

HUDSON YARDS – 3 BEDROOM

Summary	Type	Average price	Average $ per SF	Numbers of properties
Active listings	Three Bedroom	$8,797,083	$3,409	12
In-contract listings	Three Bedroom	0	0	0
Record sales	Three Bedroom	$5,711,460	3,571	27

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