

The Future of PlaNYC: Innovations in Sustainability

Spring 2013



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Final Report

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Spring 2013 Workshop in Applied Earth Systems Management
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Acknowledgements

We'd like to extend many thanks to our faculty advisor, Dr. Steve Cohen for his expert advice and guidance throughout this project. We also thank our client, the Mayor's Office of Long-Term Planning and Sustainability, and particularly Steven Caputo and Annemarie Eimicke, for this opportunity and for their hard work to advance sustainability in New York City. Finally, this report would not be possible without the help of dozens of sustainability experts around the world who spoke with us about their cities. The environmental managers of municipalities, departments, non-profits and companies are making incredible strides in addressing pressing environmental concerns; we thank them for sharing their stories.

Preface

This report concludes the final capstone course in a three-semester workshop requirement for the Master of Public Administration in Environmental Science and Policy, at the School of International and Public Affairs, Columbia University. In a semester-long project, students undertake analytical projects for public sector agencies and non-profit organizations. The goal is to develop a product that is useful to the client by gathering data, conducting analyses, and producing a final report.

This project is a benchmarking analysis for the New York City Mayor's Office of Long-Term Planning and Sustainability (OLTPS). Our objective is to study the sustainability agendas and political institutions of other domestic and international cities in order to produce a set of recommendations for New York City's future sustainability plans.

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Executive Summary

The Future of PlaNYC: Searching for Innovative Practices

Six years ago, PlaNYC set the goal of creating a “Greener, Greater New York” by proactively addressing challenges posed by population growth, aging infrastructure, a global economy and climate change. In order to inform future PlaNYC updates and to ensure that New York is implementing best programs, the Mayor’s Office of Long-Term Planning and Sustainability (OLTPS) seeks to learn from other cities’ top practices. Through examining other cities’ sustainability plans and interviewing on-the-ground experts in 36 cities around the world, this report seeks to address the following questions:

- What can OLTPS learn from other cities’ sustainability plans, planning processes and implementation efforts, in order to enhance the design and implementation of PlaNYC?
- How can these insights facilitate the long-term institutionalization of sustainability priorities and practices within New York City?

Overarching Themes

In examining 36 cities, several overarching trends were identified regarding sustainability initiatives themselves and how city governance has impacted sustainability plans.

- Efforts generally move through stages of articulation, to implementation, to integration
- Though sustainability shifts in priority through leadership changes, it is not eliminated
- Energy efficiency was most commonly cited as cities’ highest priority
- Climate resiliency is generally not prioritized and is not on scale with the threat
- Most municipal sustainability efforts have greatly accelerated in the last 5 years
- There is a global community paying attention to sustainability innovations

Cases of Innovation

The report highlights notable practices in 10 sustainability categories. Here are some examples:

- **Climate Change:** Rotterdam designed a system to withstand a 10,000-year storm
- **Energy:** San Diego generates city electricity from solar and bio-solid methane
- **Air Quality:** Indianapolis plans to convert its entire fleet to alternative fuels by 2025
- **Solid Waste:** Philadelphia tripled recycling rates after using single-stream recycling
- **Transportation:** San Francisco’s bridge congestion-pricing reduced congestion by 15%
- **Water:** By using robots, Tokyo has reduced water leakage to 3.3%
- **Public Health:** Baltimore’s food policy program uses partnerships to reduce food deserts
- **Funding:** Pittsburgh expanded its energy efficiency budget 12.5% by rolling back savings
- **Partnerships:** Phoenix’s interactive website lets residents submit sustainability ideas
- **Long-term Institutions:** Portland’s Mayor Adams integrated sustainability into operations

New York City as a Global Leader

Many cities are tackling sustainability with innovative programs and New York is certainly at the forefront of global efforts. By continuing with aggressive policies, New York can maintain its rank as a global leader in sustainability planning and can further serve as a world-class model.

Report Overview

A Greener, Greater New York

On Earth Day six years ago, the City of New York released PlaNYC, a comprehensive strategy to tackle sustainability issues. The plan set the goal of creating a “Greener, Greater New York” by proactively addressing challenges posed by population growth, aging infrastructure, a global economy and climate change. The Mayor’s Office projects that by 2030, New York City’s population will increase by one million people, placing strain on the city’s transportation network, building stock, utility system, and other critical infrastructure. Furthermore, New York City’s geographic position puts many neighborhoods at risk of rising sea levels and amplified storms associated with climate change. PlaNYC shifts the focus from the threats facing the city to the opportunities that arise by confronting these challenges, including combating climate change, strengthening the economy, and enhancing quality of life for New Yorkers.

Searching for the Best

In order to inform future PlaNYC updates and to ensure that New York is implementing best programs, the Mayor’s Office of Long-Term Planning and Sustainability (OLTPS) seeks to learn from other cities’ top practices. A team of Columbia University graduate students, as the capstone project for their Environmental Science and Policy master’s program, spent a semester researching other cities’ sustainability plans and interviewing on-the-ground experts in 36 cities around the world. Through this process, the project addressed two primary research questions:

- What can OLTPS learn from other cities’ sustainability plans, planning processes and implementation efforts, in order to enhance the design and implementation of PlaNYC 2030?
- How can these insights facilitate the long-term institutionalization of sustainability priorities and practices within New York City?

Methodology

In order to produce a comprehensive assessment of programs, 30 U.S. and 6 international cities were considered based on their similarities to New York in governance structure, population size and density, coastal geography, use of mass transit, and global leadership in sustainability. The project recognized that municipal efforts are related to each location’s history and culture, but hoped to identify common threads across a wide spectrum of cities and to glean nuance from individual cities.

The project’s key findings are presented below in four primary categories: overarching themes, U.S. cities with comprehensive sustainability agendas, case studies of specific sustainability initiatives, and the top fifteen sustainability platforms that could benefit NYC. The study concludes with areas in which NYC is excelling as a global sustainability leader.

Overarching Trends

In examining 36 cities, several overarching trends were identified. These findings relate to sustainability initiatives themselves and offer insight into how city governance has impacted sustainability plans.

Institutionalization of Plans

Early in the research process, it became clear that cities are in various stages of addressing sustainability, ranging from crafting individual programs to integrating comprehensive plans. In general, the process of transitioning from piecemeal efforts to an overarching strategy followed a similar pattern. This report identified three principal stages: articulation, implementation and integration, whereby plans were first articulated in a centralized manner, then implemented by many departments. In a few cities, plans are gradually becoming fully integrated into city operations.

Priorities Shift, but Sustainability Remains

While municipal government has played a central role in most cities' sustainability efforts, the report found that local politics typically helped encourage plans, rather than stifle them. In general, there didn't seem to be a problem with politics interfering with sustainability efforts. With leadership changes in cities, sustainability rose and fell as a priority but was never abandoned entirely. This may indicate that most cities have moved out of an articulation phase and into some degree of implementation, whereby agencies and groups less affected by political change can continue their work. This is also indicative of public support for sustainability as well as the important work played by outside actors, including non-profits, the business community, higher education and other levels of government, which maintain momentum even as governments transition.

Key Functional Areas

When asked to indicate a given city's sustainability priorities, stakeholder responses reflected the individual city's context, history and culture. Industrial cities often cited air pollution and brownfields as their primary concern, while desert cities mentioned water conservation, and growing cities highlighted transportation. Despite varying responses, energy efficiency was identified as the highest priority across most cities. While energy efficiency reduces greenhouse gas emissions, it also makes economic sense; many cities said they couldn't afford *not* to make upgrades. Furthermore, unlike some functional areas, energy efficiency is relatively easy to track and monetize.

Climate Resiliency Lacks Critical Emphasis

Though the likely effects of climate change in cities are well documented, climate resiliency was not stated as a priority for most of the cities in this report. With the world's population rapidly moving into cities and the impacts of climate change becoming clearer, the actions that some cities are undertaking may be outdated and insufficient in the near future.

Increased Activity

The development of most municipal sustainability plans has occurred recently and has greatly accelerated in the last five years. Portland and Seattle are among the few cities that proposed environmental plans in the 1990s, and most cities highlighted in this report started plans after 2007, the year in which PlaNYC was implemented. The timeline on page 12 of this report indicates when plans were implemented over the last 20 years, with a flurry of activity since PlaNYC.

Global Community

Finally, this report identifies a global community that is paying attention to sustainability innovations. Certain cities have become synonymous with some of their best initiatives, like Copenhagen with bikes, Rotterdam with flooding protection, and Bogotá with rapid bus transit. Research found that New York is also considered a global leader in sustainability efforts. Many of the cities highlighted above

indicated that they have looked at the programs NYC has in place while developing their own initiatives. Most importantly, other cities have looked to the vision that New York has laid out through PlaNYC, which serves as an ambitious guideline for other municipalities.

Peer Cities: Comprehensive Plans from Around the Country

Despite the limitations of direct comparisons, a number of U.S. cities are also driving forward with comprehensive and often bold sustainability initiatives. Each city has its own personality and nuance, and can offer unique insight and lessons. New York could learn from and collaborate with the following cities:

Austin | Boston | Chicago | Philadelphia | Portland | San Antonio | San Diego |
San Francisco | Seattle | Washington, D.C.

Cases of Innovation

While each city addresses different aspects of sustainability through different lenses, ten “functional categories” were developed for analysis. Seven categories address areas of sustainability: climate change, energy, air quality, solid waste, transportation, water and public health. Three categories concern governance practices: partnerships, funding and long-term institutionalization. Given the interconnected nature of sustainability, many areas overlap, like energy and air quality, or water and climate change. Additionally, other categories exist in municipal sustainability plans that are not given a separate category here, like public space, which this report has included in public health. A list of the functional terms and their definitions are included in Appendix C.

Climate Change (pg. 21)

The complement to climate change prevention and mitigation is adaptation. Adaptation is the ability to prepare for the impacts of climate change. New York may increase its preparedness by considering climate change in infrastructure and spatial planning. For instance, Rotterdam developed a system designed to withstand a storm estimated to occur once in every 10,000 years. The city of Hong Kong has an entire department dedicated to drainage, and is investing billions of dollars in underground storage tanks designed to take stormwater off roads. Philadelphia is the country’s first city to charge all non-residential customers for runoff, based on the area of impervious surface.

Energy (pg. 25)

This functional category is defined as a city’s initiatives to reduce energy use and secure reliable energy production, distribution and consumption. This includes using renewable energy, implementing energy efficiency, and promoting smart grid technology. Copenhagen’s district heating system supplies 98% of the city’s building with steam from combined heat and power. Philadelphia has used millions of dollars in federal funding to develop an in-city energy innovation hub. London’s heat map identifies areas of the city that use the most energy, while San Antonio and San Diego are generating their own electricity from solar and bio-solid methane.

Air Quality (pg. 29)

Air quality as a functional area includes monitoring and modeling air quality, and updating policies, codes and regulations. Last year, the City of Indianapolis announced a plan to convert its entire fleet to run on alternative fuels by 2025. Los Angeles’ Clean Truck Program accelerated the replacement of

older trucks with cleaner ones, resulting in an 80% reduction in fleet emissions. Houston has partnered with private companies to construct a wide network of electric vehicle charging infrastructure across the city.

Solid Waste (pg. 32)

The United States landfills more than two-thirds of its solid waste and generates nearly double the waste that Japan and Europe produce per capita. To manage waste sustainably, cities strive to foster technical, managerial and behavioral changes. Philadelphia tripled recycling rates after implementing single-stream recycling; the city now diverts more than 70% of its waste from landfills and generates revenue from recycling efforts. San Francisco has a citywide municipal composting program and successfully diverts 80% of its waste from landfills. Copenhagen's sanitation workers will not remove waste unless it's properly sorted and the city only sends 2% of its waste to landfills.

Transportation (pg. 36)

Investing in hybrid electric vehicles for a city's fleet, instituting bike share programs and bicycle lanes, and enforcing parking limits are key innovations. Bogotá's rapid bus system has reduced commuters' traveling time by 32%. Copenhagen has instituted innovative bike infrastructure, successfully encouraging more than a third of the city to bike to work, with new routes and preferentially timed lights. Hong Kong incentivizes public transit with state of the art fare cards that can also be used to pay for movie tickets and clothing. San Francisco's congestion-pricing on a major bridge has reportedly reduced congestion 15% below 2009 levels. Washington, D.C.'s bikeshare program is considered one of the best in the country, with more than 174 stations across the metro area.

Water (pg. 42)

New York City is unique in that its water supply is projected to be able to meet its rapid population growth. However, intense precipitation events by our upstate water sources, predicted to increase as a result of climate change, will continue to stress the city's water infrastructure, reducing water quality. Cities around the world are taking action to address similar concerns. Washington, D.C. provides incentives for homeowners to reduce stormwater runoff. Minneapolis has disconnected inflow sources to minimize CSOs. Rotterdam constructed large water retention plazas in urban areas to divert storm water. By using robots, Tokyo has reduced water leakage to 3.3%. In Hong Kong, most residences use seawater to flush toilets and the city is constructing a desalination plant.

Public Health (pg. 46)

This functional area relates to cities' efforts to improve the health of their citizens as well as enhance overall quality of life. This includes addressing pollution-inducing morbidity and infectious diseases, as well as increasing access to healthy food, social networks, parks, and recreation. Baltimore's food policy program uses partnerships to create urban agriculture in vacant lots and reduce food deserts. The City of Cleveland has starting using goats to mow grass in vacant lots. Seattle's food action plan contains several indicators to track progress on food-related goals.

Funding (pg. 48)

While many sustainability efforts present long-term savings, short-term budget crises allow local leaders to "kick the can down the road." Given increasingly tight municipal budgets in many cities, many of the cities examined for this report have developed innovative funding mechanisms. Pittsburgh uses a fund to rollback savings from energy efficiency, effectively expanding the city's energy efficiency

budget by 12.5%. Envision Charlotte is a public-private partnership that offers real time data on energy use of buildings, and places the information in public places. Philadelphia partnered with a recycling rewards program that has helped the city reduce recycling costs and increased residential recycling. Miami and Jacksonville have used block grants to fund sustainability offices.

Partnerships (pg. 51)

Partnerships between different levels of government, non-profit groups, private organizations, and educational institutions help to ensure that sustainability plans improve the quality of life of all city residents. Several U.S. cities have been successful in fostering community outreach and stakeholder engagement. Miami-Dade County has partnered with the local Chamber of Commerce to conduct energy efficiency workshops. Phoenix has an interactive website that allows residents to submit sustainability ideas. Cleveland's sustainability office hosts an annual summit of local stakeholders, connecting with more than 600 leaders to develop priority issues each year. Pittsburgh's plan is divided into sectors, involving the municipal government, as well as non-profits, the business community and higher education.

Long-term Institutionalization (pg. 54)

Long-term governance trends indicate that progressive sustainability programs and policies are enacted through the influence of a powerful figure in city government, and that sustainability evolves from general concept to concrete program proposals to departmental program implementation. In Bogotá, a mayoral transition left transportation plans in a lurch. Portland Mayor Sam Adams was instrumental in integrating sustainability into city operations. Philadelphia has used zoning and cross-referencing to ensure that the sustainability plan continues throughout mayoral transitions. Los Angeles' mayor issued an executive order, compelling city agencies to produce sustainability reports.

Top 16 Sustainability Platforms (pg. 58)

1. **Climate Change:** Rotterdam designed a system to withstand a 10,000-year storm
2. **Climate Change:** Co-location of community facilities
3. **Energy:** Special heating and cooling district systems
4. **Energy:** Large, utility-scale solar installations
5. **Energy:** Power generation from methane, solar, and hydropower in municipal buildings
6. **Air Quality:** Green municipal fleet
7. **Solid Waste:** Plastic bag fee
8. **Solid Waste:** Three-bin solid waste system for compost, recyclables, and trash
9. **Solid Waste:** Single-stream recycling
10. **Transportation:** Congestion pricing
11. **Water:** Parcel-based stormwater billing
12. **Funding:** Rollover funding tied to sustainability offices
13. **Partnerships:** Strong stakeholder support and partnerships
14. **Partnerships:** Municipal website to engage the community
15. **Long-term Institutionalization:** Integration of Sustainability Office with Planning Office
16. **Long-term Institutionalization:** Codification of sustainability initiatives by executive or legislative action

New York City as a Global Leader

New York provides strong global leadership in sustainability. The methods of institutionalization set in place in New York City, including updating the plan every four years, regularly measuring and reporting progress, and maintaining a sustainability office under the mayor, have permitted substantial progress, but the city needs to continue its commitment. International cities are on the forefront of significant improvements to address aging infrastructure and looming climate risks. New York is well positioned to maintain its rank as a global leader in sustainability planning and to further serve as a world-class model.

Introduction

This project is a benchmarking analysis conducted as a capstone workshop project by Environmental Science and Policy MPA students at Columbia University, on behalf of the New York City Mayor's Office of Long-term Planning and Sustainability (OLTPS). Our objective was to study the sustainability agendas and political institutions of other domestic and international cities in order to help inform New York City's future sustainability plans.

Our Approach

The Columbia University workshop team, assisted by a faculty advisor, analyzed the sustainability and governance practices of 30 U.S. cities and 10 international C40 cities (a network of global cities working to reduce greenhouse gas emissions), as well as the political institutions and stakeholders that have affected their sustainability agendas and practices. Upon completion of the research and analysis, the workshop team identified the top fifteen platforms that could strengthen PlaNYC and facilitate the long-term continuity of urban sustainability policy in New York City.

Our teams conducted interviews with directors and senior staff of sustainability offices to complement an analysis of published municipal data. Primary research was used to gain greater insight into the mechanisms that drive other municipalities' sustainability plans.

Research Objectives

Through our research, the team sought to answer the following questions:

- What can the New York City Mayor's Office of Long-Term Planning and Sustainability learn from the urban sustainability plans, planning processes and implementation efforts in other domestic and international cities to enhance the design and implementation of New York City's sustainability program PlaNYC 2030?
- How will these insights facilitate the long-term institutionalization of sustainability priorities and practices within the city?

Summary of PlaNYC

Background on the Plan

PlaNYC was initially released in April 2007 and updated in 2011 in accordance with New York City Local Law. In order to create “A Greener, Greater New York,” the plan proactively addresses the challenges posed by population growth, aging infrastructure, a global economy and climate change. By 2030, the Mayor’s Office projects that New York City’s population will grow to more than nine million people, placing strain on the city’s transportation network, building stock, utility system, and other critical infrastructure. Furthermore, NYC’s geographic position puts the city at risk of rising sea levels from increased storm frequency and intensity associated with climate change. PlaNYC shifts the focus from the threats facing the city to the opportunities that arise by confronting these challenges. Opportunities include combating climate change, strengthening the economy, and enhancing quality of life for New Yorkers.

The 2011 PlaNYC update contains goals across 10 key sustainability categories, or functional areas, and it outlines 132 initiatives to accomplish these goals. In addition, the plan includes more than 400 milestones to be achieved by the end of 2013. In order to ensure progress towards 2030 targets, the milestones serve as an intermediate step between the 2011 release and the next PlaNYC update. The city’s performance is measured by 29 sustainability indicators, or metrics.

Achievements to Date

Since its initial release, PlaNYC has brought together more than 25 city agencies to advance its sustainability initiatives. Key achievements between 2007 and 2011 include the creation of 64,000 units of new or preserved housing, the

establishment of 20 transit-oriented re-zonings and the investment of \$1.5 billion in green infrastructure.



Cover of New York City’s sustainability plan.
Credit: The City of New York

Plan Details

The chart contained in Appendix B outlines the details of PlaNYC. The plan consists of 10 sustainability categories, or functional areas, which include:

- Housing and Neighborhoods
- Parks and Public Space
- Brownfields
- Waterways
- Water Supply
- Transportation
- Energy
- Air Quality
- Solid Waste
- Climate Change

Each category has goals, which are followed by tasks necessary to help meet those goals. Each task includes a set of specific initiatives designed to guide the plan’s progress.

Overarching Trends

While the report sought to better understand individual cities' nuanced approaches to specific sustainability programs, several overarching trends were identified. These findings relate to sustainability initiatives themselves and also offer insight into how city governance has impacted sustainability plans.

Institutionalization of Plans

Early on in the research process, it became clear that cities are in various stages of addressing sustainability. While many cities have been addressing sustainability within individual departments for years, even decades, the process of moving from individual programs to a comprehensive plan tended to follow a similar pattern. This report identified three primary stages: articulation, implementation and integration, whereby plans were first articulated in a centralized manner, then implemented by many departments, and in a few cities, plans are slowly becoming fully integrated into city operations.

Generally, comprehensive plans were ideas floated at the mayoral level, often being developed and pushed forward by non-profit organizations. For the mayors who decided to take up sustainability on a comprehensive level, plans often began as a centralized report. This is the articulation stage. Later, plans became implemented, moving from a central location into municipal departments. Many cities find themselves in this implementation phase today. In very few cities, sustainability has moved from implementation to full integration into every aspect of the city.

This development pattern offers drawbacks and benefits. In some cases, cities have found that having strong mayoral leadership pushing forward a plan was incredibly beneficial. In cities with a weaker mayoral system, they were more successful with plans that were fostered by

outside organizations, because it allowed more community input and a broader voice. Of the cities that are beginning full integration of their plans, some indicated that it is challenging to maintain coordination in a less centralized system. Sustainability involves a significant amount of interagency collaboration, research and innovation, so while integration offers the benefit of being pervasive, cities need to focus on maintaining coordination.

Priorities Shift, but Sustainability Remains

While municipal government has played a central role in most city's sustainability efforts, the report found that local politics typically helped encourage plans, rather than stifle them. In general, there didn't seem to be a problem with politics interfering with sustainability. With leadership changes in cities, sustainability has risen and fallen in its level of priority but has never been abandoned entirely. This may indicate that most cities have moved out of an articulation phase and into some degree of implementation, whereby agencies and groups less affected by political change can continue their work. This is also indicative of the important work played by outside actors, including non-profits, the business community, higher education and other levels of government, which maintain momentum even as governments transition.

Key Functional Areas

When asked to indicate a given city's sustainability priorities, stakeholder answers greatly reflected the individual city's context, history and culture. Industrial cities often cited brownfields and air pollution as their primary concerns, while desert cities mentioned water conservation, and growing cities highlighted transportation. Despite varying answers, the functional area demanding by far the most municipal attention is energy efficiency. While also reducing greenhouse gas emissions, energy efficiency makes economic sense; many cities

said they couldn't afford to *not* make efficiency upgrades. Furthermore, unlike some functional areas, energy efficiency is easy to track and to monetize.

Climate Resiliency Lacks Critical Emphasis

Though the likely effects of climate change in cities are well documented, climate resiliency is not a top priority for most of the cities in this report. By and large, the response is not at all on scale with the threat that cities may soon be facing. Additionally, the actions that some cities are undertaking will likely be outdated and insufficient shortly after they are completed. With the world's population rapidly moving into cities and the impacts of climate change becoming clearer, this finding greatly concerns the report's authors.

Increased Activity

Portland and Seattle are among the few cities that proposed environmental or climate plans in the 1990s and have been addressing sustainability for a couple decades. Most cities, however, have implemented their plans relatively recently; this report found that New York City was pretty early in the game and there has been a flurry of activity in the time since PlaNYC was developed. This timeline on the following page indicates when municipal plans were implemented over the last 20 years.

Global Community

Finally, this report identifies a global community that is paying attention to sustainability innovations. Certain cities have become synonymous with some of their best initiatives, like Copenhagen with bikes, Rotterdam with flood control, and Bogotá with bus rapid transit. Research found that New York is also considered a global leader in sustainability efforts. Many of the cities highlighted above indicated that they have looked at the programs NYC has in place while developing their own initiatives. Most importantly, other cities have looked to the

vision that New York has laid out through PlaNYC. While there may be specific programs or initiatives that New York City could undertake, PlaNYC represents a holistic, overarching concept of sustainability, which serves as an ambitious guideline for other municipalities.

Timeline of Municipal Sustainability Plans



Peer Cities: Comprehensive Plans Around the Country

Because of New York City's unique composition, it is difficult to place New York among a comparative network of domestic peer cities, especially in relation to sustainability efforts. New York's population of over 8.2 million¹ greatly exceeds that of any other U.S. city. With 305 square miles of land² and the highest population density among domestic cities,¹ the city is geographically expansive like San Diego or Austin, but maintains a population density more similar to, though far exceeding, that of San Francisco or Boston.

Despite the limitations of direct comparisons, a number of U.S. cities are also driving comprehensive and bold sustainability initiatives. New York could learn from and work with some of the cities identified below as it seeks to strengthen and build upon its own progress. Each city has its own personality and nuance, and can offer unique insight and lessons. Cities were selected due to a combination of factors, including comprehensiveness of plan, similarity of sustainability goals and challenges to New York, and governance structure. Importantly, the selected cities do not represent an exhaustive list of U.S. cities pursuing comprehensive sustainability agendas.

Broadly speaking, the West Coast cities, such as Portland, San Diego, San Francisco, and Seattle have longer histories of sustainability and environmentalism than the East Coast cities. As a result, sustainability initiatives are often

structurally scattered and embedded throughout various government agencies, which can make it difficult for municipal staff to manage a comprehensive plan. Further, such an entrenched view of sustainability could limit a city's incentive to explicitly make sustainability a priority in and of itself. However, an established culture of environmentalism ensures that initiatives are not abandoned, and thereby protects existing initiatives from political change.

In contrast, East Coast cities such as Boston, Philadelphia, and Washington, D.C., as well as Chicago in the Midwest, are structured like New York, with a central office coordinating a comprehensive plan across city agencies. These plans are newer and more organized, and have the benefit of aggressive mayoral support. However, lack of institutionalization makes programs vulnerable to shifting priorities and economic hardships. A combination of public-private partnerships, public outreach, benchmarking, and incorporation of individual programs into city law have helped to sustain initiatives on the East Coast.

Finally, most of the Texas cities, including Austin and San Antonio, lack the environmental history of the West Coast and the strong mayoral leadership of the East Coast cities, but have pursued sustainability agendas through economic incentives.

Background on the cities and their sustainability efforts is outlined below, in alphabetical order.

Austin

In 2012, Austin's City Council adopted a comprehensive plan known as Imagine Austin, which is now the responsibility of the Planning and Development Review Department. The major components of the plan involve improving quality of life through a variety of approaches, though the plan is still in the very early stages of implementation.



Cover of Austin's sustainability plan.

Credit: City of Austin

The effort to develop the plan was collaborative and drew on the work of a variety of different city departments and other organizations. While the mayor and City Council were involved in its approval, they do not appear to have contributed to its creation any more than any other stakeholder group. At least one group, the Austin Neighborhoods Council, opposed Imagine Austin, stating that neighborhoods should shape planning instead of the City.

Imagine Austin uses a framework of seven building blocks to lay out its plans for the future. These are: land use and transportation, housing and neighborhoods, economy, conservation and environment, city facilities

and services, society and creativity. The policies for each building block are found in an action matrix, where they are classified by area, type and priority programs. At this early stage of development, however, all the policy proposals are qualitative and do not have quantitative performance targets.

Boston

Boston is the 21st largest city in the United States, with an estimated population of 625,000. The city's sustainability initiatives reside within the jurisdiction of the Mayor's Office of Environmental and Energy Services, and involve a series of plans and programs, rather than one overarching plan. Such initiatives include the Green Building Task Force, the Green Affordable Housing Plan, the Climate Action Plan, Solar Boston, and Renew Boston. The city considers climate adaptation, including storm surge and sea level rise preparedness, as well as energy use and efficiency and human behavior change among its top priorities.³

The Office of Environmental and Energy Services is responsible for benchmarking the city's progress, and the online program Boston About Results tracks the city's initiatives from month to month. Boston owes much of its success to strong mayoral leadership and to transparency and collaboration with local community leaders.



Boston. *Credit: Rick Berk/www.rickberk.com*

The Office of Environmental and Energy Services has grown 50% over the last ten years,

to a department staff of 25. Despite such rapid progress, the Mayor's Office is heavily dependent upon individual departments to pursue its sustainability agenda, and the Office has encountered barriers from some departments. The lack of a central plan or legal status for sustainability programs leaves the city's sustainability initiatives vulnerable to changes in political leadership. Still, the U.S. and Canada Green City Index stated, "Boston's overall strength lies in its well-rounded environmental policies."⁴

Chicago

Chicago made its sustainability advancements in the 2000's due to a combination of leadership from the mayor and commitment from department commissioners.⁵ Under the leadership of Mayor Daley and key city officials such as Sadhu Johnston in the Department of Environment, Chicago shifted environmental efforts beyond aesthetic improvements to developing more holistic sustainability initiatives. Initial projects, such as the green roof on City Hall, evolved into programs, such as requiring green roofs for development projects that utilized special zoning approvals or public funding. Other key initiatives included the development of Millennium Park, the Green Alleys program, the greening of street medians, and green building initiatives focused on meeting LEED standards. Many of these initiatives coalesced into the Chicago Climate Action Plan in 2008, which came to represent the City's primary plan for addressing energy use and climate change.⁶

In 2012, the Emanuel Administration released Sustainable Chicago 2015. This document is intended to serve as a guide for near-term actions through 2015. Sustainable Chicago 2015 covers a broader series of issues than the Chicago Climate Action Plan by incorporating topics such as water, food, solid waste, and transportation, beyond the way that those policy topics contribute to carbon emissions.

Notably, Sustainable Chicago 2015 makes few references to the earlier Climate Action Plan and does not explicitly commit to the same carbon reduction goals. This illustrates that new mayoral administrations tend to create their own plans and commitments that stand independent to those of their predecessors.⁷



Cover of Chicago's sustainability plan.
Credit: City of Chicago

Despite ongoing challenges with citywide sustainability staffing and coordination, the Emanuel Administration has advanced many key sustainability initiatives. Mayor Emanuel played a key role in securing the shutdown of two coal power plants that are located within the city. He also spearheaded the creation of the Chicago Infrastructure Trust, whose first proposal is a \$100 million investment in energy efficiency projects. Emanuel has created a plan to significantly increase water rates to more than double the rate of replacement for water and sewer mains. Finally, the administration has increased sustainable transportation projects such as adding bike lanes, launching the city's first bus rapid transit routes, and creating a bike share program.

Philadelphia

Philadelphia is the fifth largest city in the U.S. with a population of over 1.5 million, and is the closest city to New York geographically among the studied cities. Philadelphia's comprehensive sustainability plan, Greenworks, was modeled after PlaNYC and introduced in

2009 under the current mayor, Michael Nutter. The report articulates Philadelphia's goal to be the "greenest city in the country" and consists of concrete targets to be met by the year 2015. Mayor Nutter became a champion of the platform and has brought the message to a larger audience as the President of the U.S. Conference of Mayors.

The city's strategy includes establishing targets, reviewing progress on an annual basis, and soliciting public feedback.⁴ In the latest update from 2012, the plan outlined 167 initiatives to reach 15 targets under the categories of Energy, Environment, Equity, Economy and Engagement. The plan itself focuses on the Mayor's office, but city agencies, including transit and housing authorities, have also created complementary plans for their operations.



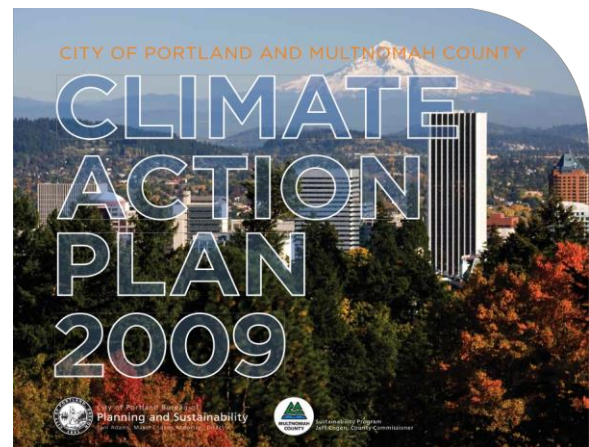
Logo for Philadelphia's sustainability plan.
Credit: City of Philadelphia

Mayor Nutter has made an effort to integrate sustainability into the city to ensure its legacy. The plan is cross-referenced within departments and agencies so that initiatives are less likely to be cut or be defunded. Additionally, in 2011, the city adopted a new citywide comprehensive plan and a new zoning code. These developments ensure that sustainability principles continue for many decades, including provisions on transit stations, walkability, alternative energy systems, water conservation and urban food production. Additionally, the city has created a

Sustainability Working Group of more than 100 city employees who meet quarterly for sustainability planning meetings and more frequent briefings.

Portland

In 1993 Portland was the first local government in the U.S. to adopt a plan to address climate change. Current plans in Portland include the Portland Plan and the Climate Action Plan 2009 (CAP). CAP outlines the carbon emission reduction goals of 40% below 1990 levels by 2030 and 80% by 2050 and includes eight sectors: Buildings & Energy, Urban Form & Mobility, Consumption & Solid Waste, Urban Forestry & Natural Systems, Food & Agriculture, Community Engagement, Climate Change Preparation, and Local Government. The original CAP 2009 is currently undergoing revision by the Bureau of Planning & Sustainability.



Cover of Portland's Climate Action Plan.
Credit: City of Portland

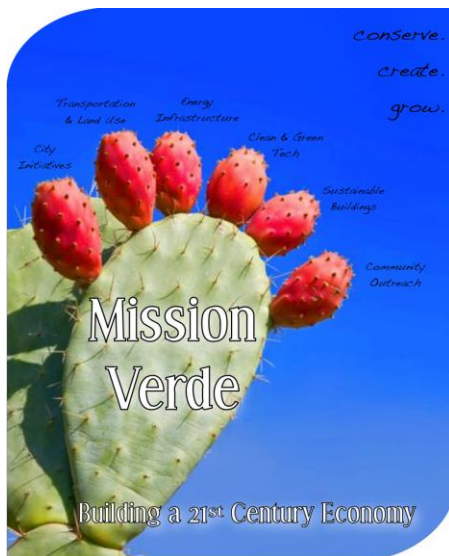
According to Michelle Crim, Sustainability Manager in the Bureau of Planning and Sustainability, Portland has targeted an environmental and sustainability agenda for so long that traditional initiatives are now integrated within city governance and the city has already picked its low hanging fruit. The city is now re-envisioning sustainability; the Portland Plan, adopted in 2012, is a broad

social plan addressing four key priorities: Prosperity, Education, Health and Equity.

After assuming office in 2009, Mayor Sam Adams merged the Bureau of Planning with the Office of Sustainability. In this way the mayor has been instrumental in institutionalizing sustainability through the consolidation of municipal agencies. Mayor Adams recently left office and it is unclear if current Mayor Hales will make sustainability as high a priority.

San Antonio

San Antonio is the country's seventh largest city, with a population of nearly 1.36 million. The city adopted the Mission Verde Sustainability Plan in February 2010, emphasizing energy and water conservation and smart growth, all framed as a development strategy to create green jobs. This economic approach, which pays for itself and reduces city costs, has generally received strong support from the public.



Cover of San Antonio's Sustainability Plan.
Credit: City of San Antonio

Mission Verde contains 11 initiatives separated into six strategies: energy infrastructure, clean and green technology development, sustainable buildings, transportation, land use, community outreach, and city operations.

Notably, San Antonio does not include solid waste in its plan. Each initiative has broad timetable benchmarks, usually culminating with implementation. In many cases, the initiatives began before the adoption of the plan, but the Mission Verde document and its detailed strategy corollaries do not appear to have been updated since January 2009.

The plan is administered and implemented by the Office of Sustainability by interfacing with other city departments and the mayor does not appear to play a large role in the plan. Interestingly, the city owns the energy and water utilities, which often act as sustainability partners for programs.

San Diego

With a population of 1.33 million, San Diego is the nation's eighth largest city. The City of San Diego was an early adopter of climate policy, developing a Climate Protection Action Plan (CPAP) in 2005. This plan has influenced the creation of related plans regarding sustainable energy, preferable purchasing, conservation and solar implementation. CPAP is managed within the city's Environmental Services Department. Major goals of the plan include inventorying GHG emissions and setting goals for emissions reduction, as well as lessening other environmental impacts of the city government.

The sustainability elements covered by the plan encompass transportation, energy, waste, urban heat island effect and environmentally preferable purchasing. The three primary focuses of emissions reductions surround transportation, energy and solid waste. The city has also developed a comprehensive water plan that supports conservation by implementing tiered rates, water recycling, collection and reuse, stormwater diversion, reservoir recharge and other approaches. CPAP was strongly supported by Mayor Jerry Sanders, who recently left office due to term

limits; it is too soon to know how Mayor Filner will address sustainability.

San Francisco

San Francisco is far less populated than New York, with just over 800,000 residents, but the city has the highest population density in the country after NYC. San Francisco has a long history of environmentalism and sustainability, and boasts a comprehensive sustainability agenda. However, this long history has also resulted in a patchwork of various municipal agencies, departments, and plans related to sustainability. For example, the Department of Public Works is focused on the Strategic Plan related to sustainability objectives, whereas the Department of Environment operates various environmental programs independently.



Logo from San Francisco's Department of the Environment.
Credit: City of San Francisco

San Francisco issued its Climate Action Plan in 2004 (updated in 2011) with the goal to reduce emissions 20% below 1990 levels by 2012. Additionally, the Department of Public Works issued a 2013-2015 Strategic Plan with four goals regarding green infrastructure, sustainable facilities, world-class public service and job creation.

Like many other regions of California, San Francisco has been required by state law since 2008 to develop a Sustainable Communities Strategy (SCS).

The priorities of the SCS are transportation, land-use, housing, and greenhouse gas emission reductions. Responsibility for the SCS

rests with the regional planning agency Association of Bay Area Governments (ABAG). The SCS is manifested in San Francisco as the Planning Department's Sustainable Development Program, which seeks to "facilitate the implementation of sustainable infrastructure systems by coordinating private development and public improvements through community engagement." A primary tool to do so is *Eco-District*, which is described as, "neighborhood-scale public-private partnerships that can strengthen the economy while creating a stronger sense of place."

Seattle

Seattle has had a long history of environmental sustainability and has set aggressive goals in the last ten years. The city has two primary sustainability plans, the Comprehensive Plan and the Climate Action Plan, which advance sustainability in their own ways, and have different origins, history and focus.

The Comprehensive Plan was first established in 1994 and is a 20-year plan that is managed by Seattle's Department of Planning and Development. Through this plan, the city establishes targets and produces regular and publically available benchmarking reports against a baseline review, though a criticism of the original baseline is that it is not as comprehensive as those of its peers.



The City's Climate Action Plan was first developed in 2005 and seeks to achieve carbon neutrality by the year 2050, with the updated

version of the plan including the goal to enhance quality of life for Seattleites. The plan includes many different sectors, including: Transportation & Land Use, Building Energy, Adaptation, and Building Support for Climate Action. In 2000, the Seattle City Council created the Office of Sustainability and Environment (OSE) to develop policy positions on transportation, growth, housing and environmental policy that is consistent with the Climate Action Plan. According to the office's website, Seattle's environmental goals are embedded within and across multiple departments.

Another notable plan is Seattle's Food Action Plan, developed in 2008 following the Local Food Action Initiative. The core goals of the Food Action Plan are: Healthy Food for All, Grow Local, Strengthen the Local Economy, and Prevent Food Waste. Each goal includes several strategies, and progress must be reported annually on several indicators (e.g. percent of residents within one-quarter mile of a healthy food access point, and percent of food waste diverted for composting).

Washington, D.C.

Though a relatively small city with a population of 618,000, Washington, D.C. boasts a comprehensive sustainability plan, Sustainable D.C., which includes strong targets, a baseline review, and continuous reporting. The plan has made public outreach to residents and local businesses a focus, and has received broad political support. Sustainable D.C. was launched in February 2013 by Mayor Vincent Gray, replacing the earlier D.C. Green Agenda and Climate Action Plan, neither of which were as aggressive or as high of a priority as the new plan. Sustainable D.C. is managed by two city agencies, the District Department of the Environment and the Office of Planning.⁸ The Office of the Administrator's Green Cabinet, consisting of agency directors and their staff,

help support the plan. The three groups meet every few months to receive updates on the plan and discuss ways in which city officials can support it.⁹

During the formulation stage of Sustainable D.C., over 700 people in nine working groups met every other week for three months to deliver over 900 recommendations that informed the content of the plan. The planning team met with communities in all eight city wards during events ranging from small community conversations to large neighborhood festivals. Moving forward, the city plans to maintain more informal versions of the working groups.



Cover of Washington, D.C.'s sustainability plan.
Credit: District of Columbia

Peer Cities Summary

In conclusion, while different cities are tackling sustainability issues in a variety of approaches, NYC could look to the above cities as partner cities with relatable experiences and similar plans.

Program Case Studies Overview

The Program Case Studies section provides an overview of municipal sustainability best practices. In this section, we highlight some of the most impactful sustainability initiatives, grouped by functional area, that are being implemented across the country and world. Getting sustainability initiatives off the ground and overcoming funding, political, and technical hurdles is one of the greatest challenges to successful implementation. In this section, we not only shed light on how city officials, community organizers and non-profits were able to launch individual projects, but we also highlight those projects' metrics of success.

While conducting interviews with directors and senior staff of sustainability offices, our team asked interviewees to discuss three to five of the top sustainability challenges in their respective cities and what programs or plans their cities use to address these priority issues. Based on these conversations, further research, and discussions among team members, particular city initiatives were selected to demonstrate useful case studies.

The case studies are grouped into 10 functional areas:

Climate Change (pg 21)

Climate change case studies targeted cities that are most impacted by flooding and other extreme climate events. Case studies in this category targeted infrastructure adaptation measures and the development of plans to improve emergency preparedness.

Energy (pg 25)

Energy case studies focused on energy efficiency and renewable energy measures. For instance, San Antonio's solar development plan will form the largest municipal solar project in the United States and will provide enough energy for nearly 10% of the city's households.

Air Quality (pg 29)

Regarding air quality and transportation issues, we found that a number of cities are focusing on greening the city's transportation, particularly municipal vehicle fleets, by investing in electric vehicle infrastructure, plug-in hybrids, and cleaner fuels.

Solid Waste (pg 32)

For solid waste, municipalities are focusing on the three R's; reduce, reuse, and recycle. For example, Washington, D.C.'s Bag Law has incentivized District residents to use six fewer disposable bags each week. Changing residents' behavior is not only reducing waste, but is also reducing the amount of trash found in local waterways.

Transportation (pg 36)

Just as Washington, D.C. has implemented innovative sustainability practices in solid waste, so have other cities adopted innovative transportation measures. San Francisco's congestion pricing has reduced the number of cars on a bridge and, subsequently, congestion and pollutants in the city.

Water (pg 42)

Water infrastructure projects across the country are reducing stormwater runoff, improving the quality of water, and conserving clean water.

Public Health (pg 46)

Public health projects include improving health and well-being, increasing access to nutritious food, and building a sense of community.

Funding (pg 48)

Given increasingly tight municipal budgets in many cities, many of the cities examined for this report have developed innovative funding

mechanisms. For instance, Pittsburgh uses a fund to rollback savings from energy efficiency, effectively expanding the city's energy efficiency budget by 12.5%.

Partnerships (pg 51)

Partnerships between different levels of government, non-profit groups, private organizations, and educational institutions help to ensure that sustainability plans improve the quality of life of all city residents. Several U.S. cities have been successful in fostering community outreach and stakeholder engagement.

Long-Term Institutionalization (pg 54)

Long-term governance trends indicate that progressive sustainability programs and policies are enacted through the influence of a powerful figure in city government, and that sustainability evolves from general concept to concrete program proposals to departmental program implementation.

Climate Change

Climate change is a crosscutting issue. Impacts are being seen globally in the form of temperature changes, extreme weather events, and rising sea levels. Actions can be taken in all functional areas to protect New York City from the effects of climate change. For instance, a 30% target reduction in greenhouse gas emissions by 2030 will have to engage the energy, transportation and solid waste sectors in climate change mitigation. Therefore, mitigation efforts are included within the different functional areas of this report.

The complement to climate change mitigation is climate adaptation. Adaptation is our ability to respond to the impacts of climate change in a manner that reduces future risk to human settlements and ecosystems. Rotterdam, Hong Kong and New Orleans are coastal cities that may also experience extreme flooding as a result of climate change, and have installed relevant infrastructure as a result. Philadelphia is also conscious of the impacts of climate change and has implemented an infrastructure adaptation program in response.

New York City could look to:

- Rotterdam's system of flood barriers to combat sea level rise;
- Hong Kong's system of underground storage tanks, drainage tunnels, and inflatable dams to deal with extreme precipitation events;
- New Orleans' collaborative development of a water management plan, and co-location of community facilities to improve emergency preparedness; and
- Philadelphia's city-wide initiative to reduce impervious surfaces.

Living Below Sea Level: Rotterdam Flood Control

At nearly six meters below sea level, flooding is a recognized threat¹⁰ and Rotterdam has chosen to embrace its delta location to become the “Water City of the Future.” As a result, Dutch flood protection standards are the highest in the world. Most of the protection system around Rotterdam is designed to withstand a storm estimated to occur once in every 10,000 years, far exceeding the planning horizon of U.S. cities. In 2010, the city authored Rotterdam Climate Proof, an adaptation program to make the city “100% climate proof” by 2025.¹¹



Maeslant Barrier, Rotterdam.

Credit: <https://beeldbank.rws.nl/>, Rijkswaterstaat

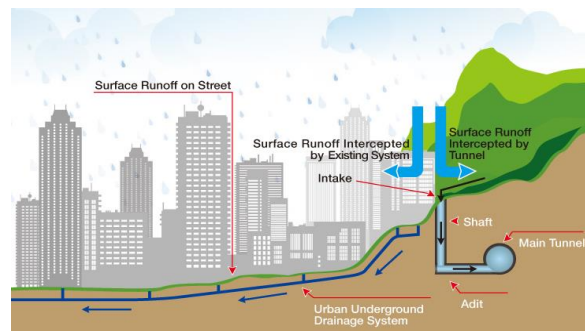
An extensive system of dikes, closure dams, storm surge barriers, and pumping stations is in place to deal with water from the North Sea and effectively combat the threat of flooding. For instance, the Maeslant flood barrier consists of a gate with two branches, both greater than the size of the Eiffel Tower, that close in the case of an extreme flood.

The Dutch government will spend over one billion Euros a year until 2100 to extend and strengthen dikes and other flood control mechanisms. One project is Flood Control 2015, in which private companies and Dutch water boards interact to create an integrated flood forecasting system. The integrated platform is designed to improve decision-making related to

management of water systems in Rotterdam and other interested cities.¹² Despite the initial capital investment, the Rotterdam government argues that there is a positive return on investment by protecting economic activity and residents from flooding disasters.

Redirecting Water: Hong Kong Flood Control

Hong Kong faces many of the same climate adaptability challenges that New York City faces in relation to flooding. Hong Kong experiences intense storms and high inflows, tight space constraints and scarce land availability, densely populated areas and congested underground utilities, as well as enhanced backwater effect due to coastal reclamation. Hong Kong’s Drainage Service Department was created after a devastating typhoon in 1992 and has a four-fold approach to flood mitigation: upgrading existing systems, constructing drainage interception tunnels, creating underground storage tanks, and large water pumping schemes.



Drainage Tunnel Scheme.

Credit: Hong Kong Drainage Services Department

The interception tunnel involves building three drainage tunnels to intercept stormwater and discharge it to the sea directly, thus reducing rainwater flowing to the low-lying areas downstream. Underground storage tanks are another option for dealing with peak flow rates and Hong Kong recently completed one such project. It is situated under a recreational ball field, holds 100,000 cubic meters of water, and cost \$2.6 billion USD to build. Other innovations that have proved successful have

been inflatable dams, used in conjunction with a low-flow pump to prevent flooding from anything less powerful than a 200-year storm.¹³

Another example of a successful storage and pump design is the Sheung Wan Stormwater Storage Scheme, which is situated in a low-lying area affected by tidal back flow from other areas of the city. The city constructed a tide gate to prevent tidal back flow and an underground storage tank and pumping station to provide a new drainage path for stormwater.

Allowing Infiltration: Philadelphia's Green Infrastructure

Sustainability is a central focus of Philadelphia Mayor Nutter's administration, according to Alex Dews, the Policy and Program Manager for Philadelphia's Office of Sustainability.¹⁴ Dews says that all departments in the city are beginning to understand the risks and urgencies of climate change, as well as the vulnerability of key infrastructure. Representatives from city departments participate in a voluntary interdepartmental working group to develop solutions to climate change challenges, developing new programs and expanding those that already exist.



Stormwater Bumpout.
Credit: Philadelphia Water Department

While many major innovations come from the Mayor's office and Greenworks, city departments are also working in this area. One major program, Green City, Clean Waters, is a partnership between the water department and the U.S. EPA. This is an ambitious 25-year \$2.4 billion plan to reduce stormwater runoff through improvements in green and grey infrastructure, with an eye towards the likely impacts of climate change. Philadelphia has a goal of creating 744 "greened acres" by the year 2015, with rain gardens, infiltration beds, green roof bus shelters, and stormwater bump-outs to redirect water. The city is also investing in porous streets, with the first street unveiled in 2011.¹⁵

The city has also changed local regulations to force private properties to reduce runoff. In 2010, Philadelphia became the first municipality to use parcel-based stormwater billing,¹⁶ whereby non-residential customers pay for stormwater based on their property's area of impervious surface. Properties with high ratios of impervious surface (parking lots, large roofs) are charged more than properties with green infrastructure (green roofs and porous cement). The city sees this policy as an equitable and incentive-based way to reduce stormwater runoff while raising awareness and bringing in funds.¹⁷ The water department offers grants and loans for best practices, and estimates that these regulations reduce runoff by more than 900 million gallons each year. According to Dews, there was some pushback when the water department transitioned to parcel-based stormwater billing. Some property owners saw their bills increase, but these increases will be phased in over five years and owners can take advantage of stormwater credit programs to help offset the cost. Ultimately, the city hopes that Green City, Clean Waters can serve as a national municipal model to manage stormwater using green infrastructure.

Collaboration and Integration: Resiliency in New Orleans

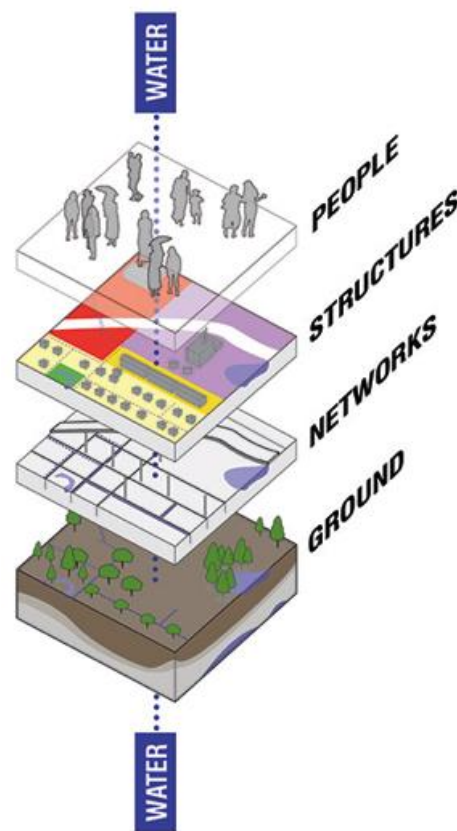
Like New York's PlaNYC, New Orleans has a master plan that carries the force of law and informs city priorities, from zoning ordinances to climate adaptation. New Orleans similarly is a coastal city that has experienced damaging storms and been forced to address climate change directly. New Orleans additionally faces the risk of land subsidence, which adds to flooding risks and stormwater challenges. Two of the innovative ways that New Orleans has addressed hazard-mitigation in the face of climate change are emphasizing co-location of facilities for community resilience and collaboration with Dutch architects and engineers to develop a water management plan.

Co-location of Community Facilities

Community resilience is one way to minimize the impact of extreme weather events on families and businesses and ideally to minimize the need for evacuation. This can be accomplished through building codes, green infrastructure, communication, and also through innovative facility planning by co-locating essential community facilities. The New Orleans master plan, *A Plan for the 21st Century: New Orleans 2030*, includes the strategy to "Create a network of public facilities and service clusters to function as neighborhood civic centers."¹⁸ Public schools, clinics, libraries, and meeting rooms can be combined to enhance efficiencies and build community, and to provide facilities for emergency response and hazard-mitigation. For instance, the city's 2013 capital budget includes \$2.6 million in funding over three years for a new police station, with a note referencing the master plan's recommendation for co-location of public facilities.¹⁹

Dutch Dialogues and a Water Management Strategy

Dutch Dialogues is the name given to a series of interactions with Dutch engineers, urban designers, landscape architects, and soils and hydrology experts to explore the common challenges of coastal flooding and land subsidence. What started as an initiative led by passionate citizens and professionals led to a planning project in partnership with the city to redesign New Orleans following the Dutch tradition of "Living With the Water."



A comprehensive approach to water management.
Credit: livingwithwater.com

Starting in 2011, influenced by Dutch Dialogues, a group led by Waggonner & Ball Architects began developing a Water Management Strategy for New Orleans. The comprehensive strategy was funded by a \$3 million community block grant from the U.S. Department of Housing and Urban Development to the Louisiana Office of Community Development-Disaster Recovery Unit.²⁰ The plan will be

formally released in the summer of 2013 but a handful of pilot projects are underway to test strategies and demonstrate results.

One of the pilot projects, the Pontilly Stormwater Hazard Mitigation Project, is a strategy to expand green spaces and utilize vacant lots to mitigate flooding at the community level. Funding for the project comes from a \$15 million award from FEMA's Hazard Mitigation Grant Program. The Pontilly Project, named for partnership with the Pontchartrain Park and Gentilly Woods neighborhoods, developed three scenarios based on minimum, middle and maximum interventions. The estimated costs range from \$7.2 million or \$7.60 per cubic foot of reduced peak stage flooding, to \$15.8 million and \$8 per cubic foot in the maximum option. In addition to the financial feasibility of the program, a neighborhood livability analysis demonstrates benefits to quality-of life through recreation and walkability that are not captured in the cost-benefit analysis of storm water management.²¹

Climate Change Summary

As demonstrated by the above case studies, cities are beginning to pursue adaptation and resiliency strategies to reduce the impact of climate change. Flood control is the number one adaptation measure being taken to prepare for climate change. New York could look to cities like New Orleans who have similarly already been affected by extreme storm events.

In addition to preparing cities for inevitable impacts of a changing climate, cities also realize that they have a role to play in mitigation. One of the key actions to slow climate change is to reduce energy use and use alternative sources of energy that release fewer greenhouse gases. In the following section, we will draw attention to what some cities are doing in the area of Energy.

Energy

The Energy category is defined by cities' initiatives to reduce energy use and secure reliable energy production, distribution, and consumption. This includes supporting renewable energy, implementing energy efficiency measures, and promoting smart grid technology development.

New York City could look to:

- Copenhagen's combined heat and power (CHP) system that reduces energy use;
- Philadelphia's Energy Efficiency Hub to test and develop new energy saving technologies;
- London's heat map and energy decentralization to identify and reduce energy use;
- San Antonio's solar development project to reduce energy costs and stimulate job growth, as well as smart growth; and
- San Diego's plans to increase municipal renewable generation capacity.

Efficient, Extensive and Green Heating: CHP in Copenhagen

Copenhagen has one of the world's largest district heating systems, supplying 98% of buildings in the city with steam from combined heat and power plants (CHP).²² District heating, combined with CHP plants, greatly increases heating energy efficiency. District heating is approximately half as expensive and produces half the greenhouse gas emissions as an oil-fired incinerator in a residential home.²³ In 2005, Copenhagen's system replaced 950,040 tons CO₂.²⁴ District heating in the city dates back to the 1920's, though large expansions were made in the 1980s as a mean to increase energy independence after the 1970s oil embargo.



Avedøre CHP Plant, south of Copenhagen.
Credit: Ramboll

Copenhagen's energy system connects the metropolitan area to four CHP plants, three waste incineration plants, and 50 peak load boilers. Copenhagen Energy owns the system and cooperates with different heating companies to form strategic plans for further development of the system. Utilizing waste heat from CHP plants greatly increases efficiency; for example, one modern plant has a 94% conversion rate. Plants are also increasing the share of renewables, such as biomass, in the CHP energy mix; fossil fuel-based heat generation is heavily taxed, while cleaner sources like biomass and waste are exempted from an energy tax. District heating systems could incorporate other renewables like geothermal, solar heating and heat pumps into the system. The city also plans to convert from steam-based heat to water-based heat, which is more efficient and can provide thermal storage.

Fostering Innovation: Philadelphia's Energy Efficiency Hub

Like many cities, Philadelphia's sustainability plan, Greenworks, is largely focused on energy management issues, which covers about one third of the report. Alex Dews, the Policy and Program Manager of the Office of Sustainability said the city largely targets energy because of the payback associated with energy efficiency.²⁵ One of Greenworks' targets is to reduce government energy use by 30% and overall building energy consumption by 10% by

2015.²⁶ The Mayor's Office has created an Energy Efficiency Fund that will accept competitive applications for funding from city departments to reduce city buildings' energy consumption.²⁷

In order to advance energy efficiency measures in Philadelphia, the city has created one of the nation's first Energy Innovation Hubs at the Navy Yard, a former Navy site outside the city center. Hundreds of buildings on the site are powered independently by the city grid, thus enabling the city to test new energy-saving technologies in the buildings where they are being developed.²⁸ The hub is largely funded by the U.S. Department of Energy, which has allocated \$122 million over a five-year period for research and development of energy efficiency.²⁹ According to Jeffrey Knowles of PECPA, a statewide non-profit, the hub aims to commercialize technology so that businesses and residents have access to better, less-expensive energy efficiency technologies.³⁰

Dews sees energy efficiency measures as a way to engage the public and to build public support. The Office of Sustainability has focused on helping residents and businesses make improvements through a program called EnergyWorks, which provides technical assistance and low-interest financing to businesses and homeowners. According to Dews, these measures also help to engage residents in sustainability. Furthermore, he noted that because of the savings realized through municipal energy efficiency efforts, future mayors would be hard pressed to abandon the energy programs established by Mayor Nutter.³¹

Combined Power and Heat: London

In 2007, the Parliament of the United Kingdom passed an act giving the mayor of London greater authority to reduce greenhouse gas emissions, within a national framework of climate change mitigation and energy policy.

The act granted the mayor clear authority over key public and private stakeholders in London to reduce emissions 60% by 2025, below 1990 levels.

Mayor Boris Johnson has utilized extended mayoral authority to pass emission-reduction energy policies including decentralized energy. In 2011, he commissioned the London Heat Map to identify the areas of the city that use the most energy and heat. By 2025 the city hopes to decentralize 25% of its heat, by designating micro-grid combined heat and power systems. Funding for this project has come from the European Union, which funded benchmarking studies, and also national programs like the UK's feed-in tariff.

The city has also implemented retrofitting programs for commercial and residential buildings. The programs function as public-private partnerships, whereby the local government appoints private companies to provide energy conservation upgrades. This model is anticipated to achieve an annual CO₂ reduction of 3.5 million tons, a tenfold increase in generating capacity and encouraging a potential \$7-10 billion USD of investment.

Capturing the Sun: San Antonio's Solar Plan

San Antonio is the second largest city in Texas, the seventh largest in the United States, and is also one of the fastest growing cities in the nation. San Antonio adopted the Mission Verde Sustainability Plan in 2010 with the intent to reduce energy costs and to catalyze job growth and innovation, while also prioritizing water conservation and smart growth.

Sustainability in San Antonio encompasses more than pollution reduction. Mission Verde is an economic development strategy designed to pay for itself. The Plan supports green jobs, reduces city costs and supports industries. Of these new industries, solar energy holds great

potential. In 2012, with funding from a Solar America Cities grant by the United States Department of Energy and support from dozens of stakeholders, San Antonio's Office of Sustainability produced the City of San Antonio Solar Development Plan. Integrated within the larger framework of Mission Verde, this plan "identifies a set of stakeholder-recommended strategies, concepts, goals, and action steps that will increase San Antonio's leadership in the solar industry." The plan seeks to guide solar development on a regional scale and uses 2015, 2020 and 2030 as benchmarks.

The solar plan acknowledges the success of the city in reaching its solar energy objectives ahead of schedule, specifically within the area of utility-scale generation. The local utility, CPS Energy, is municipally owned and has been responsive to public policy direction.³² Through collaboration with companies such as Duke Energy and SunEdison, CPS currently has more than 44 MW of solar capacity, with plans for another 400 MW through a partnership with OCI Solar Power.³³ This development will form the largest municipal solar project in the nation and will provide enough energy for nearly 10% of San Antonio households. Other aspects of the agreement include new headquarters for OCI Solar Power, a \$100 million solar panel manufacturing operation, and more than 800 professional and technical jobs, all located in San Antonio, with \$700 million in annual economic impact.³⁴



Blue Wing solar array.
Credit: CPS Energy

The city is now focusing its solar development plan on expanding into distributed generation, as well as consolidating regional efforts to build a solar industry and reassess progress and benchmarks. It is clear that key factors in San Antonio's achievements have been its policy initiatives, its engagement with a variety of stakeholders and its ownership of CPS, which provides it with the ability to pursue capacity building and partnerships.

Cogeneration & Direct Generation: San Diego

In the last decade, San Diego predicted a growing regional population and increased energy demand. The city realized that its path to sustainability required an improved energy infrastructure that incorporated diverse, reliable, and self-contained sources. Facing the challenges associated with growth, San Diego created a plan to create 100 MW of clean energy generating capacity, to be accomplished by increasing renewable energy usage by 50 MW by 2013 and reducing consumption by the same amount by 2020. Currently, 50% of the city's municipal energy needs are met by renewable energy generated at city facilities.³⁵

In its Energy Strategy for a Sustainable Future, San Diego describes political support for its energy ambitions, citing several state initiatives as well as the federal Energy Efficiency and Conservation Block Grant Program (EECBG). California has regulations mandating a 33% renewable energy makeup for state utilities by 2020, as well as state law AB 32, which mandates greenhouse gas reduction through energy efficiency and clean energy generation.³⁶

The San Diego City energy plan set six objectives. One of the key objectives calls for increasing renewable energy usage at city facilities, an apparently feasible goal given San Diego's success thus far. As of 2009, city facilities produced 19 MW of renewable energy from landfill methane, wastewater treatment

plant methane and hydroelectricity, and city-operated photovoltaic systems. These facilities are linked to each other and support collective generation activity. For example, methane produced from the Miramar Landfill provides 90% of the fuel used to power generators³⁷ at the Metro Biosolids Center, which in turn generates methane of its own from on-site digesters.³⁸ The sludge used in digesters at the Biosolids Center comes from the Point Loma Wastewater Treatment Plant, which also has on-site digesters that produce methane for power. Additionally, Point Loma operates an effluent-driven hydroelectric plant, which along with the methane, makes the facility self-sufficient in energy and allows the excess to be sold to the grid.³⁹ The solar power is generated from panel installations at a variety of city facilities, including libraries, water treatment plants, fire stations and the police and Environmental Services Department headquarters.⁴⁰

Through a combination of funding sources, San Diego has successfully expanded its municipal renewable generation capacity. It has leveraged resources such as state and federal grants, as well as low-interest loans. An existing collaboration between the city, the California Public Utilities Commission and San Diego Gas & Electric, is funded through utility rate-payers, providing millions of dollars for a broad range of projects.⁴¹

Energy Summary

Cities across the country and the world understand the central role energy plays in cutting costs, reducing GHG emissions, and growing the economy. Investments in renewable energy and energy efficiency measures also improve overall air quality. Air quality and energy, similar to other functional areas, are inextricably connected. For the purposes of the report, we treated the two as separate functional areas and will explore air quality innovations below.

Air Quality

Urban air quality is affected by stationary sources such as electricity-generating facilities and manufacturing plants, mobile sources such as vehicles, and the geographic context of a city. Our consideration of air quality as a functional area includes initiatives such as monitoring and modeling air quality, as well as updating policies, codes and regulations to improve air quality.

- Cities such as Los Angeles, Indianapolis and Houston have chosen to address air quality impacts through policies aimed at automobile and truck emissions.
- Municipal fleets and city departmental operations present opportunities to make large-scale changes to vehicular air emissions.
- In addition, innovative partnerships aimed at changing the driving public's vehicle purchase decisions toward electric vehicles can also make inroads toward reducing harmful pollution from personal automobiles.

Green My Ride: Indianapolis' Green Fleets

While cities have been greening their fleets for many years, in late 2012, the City of Indianapolis announced the first municipal plan to convert its entire fleet to run on alternative fuels. Executive Order #6 aims to phase out the city's 3,100 vehicles, and replace them with vehicles running on alternative fuels by 2025.⁴² Mayor Ballard has cited America's dependence on foreign oil as a major reason for announcing the executive order. He believes that this transition will help Indianapolis contribute to national security and hopes other cities will recognize the benefits of this transition.⁴³

The plan contains three major initiatives. The first involves the replacement of 500 non-police vehicles as needed, which is expected to save \$12,000 per vehicle over a ten-year life cycle.⁴⁴

Next, approximately 200 heavy fleet vehicles, such as snowplows, garbage trucks and fire trucks, will be converted to operate using Compressed Natural Gas (CNG). Indianapolis is currently working with energy and finance experts to make this conversion economically feasible.⁴⁴ The last initiative involves converting police vehicles to plug-in hybrids. These hybrids will serve to increase the fuel economy from about 10 to 40-50 miles per gallon, and could save the City of Indianapolis up to \$10 million per year.⁴⁴

This last initiative is thought to be the most difficult to accomplish because plug-in police cars are not readily available. The city is in the midst of negotiating contracts with automakers and international capital fleet firms in order to make the transition worthwhile.⁴⁵ Mayor Ballard hopes to change the status quo by offering up his city as a laboratory to any automobile manufacturer interested in testing more fuel-efficient solutions for police vehicles that can also meet the demands of the job.⁴³

Mayoral Directive: Lowering Transportation Pollution in Los Angeles

Mayor Villaraigosa's Executive Directive No. 10, issued in 2007, drives sustainability in Los Angeles.⁴⁶ The directive requires that city agencies create and adopt departmental sustainability plans that address issues such as energy and water use, designates Sustainability Liaisons within each department, and requires annual sustainability reports. Information disclosure has been an effective sustainability tool because the City departments are proud of their achievements, and eager to highlight these efforts to city council and management.

Los Angeles' sustainability plan includes climate change and the environment in general, but air quality is a top priority. Air quality is a serious public health issue for Los Angeles, where 3,500 or more deaths per year are attributed to air pollution.⁴⁷ Personal vehicles are a significant

source of harmful emissions, and the city addresses local air quality from vehicles by synchronizing all of its traffic lights to reduce idling.



Los Angeles smog. Credit: David Iliff

Among the suite of air quality programs implemented by the Port of Los Angeles is the Clean Truck Program, which addressed local air pollution from the diesel “drayage” trucks that carry containers from the port via local roads and highways. The Clean Truck Program accelerated the replacement of older, high polluting trucks with newer, cleaner trucks through the use of a concessions system, grants, and financial incentives; the result was an 80% reduction in emissions.⁴⁸ The LADWP controls vehicle emissions through its “Green the Fleet Program,” but also supports a plan to supply shore power to ships berthed at the Port of Los Angeles through Alternative Marine Power Systems.⁴⁹

Public-Private Partnerships: Houston’s EV Charging Stations

Spanning over 600 square miles, Houston is the fourth largest city in the United States, with a metropolitan population of 6 million. The city is also home to the nation’s second largest port and the second largest petrochemical complex in the world. Due to its high rate of automobile use and proximity to heavy industry, the Houston region has suffered from poor air quality. Many of the largest industrial polluters are outside city limits; therefore much of the

action to improve air quality is handled by local Department of Health and Human Services offices, as well as independent groups like Air Alliance Houston.

Although Houston has a strong mayoral system, the political and business culture of the city, as well as financial realities, limit the viability of executive decrees. Still, the Office of Sustainability and other city departments have taken measures to control building and transportation emissions, including a program to promote conversion to electric vehicles (EVs), known as Houston Drives Electric. To this end, Houston has partnered with two companies, eVgo and ECotality, as well as the Clinton Climate Initiative, the C40 Cities Climate Leadership Group, the Texas State Office of Energy Conservation (SECO), United States Environmental Protection Agency (EPA) and Department of Energy (DOE) to develop an EV readiness plan and related infrastructure throughout the city. To support program design, the City produced a sequence of documents.⁵⁰ The Long Range Plan examined the feasibility of travel ranges for EVs in the region and the long term plans for deployment.⁵¹ The Micro-Climate plan describes effective means of implementation in the short term that will serve the needs of EV drivers.⁵²



Nissan LEAF at eVgo Station. Credit: eVgo

The EV stations are produced by eVgo and ECotality.⁵³ Each station has space for at least two cars simultaneously,⁵⁴ and different levels of charge speeds have been deployed. Slower

chargers (45 minutes to three hours) are installed in public locations, while DC fast chargers (less than 15 minutes to recharge depleted batteries) are prioritized for widespread installation at non-municipal sites throughout the region.⁵² According to ECOtality, customers will have the ability to pay for charging at the stations through smart phones and credit cards.⁵⁵ Since breaking ground in 2011, the city has exceeded its original goal of 50 public stations and created 250 EV charging stations across greater Houston. The CEO of the C40 Cities Initiative, Jay Carson, described the program in glowing terms, praising its public-private collaboration, as well as its speed of development, cost-effectiveness, convenience, and accessibility to drivers.⁵⁶ Utilizing funding from the State of Texas (SECO, Texas Commission on Environmental Quality) and federal agencies (Department of Energy, Environmental Protection Agency), as well as effectively partnering with companies and non-profit stakeholders, the City of Houston has quickly constructed a wide network of EV charging infrastructure.⁵⁷

DC Fast Charger Annual and Cumulative Installations in Greater Houston, 2011-2020:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual Installations	50	30	30	40	60	70	90	110	130	140
Cumulative Locations	50	80	110	150	210	280	370	480	610	750

Credit: City of Houston. "Electric Vehicle Charging Micro-Climate Plan for the Greater Houston Area," June 2011.

Air Quality Summary

Air quality is a public health issue for cities, but reducing the impacts of vehicles emissions is far from straightforward. Though the sheer quantity of vehicles on the road presents a challenge to regulators, cities such as Los Angeles, Indianapolis and Houston have enacted policies aimed at improving air quality that target the largest emitters, such as municipal vehicle fleets, major city agencies and departments, and the driving public. Similarly, waste management begins with regulating the largest generators, and waste reduction policies must also influence a cultural shift in the public's practices. We explore successful waste management strategies in the following section.

Solid Waste

Solid waste concerns every aspect of a city's waste, including municipal waste, industrial and hazardous waste, organic matter, recyclables, and commercial refuse. Currently the United States landfills more than two-thirds of its solid waste and generates nearly double what Japan and Europe produce per capita.⁵⁸ In addition to concerns about air pollution from incineration, current waste disposal methods greatly contribute to climate change, with landfills accounting for the largest manmade source of methane in the United States.⁵³

In order to manage waste sustainably, cities must foster technical, managerial, and behavioral changes in conventional solid waste streams. The old adage “reduce, reuse, recycle” still holds true and many sustainability waste experts are adding “recovery” to the saying.⁵⁹ In order to meet these overarching goals, cities are employing a wide variety of strategies and tactics.

Some innovations include:

- Laws which place responsibility for waste disposal with producers and therefore motivate them to produce less of it;
- Measures that ban or tax to-go packaging and bags;
- Composting programs; and
- Low-emission waste-to-energy facilities.

The following case studies highlight different methods of handling municipal solid waste management, all with the goal of diverting solid waste from landfills.

All Together Now: Single-Stream Recycling in Philadelphia

Since 2009, when Philadelphia released its comprehensive sustainability plan, Greenworks, recycling has been a major success story. In the three years between implementing the plan and updating it in 2012, the city more than

tripled curbside recycling rates, primarily through instituting single-stream recycling and an incentive program. Through Greenworks, Philadelphia set an ambitious target to divert 70% of the city's waste from landfills by the year 2015, up from 53% in 2008. By 2010, the city had exceeded its goal, hitting a 72% total diversion rate of solid waste.⁶⁰

While the city increased waste-to-energy (26% in 2010, up from 16% in 2008), it also greatly expanded recycling. The city began customer-friendly single-stream recycling and expanded acceptable products, including all liquid and beverage cartons and plastics #1-7.⁶¹



Philadelphia's recycling public awareness campaign.
Credit: Mayor's Office of Philadelphia

According to Alex Dews, the Policy and Program Manager for Philadelphia's Office of Sustainability, single-stream recycling has been a great engagement tool to involve households in Greenworks. Furthermore, along with reducing waste and engaging the public, the recycling program actually generates revenue for the city.⁶²

In addition to making recycling easier, Philadelphia has improved participation rates and generated revenue through a recycling rewards program, run by the private company Recyclebank. Through the partnership, Recyclebank encourages residents to place barcodes on home recycling bins, which city sanitation workers scan during weekly recycling pick-up. Every time participating households recycle, they earn rewards that can be redeemed online for coupons and discounts. In just one year of outreach, the city and Recyclebank increased rewards program

participation by 45%, enrolling more than 185,000 households.⁶³ This is an innovative model that allows the city to collaborate with a private company to increase participation in recycling. Dews stressed that the Recycle Bank program engages residents in a city-wide sustainability activity that acknowledges individual participation with a small reward, which makes a big difference.⁶⁴



Philadelphia's recycling stickers.
Credit: *The Philadelphia Public Record*

In 2012, the Philadelphia started considering contracts that would divert nearly 100% of municipal solid waste from landfills in the next two years.⁶⁵

A Carrot and a Stick for Behavior Change: Incentives and Penalties in San Francisco and Copenhagen

San Francisco

San Francisco's aggressive programs to manage solid waste go back many years with an interesting legislative history. The primary components of the overall strategy include citywide legislation, producer responsibility, and involvement of the construction and demolition sector.

Currently articulated as "Zero Waste," a critically important step of the city's solid waste strategy came in 2002 with the policy goal to achieve 75% landfill diversion by the year 2010, as well as resolving to set the long term goal of zero waste once a 50% diversion rate was met.⁶⁶ Given the hugely ambitious goal of achieving zero waste, the 50% milestone was set to ensure progress and feasibility before fully committing to the goal. Having surpassed

this milestone, San Francisco now aspires to achieve zero waste by the year 2020. As recently as October 2012, San Francisco reported a diversion rate of 80%, and reaffirmed the 2020 goal.⁶⁷

2009 marked a significant step toward reaching the city's goal, with the implementation of Mandatory Recycling and Composting Ordinance No. 100-09. Met with criticism from residents and businesses, then Mayor Gavin Newsom assured residents that fines would only be incurred by the most egregious offenders. In addition, the grace period following passage of the ordinance allowed residents and businesses until July 2011 to adequately prepare for the new law.⁶⁸ In October 2012, San Francisco Department of Environment Director Melanie Nutter attributed the success of the solid waste program to innovative policies, financial incentives, outreach and education.⁶⁹

The success of San Francisco's waste strategy is primarily attributable to strong incentives imposed by legislation as well as the simplicity of use of the "Fantastic Three" bin system, which places recyclables in blue bins, compost in green bins, and trash in black bins. Success of the ongoing programs has much to do with extensive outreach by the San Francisco Department of Environment and the waste management company Recology.⁷⁰



San Francisco's three bin solid waste system.
Credit: *www.greenlichen.com*

San Francisco's successful waste strategy owes much to its close partnership with Recology, with President and CEO Michael Sangiacomo playing a strong role. However, there is currently controversy surrounding this relationship and the City of San Francisco recently revoked a 10-year, \$112 million contract following lawsuits of a non-competitive bidding process and inadequate environmental review. Some even call Recology a monopoly, as it owns all 97 waste permits.⁷¹

Copenhagen

How does a city reduce its landfilled waste to just two percent? The city of Copenhagen has increased recycling to capture 60% of municipal waste, and incinerates the rest of their trash, leaving just a small fraction for landfills. Two decades ago, the amount of landfilled waste was 20 times higher, and now the Danish capital has turned waste into a valuable resource.⁷²

The Waste Plan of 2008 laid out several new initiatives for improved recycling in Copenhagen. The city has a strict agreement with both private and public waste contractors, ensuring that only separated waste is removed from households. For example, if glass and metal cans are not removed from household garbage, sanitation workers will not remove the trash. In promoting recycling, the city found that a central problem was that people did not know the importance of recycling and did not clearly understand how to properly sort their waste. Therefore, the city developed a "caretaker" designation, whereby residents on each street block teach their neighbors how to recycle and dispose of waste correctly.⁷³

In order to spur the development of waste-to-energy, national legislation started taxing landfilled waste at a rate ten times that of incinerated waste. Now, it is illegal to landfill waste if it can instead be incinerated.

Banning the Bag: D.C.'s Bag Law

Washington, D.C.'s 2011 Bag Law, also known as the Anacostia River Clean Up and Protection Act, is the first of its kind in the U.S. and has made a huge impact in reducing the amount of garbage in the city's waterways. Prior to the law, about 47% of the trash in the Anacostia River's tributaries and 22% of the trash in the main stream was derived from plastic bags.⁷⁴ The law requires District businesses that sell food or beverages to charge customers five cents for each disposable plastic or paper carryout bag.⁷⁵ Businesses keep one to two cents, while three to four cents are diverted to the Anacostia River Clean Up and Protection Fund, a special purpose fund managed by the District Department of the Environment (DDOE).



"Skip the bag save the river" slogan for DC's Bag Law.
Credit: green.dc.gov/bags

According to John Heermans and Dan Guilbeault from DDOE, the fund is used to implement watershed education, stream restoration, and trash retention programs, as well as to purchase and distribute reusable bags. The Bag Law also requires that reusable paper and plastic bags meet specific material and labeling requirements.

Despite little control over disposable bags entering waterways from Maryland, the number of bags found in District waterways has decreased dramatically thanks to the law.

According to Kate Judson from DDOE, a 2013 survey of over 600 residents from across the District of Columbia found that 80% of city residents have reported a reduction in the average use of disposable bags since the law went into effect.⁷⁶ In addition, the survey found that households are using about four disposable bags per week, whereas prior to the law, they used about ten disposable bags per week.

While many similar bag bills across the country have been defeated, many in Washington, D.C. attribute the disposable bag fee bill's success to a strong education campaign, which included speaking with businesses and local groups, courting political allies, and ensuring part of the bag charge was directed to retailers to cover costs.⁷⁷ In order to ease implementation of the Bag Law, DDOE staff spent the first year after the law took effect conducting outreach to District businesses, residents and bag manufacturers and distributors. DDOE designed and distributed cash register decals and window flyers with a "Skip the Bag Save the River" logo for businesses to display. DDOE outreach staff also created television and radio advertisements to raise public awareness. In addition, DDOE partnered with businesses, including CVS/pharmacy and major supermarket chains, to distribute reusable bags to customers. DDOE also created a Skip the Bag Save the River website (www.green.dc.gov/bags) that includes links to the law and regulations, a tip line for reporting problems, outreach materials catered to businesses, media releases and a FAQ page about the law.

The sponsor of the Bag Bill, D.C. Council member Tommy Wells, built support for the measure by meeting with grocery stores such as CVS, environmental groups, local religious groups, and others. Realizing that low-income residents could be affected the greatest by the law, Tommy Wells and his staff reached out to these stakeholders first to raise awareness and build support for the measure.⁶³ Washington, D.C.'s bag bill has been so successful that the city is assessing the feasibility of a bottle bill, which would essentially reimburse people for depositing beverage containers in order to incentivize recycling.

Solid Waste Summary

Every city faces the challenge of how to reduce, recycle, and dispose of its waste. This functional area is particularly relevant for New York where high population density has led to increasingly complex solid waste issues. Years ago, the city used to burn its trash in incinerators. When this practice led to air quality issues, transporting waste from the city to other areas became the norm.

Transportation of waste, goods, and people presents its own set of challenges; these include costs, greenhouse gas emissions, and air quality issues. This leads to our next functional area: transportation.

Transportation

Transportation is defined as relating to improvements in existing transportation systems and infrastructure as well as expanding, investing and implementing new or different modes of transportation. Both technology and management play key roles for this sustainability area, which includes such initiatives as investing in hybrid electric vehicles for a city's fleet, instituting bike share programs and bicycle lanes, enforcing parking limits, and reducing air pollution and noise from the transport sector.

This report identified the following examples of innovative transportation planning:

- Bogotá's innovative bus system and bike path network;
- Copenhagen's extensive bike path network and bikeshare program;
- Hong Kong's Octopus smart card, which can be used for public transport, retail shopping and more;
- San Francisco's congestion pricing, carpooling, and variable pricing parking scheme;
- Washington, D.C.'s popular bikeshare program; and
- Multi-city carpooling incentive program through NuRide.

Buses and Bikes: Bogotá

Despite the ability for only the affluent to afford vehicles, Bogotá is a city built with cars in mind. Transportation in Bogotá used to be mired in traffic congestion, accidents, pollution and inequality issues. Private cars occupied 64% of the roads, while only 19% of the population drove the vehicles.⁷⁸ Former Bogotá Mayor Enrique Peñalosa's plan established two of the largest transportation projects in the city's history: Transmilenio and Ciclorutas. Since the plans were enacted, traffic death rates decreased by 50% and car traffic has been reduced by 22%.⁷⁹

Transmilenio

Mayor Peñalosa's vision for Transmilenio was a modern high-speed bus service connecting Bogotá through affordable public transportation. Despite significant opposition from politicians who preferred a fixed rail system to busing, and private bus drivers fearing for their jobs, the mayor managed to see his vision implemented. Now, about 1.5 million passengers use the Transmilenio system each day.



A Transmilenio bus in Bogotá.
Credit: Jorge Láscar/ Wikimedia Commons

Transmilenio's primary routes are fed by smaller routes and bus lanes are separated from car lanes. The system includes elevated stations every 500 meters and modern buses that can hold up to 160 passengers. The new bus system has reduced commuter traveling time by 32%. Buses run three times as fast as a typical New York bus. Traffic congestion and air pollution have diminished, and greenhouse gas emissions have been fallen by 40%.⁸⁰

Transmilenio has been so successful that it is eligible for additional revenues from carbon credits through the UN Clean Development Mechanism.⁸⁰

Transmilenio's success can be credited to a variety of factors. The mayor's strong support helped promote the program, as did its public branding campaign. Mayor Peñalosa created a team separate from his administration to oversee the implementation of Transmilenio. The Mayor also managed to turn some of the

strongest opponents, the existing private bus sector, into supporters by developing a public-private partnership that included these stakeholders in future operations.⁸¹ A from-scratch design approach made it easier to build and optimize a cost-efficient system with modern technology.⁷⁰

Ciclorutas

At more than 340 kilometers, Bogotá's Ciclorutas forms one of the world's most extensive bike path networks. Since its implementation, bicycle usage has increased fivefold in the city, with 320,000 daily trips, a large portion of which take place in poorer districts. The Ciclorutas was designed with careful consideration for the city's topography, optimizing the ease of bike travel. The system's bike paths are separated from car lanes by different methods, such as painted lines, space between lanes, cones and paved cement, which have increased cyclists' safety and willingness to use the system.



Ciclorutas in Bogotá.
Credit: idu.gov

Establishing Ciclorutas was expensive, as the system includes high-quality paved bike roads. The network now consists of three sections. The main section connects key city centers, including education and work areas, with the most populated residential areas. The secondary network connects residential areas to parks, attractions and public transportation like the Transmilenio bus system. All main bus stations have guarded bike parking facilities close by. The tertiary network connects bike

paths to recreational areas like wetlands and riverbanks.

Human-Powered Transportation: Bikes in Copenhagen

As many as 36% of Copenhageners cycle to their workplace every day.⁸² In other words, more citizens commute by bicycle in greater Copenhagen, an area of 1.2 million people, than do citizens in the entire United States.⁸³ Copenhagen has a network of cycle routes along all major roads, transportation hubs such as train stations, and recreational areas, including parks and waterfront areas. Copenhagen's bike lanes total roughly 400 kilometers of cycle track. The standard width of lanes is 2.5 meters, or roughly 8.2 feet. The system aims to integrate cycling with public transportation. Cyclists can purchase a parking ticket for a locked bike parking space in train stations or they can bring their bike on trains and subways for free, except during rush hour.⁸⁴ While in traffic, the cyclist has an advantage over motorists because bike traffic lights turn green a few seconds earlier than car traffic lights.

Green Cycle Routes is one of the newer initiatives encouraging bicycle usage. It is a cohesive network of long distance cycle and pedestrian routes, intentionally built through open, recreational areas such as parks, waterfront areas, and minor roads. Special cyclist and pedestrian bridges, which link together important paths, are one of the most important components of the system. By reducing travel times and improving the rider experience, Green Cycle Routes encourages more people to cycle.

If you want to use a bike in Copenhagen, you can obtain one easily and inexpensively through the city's bikeshare program. Copenhagen's bikeshare system includes more than 120 bike stations. In order to reduce maintenance costs, Copenhagen's program

bikes have puncture-proof tires and a heavy-duty frame. The system is funded by both sponsorships and advertisement revenues, and managed by the City Bike Foundation, an NGO that operates and maintains the bikes, while city government supplies the stations and bikes.

The city has estimated that every kilometer travelled by bike instead of car provides a net societal gain of \$0.21 and saves the city \$297,430 in health expenses each year.²² A strong focus on safety has reduced bicycle accidents, while bicycle usage has grown during the last 10 years. In addition, one study concluded that adults commuting daily by bike reduce their mortality risk by 30%.⁸⁵

The Octopus: Paying for Mass Transit in Hong Kong

In Hong Kong over 90% of the population uses public transportation, the highest rate in the world. Urban density, mountainous terrain, and lack of private vehicle ownership play a large role in encouraging public transportation. However, the rapid upgrade and expansion of the public transportation system has been due to the introduction of the Octopus Card. The Octopus Card, launched in 1997, is a smart card that holds a currency value. 95% of Hong Kong residents from ages 16 to 65 use the card, which captures over 12 million daily transactions worth over \$16 million USD.



Octopus Card at the point of sale.
Credit: Andrew Currie

Today, cards can be used for parking meters, movie theaters, public facilities such as pools and parks, clothing stores, restaurants, and all commuter-related purchases. At schools it can be used for counting attendance, purchasing meals, and even paying tuition. In 2000 the Hong Kong Monetary Authority granted a deposit-taking license to the holding company, allowing customers to expand the use of their cards, add more value, and earn interest.⁸⁶

Due to the vastness of the system, Octopus cards are scanned at entry and exit of the metro system in order to fairly charge for distance traveled as opposed to a flat fare for unlimited travel. Other benefits include streamlining travel, reducing lines, minimizing cash handling, reducing the risk of fraud by customers and cash theft by staff, improving the customer experience, and reducing the annual operating costs associated with operating transport ticketing systems.⁸⁷

The Hong Kong Mass Transit Railway (MTR) was privatized in 2000, but the government remains a large stockholder, with the Transport and Housing Bureau overseeing the system.⁸⁸ As one of the world's only profitable transportation systems, the MTRC has bought and developed properties over new and existing stations and expanded its availability to Shenzhen commuters in mainland China. The smart card system has been so successful that it has been contracted out to the Netherlands, Auckland, and Dubai, and MTR now operates transit in Hangzhou, Beijing, London, Stockholm, and Melbourne.⁸⁹

If You're Driving to San Francisco: Car Programs

California is a state synonymous with traffic jams, and San Francisco is no exception. Traffic congestion is a serious crosscutting issue, affecting human health, economic activity, and greenhouse gas emissions. To address this complex problem, San Francisco has

established a wide variety of programs designed to reduce congestion.

Congestion Pricing

As a top-down approach, the San Francisco County Transportation Authority (SFCTA) has established a congestion-pricing scheme, charging higher tolls to cross the Bay Bridge between 5 a.m. and 10 a.m. and from 3 p.m. to 7 p.m. The scheme raised prices for these peak times from \$4 to \$6. By comparison, a toll for the carpool lane is only \$2.50.⁹⁰ This pricing scheme is designed to alleviate downtown congestion as well as to generate revenue for the transportation system, as gas tax revenue has declined with increased fuel efficiency. There are conflicting views on the efficacy of the congestion-pricing program thus far, though the Bay Area Toll Authority claims congestion has decreased 15% below 2009 levels within the first six months of implementation.⁹¹



Credit: San Francisco Transportation Authority

San Francisco's online tool "Budget Czar" is a novel example of how a city can engage stakeholders in a controversial policy area. Budget Czar enables residents to express how they would allocate San Francisco's transportation dollars. The SFCTA plans to use feedback from the Budget Czar tool to inform budgeting decisions.⁹²

Casual Carpool

Existing prior to San Francisco's congestion pricing scheme was "Casual Carpool," an informal system in which drivers transported riders into downtown San Francisco. Casual Carpool is described as "informal carpools that form when drivers and passengers meet—

without specific prior arrangement—at designated locations."⁹³ The longstanding, unregulated practice provides a unique example of a grassroots solution to the complex problem of traffic congestion. One website states that casual carpooling provides rides for roughly 5,000 commuters daily in San Francisco, saving time, money and fuel.⁹³ Riders and drivers can select from 24 pickup points to meet, but the system is so popular that additional pickup points are becoming more necessary. The Casual Carpool community operates on the Internet, coordinating on discussion boards. Because casual carpooling is an informal process, it is difficult to effectively measure ridership. However, given the incentive to carpool by the variable Bay Bridge Pricing scheme, Casual Carpooling is expected to increase in popularity.



A Casual Carpool sign in San Francisco

Credit: chinwagge.com

SFpark

Another innovative program is San Francisco Municipal Transportation Agency's (SFMTA) SFpark program. Currently in the pilot phase, the SFpark program was launched in 2011, made possible by a Federal grant from the Urban Partnership Program within the Department of Transportation.⁹⁴ SFpark is designed to reduce congestion through a variable pricing scheme for parking. SFpark

“works by collecting and distributing real-time information about where parking is available so drivers can quickly find open space. *SFpark* periodically adjusts meter and garage pricing to match demand. Real-time data and demand-response pricing work together to readjust parking patterns in the city, so that parking is easier to find.”⁸³



SFpark Parking Meter.
Credit: SFpark.org

SFpark is currently testing 7,000 out of 28,000 metered spaces, as well as 15 of 20 city-owned garages. Preliminary evaluations indicate *SFpark* has increased revenues and reduced citations; however the program has not yet demonstrated significant alteration of parking behavior.⁹⁵

Though a more complete congestion-pricing scheme failed in 2008, it seems perhaps more palatable to establish a similar scheme to that of San Francisco by introducing variable pricing on primary arteries with tolls. It is unclear to what extent casual carpooling could be effective in New York City, but anecdotal evidence indicates it occurs daily on the George Washington Bridge, so motorists could take advantage of a carpool toll plan.

My Bike, Your Bike: Bikeshare in Washington, D.C.

D.C.'s bikeshare program is one of the most robust in the nation. Capital Bikeshare currently includes over 1,670 bicycles at more than 175 stations across Washington, D.C., and Arlington

and Alexandria in Virginia. Capital Bikeshare, users have five membership options and can track their ridership online through the Capital Bikeshare Dashboard and trip histories data.⁹⁶ Today, Capital Bikeshare is thought to be the country's largest and most successful bikeshare program in terms of size, ridership, and financial viability.⁸⁵

The initial launch and continued growth of Capital Bikeshare was made possible by \$200,000 from the Virginia Department of Rail, money from the D.C. Congestion Mitigation and Air Quality (CMAQ) improvement program, and an enterprise fund within DOT funded by activities like parking. The predecessor to Capital Bikeshare, SmartBike, was a joint public-private venture between Clear Channel and DDOT that began in 2008 and concluded in January 2011, and also served as a model for lessons learned. Though launched in September 2010, Capital Bikeshare really got off the ground in the summer of 2011 when it offered a discounted annual membership through a Living Social deal. Thanks to the online deal, 25% of members joined the bikeshare program between April and June 2011.⁹⁷

Capital Bikeshare's first-ever citywide survey in 2011, which received 5,000 responses, revealed a number of program successes. Nearly half of those who responded to the survey said they made a trip in the past month that they would not have without access to Capital Bikeshare. In addition, of the survey respondents, 80% reported cycling more often than they had before joining Bikeshare. As a whole, Capital Bikeshare members reduce nearly five million driving miles annually and on average save \$819 a year on personal travel costs. Capital Bikeshare estimates that, accounting for roughly 18,000 bikeshare members in November 2011, the bikeshare program has saved members in aggregate nearly \$15 million each year. The survey revealed a number of other key trends, including cycling leading to

less frequent vehicle use and bikeshare access making business establishments more attractive to program members.⁸⁶

To address safety issues, Capital Bikeshare has partnered with the Washington Area Bicyclist Association (WABA) to offer free bicycle safety classes. Members can also buy a Capital Bikeshare helmet at the time of membership purchase, or when changing or renewing their membership. Members also receive a 10% discount on helmets at select bike stores.⁹⁸

NuRide: Multi-City Carpooling Program

Single occupant vehicle trips result in massive losses to efficiency in the United States, collectively costing 16 million hours per day and \$80 billion annually.⁹⁹ The mission of NuRide, a program that rewards individuals for taking greener trips, is to incentivize biking, telecommuting, carpooling, using public transportation, or even working a compressed week instead of driving solo.¹⁰⁰ NuRide users earn reward points by utilizing greener forms of transportation. Participants earn points for the first two NuRide trips they take each day, in excess of a minimum distance.¹⁰¹ The program is currently available in the following locations: Connecticut; Hampton Roads, VA; Houston; Massachusetts; Richmond, VA; San Antonio and the Washington, D.C. metro area.

NuRiders can redeem reward points for a variety of uses, such as restaurants, retail, automobile maintenance, professional services, entertainment and cultural recreation. Although funded by state and local governments in order to reduce traffic congestion and emissions, NuRide recognizes four groups of sponsors: retailers, restaurants and venues; employers; government/transportation; and organizations/individuals.¹⁰² NuRide tracks exact emissions reductions for greener trips and is thus able to report on specific sponsor impacts for positive media exposure.¹⁰³

Sponsoring organizations can increase their sales, media exposure, green credentials, and even earn LEED certification points.¹⁰⁴

The company does not share members' information with sponsors unless explicitly authorized, and remains completely free to use. Members can use NuRide whenever they like—there are no requirements for daily use, and they are never required to take any trip. Any trip besides driving by oneself in a car is redeemable for reward points, including driving with your spouse.¹⁰⁵ In total, 69,227 NuRide members across the United States have taken 21,078,337 greener trips and redeemed \$3,879,161 in rewards since January 2003.¹⁰⁶

Transportation Summary

Public transportation, cycling, and congestion pricing are just some of the ways cities can get people out of their cars and onto more efficient, environmentally friendly, and cost effective modes of transportation. For those who must drive, incentives for carpooling are helping to reduce the number of cars on the road and the need for parking.

While city population growth increases the need for alternative modes of transport to vehicles, it also exerts pressure on our water resources and aging water infrastructure. Next, we will discuss how cities are overcoming some of these challenges and are preparing for water conservation and management.

Water

New York City is unique in its water supply's ability to meet the projected rapid population growth. However, quality must accompany quantity. Intense precipitation events, predicted to increase as a result of climate change, will continue to place periodic stress on the city's water infrastructure, reducing water quality. Sea level rise creates additional concern for shoreline development and the quality of the city's waterways. Improvements in NYC's infrastructure from small to large-scale projects could improve water distribution efficiency, and combat the pollution that results from combined sewer overflows (CSOs).

Infrastructure projects to improve the quality of waterways include:

- Incentives for property-owners to reduce stormwater runoff in Washington, D.C.;
- Construction of water retention plazas in urban areas in Rotterdam; and
- Disconnection of select inflow sources to minimize CSOs in Minneapolis.

Infrastructure improvements will also improve efficiencies in water distribution and quality.

NYC can look to international projects such as:

- Leakage prevention programs in Tokyo; and
- Water conservation projects in Hong Kong.

Stormwater Control in Washington, D.C.

Washington, D.C. has been proactive in preventing stormwater flooding through initiatives such as the RiverSmart Homes and RiverSmart Communities program. Launched in 2008, the RiverSmart Homes program provides outreach and education, design and construction assistance, materials and incentives to reduce stormwater runoff. The program offers single family homes up to \$1,200 to plant shade trees and other plants native to the Chesapeake Bay area, or to use rain barrels, rain gardens, and pervious pavers. To date, D.C.'s RiverSmart Homes program has

audited more than 2,500 homes in the district, planted more than 1,200 trees, installed 2,500 rain barrels, replaced 65 impervious surfaces, and installed 700 rain gardens and BayScapes.¹⁰⁷

Launched in 2011, RiverSmart Communities offers incentives to owners of a wide variety of property types interested in reducing the amount of stormwater pollution leaving their properties. The program offers rebates for up to 60% of the cost of installing stormwater control elements such as rain gardens, pervious pavement, and rain cisterns. Additional design/build assistance is available to properties in high priority watersheds. The District Department of the Environment (DDOE) has partnered with Casey Trees Foundation, which provides training, inventory, and rebates for tree planting, as well as conducting its own tree planting efforts.¹⁰⁸ RiverSmart Communities has audited 60 properties and installed or planned to install 15 rain gardens, cisterns, and permeable pavement projects at multifamily properties and churches.¹⁰⁹

City wide, the costs of stormwater management are partially covered by two charges that D.C. Water customers receive on their utility bills. The stormwater fee was established in 2001 as a flat fee to single-family residences based on total water consumption. In 2009, the city passed legislation that enabled DDOE to assess stormwater fees based on properties' impervious surface area. District property owners also pay an Impervious Area Charge to D.C. Water. The Impervious Area Charge (IAC) collects fees to help pay for another program, the CSO Clean Rivers Project.

Rotterdam Stormwater Storage

The Rotterdam Climate Initiative considers how architecture may contribute to the flow of water in urban areas during a flooding event. The plan is threefold and encompasses flood

protection, architecture and spatial planning, and rainwater storage.



Rotterdam Museumgarage
Credit: Rotterdam Climate Initiative

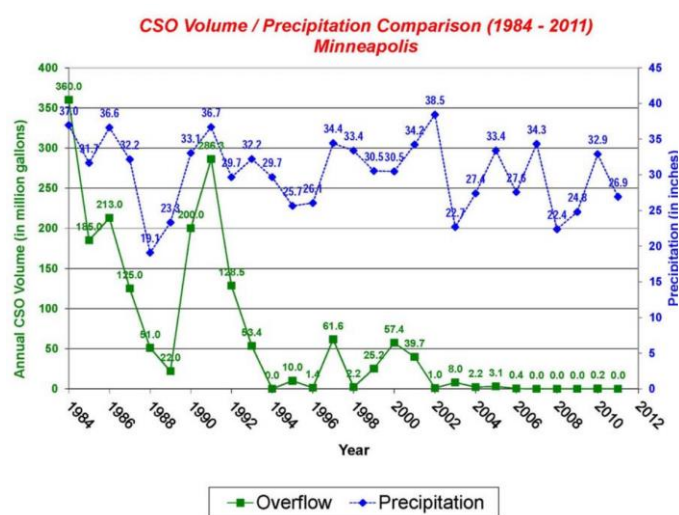
The Rotterdam Water Plan seeks to add an additional 600,000 cubic feet of storm water storage space to manage water during extreme precipitation events.¹¹⁰ Retrofitting of ponds in city parks and adjusting canals to hold more water are two possible approaches to avoid street flooding. Public areas such as playgrounds will incorporate different elevations to accommodate varying volumes of water. The designated flooding areas, known as water plazas, fill in a controlled manner during wet periods, and otherwise act as versatile recreational areas.

Underground parking garages present another opportunity for water storage. A new parking garage near the Museumgarage is the largest water storage facility in the Netherlands, where ten million liters can be captured in thirty minutes.¹¹¹ The structure is large enough to store 50% of the expected volume of rainwater from one storm in the Rotterdam city center.¹¹² The water can then be released slowly once the original burden on the sewer system has passed. Communication with residents during the early planning stages of these projects contributed to their acceptance, as well as public awareness of the risks associated with entering designated flood areas.

Minneapolis: Elimination of Combined Sewer Overflows

Over the last 20 years the City of Minneapolis has attempted to tackle its combined sewer overflows (CSOs) by performing a series of sewer separation projects, specifically targeting CSOs to local streams and the Mississippi River.¹¹³ 1986 marked the start of this two-part separation program. According to the city's annual report, in Phase I, which was supported in part by federal and state funds, storm infrastructure that contributed more than 4,600 acres of surface area to Minneapolis sanitary sewers was disconnected.¹¹⁴ Despite great efforts, these overflows persisted.

In 2001, the city's National Pollution Discharge Elimination System (NPDES) permit was set to expire. This permit required the city to make enough progress on the separation program "that overflows would be nearly eliminated and all but a few of the overflows could be sealed forever."⁹⁸ Although the Minnesota Pollution Control Agency expected resolution by the time of the permit expiration, this was not the case. The city tasked Brown and Caldwell to evaluate the success of the Minneapolis CSO Separation program and identify flow ingress and any modifications that could reduce future overflows.⁹⁸ The study showed that inflow was the major cause of CSOs, rather than infiltration. The data obtained from the Brown and Caldwell study contributed to the implementation of Phase II in 2002. The study recommended that Minneapolis disconnect public sector inflow sources, such as alley and storm drains, disconnect private sector inflow sources, such as rainleader connections, and advised that the city "study and implement storage and conveyance improvements."⁹⁹



Decreasing Annual CSO Volume
Credit: Minneapolis Public Works

In 1984 annual CSO volume was 360 million gallons. In 2011 that number stood at zero. With great success, Minneapolis has had “zero CSO events to the Mississippi River in four of the past five years.”⁹⁸ While CSOs may still occur, the efforts made by the City of Minneapolis and Minneapolis Public Works toward the eradication of CSOs have improved water quality in local waterways and the Mississippi River, extending benefits beyond the borders of Minnesota.

Tokyo Water Leakage Prevention System

The Tokyo Waterworks Bureau is responsible for delivering over five million cubic meters of water each day to the metropolitan area.¹¹⁵ Deteriorating infrastructure and an increased emphasis on disaster management prompted the Tokyo Metropolitan Government to release the Tokyo Waterworks Management Plan in 2007. As a large waterworks corporation, the Bureau has committed to disclosure and access to their technology in order to advance the international field of water infrastructure.

Aged pipes are being continuously replaced with double-pipes with higher seismic resistance.¹¹⁶ Seismic reinforcement of the water purification plant and water supply routes will ensure that important facilities such as medical institutions do not face water

shortages in an emergency situation. In this respect, water infrastructure upgrades have been identified as part of the resilient city efforts.

The reduction of water leakages from a rate of nearly 20% in the 1950s to only 4.2% in 2005 is a testament to Tokyo’s successful approach.¹⁰⁰ The methods of leak detection have evolved from acoustic detection methods in the 1960s to block water metering in the 1970s, to the development of correlative leak detectors and helium gas leak detectors. Special robots provide additional detection technology by inspecting pipes for leakage prevention.¹¹⁷ The combination of planned infrastructure replacement and diligent monitoring using leak detectors reduced the leakage rate to 3.3% in 2007.¹¹⁷ The effective use of household investigations to find and repair hidden leaks, and focus on same-day repair work has halved the amount of water wasted by the city in the last ten years.

Water infrastructure improvements are measured against an index of facility indicators. Progress is measured in three categories: steadiness of water supply, quality and safety of water, and customer confidence in the tap water supply. Specific indicators include the elimination rate of old piping, water supply availability in the event of drought, power failure or other accident, and rate of resistance of infrastructure. Facility improvements were funded through enterprise loans, government subsidies, general account transfers, and other fiscal resources.¹¹⁸

Water leakage prevention has financial and environmental benefits. Cost for leakage control is about 7.2 billion yen (60.3M USD) annually; but the saved costs from preventing leakage are about 20.6 billion yen (172.4M USD).¹⁰⁰ Furthermore, the increased efficiency of water leakage accordingly improves energy savings and reduces carbon dioxide emissions.

Hong Kong Water Conservation and Control

Hong Kong sets an international example for improved water efficiency, conservation, and savings. The city has experienced severe water shortages in the past, especially from 1963-1964. Hong Kong rationed water for 300 days that year, delivering it for four hours only every four days. The city passed legislation mandating implementation of seawater flushing in all new construction in 1960, providing funds for the construction of parallel plumbing networks. After 1972, seawater became free by subsidization with the drinking water tariff. By 1999, 79% of residences in Hong Kong used seawater for flushing. In 2012, the system supplied an average of 745,225 cubic meters per day of seawater for flushing, significantly reducing potable water demand. In 2012, the government began building a 50,000 cubic meter per day seawater desalination plant in response to more severe drought potential as well as the increasing price of imported water.

Pilot programs for greywater reuse, known as “Total Water Management (TWM) Reclaimed Water Schemes,” began in March 2006 in two districts. Reclaimed water was used for koi ponds and other fixtures, irrigation and toilets. The new projects demonstrated technical and economic viability, assuaged health concerns, and garnered public acceptance for full implementation throughout Hong Kong. With an extensive education campaign, reclaimed water was supplied for free for 12 months. The project was considered a success, and used to promote further development and mainstreaming.

Water Summary

The above water case studies reveal the importance of not only managing scarce water resources, but also preventing water contamination and flooding. While too much water can harm infrastructure and homes, access to clean water is also critical for a healthy and prosperous society. In the next

section, we will step beyond water to review other innovative programs cities are undertaking to improve public health and quality of life.

Public Health

Simply meeting citizens' basic human needs is not sufficient. This functional area relates to cities' efforts to improve the health of their citizens as well as enhance overall quality of life. This includes addressing pollution-inducing morbidity and infectious diseases, as well as increasing access to healthy food, social networks, parks, and recreation. It also includes such activities as tree planting and restoration, protecting the habitats of plant and animal species, and urban agriculture. "Access to recreation" takes various forms based on location.

Cities across the nation are taking action by turning available vacant land not only into parks, but urban gardens and farmers markets as well. These efforts, as well as local food policies, create a sense of community and improve access to more nutritious and wholesome food. Many cities have also established ambitious targets for their tree planting programs. Trees not only provide ecological and aesthetic benefits, but they have also been proven to reduce home energy use by providing shade and slow climate change by storing carbon.

Baltimore: Food Policy Initiative

Baltimore's Food Policy Initiative (BFPI) has been one of the most successful sustainability programs in the city.¹¹⁹ This initiative is managed jointly by the Department of Planning, Office of Sustainability, Baltimore Development Corporation, and Baltimore City Health Department. Initial funding came from Kaiser Permanente, Abell Foundation, Annie E. Casey Foundation and the Baltimore Community Foundation.¹²⁰ After two years of grant funding, in 2011, a Food Policy Director was appointed full-time using city funds. The program provides technical assistance to food entrepreneurs. It also uses zoning regulations and state and federal policies to address food

deserts and encourage urban agriculture. It has seen success by aligning issues such as public health, vacant lots, and economic development. It also addresses one of the goals in Baltimore's Sustainability Plan.

BFPI has been successful by leveraging partnerships and engaging stakeholders. BFPI created a Policy Advisory Committee with 45 member organizations including funders, non-profits, food industry representatives, and government departments to provide guidance on food policy and programs. As part of the initiative, the Office of Sustainability works with the Department of Housing and Community Development on their Vacant to Value program, which encourages creative uses of vacant land to gain support for urban agriculture. Partnering with the Schools and Farmers Markets has also been key to increasing the demand for healthy food and eliminating food deserts.

As an example of their approaches to encourage urban agriculture, in 2012 the Food Policy Initiative updated zoning codes to allow temporary greenhouses and other agricultural practices in the city. Animal husbandry regulations were also amended to include exemptions for bees, chickens, rabbits, and goats.

Cleveland: Buy Local and Sustainable Law and Mow Goats Program

In order to make best use of vacant land, Cleveland has instituted policies that encourage the expansion of green space by establishing parks and natural areas, urban roofs, community gardens, farmer's markets, and other public green spaces throughout the city. Cleveland's urban gardening program in particular has been successful. According to a 2008 study, the city ranks second in the nation after Minneapolis in local food and agriculture. One can currently find over 200 community gardens and 40 market gardens in the city.



Comella Community Garden, Cleveland, OH
Credit: Jeff Schuler/Wikipedia Commons

In May 2010, the city passed the first ordinance in the United States that uses bid incentives to encourage green and local food purchasing. The purchasing policy provides a 2-4% bid discount on city contracts for businesses that locally source their food and are certified as a Local Sustainable Business, determined by the Office of Sustainability.¹²¹ Minority females who own sustainable businesses receive a 9% discount. However, Cleveland's purchasing preference is not unprecedented. Women and minority business owners and small, local businesses have received bid preferences in the past, perhaps easing passage of the purchasing preference. The City Council's approval of an ordinance in 2008 that gave bid preferences to certified, local, small businesses led to a jump in city purchases from such businesses from 40% in 2008 to 49% a year later.¹²²

The overall city culture also contributes to urban gardening success, leading to high demand for local food at restaurants and farmers markets. In order to meet the demand for local food during all seasons, as well as manage vacant land, novel green space strategies have emerged. Born from Cleveland's local food movement, Tunnel Vision enables Clevelanders to grow fruits and vegetables year-round in relatively inexpensive temporary greenhouses.¹²³ In order to reduce the costs of mowing vacant lawns with minimal environmental impact, the city relies on the "Mow Goat" program, essentially renting goats to eat the grass and brush on vacant lots.¹²⁴

The goat droppings are collected at each site and used as fertilizer at community gardens.

Seattle: The Food Action Plan

Seattle's Food Action Plan was implemented in 2012, so it is very much in the articulation phase. Issues of food and health were on the city government's agenda for several years. In 2008, the City Council made the first steps toward this plan by passing the Local Food Action Initiative, which outlined a food policy framework for Seattle. A Food Interdepartmental Team helped form the Food Action Plan at the largest scale of city government to make it as comprehensive as possible.¹²⁵

This interdepartmental creation process makes the program interesting because it logically integrates existing goals and initiatives into a single plan. For example, strategies to achieve the goal to Prevent Food Waste include preventing disposal of edible food (food "efficiency") and proper composting of food waste.¹²⁶ Seattle's existing Zero Waste Strategy already addresses composting,¹²⁷ but inclusion into the Food Action Plan makes this a standalone program to achieve the overall goals of the city itself. In addition, the plan includes zoning initiatives to increase urban farming capacity.



P-Patch garden on Seattle Center Parking Garage
Credit: Trevor Dykstra

Seattle's Food Action Plan supports expansion of urban agriculture for health and economic development purposes similar to those of

PlaNYC, but the most translatable element of this plan is the goal to provide Healthy Food for All. While PlaNYC 2030 articulates Food as an important crosscutting topic, Seattle's Food Action Plan contains several indicators to track progress of achieving food-related goals. For example, the indicators include the percent of residents living within a quarter mile of a healthy food access point, the percent of residents that are food secure, and the number of businesses increasing availability of healthy foods.

Public Health Summary

Initiatives like establishing parks and natural areas, urban roofs, community gardens, farmer's markets and other public green spaces are making cities more healthy and attractive. However, implementing these programs and others often requires capital investment. In interviews with city officials, we found funding to be one of the greatest challenges to sustainability efforts. In particularly rough economic times, how are cities financing sustainability initiatives? In the following section, we explore a few innovative case studies detailing how cities are overcoming these hurdles.

Funding

Given the reality of increasingly tight municipal budgets in many cities, lack of funding for sustainability issues presents a real challenge for many of the cities examined. While many sustainability efforts present long-term savings, particularly in light of climate change, short-term budget crises allow local leaders to "kick the can down the road," waiting for future officials to address sustainability concerns.

Budget constraints have led to several notable trends among cities. The first is a strong focus on energy efficiency issues, over and above most other programmatic areas. Since energy efficiency often provides immediate returns, cities are prioritizing retrofitting and upgrades, with some saying they cannot afford not to make improvements. Secondly, cities are also developing innovative funding techniques, including public-private partnerships and different revenue sources.

Some innovative funding mechanisms include:

- Charlotte's public-private partnership for energy, water, air and waste issues;
- Pittsburgh's Green Trust Fund supported by and used to fund sustainability projects;
- Philadelphia's public-private recycling partnership; and
- Miami and Jacksonville's use of the federal Energy Efficiency and Conservation Block Grant.

Connecting Non-Profits, Companies and the City: Public-Private Partnerships in Charlotte

Envision Charlotte is a unique public-private partnership, involving employers, building owners and managers, and municipal and technology leaders.¹²⁸ Envision Charlotte's purpose is to create an environmentally sustainable urban core by connecting numerous environmental programs and initiatives. The non-profit aims to become a "global model of environmental sustainability

for measurable community and economic results.”¹²⁹



ENVISION:CHARLOTTE

UNITING FOR A SUSTAINABLE CITY

Charlotte's sustainability logo.

Credit: envisioncharlotte.org

Envision Charlotte has four different programs: Smart Energy Now, Smart Water Now, Waste, and Air. Smart Energy Now, the first pillar of Envision Charlotte, which involves Duke Energy, serves as the foundation of the overall program.¹³⁰ Envision Charlotte has partnered with Duke Energy in order to reduce energy use in 64 buildings in the uptown area by 20% by 2016.¹³¹ The promise of cost savings has worked well for the initiative and 98% of the buildings eligible under Smart Energy Now have signed on to participate. The owners of these buildings have all signed legal documents that commit them to program participation.¹³²

The Smart Energy Now component of Envision Charlotte offers real time data on energy use of buildings in the Uptown area. Each building will capture and aggregate its energy use metrics through kiosks that are placed in lobbies in all of these buildings in order to ensure targets are reached.¹³³ The city will show this data on digital displays in order to promote energy efficiency, maintain awareness of energy consumption, and help spread the word about Smart Energy Now.

The non-profit's success derives from its diverse Board of Directors, which includes members of corporations, universities and government. Envision Charlotte also has

leaders from 28 organizations and businesses working together on committees involving model programs, measurement, marketing and communications, and resources and government, which helps to involve every aspect of the community in order to make the program successful.¹³⁴

A Green Trust Fund: Roll-back Savings in Pittsburgh

In recent years Pittsburgh has suffered from incredible financial constraints, almost forcing the city into bankruptcy.¹³⁵ This has limited funding for sustainability issues. According to Lindsay Baxter, the city's first Sustainability Coordinator, "even for projects that make good financial sense that would have a quick payback, the political climate is such that decision makers are wary of taking on any debt."¹³⁶

Given such tight fiscal constraints, Pittsburgh has had to focus on sustainability efforts that provide monetary benefits and have a secure funding. In addition to bringing in grant money, the city created a Green Trust Fund, which takes costs savings from sustainability projects (mostly energy efficiency) and rolls the money back into other sustainability investments. The Office of Sustainability and Energy Efficiency is given a set utility budget each year of around \$8 million. By rolling savings from efficiency projects back into that budget, the city gains another \$1 million a year to reinvest in more projects.¹³⁷ While the green fund is a small proportion of sustainability initiatives and an insignificant part of the overall city budget, it gives the city a specially allocated pot of money for energy projects that might not otherwise get funded. Furthermore, this fund cannot be removed from the budget, ensuring that it will persist regardless of city leadership.¹³⁷

As highlighted in the Solid Waste section above, Philadelphia has been successful in generating revenue through an enhanced recycling program. One innovative technique has been providing monetary rewards to residents through a public-private partnership with Recyclebank, a private company headquartered in New York City. The company provides interested residents with a barcode to place on home recycling bins and sanitation workers scan the codes during weekly recycle pick-ups. This arrangement has helped increase residential recycling rates dramatically, which benefits the city in reduced tipping fees and increased recycling revenue, while providing monetary benefit to residents as well.¹³⁸



Funding energy efficiency in Miami and Jacksonville

Miami-Dade County (MDC) and Jacksonville both leveraged resources from the Energy Efficiency and Conservation Block (EECBG) Program in order to develop broader sustainability agendas. Jacksonville's nascent sustainability plan is built through research that was enabled through the EECBG, and brings a holistic approach to city sustainability, encompassing both government and private residents. With the phase-out of the EECBG program in Jacksonville, the city hopes to establish a dedicated sustainability staff position in the Mayor's Office.¹³⁹

Pollution prevention, climate change and sustainability programs have a longer history in MDC, but these programs were enhanced by

Funding Summary

In addition to developing private and federal funding partnerships, cities are partnering with community members and organizations to establish and build upon existing sustainability initiatives. As we will see below, community members and groups are informing and implementing sustainability plans in workshops, meetings and on the web. Stakeholder engagement has been key to sustainability plan buy-in and, ultimately, success.

Partnerships

Sustainability planning is a multi-disciplinary effort. Partnerships between city governments, non-profit groups, private organizations, and educational institutions helps to ensure that sustainability plans improve the quality of life of all city residents.

Several U.S. cities have found success through fostering community outreach and stakeholder engagement. Multiple approaches may be taken, such as:

- Fostering community-led initiatives in Miami-Dade County, Florida;
- Website use to foster community engagement in Phoenix, Arizona;
- Community summits and workshops to engage the public in Cleveland, Ohio; and
- Stakeholder involvement in sustainability planning in Pittsburgh, Pennsylvania.

Partnerships in Miami

Miami-Dade County's (MDC) GreenPrint: Our Design for a Sustainable Future is unique because it directly addresses the importance of social capital by highlighting strong leadership and connections and commitment, as well as healthy communities.¹⁴² Using the Energy Efficiency and Conservation Block Grant (EECBG) program as a catalyst, MDC took steps to engage the public in its sustainability programs through partnerships with the local Chamber of Commerce to conduct energy efficiency workshops for residents.¹⁴³

Building off the EECBG program's emphasis on partnerships, Miami continued its efforts to engage the public through GreenPrint. The MDC Office of Sustainability partnered with the Health Foundation of South Florida and the non-profit organization ioby for the Office's Local Sustainability Matching Fund grant application. MDC invited and supported ioby to use its platform to leverage its network and connect people with resources to carry out

projects on a shorter timeline that what government could accomplish alone.¹⁴⁴ In MDC, ioby presents a new funding stream for sustainability initiatives that enable community groups to implement grassroots sustainability and urban revitalization projects.¹⁴⁵



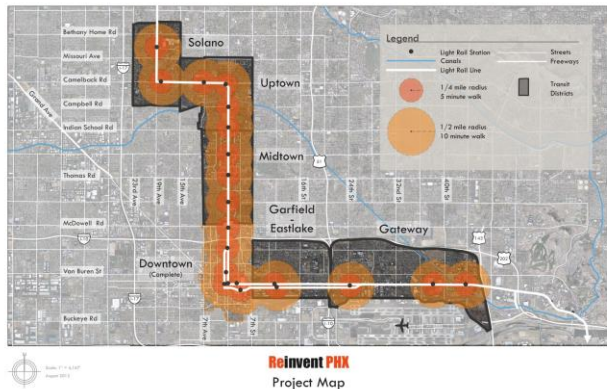
ioby, an acronym for "in our backyards", is a crowd-funding platform for environmental projects. *Credit: ioby*

In July of 2012, Miami-Dade County was awarded \$65,000 by the Local Sustainability Matching Fund, with a dollar-to-dollar match of \$65,000 from the Health Foundation of South Florida. The purpose of the funding is to advance GreenPrint's Healthy Community goals by supporting community-led, community-funded initiatives that foster urban and local agriculture, walking, biking and other projects to promote a healthy lifestyle and a more livable community. Through this grant, MDC aims to replicate the ioby technology platform to raise money, showcase local projects, organize volunteer workdays and share new solutions to community challenges of sustainability and urban revitalization. The projects address the goals of both ioby and MDC of promoting healthy communities, all while advancing key community components of GreenPrint.¹⁴⁶

Community Engagement in Phoenix

MyPlanPHX is a website that allows residents to submit ideas about the future of their city online. This interactive web portal will allow anyone to participate in dialogue about the general city plan, by adding comments, suggestions, and pictures. The site is specifically targeted towards a city project to revitalize and retrofit buildings along a 10-mile stretch of the light rail corridor, called ReinventPHX. The site

is based on the belief that “Community activism and involvement are attributes of sustainable communities.” The city has budgeted approximately \$10,000 a year to maintain PlanPHX as an inexpensive but important community outreach tool.¹⁴⁷



ReinventPHX Project Map. *Credit: City of Phoenix*

To encourage participation, users earn points for signing up and referring friends, submitting ideas, and commenting on other ideas. The City Planning and Development Office manage the effort.



Screenshot of MyPlanPHX. *Credit: myplanphx.com*

Working Groups and Champions: Collaboration in Cleveland

Cleveland has been successful at engaging the local community in its sustainability efforts. According to Matt Gray, Director at the Cleveland Mayor’s Office of Sustainability, each year the Office of Sustainability hosts an annual three-day summit consisting of more than 600 stakeholders in the community, where residents express their views on sustainability planning and vote on priority issues.¹⁴⁸ The Sustainable Cleveland Stewardship Council was created in 2009 by Mayor Jackson to suggest strategies to Cleveland on how to achieve the

Summit’s recommendations. The Council has helped inform Cleveland sustainability priorities, as well as develop the Action and Resources Guide, the Performance Indicators and the Communications Strategy.¹⁴⁹ Sustainable Cleveland includes over 20 working groups of community volunteers who work on specific issues such as renewable energy development. Sustainable Cleveland also conducts workshops that teach agency employees about sustainability best practices.¹⁵⁰

Cleveland also identifies two “Community Champions” each quarter. According to the Sustainable Cleveland 2019 website, “Community champions are businesses or organizations that have made a commitment to incorporating the principles of Sustainable Cleveland into their operations and interactions with the community.”¹⁵¹

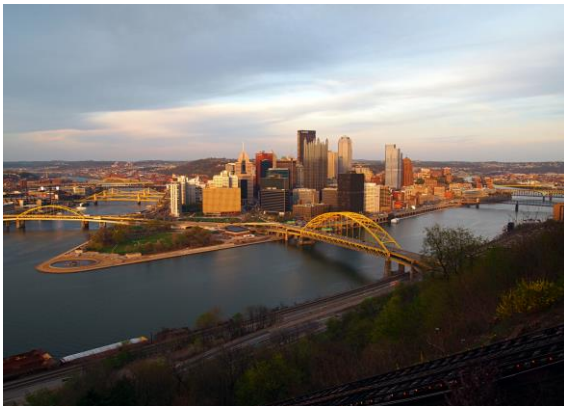
Partnerships in Pittsburgh

Pittsburgh’s “Climate Action Plan” was enacted by the city in 2008 (and updated in 2011) as a guiding document to address climate change, setting the citywide goal of reducing greenhouse gas emissions 20% below 2003 levels by 2023. While the city government was involved in crafting the plan and formally enacting it, partnerships between the business community, non-profits and higher education institutions were central to the plan’s formation. Non-governmental stakeholders remain a driving force behind many initiatives.

The plan itself is divided by sectors, with a section each for local government, business, community and higher education. These four sectors make up a partnership called the Pittsburgh Climate Initiative, broadly consisting of more than 50 organizations. Leaders from each sector met to designate the industry’s priorities, goals and strategy, and each sector authored its own section of the report. The end of the report lists the organizations involved in

the Initiative, their roles in addressing climate change, and contact information. According to Matthew Barron of Councilman Peduto's office, "this isn't just a list on paper. [These organizations] are deeply involved in this work through strong partnerships working towards common goals."¹⁵²

The partnerships within sectors are remarkable: dozens of stakeholders from each sector coordinated to produce the first plan, carry out tasks and reconvened to update the plan in 2011. However, some stakeholders indicated that the strong involvement of non-profits has meant the city has been less active in implementation, relying on organizations to do the bulk of work. Another shortcoming seems to be the lack of interaction between the sectors; each of the four industries works with stakeholders within their sectors but the different sectors do not coordinate between each other. Aftyn Giles, Pittsburgh's current Sustainability Coordinator said one way the city seeks to address this is to create a centralized physical space for sustainability where organizations can get together, share ideas, and collaborate.¹⁵³



Pittsburgh skyline
Credit: Robpinion/Wikimedia Commons

Ultimately, the Pittsburgh sustainability professionals that were interviewed for this report agree that engaging a broad group of stakeholders was critical to the success of Pittsburgh's sustainability efforts. The Climate Action Plan offers an innovative approach to sustainability whereby various sectors are all invested and involved in setting targets, their goals are published publically alongside that of the city, and their leadership is accessible through published contact information. According to Lindsay Baxter, formerly the first Sustainability Coordinator for the city, "often projects are either top-down or grassroots but [the Action Plan] really involved both."¹⁵⁴

Partnerships Summary

Sustainability initiatives are designed to improve the quality of life of city residents. Giving residents a voice to express their concerns, whether as individuals or groups, provides a mechanism for harnessing the collective power of the community in accomplishing this goal. Further, buy-in from the community—be it from residents, industries, or nonprofit organizations—can help to both move a plan forward and protect it against future political leadership changes.

The incorporation of partnerships maintains an open channel of communication between the city and its residents, and is one of the many areas that should persist as a regular characteristic of sustainability programs. Long-term institutionalization of partnerships may ensure that the community's perspective is not overlooked. We explore case studies of how cities are handling long-term institutionalization in the next section.

Long-Term Institutionalization

Despite the diversity of political and geographic contexts for cities across the country and throughout the world, similarities emerge in how sustainability takes root. The trends indicate that progressive sustainability programs and policies are enacted through the influence of powerful figures in city government, and that sustainability evolves from general concept to concrete program proposals to departmental program implementation. In addition, the crosscutting nature of sustainability topics requires public agencies to carry responsibilities that previously extended beyond their scope, but also presents opportunities to address multiple issues through a comprehensive program solution.

Bucking Party Lines: Mayoral Leadership in Bogotá

When Mayor Enrique Peñalosa took office in Bogotá in 1998, he focused on transforming transportation and the city's built environment. The most affluent country club was converted to a public park; slums were demolished and developed into open spaces; and one of the world's most extensive and comprehensive networks of bike paths was built. Perhaps most famously, the new bus rapid transit (BRT) system, TransMilenio, made public transportation popular. As Mayor Peñalosa said, "we made a city more for people and less for cars."¹⁵⁵ The city's projects were grounded in social policies, designed to make the city more livable, especially for impoverished and economically disadvantaged people. The multifaceted nature of sustainability meant that these public projects also reduced traffic congestion and pollution, and lowered Bogotá's carbon footprint.¹⁵⁶

Mayor Peñalosa was partly able to make reforms because he was an independent politician. Following his term, subsequent

mayors affiliated with the traditional political parties were unable to implement meaningful reforms from 2004 to 2007. TransMilenio lost the necessary investment and the intention to build a metro system in Bogotá was never realized. As the planned expansions have faltered and the buses have become older and less reliable, public opinion has worsened. However, as recently as 2009, the system still had 88% customer satisfaction, illustrating how infrastructure projects can make a lasting difference in people's lives. Once completed, they may lose priority but they are often difficult to remove entirely.¹⁵⁷



Crowds wait to board TransMilenio buses.
Credit: Carlos Pardo/thecityfix.com

Moving Towards Integration: Portland's History

Portland's history of environmentalism and what is now called "sustainability" reaches back several decades. Oregon adopted bottle deposit legislation in 1971, and supports strong land use laws that limit urban sprawl. In 1993 Portland was the first local government in the United States to adopt a plan to address climate change, and continued to plan and implement sustainability programs for the following two decades. Sustainability Manager Michele Crim summarized how sustainability is defined in the city. "It's always been that way in sort of an environmental ethic that is really longstanding."¹⁵⁸

Portland's progressive history exerts strong influence over the political agenda and long-term trends of the city.¹⁵⁹ A recent and notable

example emerged in 2009, when newly elected Mayor Sam Adams combined the Bureau of Planning with the Office of Sustainability. In part a response to city budget constraints, Mayor Adams wanted to “change it so sustainability is the default of all policy, of all management, of all planning decisions.”¹⁶⁰ Previously, the Office of Sustainability contained 45 staff while the Bureau of Planning contained 90; the new director for the hybrid department would be the former Sustainability Director Susan Anderson. To some critics, however, it appeared as though the Office of Sustainability was absorbing the Planning Bureau, not integrating with it.¹⁶¹



Former Portland Mayor Sam Adams
Credit: about.me/sam_adams

Another long-term trend in Portland is the transition from framing programs within a social agenda rather than a strict environmental perspective.¹⁶² The recently released Portland Plan outlines the priorities of Prosperity, Education, Health and Equity. Michele Crim described the need for this new social agenda following the more traditional sustainability programs. “If you were to take a closer look and see who is benefitting from [traditional sustainability actions] and who is being left out you would see a stark divide along income and racial lines...if you are a low income person or person of color your access

to all of those great amenities is limited if not nonexistent.”¹⁶³

Ensuring Future Efforts: Integration in Philadelphia

Mayor Nutter has made an effort to integrate sustainability into the city to ensure its legacy, and as the President of the United States Conference of Mayors, he has brought the message to a larger audience. The city’s sustainability plan is cross-referenced through departments and agencies so that initiatives are less likely to be dropped. In 2011 the city adopted a new citywide comprehensive plan and a new zoning code, using guidelines from Greenworks.¹⁶⁴ These developments will ensure that sustainability principles continue for many decades, including provisions on transit stations, walkability, alternative energy systems, water conservation and urban food production.

Additionally, the city has created a Sustainability Working group of more than 100 city employees who meet quarterly for sustainability planning meetings and more frequent briefings. The meetings are optional but there is a high level of attendance and the meetings have become an organizing tool to build collaboration among sustainability players.¹⁶⁵

According to Alex Dews, the Policy and Program Manager in the Mayor’s Office of Sustainability, Philadelphia is growing for the first time since the 1950s. He notes that quality of life improvements like walkable access to parks and open space, clean neighborhoods, better air and water quality, and a clean economy are all core elements of Greenworks, and could help to attract new residents and businesses to the city.¹⁶⁶

Philadelphia has been effective with public outreach and education so that city agencies understand their vulnerability to climate

change and the importance of adaptation planning. However, as Jeffrey Knowles of a statewide non-profit acknowledged, a less welcoming administration could set progress backwards.¹⁶⁷

Structural Changes in Chicago

A key current challenge for Chicago is the relative size of the sustainability presence in the Mayor's office. Whereas New York City's Mayor's Office of Long-Term Planning and Sustainability has approximately 20 staff members, Chicago only has two people directly leading environmental policymaking, even though the Chicago is one-third the size of the New York. Philadelphia is half the size of the Chicago but has five staff members working on sustainability in the Mayor's office.¹⁶⁸

Furthermore, the city has undergone recent reorganization, affecting the course of sustainability plan implementation. Shortly after the election of Mayor Rahm Emanuel in May 2011, the City of Chicago appointed a Chief Sustainability Officer and disbanded the Department of Environment in response to concerns about budget and agency effectiveness. The Department's responsibilities were shifted to individual agencies; for example, green stormwater infrastructure planning was moved to the Department of Water Management and air quality policy was moved to the Department of Health.¹⁶⁹

Dividing the work has presented a challenge because of the inherently multidimensional character of sustainability. Certain initiatives, such as bike lanes, seem to fit squarely in the purview of the Department of Transportation. However, green infrastructure does not readily fit into one domain, and many aspects of its management fall outside of individual agency control. Climate change and air quality policy are other complex sustainability issues that cut across many agencies. Leadership from the Mayor's Office is necessary to make headway

for the cross-cutting sustainability topics, particularly when there is no direct incentive structure to get agencies to work together or deviate from the core agency mission established by the city charter.¹⁷⁰



Chicago Mayor Rahm Emanuel
Credit: Daniel X. O'Neil

Navigating Complex Government Structures in Miami

Miami-Dade County (MDC) consists of 34 municipalities and unincorporated areas. As such, the MDC governance structure is substantially different from that of New York City, making cross-comparisons difficult. Regardless, MDC shares similarities in the sustainability governance experience with cities such as Chicago and Los Angeles. MDC's Office of Sustainability was merged, along with several other departments, into the new Department of Regulatory and Economic Resources (RER). The Office is now part of a department tasked with land use planning, zoning, building and environmental regulation, economic development, and other programs that enhance community sustainability. The merge was a result of a broader restructuring and reorganization by MDC that resulted in the consolidation of departments, from 45 to 24, with the goal of improving operational efficiencies. The Deputy Mayor also serves as the Director for RER, and has strong experience in regional sustainability planning.¹⁷¹ Other agencies remained intact through the reorganization, such as the MDC Department of Parks, Recreation & Open Spaces, which grew

to subsume other programs with similar missions in order to capture efficiencies.¹⁷²

Individual agencies also capitalize on efficiencies through programs and initiatives that cut across sustainability topics. The MDC Department of Parks, Recreation & Open Space uses the concept of landscape urbanism to combat sprawl through transit-oriented parks that also mitigate sea-level rise and provide recreational opportunities. MDC recognizes that high-functioning parks systems are not only about the parks, but must also consider public spaces and the myriad connections between natural and cultural spaces. For example, landscape urbanism entails changing street design to function as linear parks that not only move automobiles, but also establish new ways to safely move pedestrians and cyclists. In addition, one of the objectives of the MDC Parks Master Plan calls for developing 500 miles of trails. MDC has already built about 130 miles of trails, and is also proposing five-mile-wide greenways that serve as a transition from the developed areas of Miami-Dade County to the Everglades National Park.¹⁷³

Directive from the Top: Mayoral Decree in Los Angeles

In Los Angeles, Mayor Villaraigosa's Executive Directive No. 10 requires that each department generate an annual sustainability report.¹⁷⁴ When the directive was first issued in 2007, the Department of Environment was responsible for ensuring that other departments completed their Sustainability Reports, while also supplying technical assistance and training. The first round of reports was of poor quality, with the exception of the Port, which worked with a contractor. The Department of Environment determined that the agencies required additional training, and took steps such as organizing site visits to see companies that had already incorporated sustainability plans into their organizations. The quality of the reports improved for a few years, but declined again

due to budget cutbacks.¹⁷⁵ Eventually, the Department of Environment was eliminated, primarily due to budget concerns.



Los Angeles, California

Credit: Navid Serrano/Wikimedia Commons

With limited funding and persistent layoffs, the Mayor's office has difficulty requiring the Department to produce reports and process paperwork.¹⁷⁶ For 2012, departments without fleets or significant emissions were allowed to forego producing an annual report. Given these challenges, the departments implemented the Green Angel campaign to tackle emissions, which put sustainability into action through energy efficiency and water conservation outreach efforts that focused on city facilities. The campaign resulted in a 10% reduction in energy use.¹⁷⁷

Long-Term Institutionalization Summary

While the priorities may vary, cities follow similar patterns and face similar constraints to implementing their sustainability plans. Cities such as Bogotá, Portland, Philadelphia, Chicago and Los Angeles show that sustainability needs strong leadership to proceed from policy concept through implementation. The ongoing pressures of political transitions and tightening budgets are universal; however, sustainability can be protected by executive orders or changes to city code. New York can continue to look to the most innovative programs to identify similarities and opportunities to adapt sustainability innovations to its local context.

Sustainability Innovations for Consideration

As PlaNYC begins its seventh year of implementation, the Mayor's Office of Long-Term Planning and Sustainability (OLTPS) has sought to learn from the best sustainability practices in other domestic and international cities with the goal of strengthening its own sustainability plans and ensure the long-term implementation of these practices.



New York City. Credit: DigitalGlobe

Our analysis found that New York is considered a global leader in sustainability efforts, and it benefits from achievable, measurable sustainability goals, as well as an overarching and wide-reaching plan. Like New York, major cities throughout the world are also pushing forward with their own innovative and often ambitious programs.

We have identified a set of key innovative strategies from the 29 above case studies that New York might wish to consider adopting as the city continues working to advance and institutionalize sustainability.

Climate Change

- To combat rising sea levels and increased precipitation, Rotterdam has developed innovative water storage facilities and floodgates. While these programs require significant investment in infrastructure, Rotterdam sees this investment as a cost-effective one in the long-term. (p. 22)
- Without massive infrastructure projects, co-location of community facilities offers adaptation benefits as well. This refers to the practice of clustering city services in close proximity or in the same building to mitigate hazards during power outages or natural disasters. This simple yet pragmatic strategy has been applied in New Orleans as part of their approach to resilient communities. (p. 24)

Energy

- Special heating and cooling district systems have greatly increased energy efficiency in Copenhagen, accounting for much of Copenhagen's emissions reduction. These systems form a major component in the city's plan to attain carbon neutrality by 2025. (p. 25)
- Large, utility-scale solar installations have been made possible in San Antonio by public-private partnerships and government funding, creating the nation's largest municipal solar project and fostering a market for solar energy in the region. (p. 27)
- San Diego now meets 50% of its municipal electricity needs by using city facilities, such as landfills, wastewater treatment plants, and buildings, to generate power from methane, solar and hydropower. (p. 28)

Air Quality

- The implementation of a citywide green fleet can help to reduce a city's greenhouse gas emissions as well as improve local air quality. By executive order, Indianapolis has committed to greening its entire fleet by 2025. (p. 29)

Solid Waste

- Washington, D.C. utilized stakeholder engagement and inter-sector cooperation to clean up its river system by charging consumers for plastic bags, disincentivizing their use and decreasing riverine garbage. (p. 34).
- Within ten years of implementing its policy of separating refuse into three bins (compost, recyclables, and trash), San Francisco has been able to divert 80% of its solid waste from landfills, reaffirming the city's goal of zero waste by 2020. (p. 33)
- Philadelphia has exceeded its goals for solid waste diversion ahead of time by creating a single-stream recycling program, which uses incentives to promote citizen participation. This program has been able to generate revenue for the city while simultaneously diverting 72% of its waste from landfills. (p. 32)

Transportation

- To improve traffic flow, San Francisco has instituted congestion pricing on the Bay Bridge during peak times, while lowering tolls for the carpool lane by more than 50% during peak times. (p. 38)

Water

- Parcel-based stormwater billing is an innovative strategy for reducing stormwater runoff and incentivizing green infrastructure. Philadelphia's implementation of stormwater billing has been successful, helping to reduce stormwater runoff by millions of gallons, and also helps tackle the likely effects of climate change. (p. 23)

Funding

- Rollover funding in sustainability offices or departments can help to secure reliable fiscal resources in uncertain budgetary times. Pittsburgh has incorporated a permanent rollover fund from money saved through efficiency projects into its Office of

Sustainability's budget so the money can be used for other sustainability initiatives. (p. 49)

Partnerships

- An effective coalition among stakeholders is key to building a successful sustainability program. As environmental sustainability becomes important to more companies and advocacy organizations, there is a need and an opportunity to work with other groups rather than duplicating efforts, as seen in cities such as Pittsburgh and Miami. Stakeholder support can also help to insulate sustainability agendas from shifting priorities or economic hardships, as seen in cities such as Miami, Pittsburgh, and Cleveland. (pp. 51-52)
- Phoenix manages a website called MyPlanPHX which acts as a community engagement tool by allowing residents to suggest ideas for sustainability initiatives and to comment on existing programs. (p. 51)

Long-term Institutionalization

- Portland, Oregon successfully merged its Bureau of Planning with its Office of Sustainability in order to incorporate sustainability into all of the city's planning decisions. (p. 54)
- The codification of sustainability initiatives can help to secure the long-term success of these programs. Cities such as Los Angeles have issued executive orders for sustainability and climate action plans to establish long-term institutionalization. Philadelphia used a legislative approach and has incorporated guidelines from its sustainability plan into its new zoning codes. (pp. 57 and 55, respectively)

Remain a Leader

While writing a list of considerations for New York, it became evident that New York was a leading city in many categories. Here are a few areas where New York has seen notable success and should continue its efforts to lead by example:

Mass Transit

New York owes much of its impressive green credentials to its extensive and effective system of mass transit. New York is the only city in the United States in which most people take mass transit to work, and this makes the city extremely energy-efficient and facilitates sustainability. New York maintains this incredible network of transport options and plans to develop it further, improving an already-impressive system of moving people.



New York City subway cars.

Credit: © Jonathan Keller, <http://www.jkellerphoto.com>

Greener, Greater Buildings

The Greener, Greater Buildings Plan is just one part of the PlaNYC Green Buildings & Energy Efficiency, which helps the city continue to reduce its emissions. In a densely developed city like New York, buildings rather than transportation account for most of the energy use and therefore, greenhouse gas emissions. The plan targets existing, large buildings for energy efficiency improvements and is projected to decrease New York's emissions by nearly 5% and produce net savings of \$7 billion dollars.

Reducing Heating Oil Pollution

The City of New York partnered with the New York City Department of Environmental Protection to issue regulations concerning the transition of heavy forms of heating oil to cleaner fuels beginning in July of 2012.¹⁷⁸ “New York City’s Clean Heat program is a program unique to New York City that can be looked to as a model by other cities as “the program is finding practical, market-based solutions that help spur economic development, while improving our air quality and protecting our health.” New York City is now halfway toward achieving its goal of reducing heat oil pollution by 50% by 2030.¹⁷⁹



San Remo Building, Manhattan

Credit: Environmental Defense Fund

Green Infrastructure Plan

New York City’s ambitious Green Infrastructure Plan, released in 2010, aims to reduce stormwater runoff through investments in green roofs, bioswales, and other natural systems. Working with the Department of Environmental Protection, New York City plans to commit more than \$2.4 billion in public and private investment towards the plan over the next 18 years. In a city that sees nearly 30 billion gallons of untreated wastewater flow into the New York Harbor annually, effectively managing stormwater is a necessity, and the Green Infrastructure Plan should continue to

move forward with the great success that it has seen thus far.¹⁸⁰

The proposal has two key components: widespread use of green infrastructure in public spaces—such as green roofs, parks, tree boxes, roadside plantings, porous pavement in parking lots, cisterns, and rain barrels—as well as the establishment of design requirements for developers to ensure that all private property projects manage a minimum volume of stormwater on site.



New York City green roof.
Credit: Gowanus Canal Conservancy

Revisions and Transparency

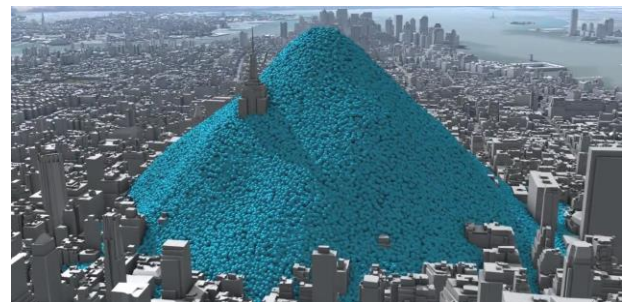
The law that codified PlaNYC in 2007 scheduled revisions to the plan every four years. Putting mandatory revisions of the Plan into law has ensured that PlaNYC will continue to be relevant and a mainstay despite political transitions. Furthermore, PlaNYC is one of the most comprehensive and easy to read plans that our team has come across after reading over 40 sustainability plans. The City should continue to make the goals of PlaNYC accessible to the public.

Continue Prioritizing Access to Parks and Green Space for All Residents

PlaNYC demonstrates a strong commitment to parks and public spaces with the goal of ensuring that all New Yorker's live within a 10 minute walk of a park. In addition to improving access, the city should continue to transform underused spaces into new parks like the High Line, which solidify the city's reputation as an urban park innovator. Since the completion of the High Line in 2009 other cities such as Chicago, Detroit and Philadelphia have been inspired by the project and have looked to open new parks of their own.¹⁸¹ Projects such as the Jamaica Bay Science and Resilience Center, in partnership with the National Park Service, should be fully supported to continue this trend.

Sustain Commitment to Greenhouse Gas Reduction By Continuing The Mayor's Carbon Challenge and Improving Data Availability

With the goal of reducing greenhouse gas emissions 30% by 2030, New York City has demonstrated how cities can and should be at the forefront of battling climate change. Rigorous inventories and engagements with public and private stakeholders should continue to support this goal. In addition, the goal should be periodically reassessed to ensure it is sufficiently realistic and ambitious in the current context.



Visualization of New York City's greenhouse gas emissions, one day's worth in one-ton spheres. This visualization was made possible by data made available through the Inventory of New York City Greenhouse Gas Emissions.
Credit: CarbonVisuals.com

Conclusion

Cities around the globe are addressing aspects of sustainability in many different ways, from gardening goats to mayoral decrees. There is no “one-size-fits-all” strategy to tackle pressing environmental issues, but a combination of best practices will make New York City even stronger. The considerations section above was designed to highlight some of the most innovative plans from other cities and consider how similar strategies could be implemented in NYC.

One important trend identified in this report is that cities’ sustainability plans are inherently woven into multiple aspects of the municipal government. Sustainability is certainly not a separate issue and most cities are considering it part of the operations of departments and agencies. Questions about the level of monetary commitment to sustainability or number of staff dedicated to sustainability went largely unanswered because cities explained that elements of sustainability are carried out throughout city operations.

Similarly, the sustainability priorities for each city are deeply embedded in the culture and history of the city. For instance, Pittsburgh’s legacy of industrialization has elevated the need to integrate sustainability with economic development and urban revitalization. Los Angeles’ role as a port hub has meant addressing air quality is a central concern.

While climate change climbs to the top of New York’s priorities, many cities have yet to make separate plans addressing likely impacts through mitigation. Some cities say public support has waned, while others indicated that financial burden means the city has to choose short-term projects rather than long-term planning. Climate change mitigation is an area where New York City can lead the country by developing and implementing innovative

strategies to protect the city from rising sea levels, increased precipitation, and heat waves.

New York City can learn from some innovative programs in each of the functional areas that have been examined. However, New York is already a national leader in most of these areas and is addressing sustainability in a comprehensive and aggressive way. Many of the highlighted cities indicated that they have looked at the programs NYC has in place while developing their own initiatives.

Most importantly, other cities have looked to the vision that New York has laid out through PlaNYC. While there may be specific programs or initiatives that the city could undertake, PlaNYC represents a holistic, overarching concept of sustainability, which serves as an ambitious guideline for other municipalities.

Given what is at stake, in terms of quality of life, economic development, and future resiliency, New York must continue its strong leadership in sustainability. The methods of institutionalization set in place, including updating the plan every four years and maintaining a sustainability office under the Mayor, are good steps, but the city needs to continue its commitment. International cities are on the forefront of monumental changes to address aging infrastructure and looming climate risks. New York should look to these cities and keep its rank as a global leader in sustainability planning.

Methodology

Comparison City Selection

OLTPS is interested in learning how other urban areas have successfully implemented sustainability plans, so the workshop emphasized the study of domestic cities because they are most similar to New York City's governance and political structure. To produce a comprehensive assessment, we initially looked at 30 U.S. cities, including New York. To select the cities, we first identified the most populous urban areas in the United States, as New York City's population is a significant factor in its sustainability efforts. While 24 of the 30 selected cities have populations in excess of 500,000, six smaller cities merited inclusion due to factors such as comprehensiveness of sustainability plans, urban density, or coastal geography.

The selected domestic cities were (in order of population): New York, Los Angeles, Chicago, Houston, Philadelphia, Phoenix, San Antonio, San Diego, Dallas, San Jose, Jacksonville, Indianapolis, Austin, San Francisco, Columbus, Charlotte, Detroit, Memphis, Boston, Seattle, Denver, Baltimore, Washington, D.C., Portland, Sacramento, Miami, Cleveland, Minneapolis, New Orleans and Pittsburgh. This list is also included as Appendix D.

The successful implementation of sustainability plans in international cities is often based on foreign political institutions and governance structures that are not often relevant for U.S. cities. Nevertheless, many global cities have made significant strides in the field of sustainability and may serve as a source of opportunity or inspiration for New York. We targeted 11 global cities using the C40 Cities Climate Leadership Group as a preliminary selection. To make the final selections, we focused on two areas: the primary sustainability challenges to New York City and common traits. We identified the primary

sustainability challenges to New York City as energy (carbon emissions, efficiency and grid resiliency), transit (population growth, traffic) and water (flooding, pollution). We also looked for traits such as coastal context, high population, population density, mass transit, strong institutions, and climate. Upon initial research, the list was reduced from 11 cities to 6 due to some global cities' decentralized sustainability efforts or overall difficulties in accessing information. The remaining cities include: London, Rotterdam, Copenhagen, Bogotá, Tokyo, and Hong Kong. This list is also included as Exhibit D.

Functional Categories

OLTPS identified ten categories upon which PlaNYC initiatives were developed. These categories include: housing and neighborhoods, parks and public space, brownfields, waterways, water supply, transportation, energy, air quality, solid waste, and climate change. While we sought to assess comparative sustainability efforts in other urban areas, we recognized that these cities will not use the same terminology. We therefore developed a universal set of functional sustainability terms and definitions that can be applied to all cities in the study and to categorize the PlaNYC initiatives within these universal functional terms. New functional terms include the following: climate change, energy, solid waste, air quality, transportation, water, and public health, recreation and well-being. Of these, OLTPS has prioritized climate change, energy, solid waste, and air quality among their sustainability goals. A list of the functional terms and their definitions is included as Appendix B.

Interviews and Data Collection

The aim of interviews with city officials, non-profit organizations, and other stakeholders was to uncover lessons from implementing sustainability plans across the country and to better understand successful and innovative

programs. Interview questions also included opportunities to discuss the impact political transitions have had on sustainability. Primary interview questions contained a combination of closed and open-ended questions. The interview questions were formulated using the multiple indicators approach, where redundancies between certain questions can capture additional data and assess consistency within the interview. The data collected through primary sources was used to help answer general questions pertaining to how “operational” the sustainability program is for a given city, which sustainability issues are of highest priority, which public policy issues have higher priority than sustainability, what level of budgetary support sustainability programs receive, how the level of support has changed through time, what role partnerships play in sustainability programs, and how city officials have taken ownership of existing programs. To complement these primary interviews, the research team also analyzed sustainability reports and data published by the cities in the study.

Data Analysis

Analysis for some cities was not straightforward because many cities lack a comprehensive plan analogous to PlaNYC. In these cities, sustainability is addressed in segmented plans or is housed within other programs or departments. For some cities, interviewers also had a difficult time contacting experts and were

unable to get useful primary insight into city policies.

Following the data collection phase, the research teams analyzed the expert interviews, reports and literature reviews in order to assess: (1) where does sustainability fit into the target city’s policy structure, (2) what are the highest priority sustainability issues, (3) which policy issues compete with sustainability, (4) how did sustainability investments (budgets) change over time, (5) through which indicators are cities measuring sustainability, and (6) is there engagement and participation of local stakeholders?

Considerations

Upon final analysis of the research data, the team assessed the lessons learned from the selected domestic and international cities and produced a set of policy considerations that could enhance PlaNYC’s initiatives and facilitate the long-term institutionalization of sustainability policy in New York City.

Throughout our research, analysis and recommendations, we expected the following questions to guide our progress: (1) What programs have been the most successful in different cities and why? (2) What cities and programs could NYC look to for future PlaNYC updates?

Appendix A: Literature Review

Long-term Leadership in Urban Public Policy

Bunce, Valerie. *Do New Leaders Make a Difference?: Executive Succession and Public Policy under Capitalism and Socialism*. Princeton, NJ: Princeton University Press, 1981.

While policy change is generally characterized by incrementalism—small changes building on current needs—there is some disagreement in the literature regarding the effect of leadership change on public policy. Bunce's study on national and state leadership found that innovation, not incrementalism, is typical in the presence of leadership succession.

Wolman, Harold, John Strate, and Alan Melchior. "Does Changing Mayors Matter?." *The Journal of Politics* 58, no. 1 (1996): 201-223.

Doubt about Bunce's findings lead Wolman, Strate and Melchior to conduct a study focused on the role of mayors and urban policy to examine the effect of succession on urban public policy. They conducted a time-series analysis of cities with populations greater than 100,000 over 9 years. Using expenditure changes per capita and changes in priorities (based on a division of expenditure categories into developmental, redistributive, and allocational) they found that:

- 1) There was greater change in spending per capita when a new mayor defeated an incumbent than when a new mayor was elected following a retirement.
- 2) There was greater change in spending per capita and spending priorities when a new mayor took office in cities that had experienced changes in population size or population composition.
- 3) There was more change in spending per capita with newly elected mayors than with the reelection of an incumbent.
- 4) There was little evidence to suggest that changing leadership, in the absence of significant population changes, has an effect on spending priorities.

Kumar, Martha. "Getting Ready for Day One: Taking Advantage of the Opportunities and Minimizing the Hazards of a Presidential Transition." *Public Administration Review* 68, no. 4 (2008): 603–617.

This article, like others in the literature about leadership transitions, focuses on advice for incoming administrations. Their study focused on recent presidential transitions but has some practical points that should apply to any new administration. Most significant was the importance of campaign promises in limiting policy options and organizing a first term agenda. They also found that a new administration should take advantage of existing transition resources and identify new ones to aid in the smooth transition of personnel and resources.

Young, Frank, and John Norris. "Leadership Change and Action Planning: A Case Study." *Public Administration Review* 48, no. 1 (1988): 564-570.

This case study examines a change in leadership at the Food and Drug Administration (FDA) amidst a backdrop of severe decreases in budget appropriations in 1984. The article was

written by the Commissioner and Deputy Commissioner at the time and is useful as a success story. The authors first point out that the literature has identified, as a risk of leadership transitions, a tendency to divert too much energy to transition issues at the expense of important day-to-day work and program maintenance. This disproportionate focus on change can lead to a breakdown in communications and a lack of commitment to organizational goals. In light of these risks, the FDA undertook a comprehensive action planning process at the start of a new administration. This successfully served to engage the new administration in agency operations, focus staff energy on a productive task, and provide a mechanism for carrying existing priorities into the new administration.

Appendix B: PlaNYC Summary

Category	Goals	Tasks	Initiative
Housing and Neighborhoods	Create 1 million new homes	Increase capacity for new housing	Transit-oriented rezoning Expand in new areas Use new housing models
	Make housing affordable and sustainable	Finance and facilitate new housing	Add to underutilized sites Existing neighborhoods On existing properties
		Encourage sustainable neighborhoods	Greener, Greater Communities Sustainability in public housing Promote walkability Preserve affordable housing Protect the quality of housing
Parks and Public Space	Ensure New Yorkers live within a 10-minute walk of a park	High impact projects in underserved neighborhoods	Open underutilized spaces Facilitate urban gardens Expand park hours
		Create destination-level spaces	Upgrade flagship parks Convert landfills to open space Increase water-based recreation
		Re-imagine the public realm	Greener, Greater Communities Sustainability in public housing Promote walkability Preserve affordable housing Protect the quality of housing
		Protect nature	Plant one million trees Conserve natural areas Support ecological connectivity
		Ensure long-term health of public space	Encourage stewardship Incorporate sustainability
Brownfields	Clean up all contaminated land	Accelerate cleanup and redevelopment	Partner with lenders and insurers Increase capacity of developers Identify, cleanup and redevelop State and federal collaboration
		Strengthen incentives	Study economic value Establish funding and incentives
		Community planning, education and service	Community-led planning efforts Increase transparency of plans
		Expand green remediation	Promote green remediation Green space on clean up sites

Appendix B: PlaNYC Summary, continued

Category	Goals	Tasks	Initiative
Waterways	Improve quality for recreation and ecosystems	Upgrade grey infrastructure	Secondary treatment standards Reduce nitrogen discharges & CSOs Optimize and expand sewer system
		Green infrastructure	Expand the Bluebelt program Build & incentivize green infrastructure Codes for stormwater capture
		Industrial pollution	Actively clean up waterways
		Wetlands and habitat	Protect, restore, create habitats
Water Supply	Ensure high quality and reliability	Ensure the quality of drinking water	Continue watershed protection Protect from hydrofracking Catskill/Delaware UV Facility Croton Water Filtration Plant
		Enhance infrastructure outside of the city	Repair Delaware Aqueduct Connect Delaware/Catskill Aqueducts Pressurize Catskill Aqueduct Maintain and upgrade dams
		Modernize in-city distribution	Complete City Water Tunnel No. 3 Backup tunnel to Staten Island Upgrade water main infrastructure
		Improve efficiency	New technology for operations Increase water conservation
Transportation	Expand choices	Improve and expand sustainable transportation infrastructure	Improve and expand bus, subway, commuter rail, and ferry service Expand for-hire vehicles Promote car-sharing Make bicycling safer and convenient Pedestrian access and safety
	Ensure reliability and high quality	Reduce congestion	Pilot technology and pricing Modify parking regulations Reduce truck congestion Improve freight movement Improve our gateways
		Maintain and improve physical condition	Funding to improve mass transit Improve roads and bridges

Appendix B: PlaNYC Summary, continued

Category	Goals	Tasks	Initiative
Energy	Reduce energy consumption Make systems cleaner and more reliable	Improve energy planning	Promote clean, reliable, affordable energy
		Increase energy efficiency	Greener, Greater Buildings plan Improve codes and regulations Improve and track compliance Improve energy efficiency in smaller, historic and City buildings Provide financing and information Energy efficiency workforce Make NYC a knowledge center Expand Mayor's Carbon Challenge
			Complete City Water Tunnel No. 3 Backup tunnel to Staten Island Upgrade water main infrastructure
			New technology for operations Increase water conservation
		Improve efficiency	
Air Quality	Achieve the cleanest air quality of any big U.S. city	Understand the scope	Monitor and model neighborhood air
		Reduce transportation emissions	Reduce, retrofit, refuel vehicles Electric vehicles Reduce for-hire vehicle emissions Reduce illegal idling Implement Clean Air Strategy with Port Authority of NY and NJ
		Buildings emissions	Cleaner-burning heating fuels
		Update codes and standards	Update regulations for indoor air Update air quality code

Appendix B: PlaNYC Summary, continued

Category	Goals	Tasks	Initiative
Solid Waste	Divert 75% of solid waste from landfills	Reduce waste generation	Waste prevention Increase material reuse
		Increase recovery of resources	Incentivize and improve recycling Reduce construction waste Recover organic material Identify markets for recycled materials Pilot conversion technologies
		Improve the efficiency of waste management	Reduce impact on communities Improve commercial waste data Remove toxic materials from waste
		Reduce City government's waste	Revise City procurement practices Improve City's diversion rate
Climate Change	Reduce emissions by 30%	Increase resilience	Update building regulations Insure flood protection Protect city infrastructure Coastal protective measures
		Protect public health	Mitigate urban heat island effect Enhance understanding of impacts
	Increase resilience	Increase preparedness	Integrate projections into emergency management and preparedness
		Public information	• Increase community resilience

Appendix C: Adapted Functional Areas for City Comparison

Functional Area	Description
Climate Change	Climate change is a crucial component to any sustainable agenda, yet adaptation and mitigation strategies cut across multiple functional areas. Climate change here includes those overarching initiatives to integrate climate change mitigation and adaptation measures into all functional areas, as well as those efforts to educate communities about climate change, track GHG emissions, and develop tools used to assess the impact of climate change.
Energy	This functional area is defined as a city's initiatives to reduce energy use and secure reliable energy production, distribution, and consumption. This includes such initiatives as supporting renewable energy, energy efficiency, and smart grid technology development.
Air Quality	Air quality is one of the most significant environmental threats we face. Pollution can cause lung and heart conditions, as well as asthma. The Air Quality functional area includes such initiatives as monitoring and modeling air quality and updating codes and regulations to improve air quality. Related activities such as reducing transportation and building emissions will fall into the respective Transportation category.
Solid Waste	Solid waste relates to applying principles of sustainable management to every aspect of cities' waste. This includes technical, management, or behavioral changes to conventional solid waste streams, as well as recycling and composting programs, and reducing dangers of hazardous waste.
Transportation	This functional area is defined as relating to improvements in existing transportation systems and infrastructure as well as expanding, investing, and implementing new or different modes of transportation. Both technology and management play key roles for this sustainability area, e.g. investing in hybrid electric vehicles for a city's fleet, instituting bike share programs and bicycle lanes, enforcing parking limits, and reducing air pollution and noise from the transport sector.
Water	Both domestically and abroad, cities face diverse challenges in the water sector. The functional sustainable area of water includes any cities' activities to address water quality, quantity, and precipitation, such as water recycling and reuse, the sewer network, source control solutions, and water education. This area also includes waterways, shorelines, and water ecosystems. These goals can be met with "hard" infrastructure development as well as "soft" institutional arrangements.
Public Health, Recreation and Well-Being	Simply meeting citizens' basic human needs is not sufficient. This functional area relates to cities' efforts to improve the health of their citizens as well as enhance overall quality of life. This includes addressing pollution-inducing morbidity and infectious diseases, as well as increasing access to healthy food, social networks, parks, and recreation. It also includes such activities as tree planting and restoration, protecting the habitats of known plant and animal species, and urban agriculture. Access to recreation will manifest itself in various ways depending on neighborhood, city, region, or country.

Appendix D: City Selection Criteria

U.S. Cities

Pop. Rank	City	State	Population
1	New York	New York	8,244,910
2	Los Angeles	California	3,819,702
3	Chicago	Illinois	2,707,120
4	Houston	Texas	2,145,146
5	Philadelphia	Pennsylvania	1,536,471
6	Phoenix	Arizona	1,469,471
7	San Antonio	Texas	1,359,758
8	San Diego	California	1,326,179
9	Dallas	Texas	1,223,229
10	San Jose	California	967,487
11	Jacksonville	Florida	827,908
12	Indianapolis	Indiana	827,609
13	Austin	Texas	820,611
14	San Francisco	California	812,826
15	Columbus	Ohio	797,434
17	Charlotte	North Carolina	751,087
18	Detroit	Michigan	706,585
20	Memphis	Tennessee	652,050
21	Boston	Massachusetts	625,087
22	Seattle	Washington	620,778
23	Denver	Colorado	619,968
24	Baltimore	Maryland	619,493
25	Washington	District of Columbia	617,996
29	Portland	Oregon	593,820
35	Sacramento	California	472,178
44	Miami	Florida	408,750
47	Cleveland	Ohio	393,806
48	Minneapolis	Minnesota	387,753
51	New Orleans	Louisiana	360,740
61	Pittsburgh	Pennsylvania	307,484

International Cities

City Name	Similarities to NYC	Buildings	Energy	Lighting	Ports	Renewables	Transport	Waste	Water
London	Coastal, population density, mass transit, strong institutions, climate	X	X				X		
Rotterdam	Coastal, climate				X				X
Berlin	Population density, climate, mass transit	X							
Copenhagen	Coastal, strong institutions, population density, climate, mass transit		X			X	X	X	X
Rio de Janeiro	Coastal, high population, population density, strong institutions, mass transit	X	X	X			X	X	X
Mexico City	High population, population density, mass transit						X		
Bogotá	High population, population density, mass transit, strong institutions						X	X	
Tokyo	Coastal, high population, population density, mass transit, strong institutions	X	X					X	X
Bangkok	Coastal, mass transit								
Hong Kong	Coastal, high population, population density, mass transit, strong institutions		X	X				X	X
Cairo	High population, population density, mass transit								

Experts Interviewed

Baltimore, MD

Alice Kennedy, Sustainability Coordinator, Office of Sustainability, City of Baltimore

Jamie Nash, Food Access Coordinator, City of Baltimore

Bogotá, Colombia

Gustavo Adolfo Carrión Barrero, Vice Manager in Environmental Politics, Environmental Authority of Bogotá

Patricia Acosta Restrepo, Professor in Urban Studies and Planning, Faculty of Political Science and

Government, University of Rosario, Bogotá

Boston, MD

Jacob Glickel, Chief of Staff, Environmental & Energy Services, City of Boston

Charlotte, NC

Rob Phocas, Energy and Sustainability Manager, City of Charlotte

Chicago, IL

Aaron Koch, Deputy Commissioner for Sustainability, Department of Water Management, City of Chicago

Cleveland, OH

Matt Gray, Director, Mayor's Office of Sustainability, City of Cleveland

Copenhagen, Denmark

Mette Morsing, Professor, Copenhagen Business School

Eske Kock Pedersen, Executive Climate Officer, The Technical and Environmental Administration,

City of Copenhagen

Dallas, TX

Frank Camp, Interim Managing Director, Office of Environmental Quality, City of Dallas

Peer Chacko, Assistant Director, Development Services-Long Range Planning, City of Dallas

Kevin Lefebvre, Sustainability Coordinator, Office of Environmental Quality, City of Dallas

Theresa O'Donnell, Director, Sustainable Development and Construction, City of Dallas

Denver, CO

Jerry Tinianow, Chief Sustainability Officer, City of Denver

Houston, TX

Lisa Lin, Sustainability Manager, Office of Sustainability, City of Houston

Indianapolis, IN

Ashlee Kilpatrick, Planner, Office of Sustainability, City of Indianapolis

Jacksonville, FL

Nicholas Zelaya, Grants Contract Coordinator, Environmental & Compliance Department, City of Jacksonville

Los Angeles, CA

Beth Jines, Director of Strategic Initiatives, Department of Water and Power, City of Los Angeles

Miami-Dade County, FL

Debbie Griner, Environmental Resources Project Supervisor, Department of Regulatory and Economic Resources, Miami-Dade County

Karja Hansen, Miami-Dade Project Recruiting Manager, ioby

Nichole L. Hefty, Chief, Office of Sustainability, Planning Division, Department of Regulatory and Economic Resources, Miami-Dade County

Maria I. Nardi, Chief, Planning and Research Division, Department of Parks, Recreation & Open Spaces, Miami-Dade County

New Orleans, LA

Aron Chang, Waggoner and Ball Architects

Linda Stone, Director, New Orleans Office, Global Green USA, City of New Orleans

New York, NY

Hilary Beber, Policy Advisor, Mayor's Office of Long-Term Planning and Sustainability, New York City

Ester Fuchs, Professor of Public Affairs and Political Science, Director of the Urban and Social Policy Program, Columbia University's School of International and Public Affairs

John H. Lee, Deputy Director for Green Buildings & Energy Efficiency, Mayor's Office of Long-Term Planning and Sustainability, New York City

Philadelphia, PA

Alex Dews, Policy and Program Manager, Mayor's Office of Sustainability, City of Philadelphia

Jeff Knowles, Project Manager, Pennsylvania Environmental Council: Southeastern office

Janet Milkman, Executive Director, Delaware Valley Green Building Council

Phil Bresee, Recycling Director, Department of Streets, Sanitation Division, City of Philadelphia

Pittsburgh, PA

Matthew Barron, Policy Director, City Councilman Peduto

Lindsay Baxter, Project Manager, Pennsylvania Environmental Council: Southwestern office

Aftyn Giles, Sustainability Coordinator, Office Sustainability & Energy Efficiency, City of Pittsburgh

Jim Sloss, Energy and Utilities Manager, Mayor's Office, City of Pittsburgh

Portland, OR

Michele Crim, Sustainability Program Manager, Bureau of Planning and Sustainability, City of Portland

San Antonio, TX

Bill Barker, Senior Management Analyst, City of San Antonio

Philip Gates, Energy Manager, Office of Environmental Policy, City of San Antonio

Norma Gonzales, Assistant Sustainability Director, Office of Sustainability, City of San Antonio

Mary Hammer, Interim Sustainability Director, Office of Sustainability, City of San Antonio

Washington, D.C.

Keith Anderson, Acting Director, District Department of the Environment, Washington D.C.

Laine Cidlowski, Urban Sustainability Planner, Office of Planning, Washington D.C.

Dan Guilbeault, Policy Analyst, District Department of the Environment, Washington D.C.

John Heermans, Policy Analyst, District Department of the Environment, Washington D.C.

Kate Judson, Environmental Protection Specialist, Stormwater Management Division, District Department of the Environment, Washington D.C.

Leah Lemoine, Environmental Protection Specialist, Watershed Protection Division, District Department of the Environment, Washington D.C.

Harriet Tregoning, Director, Office of Planning, Washington D.C.

International: London, United Kingdom; Hong Kong, China; Rotterdam, Netherlands; Tokyo, Japan

Seth Schultz, Director of Research, C40 Cities Climate Leadership Group

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