CITIES

C40

→ 100 solutions for climate action in cities

2015

C40 CITIES
CLIMATE LEADERSHIP GROUP

SUSTAINIA

10

SECTORS

56

CITIES

100

SOLUTIONS

The paper and color used to produce the Cities100 publication is biodegradable and Cradle to Cradle certified.

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→100 **solutions** for climate action in cities

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Foreword

→ Cities are Taking Lead on Climate Change

As the global discussion on climate change intensifies, cities are leading the way to a sustainable future. And for good reason. By 2050, nearly 70% of the world's population will live in a city. As urban societies continue to expand and change, so too do the challenges facing them, particularly when it comes to climate change. This growing urban population is vulnerable to the impacts of climate change – for example, 90% of all urban areas are coastal – but it is also powerful. Cities have always been centers of commerce, culture, and knowledge. Now they are harnessing their innovative, collaborative, and progressive nature to take action on climate change, forging a path to low carbon development that improves the health, well-being, and economic opportunities of urban citizens.

Cities100 could not come at a better time, as the world's leaders gather in Paris this December for the United Nations Climate Change Conference, COP21. While the hope is that nations will reach a binding deal, the 100 city solutions presented in this publication remind us that cities can and do take meaningful action at the local level. City governments are often smaller and more nimble than their national counterparts. They are directly accountable to their local constituents and are more invested in the people and places they serve. Regardless of wealth or resources, size or location, cities around the world are learning from one another, adapting global best practices to fit local circumstances, and demonstrating that they have the power to take action to build a smarter, more resilient, and resource-efficient world.

At the same time, front-running cities are proving to national governments, businesses, and citizens that sustainable development is not only viable, it's necessary for a prosperous future, and in order to reach that goal we need collaborative and cooperative action throughout all levels of society. C40, Sustainia, and Realdania are committed to facilitating innovation and collaboration between cities on climate change solutions, and to communicating these successes to the world. Cities100 is supported by a solid foundation of knowledge and experience, anchored by Sustainia's history of discovering best practice sustainable solutions and C40's ambitious system of knowledge sharing networks between the world's greatest cities.

We are proud to support the forward-thinking projects of Cities100 and we are confident they will inspire further action toward creating a more sustainable tomorrow. It is clear that our future is urban. Cities100 proves that it can also be sustainable.

"SUSTAINABLE SOLUTIONS TO URBAN CLIMATE CHALLENGES ALREADY EXIST THROUGHOUT THE WORLD, AND IT IS OUR HOPE THAT THESE 100 PROJECTS WILL INSPIRE COUNTLESS OTHER CITY LEADERS TO TAKE ACTION ON CLIMATE CHANGE."

Laura Storm
CEO, Sustainia

"IN THIS URBAN AGE, IT IS SIMPLY NOT POSSIBLE TO TACKLE CLIMATE CHANGE WITHOUT STRONG AND URGENT ACTION IN CITIES. MAYORS HAVE THE OPPORTUNITY TO HELP SET THE WORLD ON A CLIMATE SAFE PATH. FORTUNATELY, WORKING TOGETHER, THEY ARE UP TO THE CHALLENGE."

Mark Watts
Executive Director, C40

"CITIES100 MARKS AN IMPORTANT ACKNOWLEDGEMENT OF BOTH SMALL AND LARGE CITIES' COMMITMENT ALL OVER THE WORLD TO FIGHT CLIMATE CHANGE, SHOWCASING TO NATIONS, BUSINESSES AND CIVIL SOCIETY THE PATH TO A SUSTAINABLE FUTURE."

Jesper Nygård
CEO, Realdania

Introduction

→ 100 City Solutions

Cities100 presents concrete proof that cities are taking action on climate change through projects, programs, and policies that will create the resilient and low carbon urban environments of the future.

Cities100 showcases 100 city solutions to climate change that can be scaled and replicated across the world. The solutions point to the reality that meaningful action to combat climate change is already underway at the local level. From retrofitting buildings to encouraging active transportation, creating green financing schemes to launching sustainable adaptation plans, the solutions you hold in your hands reflect the broad range of action cities are taking to mitigate and adapt to climate change, while at the same time creating valuable co-benefits for their economies, communities, and citizens' health.

These 100 solutions were selected after reviewing 216 applications from 94 cities spread across the globe. By identifying readily available city solutions, the partners behind Cities100 – C40, Realdania, and Sustainia – wish to highlight the potential for a sustainable urban future and inspire change makers throughout the world.

Welcome to a world of city action on climate change!

How we found the 100 projects

Cities100 is a mission shared by Sustainia and C40 to find the 100 leading city solutions to climate change. To identify groundbreaking projects from around the world, C40 and Sustainia launched a public campaign for applications, which yielded 216 eligible project applications. In order to find the projects with the largest potential to create low carbon and resilient cities, the applications were vetted and assessed by city and climate change experts at C40 and Sustainia, who used a detailed assessment scoring system based on five criteria:

1. EXPECTED OR ACHIEVED LEVEL OF SUCCESS WITH CLIMATE CHANGE TARGETS
2. LEVEL OF INNOVATION IN ADDRESSING MAJOR ENVIRONMENTAL ISSUES
3. CO-BENEFITS OF THE PROJECT THAT HAVE CONTRIBUTED TO ITS SUCCESS
4. DEMONSTRATION OF GOOD LEADERSHIP AND GOVERNANCE
5. POTENTIAL TO REPLICATE AND SCALE THE PROJECT

WHAT IS SUSTAINIA?

Sustainia is an international sustainability think tank working to identify and secure deployment of sustainable solutions that improve quality of life in communities around the world. Based on tangible know-how and technologies, Sustainia demonstrates the sustainable future we could achieve if existing solutions were implemented on a large scale. Sustainia is founded by Scandinavian think tank Monday Morning and developed in close collaboration with UN Global Compact, Regions20, Connect4Climate and world-leading companies and organizations, DNV GL, Realdania, Storebrand and WWF.

WHAT IS C40?

The C40 Cities Climate Leadership Group (C40) is a global network of the world's greatest cities focused on tackling climate change. Collectively, C40 cities have taken 10,000 climate actions in their commitment to reduce emissions by 1 gigaton by 2020, and they are on course to deliver more, while also taking necessary steps to boost climate resilience. By helping member cities create, share, and measure the impact of climate action, C40 accelerates results, and helps to transmit the most successful solutions around the world. C40's work is made possible by three strategic funders: Bloomberg Philanthropies, Children's Investment Fund Foundation (CIFF), and Realdania.

WHAT IS REALDANIA?

Realdania is a Danish, modern philanthropic association that works to create quality of life and benefit the common good by improving the built environment: cities, buildings, and the built heritage. Realdania is both a strategic funder of C40 and a founding partner of Sustainia.

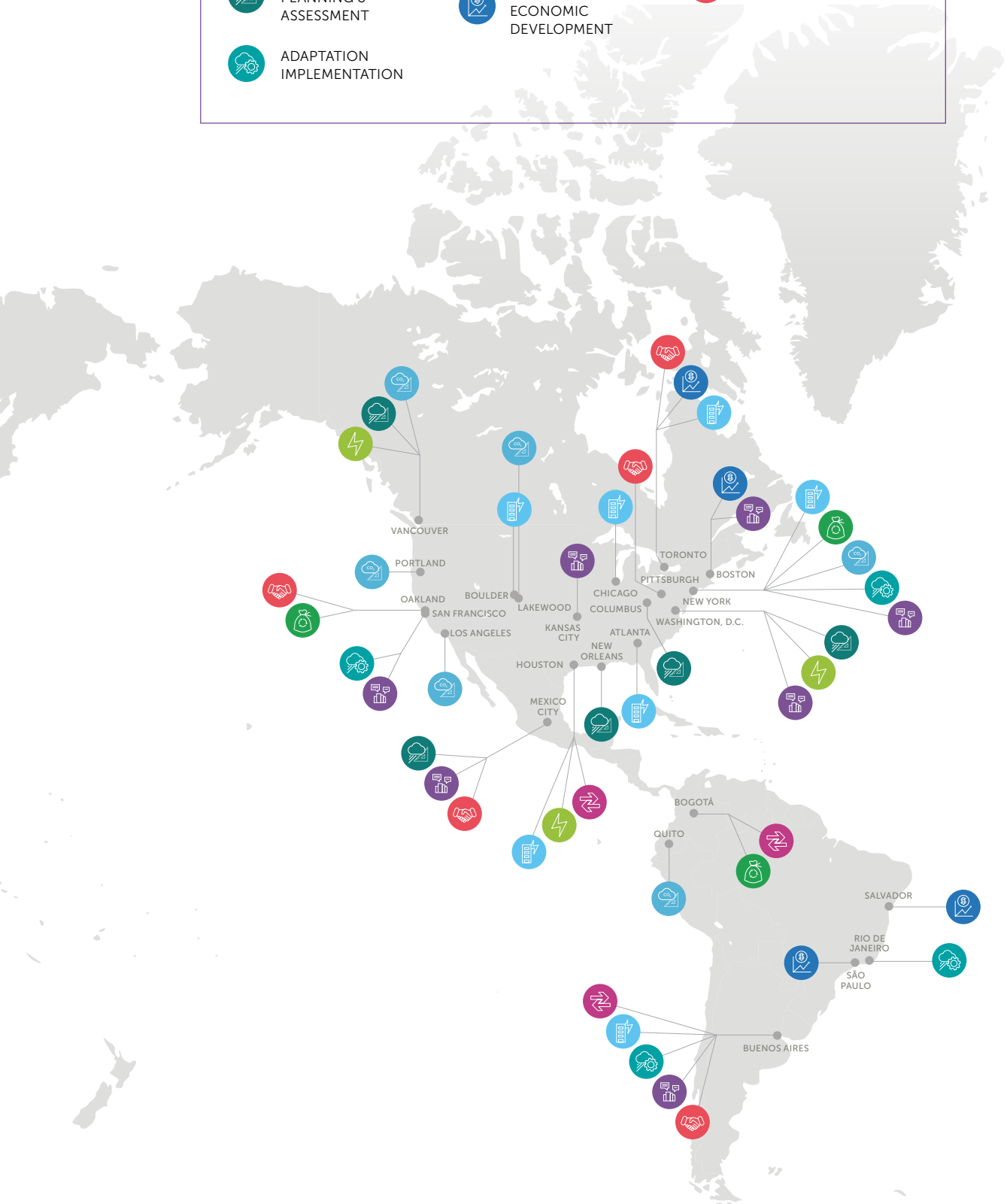
World Map

→ Putting City Solutions on the Map

Cities100 is a testament to the fact that cities are leading the global movement toward a low carbon future.

THESE 10 SECTORS REFLECT AREAS IN WHICH CITY GOVERNMENTS CAN TAKE MEANINGFUL ACTION TO ADDRESS CLIMATE CHANGE AND ITS EFFECTS:

- GREEN ENERGY
- SOLID WASTE
- ADAPTATION PLANNING & ASSESSMENT
- ADAPTATION IMPLEMENTATION
- CARBON MEASUREMENT & PLANNING
- BUILDING ENERGY EFFICIENCY
- FINANCE & ECONOMIC DEVELOPMENT
- SMART CITIES & SMART COMMUNITY ENGAGEMENT
- TRANSPORTATION
- SUSTAINABLE COMMUNITIES



GREEN ENERGY

The solutions in this sector incentivize the use of renewable technologies, introduce new green procurement strategies, and increase the use of green energy in an effort to push for a low carbon transition in city energy systems.

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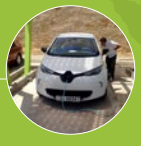

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RETURN TO
WWW.SUSTAINIA.ME

CITY: **WASHINGTON, D.C.**

Wind Power Purchase Saves Money

→ By entering into a Power Purchase Agreement to buy wind energy at a fixed rate over the next 20 years, Washington, D.C. is lowering its carbon footprint and saving money for taxpayers.

100K

TONS OF CO_2 REDUCED EACH YEAR FROM THE WIND PPA

THE CHALLENGE

Large-scale wind power is not feasible in Washington, D.C. but, with the use of a PPA, the District is able to directly source wind power and advance the regional market for renewable energy. The PPA also reduces the District's vulnerability to volatile energy prices by establishing a long-term price for electricity that is fixed for 20 years and cheaper than fossil fuel-based power.

CO-BENEFITS

Environmental

Greenhouse gas emission reductions from the PPA are equivalent to taking 20,000 cars off the road.

Social

The wind farm that the PPA supports has created close to 100 clean energy jobs during construction and supports roughly half-a-dozen permanent positions.

Economic

The PPA will help stabilize long-term electricity costs and is estimated to save District taxpayers $45 million over the next 20 years through lower electricity rates.

Health

The majority of the District's air pollution comes from fossil fuel-fired power plants located outside its borders. The PPA prevents the release of air pollutants such as soot, smog, and mercury that are harmful to human health.

In 2015, Washington, D.C. entered into a 20-year Power Purchase Agreement (PPA) with Iberdrola Renewables. Wind power procured under the PPA will supply roughly one-third of the District government's electricity from a 46 MW wind farm. The deal is the largest of its kind ever entered into by an American city. Under the PPA, the District does not pay for the wind farm itself, but rather, agrees to purchase **125,000 to 150,000 MWh of wind electricity** every year at a fixed rate 30% lower than fossil fuel power.

The avoided emissions will reduce government-wide greenhouse gas emissions by 17% from 2013 levels, which is the equivalent of growing 24 million trees each year. The PPA is expected to spur additional investment in the local renewable energy market by demonstrating confidence in wind energy as a scalable, long-term solution. The District is also negotiating two solar PPAs that would install **12.5 MW of solar arrays on roughly 50 District buildings**, providing another 3% to 5% of the government's electricity consumption.

The PPA is guided by the Sustainable DC Plan, which establishes a policy for the city to source 50% of its energy from renewable sources and cut its greenhouse gas emissions in half by 2032.

CITY: **CAPE TOWN**

Building Trust in Solar Water Heating

→ In Cape Town, a public campaign and accreditation system target the lack of trust in solar water heater providers in order to reduce household energy use and greenhouse gas emissions.

↓14K

TONS OF CO_2 REDUCED FROM SOLAR WATER HEATERS BY 2015

THE CHALLENGE

Cape Town has a high carbon footprint relative to other similar-sized cities, driven by electricity sourced largely from coal-fired power stations. Solar water heaters have the potential to significantly reduce electricity consumption, but recently a national rebate for solar water heaters was suspended. The Accredited Solar Water Heater Programme has successfully addressed the lack of trust in providers, which has spurred the market and increased installation of solar heaters.

CO-BENEFITS

Environmental
The use of solar water heaters leads to less coal burned in power plants, reducing air pollution and water use.

Social
The installation of solar water heaters under the program has created 158 jobs.

Economic
The Accredited Solar Water Heater Programme has contributed $7.7 million to the local economy.

Health
The installation of solar water heaters reduces the need for coal-fired power plants, which in turn reduces respiratory diseases for residents living near the plants.

The residential sector uses 37% of the total electricity consumed in Cape Town, and **water heating is one of the highest energy users** in the city's homes. Cape Town's Accredited Solar Water Heater Programme promotes installation of solar water heaters among middle-class home owners, replacing electric water heaters that are typically responsible for about 40% of the electricity used in residences. **Lack of trust in suppliers was identified as a main barrier** for consumers to install solar water heaters, which the city addressed by vetting providers and accrediting those meeting rigorous standards for competence and customer service.

With steeply rising electricity tariffs, the investment case for solar water heaters is strong. The Accredited Solar Water Heater Programme actively promotes their use through direct marketing, media advertising, social media channels, and a dedicated website providing easy access to practical information. The results thus far have been remarkable, with **5,729 solar water heaters installed in the first 21 months, reducing energy use by 15.9 GWh**, and saving residents a total of $2.2 million on utility bills. Information about benefits, installation, and the 20 accredited providers can be easily accessed through a dedicated website. Cape Town is investigating whether to expand the Accredited Solar Water Heater Programme to heat pumps and solar photovoltaic systems.

The attitude toward providers has also changed, with an increase from 32% to 48% of the target audience agreeing that solar water heater installers are trustworthy and competent.

CITY: **COPENHAGEN**

Carbon Neutral District Heating

↓500K

TONS OF CO_2 REDUCED PER YEAR BY 2025

→ Copenhagen is making the world's largest district heating system carbon neutral by substituting fossil fuels with biomass.

The Danish capital has the world's largest district heating network. **The system serves 98% of Copenhagen's buildings**. Over a 15-year period ending in 2025, the Greater Copenhagen Utility (HOFOR) will make the system carbon neutral by transitioning from coal, oil, and natural gas to sustainable biomass. To produce carbon neutral heating, HOFOR will replace fossil fuels at large combined heat and power (CHP) plants with **wood pellets from sustainably grown forests**. It will also deploy large-scale heat pumps that run on wind energy and geothermal energy and incorporate heat storage provided by large water tanks.

The plan also aims to reduce energy consumption in buildings and homes through remote monitoring of customers' energy use. If a large deviation occurs, the customer will be alerted and she can review the heating unit for errors and ensure optimum settings and operation. Finally, real-time monitoring of the distribution system, and the use of weather forecasts to ensure operational efficiency, will reduce heat losses in the district heating system by 6% by 2025.

THE CHALLENGE

To achieve carbon neutral heating in Copenhagen's comprehensive district heating system, the city decided to focus on upgrading old coal-fired combined heat and power plants to now be fired with wood pellets. The city will also construct a new wood chip-fired CHP plant. To diversify the energy sources needed and increase the flexibility of the system, Copenhagen is also testing the possibility of using large heat pumps to capture the heat from cleaned wastewater, drinking water, industrial surplus heat, and geothermal wells.

CO-BENEFITS

Environmental

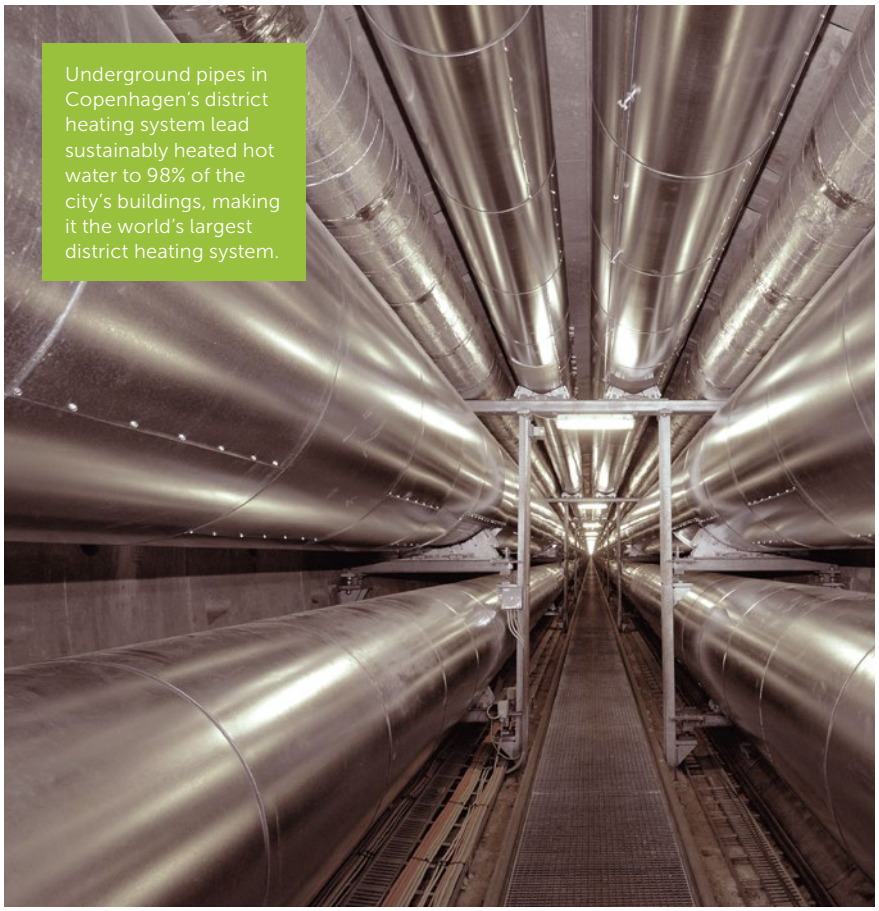
The plan includes building a 65 MW geothermal renewable energy facility.

Economic

Upgrading existing CHP plants, and constructing a new CHP facility, will create local employment.

Health

By establishing a small number of large CHP plants, emissions will come from a few large chimneys, all equipped with efficient filters that remove NOx, sulfate, and particles from the exhaust, which will reduce air pollution in the city.



Underground pipes in Copenhagen's district heating system lead sustainably heated hot water to 98% of the city's buildings, making it the world's largest district heating system.

Photos © Gottlieb Paludan Architects

CITY: **VANCOUVER**

Low Carbon District Heating Cuts Emissions

→ The Canadian City of Vancouver is building new district heating systems and converting existing systems to run on low carbon fuel sources, resulting in significant CO_2 reductions.

The Vancouver Neighbourhood Energy Strategy is rolling out low carbon district heating and cooling systems in high-density areas of the city. The strategy serves the dual purpose of converting existing fossil fuel-based district heating systems to run on low carbon fuel sources, such as wood chips, and building new district heating systems to serve both new developments and existing buildings. With three new systems operational, two new systems on the way, and an additional two low carbon conversions of existing systems to be completed in 2020, the Neighbourhood Energy Strategy aims to **reduce city-wide carbon pollution by 11%**, which is one-third of the city's overall climate reduction target.

To facilitate the roll out of low carbon district heating, Vancouver has created a competitive selection process involving relevant utilities and use of franchise agreements to leverage private sector expertise and financing. This approach includes the use of a number of different enabling policy tools, and results in minimal financial exposure and risk to the city government. Vancouver has taken the unusual step of **openly sharing its information**, including consultant studies, financial models, building standards, and franchise agreement contracts with other cities.

The Neighbourhood Energy Strategy was developed using lessons learned from the city-owned low carbon district heating system, which serves the Southeast False Creek area in Vancouver. The development of this system resulted in significant capacity building within the city government, which has enabled successful leveraging of private sector investment for new projects.

↓120K

METRIC TONS OF CO_2 REDUCED EVERY YEAR FROM NES PROJECTS BY 2020

THE CHALLENGE

Energy used for space heating of buildings generates more than 50% of the CO_2 emissions in Vancouver. The Neighbourhood Energy Strategy provides a cost-effective solution to significantly reduce these emissions. In order to compete with very low-cost fossil fuels, the city has established a number of enabling policies for district heating to be more cost-effective and competitive.

CO-BENEFITS

Environmental

The district heating projects tap waste heat from sewers, data centers, and solid waste residues that would not otherwise be available to individual buildings, thereby making more efficient use of resources.

Social

Customers connected to low carbon district heating benefit from much more stable and predictable energy costs as a result of using local renewable energy sources rather than depending solely on fossil fuels.

Economic

The Neighbourhood Energy Strategy projects generate employment activity stemming from $173.6 million in construction investments as well as ongoing operations.

Health

The roll out of district heating in Vancouver results in less combustion of fossil fuels for heating, improves local air quality, and reduces the potential for respiratory illness for residents.

CITY: **MELBOURNE**

Teaming Up to Buy Renewable Energy

→ To reach its renewable energy targets and drive investments in green energy, Melbourne has joined forces with 13 organizations to procure 100 GWh of renewable energy.

134K

METRIC TONS OF CO_2 REDUCED PER YEAR BY CONVERTING 100 GWH OF ELECTRICITY FROM BROWN COAL TO RENEWABLE SOURCES

THE CHALLENGE

By entering into partnerships with other organizations, Melbourne is able to significantly improve the share of renewable energy consumed in the city and provide reliable demand for renewable providers to allow their projects to proceed and further drive down costs.

CO-BENEFITS

Environmental

In Australia, a major barrier to investment in utility-scale renewable energy facilities is the inability of new generators to secure power purchase agreements. This procurement project seeks to change this trend.

Social

Utility-scale renewable energy facilities are creating employment in areas that are in economic and social decline due to the closure of other industrial sectors or challenging environments for agriculture due to drought and climate change.

Economic

Approximately 144 jobs will be created to construct the new renewable energy facility, plus 12 jobs in the ongoing operation and maintenance of the plant.

About 90% of Melbourne's electricity comes from brown coal power plants and as the city center is dominated by high-rises, it is not possible to de-carbonize the electricity supply sufficiently through on-site renewable use. Therefore, Melbourne is developing an innovative group procurement model for renewable energy where **the city and 13 other organizations** agree to purchase electricity from a renewable energy plant via a long-term contract. The combined procurement of the group, consisting of other city governments, cultural institutions, financial institutions, and property businesses, will result in the construction of a new solar plant or wind farm supplying approximately **100 GWh of electricity** to the grid.

Melbourne aims to scale the model further to reach its target of 25% electricity from renewable sources by 2018. The city adopted the procurement model to circumvent national policy inertia in the renewable energy industry by **using existing market mechanisms and developing a replicable model** that is not reliant on policy changes. Melbourne is developing a full suite of tools and information to assist other cities in adopting similar procurement models.

Together with a group of businesses and government entities, Melbourne is driving investment in a 100 GWh renewable facility through long-term electricity procurement contracts.

CITY: **HOUSTON**

Green Power Procurement Program

→ The City of Houston is increasing its use of green energy through procurement and long-term contracts to purchase solar energy.

Houston's green power purchase program is the largest of its kind in the USA, with more than 140 MW of renewable power for municipal use procured from 2013 to 2015, and an additional 70 MW through to 2016. In total, the 210 MW, purchased through renewable energy credits that are Green-e certified, enable Houston to use almost **623,000 MWh of green power annually**, which is equivalent to the electricity needed to power more than 55,000 homes. The program offsets more than 1 million metric tons of CO_2 over the three-year agreement compared to fossil fuel-based power plants.

To complement these efforts, Houston is also generating green power through a 15-year **power purchase agreement (PPA) for a 30 MW solar plant**, estimated to provide 77,000 MWh or 6.2% of the City of Houston's average annual consumption of electricity, offsetting an additional 42,000 metric tons of CO_2 per year. Houston's green power purchases make the city the largest municipal buyer of renewable power in the USA, according to the Environmental Protection Agency's Green Power Partnership rankings.

345K

METRIC TONS OF CO_2 REDUCED ANNUALLY FROM HOUSTON'S GREEN POWER PURCHASE PROGRAM

THE CHALLENGE

The City of Houston's purchase of wind power represents a significant investment in the renewable energy market. With such an investment, the city is helping to grow the renewable energy industry, adding more stability to the market.

CO-BENEFITS

Environmental

The program avoids 503 metric tons of NOx emissions and 368 metric tons of PM10 emissions through increased use of green energy.

Economic

Long-term contracts for renewable energy offer price stability, unlike the volatile fossil fuel markets.

Health

Emissions from coal-fired power plants cause negative health effects, including asthma and heart attacks. Renewable wind power is emissions-free.

With the largest green power purchase program in the USA, Houston - dubbed the energy capital of the world - is transitioning from a fossil fuel powered economy to a low carbon future.

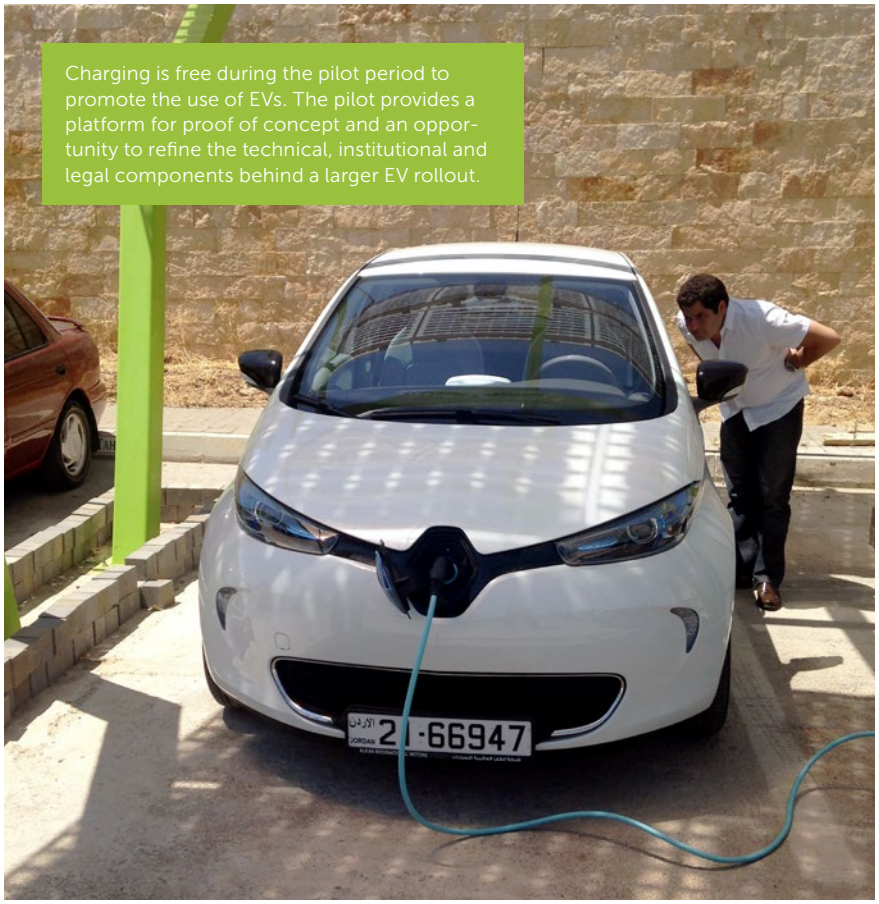
CITY: **AMMAN**

Solar-charged EV Rollout

→ Jordan's capital of Amman is preparing a rollout of electric vehicles fueled by solar energy with the aim of lowering air pollution and fossil fuel energy consumption.

More than 1 million cars are registered in Amman, and a significant portion of these cars are older, second-hand vehicles that do not meet today's fuel efficiency and emissions standards. To begin to clean the city's vehicle fleet, Amman launched a pilot project – in collaboration with public and private partners – that promotes a transition to solar-charged electric vehicles (EVs). In 2015, the pilot included **150 EVs and 10 charging stations** that are free to use. The project also comes with an advanced information and monitoring system, which will contribute to a positive user experience.

The pilot prepares for a gradual rollout of EVs, with an expected **next phase including 10,000 EVs and 3,000 charging stations** that will be supplied with electricity from a 30 MWh solar farm. The city hopes to further scale the project if the pilot is deemed successful. A 10% shift to solar-powered EVs in Amman would save 120 million liters of fuel and 268,000 tons of CO_2. In addition, a car-free zone in the downtown area is planned, which will rely on solar-powered EV taxis and public transport nodes that connect to parking facilities in the perimeter of the city.



Charging is free during the pilot period to promote the use of EVs. The pilot provides a platform for proof of concept and an opportunity to refine the technical, institutional and legal components behind a larger EV rollout.

300

TONS OF CO_2 REDUCTION PER YEAR FOR THE PILOT

THE CHALLENGE

Transportation accounts for more than 40% of Jordan's energy use and is the country's leading source of air pollution. As Amman is responsible for a majority of the more than 1.73 billion liters of gasoline and diesel fuels burned in Jordan annually, solar-charging EVs provide a win-win situation by reducing energy consumption and air pollution.

CO-BENEFITS

Environmental

For every liter of fuel saved by a solar-charged EV, 2.3 kg of CO_2 is reduced.

Economic

The pilot will create up to 300 jobs, while opening up business opportunities for related services and industries in Jordan.

Health

With significant air pollution stemming from private cars in Amman, the project will, when rolled out extensively, reduce respiratory illnesses.

CITY: **STOCKHOLM**

World's First Urban Carbon Sink with Biochar

→ The Stockholm Biochar Project is turning the city's park and garden waste into renewable energy for heating while sequestering carbon.

The Swedish capital of Stockholm is building a pyrolysis plant, which allows the city to produce biochar and renewable energy from its green urban waste. By 2020, the energy generated from biochar production will be turned into **25,000 MWh of heat** for the city's district heating network, enough to heat 400 apartments.

With current levels of global greenhouse gas emissions, there is an urgent need to lower the level of carbon dioxide in the atmosphere. The Stockholm Biochar Project does just this by turning park and garden waste, which contain carbon taken up through photosynthesis, into biochar. Biochar sequesters carbon by converting it into a stable element of the soil that can stay in the ground for millennia. The biochar serves as a substitute for finite materials, such as peat, clay, and sand, and is used by the city in public plant beds – creating the world's first urban carbon sink. The Stockholm Biochar Project plans to produce **7,000 metric tons of biochar by 2020**, which sequesters carbon equivalent to the yearly CO_2 emissions from 3,500 green cars.

Biochar from the Stockholm Biochar Project is given to Stockholm's citizens to be used in their private gardens.

↓25K

METRIC TONS OF CO_2 WILL BE SEQUESTERED BY 2020 IN THE STOCKHOLM BIOCHAR PROJECT

THE CHALLENGE

Cornell University estimates that producing biochar from biomass – such as organic waste that does not compete with food production or increase land use – could sequester carbon equivalent to 12% of global CO_2 emissions, which is on par with emissions from the global transport sector. As any type of clean organic material can be used to make biochar, the Stockholm Biochar Project paves the way for cities to create urban carbon sinks from their organic waste.

CO-BENEFITS

Environmental
6,500 metric tons of organic waste will be turned into a resource every year by the Stockholm Biochar Project.

Social
The project aims to have 100,000 residents using biochar in their gardens by 2020.

Economic
Park and garden waste is difficult and costly for Stockholm to dispose of. When processed by the Stockholm Biochar Project, this waste can help lower the overall cost of waste management and generate an income from selling heat.

CITY: **CARDIFF**

Green Energy Combats Fuel Poverty

→ Cardiff's One Planet Energy portfolio of projects reduces energy use and increases renewable energy generation while addressing fuel poverty.

↓26%

CO_2 REDUCTION PER CAPITA IN CARDIFF IN 2020 SUPPORTED BY ONE PLANET ENERGY

THE CHALLENGE

High energy prices in Wales, combined with poor housing stock quality and low incomes, has resulted in increased fuel poverty among residents in cities like Cardiff. Through One Planet Energy's household retrofit projects, underprivileged Cardiff families will receive affordable and sustainable heating. One Planet Energy also utilizes local supply chains and labor, while training local unemployed youth at a rate of three trained per $1.5 million spent on projects.

CO-BENEFITS

Environmental

Cardiff aims to reduce CO_2 emissions from Council services by 60% by 2022.

Social

The Cyd Cymru efficiency project under the One Planet Energy portfolio has lowered household energy bills by an average of almost $400 annually.

Economic

On energy efficiency retrofit projects, Cardiff has achieved a minimum of two new, green jobs per $1.5 million spent.

Health

Retrofitted homes are warmer, which can help occupants with conditions such as arthritis and rheumatism, and may help reduce the risk of colds, flu, and respiratory and cardiovascular diseases.

If everyone in the world consumed natural resources and generated CO_2 at the rate Cardiff does today, three planets would be needed to support the human race. The Welsh city **aspires to be a "one planet city" by 2050** and has created a One Planet Energy portfolio of projects that supports this mission. The projects take a holistic, city-wide approach to increase renewable energy generation and energy efficiency that addresses the problem of fuel poverty in underprivileged households.

Renewable energy installations at city facilities are **expected to produce 3 GWh annually by 2022**. The portfolio of projects utilizes a suite of renewable energy sources such as solar, hydro, geothermal, hydrogen, and landfill gas. The Hydrogen Enabled Local Energy Systems project will integrate a solar photovoltaic farm with the city's landfill gas plant in order to produce hydrogen fuel that functions as energy storage for the grid. With a special focus on engaging the fuel poor, the energy efficiency projects retrofit private households as well as public sector buildings, resulting in annual savings of 2,200 metric tons of CO_2, as well as increased awareness about energy efficiency amongst all residents regardless of income and education.

Renewable energy generation projects reduce energy bills for residents and provide them with income from exporting energy back to the grid.

CITY: **PARIS**

Renewable Energy Lights the Way

→ The City of Light will soon run on 100% renewable energy for public lighting, while at the same time reducing electricity consumption.

13.9K

TONS OF CO_2 SAVED ANNUALLY FROM THE 30% REDUCTION IN PUBLIC LIGHTING ELECTRICITY USAGE BY 2020

Dubbed "The City of Light," Paris has 345,000 public light sources, including signage, street, and park lighting. The electricity consumption of public lighting in Paris is 150 GWh, and the energy bill for this amounted to $17.9 million in 2012. To reduce the climate impact of public lighting, the city has committed to **purchasing 100% renewable energy** for municipal public lighting from 2016, while simultaneously reducing energy consumption of Paris' public lighting. The contract to purchase all electricity from renewable sources also includes electricity consumed in municipal buildings, **amounting to a total of 350 GWh per year**.

To achieve a 30% reduction in electricity consumption in 2020 while maintaining the current scope of public lighting, the City of Paris entered into a 10-year energy performance contract in 2011 for public lighting and luminous signage installations. After the first year of operations, the upgrades led to a 12% reduction in electricity consumption compared to 2004.

THE CHALLENGE

Paris' public lighting is iconic and contributes to the appeal of the French capital, both for Parisians and visitors. This project addresses the need to maintain the current standard of service while reducing electricity consumption, a substantial expenditure in the city's budget.

CO-BENEFITS

Environmental

Paris expects to save more than 40 GWh of electricity on its public lighting in 2020.

Social

Upgraded public lighting provides safety and comfort for pedestrians.

Economic

The 10-year energy performance contract provides a legal guarantee that goals are reached, with achievements assessed each year and penalties applicable in the case of non-compliance. At the same time, bonuses are awarded if observed savings exceed targets.

Paris' 345,000 public lights will run on renewable energy sources from 2016.

SOLID WASTE

Solutions in this sector help cities transform waste resources into clean energy and raw materials, effectively manage waste collection and separation, and limit food waste, proving the potential to reduce greenhouse gas emissions from city waste while providing co-benefits such as reduced air and soil pollution and fossil fuel consumption.

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CITY: **YOKOHAMA**

Engaging Businesses and Residents in Waste Reduction

→ The 3R Dream Plan encourages behavior change and coordination between residents, businesses, and the city government in order to increase recycling and reduce waste.

↓71K

TONS OF CO_2 REDUCED EACH YEAR BY 2017 THROUGH WASTE REDUCTION EFFORTS

THE CHALLENGE

Rapid economic development and urbanization have caused explosive population growth in Yokohama. The city is now constrained in terms of resources and will soon run out of land for depositing the ash from waste incineration. This situation left Yokohama with only one option: reduce waste through increased reuse and recycling city-wide.

CO-BENEFITS

Environmental

By urging residents to collect their kitchen waste, the city has managed to convert one year's worth of kitchen waste into enough energy to power 170,000 households for one day.

Economic

As Japan has limited physical resources and must import many of the materials used in the waste incineration process, extensive recycling is a prerequisite for future growth in Yokohama.

The Yokohama 3R Dream Plan teaches manufacturers to use recycled and recyclable materials during production and **urges businesses to sell eco-friendly products and services**, which will lead to less resources imported and used and, ultimately, wasted. Residents are encouraged to participate by managing their household waste, reusing plastic bags and water bottles, and supporting environmentally friendly businesses. Residents are engaged by invitation to tens of thousands of resident briefings, more than 2,000 campaigns at collection points, and hundreds of campaigns at train stations.

The city has already **reduced waste 45% from a peak of 1.61 million tons** due to city-wide measures such as thorough sorting, to avoid burning recyclables, and recycling. By undertaking these efforts, Yokohama aims to mitigate climate change and reduce greenhouse gas emissions by at least 50% in 2025.

Through extensive campaigns and resident briefings, Yokohama is promoting environmentally conscious behavior to not only affect the city's waste disposal but also make efficient use of resources and energy.

CITY: **NEW YORK CITY**

Zero Waste Plan to Eliminate Waste to Landfill

→ With a comprehensive plan to reduce waste, improve recycling rates, and divert organics from landfill, New York City aims to reduce the amount of material it sends to landfill by 90% by 2030.

New York City's Zero Waste plan is to eventually eliminate the use of landfills. Through a combination of waste reduction, reuse and recycling programs, and wastewater treatment plants with anaerobic digestion that harness food scraps to create energy, **the city aims to achieve 90% reduction in waste to landfill** and render landfills a thing of the past.

The city is already well on the way to achieving its goal, as initiatives such as expanding the collection of organics, implementing more zero waste school programs, increasing recycling of textiles and electronics, and reducing the use of non-recyclable materials have led to a **22% drop in emissions from the solid waste sector**. Aside from reducing waste, these initiatives will help alleviate another challenge for the city: limiting the number of trucks needed to collect and transport waste to landfills. Reducing the number of these vehicles will minimize neighborhood traffic congestion and limit associated emissions.

New York City's Zero Waste plan has a number of initiatives; one of them is using food scraps to create energy through anaerobic digestion.

↓2.56

MILLION METRIC TONS OF CO_2 WILL BE REDUCED BY 2050

THE CHALLENGE

More than 6 million tons of waste are disposed of yearly in New York, and with no local landfills, the city's current solution of trucking waste to out-of-state landfills not only has negative environmental and social consequences, but is extremely costly. The zero waste plan will thus limit the city's CO_2 emissions, improve conditions in affected neighborhoods, and save the city a great expense.

CO-BENEFITS

Environmental

The average New Yorker throws out about 11 kg of waste every week, adding up to 6 million tons of waste per year. Reducing the waste volume will decrease air pollution with fewer trucks transporting waste to landfills.

Social

The zero waste plan continues the city's commitment to reducing the impact of its waste management system on historically overburdened poor and minority communities including, but not limited to, the South Bronx, North Brooklyn, and Jamaica neighborhoods.

Economic

Eliminating the transportation of waste to landfills will save the city more than $310 million a year.

Health

Waste reduction and less truck traffic will improve pedestrian safety, respiratory health, and overall quality of life.


PROGRAMA
basuracero
Ades

CITY: **BOGOTÁ**

Improving Equality for Recyclers

→ By including Bogotá's informal recyclers in the city's social and economic structure, thousands of people have been granted deserved dignity and the city's emissions are significantly lowered due to increased recycling.

In an effort to lower emissions and improve social justice, Bogotá launched the Zero Waste program in 2012. The program aims to increase recycling and reduce waste sent to landfills, while establishing **more equitable conditions for the city's recyclers**, who previously had been excluded from the social and economic structures of the city.

The Zero Waste program is part of the city's development program, Bogotá Humana, which prioritizes environmental stewardship, with a particular focus on social inclusion. This focus has meant that **thousands of recyclers have been given the chance to work** under the city's new waste collection scheme, giving them financial incentives to help increase recycling and providing them with formal recognition by the government. The recyclers' efforts, along with conscious consumerism and improved residential waste separation, are key components of the city's strategy to fulfill a goal of **reducing waste sent to landfills by 20%** by 2016.

The thousands of informal recyclers in Bogotá are now included in the city's official waste collection, providing them with a hitherto unseen economic compensation and social status while significantly increasing recycling.

↓700K

TONS OF CO_2 EMISSIONS REDUCED PER YEAR

THE CHALLENGE

Historically, waste collection services in Bogotá have not been prioritized and informal waste pickers were valued neither socially nor economically. The city's Zero Waste program focuses on awarding dignity to the city's recyclers, which has led to improved collection of reusable materials, increased energy produced at biogas plants, and reduced CO_2 emissions.

CO-BENEFITS

Environmental
A biogas plant located at one of the city's landfills produces about 39 MW worth of energy.

Social
The city recyclers are now compensated for their work, and collect about one ton of reusable materials daily.

Economic
As a result of the Zero Waste program, the price of service collection has been reduced by 15%.

Health
As part of Bogotá's social inclusion strategy, 12,000 protection kits are being delivered to the city's recyclers, allowing them to more safely do their jobs.

CITY: **MILAN**

Collecting Food Waste City-wide

→ Milan is the largest city in Europe to establish residential food waste collection city-wide, involving nearly all residents in less than two years.

In 2011, the Italian City of Milan's overall recycling rate was low and consisted mainly of dry recyclables, like paper and plastic, collected separately at the curbside. Food waste was only collected from commercial sources. The city decided to improve planning and subsequent collection in 2012 and, already by 2014, the entire city was included in the process, with **over 90 kg of waste collected per resident each year**, reducing CO_2 by 8,800 tons.

Citizens collect their food waste in compostable bags picked up twice weekly at the curbside. That same day, **the food waste is transferred to an anaerobic digestion and composting facility**. The logistics of the collection and transfer are carefully organized to limit fuel consumption and minimize traffic. To ensure citizen engagement, the city made sure to inform and involve citizens by designing a dedicated app. Furthermore, free vented kitchen bins were delivered to all households.

The City of Milan has managed to involve nearly all of its citizens in collecting food waste in compostable bags. The food waste is used for production of biogas and compost for soil remediation.

↓9.5K

TONS OF CO_2 EXPECTED TO BE REDUCED PER YEAR THROUGH FOOD WASTE COLLECTION IN MILAN

THE CHALLENGE

With a population of 1.36 million people, Milan faced the difficulty of managing high quantities of food waste within a densely populated area. In order to meet the challenge, Milan engaged the population and restructured waste collection services to minimize traffic and fuel consumption.

CO-BENEFITS

Environmental
The project ensures better use of resources, as waste is used in the production of biogas and reduces fossil fuel consumption.

Social
After being successfully engaged in the project, the Milanese now feel more involved in environmental policies and are generally participating more in city initiatives.

Economic
Implementing food waste collection in large cities can boost the bio-waste treatment sector and lead to job creation in the city.

CITY: **WUHAN**

Transformation from Landfill to Garden

→ The Chinese City of Wuhan has restored more than 50 hectares of land from a closed landfill in less than a year, improving the living environment for residents and solving pollution challenges.

↓66

TONS OF CO_2 ABSORBED PER YEAR BY RESTORED LAND

THE CHALLENGE

Natural degradation of pollutants from the Jinkou landfill would have taken at least 30 years, and restoration through excavation measures is very costly. To solve the issue, Wuhan restored the landfill and surrounding environment using aerobic ecological restoration, thereby ensuring that the land is re-utilized for enjoyable purposes.

CO-BENEFITS

Social

The new ecological park improves the quality of life for the citizens of Wuhan and promotes economic and social development in the surrounding areas.

Economic

The project saved $125 million by using aerobic ecological restoration compared to conventional restoration methods.

Health

Restoring the landfill site ensures reduced air pollution for more than 100,000 people living in close proximity to the landfill.

The closed Jinkou landfill in Wuhan caused pollution, which natural degradation would have taken decades to remove, affecting not only the environment but also residents in nearby areas. To restore this wasteland more efficiently, the city began an aerobic ecological restoration project. Not only does it alleviate risks of long-term safety issues from pollutants and eliminate the threat of methane explosions, this project also restores more than 50 hectares of land for city landscaping. Proving that even the **most polluted areas can become ecological havens**, this former landfill site hosted the China International Garden Expo in 2015.

The restoration process, which began in 2014, introduced **proper planting techniques, diverse plants, and measures to improve the soil** aiming to promote continuity of the fundamental ecological system. The project ties in with Wuhan's General Urban Planning scheme to improve the quality of the city's ecological environment and enhance sustainable urban development, and eventually become a National Garden City, which is a title the Ministry of Housing and Urban-Rural Development grants to Chinese cities focusing on green, sustainable development.

The landfill underwent revitalization, maximizing land resource values to become the unique garden area it is today. Hosting the International Garden Expo in 2015, the garden will become one of the key attractions in Wuhan and garner many tourists.

CITY: **OAKLAND**

Partnerships to Divert Waste from Landfills

→ By engaging in local partnerships, Oakland has achieved high levels of diversion from landfills and expanded community outreach.

↓450K

METRIC TONS CO_2 REDUCED ANNUALLY FROM OAKLAND'S WASTE MANAGEMENT

THE CHALLENGE

Oakland faced a number of issues in relation to waste management, such as illegal dumping of waste and a lack of knowledge among residents on how to handle waste. By developing partnerships with key local stakeholders, Oakland is diverting waste from landfills and reducing greenhouse gas emissions.

CO-BENEFITS

Environmental
The city's new solid waste measures aim to reduce greenhouse gas emissions by 36% by 2020.

Social
The city's many partnerships ensure better convenience for citizens when recycling and composting as well as improved equity of service offerings for the city's renters.

Economic
With the goal of preventing 100% of compostable and recyclable materials from going to landfills, Oakland will benefit financially from reduced spending on landfill-related resources and the generation of CNG from compost.

Health
Locally generated compressed natural gas fuels 70% of the waste collection vehicles, which improves air quality for Oakland's residents.

To reach its goal of zero waste, Oakland, California, has engaged local businesses and communities. The city has established partnerships with waste collection companies and the local solid waste authority, which **has made curbside composting and recycling possible for all Oakland residents**. Moreover, to reduce emissions, the fleet of trucks used by waste collection companies was replaced by compressed natural gas-fueled vehicles.

Other partnerships with the city's local water provider, recycling businesses, and Civicorps, an AmeriCorps program focused on environmental stewardship, have expanded Oakland's community outreach. The partnerships have also made bulky item pickups available to multifamily buildings and condominiums, and free drop-off events for over-sized trash are now held throughout the year. Oakland is already seeing results: **250,000 tons of materials are diverted from landfills** each year and the city's new solid waste collection measures – including its locally generated CNG-fueled collection fleet – will slash greenhouse gas emissions from waste by more than one-third annually.

By engaging in partnerships, Oakland has made curbside composting and recycling possible for all Oakland residents resulting in a greener and cleaner city.

CITY: **BENGALURU**

Digital Mapping to Manage Solid Waste

→ Bengaluru's goal of 100% solid waste collection proves that inefficient waste management can be turned around using digital mapping to inform waste collection and transportation systems.

↓109

METRIC TONS OF CO_2 EXPECTED TO BE AVOIDED PER YEAR

THE CHALLENGE

A complex city fabric and a high degree of informality were challenging effective solid waste management in Bengaluru, resulting in a waste collection rate of just 50%. Facing rapid urbanization, the government came up with the solution to create a GIS-based model to manage solid waste, ensuring a more efficient and reliable collection and transportation system.

CO-BENEFITS

Social

The new norms of waste handling will ensure cleaner and healthier living conditions in vulnerable communities.

Economic

Nineteen thousand jobs are expected to be created when the GIS model covers the entire city by 2016.

Health

With door-to-door collection for the entire city, open burning and dumping of waste is minimized, reducing air and soil pollution.

With several closed landfills, an ineffective solid waste management system, and unreliable data to accurately plan effective collection and transportation, Bengaluru needed a re-set in its approach to solid waste management. In 2013, in collaboration with Center for Public Problem Solving, the city launched a process to create a geographic information system-based model (GIS) for its solid waste management, and is now ready to roll it out in almost half the city. GIS is a system that can store, analyze, and share mapped geographic information, such as **decentralized infrastructure and existing vehicle routes**, which are crucially important when planning waste collection and transportation.

The data-driven model enables a cost-efficient waste management system by using optimal route algorithms and automated rules for data collection. A better-planned, efficient, and accountable collection and transportation system is expected to **reduce the distance over which waste travels by 80%** and expand the door-to-door collection system to cover the entire city by 2016, resulting in CO_2 reductions from the waste sector.

The GIS-based model is ensuring a more accountable and efficient solid waste collection enabling Bengaluru to reach its goal of collecting 100% of the city's solid waste.


INKOMAZI
Tab

CITY: **DURBAN**

Landfill Greening Empowers a Community

→ Durban is alleviating poverty and reducing CO_2 by engaging the local community in turning a landfill buffer zone into a conservancy, planting indigenous trees and rehabilitating local natural habitat.

Rarely are landfills viewed as a positive factor for a city, but the Buffelsdraai Landfill Site Reforestation Project in Durban, South Africa is the exception to the rule. The project enhances the city's environment by involving citizens in turning the buffer zone around the landfill into a conservancy, thus improving quality of life for local citizens and limiting the landfill's carbon footprint. With 200 hectares of local natural habitat around the landfill rehabilitated and **more than 750,000 indigenous trees planted**, Durban is not only mitigating its carbon footprint but also increasing local climate adaptation capacity.

Empowering local communities to become "tree-preneurs," the project **addresses unemployment and assists in alleviating poverty** by giving the tree-preneurs vouchers for school fees, bicycles, food, or other services in exchange for growing and planting trees. To further limit greenhouse gas emissions, methane gas from the landfill is burned for electricity. Durban plans to be the first city in Africa to turn a landfill's methane gas into electric power.

10

MILLION TONS OF CO_2 IS PREDICTED TO BE AVOIDED IN THE LIFESPAN OF THE LANDFILL

THE CHALLENGE

Historically, landfills have been viewed as detrimental to the environment, but through the Buffelsdraai Landfill Site Reforestation Project, Durban is proving that enhancing both social and environmental conditions is possible with innovative thinking and local community involvement.

CO-BENEFITS

Environmental

The amount of trees currently planted will save about 55,000 tons of CO_2.

Social

The Buffelsdraai Landfill Site Reforestation Project has created 43 full-time jobs, 16 part-time jobs, and 389 temporary jobs, decreasing the poverty level in the local community.

Economic

Vouchers worth $970,000 have been distributed to the local community for taking part in planting trees near the landfill.[1]

Health

Due to the regular meals provided through vouchers for the underprivileged residents of the local community, their overall health and quality of life have improved.

Seven hundred hectares have been converted into conservancy, contributing to the sustainable development in the community.

[1] Environmental Planning and Climate Protection Department. "The Buffelsdraai Landfill Site Reforestation Project." 2015.

CITY: **HONG KONG**

Reducing Food Waste by Raising Awareness

→ A city-wide promotional campaign is changing the food waste culture in Hong Kong by engaging citizens, businesses, and civil society.

460K

METRIC TONS OF CO_2 ARE AVOIDED ANNUALLY DUE TO HONG KONG'S INITIATIVES TO REDUCE FOOD WASTE

THE CHALLENGE

Hong Kong's three landfills are estimated to reach capacity within the next five years. With limited opportunities to facilitate source separation due to the density of Hong Kong, the city has found a way to reduce waste and avoid potential health risks associated with daily disposal of tons of municipal waste.

CO-BENEFITS

Environmental
Food waste will be reduced by 1,440 tons per day by 2022 from the Hong Kong Food Wise Campaign.

Social
An estimated 900 tons of surplus food will be redistributed to Hong Kong's disadvantage residents within the next two years.

Health
Hong Kong's overfilled landfills will pose serious health risks to nearby residents, which can be reduced by generating less waste.

The Hong Kong Food Wise Campaign increases public knowledge of the growing food waste problem in the dense city. Trained Food Wise Ambassadors spread targeted key messages and practical tips about food waste reduction across communities. Through an extensive media campaign, including **televised commercials and an eye-catching mascot**, messaging is spread throughout all of Hong Kong. As part of the campaign, the city is also financially supporting NGOs in implementing food donation projects.

The Food Wise Campaign and its associated charter, which has been **signed by more than 420 companies**, are paving the way for a new "food wise" culture, projected to limit food waste disposal to landfills by 40% in 2022. Due to the campaign's early success, Hong Kong is now going further to target one of the city's major contributing sectors to food waste: eateries. By signing up to the Food Wise Eateries Scheme, restaurants and other food service providers are encouraged to adopt initiatives such as serving portioned meals to reduce Hong Kong's food waste even further.

The mascot of the campaign plays on the saying that one's eyes should not be larger than one's stomach.

CITY: **DELHI**

Turning Waste into Compost and Fuel

↓500K

TONS OF CO_2 AVOIDED YEARLY FROM THE COMPOSTING PLANT

→ Delhi is turning municipal waste into compost for agriculture and fuel to substitute for local use of coal, while also limiting CO_2 emissions and severe air pollution.

The dense Indian City of Delhi generates over 9,000 tons of waste every day, most of which end up in waste disposal sites resulting in a number of detrimental environmental consequences. To limit these negative impacts, Delhi's municipality collaborated with the company IL&FS to reopen a composting plant to process waste and **produce compost and resource-derived fuel**, which is fuel produced by shredding and dehydrating solid waste. The plant currently handles 200 tons of waste per day, but is undergoing upgrades in order to handle **500 tons per day by 2016**.

To successfully generate valuable compost, the plant carefully handles the waste by, for example, turning the waste weekly to ensure an appropriate supply of oxygen. The city has teamed up with the company Mother Dairy to sell the compost to farmers. The resource-derived fuel generated at the plant is sold to cement manufacturing plants, thus limiting their need to burn coal.

THE CHALLENGE

With thousands of tons of municipal waste generated daily, Delhi was suffering from increased greenhouse gas emissions from anaerobic decomposing waste, contamination of groundwater, and air pollution in the vicinity of waste disposal sites. To combat this, a composting plant was reopened to produce compost and resource-derived fuel from the city's municipal waste.

CO-BENEFITS

Environmental

Every 250,000 tons of waste processed at the plant reduces greenhouse gas emissions by the same amount as removing 1 million cars from the streets of Delhi for 10 days.[1]

Economic

As a composting plant requires much less land for managing waste than landfills do, land is freed for sustainable urban development which can financially benefit the city.

Health

With greater amounts of waste handled at the composting plant, toxic gasses from open burning of waste at dumpsites are reduced, which limits air pollution that harms the health of citizens in Delhi.

The plant will generate compost and resource-derived fuel from 500 tons of waste each day in 2016.

[1] IEISL. "Earth Day Message." April 2015. Online: www.ilfsenv.com/Brochures/Earth-Day-Message-Mahesh-Babu.pdf

ADAPTATION PLANNING & ASSESSMENT

This sector showcases how targeted risk assessments and plans can make cities more resilient and adaptable for future climate changes, such as extreme weather, sea level rise, and increased temperatures, while at the same time increasing recreational opportunities and providing significant social benefits to city residents.

COPENHAGEN

Green Infrastructure Prevents Flooding

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ROTTERDAM

Resilience and Quality of Life Go Hand in Hand

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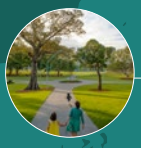

SYDNEY

Inclusive Adaptation to Climate Risks

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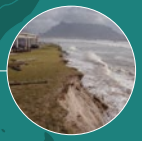

CAPE TOWN

Set-back Line Protects the Coast and Guides Development

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First Holistic City Climate Adaptation Tool

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NEW ORLEANS

Cooperation Strengthens Coastal Stormwater Protection

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CITY: **MELBOURNE**

First Holistic City Climate Adaptation Tool

→ Melbourne developed the first-ever interactive climate adaptation tool to manage the city's multiple climate risks simultaneously and to inform optimal adaptation planning.

4°C

COOLING OF THE CITY BY 2015 THROUGH MELBOURNE'S ADAPTATION STRATEGY

THE CHALLENGE

No longer undertaking adaptation activities in isolation without understanding how each intervention impacts the other or the full spectrum of climate risks, Melbourne is moving towards a holistic adaptation approach with its new ICAM tool, enabling the city to manage a range of climate risks simultaneously and deliver multiple benefits for the city and residents.

CO-BENEFITS

Environmental

Having already experienced two "1 in 500 year" rainfall events in 40 years, the ICAM enables better adaptation planning for future events.

Social

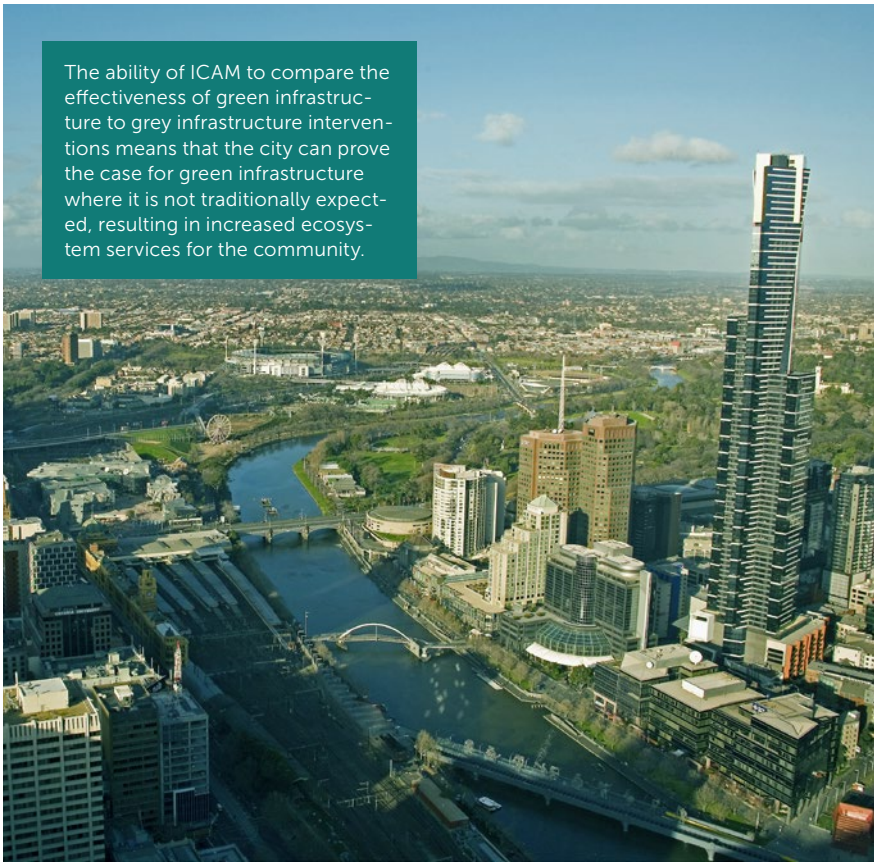
ICAM's ability to model interventions enables the city to select the interventions that will provide multiple returns, and therefore a broader range of community benefits can result from city investment.

Economic

As the ICAM tool enables early adaptation intervention, it will ultimately lower the cost of intervention.

Although Melbourne was the first Australian city to develop an adaptation strategy to alleviate climate change risks, that plan had only focused on extreme heat and drought. In 2014, the city therefore decided to develop the Integrated Climate Adaptation Model (ICAM). Capable of running multiple climate scenarios, spatially identifying vulnerability, and assessing multiple intervention options, the ICAM enables the city to develop adaptation interventions that deliver multiple benefits. The **holistic approach to adaptation enables a better understanding of climate vulnerability** to inform investment and action for adaptation to all relevant climate risks, including sea level rise, flood, extreme heat, and drought.

Developing the ICAM tool involved Australia's leading climate scientists, hydrologists, IT and adaptation specialists, spatial scientists, and engineers, and **is the first of its kind**: an interactive decision support tool combining geographical information systems and hydrological and climate modeling to inform the most beneficial adaptation planning.



The ability of ICAM to compare the effectiveness of green infrastructure to grey infrastructure interventions means that the city can prove the case for green infrastructure where it is not traditionally expected, resulting in increased ecosystem services for the community.

CITY: **CAPE TOWN**

Set-back Line Protects the Coast and Guides Development

→ Cape Town's Coastal Set-back Line ensures that development does not encroach on the immediate coastal environment, encouraging risk-averse coastal planning that takes into account climatic changes now and in the future.

$5.9

MILLION WORTH OF ECOSYSTEM SERVICES ARE PROTECTED BY THE COASTAL SET-BACK LINE

THE CHALLENGE

While Cape Town's coastline is one of the city's most important assets, it is also a source of risk, given rising sea levels and frequent storms. The coastline's complex nexus of social, economic, ecological, and legislative systems is managed by three distinct tiers of government, and the absence of a city-wide strategic decision-making support framework had aggravated the risks to the coast. The city's Coastal Set-back Line therefore guides strategic municipal decision-making and promotes sustainable coastal development that ensures the coast will remain a treasured asset for Cape Town.

CO-BENEFITS

Environmental

The Coastal Set-back Line protects more than 240 km of coastline, securing biodiversity in the local environment.

Social

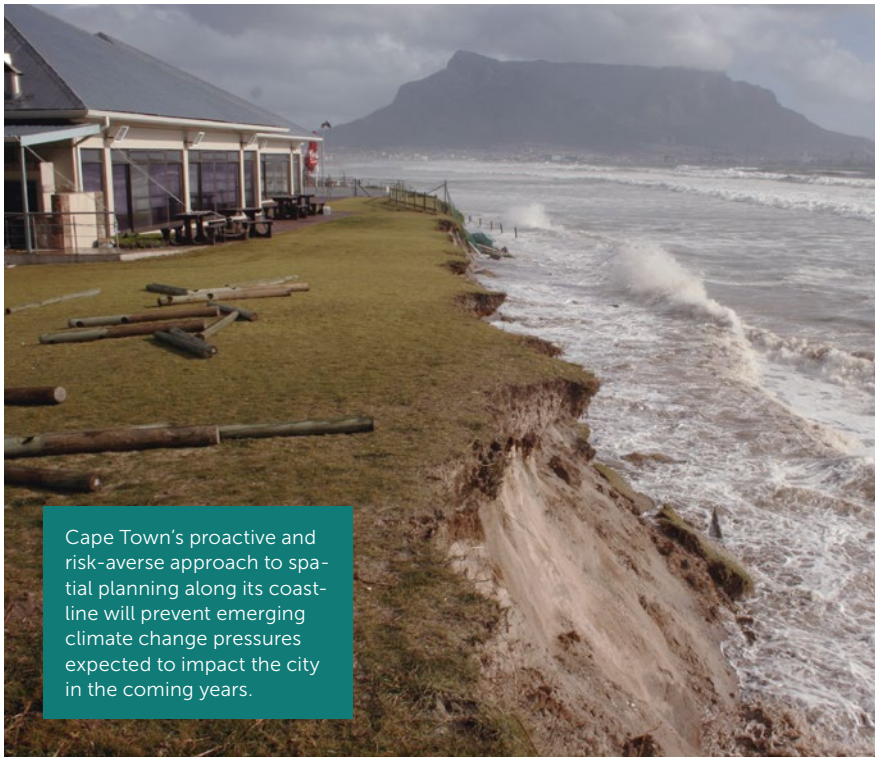
The socio-economic potential of the coast can be enhanced through economic development strategies, supported by the Coastal Set-back Line, which will benefit previously disadvantaged communities and help redress entrenched social injustices caused by apartheid.

Economic

Protecting and enhancing the socio-economic value of the coastline by encouraging development that is set back from the immediate coastal environment will enhance the benefits provided by the coastline.

In 2012, the City of Cape Town developed the Coastal Set-back Line in order to guide the city's decision-makers to more effectively regulate coastal development and to safeguard the coastline against future climate change risks. Creating the Coastal Set-back Line included both biophysical considerations, such as risks related to sea level rise, coastal erosion, and biodiversity as well as socio-economic considerations such as promoting access to the coast and involving members of the public in the design, thereby **improving city resilience and social justice**.

Critical to the development of the set-back line was the fact that no legislation in South Africa had previously been designed to resolve and manage existing at-risk infrastructure – both natural and manmade. The implementation of the Coastal Set-back Line will be used to **enhance other regulatory mechanisms** within the city that address climate change risks. Cape Town's commitment to coastal protection and ambition for guided decision-making across departments and spheres of government are also reflected in other new policies, such as the Coastal and Sea Defense Decision Framework, which seeks to reduce the risks connected to sea level rise.



Cape Town's proactive and risk-averse approach to spatial planning along its coastline will prevent emerging climate change pressures expected to impact the city in the coming years.

CITY: **ROTTERDAM**

Resilience and Quality of Life Go Hand in Hand

→ Securing and maintaining a robust city by incorporating adaptation measures in urban development, Rotterdam is achieving climate resilience while improving living conditions.

17.5

MILLION M^3 OF RAINWATER SECURED AND RETAINED FROM RAS ACTIONS

THE CHALLENGE

Facing floods caused by sea level rise and extreme precipitation, Rotterdam needed resilient solutions to combat the consequences of climate change. The city has found solutions integrated in the city's urban development to increase climate resilience, while also increasing the value of the city's living environment.

CO-BENEFITS

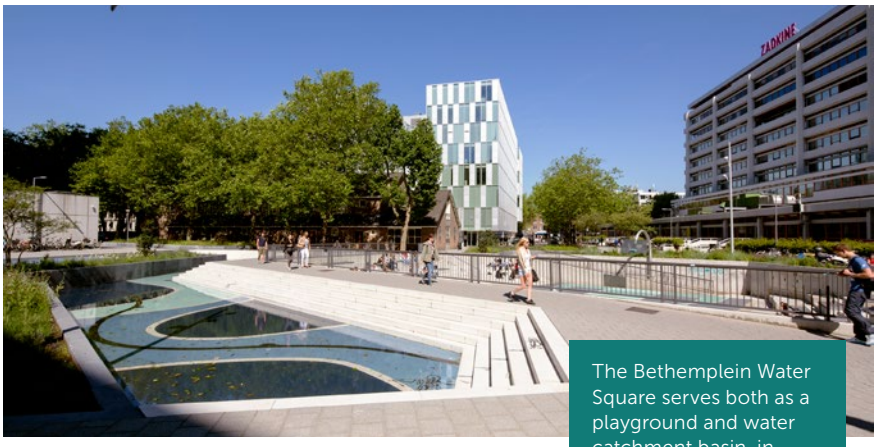
Environmental
The urban heat island effect is reduced in areas where the city experiences increased temperatures of up to 8°C.

Social
The Benthemplein Water Square has acted as a catalyst for community engagement and increased recreational activities, making it an integral part of the area's contribution to the living environment.

Economic
Businesses benefit from the increasing interest in climate change adaptation solutions, which, at present, account for 3,600 jobs in the region.

With 55% of the country vulnerable to floods,[1] the Netherlands is particularly exposed to rising sea levels. Acknowledging this, Rotterdam developed the Rotterdam Adaptation Strategy (RAS), which addresses the need for adaptation planning in all city projects. RAS is an integral strategy for the entire city, securing safety and livability for more than 600,000 citizens.

The city has **built 219,000 m^2 of green roofs** which, besides being comfortable spaces for recreational activities, absorb at least 82 metric tons of CO_2 and can retain 15 liters of water per m^2 in case of heavy rainfall. Car parks double as water catchment basins, able to store 10 million liters of water. Similarly, the Benthemplein Water Square doubles as a playground and is **able to retain 1.8 million liters of water**. These, and other RAS adaptations, reduce the burden on sewer systems and the risk of flooding in the city, while providing citizens with new spaces for leisure time, which improve aesthetics and quality of life in the city.



The Bethemplein Water Square serves both as a playground and water catchment basin, increasing resilience in the city and improving quality of life in Rotterdam.

[1] National Center for Biotechnology Information. "Assessment of the Netherlands' Flood Risk Management Policy Under Global Change." March, 2012.

CITY: **VANCOUVER**

Building Strategically for Sea Level Rise

→ Vancouver developed a comprehensive climate change adaptation strategy and changed bylaws to ensure that new buildings are elevated to protect against floods and future sea level rise.

11.8

KM² OF LAND PROTECTED AGAINST FLOODING DUE TO THE CLIMATE CHANGE ADAPTATION STRATEGY

THE CHALLENGE

Vancouver is ranked among the 20 most vulnerable cities in the world to sea level rise. Being the largest port in Canada, coastal flooding would also cause serious economic implications for the city. Canada does not have insurance mechanisms for residential flooding or a national flood hazard program. With the Climate Change Adaptation Strategy, the city plans to ensure that Vancouver remains livable and resilient in the face of climate change and sea level rise.

CO-BENEFITS

Environmental

The debris created by a 500-year storm would fill over 4,500 trucks, causing a significant waste concern in the city.

Social

Under a scenario in which the sea level rises one meter in connection with a 500-year storm, the Climate Change Adaptation Strategy is estimated to avoid damage to 800 buildings and displacement of 14,000 residents.

Economic

Climate-related disaster response costs, including damage to buildings, direct business impacts, city infrastructure costs, and emergency response costs, would be widespread and significant if no adaptation action was taken.

In 2012, Vancouver City Council adopted a comprehensive Climate Change Adaptation Strategy due to an increased focus on the city's vulnerable position. This strategy also led Vancouver to change its building bylaws, so that new buildings in flood-prone areas must be **built to elevations that account for sea level rise projections**. Major city projects near the coast, such as an initiative to area-plan a large industrial site, now prioritize adaptation to sea level rise.

As part of the strategy, a Coastal Flood Risk Assessment (CFRA) has been developed, which will result in area-specific adaptation responses to sea level rise and the associated increase in flood risk. As the CFRA requires information such as the depth of potential flooding under various sea level rise scenarios, as well as information about the assets and people that are vulnerable to flooding, decision-makers are able to comprehend the consequences of flooding in their communities and compare response options. The goals for these responses are maximizing actions that will benefit the community regardless of the degree of sea level rise, **prioritizing vulnerable populations**, and minimizing flood risk.

Sharing knowledge around Vancouver's strategy has prompted action by the city's transportation authority, government agencies, and stakeholders. A regional flood management strategy is underway, and provincial guidelines are being amended using Vancouver's methodology.

CITY: **COPENHAGEN**

Green Infrastructure Prevents Flooding

→ The Danish capital plans to increase blue and green infrastructure city-wide to withstand more frequent cloudbursts in the future.

Acknowledging future risks of increased stormwater volumes and more frequent cloudbursts – including a severe event in 2011 that resulted in more than $910 million in repairs – the Copenhagen City Council adopted a Cloudburst Management Plan in 2012. The city is preparing a full-scale rollout of **300 cloudburst projects** over the coming 20 years, and has drafted plans for seven cloudburst catchment areas dispersed throughout the city, designed to increase the city's blue and green infrastructure and prevent flooding.

The green infrastructure, in the form of parks and natural areas, will absorb rainwater for storage and managed seepage, while water-transporting boulevards will funnel excess water away from inundated areas. These actions address not only cloudburst events but also urban heat island issues. The 300 cloudburst projects that combine green surface and sewer-based solutions will not only retain and drain water and protect the entire city against a 100-year rainfall, but also represent a good business case as they result in an estimated overall **benefit of $767 million**. The property market is expected to respond positively to the security associated with a climate adapted city.

Copenhagen plans to use green infrastructure to store rain water and prevent surface flooding, as it is economically viable, contributes to recreational improvements, and can easily be expanded if climate change proves to be more severe than expected in the future.

40K

M^3 OF WATER CAN BE CONTAINED IN JUST ONE PARK DURING CLOUDBURSTS

THE CHALLENGE

Faced with stormwater volumes increasing by up to 40%, and the risk of stronger and more frequent downpours rising by up to 55%, Copenhagen decided to prepare a comprehensive cloudburst plan. With an expected monetary gain, the city proves that a climate adapted city also makes economic sense.

CO-BENEFITS

Environmental

The city's green infrastructure has many functions, such as creating shade and air circulation, which assist in reducing the energy Copenhagen uses to cool buildings.

Social

The city's green infrastructure provides opportunities for recreation and stress prevention, which maintain a high quality of life for Copenhagen residents.

Economic

The damage from stormwater and heavy rains is calculated to cost up to $3 billion over a period of 100 years in Copenhagen, which the city reduces with the Cloudburst Management Plan.

Health

Some of the benefits to the Cloudburst Management Plan include remediation and reduction of air and noise pollution in the bustling Danish capital.

CITY: **NEW ORLEANS**

Cooperation Strengthens Coastal Stormwater Protection

→ Increased cooperation between federal, state, and local agencies has enabled New Orleans to strengthen its resilience against more frequent future floods and storms.

Facing rising sea levels, regular flooding, and land subsidence, the American City of New Orleans needed to re-set its approach to adaptation planning, as a lack of coordination between government agencies had left the city unprepared. The solution was establishment of the Urban Delta initiative, an integrated approach to storm protection, **fostering cooperation between federal, state, and local agencies** in order to build a strong, resilient city.

Through Urban Delta, New Orleans identified gaps in coordination and areas of service for which no agency had official responsibility, and took steps to rectify these oversights. One such case is management of groundwater and subsidence. These areas are now managed by the Sewerage and Water Board of New Orleans, which is working with the city and citizen groups on the best ways to cooperatively manage threats. Increased coordination is paying off, as New Orleans has begun a collaborative reconstruction of the city's streets, drainage, and sewer systems. This rehabilitation is expected to increase the city's protection from a 100-year storm level to a 500-year storm level, while also **preventing 600,000 tons of debris** from flood-related property damage over the next 50 years.

The NORA rain garden is one of Urban Delta's pilot projects designed to collect, temporarily store, and clean up to 1,900 liters of rainwater and allow it to gradually flow into the city's drainage system, thereby mitigating flooding risk and helping to reduce subsidence.

↓30%

ANNUAL REDUCTION IN MUNICIPAL ENERGY USE RELATED TO WATER MANAGEMENT

THE CHALLENGE

Facing numerous complex challenges – including rising seas, diminished protective wetlands, intense storm threats, land subsidence, and regular flooding – the City of New Orleans has had to reassess its water management practices and increase collaboration between agencies to close gaps in services and ensure that the city is fully prepared to deal with extreme weather events.

CO-BENEFITS

Environmental

The energy needed to process and pump out water that falls within the protective levee system represents 60% of municipal energy use. Urban Delta is expected to reduce this energy consumption by up to 30%.

Social

Urban Delta will create a defensible city that can provide equitable levels of protection for all city residents and accept displaced citizens from communities no longer viable due to coastal land loss.

Economic

With Urban Delta, properly maintained groundwater levels will reduce land subsidence in New Orleans, which is estimated to cost around $2.2 billion in damages to structures over the next 50 years.

Health

The project expects a correlated decrease in respiratory illnesses due to mold and other harmful health outcomes linked to water damage in buildings.

CITY: **MEXICO CITY**

Comprehensive Program Increases Resilience

→ Already a national leader on climate change, Mexico City has implemented a successor to its first adaptation tool, increasing the city's resilience even further with an extensive range of adaptative actions.

↓10

MILLION TONS OF CO_2 REDUCED BY 2020

THE CHALLENGE

Climate change presents a host of challenges and consequences for cities; without adequate adaptation measures, infrastructure and citizens are left vulnerable to extreme weather events and other hazards. With Mexico City's PACCM, the city aims to ensure resilience and sustainable development, with low carbon intensity, through an extensive adaptation planning program.

CO-BENEFITS

Environmental

Under PACCM, new bus rapid transit lines and inter-modal transport schemes are developed and the subway system is modernized, which will reduce CO_2 emissions by 3.3 million tons by 2020.

Social

Under PACCM, the city's resilience, as well as the population's adaptation capacities, are increased, improving quality of life for the 5.6 million city residents most vulnerable to consequences of climate change.

Economic

PACCM provides cost savings for the city by minimizing adverse climate effects, such as weather-related disasters, that could damage infrastructure, crops, and property.

Health

PACCM improves public health, as it tackles increasing pollutants and toxic air emissions in the city.

In 2008, Mexico City became the first city in Mexico to develop and implement a local plan in response to climate change. Six years later, Mexico City initiated the Second Climate Action Program (PACCM), **continuing actions to increase resilience and combat climate change** with a planning tool that integrates, coordinates, and promotes methods to reduce environmental, social, and economic risks posed by climate change. PACCM is a comprehensive program – comprising 69 actions – targeting a wide range of challenges, such as **increasing energy efficiency, containing urban sprawl, managing natural resources** and preserving biodiversity, educating citizens about climate change, and increasing research and development.

The various PACCM actions include creation of a territorial planning program that integrates environmental and urban polices resulting in increased conservation of soil and saving 19,242 m^3 of water. PACCM will also modernize Mexico City's public transport to become more energy efficient and save 2.7 million KWh of energy. Full implementation of PACCM is expected to **decrease the city's emissions by 30% by 2020**.

Part of Mexico City's Second Climate Action Program is building new bus rapid transit lines and inter-modal transport schemes to become more energy efficient and reduce the city's emissions.

CITY: **SYDNEY**

Inclusive Adaptation to Climate Risks

→ Sydney has developed an adaptation strategy across multiple jurisdictions to safeguard the city from pressing climate change risks.

↑10K

TREES PLANTED AS PART OF THE STRATEGY

THE CHALLENGE

In Australia, a lack of national-level political commitment to climate change adaptation has meant that local policy development is the best course of action for cities eager to create meaningful change. Sydney has demonstrated significant leadership in terms of adapting to the effects of climate change such as extreme heat, frequent storms, and sea level rise.

CO-BENEFITS

Environmental

The additional trees have improved Sydney's air quality, and the urban tree canopy has increased to cover 23% of the city.

Social

The community vulnerability assessment is leading to stronger community networks, with the city helping residents to help each other.

Economic

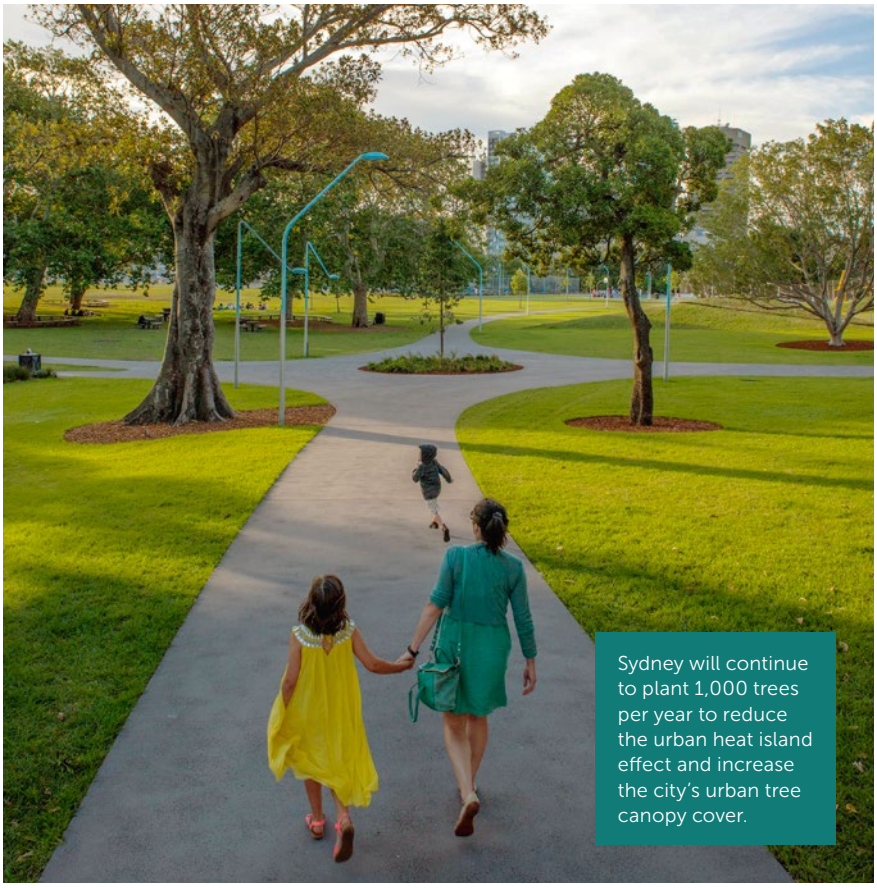
Sydney's Climate Adaptation Strategy advocates for more tree-lined streets, which are proven to increase property values.

Health

Part of the Climate Adaptation Strategy is revising outdoor working practices for city staff to address heat-related health risks.

To protect Sydney from climate change-related extreme weather, ranging from changing rainfall patterns and rising sea levels to more severe heat waves, the city developed the Sydney Climate Adaptation Strategy, taking an **inclusive and collaborative approach** to the multiple jurisdictions operating across Sydney's local government. In developing the strategy and prioritizing actions, a scientific reference group was established to ensure rigorous academic inputs, an interdependency analysis was undertaken to identify responses to climate risks and extreme weather, and a citizens' panel was created to review adaptation actions and increase democratic engagement.

The city's efforts are paying off, and Sydney's Climate Adaptation Strategy is seeing results. Many adaptation actions have been realized, such as the Urban Forestry Strategy, resulting in over 10,250 trees planted, drought-proofing parks, and testing **light-colored pavement to reduce the urban heat island effect**. New planned actions include a heat wave management plan, detailed community vulnerability assessment, and community awareness-raising.



Sydney will continue to plant 1,000 trees per year to reduce the urban heat island effect and increase the city's urban tree canopy cover.

CITY: **WASHINGTON, D.C.**

Collaborating to Reduce Flood Risk

→ Forming a team to improve coordination between government agencies, Washington, D.C. is now properly managing its flood risk and avoiding costly damages in the future.

20

MILLION LITERS OF WATER PER SECOND FLOW-RATE EVENT WITHSTOOD WITH THE COMPLETION OF THE POTOMAC PARK LEVEE SYSTEM

THE CHALLENGE

Washington, D.C. faces flooding risks due to sea level rise, increased precipitation, and storms. As no single agency had the authority to address these challenges, and since managing flood risks not only falls under floodplain management, but also emergency and stormwater management, public health administration, and land-use planning, the city was in dire need of joint efforts. The DC Silver Jackets team was thus established to improve coordination to reduce flood risks.

CO-BENEFITS

Environmental

With improved water management, natural and wetland areas will increase, as will the degree of stormwater retention through green infrastructure.

Social

The project will communicate flood risks to residents of Washington, D.C., particularly owners of the 4,000 private and public buildings located within 100- and 500-year floodplains.

Economic

The last flooding to hit Washington, D.C. in 2006, cost more than $1.5 million for just the immediate cleanup. The efforts from the DC Silver Jackets will help avoid costly damages from future flood events.

Health

The projects that reduce the risk of flooding will also reduce exposure to waterborne disease, chemical hazards, and injuries to residents.

In a complex jurisdiction like Washington, D.C. managing coastal, river, and surface flooding hazards and building climate resilience requires coordination across multiple levels of government and with private stakeholders. The DC Silver Jackets team, led by the District's Department of Energy and Environment, was established in 2014 to **improve coordination and collaboration to reduce flood risks**, providing a platform for representatives from federal, regional, and District of Columbia government agencies and academia to meet bimonthly and advance joint initiatives to better prepare for, respond to, and recover from flood events.

The DC Silver Jackets use available resources and opportunities within each member agency to address common issues. For instance, developing the inter-agency **flood inundation mapping tool leveraged $291,000** in financial support from its members. On top of an online flood inundation mapping tool to better predict flood impacts and a flood-fighting tabletop exercise to teach the necessary agencies which actions to take during a storm, the DC Silver Jackets are also planning to complete the Potomac Park levee system, protecting the U.S. Capitol, monuments, museums, and residential and commercial buildings from a 500-year flood event and **preventing $1.5 billion in potential damages**.

The DC Silver Jackets link government agencies to better collaborate on climate change efforts, such as this removable part of the Potomac Park levee system.

Photo credit: Brittany Bangert/U.S. Army Corps of Engineers ©

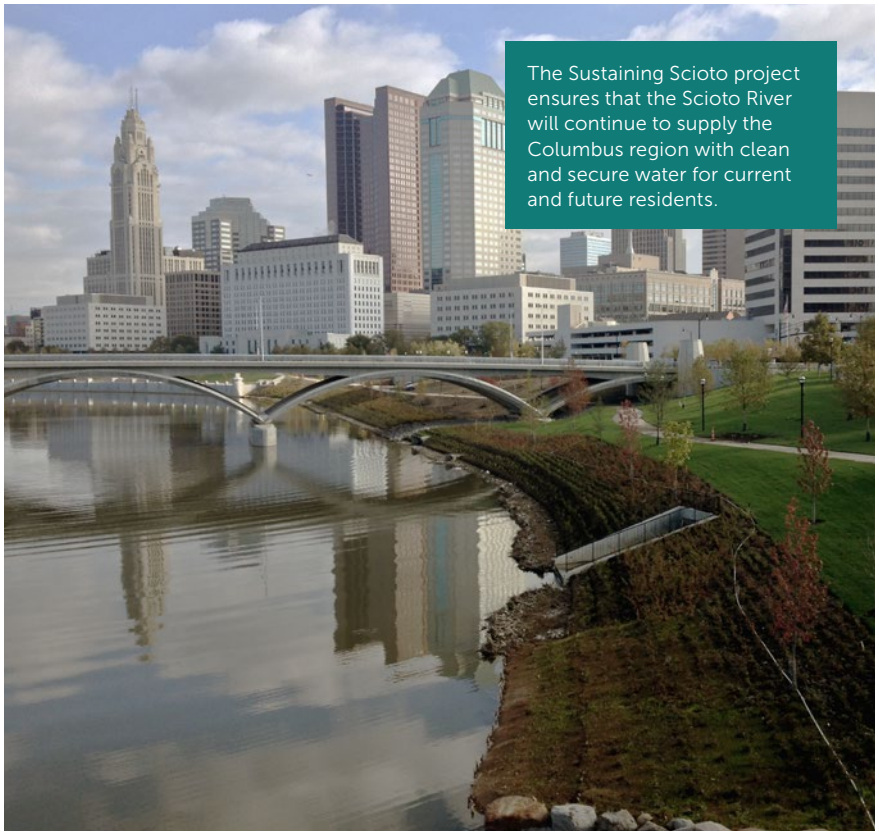
CITY: **COLUMBUS**

Securing Local River Water Supply

→ Anticipating that the increasing effects of climate change could threaten the city's water resources, Columbus is taking steps to secure its water supply from the Scioto River.

Today, the Scioto River supplies 85% of the Columbus, Ohio region's water needs. The region receives less than 97 cm of precipitation on average annually. In order to identify risks to the region's water resources, the **city commissioned a study** which found a need to plan for more frequent heat waves, increased incidence of extreme storm and weather events, and unpredictable precipitation. Using these results, the Sustaining Scioto Plan – an adaptive management plan – was developed to guide future actions within the region that would maintain a resilient water supply system based on water sourced from the Scioto River.

The Sustaining Scioto Plan provides utilities, developers, agriculture, and industry with an understanding of potential climate change risks and serves as **a guide for future investment and planning** for water resource management within the region. One goal of the Sustaining Scioto Plan is to keep the water from the Scioto River clean directly at the source, making the subsequent water treatment more cost-effective and lowering water rates for local residents and businesses.



The Sustaining Scioto project ensures that the Scioto River will continue to supply the Columbus region with clean and secure water for current and future residents.

↑3.2

MILLION PEOPLE ARE PROJECTED TO HAVE CLEAN DRINKING WATER BY 2090, DUE TO THE SUSTAINING SCIOTO PLAN

THE CHALLENGE

Columbus, Ohio has yet to experience water shortages. However, with extreme weather events becoming more common, and with the region experiencing record-breaking heat, unprecedented flooding, and prolonged periods of drought, the city has developed an adaptive management plan to ensure a resilient water supply system in the coming decades.

CO-BENEFITS

Social

By adapting to climate change, Columbus will ensure that rivers, streams, and reservoirs in and around the city continue to serve as scenic gathering places, recreational areas, and enjoyable public spaces for residents.

Economic

By adapting the region's water management to a changing climate, the Sustaining Scioto Plan aims to prevent many of the economic consequences of extreme weather events, such as increased food prices, decreased human productivity, increased cost of utility services, increased cost of insurance, and costly post-storm damages.

Health

The Sustaining Scioto Plan aims to reduce the risk of waterborne diseases through effective water management.

ADAPTATION IMPLEMENTATION

This sector highlights solutions that ensure urban resilience by adapting infrastructure and landscapes to volatile environmental conditions and implementing regulations and incentives to withstand future climate hazards.

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CITY: **SAN FRANCISCO**

Mandatory On-site Treatment Conserves Water

→ San Francisco requires all new large buildings to treat their non-potable water on-site, reducing the use of potable water and conserving the region's scarce resources.

191

MILLION LITERS OF POTABLE WATER SAVED EACH YEAR SINCE 2012

THE CHALLENGE

By 2050, based on current per-capita water use, California's estimated 22 million additional residents will need an additional **6.8 billion m³ of potable water** per year. As California sees longer-lasting droughts and increased urbanization, San Francisco's Non-potable Water Program anticipates an increase in the number of on-site water treatment systems installed, making it a critical strategy for dealing with a shrinking water supply due to climate change.

CO-BENEFITS

Social

On-site water systems build water resilience and enable communities to sustainably utilize available water resources to withstand and recover from adverse situations.

Economic

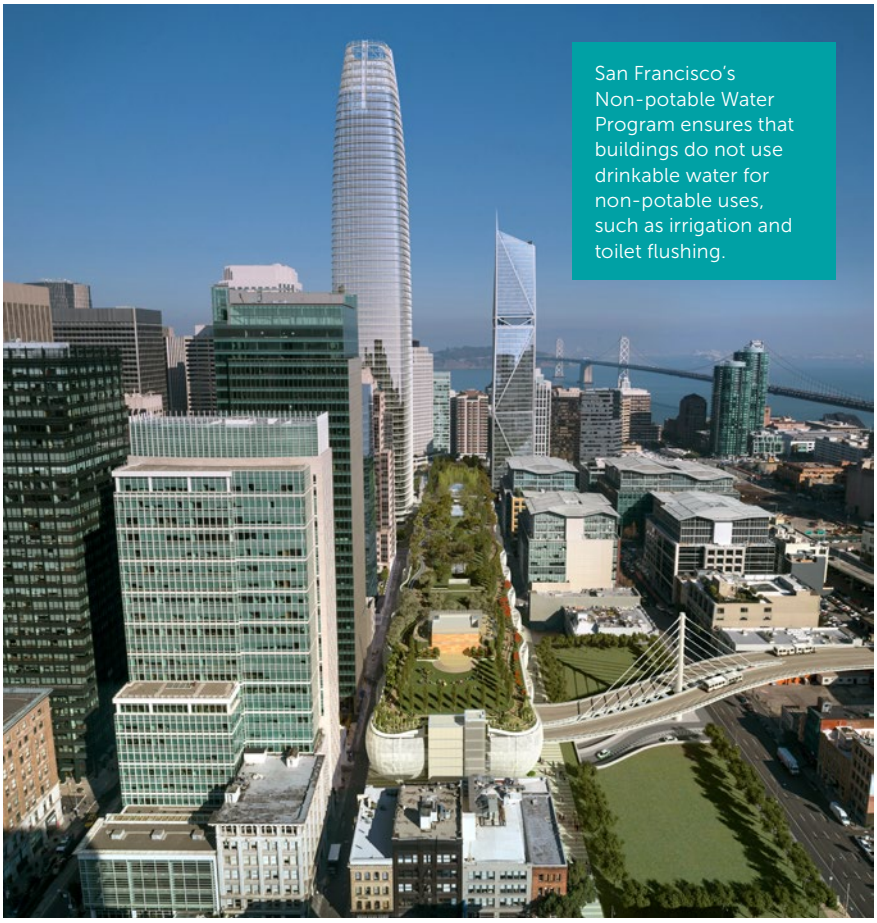
The program provides **grants of up to $500,000** to projects implementing on-site water reuse systems.

Health

The program regulates the entire lifecycle of water recycling installation systems, guaranteeing safe operation and usage and the protection of public health.

San Francisco's program allows buildings and districts to incorporate decentralized, on-site water systems. Collecting and treating non-traditional sources of water, such as rainwater, stormwater, blackwater, and graywater, can reduce the use of potable water by up to **50% for residential buildings and 95% for commercial buildings**. The collected water is used for irrigation of green surfaces, toilet flushing, and other non-potable uses. San Francisco's program is designed to streamline the process for the private sector and create a new water management paradigm within the city.

The program began in 2012 as a voluntary measure, but, as of 2015, it became **mandatory for all new buildings over 23,000 m²** to recycle water on-site, making it the first policy of its kind in the USA. This groundbreaking step ensures that all new developments in San Francisco are built with water conservation as a top priority. Since the program's inception in 2012, 33 projects have installed on-site water reuse systems.



San Francisco's Non-potable Water Program ensures that buildings do not use drinkable water for non-potable uses, such as irrigation and toilet flushing.

CITY: **RIO DE JANEIRO**

Reservoirs and River Diversion Prevent Flooding

→ Rio de Janeiro has built a range of flood-prevention infrastructure to help protect the vulnerable Tijuca region from river and surface water overflows.

12.4K

METER DRAINAGE TUNNEL PREVENTS FLOODING OF THE JOANA RIVER AND MANGUE CHANNEL

THE CHALLENGE

Heavy rains in Rio de Janeiro cause flooding due to poor drainage or overflow, traffic congestion, damage to buildings and infrastructure, landslides, and diseases due to water contamination. The Great Tijuca area is particularly susceptible to landslides and flooding, due to its low-lying position. These projects are therefore necessary to protect residents and infrastructure from more frequent flooding.

CO-BENEFITS

Social

More open and accessible green areas encourage the use of public spaces and help catalyze civic engagement and a more enjoyable urban environment.

Economic

The city anticipates that fewer floods, and their resulting damage, will help real estate values, revitalize local businesses, and prevent economic losses due to traffic congestion caused by flooding.

Health

By reducing the risk of flooding, the city also reduces the spread of water-borne diseases.

In 2012, the Brazilian City of Rio de Janeiro started construction on **four underground reservoirs** as well as a diversion tunnel for the Joana River in order to improve the resilience of the city's Tijuca region. Excess water volume, which normally would overflow and cause flooding, will now accumulate in the tanks and be pumped out to the nearby bay. The reservoirs, one of which is complete, while the others are under construction, can accommodate a 25-year rainfall event. Revitalizing the Praça da Bandeira reservoir has transformed the area into a large, welcoming public space, including a 450 m^2 skating rink, fitness center for seniors, **green areas, new lighting, and a 212 meter circuit for walking**.

The flood-control plan also involves the construction of a diversion tunnel for the Joana River, to relieve the over-burdened Mangue Channel, which receives water from five different rivers. The Joana River course diversion will create a second outflow to the bay, decreasing dependence on the Mangue Channel. The outflow will also be faster because the water will travel a shorter course. Together, these flood-control plans will prevent flooding onto city streets, infrastructure damage, and the spread of waterborne diseases, and, at the same time, improve traffic conditions.

The revitalized Praça da Bandeira not only reduces flooding by storing excess water in its underground reservoir, but it also offers citizens a public gathering space.

© Rio Águas/ Rio de Janeiro City Hall

CITY: **COPENHAGEN**

Creating a Climate-resilient Neighborhood

→ The Copenhagen neighborhood of Østerbro adapts the city to extreme weather using affordable green infrastructure that also improves quality of life for citizens.

↑20%

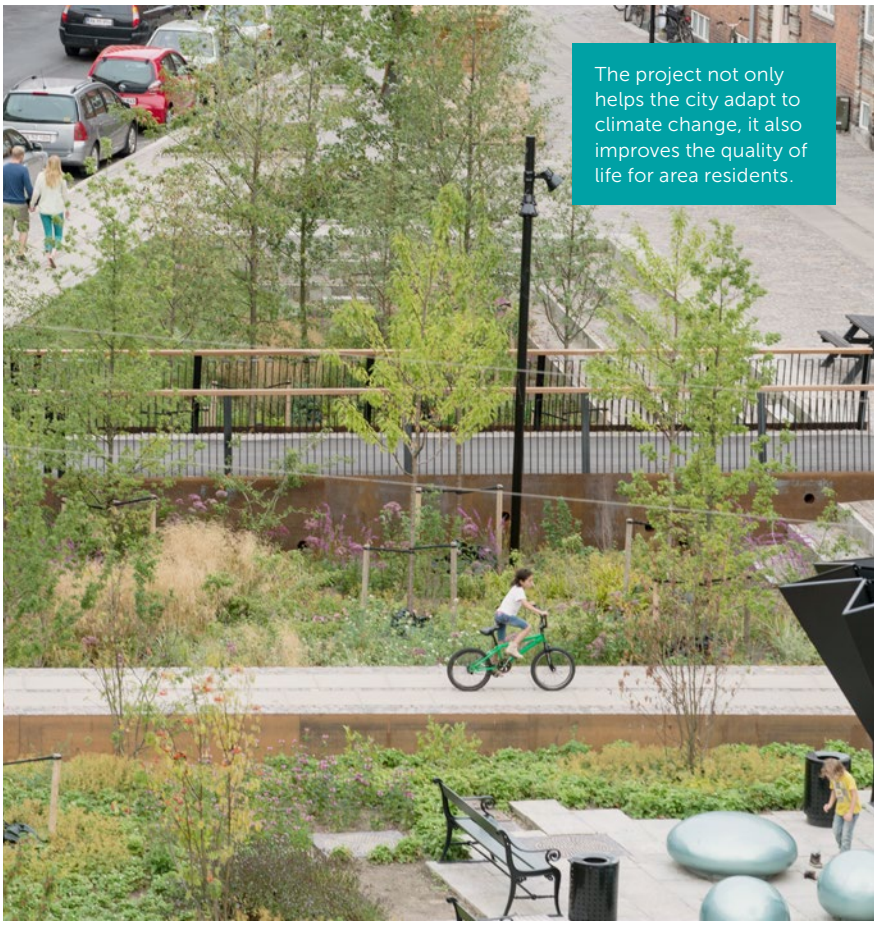
OF NEIGHBORHOOD SURFACES ARE TO BECOME GREEN

THE CHALLENGE

A single cloudburst in July 2011 caused over $1 billion in damage to Copenhagen, according to the city's Technical and Environmental Administration.[1] Faced with the reality that these events will become more frequent in the coming years, the city is taking serious precautions to prepare itself. Østerbro Climate Quarter's resilience demonstrates that adaptation measures not only protect citizens and infrastructure but also contribute to a more enjoyable and livable city.

Copenhagen has learned that large-scale grey infrastructure renovations are not always the best response to climate change. Instead, faced with increasing rates of flooding, the Danish capital created the world's first climate-resilient district - Østerbro Climate Quarter - by implementing green infrastructure. This concept is **cheaper to implement and maintain than expanding sewers, and it reduces the financial impact of extreme weather events**.

Should a storm-related flood hit the area, the integrated system of green streets and pocket parks will serve as retention areas and water basins. Local hills will function as the sides of a bowl, funneling water to designated retention areas. Public squares will even be able to collect water from surrounding buildings' roofs and distribute the water locally, thanks to a new pipe system. When completed, 30% of rainwater is expected to be managed this way, instead of ending up in the sewer system. In total, **50,000 m² of cityscape** will become climate-resilient, natural urban infrastructure.



The project not only helps the city adapt to climate change, it also improves the quality of life for area residents.

CO-BENEFITS

Environmental

Creating greener infrastructure can improve air quality, sequester CO_2, and improve local biodiversity.

Social

More than 10,000 people have taken part in the project's 170 citizen-led initiatives to create green surfaces, usable urban spaces, and a climate-prepared neighborhood.

Economic

The green and surface-based climate adaptations of the Østerbro Climate Quarter will reduce the cost of damage from cloudbursts and are cheaper to implement than sewer expansions.

[1] City of Copenhagen, Technical and Environmental Administration. ICLEI Resilient Cities Presentation. 2012.

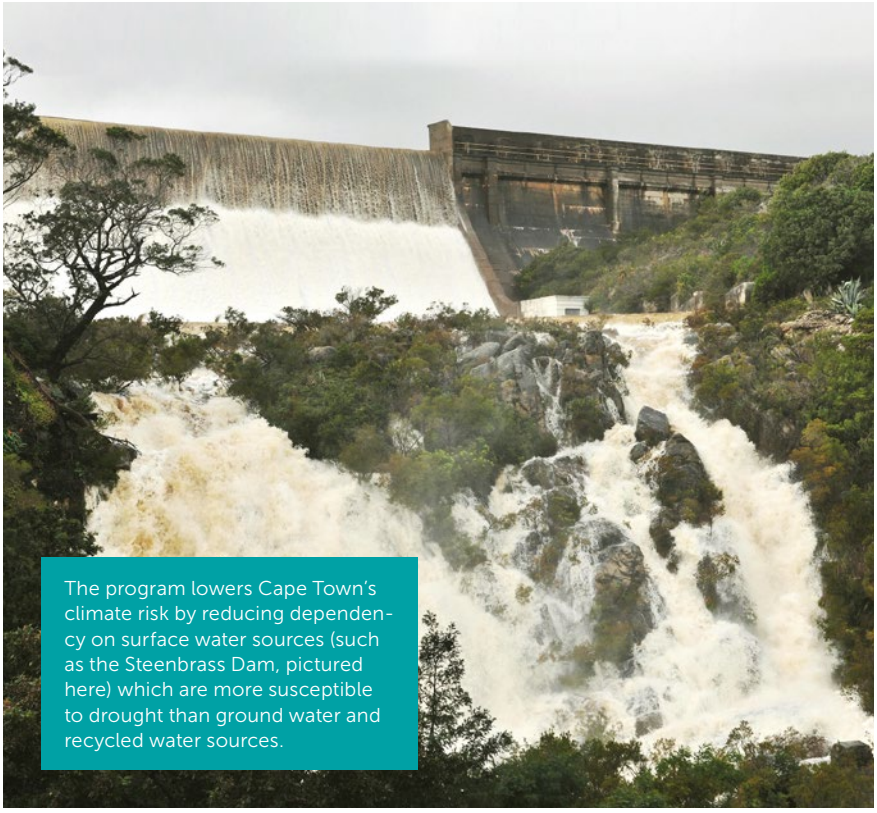
CITY: **CAPE TOWN**

Better Management Prevents Water Stress

→ Cape Town has found a way to provide clean and safe water to its growing population even as the region becomes increasingly water stressed.

Faced with looming water scarcity due to changing environmental conditions and population growth, South Africa's second-largest city has committed itself to a comprehensive program of water conservation and water demand management aimed at minimizing water waste and promoting efficient water use. The extensive program targets both technical and behavioral changes, including public awareness campaigns about water use efficiency, the introduction of a water tariff designed to encourage water savings, the promotion of the use of recycled water for irrigation, as well as a range of technical interventions to minimize water losses.

Particularly vital and socially inclusive elements include offering free plumbing repairs for low-income households and training "community plumbers." More than **4,000 households have been visited for leak detections** and repairs, and 258 km of water pipes have been replaced in order to reduce pipe bursts and water leaks. So far, the program has been a success, as water demand has grown at an average of 1.78% compared to an average growth of more than 4% before implementation. This is despite population growth of more than 30% between 2001 and 2011.



The program lowers Cape Town's climate risk by reducing dependency on surface water sources (such as the Steenbrass Dam, pictured here) which are more susceptible to drought than ground water and recycled water sources.

↓58K

TONS OF CO_2 SAVED EACH YEAR

THE CHALLENGE

Cape Town is facing the dual challenge of increased water demand, due to population growth, urbanization, and economic development, along with increased water scarcity, a consequence of climate change. This wide-ranging water management program consists of technical adjustments as well as social and behavior changes to limit water losses while helping low-income residents.

CO-BENEFITS

Environmental
Recycled water is used to irrigate public parks and green areas and 6% of all potable water is now recycled.

Social
10,500 liters of free water are provided each month to impoverished households in the city.

Economic
This project has postponed and possibly eliminated the need for expensive capital infrastructure projects, including an additional water supply scheme, which would have cost $85 million – five times more than this project.

Health
This program enables the city to provide safe, high-quality drinking water by ensuring that treatment plants are able to meet the water needs of residents.

CITY: **PARIS**

Green Spaces Keep the City Cool

↑20K

NEW TREES
PLANTED BY 2020

→ Paris has added nearly 70 hectares of green infrastructure and rooftop gardens in order to reduce the urban heat island effect.

One of the most urgent and noticeable ways in which climate change affects the French capital is the city's urban heat island effect. To alleviate rising temperatures, Paris is greening its grey infrastructure, planting trees, and creating rooftop gardens all over the city in order to adapt to climate change and create a more pleasant living environment for its citizens. The city has already added **62 hectares of green space** and 4.7 hectares of green roofs.

The coming years will see this progress expanded. Going forward, vegetation must be planted on all new buildings, and, by 2020, the city will build **100 additional hectares of green roofs** – one-third of which will be used to produce fruit and vegetables. To get citizens on board with the initiatives, the city issued a **"license to green" to all Parisians** encouraging them to plant more trees and gardens on vacant pieces of land – anything from a small strip of grass on a sidewalk to a full-fledged community garden.

THE CHALLENGE

Paris' dense infrastructure network, built largely of concrete and asphalt, causes a significant urban heat island effect in which city temperatures are noticably higher than those in nearby rural areas. This trend is exacerbated by climate change, and to help reverse its effects, the city has instituted a range of greening initiatives that will make the city's infrastructure more permeable and absorbent and improve air quality.

CO-BENEFITS

Environmental
Increased vegetation absorbs more CO_2 and improves air quality.

Social
80% of Parisians support the initiatives to create more green spaces in the city, which will lead to a more pleasant living environment.

Health
Fifteen thousand people died in France during a heat wave in 2003.[1] To prevent such disasters from becoming more common, Paris is protecting its citizens – particularly the elderly and those in ill health – from excessive heat.

By greening its roofs, Paris is making efficient and sustainable use of its existing built infrastructure while also ensuring that future construction accommodates green spaces.

[1] Laaidi, K. et. al. "The Impact of Heat Islands on Mortality in Paris During the August 2003 Heat Wave." Environmental Health Perspectives, vol.120, ed. 2. 2012.

CITY: **BUENOS AIRES**

Flood Prevention in Low-income Communities

→ A reservoir upgrade in Buenos Aires will have a positive impact on the city's underprivileged neighborhoods.

700K

RESIDENTS PROTECTED BY THE INITIATIVE

THE CHALLENGE

The combination of poor stormwater drainage, due to recent urbanization, and increasing rates of floods has put Buenos Aires' most vulnerable and low-income populations at serious risk. The new network of reservoirs aims to decrease the frequency of flooding and improve the social and economic standing of at-risk residents.

CO-BENEFITS

Environmental

The rehabilitation of Lake Soldati will involve an extensive cleanup, as well as an outreach campaign to ensure that residents have the knowledge and resources needed to keep the lake clean.

Social

The Lake Soldati project not only protects low-income residents, but contributes to their neighborhood's development by ensuring access to essential services such as transportation, health, and education.

Economic

Fewer floods equal fewer disruptions to transportation, communication, and resource access, all of which will mean savings for the city as well as individual residents.

Health

The project will improve sanitation conditions for the vulnerable residents who live in informal settlements around Lake Soldati.

In 2011, Buenos Aires unveiled a Hydraulic Master Plan intended to combat the increasing frequency of floods and their associated social and economic damage. The project will upgrade the city's stormwater drainage network to provide protection against 10-year rainfall events. The project consists of the installation of three reservoirs that together can hold up to 300 million liters of water during heavy rains. These projects will **benefit about 700,000 people** living in the target basins, 10% of whom are in the most critical areas.

One of these reservoirs is Lake Soldati. This flood-prone lake, surrounded by about **46,000 mainly low-income residents**, will be turned into a natural reservoir, allowing excess rain water to flow to a nearby river in a controlled manner, and prevent flooding of the lake's shores. The goal of this reservoir is to protect vulnerable residents and help foster sustainable social and economic development in the area.

Green flood prevention infrastructure and natural reservoirs, such as these in Buenos Aires' Sarmiento's Park, help the city reduce flooding and its associated social and economic damage.

CITY: **CHANGWON**

Improving Water Quality and Biodiversity

→ Changwon's integrated water management plan enhances drinking water quality, improves irrigation management, and restores aquatic biodiversity.

In an effort to revitalize the city's local water supply, the South Korean City of Changwon launched a three-phase master plan to better manage water drainage, **improve drinking water quality, and boost biodiversity** in the region's aquatic environments. The city is taking an integrated approach to solving these local water challenges, targeting thorough water quality management, controlling pollution caused by runoff, restoring streams, and capping ocean pollutants. So far, the city has revitalized 10% of its 535 km of streams. This includes reducing organic pollutant levels from **2.5 ppm in 2010 to 1.8 ppm in 2013**. Similarly, the region's water ecosystems experienced a growth in aquatic plant species, from 33 species in 2010 to 70 in 2014.

The project is carried out in collaboration with private stakeholders, including citizens and academia, to promote participation and to reflect public opinion. Changwon hopes to expand on its already successful water management plan by applying it to more rivers and streams in coming years.

140K

TONS OF DRINKING WATER TREATED THROUGH SAND-FILTRATION EVERY DAY

THE CHALLENGE

As an industrial city, Changwon's water supply has been polluted by its many factories over the years. The action taken by the city to clean up its water sources not only reverses the damage done, but also prepares Changwon for expected increased frequency of droughts in coming years by improving quality and efficiency in water management.

CO-BENEFITS

Environmental

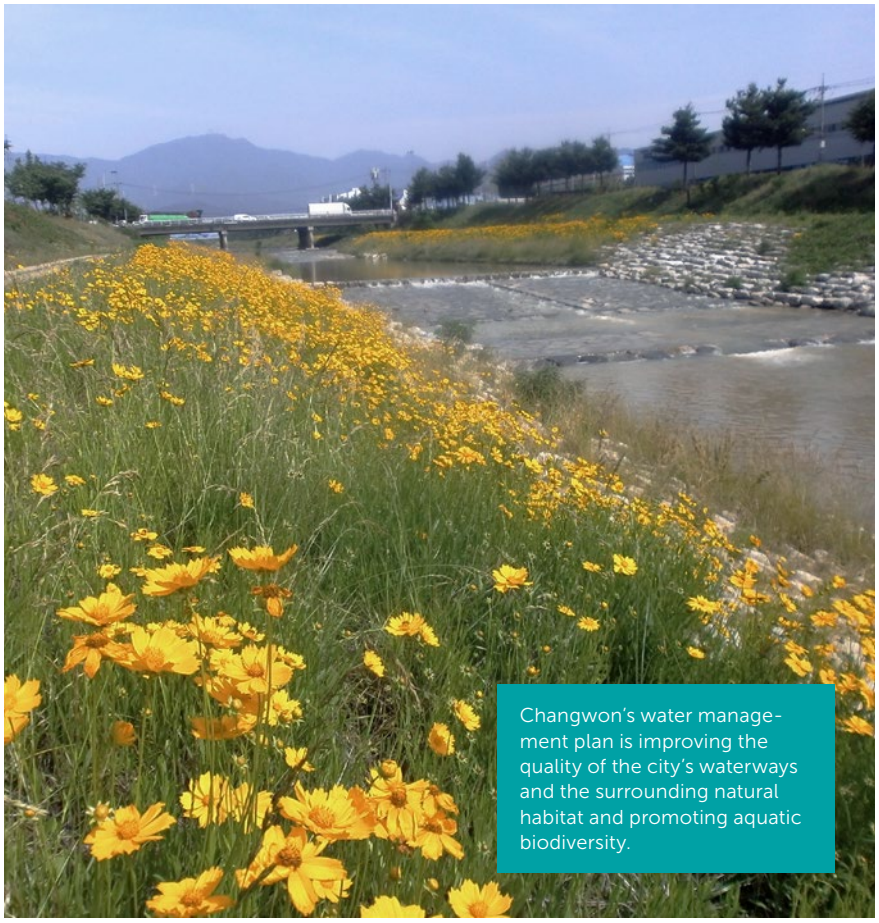
Changwon expects that, when complete, the rehabilitation of these aquatic ecosystems will lead to a rise in the number of animal species in the region.

Social

Areas near the 53 km of revitalized waterways have also been regenerated and cleaned up, providing residents with safe and pleasant walking trails.

Health

A primary goal of this project is to improve drinking water quality, which will help improve the overall health of the city's residents.



Changwon's water management plan is improving the quality of the city's waterways and the surrounding natural habitat and promoting aquatic biodiversity.

CITY: **NEW YORK CITY**

Engaging Communities in Climate Change Adaptation

→ New York City's two community climate adaptation projects prevent flooding and the loss of critical services for residents, businesses, and key local resources, while encouraging community involvement.

13.5km

OF FLOOD-PROTECTION SYSTEMS WILL BE CREATED ALONG THE EAST RIVER

THE CHALLENGE

New York's vulnerability to climate change was made clear after Hurricane Sandy ripped through the city, costing it more than $19 billion in damages.[1] These projects will protect the city's residents housing, infrastructure, and other assets from coastal flooding, wind, extreme heat events, extreme precipitation events and other energy system outtages, while also enhancing the environmental, social, and economic conditions of each neighborhood.

CO-BENEFITS

Environmental

Improved storm water management and drainage will result in improved water quality by reducing sewage entering waterways during coastal surge events.

Social

In Hunts Point, resilience interventions will bring community-building opportunities to a well-organized residential, civic, and business community in one of the country's poorest congressional districts.

Economic

Safeguarding the Hunts Point Food Distribution Center alone will protect 8,400 jobs and meat, fish, and produce markets that generate over $4 billion in annual revenue.

Health

Disruption to the operation of Hunts Point Food Distribution Center could put at risk the food supply for 22 million people in the region.

[1] The City of New York. A Stronger, More Resilient New York. 2013.

The East Side Coastal Resiliency (ESCR) and Hunts Point Resiliency (HPR) projects utilize community participation in the planning for physical infrastructure and public improvements which enhance the resilience of two critical communities along New York City's coastline. The ESCR project will create a flood-protection system and improve open spaces along Manhattan's East River waterfront, **consisting of vegetated berms and deployable flood barriers**. The HPR project will support the resilience of the South Bronx neighborhood, including the Food Distribution Center, a crucial node in the region's food supply chain, by studying the most effective coastal protection and resilient energy strategies for the area. In all, the projects will **protect more than 350,000 New Yorkers**, 10,000 buildings, and more than 1,200 hectares of land.

Both projects rely heavily on community boards, civic groups, tenant associations, and business owners in designing the adaptation strategies for these neighborhoods. Other participatory planning methods, such as hands-on public workshops, stakeholder-led working groups, community task forces, and large public meetings help the larger community engage with these plans to ensure that outcomes reflect the needs and desires of those affected.

Community involvement is vital in shaping and designing the resilient infrastructure along Manhattan's East River.

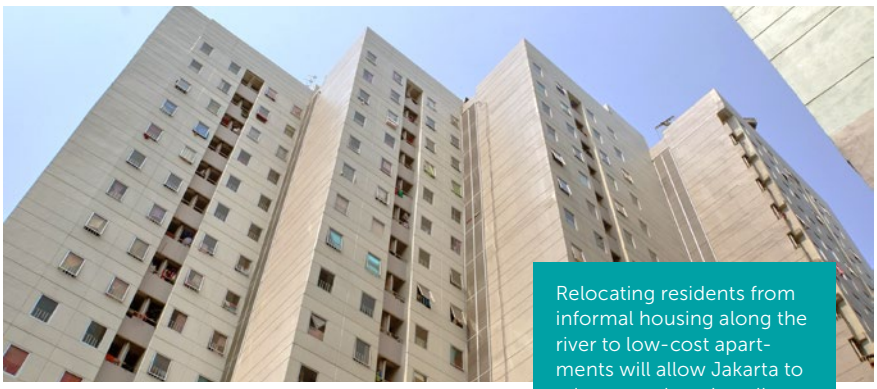
CITY: **JAKARTA**

Low-cost Housing Protects People and Land

→ To address the fact that its poorest citizens live in informal housing on the most vulnerable land, Jakarta is resettling residents in low-cost apartments and revitalizing land and water bodies.

To cope with increased rates of flooding and to protect its poorest citizens, Indonesia's bustling capital city provides low-cost housing to the 400,000 citizens who reside along the city's waterfront in informal housing. With the land free of settlement, the city will revitalize the nearby water bodies, increase the water retention ability of the land, and boost reservoir capacity, thus reducing the risks of floods while protecting citizens. By the end of 2014, Jakarta had already built more than **14,000 low-cost apartment units**, 13% of its goal of 52,656, which it hopes to accomplish by 2017. Units come furnished and are **rent-free for the first six months**, after which families are responsible for paying $22 per month.

City officials consulted with residents face-to-face and involved them in the planning process to ensure that relocation is dignified. The new housing units will provide residents with safer, cleaner housing that will improve the livelihoods of tenants and alleviate environmental stress on the land they formerly occupied.



Relocating residents from informal housing along the river to low-cost apartments will allow Jakarta to adapt to a changing climate and protect residents from flooding.

↑11K

HECTARES OF REVITALIZED GREEN OPEN SPACE ONCE THE RESETTLEMENT IS COMPLETED

THE CHALLENGE

Jakarta is surrounded by 13 rivers, and 40% of the city sits below sea level, making it extremely susceptible to flooding arising from changes in rainfall pattern and sea level rise. As the risk is especially high in the city's informal settlements along the waterfront, this relocation scheme offers these residents protection from environmental disasters and enhanced economic opportunities, while also improving the resilience of the land and water.

CO-BENEFITS

Environmental

As much as 200 tons of rubbish reach Jakarta's rivers each day. With fewer people living along the waterfront, less waste will be disposed of in the city's rivers and reservoirs, making the water cleaner, safer, and more hospitable to biodiversity.

Social

The program will provide safer, more sanitary housing conditions and improved economic opportunities for 400,000 Jakartans.

Economic

Improved sanitation conditions will prevent unmanaged waste disposal, which currently costs the city $80 million every year.

Health

Housing with better sanitation facilities and waste management services will help prevent disease outbreaks, such as malaria, typhus, and E. coli.

CITY: **HONG KONG**

Stormwater Management Prevents Flooding

→ Hong Kong is tackling its serious flooding problem by taking a holistic and integrated approach to stormwater management.

To address severe flooding, Hong Kong's Drainage Services Department implemented a range of projects to improve water drainage in the city. Rather than building drainage facilities in flood-prone areas, the city is intercepting and diverting waterways along their natural courses to better prevent flooding. To date, Hong Kong has created **2,400 km of stormwater drains**, 350 km of river channels, and three underground flood storage tanks that hold a total of 17,000 m^3. The city's robust drainage infrastructure not only reduces the risk of flooding, it also revitalizes water bodies and creates green spaces, which in turn promote biodiversity and mitigate the heat island effect.

The city has committed nearly **$5 billion to flood-prevention** and water revitalization projects. Successful examples include the sophisticated Happy Valley Underground Stormwater Storage Scheme, which monitors water retention in underground storage tanks. Similarly, the 3.7 km Lai Chi Kok Drainage Tunnel intercepts runoff from uphill catchment in West Kowloon.

↓115

TONS OF CO_2 REDUCED PER YEAR THROUGH PLANTING TREES AND INSTALLING GREEN ROOFS

THE CHALLENGE

Hong Kong averages more than 2,300 mm of rainfall each year, one of the highest rates in the Pacific Rim, and storms are expected to become more common in coming years. Its dense population and mountainous terrain exacerbate the challenges of flooding. This wide-ranging, integrated approach to flood management helps the city maintain its economic growth without sacrificing sustainability or safety.

CO-BENEFITS

Environmental

Photovoltaic panels installed at Hong Kong's water treatment facilities will generate 828,000 KWh of electricity by 2017.

Social

The 144 km of revitalized waterways provide residents with more enjoyable places to walk and cycle, thus promoting more outdoor urban activities.

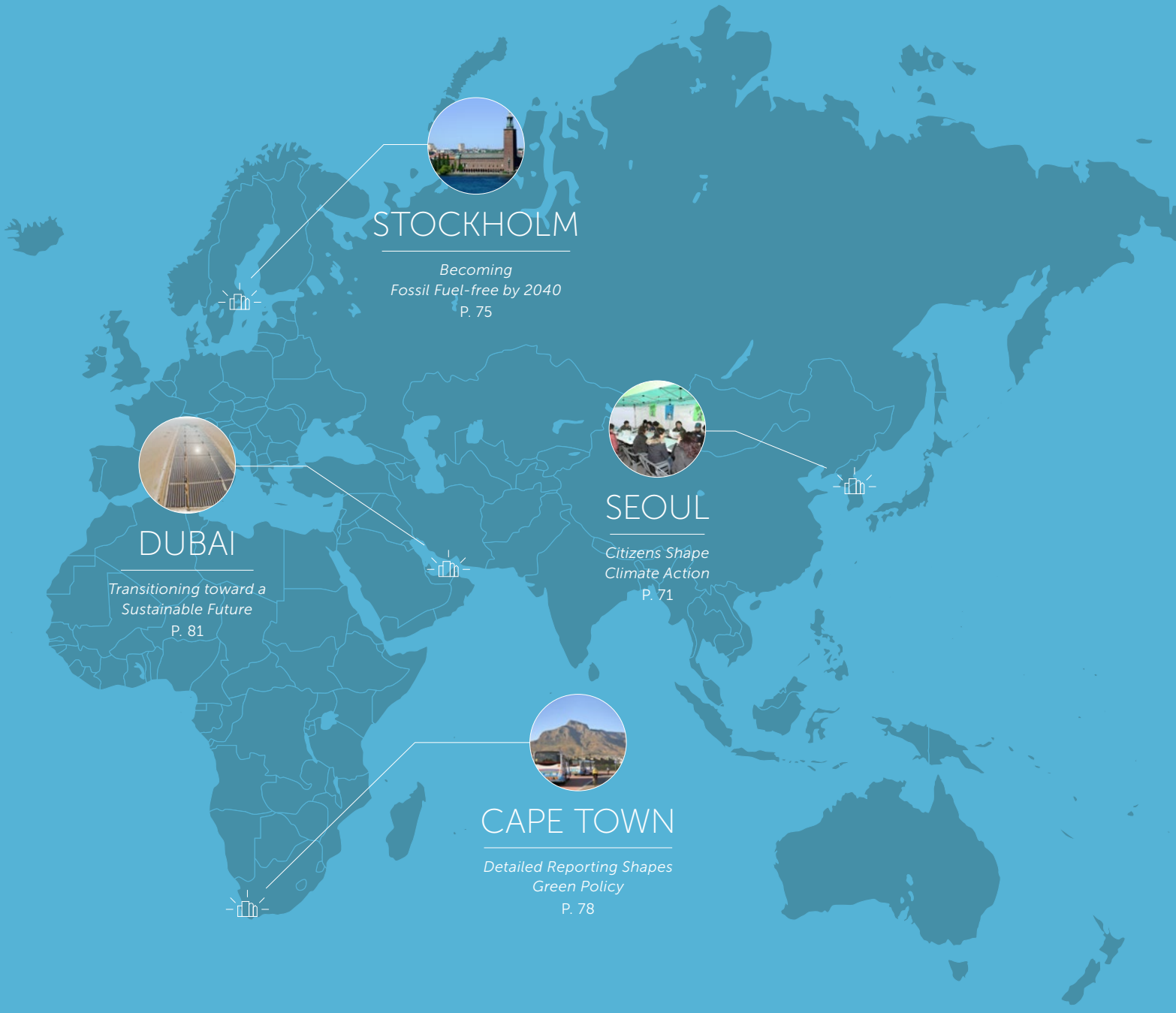
Economic

Property values have risen by up to 10% in areas that have experienced water revitalization.

Upstream management and stormwater drainage tunnels are helping Hong Kong prevent flooding and improving the natural environment of the city and its surrounding areas.

CARBON MEASUREMENT & PLANNING

This sector presents comprehensive and far-reaching plans and actions taken by cities to lower their CO_2 footprints and pursue long-term social, economic, and environmental agendas. These solutions demonstrate the strategic role that greenhouse gas emissions reduction targets can have in cities' overall green development strategies.



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Becoming Fossil Fuel-free by 2040

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RETURN TO
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CITY: **NEW YORK CITY**

Planning for an Equitable and Sustainable City

→ New York City's new OneNYC plan for future development focuses on growth, sustainability, resilience, and equity to ensure that social justice and climate change are managed together.

OneNYC is New York City's blueprint for the future. It is a comprehensive long-term plan for sustainable development built on the core themes of prior plans – growth, sustainability, and resilience – with an added focus on justice and equity. Within four key themes, the far-reaching plan has 27 specific goals, 62 performance indicators, and **199 initiatives** that address everything from waste and transportation to climate adaptation and social justice.

The plan is unique in its added focus on the interconnectedness of poverty alleviation and climate change. The plan aims to reduce the risk of flooding in vulnerable neighborhoods and to eliminate long-term displacement from homes and jobs after shock events by 2050. Through OneNYC, the city aims to **lift 800,000 New Yorkers out of poverty** by 2025. The plan will also reduce disparity in PM2.5 air pollution across city neighborhoods by 20% by 2030 and increase the percentage of NYC residents living within walking distance of a park from 79.5% to 85% by 2030.

It is the city's goal that under OneNYC 90% of New Yorkers can reach at least 200,000 jobs by transit within 45 minutes by 2040.

143

MILLION TONS OF CO_2 EMISSIONS REDUCED BY 2050

THE CHALLENGE

Despite the city's overall growth and prosperity, it struggles with high poverty rates and growing income inequality. The fact that the city's most disadvantaged populations tend to be the most vulnerable to the effects of climate change has spurred New York to action in addressing the connection between climate change and social justice through OneNYC.

CO-BENEFITS

Environmental

Under the plan, New York aims to eliminate the need to send waste to landfills by 2030, thus minimizing the overall environmental impact of waste and reducing the city's greenhouse gas emissions by 80% by 2050 relative to 2005 levels.

Social

The plan aims to create and preserve 200,000 affordable housing units and support the creation of 160,000 additional new housing units by 2024.

Economic

To help lift nearly 1 million New Yorkers out of poverty by 2025, OneNYC aims to spur the creation of more than 4.9 million jobs by 2040.

Health

OneNYC seeks to reduce premature mortality by 25% by ensuring that all New Yorkers have access to physical and mental healthcare services.

CITY: **SEOUL**

Citizens Shape Climate Action

↓10

MILLION TONS OF CO_2 EMISSIONS REDUCED BY 2020

THE CHALLENGE

Many cities struggle to engage their citizens in public policy initiatives. To combat this, the Promise of Seoul is dedicated to involving people city-wide. Public, civil, and corporate bodies will realize the vision by carrying out detailed action plans in areas including energy, urban planning, air quality, transportation, resource recycling, water, ecosystems, health, and safety.

CO-BENEFITS

Environmental
The city plans to recycle 73% of waste by 2020 under the Promise of Seoul.

Social
The project includes plans to extend bike lanes by 1,000 km, making active transportation throughout the city safer and more enjoyable.

Health
The Promise of Seoul will improve public health by employing preventive measures against infectious diseases and heat waves, while increasing its capacity to respond to climate related disasters.

→ The Promise of Seoul engages citizens in helping the South Korean capital reach its climate targets.

In 2015, Seoul unveiled its new ambition to reduce greenhouse gas emissions and take action against climate change: the Promise of Seoul. This citizen-led project aims to curtail CO_2 emissions by 25%, or 10 million tons, by 2020. Given Seoul's population of approximately 10 million people, this equates to one ton of CO_2 reduced per person. Other goals include increasing the use of public transportation to 66.5% by 2020 and saving the equivalent of 5 million tons of oil by 2030 through energy efficiency and conservation practices. The project is closely tied to Seoul's energy initiative, One Less Nuclear Power Plant, which cuts energy consumption by the equivalent of 2 million tons of oil – the capacity of one nuclear power plant – between 2012 and 2014.

While One Less Nuclear Power Plant has been a success thus far, the city felt more public involvement was needed to truly galvanize action. Therefore, the Promise of Seoul was initiated to solicit help from citizens and private organizations in shaping the project and in carrying out the goals and measuring results. In all, more than 830,000 citizens and 52 civil organizations took part in Seoul's commitment to reduce one ton of carbon dioxide per person.

Public meetings, and feedback provided by citizen groups, were integral in establishing the Promise of Seoul.


2930
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THE VANCOUVER FOUNDATION
THE CITY OF VANCOUVER

CITY: **VANCOUVER**

Plan Creates Green Jobs and Green Thumbs

→ Vancouver aims to become the greenest city in the world by 2020, in large part by developing green jobs and industries and promoting sustainable local food systems.

↓33%

REDUCTION IN CO_2 EMISSIONS BY 2020 BASED ON 2007 LEVELS

THE CHALLENGE

Vancouver's population is constantly growing, and its coastal location makes it vulnerable to rising sea levels. The ambitious GCAP builds on decades of positive climate action and will help Vancouver achieve its climate goals, such as reducing its ecological footprint by 33% and exceeding the highest regional, national, and WHO air quality guidelines.

CO-BENEFITS

Environmental

Vancouver's GCAP aims to reduce per capita water consumption by 33% by 2020.

Social

By empowering residents to grow their own food, and providing access to community gardens and mobile food markets, GCAP improves food security, food justice, health, and citizens' well-being.

Economic

The plan is dedicated to creating more green jobs. Currently, 20,000 people in Vancouver, nearly one in 20, have a job in a green or local food-related industry.

Health

The plan promotes active transportation infrastructure and local food suppliers, in part, to help lower obesity rates and improve overall health outcomes.

Vancouver's 2011 Greenest City Action Plan (GCAP) sets the overall sustainability direction for this Canadian city's future development, focusing on job creation, carbon emission reduction, and local food systems, in the hopes of becoming the greenest city in the world. Green jobs and local food systems play a major role in this plan. By 2020, the GCAP aims to **double the number of green jobs and green companies**, and action is already being taken. Since 2010, green building design and construction jobs have increased by 50%. Similarly, **local food jobs have grown by 21%** and green transportation-related jobs have grown by 19%, largely through local electric vehicle infrastructure projects and increasing demand for car-sharing services.

Aside from green job growth and local food systems, Vancouver's GCAP also requires **all new buildings from 2020 onwards to be carbon neutral** and that the volume of solid waste going to the landfill or the incinerator be reduced by 50%. In all, the city's nearly 170 actions, completed or underway, ensure that GCAP targets will be achieved and that the city is transparent and accountable throughout the process.

A primary aim of the GCAP is to promote local food jobs.

CITY: **PORTLAND**

Tracking Emissions at Home and Abroad

→ Portland unveiled a climate plan that judges emissions based not only on what happens within its borders but also on where the city and its residents source their goods and services.

↓40%

REDUCTION IN CO_2 EMISSIONS BY 2030

THE CHALLENGE

Portland, Oregon, has been an American leader on climate change for many years. This ambitious plan builds on decades of action and takes the city a step further by analyzing how Portland residents' and businesses' purchasing habits influence greenhouse gas emissions elsewhere in the world. With this knowledge, the city is preparing for even more rigorous climate action in the future.

CO-BENEFITS

Environmental

The plan aims to double the city's installed solar capacity to 30 MW, which will reduce emissions by 6,000 metric tons annually by 2020.

Social

The plan focuses on social equity and prioritizes climate actions that reduce disparities in wealth, access to amenities, and public health, by, for example, prioritizing sidewalk construction and tree planting in underserved areas of the city.

Economic

The plan builds on Portland's recent experience in growing the clean technology sector at a much faster rate than the city economy as a whole, and the city now boasts more than 12,000 local jobs in clean tech.

Health

Portland's Climate Action Program aims to expand urban forest canopy to cover at least 31% of the city, which will improve air quality.

In addition to this new methodology, the comprehensive plan targets an 80% reduction in emissions by 2050, and includes a host of climate change-related targets for 2020, such as increasing the combined mode share for transit, bicycling, and walking to at least 50%, reducing energy use in existing buildings by 1.7% annually, and increasing the total recovery of solid waste to 80%.

By 2020, Portland wants 50% of all trips to be made by public transit, bicycling, and walking.

CITY: **STOCKHOLM**

Becoming Fossil Fuel-free by 2040

→ The Swedish capital is planning and executing impressive policies across all sectors in order to move beyond carbon neutrality and reach the goal of producing zero CO_2 emissions in the next 25 years.

↓57%

REDUCTION IN CO_2 EMISSIONS BY 2020 BASED ON 1990 LEVELS

THE CHALLENGE

Stockholm aims to be a true world leader as the largest city to become fossil-fuel free. In the past few years it has surpassed many of its climate change goals, proving it has the political will and technical experience necessary to achieve its ambitious target of a renewably-fueled future.

CO-BENEFITS

Environmental

By removing all fossil fuel-burning cars from city streets by 2040, Stockholm expects to see reductions in air and noise pollution.

Economic

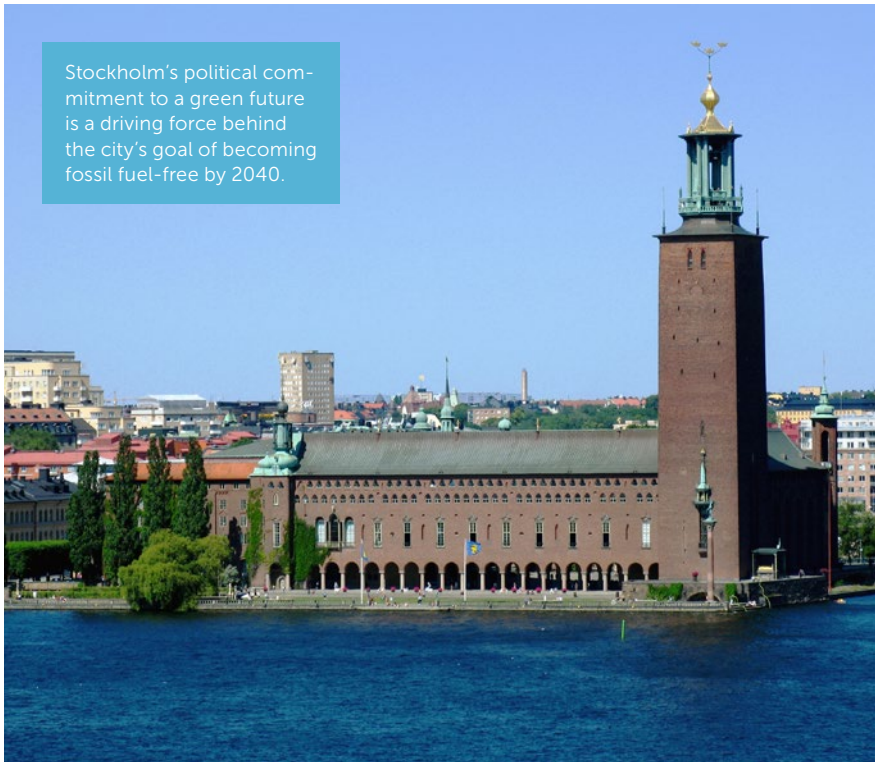
Building a fossil fuel-free city will create jobs within renewable fuel production, clean vehicles, technologies for building energy efficiency, and public transport infrastructure.

Health

Improving conditions for walking and biking will be vital in achieving a 100% fossil fuel-free transport sector. These activities will also bring health benefits to Stockholm's residents.

In 2012, the City of Stockholm set the goal of becoming fossil fuel-free by 2050. Driven by ambitious leadership and actionable goals, in 2015, the city pushed the target date up by a decade, and now plans to **run exclusively on renewable energy by 2040**. The comprehensive plan relies on overall energy reduction and an increase in renewable energy use. For instance, energy standards for new buildings built on city-owned land are 55 KWh/m² compared with national standards of 80 KWh/m². Similarly, the city aims to **reduce energy use in the building sector by 50%** between 1995 and 2050.

By 2040, natural gas will be entirely phased out of the city's energy grid and heating system, replaced primarily by biogas. The energy company that provides district heating is particularly ambitious and has decided to phase out fossil fuels by 2030; starting in 2016, renewable energy will be able to fuel 90% of the city's district heating system, up from 80% today. **Increasing the use of renewable energy in transportation from 16% to 100%** by 2040 will likely be the city's most significant challenge, as this will entail removing all conventional fuel-powered vehicles from the city's streets. To achieve this goal, the city plans to double the capacity of the public transport system, while improving walking and biking infrastructure.



Stockholm's political commitment to a green future is a driving force behind the city's goal of becoming fossil fuel-free by 2040.

CITY: **LOS ANGELES**

Sustainability Embedded in Every City Department

→ Los Angeles has integrated its wide-reaching sustainability plan into all municipal departments in the pursuit of an impressive list of "firsts" within the world of sustainable city development.

Launched in 2014, Los Angeles' ambitious and comprehensive 20-year sustainable development strategy, pLAn, aims to make California's largest city a national leader in sustainable development. Under the plan, Los Angeles plans to be the first large American city to achieve an **80% waste diversion rate by 2017**, while at the same time seeking the title of most new green jobs created. Additionally, the city plans to **derive 50% of its electricity from renewable sources** by 2030 and support active and public transit such that, by 2025, 50% of all journeys will be taken by foot, bike, or public transit, up from 26% in 2012.

Another important "first," which will be necessary in order to achieve the impressive goals: Los Angeles is the first American city to incorporate a sustainability plan into department performance reviews and budget prioritization, and to require Chief Sustainability Officers at the department level. By **integrating the sustainability plan into every level of city government**, Los Angeles is poised to circumvent traditional municipal bureaucratic hurdles and ensure that the plan leads to meaningful action, all while ensuring accountability and transparency.

pLAn supports projects like CicLAvia, an event in which streets are closed to cars so that residents can walk, bike, and skate through open streets, which has been found to significantly improve air quality.

↓60%

REDUCTION IN CO_2 EMISSIONS BY 2035

THE CHALLENGE

Consecutive years of drought and extreme heat, combined with an increasing population, have left Los Angeles vulnerable to the effects of climate change. As water scarcity is a particularly severe problem in the region, pLAn has set the city on track to reduce the purchase of imported water by 50% by 2025, and to source 50% of water locally by 2035.

CO-BENEFITS

Environmental

In the face of a persistent drought, the city recently set the goal of a 20% reduction in water use per capita by 2017.

Social

As part of the plan's effort to create thriving, safe, and equitable neighborhoods, by 2017, 56% of Angelenos will live less than one km from a park or open space.

Economic

Los Angeles' policies on green building, water infrastructure, energy efficiency, and transit have set the city on the path to create 20,000 new green jobs by 2017.

Health

To help with unhealthy extreme heat, Los Angeles plans to install 10,000 cool roofs by 2017 and prepare additional city buildings to function as cooling centers and disaster gathering places.

CITY: **QUITO**

Planning for Smaller CO_2 and Water Footprints

→ By measuring its water and carbon footprints, Quito is developing tailor-made, cost-effective policies and projects that help the city develop sustainably while reducing its climate impact.

14

MILLION TONS OF CO_2 REDUCED BY 2032 AS PART OF THE FOOTPRINT ASSESSMENT PROJECT

In Quito, Ecuador, the use of carbon and water footprint assessment tools led the city to develop a targeted Action Plan of initiatives to lower its CO_2 emissions and water use. The plan is divided into two "portfolios." The carbon portfolio includes actions that **reduce Quito's CO_2 emissions by 20% by 2032**. As one of the many initiatives planned to achieve this goal, Quito will complete a landfill biogas project that will reduce CO_2 emissions by almost 5.5 million tons each year. Other initiatives include the creation of solar power plants, which will avoid the generation of 1.42 million tons of CO_2 emissions annually.

Similarly, in order to avoid the use of 1.5 billion m^3 of water by 2032 – cutting the city's water footprint by 68% – Quito is instituting policies that promote the use of water efficient appliances, ecological toilets, vacuum systems, and water reuse. Through these carbon and water footprint tools, the city is demonstrating how to translate energy assessments and observations into customized and measureable targets and policies.

THE CHALLENGE

Rising temperatures, decreased rainfall, and more frequent extreme weather events are forcing Quito to more efficiently manage its energy and water use. The carbon and water footprint measurement tool helps city officials sculpt policies and projects that will lower Quito's energy use. Quito plans to expand these mechanisms to the private sector in the coming years to make an even greater impact on the city's carbon and water footprints.

CO-BENEFITS

Environmental

The city aims to outfit all 223,000 public light fixtures with energy-efficient LED lights by 2020.

Social

Improving communication and engagement between municipal departments and the public is the most cost-effective method of achieving many of the city's carbon and water targets.

Economic

The planned landfill biogas plant and the promotion of hybrid and electric vehicles represent the greatest cost-benefit payoff of projects seeking to lower Quito's carbon footprint.

In 2011, transportation accounted for 56% of Quito's carbon footprint. Through the footprint assessment project, the city is creating programs that encourage active transit, such as BiciQuito, the city's bike-share system.

CITY: **CAPE TOWN**

Detailed Reporting Shapes Green Policy

→ Cape Town's detailed and comprehensive energy report enables the city to understand its current and future environmental impacts and sets the stage for the city's 2040 vision of sustainable development.

↓15%

REDUCTION IN PER CAPITA CO_2 EMISSIONS BETWEEN 2007 AND 2012

THE CHALLENGE

Cape Town faces numerous threats from climate change, including flooding, rising sea levels, and water shortages. In order to better prepare for such conditions, and to develop a plan to efficiently and effectively reduce energy use, the city has employed comprehensive reporting and detailed planning based on the report's findings.

CO-BENEFITS

Social

Data provided in the State of Energy Report indicate that 35% of Cape Town commuters spend 30 minutes to an hour traveling to work, and black residents bear the greatest burden in terms of travel time.

Economic

The State of Energy Report enables the city to understand the cost-benefit of renewable energy upgrades. For instance, between 2010 and 2014 upgrading all street lights to LEDs cost $2.1 million in investment, but has already yielded savings of $4 million.

Health

Understanding how households are heated enables the city to promote the use of electricity and reduce the use of paraffin, particularly in low-income households. Inefficient paraffin heaters cause indoor air pollution and condensation, leading to damp and polluted conditions and poor respiratory health.

In order to take comprehensive climate change action in the future, Cape Town, South Africa, realized that it must understand where its energy use and emissions stand today. The city developed a yearly State of Energy Report that provides data and analysis on which the city can model alternative energy plans. For instance, Cape Town officials learned from the report that **the transport sector is responsible for 64%** of the city's energy consumption, followed by commerce at 13%, the residential sector at 12%, and industry and municipal consumption at 8% and 1%, respectively.

The city's most recent State of Energy Report was the foundation for the **development of the Cape Town Energy 2040 vision**, which serves as a strategic tool for future decision-making and action planning. The Energy 2040 vision and action plan contributes to Cape Town's overall climate change goals by increasing the city's resource efficiency; achieving greater energy security, diversity, and price stabilization; and reducing carbon emissions.

The knowledge amassed in the Energy Report allows Cape Town to plan for important energy use changes, such as a shift from private and informal transport toward public transit and cycling.

GENERGY
5 4 5 9 9

CITY: **LAKEWOOD**

Emissions Calculators Ensure Achievable Climate Targets

→ A small city in Colorado has employed emissions calculators to help design appropriate, measureable, and achievable climate change strategies.

400K

METRIC TONS OF CO_2 REDUCED BY 2025

THE CHALLENGE

The emissions calculators ensure that Lakewood's targets are appropriate and achievable. This knowledge can help officials, residents, and businesses become more engaged in climate change action, as the goals are not abstract, but based on data regarding the city's past, present, and future potential for action.

CO-BENEFITS

Environmental

Under the Sustainability Plan, the city plans to achieve tree canopy coverage of 30% by 2025.

Economic

Emissions calculators supported the creation of the Lakewood Sustainability Plan, which aims to have 20 local businesses participate in the first three years of a green business certification program.

Health

To create healthier communities, the Sustainability Plan seeks to eliminate food deserts – areas where residents cannot access healthy or fresh food – in Lakewood.

Lakewood, Colorado, proves that small cities can take meaningful action on climate change and make a serious impact on their communities' environmental footprint. As part of the city's 2015 Sustainability Plan, this Denver-area town of 145,000 residents developed customizable greenhouse gas emissions **calculators with Lakewood-specific data inputs and assumptions**. The calculators were used to model strategies related to each of the plan's topic areas, such as energy and water, transportation, and waste.

As a result, the city has developed plans and strategies to reduce emissions across every sector. For example, the calculators taught city officials they could reduce emissions from the energy and water sector by 10,977 metric tons a year, and that residential curbside recycling and waste diversion have the potential to **eliminate 37,627 metric tons of CO_2** emissions each year. Emissions calculators ensure that the plan's goals, targets, and strategies are practical and supported by reliable data. Additionally, the calculators can be easily tailored for use by other communities; Lakewood has already shared the tool with nearby jurisdictions, including Denver and Boulder.

A working group convenes to discuss how emissions calculators could address sustainable economic development, one of the Lakewood Sustainability Plan's six topic areas.

CITY: **DUBAI**

Transitioning toward a Sustainable Future

→ Long defined by its oil dependence, Dubai seeks to change its reputation and position itself as a regional leader in sustainable development and green growth.

Dubai seeks to become a regional leader in sustainable development and green growth through its Carbon Abatement Strategy (CAS) 2021. Focusing primarily on the power, water, and waste sectors, the CAS seeks to eliminate 11 million tons of CO_2 by 2021. Launched in 2012, the CAS has already increased resource and system efficiency by yielding water savings of nearly 16 million m^3 between 2011 and 2014, **increasing the recycling rate to 10% from almost 0% in three years**, and committing 48 km^2 for the development of large-scale utility solar power projects.

Dubai's CO_2 reduction targets may not be as ambitious as those of other cities, but they are an important step in the United Arab Emirates' transition toward more sustainable development and a significant departure from its past. Dubai is already a global business destination and is seen by many cities in the region as a source of innovation. The CAS's **focus on green economic development**, led by the Green Economy Partnerships program, which encourages green trade and investment and accelerates the adoption of green technologies, products, and services, showcases to the entire region that green growth and reduced fossil fuel dependence are economically viable and improve quality of life for citizens.

In 2015, Dubai announced plans to triple its use of solar power, from 5% to 15% of installed capacity, by 2030.

↓16%

REDUCTION IN CO_2 BY 2021 COMPARED TO BUSINESS AS USUAL

THE CHALLENGE

Throughout the United Arab Emirates, up to 85% of the population and 90% of the infrastructure of coastal zones are at risk from climate change. Such vulnerability, combined with expected population growth, has led the city to create strategies and programs that decouple economic growth from CO_2 emissions.

CO-BENEFITS

Environmental

A 200 MW solar photovoltaic plant, scheduled to open in 2017, is estimated to displace almost 500,000 metric tons of greenhouse gas emissions.

Social

By increasing transit ridership 11% between 2011 and 2013, and an additional 16% between 2013 and 2014, Dubai has created better and less expensive access to urban resources for all residents.

Economic

The Carbon Abatement Strategy's eight demand side management programs (focused on building retrofits, LED lighting, district cooling, and other initiatives) have led to $225 million in savings.

Health

Waste-to-energy projects will reduce the use of landfills, which will improve air quality and public health for nearby communities.

BUILDING ENERGY EFFICIENCY

This sector focuses on solutions that mitigate environmental impact of the built environment, such as buildings and other city assets. For example, by refurbishing buildings with energy-efficient innovations, encouraging greener building regulations, and retrofitting street lighting, these solutions highlight cities that are taking action against the most energy-intensive sector of society.

LONDON

Large-scale Building Retrofits Reduce Emissions

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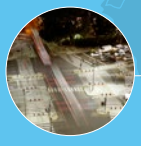

BUENOS AIRES

Smart LED Retrofit Optimizes Resources

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RETURN TO
WWW.SUSTAINIA.ME

CITY: **LONDON**

Large-scale Building Retrofits Reduce Emissions

→ Three London programs are retrofitting public buildings and homes and showcasing private sector leaders in energy efficiency.

155K

METRIC TONS OF CO_2 SAVED PER YEAR THROUGH RE:FIT AND RE:NEW PROJECTS

THE CHALLENGE

Workplaces and homes account for 43% and 36% of London's CO_2 emissions, respectively. These programs incentivize investment in energy efficiency upgrades, since, under RE:FIT, the level of energy savings is contractually guaranteed by the energy services company, offering secure financial savings to participating organizations over an agreed payback period.

CO-BENEFITS

Environmental

RE:FIT projects are generating over 2,000 MWh per year from renewable energy technologies. BEC data will shed light on the potential market for solar energy in private businesses.

Social

RE:FIT has created over 1,700 jobs, and its next phase is slated to yield 2,000 more.

Economic

The energy saved by the 27 BEC award winners in 2014 was worth $19 million in avoided energy bill charges.

Health

Replacement boilers are a key measure for numerous RE:FIT and RE:NEW projects, resulting in improved air quality and cuts in NOx emissions.

London has rolled out three initiatives to improve the energy efficiency of the city's building stock. The suite of programs is composed of two retrofit programs, RE:FIT and RE:NEW, and a commercial sector incentive program, Business Energy Challenge (BEC). RE:FIT aims to retrofit at least 40% of London's public-owned buildings by 2025 and cut CO_2 emissions across the city's public sector by 45,000 metric tons by the end of 2015. Similarly, RE:NEW plans to retrofit 275,000 private homes by 2017, while reducing CO_2 emissions by 93,000 metric tons. RE:NEW's current phase aims to retrofit approximately 5% of London households. Combined, these programs have retrofitted more than 110,000 London homes and 460 public buildings.

The third program, BEC, complements the public and private home retrofit programs by driving energy efficiency in the commercial sector through an awards scheme based on applicants' submitted energy data. Fifty-eight businesses have participated in BEC, and the 27 award winners reduced their energy consumption by 181,892 MWh from 2010 to 2014 – enough to power 10,700 UK households for a year.

London's comprehensive building retrofit program seeks to reduce CO_2 emissions from municipal, commercial, and private buildings through more efficient energy use.

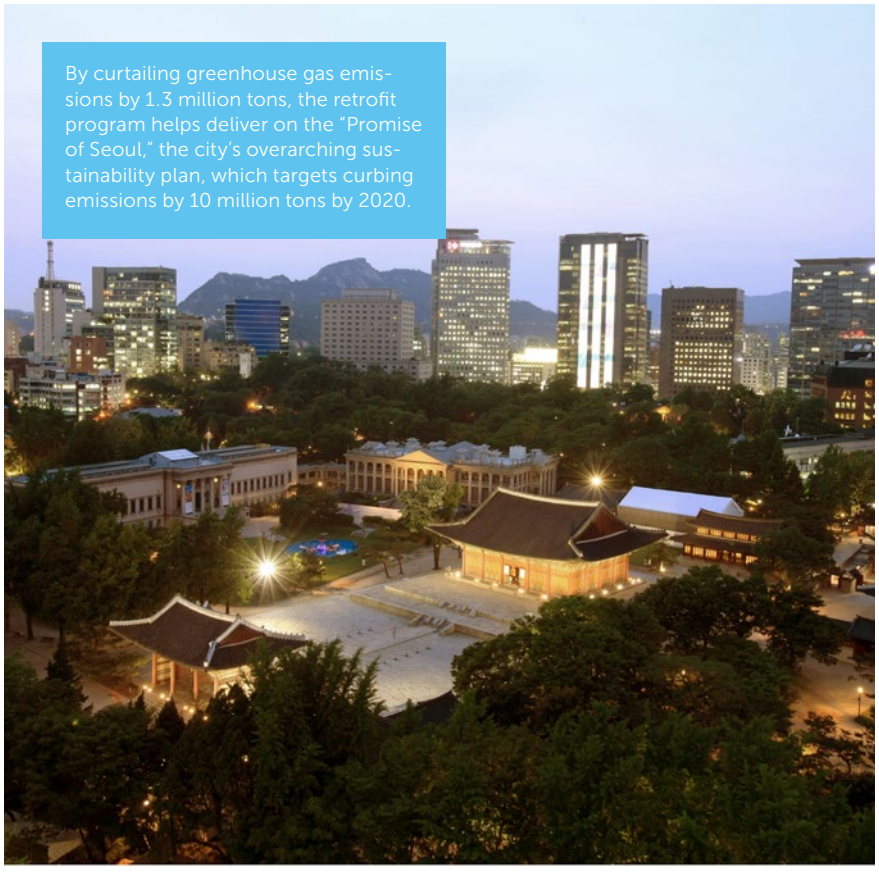
CITY: **SEOUL**

Financial Incentives Spur Retrofits

→ Seoul is subsidizing energy efficiency upgrades in buildings, encouraging residents and businesses to retrofit their homes and workplaces.

Seoul has unveiled a comprehensive program to retrofit its buildings, providing generous financial incentives and free consultation services to encourage all citizens and businesses to participate. To reduce the financial burden and encourage homeowners, tenants, building owners, and businesses to get involved, the city offers eight-year loans that cover all retrofit expenses at an **ultra-low interest rate of 1.75%**, lowered from the initial 3%. These incentives are clearly paying off, as increasing the loan coverage from 80% to 100% of retrofit costs sparked a huge increase in loan applications, from $4.4 million in 2012 to $20.7 million in 2014.

Seoul's city government has also deployed "energy consultants," who make house calls to small- and medium-sized commercial buildings and homes, to provide free energy efficiency consultation services. By the end of 2014, 45,000 buildings had already received the service. The project aims to enhance energy efficiency in 90,000, or 20%, of outdated buildings that are more than 20 years old by 2018. To date, Seoul's retrofit program **has improved energy efficiency in 72,000 buildings**.



By curtailing greenhouse gas emissions by 1.3 million tons, the retrofit program helps deliver on the "Promise of Seoul," the city's overarching sustainability plan, which targets curbing emissions by 10 million tons by 2020.

1.3

MILLION TONS OF GREENHOUSE GAS EMISSIONS WILL BE AVOIDED BY 2020

THE CHALLENGE

As buildings are responsible for 56% of Seoul's total energy consumption, the retrofit program is effective in curbing greenhouse gas emissions and reducing energy demand. In addition to encouraging citizens and businesses to act, the city is also making impressive strides with its own facilities by, for instance, replacing conventional lights in all 243 subway stations with LEDs.

CO-BENEFITS

Environmental

The equivalent of 1.04 million tons of oil is expected to be reduced in total in 90,000 buildings by 2018 through energy efficiency upgrades.

Social

Energy efficiency upgrades in 59 municipal social welfare facilities save the equivalent of 1,426 tons of oil each year, and the saved energy expenses are reallocated to improve welfare services.

Economic

In the first phase of the project, Seoul will save 57 GWh of electricity and $6.6 million in electricity expenses annually, allowing for a full recovery of the investment within seven years.

CITY: **NEW YORK CITY**

Energy Efficiency, Built to Last

→ New York City is improving energy efficiency for its new and existing buildings, with a target of reducing building-based CO_2 emissions by 30% by 2025.

One City: Built to Last is a 10-year plan to improve the energy efficiency of New York City's buildings through a combination of public investments in city-owned buildings and new programs to spur private-sector action. Initiatives for public buildings, which are backed by more than $1 billion in funding, will improve city operations and maintenance and **retrofit every city-owned building with significant energy use** by 2025. To encourage private sector action, the plan includes energy audit ordinances, lighting upgrades, and sub-metering for mid-sized buildings, as well as assistance for private building owners undertaking efficiency upgrades. Cumulatively these programs will **reduce building-based emissions 30%** by 2025 in private sector buildings, and 35% by 2025 for city-owned buildings.

To analyze potential greenhouse gas reduction pathways for the buildings sector, the Technical Working Group of 38 experts in architecture, engineering, real estate, and the environment will recommend the additional policies necessary to reach the city's goal of an 80% reduction in CO_2 emissions by 2050.

One City sets two 10-year targets for solar power by 2025: 100 MW capacity on municipal buildings and 250 MW capacity on private buildings.

↓3.4

MILLION METRIC TONS OF CO_2 REDUCED ANNUALLY BY 2025 THROUGH ONE CITY INITIATIVES

THE CHALLENGE

In densely populated New York City, buildings account for nearly three-quarters of greenhouse gas emissions.[1] In order to achieve the ambitious goal of 80% reduction in greenhouse gas emissions by 2050, the city must increase investments in energy efficiency for public buildings, and the private sector must overcome barriers to energy efficiency investments in a fragmented market for energy efficiency and clean energy services. This new program integrates the market and helps the public and private sectors realize the benefits of more efficient building energy use.

CO-BENEFITS

Environmental

The programs and initiatives included in One City are expected to reduce water use in buildings by at least 14 million liters annually by 2025.

Social

Lower utility bills will help to alleviate the rent burden faced by many New Yorkers, especially low-income households.

Economic

One City will save New Yorkers $8.5 billion in energy costs by 2025 and create 3,500 new jobs.

Health

By 2030, improved air quality as a result of NYC Clean Heat – a One City program – could prevent an estimated 290 deaths, 180 hospital admissions, and 550 emergency room visits for asthma annually.

[1] City of New York. One City: Built to Last, Message from the Mayor. www.nyc.gov

CITY: **HOUSTON**

LED Street Light Conversion Yields Big Savings

→ The Texan City of Houston aims to retrofit 165,000 street lights over the next three years, making it the largest such project in the USA and cutting street lighting electricity use in half.

In 2014, the City of Houston partnered with CenterPoint Energy to convert approximately **165,000 street lights** from high-pressure sodium, mercury vapor, and metal halide to LED technology. As the largest LED street light conversion in the USA, this project will **reduce Houston's street light electricity usage by approximately 50%** and reduce municipal greenhouse gas emissions by 5%. In the process, the conversion will save the city more than $1.4 million annually in electricity savings. Thirty-five thousand street lights have already been converted, with the remainder planned for the next three years.

While CO_2 reductions and energy efficiency are the primary goals of this project, converting conventional street lights to LEDs has the **added benefits of increasing the quality of outdoor lighting** and safety of public spaces. The project builds on a 2009 partnership with Siemens, in which the city retrofitted more than 40,000 traffic lights and 7,000 pedestrian signals, saving nearly 10 million KWh of electricity and $1.3 million annually.

↓38K

METRIC TONS OF CO_2 REDUCED ANNUALLY ONCE LED INSTALLATION IS COMPLETE

THE CHALLENGE

As this project has been a partnership with the private utility company, CenterPoint Energy, it highlights that energy efficiency upgrades are not only necessary for environmental sustainability but make a strong and compelling business case. By learning from other best practice cases and taking time to run multiple successful pilots, this partnership proves that energy-efficient LED conversion can appeal to multiple bottom lines.

CO-BENEFITS

Environmental
Nearly 60 million KWh will be reduced annually through the LED street light conversion.

Social
The project promotes safety and comfort in the city by improving nighttime visibility, producing more uniform lighting distribution, and eliminating dark areas between light fixtures.

Economic
The LED street light project will save the city more than $28 million over the life of the LEDs.

Health
Once completed, the LED conversion will reduce the amount of mercury in the environment by 7,255 grams annually.

Houston Mayor Annise Parker unveils examples of new LED street lights being installed throughout the city.

CITY: **BOULDER**

Collaborative Approach to Efficiency Regulations

→ The City of Boulder, Colorado, has created a suite of programs to improve the energy efficiency of households and businesses, while engaging residents in the design and implementation.

Boulder's "Smart Suite" of energy efficiency programs integrates requirements, energy services, and financing to spur investment in energy efficiency. The coordinated program interventions include SmartRegs, which mandates energy efficiency requirements for rental housing, and EnergySmart, a community-designed energy advisor program that provides assessments and helps customers interpret results. Additional programs include a tax on electricity use to fund efficiency efforts and reduce greenhouse gas emissions, and leading-edge building codes for new construction and remodels.

SmartRegs was developed in collaboration with property owners, management companies, tenant representatives, and energy experts. The program requires attic and ceiling insulation, air-sealing, and furnace replacements to Boulder's rental units. By 2019, the city aims to achieve 100% compliance in residential energy efficiency requirements through the program. Equally impressive, the advisor program, EnergySmart, has already served more than 12,000 households and more than 3,000 businesses, while the full suite of programs has leveraged over $18 million in private investment.

Solar panels on a Boulder recreation center contribute to the city's goal that by end of 2018 over half of the existing buildings in the city will have made efficiency improvements.

↓50K

METRIC TONS OF CO_2 EMISSIONS AVOIDED SO FAR THROUGH SMART-SUITE PROGRAMS

THE CHALLENGE

Boulder has long been an American front-runner in environmental thinking and green energy promotion. This program builds on years of experience and strong community support in an effort to help Boulder achieve its goal of reducing CO_2 emissions by 80% by 2050.

CO-BENEFITS

Environmental

Smart Suite programs have helped Boulder reduce electricity demand by more than 13 million KWh a year, meaning less pollution from the city's coal-powered plants and improved air quality.

Social

Under the program, 1,650 affordable housing units are now compliant with efficiency requirements, which lowers monthly housing costs for the city's lowest income households.

Economic

Investments in residential and commercial buildings via the energy advisor programs save residents and businesses more than $1.7 million a year based on current utility rates.

CITY: **CHICAGO**

Integrated Campaign Boosts Energy Efficiency

→ Chicago's integrated building retrofit program is reducing energy use city-wide by targeting residents, businesses, and municipal buildings.

142K

METRIC TONS OF CO_2 REDUCED ANNUALLY THROUGH COMMERCIAL AND MUNICIPAL RETROFITS

THE CHALLENGE

Responsible for 71% of the city's emissions, buildings are Chicago's biggest polluter. Therefore, a far-reaching and integrated program to target energy efficiency in all buildings is an important step towards tackling climate change in the Windy City.

CO-BENEFITS

Environmental

The program reduces buildings' energy requirements, which helps make onsite renewable energy generation more affordable.

Social

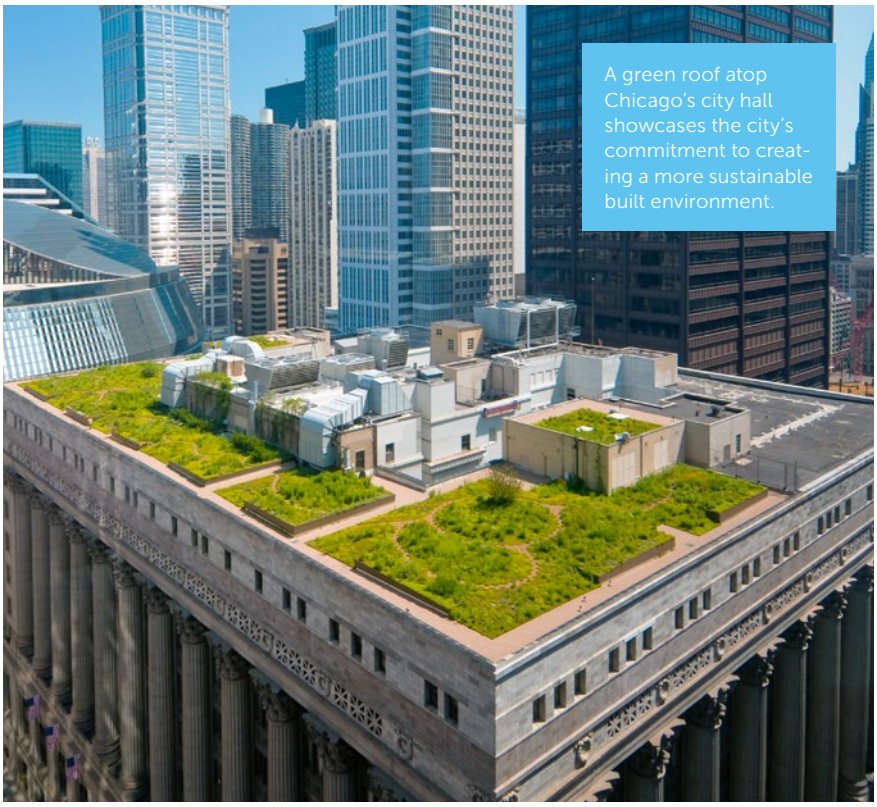
Retrofit Chicago's residential program focuses on economically-disadvantaged communities, helping to improve energy efficiency and lower utility costs for those most in need.

Economic

Chicago's electric utility estimates that commercial participants' efficiency efforts have delivered more than $350,000 in savings to Chicago's electricity grid.

The USA's third-largest city is tackling municipal, residential, and commercial building energy use through its comprehensive and engaging Retrofit Chicago program. Under the municipal program, 60 public libraries, police stations, community centers, and other public facilities are undergoing comprehensive energy retrofits worth $12.2 million in investments, resulting in an **18% energy use reduction** across more than 455,000 square meters of public buildings. To target the private sector, 50 buildings, representing 3.7 million square meters of commercial, institutional, hotel, and higher education space, have committed to improve energy efficiency by 20% within five years.

Finally, the residential component of Retrofit Chicago has coordinated between utilities, financiers, and nonprofit partners to **retrofit 18,000 residential units, install 128,000 low-flow water fixtures** and programmable thermostats, and save residents more than $7 million annually. The Chicago Energy Data Map has also increased residents' awareness of energy use by providing Chicagoans with access to interactive, block-by-block data on building energy use. Streamlining these three initiatives into one program has allowed Retrofit Chicago to maintain clear, strong messaging and engage citizens and businesses in the energy efficiency upgrade effort.



A green roof atop Chicago's city hall showcases the city's commitment to creating a more sustainable built environment.

CITY: **BUENOS AIRES**

Smart LED Retrofit Optimizes Resources

→ Buenos Aires is retrofitting its street lights with smart LEDs in order to save electricity and better control lighting throughout the city.

↓24K

TONS OF CO_2 AVOIDED EACH YEAR ONCE THE PROJECT IS FULLY IMPLEMENTED

THE CHALLENGE

Faced with the threat of rising energy prices and a volatile market, Buenos Aires decided to become a leader in energy efficiency by embarking on this four-year street light retrofit project. The most efficient way to reduce energy costs is to reduce electricity usage, and the city is already making headway on that front, as the nitiative saves 44.5 million KWh of electricity annually.

CO-BENEFITS

Social

The city expects to see a reduction in crime and increase in use of public space in areas with new LED lights.

Economic

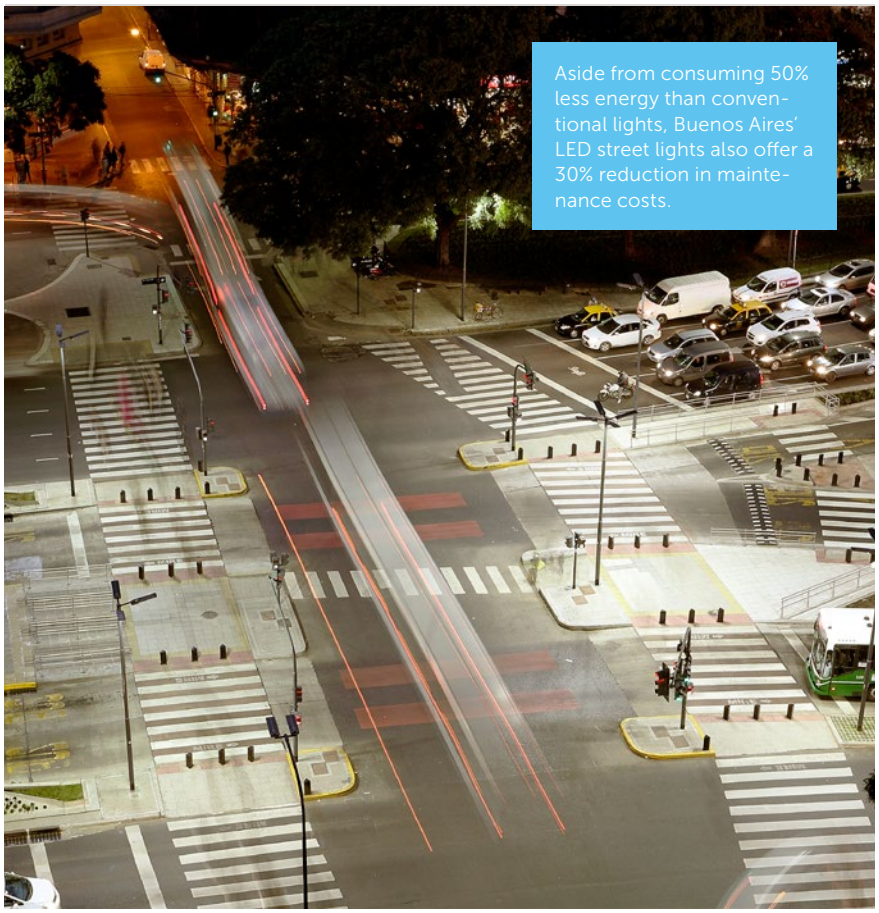
According to estimates, the initiative will reduce electricity consumption by more than 50%, generating savings of more than $7.4 million per year.

Health

Traffic accidents are expected to be reduced, as drivers, pedestrians, and cyclists all have better visibility due to new LED street lights.

In 2013, the Argentine capital began a public light retrofit project with the goal of replacing 91,000, or 72%, of conventional street lights with energy-efficient LEDs by the end of 2016. The city is well on its way to achieving its goal, as **60,000 street lights have already been retrofitted**. So far, these new lights have avoided 9,866 tons of CO_2 emissions and generated 14.77 GWh of energy savings. On top of the street light plan, the city has also replaced all 138,000 traffic lights with high-efficiency LED bulbs, leading to a 90% electricity savings.

The LED fixtures generate **electricity savings of between 40% and 70% compared to conventional technologies**. But the new street lights are not just efficient, they are smart. Buenos Aires' new street lights include a built-in tele-management system under which every city street light can be controlled remotely from a centralized control panel. This enables the city to **turn the lights on incrementally as it gets darker**, quickly detect and correct failures, and plan maintenance more efficiently.



Aside from consuming 50% less energy than conventional lights, Buenos Aires' LED street lights also offer a 30% reduction in maintenance costs.

CITY: **SYDNEY**

Tackling Apartment Building Emissions

↓40%

REDUCTION IN APARTMENT-SECTOR CO_2 EMISSIONS BY 2030

→ Australia's largest city is reducing emissions from its buildings sector by targeting existing and new apartment buildings for water and energy efficiency upgrades.

The Residential Apartments Sustainability Plan (RASP) is Sydney's ambitious plan to improve resource efficiency across new and existing apartment buildings. When fully implemented, actions in RASP for new and existing apartment buildings could see a **reduction in apartment-sector CO_2 emissions by 40%** and water consumption by 7% by 2030, as well as 70% of waste diverted from landfills by 2021. RASP aims to reach these targets through cost-effective energy efficiency projects and technologies spanning lighting, pool pumps and motors, heating, and ventilation systems. The plan seeks to teach owners and building managers to identify, approve, and implement projects, and to facilitate a Leadership Network for peer learning amongst stakeholders. RASP also addresses building owners' concerns about the costs of retrofits by providing financial incentives for upgrades.

RASP builds on learnings from the Smart Green Apartments (SGA) pilot program, which upgraded 30 apartment buildings and verified that Sydney could reduce apartment-sector energy use by 30%. **The SGA pilot achieved annual energy savings of 3,223 MWh** and annual greenhouse emissions reductions of 3,191 tons. By scaling these results city-wide, Sydney can make impressive strides in energy efficiency in a short time.

THE CHALLENGE

The apartment sector is responsible for 11% of Sydney's emissions. With 73% of city residents living in more than 1,900 apartment buildings, RASP responds to the need for sector-specific action to drive down emissions and energy use in apartment buildings. By 2030, over 90% of new dwellings built will be high-rise buildings. While dense housing typically has a lower environmental impact, RASP ensures that these high-rises are built to prioritize energy efficiency.

CO-BENEFITS

Environmental

By adopting actions from RASP, Sydney's apartment sector stands to reduce water consumption by 7% by 2030.

Social

RASP has encouraged cooperation and a shared sustainability vision among the city's apartment managers, owners, and tenants.

Economic

The SGA pilot verified that projects generally show a payback of less than four years, saving individual apartment buildings up to an average of $66,013 per year.

A Sydney apartment building receives "the green treatment" as part of the city's RASP program to improve energy efficiency in residential apartment buildings.

CITY: **TORONTO**

Promoting Efficiency in New Developments

→ Canada's largest city has instituted a two-tiered suite of voluntary and mandatory programs to enforce sustainability standards in all new developments.

Toronto Green Standard (TGS) is a two-tier package of environmental performance measures designed to address Toronto's five major environmental challenges: air quality, climate change, water quality and efficiency, urban ecology, and solid waste. TGS ensures that all new developments in the city achieve high energy performance targets. **Tier 1 compliance is required for all new construction in Toronto**, while Tier 2 is a higher, voluntary level of performance, and compliant projects may be eligible for a partial refund of development expenses.

To promote water use efficiency, Tier 1 requires buildings to retain at least the first five mm from each rainfall event, while Tier 2 requires the retention of at least 25 mm. Tier 1 requirements have been applied to more than 850 new construction projects, including 75 high-rise buildings, since the program launched, and **15% of new buildings are targeted for Tier 2** level compliance. This program has made Toronto a regional leader in energy efficiency measures. Currently, three municipalities outside of the City of Toronto have adopted the performance measures in their jurisdictions, and other municipalities are looking to do the same.

Toronto's TGS program encourages all types of building retrofits, from full building energy renovations for social housing to rooftop garden installations.

↓115K

TONS OF CO_2 REDUCED THROUGH TGS EACH YEAR

THE CHALLENGE

Toronto has experienced unprecedented levels of new development in recent years. But positive economic growth can often result in detrimental environmental consequences. TGS ensures that sustainable building standards are part of the city's growth and development, making Toronto a regional leader in sustainability.

CO-BENEFITS

Environmental

Over 2 million liters of water have been saved each day from high-efficiency fixtures required by TGS Tier 2, a potable water use reduction of 30%.

Social

In order to promote cycling and a more pleasant urban environment, TGS requires the construction of nearly 200,000 new secure bicycle parking spaces.

Economic

A 2008 cost-benefit study indicated that implementing Tier 1 would result in savings of more than $1.2 billion in avoided hard infrastructure expansion costs to the city over the next 25 years.

CITY: **ATLANTA**

Encouraging Energy and Water Savings while Creating Jobs

→ A new building ordinance in Atlanta is promoting energy efficiency and reducing water use by 20%, helping the drought-prone American city conserve resources.

↓50%

REDUCTION IN COMMERCIAL BUILDING CO_2 EMISSIONS BY 2030 FROM A 2013 BASELINE

THE CHALLENGE

During the last 10 years, the Southeastern region of the USA has experienced two of the most severe droughts on record, which killed more than 200 people and caused an estimated $12 billion in damages. By encouraging a 20% reduction in water and energy use in commercial buildings, Atlanta can optimize its valuable and scarce water resources and reduce the city's vulnerability to drought.

CO-BENEFITS

Environmental
Commercial buildings expect to increase renewable energy usage by 1.9 million KWh per year by 2030.

Social
The ordinance will create more than 1,000 jobs per year in the first few years, in the fields of benchmarking, energy and water audits, and commissioning and retro-commissioning.

Economic
The ordinance will generate a $2 billion return to the commercial sector through energy savings by 2030.

The 2015 Atlanta Commercial Buildings Energy Efficiency Ordinance aims to reduce the city's energy and water footprint while creating jobs. The city projects that the ordinance will drive a 20% reduction in commercial energy and water consumption, create more than 1,000 jobs annually in the first few years, and reduce CO_2 emissions by 2.5 million metric tons by 2030. The ordinance addresses energy and water use in 3,000 large private- and city-owned buildings that account for 80% of the city's commercial sector, requiring that these buildings comply with benchmarking, transparency, and audits – including water audits – and voluntary retro-commissioning.

The city expects a 20% reduction in commercial use of water from 2012 levels by 2030. Additionally, results from benchmarking and audits will provide tools to the real estate market to promote efficient buildings. The city expects this to, in turn, incentivize the installation and adoption of renewable energy for commercial buildings. Building owners are also required to track and disclose information regarding their buildings' energy use, water use, and solid waste generation.

The ordinance is part of Atlanta's participation in the City Energy Project (CEP), a 10-city partnership to reduce CO_2 emissions by up to 7 million tons annually and save residents and businesses nearly $1 billion each year on energy bills.

FINANCE & ECONOMIC DEVELOPMENT

This sector includes city solutions that are re-thinking ways of financing and incentivizing investments in low carbon projects in order to achieve sustainable growth. At the same time, these solutions demonstrate that environmental protection and climate change mitigation make good business sense for cities.

STOCKHOLM

Congestion Pricing Finances Metro Expansion

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GOTHENBURG

Pioneering Green City Bonds for Climate Action

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CITY: **JOHANNESBURG**

Green Bonds Fill Gaps in Financing Climate Projects

→ Johannesburg's 2014 green city bonds scheme has secured finance for investments in a suite of projects mitigating climate change and creating a more resilient city.

↓15%

CO_2 REDUCTION IN JOHANNESBURG ACHIEVED THROUGH MITIGATION PROJECTS FROM 2013 TO 2016

THE CHALLENGE

Cities across the world are experiencing difficulties in securing financing for green urban development, resulting in unrealized projects. Green bonds have helped Johannesburg overcome this barrier by providing access to additional funding and tapping into a new base of socially responsible investors. According to the World Bank, investors are increasingly looking to green bonds, with investments in these programs tripling to $35 billion between 2013 and 2014.

CO-BENEFITS

Environmental

The extensive installation of solar water heaters will save the equivalent of 22.5 GWh of electricity per year, enough to power a small town.

Social

Green bond-financed projects to increase recycling separation at the source target 470,000 households and will help increase job creation in Johannesburg.

Economic

Johannesburg's green bonds have reduced the costs of realizing the city's green projects. As the bond auction in 2014 was 150% oversubscribed, the city sees even bigger potential for future issuances.

As the first emerging market city to issue green city bonds, Johannesburg is a front-runner in finding innovative funding sources for climate action. The $143 million worth of green bonds sold in 2014 **fill gaps in much-needed development finance** for projects within energy, water, waste, and transportation. The funding will help implement the city's climate change mitigation strategy and accelerate projects, such as a rollout of 42,000 building smart meters, 43,000 solar water heaters, deployment of 152 hybrid buses as well as conversion of buses from diesel to natural gas.

One project financed by the bonds is a **16 km extension of the Rea Vaya Bus Rapid Transit system**, which will result in 10 new stations, and 5 km of walking and cycling lanes. Due to the successful 2014 issuance, the city has become a global role model and has shared its approach to green bonds with cities across the world. Johannesburg is planning to issue new green bonds to finance further climate action.

Through green bonds, a number of projects in Johannesburg are transforming the city toward greater energy and water efficiency, low carbon transportation, more renewable energy and better waste management.

CITY: **TORONTO**

Public Fund Invests in Climate Solutions

→ The Toronto Atmospheric Fund (TAF) is a city-owned agency that provides grants, makes loans, undertakes special projects, and creates partnerships to facilitate action on climate change.

TAF helps advance Toronto's community-wide greenhouse gas and air pollution reduction targets. With more than **80% of its endowment invested in projects that have positive climate impacts**, the fund is increasingly acting as an "impact investor," mobilizing public and private capital toward investments that are not only financially sound, but socially and environmentally conscious. The fund's investment returns have covered all TAF program expenses, at no cost to the taxpayer, since its **establishment 25 years ago**.

TAF targets the transport and building energy sectors, as they are responsible for 41% and 48% of Toronto's CO_2 emissions, respectively. To unlock the significant local energy efficiency investment opportunities in buildings, TAF launched Efficiency Capital Corp. in 2015. This private venture will fund efficiency investments in Toronto's building stock and **raise up to $75 million** in capital through third-party investors. To address transportation energy use, TAF funds a collective impact initiative called Move the Greater Toronto and Hamilton Area, consisting of 12 diverse civic groups who leverage provincial support for local transit. In 2014, their efforts helped secure a public commitment of almost $11.3 billion over 10 years for regional transit investments.

Traffic congestion costs Toronto $4.5 billion in lost business productivity each year. TAF's Move the Greater Toronto and Hamilton Area initiative supports the transition toward low carbon transit to mitigate climate change, improve air quality, and improve productivity in the city and region.

↓25%

CO_2 REDUCTION BELOW 1990 LEVELS IN TORONTO WITH SUPPORT FROM THE TAF

THE CHALLENGE

Two of Toronto's largest greenhouse gas reduction opportunities – investment in energy efficiency and public transit – face major barriers due to competing capital needs in a city juggling multiple priorities. Establishing a permanent fund to address this long-term issue proved a solution to reduce emissions, improve air quality, and save the city $41 million in energy costs.

CO-BENEFITS

Environmental

With support from the TAF, the City of Toronto has achieved a 25% reduction in GHG emissions below 1990 levels.

Social

TAF's "Climate Spark" initiative supports social ventures that offer significant greenhouse gas emissions reductions and pair a social and commercial mission with service to the broader community interest.

Economic

Every $1 million spent on energy efficiency retrofits in the province of Ontario - home to Toronto - generate a net increase of $2.4 million in provincial GDP, and a net increase in employment of 17 person-years.

Health

Toronto has reduced premature deaths related to air pollution from 1,700 to 1,300 within 10 years, due largely to the phase-out of coal-fired electricity. TAF funded research and advocacy to support the coal phase-out over a 10-year period.

CITY: **GOTHENBURG**

Pioneering Green City Bonds for Climate Action

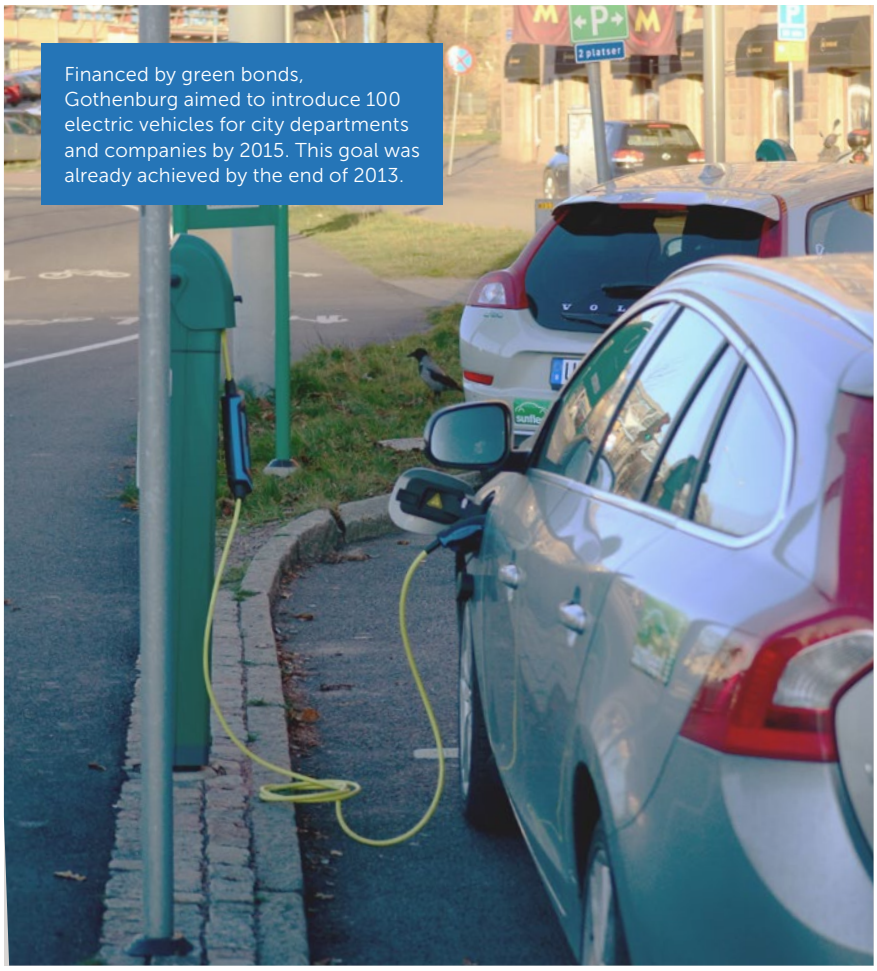
→ In 2013, Gothenburg became the first city in the world to issue green bonds – a financial tool designed to counter and reduce the impact of climate change.

136K

TONS OF CO_2 ARE REDUCED PER YEAR BY THE GREEN BONDS-FINANCED BIOGAS PLANT

In three years, Gothenburg has issued green bonds worth almost $400 million for a selected pool of projects that promote the transition to low carbon and climate-resilient urban development. Green bonds are **a win-win situation for the city and investors** as they offer a return on investment, just like traditional bonds, but also contribute to tackling climate change.

The green bonds ensure that the municipality only builds new facilities that are in line with passive house standards – using about 60% less energy than required under national building regulations. One of the projects financed by green bonds is the GoBiGas large-scale biogas plant. The facility creates biogas from the waste generated by the forestry industry, agriculture and municipal services to **deliver 800-1,000 GWh worth of energy** to city residents. Other projects financed by green bonds include district heating, water treatment, electric vehicles, and nitrogen retention.



Financed by green bonds, Gothenburg aimed to introduce 100 electric vehicles for city departments and companies by 2015. This goal was already achieved by the end of 2013.

THE CHALLENGE

One of the key objectives of introducing green bonds was to overcome the challenge of limited communication between the environment and finance departments in the city. Given the large investments, it has been necessary to establish strong collaboration and partnership between these two departments. The cooperation is paying off, as the city has greatly improved its ability to realize green projects.

CO-BENEFITS

Environmental

When the GoBiGas biogas plant is fully operational, the energy generated each year will be equivalent to the fuel it takes to power up to 100,000 cars.

Economic

The green bonds-financed Lackarebäck water treatment and purification plant will result in fewer disease outbreaks, which will prevent up to 290,000 days of lost productivity from 2014 to 2038.

Health

With cleaner water provided by the Lackarebäck water treatment and purification plant, Gothenburg's citizens will avoid 1.4 million days spent in the hospital.

CITY: **SÃO PAULO**

Incentivizing Density Near Public Transit

→ São Paulo has created a scheme that encourages new real estate developments near public transportation and holds developers accountable for their projects' environmental footprints.

19.5%

REDUCTION IN CO_2 EMISSIONS FROM SÃO PAULO'S MUNICIPAL BUS FLEET BETWEEN 2010 AND 2012

THE CHALLENGE

São Paulo has been challenged by new commercial and residential developments being built in parts of the city with suboptimal existing public infrastructure. This scheme of charging developers according to a model that takes into account socio-economic factors, such as access to public transit, and environmental footprints drives real estate development toward areas of the city in need of investments.

CO-BENEFITS

Social

As part of this scheme, the city aims for all citizens to live within 300 meters of a BRT stop and 600 meters of a subway or train station.

Economic

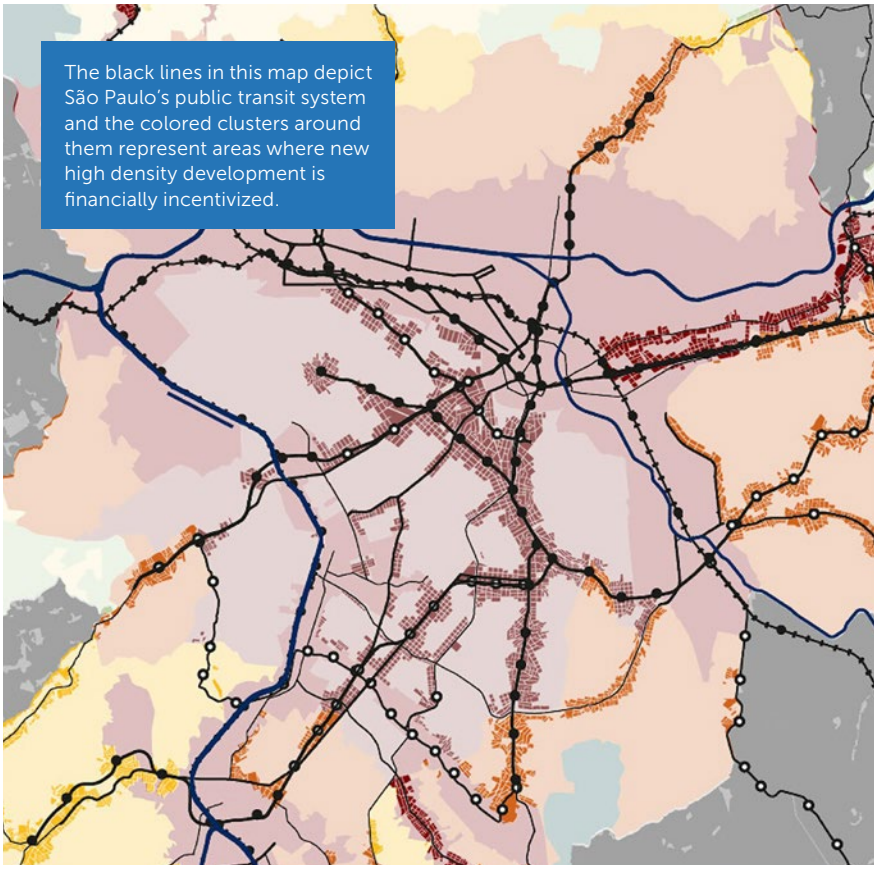
The scheme promotes more efficient public transit, which reduces the economic opportunity cost of commuting between São Paulo's peripheries and the city center.

Health

By encouraging more mixed-use developments and active transportation, such as biking and walking, the scheme offers health benefits to citizens.

To promote more sustainable and transit-oriented urban development, São Paulo devised a scheme in which **real estate developers must financially compensate the city for new developments** based upon the value of the land, the cost of creating new urban infrastructure – particularly public transportation – and the environmental impacts of new construction. The scheme **incentivizes mixed-use development** in an effort to reduce the need for transport, while stimulating developments in less valued areas near existing public transportation. The plan also creates new economic opportunities in the city's poorest neighborhoods.

With the scheme raising $150 million per year, the city has been able to invest in projects such as bus rapid transit, subway, and train service, as well as create parks to reduce the urban heat island effect and improve rainwater management. São Paulo aims to have its **entire municipal bus fleet run on renewable fuels by 2018**, and the increased use of public transportation significantly contributes to the reduction of the city's greenhouse gas emissions.



The black lines in this map depict São Paulo's public transit system and the colored clusters around them represent areas where new high density development is financially incentivized.

CITY: **SHENZHEN**

Carbon Trading Decouples Growth from Climate Impact

→ Shenzhen has created a market for trading carbon emission allowances between the city's largest companies, driving down carbon intensity and CO_2 emissions.

14

MILLION TONS OF CO_2 REDUCED UNDER THE ETS SINCE 2010

THE CHALLENGE

The main challenge for Shenzhen's ETS is regulating allowance allocation as well as enforcing companies' adherence to their allowances. To overcome this, the city carefully monitors the market at each step and produces frequent assessment reports that clearly show how the ETS has succeeded in driving low carbon development without harming economic growth.

CO-BENEFITS

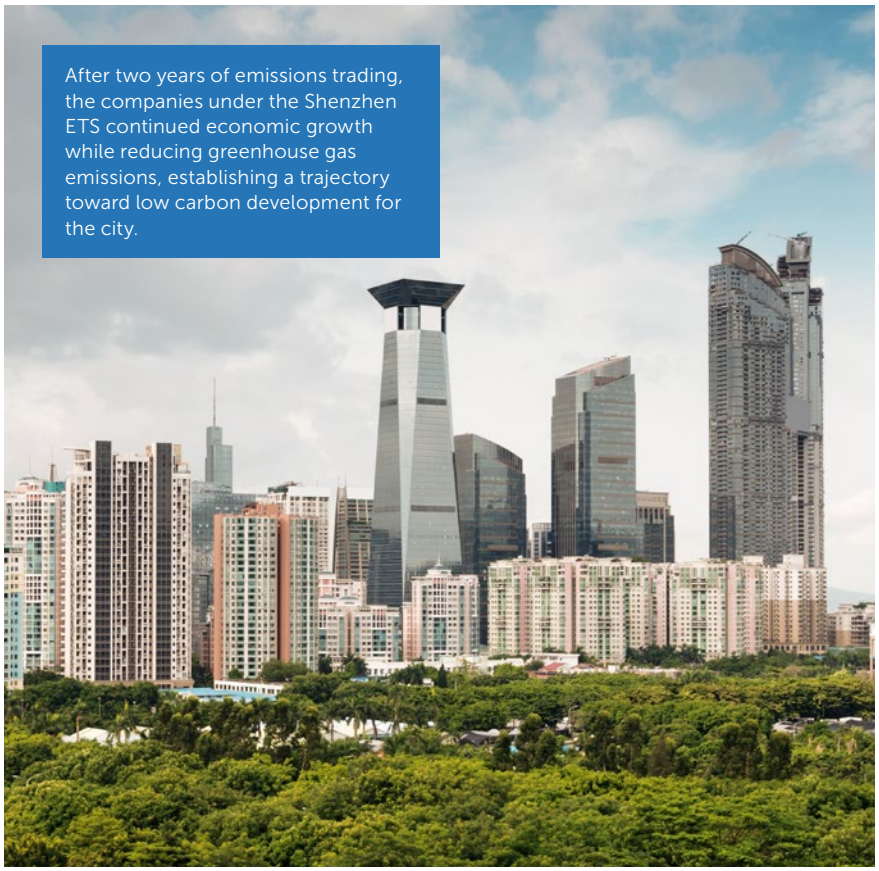
Environmental
By reducing power generation from coal, the ETS improves air quality and lowers harmful PM2.5 particle emissions.

Social
In order to involve the local community, the city holds exhibitions and promotional campaigns to promote the uptake of a low carbon lifestyle.

Economic
Companies covered by the ETS represent 26% of the city's GDP and have reduced their carbon intensity by 34%.

In 2013, the Chinese City of Shenzhen launched an emissions trading scheme (ETS), which allows companies and public infrastructure projects to trade carbon emissions under the Chinese Certified Emissions Reduction program. The allowances in Shenzhen's ETS are based on carbon intensity and the city caps the number of allowances based on the results of the best performing companies and agencies, creating healthy competition. **Six hundred thirty-five key companies and 197 large public infrastructure projects** participate in the scheme; together these emitters are responsible for 40% of the city's carbon emissions, making the impacts of the scheme substantial.

Shenzhen's ETS has successfully decoupled economic growth from climate impact, as participating industrial companies have **achieved a 12.6% reduction in CO_2 emissions** while increasing their value by almost 40%. The city plans to scale its ETS to include more companies as well as the transportation sector, where CO_2 emissions are rapidly rising. Shenzhen expects the scope of transactions within the market to expand, and, when implemented at full scale, to reduce companies' long-term costs of mitigating emissions.



After two years of emissions trading, the companies under the Shenzhen ETS continued economic growth while reducing greenhouse gas emissions, establishing a trajectory toward low carbon development for the city.

CITY: **STOCKHOLM**

Congestion Pricing Finances Metro Expansion

→ Stockholm is tapping revenues from its congestion pricing scheme to raise funds for new metro lines that will service affordable housing developments.

15-20K

METRIC TONS OF CO_2 REDUCED ANNUALLY DUE TO THE EXPANDED CONGESTION PRICING SCHEME

THE CHALLENGE

The population of Greater Stockholm is increasing by around 35,000 people per year. To accommodate this growth, the city plans to build around 10,000 apartments per year while increasing density and mix of uses. As the transport sector is responsible for around one-third of the city's greenhouse gas emissions, Stockholm realized there was a need for integrated solutions to urban development in which new housing and public transit are intrinsically connected.

CO-BENEFITS

Economic

Traffic levels are projected to fall by around 7% to and from the city, and by around 10% on the motorway bypass, due to the congestion pricing scheme. The resulting travel time reductions are equivalent to $80 million per day.

Health

Congestion pricing has led to 15% reductions in PM10 and NOx emissions in the inner city as well as reduced noise levels.

Stockholm's population is growing rapidly, causing **an acute need for affordable housing and improved urban mobility**. To tackle these challenges and lower CO_2 emissions from the transportation sector, the Swedish capital has developed an integrated solution with an innovative financing model that taps into the revenues from the congestion pricing scheme. These revenues will be used to fund the construction of new metro lines to **serve the residents of 78,000 apartments** under construction in high-density, mixed use areas close to the urban core.

Stockholm's existing congestion pricing scheme was expanded in terms of price and geographic area to increase revenues in order to help fund the metro construction. The expanded congestion pricing scheme takes effect in 2016 and will reduce traffic levels as well as greenhouse gas emissions from road transport in Stockholm County. The expanded congestion pricing scheme will also **reduce daily vehicle kilometers traveled by around 270,000**.

Stockholm's existing congestion pricing scheme is calculated to reduce CO_2 emissions by 38,000 metric tons per year, as a result of a 13% reduction of emissions from road traffic in the congestion pricing area.

CITY: **BOSTON**

Filling the Finance Gap for Building Upgrades

→ Boston developed an investment fund that pools and mitigates risks in order to obtain capital for energy efficiency and resilience upgrades of the city's buildings.

↓12.5%

CO_2 REDUCTIONS FROM LARGE BUILDINGS AND INSTITUTIONS IN BOSTON TARGETED BY THE CITY BY 2020[1]

THE CHALLENGE

Over the next 10 years, buildings in Boston will have an upgrade investment opportunity of $158 million annually, which is more than three times current levels of investment. The Boston Deep Green Loan Pool aims to help fill this funding gap for valuable and environmentally sustainable infrastructure projects.

CO-BENEFITS

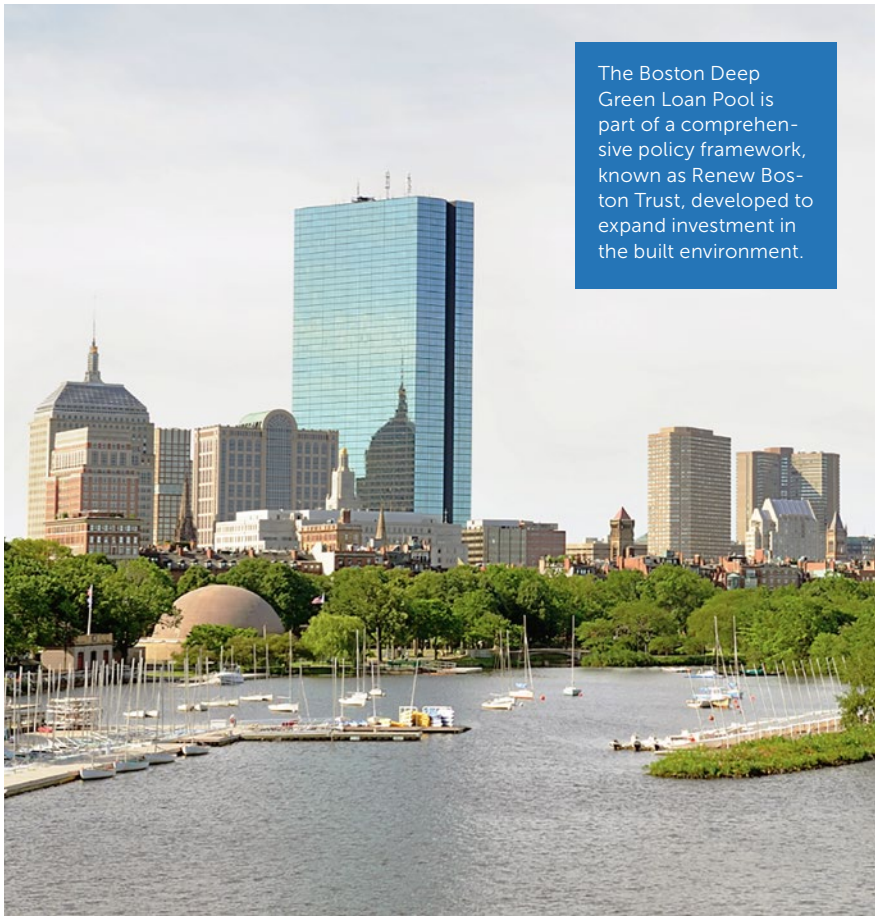
Economic
Buildings in Boston have a $1.6 billion self-funding upgrade investment opportunity.

Social
Expanding investment in property upgrades will make affordable, quality housing more widely available.

Health
Building upgrades financed by the fund will improve indoor air quality and therefore the health of those suffering from respiratory and heart-related illnesses.

The Boston Deep Green Loan Pool is an **investment fund providing loans to retrofit the city's buildings** for greater energy efficiency and resilience. The fund addresses the difficulty that public and private sector property owners have in obtaining financing for operational upgrades. By pooling risks, the Boston Deep Green Loan Pool offers loans with favorable terms such as default protection and credit enhancement that **make it easier for property owners to secure additional capital**.

The fund mitigates credit risk by using an energy performance contract under which operational savings are tightly linked to repayment of the loan and risks are assessed through a standardized process. The fund's implementation of energy performance contracts includes **guaranteed reductions in building energy use** or production of on-site renewable energy, which enables greenhouse gas reductions. Fundraising for the Boston Deep Green Loan Pool began in December 2014.



The Boston Deep Green Loan Pool is part of a comprehensive policy framework, known as Renew Boston Trust, developed to expand investment in the built environment.

[1] City of Boston. "Greenovate Boston 2014 Climate Action Plan Update." 2014.

CITY: **LONDON**

Leveraging Private Funds to Reach City Climate Goals

→ London has created a fund consisting of public and private sector money to finance projects needed to realize the climate, energy, and waste reduction targets of the city.

↓218K

METRIC TONS OF CO_2 REDUCED PER YEAR ONCE ALL FUNDED PROJECTS ARE REALIZED

THE CHALLENGE

Due to uncertain demand, implementation of emerging technologies, and long payback periods, the inability to secure funding is a key barrier to establishing low carbon infrastructure. The London Green Fund addresses the lack of investment in London's waste and energy infrastructure by leveraging private sector funds to achieve the twin objectives of environmental goals and financial returns.

CO-BENEFITS

Environmental
The waste management projects financed by the fund will divert 330,980 metric tons of waste from landfills per year.

Social
Over 2,000 social housing properties will undergo energy retrofitting, which will provide financial and social benefits to low-income citizens.

Economic
Nearly $7 million in savings are expected from the energy efficiency projects financed by the fund.

London's goal of reducing CO_2 emissions by 60% by 2025 is estimated to cost $63 billion, which cannot be delivered by public sector investments alone. Therefore, the city established the London Green Fund, in which private funding, e.g. from pension funds and commercial banks, is combined with public money to finance sustainable infrastructure projects via equity finance and loans. By mid-2015, $165 million of public money, with support from the EU, had been invested in schemes valued at $1.1 billion – **a leverage of seven times the public money invested**. The fund is an efficient use of public resources as financial returns can be re-invested into similar projects.

The fund has made 16 investments in energy efficiency, decentralized energy, and waste infrastructure between 2012 and 2015. The first stage of projects resulted in **35% energy savings** compared to conditions before investment, while **creating over 2,000 jobs**. A further $780 million in EU funding has been earmarked for the second stage of the London Green Fund, and the intention is to combine this with $156 million from the European Investment Bank.

London's first biogas plant using anaerobic digestion technology in Dagenham Dock, East London, was financed by the London Green Fund.

CITY: **PARIS**

Dedicated Climate Bonds for Cities

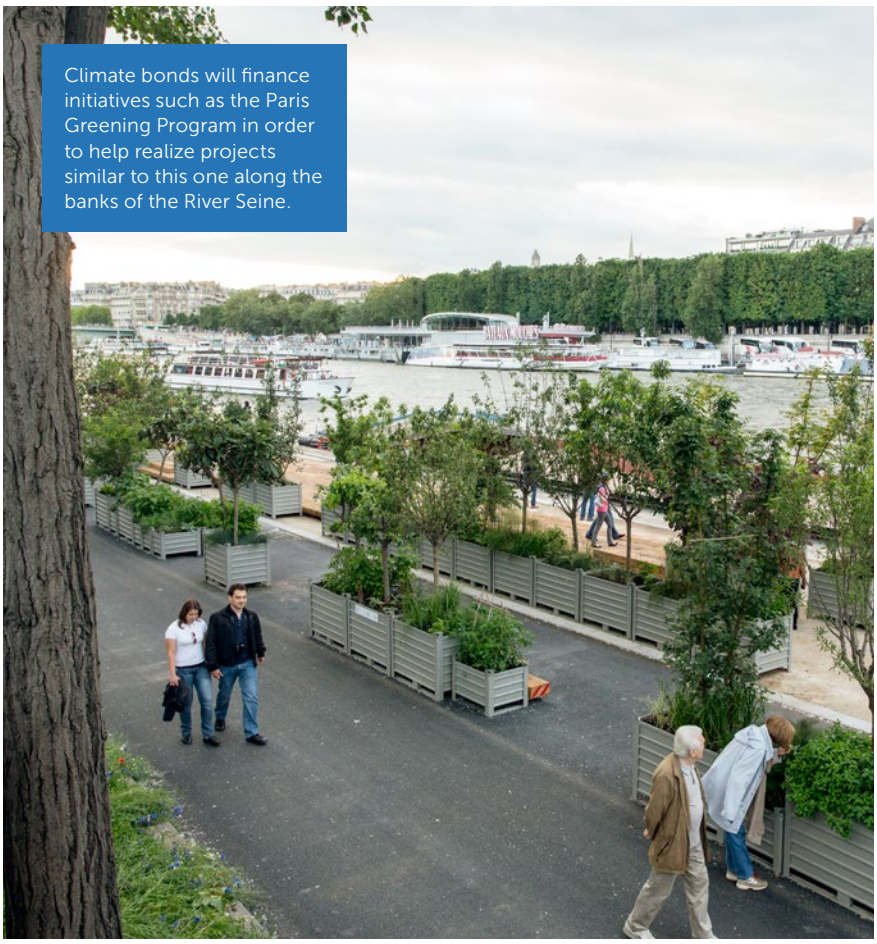
→ Paris' green bonds, dubbed "climate bonds," specifically target the financing of city climate action projects, with a first issuance worth $336 million.

100–500K

METRIC TONS OF CO_2 REDUCED PER YEAR THROUGH CLIMATE BOND-FINANCED PROJECTS

In November 2015, just before the UN Climate Change Conference in Paris, COP21, the City of Paris launched the first-ever city **"climate bonds" – a variation of green bonds** that focus solely on securing finance for city government climate change mitigation and adaptation projects. The $336 million issuance of climate bonds makes it one of **the largest issuances of green city bonds** to date. By raising funds through green bonds, Paris is sending a clear signal to the market and instilling confidence in suppliers of green products and services.

The bonds finance projects in the Paris Climate Action Plan that aim to reduce greenhouse gas emissions by 75% by 2050. Areas of action include renewable energy, building energy retrofits, mobility electrification, improved waste collection, water use demand management, and reduction of the urban heat island effect. Notable projects are a 20 GWh per year-saving **retrofit of 200 schools**, 300 charging points for electric vehicles, and the creation of a new electric bus rapid transit line, as well as urban farming and city greening programs.



Climate bonds will finance initiatives such as the Paris Greening Program in order to help realize projects similar to this one along the banks of the River Seine.

THE CHALLENGE

Prior to the introduction of climate bonds, more than $5.6 billion was invested in projects under the Paris Climate Action Plan through traditional bonds or loans. The climate bonds aim to persuade private and institutional investors to invest in the low carbon economy by providing attractive rates and guarantees, while securing finance for Paris' extensive investment in climate change adaptation and mitigation.

CO-BENEFITS

Environmental

All projects registered in Paris' climate bonds will reduce CO_2 emissions by a minimum of 30%.

Social

Projects funded by climate bonds include the retrofitting of 25,000 social housing units, a goal of the Paris Climate Action Plan.

Economic

To ensure investor confidence in the green bonds, and accountability in terms of results, a yearly audit will be published evaluating all supported projects.

CITY: **SALVADOR**

Tax Rebate Incentivizes Building Green

→ The Brazilian City of Salvador is using a discount on property taxes to incentivize the deployment of sustainable technologies in the building sector.

Salvador's IPTU Verde is a property tax tied to a public certification scheme by which building construction and renovation projects are rated according to their investments in sustainable technologies and ability to reduce CO_2 emissions. Projects gather points toward a bronze, silver, or gold certification, which awards the developer a **5%, 7%, or 10% discount on the property tax**, respectively. The construction and renovation projects that pursue certification under the IPTU Verde are also prioritized under local government permitting of new developments.

The sustainable technologies recognized under the IPTU Verde certification fall within the areas of water and waste management, energy efficiency, and alternative energy sources and range from natural lighting and ventilation to use of rainwater, and wind and solar energy generation. Through the increased demand generated by the IPTU Verde, Salvador aims to attract green companies and **position the city as a hub for sustainable business**.

↓80%

CO_2 REDUCTION AS COMPARED TO CONVENTIONAL BUILDINGS AS PART OF THE CERTIFICATION SCHEME

THE CHALLENGE

Salvador has opted to confront one of the worst economic crises Brazil has endured in recent history by betting on the sustainability market as an economic leverage tool. Encouraging citizens and businesses to develop sustainable projects through reduced taxes will reward an environmental mindset, increase demand for sustainable technologies, and attract new business to the city.

CO-BENEFITS

Environmental

Owners of land located in environmental protection areas who opt not to build or exploit the land economically are granted an 80% discount on their property tax.

Economic

The program aims to develop a sustainable market of equipment, technologies, and services in Salvador based on the expected growth in demand for green building practices generated by the city's incentives.

The IPTU Verde certification scheme rewards water retention capacity of new developments as well as reduced energy consumption, renewable energy generation, and water savings.

SMART CITIES & SMART COMMUNITY ENGAGEMENT

This sector highlights solutions that are intelligently utilizing information technology, data management, and online communications to engage citizens in climate change action and build more sustainable urban environments.

YOKOHAMA

City-wide Rollout of Smart Energy Management

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BUENOS AIRES

Monitoring Climate Data for Flood Prevention

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CITY: **YOKOHAMA**

City-wide Rollout of Smart Energy Management

→ Deploying a world-leading smart city model city-wide within a few years puts Yokohama on track to be transformed into a low carbon metropolis with lower energy use, more renewable power, and cleaner transport.

139K

TONS OF CO_2 REDUCED ANNUALLY

THE CHALLENGE

With increasing urbanization, Yokohama is experiencing fast growth that poses challenges in terms of energy use, traffic jams, air pollution, and an overall increase in greenhouse gas emissions. The YSCP strives to better manage energy use and mitigate climate change through a rapid deployment of smart energy infrastructure.

CO-BENEFITS

Environmental
The installation of solar photovoltaic panels under the YSCP totals 37 MW.

Social
In 2012, 418 lectures on climate change were held for 35,000 participants and 121 partner organizations to increase participation in the YSCP.

Economic
By using locally produced products, the YSCP creates new jobs and boosts the city's economy.

Health
The introduction of electric vehicles will reduce ambient air pollution, which improves public health.

In 2010, the Japanese City of Yokohama formulated the Yokohama Smart City Project (YSCP) as a five-year pilot in three city districts. It has since been deployed to the entire **city of 3.7 million people**. The YSCP applies smart grids for the energy management of households, buildings, and local communities; introduces large-scale renewable energy; and promotes green transportation systems.

Under the project, energy management systems have been **installed in 4,200 homes**, resulting in a 20% reduction in energy consumption through visualization of energy use and curbing power demand by providing consumers with incentives to limit electricity use. Similarly, energy management systems in offices and commercial buildings have resulted in a 20% reduction in peak energy consumption. In addition, the project has introduced 2,300 electric vehicles, and installed charging stations throughout the city. The use of renewable energy sources is also a priority under the YSCP, aiming for **solar power generation in 249 locations**, wind power generation in two locations, hydropower generation in three locations, and biomass power generation in six locations.

Citizen participation is key to the success of YSCP. For example, the Yokohama Eco School project was developed to increase citizen participation in YSCP and educate citizens about climate change through lectures, events, and workshops.

CITY: **NEW YORK CITY**

Green Campaigns Change Consumer Behavior

→ By using positive messaging via targeted media to support New Yorkers' in reducing their personal waste, GreeNYC has made a meaningful dent in the amount of paper and plastic wasted in the city.

↓140K

METRIC TONS OF CO_2 EXPECTED TO BE REDUCED THROUGH GREENYC'S STOP JUNK MAIL AND B.Y.O. INITIATIVES

THE CHALLENGE

New York City's sanitation department annually collects about 10 billion single-use bags, 315,000 tons of paper for recycling, and about 800 million water bottles discarded by city residents. Similarly, New Yorkers receive an estimated 2 billion pieces of unwanted mail each year. The city's GreeNYC campaign gets residents involved in behavior changing initiatives in order to stop this unnecessary waste and promote civic engagement.

CO-BENEFITS

Environmental

The campaign's next initiative will be to promote home weatherization – including insulation, air duct sealing, and ventilation – in order to lower household energy use.

Social

The community engagement elements of GreeNYC increase residents' involvement and interest in civic activities.

Economic

GreeNYC has many campaigns dedicated to promoting energy efficiency at home. As New Yorkers reduce their energy use from lighting, appliances, and heating and cooling, they also reduce their energy bills.

GreeNYC is New York City's branding campaign to reduce waste and encourage more sustainable habits by all New Yorkers. Informed and measured by robust consumer behavior and environmental impact data, the campaign uses positive messaging and resident engagement to drive environmental behavior change. GreeNYC programs have **reached more than 3 billion New Yorkers** through marketing campaigns, and half of all New York City residents report familiarity with the program. The city has even created a GreeNYC mascot, "Birdie," to get residents on board with conservation and environmental awareness.

GreeNYC's 2014 "Stop Junk Mail" initiative, and the 2015 B.Y.O. (Bring Your Own) initiative to promote reusable water bottles, coffee mugs, and plastic bags, are examples of recent schemes targeting a high-impact area – in these cases, solid waste, using tailored marketing techniques for messaging and media planning. Stop Junk Mail has so far **achieved a 1.75 million kg reduction in solid waste**, and the B.Y.O. initiative has already avoided the use of 157 million disposable plastic bags.

GreeNYC strategically uses positive messaging, delivered to target audiences via social media, out-of-home advertising, radio, digital ad buys, and more, and engaging events to get New Yorkers on board with climate initiatives, such as the B.Y.O. campaign to promote reusable water bottles, coffee mugs and shopping bags.


ECOBICI
SISTEMA DE TRANSPORTE INDIVIDUAL
CDMX
1403

CITY: **MEXICO CITY**

Public Transit Integration Catapults Bike-share

→ To create a true shift in transit habits, Mexico City integrated its bike-share program with the city's public transport network, making bicycle commuting an easier, faster, and more obvious choice for citizens.

↓13K

TONS OF CO_2 REDUCED BETWEEN 2010 AND 2020

THE CHALLENGE

The decades-long development of a car culture in Mexico City has resulted in the presence of more than 5 million automobiles on the city's streets. This has led to enormous traffic congestion problems, as drivers spend an average of four hours a day commuting. ECOBICI's integration into Mexico City's transit system and sheer size encourage faster, healthier, and more sustainable transportation options.

CO-BENEFITS

Environmental

By encouraging citizens to use bicycles and other public transit options instead of private vehicles, ECOBICI helps to reduce air pollution in the Mexican capital.

Social

Aware of the ability for transport access to improve social equity, ECOBICI's targeted effort has doubled the number of women using the system from 2010 to 2015.

Economic

Severe traffic congestion costs Mexico City $10 billion in lost productivity each year. ECOBICI has generated more than 45.5 years worth of productivity savings since 2010.

Health

ECOBICI has found that 54% of their users have improved their physical condition since beginning to ride, 7% have lost weight, and 15% have improved their overall health.

While bike-sharing systems have become commonplace in many large cities, Mexico City's ECOBICI stands out as one of the few systems in the world that is integrated with the city's overall public transit network. One card allows users to access the metro, buses, trains, and bicycles – making pedal-powered transport a viable commuting method. This integration is vital to the system's success, as data from a 2014 User Perception Survey show that **87% of trips are made in combination with other modes of transportation**.

ECOBICI has seen a massive uptake in popularity, with the number of daily trips increasing from 3,053 in 2010 to 33,700 in 2015. This is thanks, in part, to the ECOBICI's size: **the system boasts 6,025 bikes at 444 docking stations** across 42 neighborhoods of the city. Similarly, the integrated card has made the shift to bicycle use easier for residents, and it has allowed the system to overcome one of the biggest challenges in transportation: changing commuting habits. Six of 10 system users did not previously use a bicycle as a mode of transport before ECOBICI was launched, and **14.5% of users shifted from driving to biking**.

ECOBICI's integration with Mexico City's public transit system has garnered 182,000 registered users, who have made more than 26 million trips in 5.5 years of operation.

CITY: **BOSTON**

New Media Engages Residents in Climate Action

→ Boston's sustainability messaging and branding campaign uses digital media and monitoring systems to engage residents in achieving climate goals.

After recognizing that many climate-related projects – such as those related to transportation, air pollution, food, and solid waste – were handled by many different city departments, each with its own brand and logo, Boston officials created Greenovate Boston to **unify the separate brands and establish a broad platform for communication**, community engagement, and recognition of achievement. In order to help constituents clearly understand the interrelatedness of the city's climate programs, Greenovate Boston uses social media and newsletters to reach multiple audiences, and utilizes a state-of-the art system to track and measure how well campaigns and events spur environmental action.

Greenovate Boston's "Solarize Boston" initiative incentivized installation of residential rooftop photovoltaic systems; in a six-month period in 2012, this program led to **116 projects with a combined capacity of 522 KW**. Greenovate Boston has also contributed to a record 4 billion transit riders in 2014. In 2014, Greenovate Boston established additional goals for 2020, including **36,000 additional residential home weatherization** and significant energy upgrades, 10 MW of additional solar capacity on commercial buildings, and a 5.5% reduction in distance traveled by cars, below 2005 levels.

This "Community Composting" campaign diverted more than 2.6 tons of food waste from landfills in a nine-week period during 2015.

↓25%

REDUCTION IN CO_2 EMISSIONS BY 2020 FOR THE CITY OF BOSTON, SUPPORTED BY GREENOVATE BOSTON

THE CHALLENGE

Greenovate Boston was designed to ensure that constituents were not just targets of outreach, but active contributors to the content of the program. To solve this challenge, Greenovate Boston took advantage of the rapidly expanding social media universe to spur a variety of climate actions at home, at work, and in communities.

CO-BENEFITS

Environmental

The 2015 Arbor Day event in the city, sponsored by Greenovate Boston, resulted in 216 trees planted, pruned, and mulched across the city.

Social

The program catalyzes community building through partnerships with neighborhood organizations and city departments specifically focused on neighborhood action.

Economic

Greenovate Boston's "Taste the Tap" campaign results in up to $1,400 saved per person each year when residents drink tap water instead of bottled water.

Health

Many Greenovate Boston climate initiatives also have health benefits, such as encouraging Bostonians to take the stairs at work instead of the elevator, and to ride a bike or walk rather than driving a single occupancy vehicle.

CITY: **SEOUL**

Data-driven Public Service Development

→ In Seoul, a smart city project is using wide-ranging data to optimize public services to the needs of citizens and to address environmental concerns.

Smart Seoul 2015 is a plan for the e-governance of Seoul that strives to create an innovative urban culture based on IT and data. Under the project, data, often generated by citizens themselves, help City of Seoul officials make more informed decisions and **develop real-time, mobile-based services** that cater to citizens' diverse needs. As citizen access to digital data is vital for the project's success, fast public Wi-Fi is available at **972 hotspots across Seoul**, including throughout the city's subway networks as well as parks and other public facilities.

Data for the project is collected through various e-government functions and the country's private sector. For instance, the available pool of **big data on telephone calls and transportation** helped the city revise and streamline nighttime bus routes along the five most trafficked routes, resulting in increased public satisfaction as well as reduced fuel consumption. Another initiative under the project is a mapping application providing 3D street information, which can be used to predict which areas will be most affected by floods, thereby enabling the development of preemptive flood-response measures.

The government app, mSeoul, provides location-based services to people looking for key government buildings, public bathrooms, hospitals and clinics, supermarkets, and bus stops. Seoul also provides live real estate listings, job postings, and free and public cultural event notices.

↓40%

CO_2 REDUCTION IN SEOUL BY 2030, SUPPORTED BY SMART SEOUL 2015

THE CHALLENGE

Seoul has recognized that many of its environmental, social, and economic issues could be addressed by applying smarter information and communications technology (ICT) to the city's public services and capitalizing on the widespread use of social media and mobile devices. Smart Seoul 2015 aims to effectively manage rapid changes in the urban environment and strategies for spearheading future ICT developments.

CO-BENEFITS

Environmental

The energy efficiency measures at the data center that oversees all municipal information systems in Seoul, consisting of automated temperature distribution and heat- and humidity-proof systems, help to save up to 727 MWh of electricity per year.

Social

Ensuring access to technology across social divides, the city provides second-hand computers, smartphones, and IT classes for the underprivileged. Distribution of second-hand computers reached 2,700 per year in 2014.

Economic

Seoul has achieved a 30% cost reduction on server and software maintenance resulting from increased use of cloud computing and energy efficiency measures.

Health

The mobile service "Staying Safe in Seoul" informs residents of potential or imminent dangers, such as floods, heavy snowfalls, storms, and fires.

CITY: **SAN FRANCISCO**

Coupling Public Health and Climate Resilience

→ San Francisco is linking health and climate change impacts under a program that aims to educate and empower citizens and public agencies to improve resilience.

↓25%

CITY-WIDE CO_2 REDUCTION BY 2017, SUPPORTED BY THIS PROGRAM

THE CHALLENGE

For the last decade, cities have invested in developing climate action plans to reduce their greenhouse gas emissions, yet less attention has been paid to developing adaptive measures to protect public health during climate change-related extreme weather events. This program seeks to rebrand climate change as a public health issue and has partnered with city agencies to educate them about climate change health impacts.

CO-BENEFITS

Environmental

This data-driven approach to tracking the health impacts of climate change supports projects that reduce CO_2, improve energy efficiency and increase renewable energy production, as well as reduce water use and support sustainable transportation.

Social

The development of a heat wave and flood disaster response plan, as well as appropriate surveillance and outreach activities, are keeping San Franciscans safe in the event of extreme weather and natural disasters.

Economic

Low-income communities are more sensitive to the economic stresses associated with climate change, such as increased prices for basic needs and threats of job loss, which this program addresses.

Health

The program's use of climate data helps the city design solutions that eliminate health disparities.

Climate change is expected to more seriously affect the health and well-being of communities that are least able to prepare for, cope with, and recover from the impacts, such as the fact that extreme heat days in San Francisco are projected to increase by up to 40 days per year. To address this challenge, the City and County of San Francisco's Climate and Health Program is successfully addressing the public health impacts of climate change by **leveraging data-driven planning and health indicators** to create policies around climate adaptation on a local level.

By centralizing and formalizing the collection of neighborhood-level data, the program provides neighborhood organizations, city departments, and direct-service providers a simple, streamlined way to access information on climate and health. The Community Resilience Index is a summary of **36 equally weighted indicators from nine categories**, such as hazards, environment, housing, economy, and demography. The index scores are visualized on neighborhood-level maps on a website where all data is open-access. The innovative use of data and assessments has initiated a public dialogue on the link between climate change and health, and resulted in actions to strengthen community resilience.

Climate change impacts will not affect everyone in the same way. For instance, low-income communities and communities of color are expected to be hit harder by extreme heat, extreme weather events, and worsened air pollution.

CITY: **BUENOS AIRES**

Monitoring Climate Data for Flood Prevention

↓30%

REDUCTION IN CO_2 EMISSIONS IN BUENOS AIRES BY 2030[1], SUPPORTED BY THE MONITORING SYSTEM

→ The Argentine capital launched a water and weather monitoring system to help prepare for and prevent damaging floods.

Buenos Aires has created a hydro-meteorological monitoring system to provide reliable and accurate information needed for planning and emergency management, risk management and flood mitigation, as well as for monitoring and protecting water resources. The monitoring system consists of a network of interconnected sensors that automatically measures and monitors meteorological, hydrological, and environmental parameters. So far, **30 information collection points have been installed**, with more sensors under development. With the knowledge of changes in rainfall, temperature, humidity, wind direction and speed, and stream water level, the city can generate much more reliable community alerts and make better-informed, real-time decisions during emergencies.

With the data derived from the monitoring system, Buenos Aires will be **better equipped for emergency management** by pre-empting social and medical assistance needs; predicting and monitoring weather phenomena; automatically operating pumping stations and floodgates; issuing warnings to key institutions and the public; and sending cleaning crews to compromised drains. All these data-informed actions can save lives, infrastructure, and money.

THE CHALLENGE

In recent years, Buenos Aires has set records for rainfall and heat waves, and the intensity of storms and flooding is expected to increase in the future. The frequent floods have caused property damage, loss of income, negative public health impacts, and impaired living and working conditions. These events led the city to develop a monitoring system in order to help prevent and lessen the consequences of floods.

CO-BENEFITS

Environmental

Better information on water sources and water quality will help restore and protect aquatic ecosystems.

Social

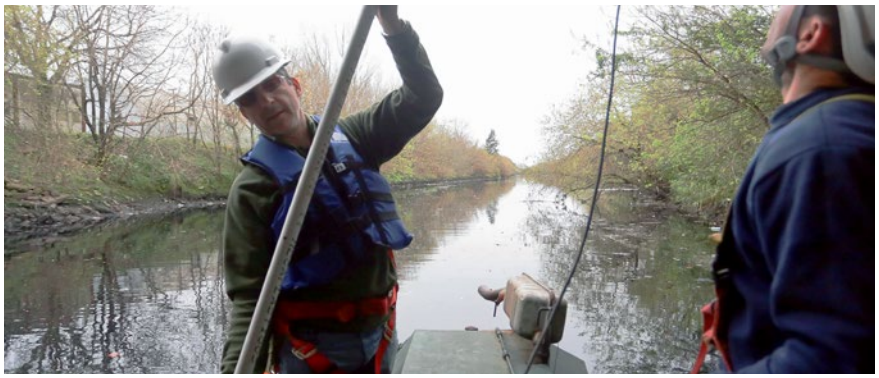
Including residents and daily commuters, the monitoring system will protect approximately 6 million people.

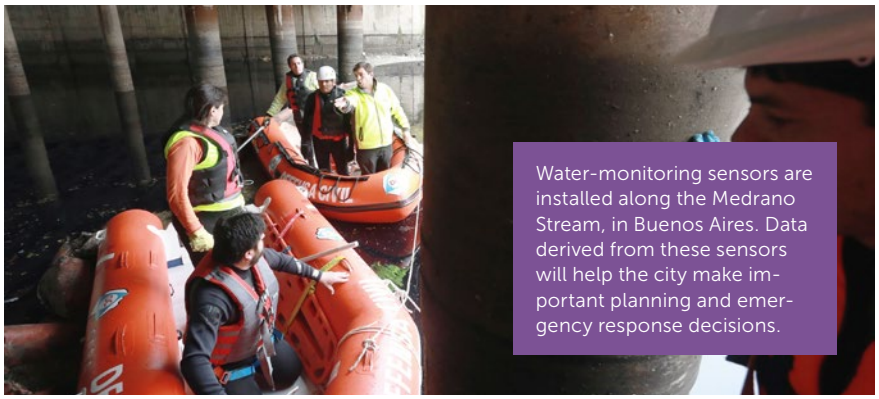
Economic

In April 2013, Buenos Aires suffered a record rainfall, causing more than $300 million in damages. The hydro-meteorological monitoring system will help prevent such catastrophes in the future.

Health

The monitoring system will help avoid injuries caused by flooding and illness caused by waterborne diseases.





Water-monitoring sensors are installed along the Medrano Stream, in Buenos Aires. Data derived from these sensors will help the city make important planning and emergency response decisions.

[1] C40. Emission Reduction Targets 2014. www.c40.org

CITY: **MELBOURNE**

Web Tool Enables Building Retrofits

→ A retrofit program in Melbourne uses a web-based tool to allow apartment owners to track and manage their building's energy-saving and renewable energy projects online and solicit expert advice on upgrade options.

Smart Blocks is a building retrofit program in Melbourne, Australia, underpinned by a comprehensive online interface equipping residents within a building with tools to work collaboratively, learn about apartment living and sustainability, and manage projects from initiation to completion. An owners' corporation, composed of individual apartment owners in a building, signs their building up for the service, enters detailed information about the building, and then receives expert advice and feedback regarding optimal retrofit options, quote request templates, and payback calculators. Through the tool, users can then **track energy usage statistics over time**. These tools and services help building owners make the most informed and economically viable choices regarding retrofit options and ensure that progress is tracked and recorded.

So far, **125 Melbourne buildings have signed up for the program**, representing 10% of the city's building stock. Already, 40 energy efficiency or renewable energy projects have been completed using the online tool, and 67 more are underway. The program aims to help Melbourne achieve its goals of producing zero net emissions by 2020 and using 25% renewable energy by 2018.

The City of Melbourne supports Smart Blocks by offering solar rebates to buildings undergoing retrofits. So far, rebates have resulted in the installation of 62 KW of solar panels in the municipality.

↑25%

RENEWABLE ENERGY USE IN MELBOURNE, SUPPORTED BY SMART BLOCKS

THE CHALLENGE

Apartment buildings in Australia consume 25% more energy per resident than stand-alone homes. About half of this energy is consumed by "common property" assets such as hallway lighting, parking lot ventilation, and pool pumps. The process to make changes to common property has been highly regulated and challenging. With more than 70% of Melbourne's residents living in apartments, Smart Blocks helps this sector become more sustainable.

CO-BENEFITS

Environmental

Sixty-seven energy efficiency or renewable energy projects are currently underway in the Smart Blocks program.

Economic

As part of Smart Blocks, one apartment building was retrofitted with LED lights at a cost of $6,500. The retrofit has already saved the owners' corporation $2,000 a year in electricity bills and will pay back the investment in just over three years.

McDonald's
McDonald's
THE MEAT & WINE CO

CITY: **KANSAS CITY**

Public-private Partnerships Build Smart City Infrastructure

→ Kansas City, Missouri, is using public-private partnerships to create a network of smart city infrastructure to reduce energy use, boost public transit, and improve quality of life.

13.5

KM OF WI-FI-CONNECTED STREETCAR LINE PLANNED AS PART OF THE SMART+CONNECTED CITY

THE CHALLENGE

In an effort to improve its energy efficiency while at the same time attracting businesses, residents, and visitors to the city, Kansas City partnered with several private firms to create the Smart+Connected City project. New technologies, such as the availability of free Wi-Fi and easier downtown transportation, seek to attract talent – companies, employees, entrepreneurs, and students – to the area, while improving the city's overall sustainability.

CO-BENEFITS

Environmental

Smart lighting controls result in energy and cost savings, more effective and higher-quality lighting, and reductions in both carbon and light pollution.

Social

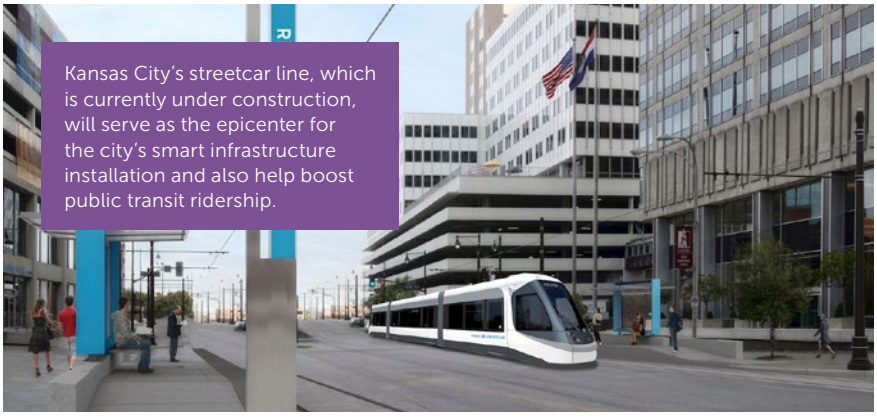
Better public lighting and improved public transportation options not only lower emissions but also improve the urban experience by allowing residents safer, faster, and more enjoyable access to city resources.

Economic

The LED lighting alone is expected to save a substantial amount of money for the city budget, and the city expects to see cost savings from water efficiencies and public services.

Kansas City, Missouri, is partnering with Cisco, Sprint, and other private firms to create a city-wide network of digital solutions to lower energy use and improve quality of life. Currently in the pilot stage, the first phase of the Smart+Connected City project consists of **Wi-Fi connectivity along the planned Kansas City Streetcar route**. This network will help enable smart lighting, which reduces power consumption and enables better tracking of total energy used; digital kiosks, which provide citizens with information about local businesses and events; and sensor technology, which collects city data, allowing officials to make **real-time decisions about infrastructure needs** and service delivery.

The installation along the streetcar line is no coincidence. The project is part of a larger city effort to improve public transit. To accelerate these efforts, Kansas City launched a **free bus pass program for municipal employees**. The move boosted average daily city employee transit ridership by 60%, and the number of employees trying transit almost tripled over the first 12 months of the program. In the future, sensors may detect fluctuations in vehicle traffic volume. This data can then be communicated to, for example, parking garage managers, who may want to adjust the number of garage-entry lanes or attendants on duty to improve efficiency.



Kansas City's streetcar line, which is currently under construction, will serve as the epicenter for the city's smart infrastructure installation and also help boost public transit ridership.

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CITY: **WASHINGTON, D.C.**

Peer-to-Peer Messaging Targets Sustainability

→ The Sustainable DC Ambassador program trains Washington, D.C. residents to engage with their communities and make sustainability accessible and relevant for everyone, while tracking data on the results of the engagement.

↓50%

REDUCTION IN CO_2 EMISSIONS BY 2032 IN WASHINGTON, D.C., SUPPORTED BY SUSTAINABLE DC AMBASSADORS

THE CHALLENGE

Without strong community buy-in and subsequent action, the District will not be able to reach its sustainability or climate goals. By training a diverse pool of outgoing residents from across the city on the importance of sustainability and climate programs, along with specific action residents can take, the District has been much more successful in engaging the broader community and making progress towards its goals.

CO-BENEFITS

Environmental

City-wide renewable energy use increased from 11.4% in 2012 to 13.2% in 2015, supported by Sustainable DC Ambassadors.

Social

By specifically targeting underserved and minority populations, the program aims to bring the entire city into the discussion of sustainability and remove any elitist associations with the term.

Economic

Promoting energy efficiency in homes has the added benefit of lowering monthly household energy bills.

Health

With the help of the Sustainable DC Ambassadors, the District achieved a 15% and 14% increase in commuting by bicycle and walking, respectively, between 2012 and 2014.

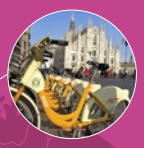
The Sustainable DC Ambassadors Program is a community volunteer program in the American capital. The program **trains District residents to talk to their neighbors** about the importance of energy efficiency, renewable energy, water conservation, and sustainable materials management, and how these issues impact their daily lives. Through its online tracking program, Ambassadors' outreach is recorded to ensure that messages are being spread to as many people as possible, and that a diverse array of neighborhoods, particularly disadvantaged communities, are reached. In 2013, staff and volunteers had 6,320 conversations and 127 community events; the next year, **they spoke to 8,030 people at 132 events**. The program is on track to increase its numbers even further in 2015.

With a **strong emphasis on underserved populations within the city**, the 60 trained Sustainable DC Ambassadors of the 2015 program engage their communities in meaningful conversations about sustainability at a level that is not possible when delivered by government representatives alone. The program helps the city achieve its 2032 climate goals, such as reducing water consumption by 40% and reducing waste generation by 15%.

Sustainable DC Ambassadors not only inform residents about the city's overall climate targets, but also explain how sustainability affects all aspects of society, such as job growth, health, inequality, and more.

TRANSPORTATION

The solutions in this sector showcase how flexible public transportation systems, ambitious electric vehicle programs, and committed policies that prioritize people over cars can reduce greenhouse gas emissions and traffic congestion and make the future of urban transportation greener and more enjoyable.



MILAN

World's First Free-floating Ride-sharing System

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CHENNAI

Transforming Streets for Walking and Cycling

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CAIRO

Taxi Trade-in Scheme Improves Air Quality

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NANJING

World's Fastest Electric Vehicle Rollout

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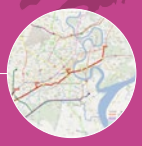

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Small Changes Lead to Efficient Bus Service

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LONDON AND BOGOTÁ

Global Procurement Alliance Boosts Green Transit

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RETURN TO
WWW.SUSTAINIA.ME

CITIES: **LONDON AND BOGOTÁ**

Global Procurement Alliance Boosts Green Transit

→ Under London and Bogotá's leadership, 24 cities have committed to buying 40,000 clean buses from now until 2020, proving the potential size of this growing market.

↓32%

CO_2 SAVED EACH YEAR BY 2020 COMPARED TO THE "DO NOTHING" SCENARIO

THE CHALLENGE

The transport sector accounts for 27% of the world's energy use, and baseline CO_2 emissions could almost double by 2050 if no steps towards low-emission transportation are taken. This large-scale collaboration aims to transform the urban transportation industry and create new standards of sustainability around the world.

CO-BENEFITS

Social

In London, disadvantaged communities and minority populations are more exposed to unhealthy exhaust fumes. Deploying cleaner buses will provide a cleaner environment for all citizens.

Economic

In London, the ultra-low emission vehicle sector generates $2 billion in sales, supporting nearly 600 companies across the supply chain and around 9,000 jobs.

Health

The project hopes to save up to 58,104 metric tons of NOx by 2020, equivalent to a quarter of NOx emissions from the signatory cities' bus fleets.

London and Bogotá have joined forces in an effort to propel the hybrid bus market to the next level. Although cities are increasingly buying ultra-low emission buses, such as electric, hydrogen, and hybrid buses, by 2014 there had been no corresponding reduction in price as sales increased. Discussions with manufacturers made clear that this was because of a perceived lack of commitment to new technologies by a large enough number of cities. By getting 24 cities on board the Clean Bus Declaration, this cross-city initiative is able to prove to manufacturers and industry stakeholders that public transit systems around the world are ready for a change. If signatory cities reach their collective goal of 40,000 hybrid and electric buses by 2020, the project will save **880,528 tons of CO_2 annually**.

London has committed $510 million so that by 2020, all 300 single-deck buses in central London will be zero emission capable and all 3,000 double-deck buses will be hybrid. In Bogotá, the aim is for the existing fleet of **1,200 diesel buses to be replaced with hybrid or electric models** by 2020. These efforts are already paying off: since the program launched in March 2015, the average price for a hybrid bus has declined by 10%.

An electric bus is ready to roll at the Clean Bus Declaration launch event in London.

CITY: **NANJING**

World's Fastest Electric Vehicle Rollout

→ The Chinese City of Nanjing has positioned itself as a world leader in electric vehicle use, ushering over 4,300 EVs onto the streets in just one year.

↓246K

TONS CO_2 SAVED IN THE FIRST YEAR OF NANJING'S EV SCHEME

THE CHALLENGE

As air pollution is the cause of one in six premature deaths in China,[1] Nanjing's promotion of electric vehicles not only helps alleviate this crisis, but also lessens fossil fuel dependence and supports a more sustainable automobile industry.

CO-BENEFITS

Economic

This project has positioned Nanjing as an industry hub; manufacturing facilities of 46 EV companies now call the city home. These companies bring Nanjing yearly tax revenues of $16 million.

Health

Reducing CO_2 emissions by a quarter of a million tons translates into better air quality for city residents.

Nanjing has raised the bar on electric vehicles to new heights with its enormous and speedy EV deployment scheme. Since 2014, the city has put more than **4,332 electric vehicles** on the road, including 1,208 buses and 940 taxis. The city has also created three battery-swapping stations and 14 battery-charging stations equipped with 791 charging facilities. While it is not the largest EV fleet in the world, it is the fastest of its size to be implemented: **Nanjing was able to roll out its full, operating fleet in under a year**.

The government has facilitated this growth by implementing purchase price and electricity price subsidy schemes and by offering incentives for the construction of charging stations. In total, the city government has invested $168 million in this project, and has already seen a clear payoff. In the first year of operation, **the city saved 61 million liters of oil and reduced CO_2 emissions by 246,000 tons** – all in all saving $71 million in energy bills. Nanjing plans to continue its successful scheme, and increase the number of EVs on the road to more than 7,215 by the end of 2015.

Citizens in Nanjing board one of the city's 1,200 electric buses.

[1] Rohde, R.A., Muller, R.A. "Air Pollution in China: Mapping of Concentrations and Sources." PLoS ONE, vol. 10, ed. 8: e0135749, 2014.


After
Before

CITY: **CHENNAI**

Transforming Streets for Walking and Cycling

→ The Indian City of Chennai has adopted a policy to prioritize walking and cycling and discourage the use of motorized vehicles, renewing the city's approach to transportation.

↓24%

CO_2 EMISSIONS FROM TRANSPORT WILL BE REDUCED BY 2018

THE CHALLENGE

Despite a lack of safe infrastructure for non-motorized transport, one-third of all trips in the city are already made on foot and bicycle. Chennai Street Design Project will ensure that these trips become safer, healthier, and more enjoyable through a redesigned urban transportation network.

CO-BENEFITS

Environmental
By promoting walking and cycling, the new streets encourage more residents to walk, which limits automobile usage and contributes to a cleaner, less polluted city.

Social
The initiative ensures that street space is accessible and available for all citizens regardless of age, class, gender, or physical abilities.

Economic
The initiative will limit the cost of road crashes in India, which the government estimates to be about 3% of the country's GDP.[1]

Health
Active transportation increases physical activity and improves health while contributing to better quality of life.

With **more than 10,000 traffic crashes reported every year**, Chennai has one of the highest rates of road deaths in India. In 2012, the city government launched the Chennai Street Design Project to address this problem. This project aims to reclaim the city's streets for pedestrians and cyclists by prioritizing modes of transport other than private automobiles.

The policy requires at least **60% of the city's transport budget** to be allocated to constructing and maintaining infrastructure for non-motorized transit. This includes widening sidewalks, building safe bicycle infrastructure, better managing intersections, and even implementing street furniture. By 2018, the city aims to have built safe and continuous **footpaths on at least 80% of all streets**, increase the share of walking and cycling trips to more than 40%, and, most significantly, eliminate pedestrian and cyclist deaths.

Before and after shots of a transformed street in Chennai. Pedestrians now have more space to move around the city, while cars and motorcycles make do with smaller roadways.

[1] Government of India, Ministry of Road Transport and Highways. "Road Accidents in India – Issues & Dimensions." Undated.

CITY: **TSHWANE**

Creating a Reliable Alternative to Informal Transit

→ This South African city's bus rapid transit system will provide more reliable and efficient transportation for residents on the outskirts of Tshwane, all while reducing emissions.

↓209K

TONS OF CO_2 REDUCED PER YEAR IF THE CITY'S GOAL OF 10% MODAL SHARE IS REACHED

THE CHALLENGE

For decades, an inefficient informal transit system has been the primary mode by which underprivileged and remote communities could access economic development opportunities in the city center. This BRT system seeks to remedy this injustice by making affordable, reliable, and safe transit an easy option for more residents.

CO-BENEFITS

Social

The system will provide faster and more equitable access to the city's resources including jobs, universities, and hospitals, for those on the urban periphery.

Economic

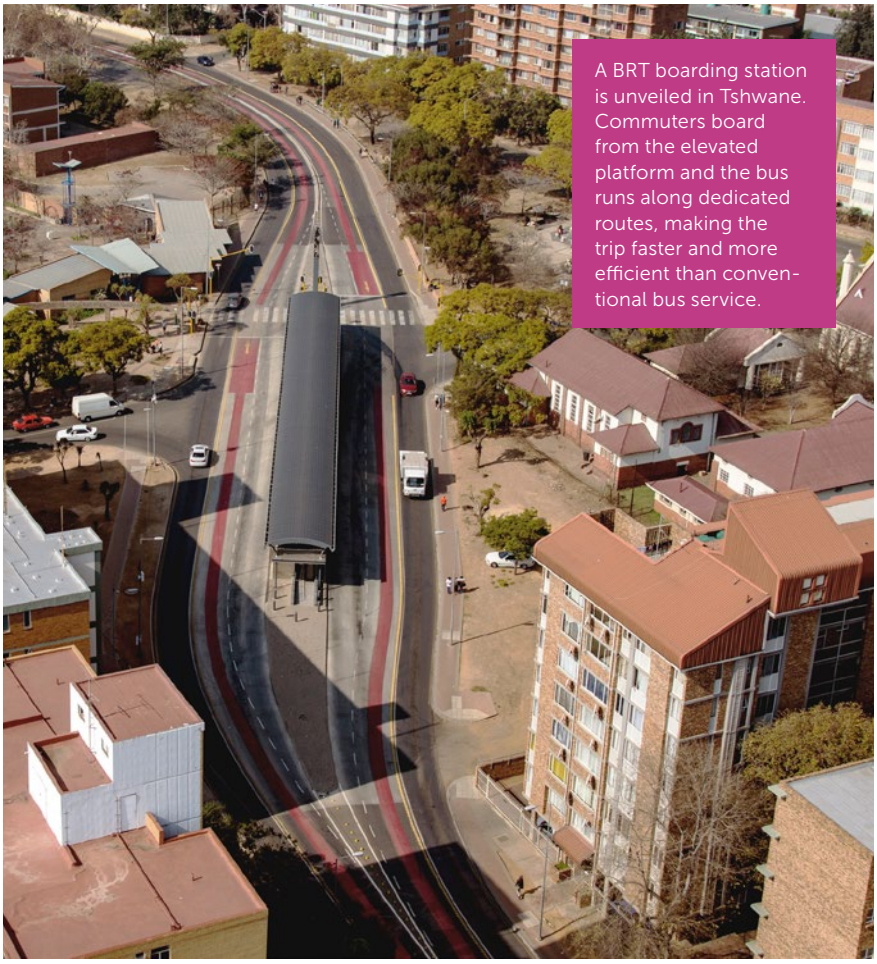
With more commuters shifting from private to public transport, the city anticipates fewer traffic crashes and a 4.7% reduction in the financial cost of accidents.

Health

The city hopes the project will achieve a 2.4% reduction in NOx and 7.9% drop in particulate matter, which in turn contribute to better air quality.

Approved in 2011, this multi-phase project aims to provide an alternative to private cars and minibuses for commuters in the Pretoria region. While minibuses – a common form of transport in South Africa – are more efficient than traditional cars, the introduction of a dedicated BRT route will provide residents with a **faster, scheduled, and more reliable direct route to the city center**. Aware of the economic losses this may cause for minibus operators along the corridor, those affected will receive financial compensation and be offered a shareholder position in the new BOC (Bus Operating Company).

The BRT bus fleet will run on low-emission diesel engines and compressed natural gas, and will emit on average 34% less CO_2 and 24% less NOx than a standard diesel counterpart. The project hopes to carry **100,000 passengers a day** when the 69 km BRT trunk is fully operational in 2020.



A BRT boarding station is unveiled in Tshwane. Commuters board from the elevated platform and the bus runs along dedicated routes, making the trip faster and more efficient than conventional bus service.

CITY: **MILAN**

World's First Free-floating Ride-sharing System

→ Milan has launched the world's first free-floating and integrated ride-sharing system, allowing residents and visitors access to electric cars, bikes, and scooters anytime, anywhere.

Started in 2013 and now operating with **more than 2,000 cars, 150 scooters, and 4,600 bikes**, Milan's "All you can share" mobility system is convincing the city, and the world, that private car ownership is a thing of the past. While the bikes – 1,000 of which are electric – can be picked up and dropped off at fixed stations, the scooters and cars – half of which will be electric by the end of 2015 – are available throughout the city without set locations. They are part of an **integrated and easy-to-operate system that users manage via a dedicated smartphone app**. Riders just log on, find an available ride near their current location, and hit the road.

The scale of this project is critical to its success. Without a critical mass of vehicles and bicycles to choose from, such a program could not work. The city's bike-share system boasts **39,000 yearly subscribers**, while the car-share system has nearly 300,000. The electric scooter system just launched this year, but anticipates similar success.

4,600 bicycles are part of Milan's "All you can share" mobility system, allowing users shared access to low carbon transportation options.

© Steve Fürst

↓457

TONS OF CO_2 AIM TO BE REDUCED DUE TO USE OF E-BIKES

THE CHALLENGE

Milan has long been known as a car-loving city, with more than one vehicle for every two people – one of the highest rates in Europe. The project is changing this reputation by providing viable alternatives to private car ownership, and making it easier than ever for residents and visitors to make more sustainable transportation choices.

CO-BENEFITS

Environmental

Vehicles used in the sharing program are either electric, hybrid, natural gas-fueled, or meet other European emissions standards.

Social

Eight to 15 cars are removed from the streets for each available car-sharing vehicle, allowing Milan to cater to its citizens, and not their cars.

Economic

As operators pay the city to operate their ride share programs, the $2.2 million in revenue can be used to improve public services.

CITY: **HO CHI MINH CITY**

Changing Public Opinion of Mass Transit

→ The Vietnamese City of Ho Chi Minh City has introduced a city-wide transportation plan that will reduce the pressure on the city's strained roadways and foster a new outlook on mass transit.

123K

METRIC TONS OF CO_2 WILL BE REDUCED BY 2020[1]

THE CHALLENGE

The city's current road system is congested and dangerous, experiencing an average of 4,700 accidents each year. Many of these crashes involve motorbikes, of which there are eight for every 10 people. The SaiGon BRT line, which will expand to six corridors upon completion, will help ease this congestion and prepare Ho Chi Minh City for a safer and more sustainable future.

CO-BENEFITS

Social

By ensuring safer, faster, and more comfortable transportation, the Green Transport Development Project aims to change commuting habits and improve the public's attitude towards mass transit.

Economic

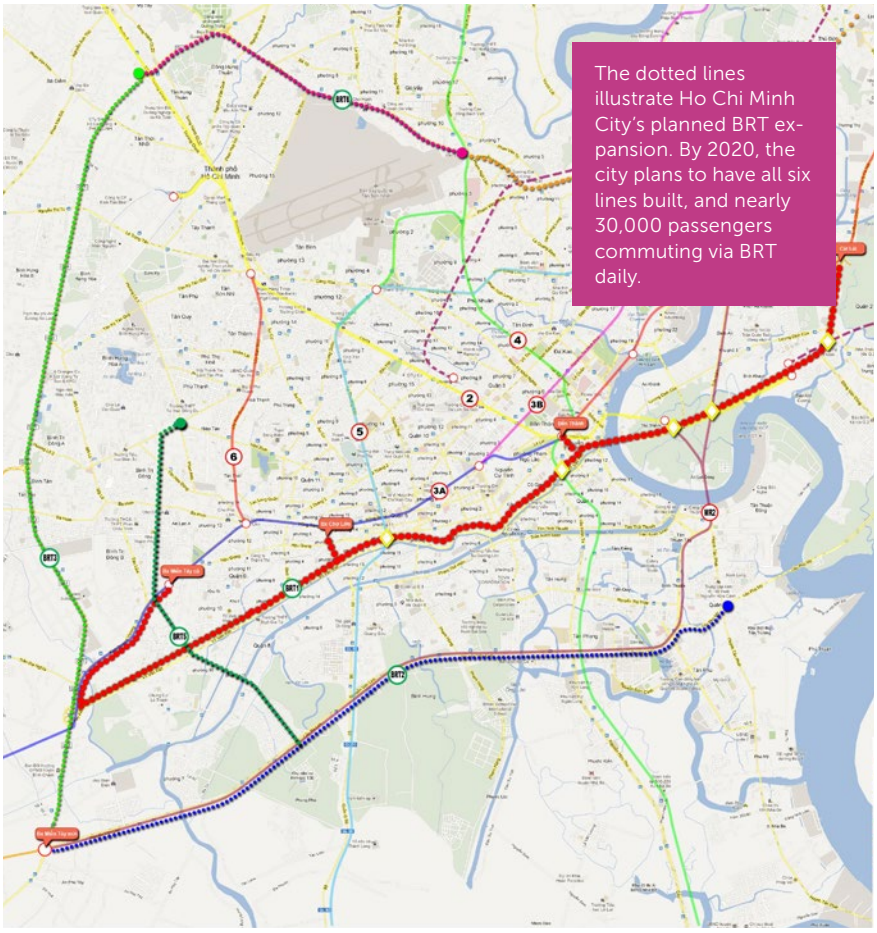
The city anticipates a substantial decline in traffic accidents and their associated costs due to the introduction of the BRT system.

Health

Ho Chi Minh City foresees improvements in air quality that will reduce cases of bronchial and asthmatic diseases among residents.

In cooperation with the World Bank, Ho Chi Minh City launched the Green Transport Development Project in 2013, with the aim of catalyzing a cultural shift around transportation in the region and getting more people onto mass transit and off of the congested roadways. The cornerstone of the project is SaiGon BRT, a 23 km bus rapid transit system that will accommodate up to **28,300 passengers daily** when fully operational.

In addition to the bus infrastructure, the BRT corridor will also provide space for cycling and walking, as well as bike parking facilities. With SaiGon BRT, the city seeks to transform how citizens view public transport, and lay the groundwork for a **more sustainable future based on transit-oriented development**. Prospective communities and commercial nodes will be built around tree-lined transit corridors, making mass transit the optimal way to get around the city while supporting development and growth.



The dotted lines illustrate Ho Chi Minh City's planned BRT expansion. By 2020, the city plans to have all six lines built, and nearly 30,000 passengers commuting via BRT daily.

[1] World Bank. Ho Chi Minh City Green Transport Development.

CITY: **HOUSTON**

Public Transit Overhaul Counteracts Sprawl

→ Houston has created faster and more efficient light rail and bus lines that better connect the growing city.

In 2015, Texas's largest city overhauled its transportation system, aiming to boost ridership, ease traffic congestion, and expand residents' mobility options. Two cornerstones of the overhaul are the improved light rail and bus systems. The opening of two new light rail lines brought the **total system length to 36.5 km**, and the New Bus Network more than doubles the number of people with access to frequent (every 15 minutes or less) bus service to 1.1 million.

The improvements acknowledge that Houstonians' living and working patterns have changed over time, and that residents require access to all areas of the city – not just the downtown core – at all times of the day and week. The New Bus Network's routes address this issue by connecting the city in a grid pattern, rather than the radial system it had operated on for decades. The percentage of riders served by **frequent service has jumped from 25% to 75%**, and every bus route now operates seven days a week.

Houston's new light rail and revamped bus lines intersect on a downtown street.

↓90K

METRIC TONS OF CO_2 ARE EXPECTED TO BE REDUCED DUE TO INCREASED BUS RIDERSHIP

THE CHALLENGE

Houston's population has been rising steadily for years, and it currently stands as the fourth largest city in the USA. At the same time, the sprawling city has notoriously been a haven for cars. Houston now operates the **third-busiest light rail line** in the USA, proving that committed city leadership can overcome historical and geographic challenges.

CO-BENEFITS

Social

Making the system work for citizens, the new bus system will ensure that 58% of trips between 30 key destinations are at least **10 minutes faster** than before. Additionally, 94% of riders can board at their usual bus stop.

Economic

The improved frequency of service can boost economic development opportunities by connecting **1 million people** to an equal number of jobs throughout Houston.

Health

Five hundred and eighty trees were planted along the two new light rail lines, improving air quality and the aesthetic appeal of the area.

CITY: **BUENOS AIRES**

Small Changes Lead to Efficient Bus Service

→ Operating under institutional constraints, the Argentine capital has developed an efficient bus rapid transit solution using the city's existing infrastructure.

Three million commuters are on the move each day in the Buenos Aires metro region, 60% of whom use public transport to get around town. The city's state-controlled public transit network, however, was unable to accommodate this many people. In 2011, the city launched the first phase of an extensive bus rapid transit system (BRT), Metrobus, which **transforms existing bus routes into highly efficient dedicated BRT lanes**, equipped with standard elevated platforms, faster boarding, and safer and more comfortable bus stops.

The simple concept has had impressive results: in four years, the city has not only revitalized existing routes, it **built an additional 50.5 km of bus-only lanes**. Average travel time has been reduced by 50%, and frequency of stops has increased from 180 to 220 stops hourly. A key corridor of the BRT system, the enormous, 16-lane 9 de Julio Avenue has been transformed by the project. Previously, cars dominated the Avenue's central lanes, but today, the four central lanes of the avenue are exclusively reserved for 11 bus lines with infrastructure to ensure safe pedestrian access.

Buenos Aires' new BRT corridors make streets safer and more enjoyable for transit users, drivers, and pedestrians.

149K

TONS OF CO_2 REDUCED ANNUALLY

THE CHALLENGE

In Argentina, the federal government operates public transportation systems, including where buses run and how frequently they stop. A decade of deregulation and state subsidies had led to poor service and inefficiency on many routes. Unable to change the system completely, the City of Buenos Aires developed a way to introduce a well-functioning BRT system into the existing bus infrastructure, thus satisfying both political demands and residents' needs.

CO-BENEFITS

Environmental

The system improves air quality thanks to an average distance of 400 meters between bus stops, which diminishes buses' stops, starts, and sudden braking, cutting harmful emissions and reducing fuel consumption.

Social

The system ensures that street space is accessible and available for all citizens regardless of age, class, gender, or physical abilities.

Economic

One formerly dangerous route experienced an average of eight accidents per month before the introduction of Metrobus and only one accident in an entire year afterward.

152
OLIVOS
BOCA
Tandilense S.A.
Samsonite
Daheza

CITY: **CAIRO**

Taxi Trade-in Scheme Improves Air Quality

→ A trade-in program for Cairo's aging taxi fleet encourages replacement of high-polluting cars with safer, more sustainable options.

Financed by the World Bank, Cairo has launched a taxi trade-in scheme in which owners can turn in their old cars for safe, managed scrapping and recycling and receive $600 towards the purchase of a new, cleaner vehicle. The scrapping and recycling program is a successful collaboration backed by the public and private sectors. The Ministry of Finance lifted the sales taxes on eligible vehicles to encourage taxi owners to purchase these options. Likewise, participating car companies offer **new vehicles at a 25% to 30% discount** and banks offer drivers loans with competitive interest rates.

The program also has a strong legal backing, as Cairo has instituted a law stating that owners of mass transport vehicles, such as taxis, older than 20 years are not eligible for new operating licenses or license renewals. All of these actions are paying off, as **the program has a 94% success rate**: 40,689 new taxis have replaced aging vehicles in the city.

Newer, more fuel efficient taxis are helping Cairo reduce its air and noise pollution.

↓130K

TONS OF CO_2 WERE AVOIDED IN 2013 AND 2014 THROUGH THE PROGRAM[1]

THE CHALLENGE

Sixty-eight percent of the more than 1.5 million vehicles operating in the Cairo area are more than 15 years old, meaning they use more fuel and emit more pollution. The program has demonstrated that committed financial incentives can encourage more environmental choices.

CO-BENEFITS

Environmental

The program has not only reduced CO_2 emissions, but also CH_4 and N_2O emissions, all of which significantly improve air quality and reduce air pollution from the transportation sector.

Social

Replacing vehicles in an aging, deteriorating taxi fleet with newer, safer vehicles has also led to safer streets and fewer vehicle-related traffic crashes.

Economic

Newer, more efficient vehicles reduce fuel consumption and thus save drivers and companies money on petrol.

[1] The World Bank. Scrapping and Recycling Old Vehicles in Egypt. 2015.

CITY: **SINGAPORE**

Boosting Public Transit While Limiting Cars

→ Ultra-dense Singapore is planning for a future based on public transportation while simultaneously working to limit the number of private vehicles on the road.

780K

TONS OF CO_2 EXPECTED TO BE REDUCED BY 2020 BY INCREASING THE PUBLIC TRANSIT MODE SHARE

THE CHALLENGE

Roads already take up 12% of Singapore's land; in order to keep a healthy, active, and livable city, it simply cannot afford to allocate much more space to cars. The city's safe, convenient, and integrated transportation network helps promote sustainable growth for years to come.

CO-BENEFITS

Environmental

Vehicles are responsible for 57% of Singapore's PM2.5 emissions. Reducing car usage will help to lower PM emissions and improve public health.

Social

Low-wage workers and persons with disabilities receive at least a 15% and 25% discount on public transit, respectively, ensuring that every citizen has access to quality transportation.

Economic

The transport network will include 13 integrated transport hubs by 2025 at which bus and rail connections will intersect residential and commercial developments, promoting economic activity and growth.

Faced with a rising population and extremely limited land, Singapore recently unveiled a long-term vision for bolstering its public transit system in order to keep people moving efficiently around the city without building more roads. By 2017, the city-state will add 1,000 buses to its fleet, and by 2030, it will double its urban rail network to about 360 km, ensuring that **80% of households are within a 10-minute walk of a train station**.

By incentivizing public transit and actively discouraging car use, the city-state's Land Transport Master Plan has already achieved impressive results. The share of journeys made by public transport has increased from 59% in 2008 to 66% in 2015, with the goal of reaching 75% by 2030. Additionally, the city is controlling growth in the number of cars and amount of road infrastructure created. For instance, **new roads will be built only to support public transport travel** by buses or to serve newly developed areas. Wherever possible, Singapore plans to reclaim road space to increase greenery, pedestrian walkways, and cycling paths.

Public and active transportation infrastructure is helping Singapore lower its CO_2 emissions and create a more liveable city.

SUSTAINABLE COMMUNITIES

This sector includes solutions that illuminate the pathway to sustainable, resilient, and low carbon community action. From local neighborhood initiatives to city-wide community action, these solutions are transforming neighborhoods into thriving communities, building efficient and sustainable public transport, and encouraging urban farming.

STOCKHOLM

From Brownfield to Sustainable District

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WUHAN

Industrial City Becomes Ecological Town

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HEIDELBERG

Becoming the World's Largest Zero-emissions District

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LONDON

Communities Take Root at Urban Gardens

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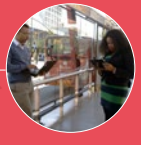

JOHANNESBURG

Building Green Public Transport for Equality

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OAKLAND

Partnership Reverses Neighborhood Decline

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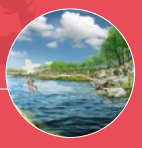

TORONTO

De-contamination Begets a New Green Community

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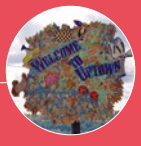

PITTSBURGH

Sustainable and Inclusive Neighborhood Development

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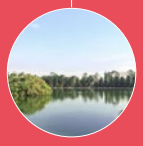

MEXICO CITY

Park Revitalization Promotes Accessibility

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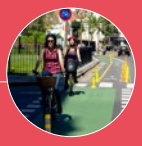


BUENOS AIRES

Improving Safety for Cyclists and Pedestrians

P. 144

RETURN TO
WWW.SUSTAINIA.ME

CITY: **STOCKHOLM**

From Brownfield to Sustainable District

→ Developing a modern, sustainable city district on a former industrial site solves population growth issues and helps Stockholm achieve its goal of becoming fossil fuel-free by 2040.

In 2009, the City Council of Stockholm decided to develop the abandoned Stockholm Royal Seaport (SRS), a brownfield area, into a modern, sustainable city district for residents and businesses. The SRS project's goal of becoming a **fossil fuel-free district by 2030** is linked with Stockholm's ambitious goal to become fossil fuel-free by 2040, as well as the city's need to adapt to growing impacts of climate change and deal with projected population growth. As the population in the Swedish capital is expected to reach 1.5 million within the city and 3.5 million in the region by 2030, **12,000 new homes and 35,000 workplaces have been built** in the new district and 140,000 new homes are planned by 2030.

The SRS project involves multiple aspects of sustainable urban development, including waste management goals of sending zero waste to landfills and collecting all food waste to increase biogas production by 50%. The project also requires all developers to install solar photovoltaic systems to cover up to 20% of a building's electricity needs and mandates that average **water use be reduced from 150 liters of water per person daily to 100 liters**.

The fossil fuel-free and climate positive goals of the Stockholm Royal Seaport project are achieved through requirements on developers and infrastructure, achieving energy-efficient buildings, production and use of renewable energy, and improved waste, traffic, and mobility management.

↓83%

REDUCTION IN CO_2 BETWEEN 2010 AND 2030 FROM THE SRS PROJECT

THE CHALLENGE

Stockholm faces the challenge of developing a livable city district in a former industrial brownfield area. In the area, 17 hectares of contaminated land have been remediated with local treatment and 200,000 metric tons of rock have been crushed and reused. With the development of the Stockholm Royal Seaport, the city plans to support green growth to meet global and local challenges.

CO-BENEFITS

Environmental

Energy-efficient housing and automated waste management systems reduce energy use by up to 80%, and production of renewable energy reduces the use of fossil fuel.

Social

Proximity to and availability of outdoor recreational areas, as well as walking and biking infrastructure, will provide opportunities for physical activity and improve residents' well-being.

Economic

Policies for lower resource use will deliver economic savings for residents and the local government, and contribute to growth by creating jobs in green service sectors.

Health

With restrictions on private cars and parking per household, and a Mobility Index tool to nudge users to more sustainable mobility behavior, 70% of work-related trips are expected to be made by public transport, reducing air pollution in the city.

CITY: **JOHANNESBURG**

Building Green Public Transport for Equality

→ Creating affordable public transport and focusing new development along transport corridors promote equality among Johannesburg's residents while reducing greenhouse gas emissions.

↓39.8K

TONS OF CO_2 REDUCED PER YEAR WITH THE CORRIDORS OF FREEDOM

THE CHALLENGE

Johannesburg is still shaped by its apartheid past, resulting in a large share of black citizens struggling with unemployment – up to 60% of residents in some areas – or traveling long distances to work and school, forced either to walk or pay a disproportionate share of their earnings for transport. With the Corridors of Freedom, the city combats high levels of inequality by creating affordable public transport services and improving economic growth and job density.

Johannesburg is undergoing a transformation to rid itself from its past as a segregated city. The city plans to build high-density housing, offices, social facilities, and retail along its revitalized transport corridors – the Corridors of Freedom – enabling residents to have shorter, more enjoyable commutes, without using private motorized transport. Implementing a low-emissions bus rapid transit (BRT) system will offer **fast, safe, and affordable mobility**, and increase employment opportunities for residents living far from central city areas.

With transportation responsible for 25% of the city's total emissions, Johannesburg is a big emitter of greenhouse gases, **contributing 56% of emissions in South Africa.** Johannesburg therefore aims to replace old minibus taxi fleets with cleaner buses using alternative fuels. As an incentive, taxi owners handing over their vehicles – which 585 owners have done to date – are granted shares in the company operating the new BRT system. The city makeover is estimated to reduce CO_2 emissions by 1.6 million tons by 2020.

CO-BENEFITS

Environmental

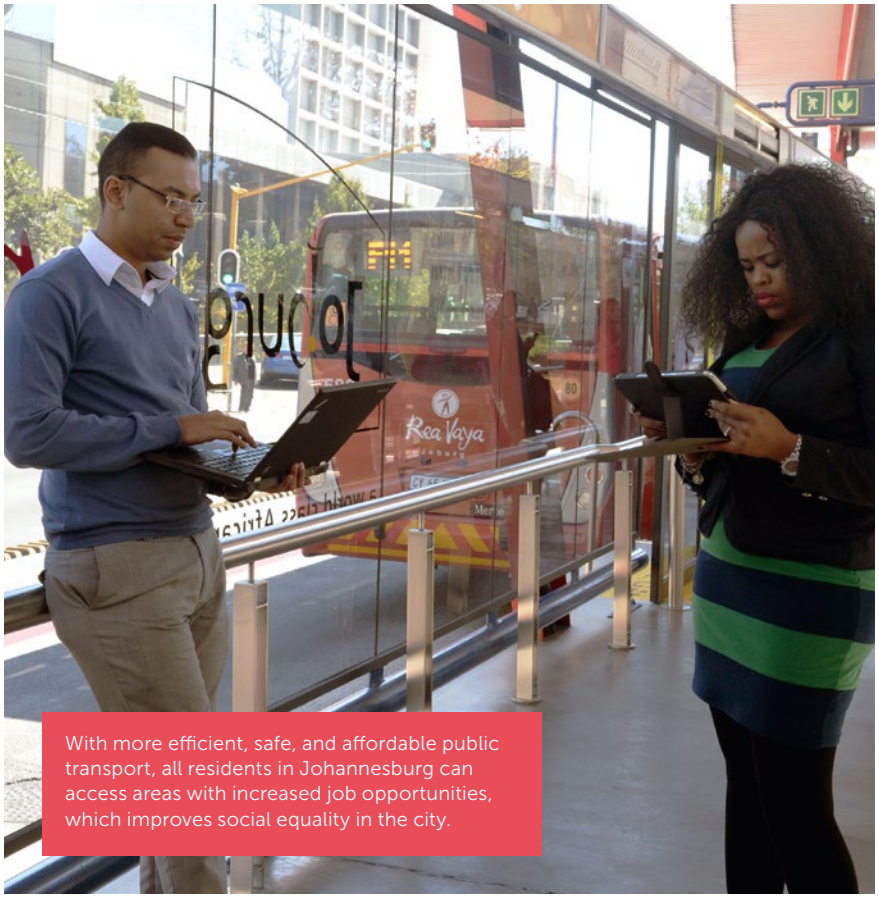
As the transportation sector is the second highest source of pollution in Johannesburg, the Corridors of Freedom will relieve some of this environmental burden on the city.

Social

As 67.4% of households in Johannesburg live on less than $325 per month, the introduction of affordable public transport service simply puts more money back into residents' pockets.

Economic

Building the BRT system has already created more than 24,600 jobs, and the ongoing expansion will create an additional 18,600 job opportunities.



With more efficient, safe, and affordable public transport, all residents in Johannesburg can access areas with increased job opportunities, which improves social equality in the city.

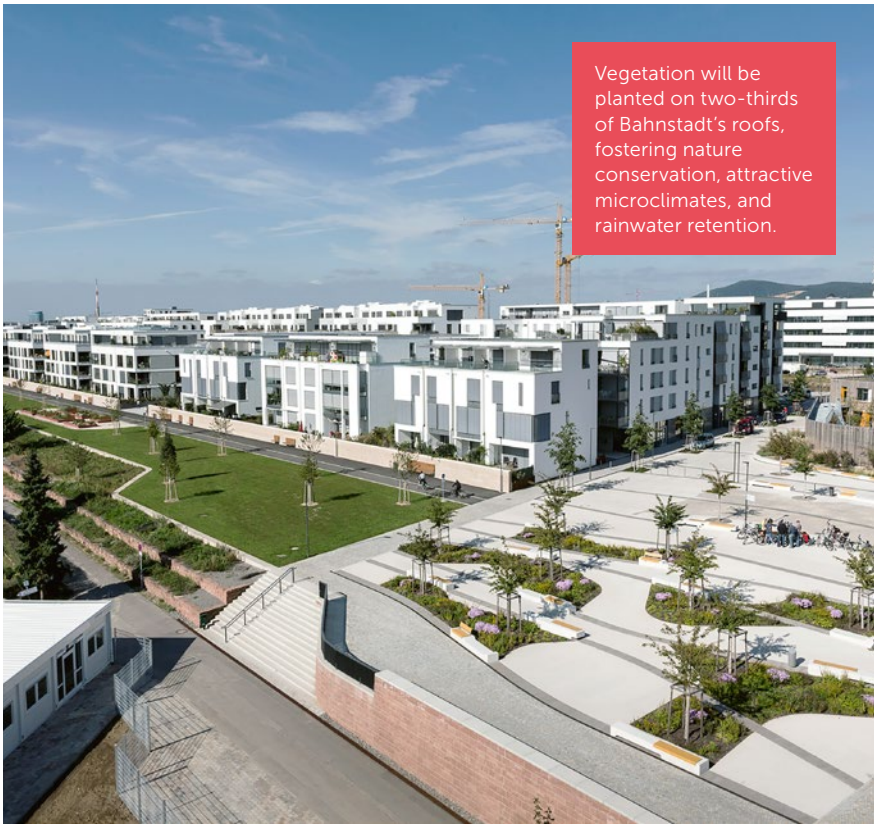
CITY: **HEIDELBERG**

Becoming the World's Largest Zero-emissions District

→ Passive house standards, rooftop vegetation, and non-motorized transportation will make Bahnstadt the largest zero-emissions city district in the world.

In Heidelberg, the new district Bahnstadt is the largest urban development project in Germany, and, at 116 hectares, boasts **the largest area covered by passive houses in the world**. The houses' ultra-low energy consumption is far lower than required under the country's building energy efficiency standards. A large wood chip-powered combined heat and power plant was constructed specifically for the district that provides Bahnstadt with 24 million KWh of electricity and 80 million KWh of heating energy annually, enough to cover the entire district's energy demand and to **reduce CO_2 emissions to almost 0%**. The wood chips are collected from sustainable sources, such as landscape maintenance waste.

Due to Bahnstadt's central location in Heidelberg, with quick access to the city's main railway station, trams, and buses, private transport is minimized. When residents do need a car, a car-sharing fleet of electric vehicles is readily available – and planned to be **expanded to 1,800 EVs by 2020**. Attractive walking and cycle paths in and outside the district have made the bicycle the main mode of transport in Bahnstadt, contributing to Heidelberg's goal of reducing greenhouse gas emissions by 95% by 2050.



Vegetation will be planted on two-thirds of Bahnstadt's roofs, fostering nature conservation, attractive microclimates, and rainwater retention.

↓30K

METRIC TONS OF CO_2 REDUCED EACH YEAR FROM THE WOOD CHIP-POWERED COMBINED HEAT AND POWER PLANT

THE CHALLENGE

When a former freight and switch yard was shuttered in Heidelberg, a central city district became a desolate brownfield. With scarce living space in the city center, Heidelberg initiated an urban redevelopment project, Bahnstadt. Built to accommodate the city's ambition of dramatically lowering its CO_2 emissions, the project proves the case for zero-emissions city districts.

CO-BENEFITS

Environmental

All households in the district are equipped with smart meters, so residents can keep track of their energy consumption and costs, encouraging low energy use.

Social

The district offers accessible flats for handicapped and elderly residents, large flats for families, small flats for students, and a funding program which provides low-income residents with up to one-third of the monthly rent.

Economic

The development of the Bahnstadt district has created 7,000 jobs,[1] lowering the unemployment rate and contributing to economic development.

Health

By providing attractive infrastructure for cyclists, bike parking facilities, and other bicycle-related services, the city encourages Bahnstadt's residents to bike, improving residents' health.

[1] Heidelberg Bahnstadt, "Fact Sheet."

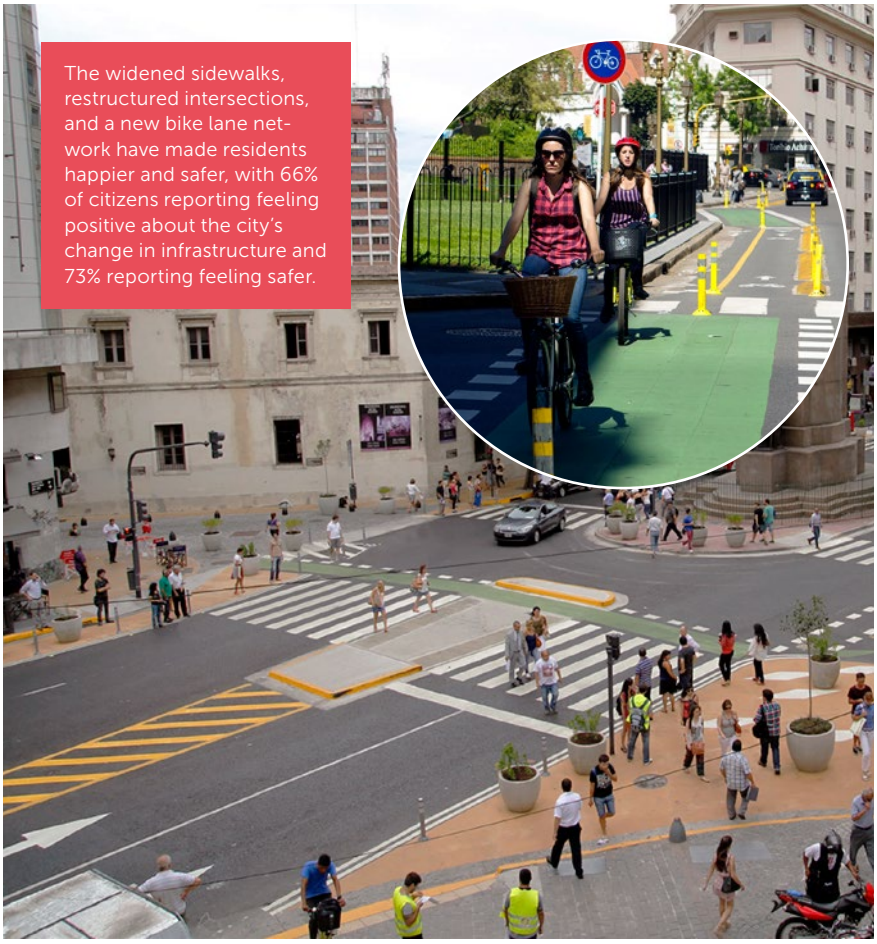
CITY: **BUENOS AIRES**

Improving Safety for Cyclists and Pedestrians

→ Increasing sidewalk space and building networks of bicycle lanes have put Buenos Aires on the map as the most bicycle- and pedestrian-friendly city in Argentina.

Under the Healthy Mobility project, Buenos Aires became the first city in Argentina to implement a program focused on increasing the number of pedestrians and cyclists and limiting the number of cars on the road. The project represents a paradigm shift, as the city now puts people before cars, promoting cycling and walking and aiming to reduce the use of cars.

To boost the number of trips made on foot, the city has reclaimed **7,735 m² to widen sidewalks and redesign intersections** to reduce vehicle speed and make crossings safer. A network of on-street protected bike lanes was built and includes **140 km of bi-directional lanes** separated by a physical cord from cars for increased protection. The bike lanes are expected to increase by 30.5 km per year. In addition, Buenos Aires also introduced a bike-sharing system to further encourage citizens to choose this sustainable and healthier transportation option.



The widened sidewalks, restructured intersections, and a new bike lane network have made residents happier and safer, with 66% of citizens reporting feeling positive about the city's change in infrastructure and 73% reporting feeling safer.

↓14K

TONS OF CO_2 REDUCED PER YEAR

THE CHALLENGE

Facing a number of issues linked to increasing numbers of vehicles and traffic congestion, such as a lack of safety for cyclists and pedestrians and worsening air pollution, Buenos Aires introduced the Healthy Mobility project. The project promotes mobility in the city by making streets safe for pedestrians and cyclists.

CO-BENEFITS

Environmental

The Healthy Mobility project results in a cleaner environment, as each passenger traveling by car emits 152 grams of CO_2 per km, while cycling and walking are emissions free.

Social

The city is planning to cover 160 more areas with pedestrian-friendly interventions, mainly including areas vulnerable to high-traffic flows, such as schools and hospitals, improving safety for 400,000 people.

Economic

The interventions are beneficial for businesses that have installed tables and chairs on the reclaimed pedestrian areas, and reorganized bus stops have increased revenue during peak hours.

Health

Before the project, just 0.4% of all trips in Buenos Aires were made by bicycle. Today, 3.5% of trips are made by bike, with the goal of reaching 5% by the end of 2015, significantly increasing citizens' health.

CITY: **OAKLAND**

Partnership Reverses Neighborhood Decline

→ By enabling low carbon transportation via bus rapid transit (BRT) and affordable green housing, Oakland is reversing a neighborhood downturn and initiating long-term sustainable growth and resilience.

↓4.5K

METRIC TONS OF CO_2 REDUCED PER YEAR FROM OSNI

THE CHALLENGE

Oakland's International Boulevard is the city's most diverse area, and one in ongoing economic decline. Due to an alarmingly high 38.5% poverty rate and sub-standard housing, it is considered a "Disadvantaged Community" and a "Priority Development Area" by the state of California, making the neighborhood eligible for greenhouse gas reduction funds and a target for regional growth. This creates opportunities for strategic investment, which Oakland has used to turn the declining neighborhood into a place of development, growth, and resilience.

CO-BENEFITS

Environmental

Increased water conservation, tree planting to reduce particulate matter, and an energy efficiency pilot project for small businesses all have a positive impact on the environment.

Social

With increased bike parking and more accessible clean commute strategies, residents are encouraged to opt for the more sustainable and healthier transportation option.

Economic

Targeted and coordinated strategic planning and neighborhood governance efforts have spurred a cascade of public and private investment in the neighborhood, worth more than $180 million to date.

Health

Fewer emissions from cars and diesel buses will reduce rates of childhood asthma and improve residents' overall health.

In response to ongoing neighborhood decline and high poverty rates in the International Boulevard neighborhood, in 2013, the city launched the Oakland Sustainable Neighborhood Initiative (OSNI). The initiative is a true whole-neighborhood effort, **including grassroots organizations, public agencies, and community leaders** working together to address the neighborhood's needs. In addition to realizing local social and environmental benefits, OSNI also increases neighborhood safety by improving streetscapes, lighting, and roadway striping.

The initiative led to the International Boulevard Bus Rapid Transit project, currently under construction. The BRT line will reduce emissions by 4,065 metric tons of CO_2 annually by **eliminating 12,800 vehicle km traveled** and by replacing old diesel buses with 27 hybrid buses. The neighborhood was awarded a grant from California's Greenhouse Gas Reduction Fund to invest in several affordable housing developments, including the construction of **95 solar photovoltaic panel-equipped green housing units** and other sustainable neighborhood improvements planned in coordination with the coming BRT. The city also plans to improve stormwater management systems to reduce flooding in order to increase resilience in the vulnerable neighborhood.

Affordable housing and new bus rapid transit will enable International Boulevard to become a thriving and healthy place to live for Oaklanders.

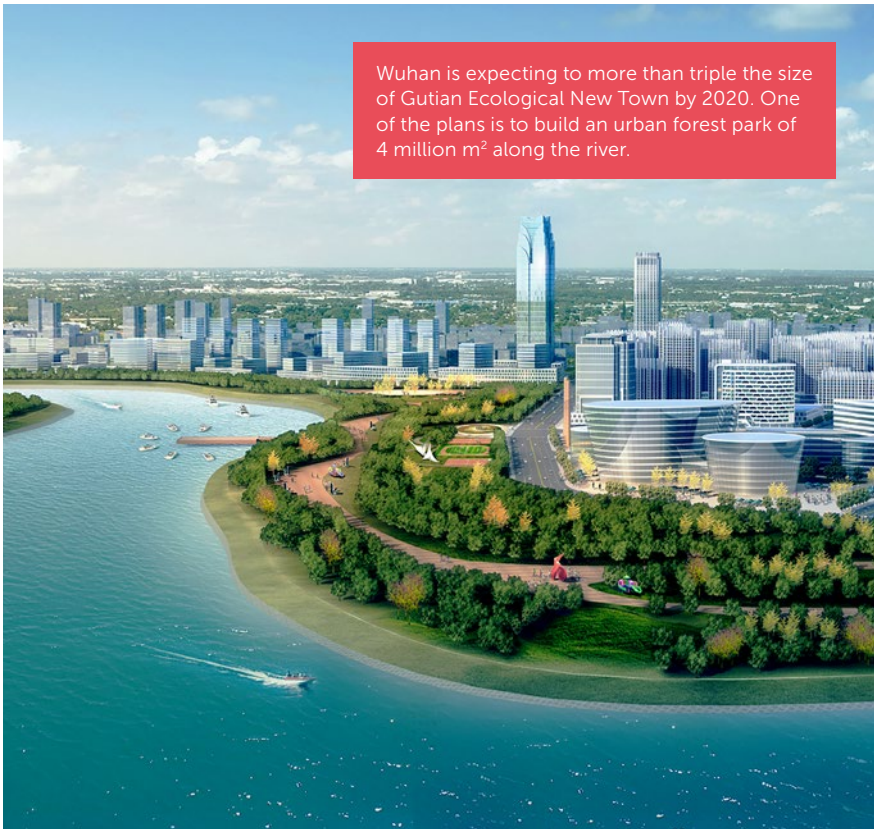
CITY: **WUHAN**

Industrial City Becomes Ecological Town

→ By shutting down chemical companies and turning industrial areas into new ecological communities, Wuhan has dramatically reduced pollution and enabled healthier lives in the restored environment.

In 2014, the City of Wuhan converted an industrial area, the Gutian Old Industrial Zone, into a green, low carbon district called the Gutian Ecological New Town. To do so, the city **shut down or relocated 99 chemical enterprises**, reducing the total emissions of main pollutants by at least 90%. The Gutian Ecological New Town will make use of solar and wind power and absorb heat from the Han River to supply residential units with heating and cooling. All buildings will be constructed using ecological building technologies. Green bicycle routes and a **low carbon light-rail network** with stations within 300 meters of all residents will ensure eco-friendly traveling in the new ecological town.

Under the project, the area of Gutian that had been most polluted by the former chemical companies will become a park and testing area for soil purification using biological restoration to absorb pollutants. The green projects already constructed take up **1.2 million m² and will save 3.8 million KWh** of energy and 1.3 million tons water. By 2020, the area is expected to expand to 4 million m².



Wuhan is expecting to more than triple the size of Gutian Ecological New Town by 2020. One of the plans is to build an urban forest park of 4 million m² along the river.

↓33.8

MILLION TONS CO_2 REDUCED BY THE GUTIAN ECOLOGICAL NEW TOWN'S CURRENT AREA

THE CHALLENGE

In Wuhan, an industrial park consisting of chemical enterprises was a large contributor of pollutants, resulting in detrimental environmental consequences and poor public health. The industrial park was demolished and enterprises moved. The development of an ecological city has improved the environment and the living conditions for its residents.

CO-BENEFITS

Environmental

Investing over $157 million to restore the environment after closing the Gutian Old Industrial Zone, Wuhan is determined to forego its industrial past with the ecological town.

Social

Public green areas per capita have increased from 4.5 m² to 12.5 m² and in total have increased from 2.5 million m² to 6.6 million m², improving quality of life in the community.

Economic

With 5,000 new green households built, and with more than $1.5 billion invested in shopping, tourism, and trade, Wuhan is expecting to see significant economic development in the area.

Health

To ensure the health and well-being of citizens, Wuhan erected a public health services complex with a disease control center, a women and children's hospital, and a social charity house with 1,000 beds.

CITY: **TORONTO**

De-contamination Begets a New Green Community

→ Revitalizing a contaminated urban brownfield and creating an ecologically functional river mouth will foster a new sustainable community and reduce the risk of flooding in Canada's largest city.

The City of Toronto is working with Waterfront Toronto, the Toronto and Region Conservation Authority, the Province of Ontario and the Federal Government to re-naturalize the mouth of the Don River into a healthier and ecologically functional river outlet to Toronto's Inner Harbour. This will allow for the transformation of the Port Lands, an underutilized and contaminated industrial area, into a new sustainable community. Creating the new river mouth will **protect 290 hectares of land** east and south of the Don River which is currently at risk of flooding and will include the decontamination or removal of approximately 2.5 million m^3 of polluted soil.

The plan is to transform the Port Lands Neighbourhoods into a resilient and sustainable community with 12,500 homes, 279,000 m^2 of commercial and retail space, and 53 hectares of parks and public spaces. The sustainability focus includes implementing aggressive energy and transportation strategies such as targets for energy use intensity and measures to **encourage active mobility by building bike-share facilities** and designated lanes for pedestrians and bikes.

The naturalization of the Don River mouth is the centerpiece of the plan and will provide flood protection to enable the revitalization of the Port Lands Neighbourhoods and create a new terrestrial and aquatic habitat in Toronto's waterfront.

↓23%

ANNUAL REDUCTION IN CO_2 EMISSIONS FROM THE REVITALIZATION PROJECT

THE CHALLENGE

The Port Lands Neighbourhoods was once a massive wetland teeming with aquatic wildlife, but the area was filled to create an industrial district. Now, after years serving industrial purposes, the district has become an underutilized, heavily contaminated brownfield site. Toronto plans to revitalize the area to develop a sustainable community.

CO-BENEFITS

Environmental

The project aims to reduce potable water consumption in the new community by mandating high-efficiency fixtures and appliances in buildings and exploring opportunities for grey water reuse for irrigation, toilets, and other uses.

Social

The project is estimated to generate 7,672 person years of employment.

Economic

The direct investment in flood protection will generate approximately $859 million in economic value added to the Canadian economy.

Health

The project aims to make the district a zero waste export community by requiring high levels of domestic, commercial, industrial, and construction waste diversion, reducing pollutants from unmanaged waste and overused landfills.

CITY: **LONDON**

Communities Take Root at Urban Gardens

→ By turning unused land into community gardens, London has found it is possible to grow local, low carbon food, and to engage thousands of citizens in the process.

↓2.6K

METRIC TONS OF CO_2 SAVED PER YEAR FROM 991,000 M² OF CAPITAL GROWTH PROJECTS

THE CHALLENGE

London has more than 8 million citizens and is growing steadily, which means more food consumption and more carbon emissions associated with food production and distribution. London officials launched Capital Growth so that local food production could help the city make good on its ambition to achieve substantial emissions reductions.

CO-BENEFITS

Environmental

Capital Growth projects have incorporated rainwater harvesting, where rainfall run-off that would have drained into London's sewer system is instead utilized for garden watering, easing the burden on the drainage system and reducing water consumption.

Social

Capital Growth enables often-marginalized people to engage with their communities, leading to increased feelings of community cohesion.

Economic

The financial value of produce grown at just 160 growing spaces was $233,179 between March 2013 and February 2014.

Health

Hands-on involvement in horticulture and its accompanying sense of achievement support mental health and well-being for food growers.

In response to a growing population and a wish to lower its CO_2 emissions, London developed Capital Growth, a project enabling local food production and consumption. Initially aiming to create 2,012 community food growing spaces by 2012, the city already boasts **2,432 community food gardens covering 991,000 m²** across the city. With more than two-thirds of the gardens built on previously unused, derelict, or inaccessible land, the city has proven that scarce land is not an obstacle to growing local food.

Capital Growth doesn't just help to expand London's community food production network, it also provides support, enabling the city's gardens to flourish. More than 80 training sessions have educated growers, and, according to estimates, the Capital Growth network could grow at least 357 metric tons of its 10 most popular crops per year. With **edible gardens found all over the city, supported by more than 150,000 volunteers**, London is demonstrating the positive social, economic, and environmental returns that come with local food production.

With three Edible Garden Open Days and two Big Dig volunteering days, Capital Growth engaged more than 5,500 Londoners, and as more gardens are registered each year, local food production is taking deep root in London.

CITY: **PITTSBURGH**

Sustainable and Inclusive Neighborhood Development

→ Pittsburgh's Low-Carbon Corridor seeks to revamp the city's struggling Uptown neighborhood by targeting emissions and energy use reductions, along with active community engagement.

↓388K

TONS OF CO_2 REDUCED BY 2050 BY REDUCING ENERGY CONSUMPTION AND TRANSPORTATION EMISSIONS 50% IN SELECTED NEIGHBORHOODS

THE CHALLENGE

Despite its location between two thriving business districts, the Uptown neighborhood of Pittsburgh has not fared as well over the past several decades, and today it has an estimated 40% vacancy rate and an 80% poverty rate. But with more than 50,000 people traveling through Uptown daily between the city's main business districts, the Low-Carbon Corridor seeks to capitalize on this neighborhood's potential to be economically profitable, socially equitable, and environmentally sustainable.

CO-BENEFITS

Environmental
The Corridor promotes the use of alternative fueled vehicles by offering these cars priority parking.

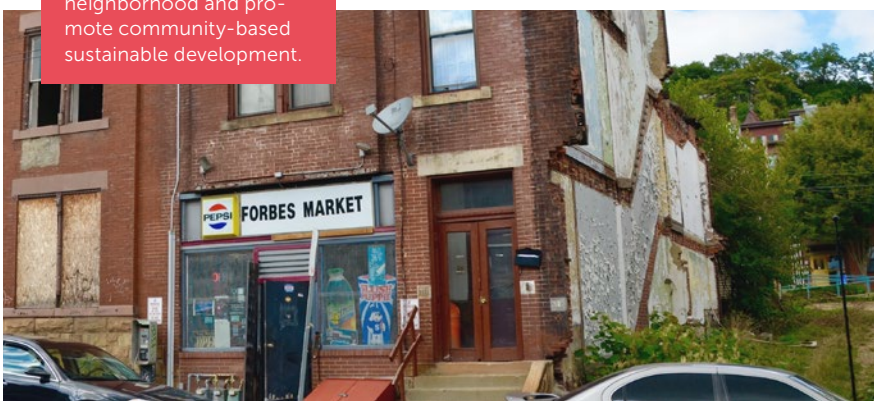
Social
The Corridor allows for easier access to Downtown's and Oakland's rich cultural, commerce, and natural assets.

Economic
This project will attract new business to the area, and link residents to employment opportunities.

Health
In addition to the health benefits associated with improved air quality, this project will enable and encourage active transportation.

The City of Pittsburgh is reconnecting and revitalizing an underserved district with its two prosperous neighbors through the energy-saving and community development project Low-Carbon Corridor. The project will target emissions reductions along the transit corridor running through central Pittsburgh, while also focusing on **making streets and public spaces safe, accessible, and enjoyable**. Ultimately, the project aims to reduce emissions from transportation by 50% by 2030, and 6 million m^2 of commercial buildings are committed to reducing water and energy use by 50% by the same year. The project has already achieved a 6.3% reduction in energy use and a 10% reduction in water use.

To achieve its goals, the Low-Carbon Corridor uses traditional methods, such as promoting public transit and bicycle use to limit driving, as well as smart technology, such as LED street lights that not only save energy but also **measure air quality, temperature, and other indicators**. To promote public involvement, the Uptown neighborhood has created an EcoInnovation District plan, which will entail 18 months of public participation to ensure that future land use, investment, and entrepreneurship create opportunities for all in the disadvantaged neighborhood.



The Low-Carbon Corridor project aims to reverse the legacy of a disadvantaged neighborhood and promote community-based sustainable development.

CITY: **MEXICO CITY**

Park Revitalization Promotes Accessibility

→ Mexico City is revitalizing one of its most iconic parks in order to improve the area's sustainability and make nature more accessible for all city residents.

Mexico City's enormous Chapultepec Park is undergoing a makeover to become more connected to the city, more accessible to residents, and more environmentally friendly. In 2013, the city created the Chapultepec Second Section's Master Plan to address four priorities: improving mobility options, achieving better water and infrastructure maintenance, organizing merchants and vendors so as to optimize the use of public space, and revitalizing green spaces.

In order to make the park's 6.86 million m² more accessible and enjoyable for its 19 million annual visitors, the city plans to expand public transit via a **3.5 km long bus and cycling circuit and the creation of 16,500 m² of sidewalks**. The city will also rehabilitate fountains and clean lakes, install 500 solar-powered lamps, and create more maintained and accessible spaces for recreational activities. The plan seeks to break down the borders between the city and the park and to **make nature easily accessible** for all residents and visitors.

Cleaner lakes and improved pedestrian accessibility are helping to revitalize the Chapultepec Park.

↓15%

REDUCTION IN CO_2 EMISSIONS THROUGH THE REDUCTION IN CAR TRAFFIC IN THE PARK

THE CHALLENGE

The Chapultepec Park is a beacon of nature in the bustling Mexican capital. Yet, years of poor maintenance within the park, and low connectivity between the park and the rest of the city, left it underutilized. Chapultepec Second Section's Master Plan seeks to reinvigorate the park by adding better features and services for visitors and making it more accessible to all.

CO-BENEFITS

Environmental

More than 400 new trees were planted as part of the plan, and 15,000 m² of green area were recovered.

Social

Improving public transit options and walking and cycling networks makes the park more accessible to all citizens and visitors regardless of social class or car ownership.

Economic

The plan improves the quantity and quality of services available to visitors, such as public lighting, walkways, and squares, which will attract more visitors and increase sales of goods and services by park vendors.

Health

Revitalizing open green spaces encourages sports activities, and newly built, safe pedestrian and cycling infrastructure invites visitors to experience the park on foot or by bike rather than by car.

Methodology

→ Arriving at the Top 100

Creating Cities100 was a long, multi-step process. The transparency of our application and evaluation procedures is of the utmost importance to the integrity of Cities100. By presenting our methodology we enable readers to understand how we selected these 100 city solutions.

Finding the solutions
Throughout July and August of 2015, Sustainia and C40 conducted a public campaign to encourage as many cities as possible to submit applications for exciting climate change projects to be featured in Cities100. This campaign included direct contact with city officials, desk research, and social media outreach and communication. In all, these efforts yielded 216 applications from 94 cities across every region of the world.

Who was eligible?
In order to ensure that applications came from the most viable, innovative, and replicable solutions, all applications had to meet the following eligibility requirements:

- **Applications had to be submitted by a municipality, or by a third-party organization with the support of the cooperating municipality**
- **Solutions must be operating, and had to be initiated within the past four years**
- **Solutions must have secured funding**

CITIES SUBMITTED APPLICATIONS WITHIN 10 SECTORS:

- GREEN ENERGY
- SOLID WASTE
- ADAPTATION PLANNING & ASSESSMENT
- ADAPTATION IMPLEMENTATION
- CARBON MEASUREMENT & PLANNING
- BUILDING ENERGY EFFICIENCY
- FINANCE & ECONOMIC DEVELOPMENT
- SMART CITIES & SMART COMMUNITY ENGAGEMENT
- TRANSPORTATION
- SUSTAINABLE COMMUNITIES

Only C40 cities or cities that have committed to the Compact of Mayors were eligible to submit to the following sectors: Adaptation Planning & Assessment, Building Energy Efficiency, Carbon Measurement & Planning, and Green Energy. The other six sectors were open to all cities.

How did we score them?
Scoring and ranking such a wide range of innovative solutions was no easy task. In order to be as rigorous and objective as possible, we created a detailed, multi-step scoring system.

STEP 1: First, the Sustainia team of experts analyzed all 216 applications and scored them on the following five criteria and sub-criteria:

1. Expected or achieved level of success with climate change targets

- Absolute and percentage reduction in CO_2 in metric tons per year and/or qualitative or quantitative assessment of the solution's contribution to risk/vulnerability reduction
- The stage of the solution's development and implementation

2. Level of innovation in addressing major environmental issues

- The geographic scale of innovation
- The relative change in the level of innovation from the city
- The amount of information provided to substantiate claims about the level of innovation

3. Co-benefits of the project that have contributed to its success

- Whether the solution contributes to urban economic development in the city
- Whether the absolute and relative sustainability co-benefits (environmental, social, and economic) have been measured and evaluated by the city

4. Demonstration of good leadership and governance

- The degree to which the solution is integrated in the city's overall planning strategy and climate action plan, or demonstrates direct relevance to overall sustainability planning guidelines
- The relative level of stakeholder engagement as compared to other applicants
- The methods of stakeholder and citizen engagement used and the quantifiable outcomes resulting from that engagement

5. Potential to replicate and scale the project

- The extent to which the solution is scalable within the city, and demonstrates that there is a clear process in place to scale the solution
- The extent to which the solution is replicable to other cities and demonstration of the actions the city has taken in sharing its experience with other cities

Within each of the five evaluation criteria, solutions were scored on sub-criteria (bullet points listed below each of the aforementioned evaluation criterion). For each sub-criterion, a solution could score 1 (low), 2 (medium), or 3 (high). A solution's overall score is the sum of their five evaluation criteria scores.

STEP 2: Once solutions received their initial overall score, a team of C40 sector-specific experts analyzed all projects within their given sector and provided detailed input for all evaluation criteria of every solution based on years of hands-on knowledge and experience. Solutions' initial scores were adjusted according to this input, yielding a final score for every solution. The 10 highest scoring solutions in each sector were selected to be featured in Cities100.

Writing Notes
Monetary amounts provided by cities have been converted to United States dollars. Distance and volume measurements have been converted to metric system units. In regards to mass, we have used the unit provided by the city in their applications (either tons or metric tons). Tonnes have been written as metric tons.

Explore Sustainia

→ We Make Sustainability Your Business

Sustainia is an international sustainability think tank working to identify and secure deployment of sustainable solutions that improve quality of life in communities around the world.

We know that the road to sustainable societies depends on your starting point. This differs from organization to organization. What remains the same is the ambition to make sustainability a part of your future growth. Together, we customize your path to making sustainability a business advantage.

We take a holistic approach to sustainability, which means that we work across a range of sectors. A collaboration with Sustainia is shaped to fit your organization's unique needs and ambitions. However, our approach always combines three key components: Analysis & Strategic Advisory, Solutions & Innovation, and Communication & Thought Leadership.

1) INPUT: Analysis & Strategic Advisory

We analyze the context in which your organization is navigating. By providing you with a clear picture of your strategic environment, we make it possible for you to articulate a clear path to a sustainable future. Our expertise ranges from sector-specific innovation insights to trend reports and forecasts.

Most recent project: the publication, *"EAT in Sustainia,"* created with partner EAT Initiative, takes the reader from the current state of unsustainable and unhealthy food systems to the opportunities and solutions for using food systems as catalysts for economic, human, and societal development.

Other projects include: a series of global workshops which resulted in the publication of *"The State of Healthcare: From Challenges to Opportunities,"* with partner DNV GL; advisory on communicating sustainable investments, with partner Storebrand; advisory on an innovation program for sustainable buildings, with partner Nordic Innovation; publication of *"The Copenhagen City Guide,"* with partner City of Copenhagen; and more.

2) INSPIRATION: Solutions & Innovation

We connect you to the ready and available solutions of today. Sustainia is the world-leading host of global sustainable solutions and we have published four editions of the *"Sustainia100"* publication, presenting state-of-the-art innovation across 10 sectors. By connecting your sustainability needs with solutions that are available today in the same field, we can inspire you to accelerate your own sustainable transition. Our database of sustainable innovations includes more than 3,500 solutions.

Most recent project: the publication, *"Cities100,"* with partners C40 and Realdania, identifies 100 leading city solutions to climate change within 10 different sectors, serving as a guide to policies, programs, and projects all over the world.

Other projects include: four editions of Sustainia's annual flagship publication *"Sustainia100"*; publication of the *"Green Guide to Universities,"* with partner The International Alliance of Research Universities; and more.

3) INFLUENCE: Communication & Thought Leadership

We turn complex information into actionable knowledge. The global challenges in the realm of climate change and sustainability are complex and interconnected. We help you communicate your burning platform in a language and with design that is engaging and easy to decipher. We have designed and conducted workshops in more than a dozen countries, and our communication efforts have reached more than 150 million people around the world.

Most recent project: the *"Cheers to Green Ideas"* project, with partner Carlsberg, was an online campaign calling for consumers and entrepreneurs across the globe to submit ideas on how to improve Carlsberg's value chain, making it more sustainable and circular.

Other projects include: publication of *"Guide to Co-Creating Health,"* with partner Novo Nordisk; publication of *"Building Sector Guide – Exploring the Sustainable Buildings of Tomorrow,"* with partners VELUX, City of Copenhagen, DONG Energy, Realdania, and Vestas; online submissions campaign *"Future Sustainability Leaders"* with partner DNV GL; external workshops on food, with partner Arla; external workshops on water, with partner Grundfos; and more.

Explore C40

→ Local Action, Global Impact

The C40 Cities Climate Leadership Group (C40), now in its 10th year, connects over 80 of the world's greatest cities, representing 500+ million people and one quarter of the global economy. Focused on tackling climate change, C40 provides a forum for cities to share strategies for reducing greenhouse gas emissions and climate risks, while increasing the health, wellbeing and economic opportunities of urban citizens.

Connecting & Learning

C40 networks connect hundreds of city officials around the world, helping them to implement climate action, access partnership resources and overcome technical and financial barriers. Currently working across six initiative areas, C40 delivers over 100 workshops and webinars each year, alongside a dynamic online knowledge exchange platform. Sharing is working. The power of our network is that when one city demonstrates the success of a great idea, other cities can quickly implement it.

- Nearly 75% of C40 cities have been able to take, new, better or faster climate actions as a result of participating in C40 networks; for example, investment in bus rapid transit (BRT) grew from 21 to 35 cities in two years.
- C40 cities focus on what works, scaling up climate action: 50% of all reported actions are now city-wide, up from 15% in 2011.
- Cities' ambitions are still growing with nearly 90% of all actions planned for future expansion.

Empowering Cities with Data

C40 leverages our unprecedented database of city actions, extensive network of partnerships, and unique organizational insight to demonstrate the power of cities to address climate change.

Our research analyzes key trends, identifies opportunities for further action across the global C40 network, and helps to prioritize initiative areas with the greatest potential impact.

C40's research agenda is committed to creating actionable data, supporting decision-making and driving investments. Our cutting-edge tools, standards and frameworks help cities to implement the most impactful mitigation and adaptation strategies, and measure and manage their effectiveness.

The Voice of Megacities on the Global Stage

By engaging mayors in the international debate on climate and sustainable urban development, C40 highlights the crucial role of cities and the decisive leadership of mayors to place the world on a climate safe pathway, and help secure resources for ambitious local climate action.

C40 helped to launch and build momentum around the Compact of Mayors[1], the world's largest effort by city leaders to reduce local greenhouse gas emissions, enhance resilience to climate change, and track their progress transparently.

Through the Compact, cities are making a major contribution toward global progress on climate change, and are also showing their national governments that more ambitious goals are both possible and achievable.

C40 research shows that cities are three times more likely to take climate action if they have set a robust reduction target or goal.

[1] This world-leading initiative was launched by UN Secretary-General Ban Ki-moon and his Special Envoy for Cities and Climate Change, Michael R. Bloomberg, under the leadership of the world's global city networks – C40 Cities Climate Leadership Group, Local Governments for Sustainability (ICLEI) and the United Cities and Local Governments (UCLG) – with support from UN-Habitat, the UN's lead agency on urban issues.

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As the global discussion on climate change intensifies, cities are leading the way to a sustainable future. And for good reason. By 2050, nearly 70% of the world's population will live in a city. As urban societies continue to expand and change, so too do the challenges facing them, particularly when it comes to climate change. This growing urban population is vulnerable to the impacts of climate change – for example, 90% of all urban areas are coastal – but it is also powerful. Cities have always been centers of commerce, culture, and knowledge. Now they are harnessing their innovative, collaborative, and progressive nature to take action on climate change, forging a path to low carbon development.

The solutions in Cities100 were selected after reviewing more than 216 applications from 94 cities across all regions in the world. They point to the reality that meaningful action to combat climate change is being taken outside of the national arena. From retrofitting buildings to encouraging active transportation, creating green financing schemes to launching sustainable adaptation plans, the solutions of Cities100 reflect the broad range of action cities are already taking to mitigate and adapt to climate change, while at the same time creating valuable co-benefits for their economies, communities and citizens' health.

→ 100 solutions for climate action in cities

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