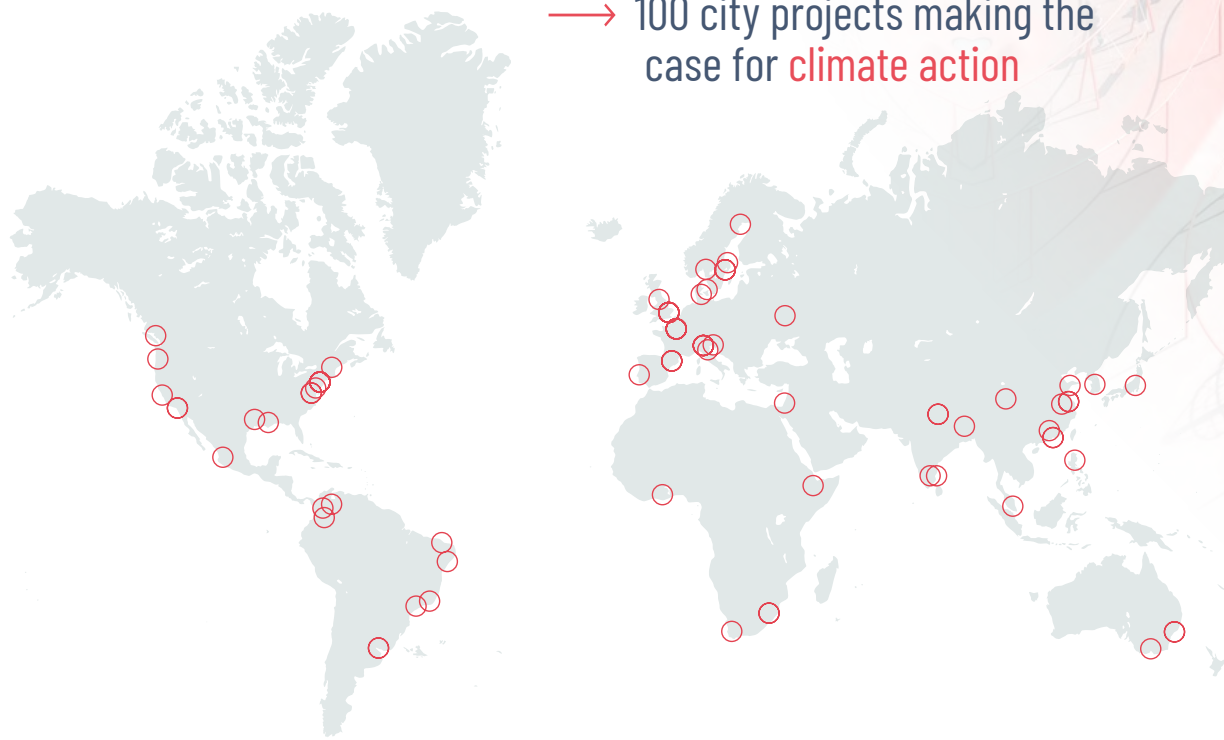


2019

Cities100

→ 100 city projects making the case for **climate action**



"CITIES ARE ON THE FRONT LINES OF CLIMATE CHANGE, FEELING THE IMPACTS OF RECORD-BREAKING TEMPERATURES, RISING SEA LEVELS, AND CLIMATE RELATED NATURAL DISASTERS. **MAYORS RECOGNISE THAT THE ACTIONS THEY TAKE TODAY ARE KEY IN SECURING A SUSTAINABLE, PROSPEROUS AND HEALTHY FUTURE FOR THEIR CITIZENS, AND ALL PEOPLE ON OUR SHARED PLANET.**"


Jesper Nygaard | CEO OF REALDANIA


Anne Hidalgo | MAYOR OF PARIS & CHAIR OF C40

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FOREWORD

Solutions to the climate crisis from the world's leading cities

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) published its landmark 'Special Report on Global Warming of 1.5°C' and the global conversation on the climate crisis changed forever. The scientific evidence is indisputable. Keeping global heating below 1.5°C is the only hope that we have of preventing irreversible disruption of the global water cycle, severely impacting global food security, exacerbating global inequality, and putting the health of billions of people around the world at risk. All the evidence points to the same alarming conclusion: we are not on track.

The bottom line is: this generational battle against climate change is a moral imperative, an environmental emergency, and a massive economic opportunity. The ambition of the Paris Agreement, including the 1.5°C heating goal cannot be realised without urgent, coordinated efforts by nation states. Yet, just a handful of countries have set emissions reductions targets that are consistent with keeping global heating below 1.5°C. In contrast, more than 100 cities around the world

have now committed, through C40's Deadline 2020 initiative, to peak their emissions by 2020, halve them by 2030 and reach zero emissions by 2050. Today, it is mayors of the world's great cities that are the most active and committed champions of the Paris Agreement.

This is a fight we cannot afford to lose.

Cities are on the front lines of climate change, feeling the impacts of record-breaking temperatures, rising sea levels, and climate related natural disasters. Mayors recognise that the actions they take today are key in securing a sustainable, prosperous and healthy future for their citizens, and all people on our shared planet. The first priority of a mayor is to protect their cities and their citizens. They can't do that if the climate is in breakdown. Citizens need to know there will be a liveable planet and a place for them in it.



Anne Hidalgo | Mayor of Paris & Chair of C40



Jesper Nygård | CEO of Realdania

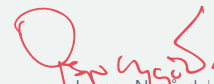
We are seeing cities and mayors rise to the challenges of the climate crisis whilst also acknowledging that climate breakdown is inherently unfair. The most vulnerable members of society disproportionately feel the impacts of climate change, including low-income communities, minorities, our oldest and youngest citizens. That is why cities are inviting marginalised groups and local people to help co-create sustainability plans, policies, and projects. In recognising that climate action and social justice must go hand in hand, cities are providing safe homes, creating dignified jobs, building green transport systems, and cleaning the air that all citizens breathe.

These actions are transforming the world's urban centres, improving people's lives whilst also ensuring cities continue to prosper. They are building a future based not on fear, but rooted in hope. The 2019 edition of Cities100 identifies the specific climate policies and projects setting the global standard for what action to deliver the 1.5°C global heating target looks like. The 100 solutions bear witness to the leadership of mayors in the global fight against climate change.

Mayors can't solve the climate crisis alone. Our work is only made possible with the collaboration, support, and shared ambition of all those nations states, businesses, and civil society groups that are committed to uphold the highest ambitions of the Paris Agreement.

This year's Cities100 will feature an analysis of how cities are facing the challenges and opportunities that come with being at the forefront of climate action. Mayors, youth activists, climate scientists, and business leaders will meet in Copenhagen for the launch of Cities100 at the C40 World Mayors Summit. The Summit provides an opportunity for mayors to learn from their peers and take home the lessons of the 100 most innovative city solutions.

Congratulations to the mayors and citizens of every city featured in this report, for their leadership in creating the future we want.


Jesper Nygård | CEO OF REALDANIA


Anne Hidalgo | MAYOR OF PARIS & CHAIR OF C40

EDITORIAL

Why 1.5°C is the most important number for the world's cities

By Jesper Nygaard, Marco Lambertini, Mark Watts and Esben Lanthén

Mayors and city leaders have been amongst the first to recognise the scale of challenges presented by the global climate crisis. They are on the front lines of climate change, already dealing with extreme weather, sea level rise, severe flooding, wildfires, and droughts.

That is why local governments are currently delivering some of the world's most ambitious and innovative climate projects, plans, and policies, designed to deliver on both the Paris Agreement and the UN Sustainable Development Goals. The 100 climate action projects featured in the Cities100 report are a testament to this leadership and serve as inspiration for how cities around the globe are tackling the climate crisis. The report offers new insights on the experiences of leading cities, from which all local governments can benefit.

Mayors know exactly what they need to do to stay within a safe carbon budget: emissions need to peak by 2020 and then fall rapidly to at least half by 2030. Net zero emissions must be

achieved by 2050 at the latest. While mayors are aware that climate change is already happening, they are protecting their cities to be more resilient in a world currently headed towards 3°C or more of over-heating. Cities are therefore where the future happens first.

Cities can't do it alone

The Cities100 report profiles many cities that are trailblazers of the green transition. 12 C40 cities have now published climate action plans to ensure they deliver their fair share of emissions cuts to achieve the 1.5°C goal of the Paris Agreement. Their efforts often surpass national targets and help close the gap between expected national efforts and what is needed to maintain global heating to within safe, science-based limits. These plans are also frequently rooted in a commitment to deliver inclusive climate action, ensuring investment in green infrastructure benefits all people within the city equitably.



In their bid to green the city, and create a better home for wildlife and residents alike, London has become the world's first National Park City. You can read more on page 154.



Umeå in Sweden is empowering citizens to make long-lasting sustainable behaviour change. You can read more about the project on page 164.

This leadership by the world's megacities is essential, but climate action plans aligned with the 1.5°C threshold need to become the new normal in cities of every size. Through C40's Deadline 2020 Climate Action Planning Programme, the C40 Knowledge Hub, and WWF's One Planet City Challenge (OPCC), all cities regardless of size, can now access best practice, tools, and guidance on their individual journey towards a 1.5°C future.

Leaders of cities around the world should take advantage of the support available through programmes such as those run by C40 Cities and WWF, to ensure they play their part in limiting global overheating and averting the climate crisis. Cities should also publicly disclose their commitments and climate action plans as part of this process. Such transparency and leadership can help inspire a "race to the top," encouraging both their own citizens, and other cities to play an active role in securing a sustainable future for all.

Yet cities cannot tackle the climate crisis alone. Delivering on the ambitions of the Paris Agreement is only possible with the commitment and leadership of nation states. On the issue of climate change, national leaders should recognise the incredible allies they have in the leaders of their cities. By working together, local and national governments can achieve far more than when working alone. For example, city leaders should be closely involved in setting national climate change targets. National governments should also encourage and support cities to experiment with new policies and projects.

Inspired by the incredible initiatives profiled in the Cities100 report, now is the moment to take risks and support the roll-out of best practice from those cities that are leading the way.

The leadership demonstrated by so many mayors from towns and cities of every size, provides a rare source of optimism in the global fight against the climate crisis. The time has now come for all cities to engage and commit to playing their part. The Cities100 projects can provide the inspiration, whilst support from organisations such as C40 and WWF can provide the technical and practical support. There is no time to lose in securing the sustainable, healthy and prosperous future we want.


Jesper Nygaard | CEO OF REALDANIA


Marco Lambertini | DIRECTOR GENERAL OF WWF


Mark Watts | EXECUTIVE DIRECTOR OF C40 CITIES


Esben Lanthén | MANAGING PARTNER AT NORDIC SUSTAINABILITY

Where can cities turn for help with 1.5°C alignment

Cities around the world now have access to a multitude of resources and support, with organisations ready to help them work more strategically toward delivering on their fair share of the Paris Agreement goals. Among those resources are C40's Deadline 2020 programme, the C40 Knowledge Hub, and WWF's One Planet City Challenge.

About C40's Deadline 2020 Climate Action Planning Programme & the C40 Knowledge Hub

Within months of the Paris Agreement being agreed, mayors of C40 Cities identified the goal of contributing to limit temperature rise to 1.5°C above pre-industrial levels. It is now a condition of membership of the C40 network that all member cities will develop and begin implementing a climate action plan before the end of 2020, which will deliver action consistent with the objectives of the Paris Agreement. That means an integrated and inclusive plan that addresses the need to reduce greenhouse gas emissions, adapt to the impacts of climate change, and deliver wider social environmental and economic benefits. C40 is providing support to member cities through the C40 [Climate Action Planning Programme](#).

The C40 Knowledge Hub is a new online platform which equips city policymakers and practitioners around the world with the tools to accelerate climate action.

For the first time, the Knowledge Hub brings together the insights, practical experience, and tried-and-tested approaches from leading climate cities, alongside critical data, implementation guides, and other resources, on a platform created specifically for cities of all sizes. It includes new tailor-made material, as well as resources from C40, from cities, and from a wide range of expert organisations. You can find resources on 1.5°C climate action planning and on building energy efficiency, clean energy, transport, waste, financing, and more.



The platform will be launched before the C40 World Mayors Summit; you are invited to register, read, and save resources, and to get in touch if you wish to contribute.

The 100 climate action projects from the 2019 Cities100 report can also be found on the Knowledge Hub.

About WWF's One Planet City Challenge (OPCC)

WWF, one of the world's largest and most respected independent conservation organizations, created the One Planet City Challenge (OPCC) in 2011 to mobilize action and support from cities in the transition toward a sustainable and climate-resilient future and to stimulate the dissemination of best practices for climate mitigation and adaptation in cities around the globe. This biennial programme has to date engaged +500 cities on all inhabited continents. The OPCC invites cities to report GHG emissions, vulnerabilities, climate commitments and climate action plans that deliver on those commitments.

The reporting requirements are aligned with the common reporting framework of the Global Covenant of Mayor on Climate and Energy (GCoM), meaning that cities can now report for the GCoM while participating in the OPCC and vice versa. Thanks to a new, expert verified 1.5°C assessment framework which includes the latest IPCC data, all participants receive feedback on how their efforts align with the Paris Agreement objective of a maximum of 1.5°C of global warming. The assessment framework also integrates criteria for evidence-based climate action planning and all participants receive action-oriented guidance on opportunities to accelerate both mitigation and adaptation action.

Visit www.panda.org/opcc for more information and how your city can join the movement.



ANALYSIS

How frontrunner cities are tackling the climate crisis

Cities100 2019 highlights 100 of the most innovative projects from cities across the globe that are taking a lead in tackling the climate crisis. In this year's report, we have collated and analysed data from each project in order to provide insights into how frontrunner cities are finding innovative approaches to dealing with the most urgent social and environmental issues of our time.

The objective of this in-depth analysis is to offer a new perspective that can be of use to cities with similar challenges across the planet. While we recognise there is no one-size-fits-all approach to successfully develop or implement climate action projects, this analysis points to several central insights that are applicable for many hundreds of cities around the world.



Interactive data analysis

→ *Click here to take a deep dive into the Cities100 2019 data in an all new online interactive. With a customisable series of world maps and charts, you can explore the data and insights most relevant and interesting to your city.*

[EXPLORE THE DATA](#)

ANALYSIS

Four insights from 100 climate cases

INSIGHT ONE

CITIES DELIVER SIGNIFICANT CO₂e REDUCTIONS

As climate change climbs up the local government agenda, an ever-growing number of exciting climate action projects are being initiated. However, with a need to halve global carbon emissions by 2030 to limit warming to 1.5°C*, achieving significant results from city climate action has never been more urgent.

Fortunately, there is much to learn from the approach taken by cities in the publication to cutting emissions. The results speak for themselves, with the top 10 emissions reductions projects in this year's report totalling 9.3 million tonnes of CO₂e emissions avoided every year – equivalent to the annual emissions of Panama.

Due to the wide variety of projects highlighted below, some of these savings – such as Chengdu, which managed to reduce its annual CO₂e emissions by 2.9 million tonnes between 2013 and 2017 – have already been achieved, while other projects expect the full potential of the savings to be realised in the coming years.

**The findings of the IPCC's Special Report on 1.5°C suggest that to limit warming this century to 1.5°C, global carbon emissions need to be cut in half by 2030.*

Top 10 CO₂e emissions reductions projects from Cities100 2019

	CITY	PROJECT NAME	CO ₂ e EMISSIONS SAVINGS PER YEAR	STATUS OF PROGRESS
1	Chengdu	Prioritising pollution prevention with a five-point plan	2.9 million tonnes	Achieved
2	Delhi	Shifting to green power and saving lives	1.6 million tonnes	Achieved
3	London	Net-zero new builds put London ahead of the pack	1.2 million tonnes	Partly achieved by 2020, expected by 2050
4	NYC	Residents get a seat at the table in planning for long-term resiliency	0.9 million tonnes	Achieved
5	Kolkata	Electrifying Kolkata's buses and ferries	0.8 million tonnes	Expected by 2030
6	NYC	Slashing skyscrapers' emissions via first-of-its-kind legislation	0.6 million tonnes	Achieved
7	San Francisco	Green energy programme fuels the transition towards a renewables-powered city	0.5 million tonnes	Achieved
8	Durban	From traditional landfill to ecological conservation area	0.3 million tonnes	Partly achieved, expected by 2030
9	Fortaleza	Prioritising public transport, cycling, and walking	0.3 million tonnes	Expected by 2020
10	Guangzhou	City-wide rapid bus electrification	0.3 million tonnes	Achieved

ANALYSIS

INSIGHT TWO

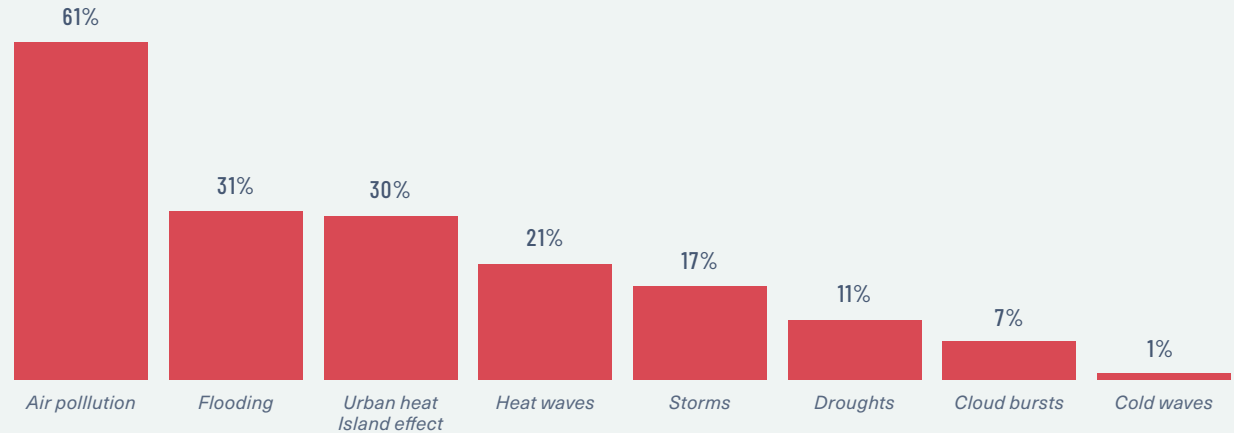
CLIMATE ACTION PROJECTS ADDRESS MORE THAN JUST CO₂e

While the importance of curbing carbon emissions must not be underestimated, it is worth highlighting that 61% of the 100 projects are addressing air pollution. Given that outdoor air pollution from fossil fuel combustion causes an estimated 3.6 million deaths globally each year¹, improving urban air quality will result in significant, tangible benefits to public health and citizens' lives.

The two other most prominent local climate change challenges being addressed were flooding and the urban heat island effect with 31% and 30% of projects targeting each issue, respectively.

¹ Lelieveld, J., et al., 2019. Effects of fossil fuel and total anthropogenic emission removal on public health and climate. *Proceedings of the National Academy of Sciences*, 116(15), pp.7192-7197

Local climate change challenges addressed by projects



ANALYSIS

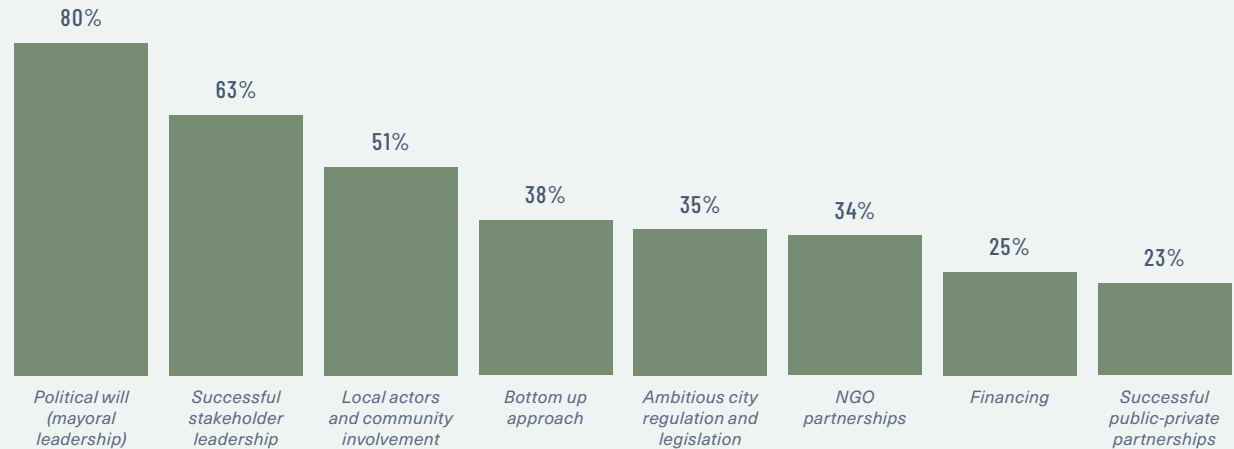
INSIGHT THREE

MAYORAL LEADERSHIP IS A KEY FACTOR FOR PROJECT SUCCESS

While waiting for national governments to set ambitious targets and goals for the climate, mayors and local city officials are moving forward with projects targeting both environmental and social issues. 80% of the projects in this report identified this kind of strong political will as crucial to achieving successful outcomes.

Successful stakeholder leadership was considered key for 63% of projects, while just over half (51%) of projects deemed local community involvement to be instrumental in realising climate action projects.

Success factors in the implementation of projects



ANALYSIS

INSIGHT FOUR

NEW TECHNOLOGIES ARE NOT ALWAYS CRITICAL FOR CLIMATE ACTION

Although new technologies were considered “very important” and “moderately important” in 36% and 34% of cases, respectively, it is worth noting that almost a third (30%) of projects did not consider new technologies to be of any importance to their project’s success.

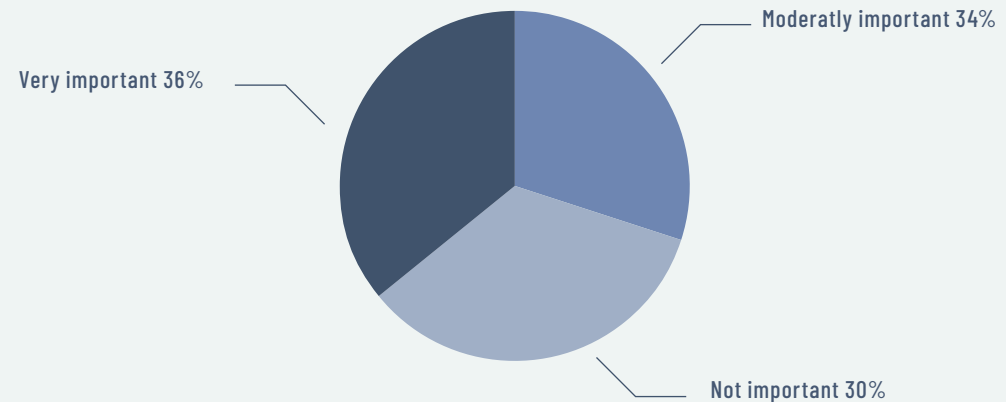
Even though technological advances can be important in certain sectors, such as clean energy and low-carbon transport, a lack of access to the latest technology is not a barrier to taking effective climate action.

Many of the projects featured in Cities100 utilise natural climate solutions, engage citizens in local climate projects, or enhance cityscapes to encourage active transport, ultimately taking substantial climate action without turning to the newest technological fixes.

How we did it

A part of the Cities100 application process included a number of quantitative survey questions. These questions were designed to provide insights into the process of the entire project development and not merely the final project outcome.

Importance of new technology in the development of projects



While it was obligatory for the cities to answer the survey questions regarding the process, the answers were not a part of the project evaluation. The projects were chosen based on the methodology outlined on page 227.

MAP OF ALL PROJECTS



2019

Cities100

SUSTAINABLE MOBILITY

→ The sustainable mobility sector highlights how cities are putting people before cars. Prioritising public transport, cycling, and walking, and redesigning cities to be bicycle- and people-centric are some of the steps cities are taking towards a low-carbon future.



STOCKHOLM:

Sweden's Beloved City initiates collaboration that slashes emissions

→ In a bid to reduce Stockholm's city centre congestion, five years ago city council officials initiated and have since helped facilitate a successful and **long-lasting set of relationships between different private sector actors** via the 'Älskade stad' collaboration (Beloved City). These three businesses – Bring (logistics operator), Vasakronan (property owner), and Ragn-Sells (recycling company) – have cooperated with each other via this city initiative to **help solve the pressing sustainability freight issues** stemming from first-mile waste collection and last-mile parcel distribution. This combination of business operations has led to the replacement of six regular diesel-run trucks by one silent electric vehicle.



What has the city achieved?

As part of Stockholm's plan to be fossil fuel-free by 2040, the city decided to tackle the notoriously difficult heavy motor vehicle-related carbon emissions. Through these inter-business collaborations, greater energy efficiency and lower production cost practices were devised, streamlining their business operations to become more economically and environmentally sustainable, as well as more competitive for the post-carbon future. This reduction of both the number of vehicles and journeys has reduced the city's air and noise pollution, on top of the reduction in transport-related CO₂ emissions.

Trust has been an important element in this process as many logistics operators would likely not be willing to let another company deliver parcels to their customers, which is why Bring's cooperation with Ragn-Sells is impressive.

Such has been the success of the project that the area covered in Stockholm has been ever-increasing.

Stockholm 

STOCKHOLM

↓ 74%

DECREASE IN CO₂ EMISSIONS have been estimated as a result of the project

What can other cities learn?

City council can play a key role in facilitation:

The city played a central role in facilitating proceedings and aiding successful business partnerships. Over the course of the five years of the project, only 1-2 full-time civil servant coordinators' salaries have been funded by the city. All other investments have been made by the businesses, with the enterprises being commercially viable since the project's start.

Share widely, and inspire other cities to follow suit:

This solution is eminently scalable to other cities, which is why Stockholm has been sharing Beloved City so widely. Following the city's successful scaling-up, other cities have taken note. In April 2019, Oslo inaugurated its own version of this project, with Malmö – Sweden's third-largest city – scheduled to roll out its own project later in 2019.

What are the co-benefits?

Social:

Less congested city streets can lead to more community activities in public spheres.

Health:

A reduction in local air and noise pollution improves the local citizens' health.

Economic:

Public spaces that are more attractive will likely result in greater foot traffic, meaning increased economic activity on the high street.

Environmental:

This project has led to a 74% reduction in CO₂ emissions. The energy use of this waste collection is only a third of ordinary waste collections' energy use.

Stockholm's Beloved City collaboration has led to the replacement of six regular diesel-run trucks by a single silent electric vehicle.



NEW YORK CITY: Vision Zero Campaign

→ Since entering New York City's Mayor's office in 2014, Bill de Blasio's administration's holistic, integrated, and data-driven Vision Zero strategy to boost **greater safety, equitability, and sustainability in urban mobility** is proving to be a notable success.

Increasing active transportation is a crucial component to Vision Zero, with daily cycling trips now exceeding 490,000 – a 29% increase since 2013. Meanwhile, whilst traffic fatalities in the USA are up 15% since 2013, in NYC they are down 32%. This effective strategy has become a global model for urban traffic safety, with NYC also hoping to soon become the USA's cleanest big city.



What has the city achieved?

The need to significantly overhaul NYC's transport system had become increasingly clear, explaining why such a wide variety of policy initiatives were implemented. The speed limit has been lowered to 40 km per hour and critical street space has been shifted away from low-density motor vehicles. Pedestrian spaces have been expanded and buses, cyclists, and pedestrians all now have greater priority. An additional 132 km of segregated bicycle lanes have been built, with the bike network now totalling 772 km and less-polluting personal vehicles have been promoted. An ever-increasing city-wide speed camera programme has been deployed with speeding down by 85% at camera locations, while targeted interventions have been introduced in specific areas that have suffered disproportionately from serious crashes.

These far-reaching measures have led to a safety-in-numbers effect to emerge with a greater share of New Yorkers making trips on foot, by bicycle, and by public transport. These developments have led to more liveable streets, which in turn has led to higher retail receipts and sales tax revenues. These efficient, cheaper, and more convenient transport methods also increase the connectivity of the whole city, thereby linking those living in less-affluent neighbourhoods to jobs, an essential component for more equitable economic development.

New York City 

NEW YORK CITY

↓ 3,011

TONNES OF CO₂ EMISSIONS are estimated to have been avoided thanks to the 29% increase in daily cycling trips between 2014-2017

What can other cities learn?

A holistic approach proves more effective:

In addition to framing the urban mobility transformation with an environmental lens, city officials believe Vision Zero has been an even greater success by framing it around the issues of equity, justice, and public health. These concerns have proved to be more pressing to citizens, allowing for more socially and environmentally just solutions, demonstrating that the former's importance ought not be underestimated.

The bicycle is at the heart of sustainable urban mobility planning:

Cycling has been a crucial aspect of Vision Zero as, by 2050, NYC hopes to boost its modal share to 10%. Schemes like "Prescribe a Bike" have enabled low-income citizens to have access to NYC's sharing Citi Bikes. In the past decade, bicycle trips have increased by 134%, which means that approximately 2.6 million car trips are now avoided annually. Pedal-assisted electric bicycles will now be introduced into the bike-sharing system, which in itself will grow from 12,000 to 40,000 over the next few years.

What are the co-benefits?

Social:

The analysis of fatality data in NYC showed that the poorest neighbourhoods suffered from a disproportionately high level of pedestrian deaths. Vision Zero measures were introduced to counter these unjust correlations.

Health:

Vision Zero is a key component of NYC's air pollution clean-up strategy. At present, traffic-related fine particulate matter causes around 320 premature deaths and 870 emergency department hospitalisations in New York City each year. The city hopes this multifaceted strategy results in superior public health.

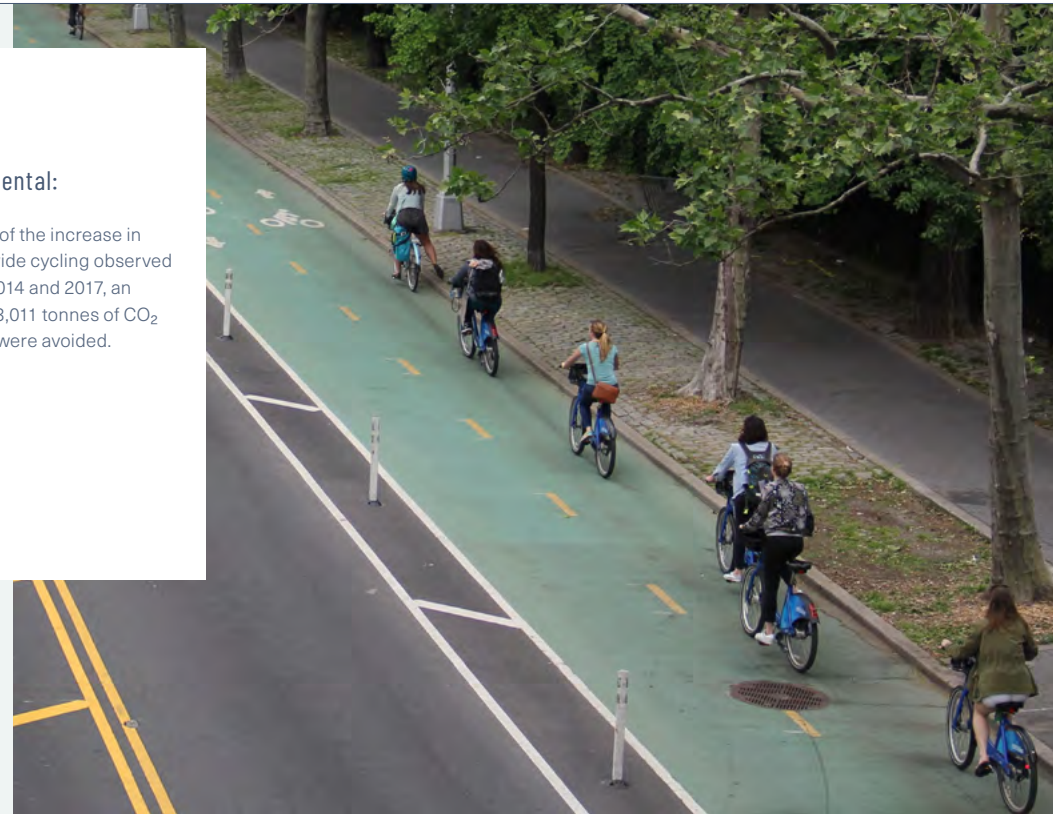
Economic:

NYC has budgeted \$1.6 billion until 2022 for the full implementation of Vision Zero projects. By solely factoring the reduction in traffic fatalities since 2013, there has already been at least a return on investment of \$3 per \$1 invested, as the total savings are estimated to have been more than \$4.8 billion already.

Environmental:

As a result of the increase in daily city-wide cycling observed between 2014 and 2017, an estimated 3,011 tonnes of CO₂ emissions were avoided.

Prioritising pedestrians, bicycles, and public transportation has been a crucial component of New York City's successful Vision Zero scheme.



KOLKATA:

Electrifying buses and ferries

→ With the ambitious aim of retaining its public transport's impressive 88% modal share, Kolkata has decided to invest and improve the city's public transport options. By 2030, the city plans to have **inducted 5,000 electric buses, as well as fully electrifying the ferries** that run across the Ganges River.

On top of its narrow street layout, only 7% of Kolkata's land area is dedicated to roads, meaning that **effective and coordinated public policy is crucial** to minimise and help solve urban congestion issues as this city continues to grow.



What has the city achieved?

Kolkata's air pollution levels are a cause for concern, this was a key reason behind the West Bengal State Government's decision to transition the city's entire bus and ferry fleets to electric models over the next 11 years.

The shift makes financial sense, too. From a 10 year perspective, 125 kWh and 180 kWh battery buses are much cheaper to run, having only a third of the operational costs of a diesel bus.

With citizens in mind, a common mobility card was introduced in 2017 to facilitate transfers between different modes of travel. In addition to keeping costs and travel times down for

users, providing a more seamless commuting experience is important to the West Bengal Transport Corporation, the city's state-owned public transport provider.

As of 2019, 80 electric buses have been introduced to the city, with another 100 planned for 2020. These 180 electric buses will lead to an annual reduction of 14,086 tonnes of CO₂ emissions.

Kolkata ○

KOLKATA

↓ 783K

TONNES OF CO₂ EMISSIONS are expected to be reduced per year by 2030 once Kolkata's ferries and buses are electrified.

What can other cities learn?

Adopt helpful national policies:

The Indian government's national policy of Faster Adoption and Manufacturing of Electric vehicles (FAME) and state decision to link technology to mobility is what enabled this ambitious plan to get off the ground. The national government's FAME scheme provided 60% of the funds for the initial 80 electric bus procurement. FAME is also partly subsidising the installation of charging infrastructure.

Effective public partnership enable rapid transitions:

The national and state-level long-term vision has enabled Kolkata to be first Indian megacity to transition its entire bus and ferry fleets to electric models.

The West Bengal State Government has come up with the remaining funds for the buses and charging stations, as well as the last infrastructure costs. The West Bengal Transport Corporation – the state-owned enterprise that runs Kolkata's public transport system – is responsible for the implementation of this city-wide project.

What are the co-benefits?

Social:

Effective policies to maintain public transport's impressive modal share are crucial to ensure that urban mobility options are more equitable, sustainable, and inclusive to all citizens.

Health:

These developments will mean that the insidious health risks associated with direct exposure to particulate matter and poor air quality will be substantially mitigated for regional citizens.

Economic:

The electrification of 5,000 buses will save 11 million litres of diesel fuel, meaning the city will see net savings of \$98 million per year by 2030.

Environmental:

By 2030, the electric buses will reduce CO₂ emissions by 782,560 tonnes, NOx emissions by 1.3 million tonnes, and carbon monoxide emissions by 1.7 million tonnes each year.

The introduction of 5,000 electric buses by 2030 will reduce CO₂ emissions by 782,560 tonnes every year.



GUANGZHOU:

City-wide rapid bus electrification

→ The year 2018 witnessed the **rapid conversion of Guangzhou's entire fleet of 11,220 buses to models run solely on electricity**. This ambitious project, which also included the installation of 4,000 charging stations across the city, required an investment of \$2.1 billion.

Given the necessity for a well-planned network of charging stations, extensive adjustment to the city grid, and the myriad green finance instruments involved, **significant cooperation within the different hierarchies of the Chinese government** was required to see this project to a successful completion.



What has the city achieved?

Guangzhou has become one of China's forerunners for sustainable urban mobility, racing alongside 30 Chinese cities aiming to have all their buses running on electricity by 2020. Despite each electric bus costing about \$266,000, Guangzhou, alongside other Chinese cities, have not been put off by these large investments, as the country is home to around 99% of the electric buses currently in operation worldwide.

The city's six million citizens were the ones who demanded the e-bus transition as the air and noise pollution of the previous fossil-fuelled buses had become a major irritant. This project had the goal of shifting the city to be more attractive, liveable, and user-friendly. For example, with bus stops now a more agreeable place to be, the city

hopes for these spaces to become more social, as well as harbouring more small and medium enterprises. Guangzhou's bus transition is only one aspect of its sustainable urban mobility plans. Within three years, the city hopes to realise the electrification of all taxis. Financial incentives have also been introduced to promote the private ownership of electric vehicles. This explains why the charging needs of these other types of EVs were planned for in the design of the city-wide bus network in order to maximise the opportunities for investment cost recovery via charging service fee income.

Guangzhou 

GUANGZHOU

↓ 249K

TONNES OF CO₂ EMISSIONS are estimated to be reduced yearly via the electrification of 11,220 buses

What can other cities learn?

Strong urban governance is required:

Ambitious projects such as these demand strong and effective leadership from all facets of society: local government, industry, bus companies, and civil society. Greater engagement and cooperation between different areas of the public sector had to take place to allow for more effective public-private partnerships, as well as devising the crucial green finance instruments.

Making use of green finance instruments:

Guangzhou city officials, in collaboration with financial institutions and the involved bus manufacturers, operators, and transport companies, made good use of a plethora of green finance instruments. Some of these include: the financial leasing and rental contracts for acquiring electric buses, zero-margin benchmark interest rates, and purchase discounts for vehicles.

What are the co-benefits?

Social:

The work lives and health of the city's 30,000 bus drivers are now easier and better, thanks to the e-bus transition.

Health:

The elimination of local air pollution, as well as the halving of noise pollution, improves the health of Guangzhou's citizenry. The need for noise-reducing building seals has also been decreased, enabling architects to make greater use of natural ventilation, thereby reducing energy demand for cooling.

Economic:

The lifetime energy costs for electric buses is 20% lower than conventional fuel buses, resulting in energy cost savings of around \$58 million. Maintenance costs are approximately 20% lower, too.

Environmental:

The electrification of these buses is estimated to reduce CO₂ emissions by 249,000 tonnes, and nitrous oxide emissions by more than 16,000 tonnes, annually.

Guangzhou's ambitious sustainable urban mobility project includes the electrification of its entire fleet of 11,220 buses, as well as constructing 4,000 charging stations across the city.



COPENHAGEN:

Cycle Superhighways - where both people and the climate are winners

→ The year 2012 marked the start of an ambitious 33 year project, a collaboration between the Capital Region of Denmark and 26 municipalities to **create 746 kilometres of cycling paths** across 45 interconnected routes to form a cohesive network.

This significant \$332 million investment in the regional cycling infrastructure is what has enabled Greater Copenhagen to maintain its reputation as **one of the globe's most cycling-friendly regions**.



What has the city achieved?

In the seven years since its inception, 167 kilometres of Cycle Superhighways have been built, with an additional seven more routes expected to be completed over the next two years. These superhighways connect residential, educational, and business areas as well as public transportation hubs and stations. This highly coordinated, long-term planning has made cycling to work easy, safe, and flexible for all the region's citizens. Indeed, between 2007 and 2016, the number of cycle journeys has risen by 20%, with 408 million cycle journeys taking place every year.

Even though 24% of all regional journeys are by bicycle, this conurbation is not resting on its laurels. The Cycle Superhighways project hopes to increase the number of annual bike trips in the Capital Region by 6 million.

It goes without saying that traffic does not take municipal borders into consideration, which is why much of this initiative's success can be attributed to the cooperation between the 26 participating municipalities and the Capital Region of Denmark. Without the long-term political will, a project of this magnitude across an area of this size would not be possible.

This forward-thinking project provides a good example of how working together can help solve some of society's most pressing issues.

Copenhagen 

COPENHAGEN

↑ 6 MILLION

ADDITIONAL CYCLE JOURNEYS expected to take place every year by 2045

What can other cities learn?

Focus on cost-effective modes of transportation:

Increasing the number of cycling commuters is an extremely cost-effective way of reducing large amounts of CO₂ and NO_x emissions, while also significantly improving public health. Compared with other regional infrastructure investments, the Cycle Superhighways project is significantly cheaper as the route network offers a socioeconomic return of 19% compared to 3.1% for the city's new City Circle Metro Line.

Divide task to ensure successful implementation:

Various public actors have played different roles in this project. The process of planning and constructing the Cycle Superhighways lies entirely with the participating municipalities. The Capital Region has provided financial support by co-financing the coordinating office with 75% funding. The state has contributed 50% of the total construction costs, with the local municipalities, as well as public funds, filling the remaining gaps in funding.

What are the co-benefits?

Social:

Every year, this completed initiative will result in 720,000 fewer car journeys, as well as 55,000 fewer hours spent in traffic. As a mode of transport, cycling is a time-efficient way of exercising as part of a person's daily commute.

Health:

An additional 6 million cycle journeys are expected to take place annually. The city expects approximately 40,000 fewer sick days per year, thereby resulting in significant public cost savings, as well as significant extra tax revenue.

Economic:

This scheme will result in less congestion, which is important given the fact that car traffic is on the rise in the Greater Copenhagen region. The enhanced cycling infrastructure will lead to a \$860 million surplus thanks to the myriad economic benefits.

Environmental:

The 45 Cycle Superhighways will result in an annual reduction of 1,500 tonnes of CO₂ emissions, as well as avoiding 2,500 kilograms of NO_x emissions per year.

Despite one out of every four journeys already involving the bicycle, the Capital Region hopes to increase the number of annual bike trips by 6 million once the Cycle Superhighways project is completed in 2045.



BUCARAMANGA:

Boosting Bucaramanga's bicycle inclusiveness



→ Since 2016, Bucaramanga's Mayor's office has **put the bicycle high on the city's transport agenda.**

The creation of the Bicycle Office, as well as the first dedicated 2.6 km bicycle lane connecting the public library with the public university, were the first two concrete implementations by the city on its quest to increase cycling ridership to 5% by 2030. Following this, the Cycling Strategy was published in 2018, thereby **creating an institutional framework in order to implement, replicate, and upscale these ambitious city-wide developments.**

What has the city achieved?

Like countless cities around the world, Bucaramanga struggles with congestion within its city limits, in spite of the mean travelling distance being less than 7 km. In early 2016, it did not have any bicycle infrastructure and cycling represented less than 1% of modal share. However, by taking a strong, forward-thinking political stance, city officials have steadily introduced cycle-inclusion policies, with the overarching goal of significantly boosting bicycles as a viable transportation alternative, thereby decreasing both noise and local air pollution and reducing carbon emissions from transport. By the end of 2019, construction will end on a 20 km cycle path network – a \$4.4 million investment – along the main urban thoroughfares. Following which, residents from all backgrounds of this metropolitan of one million inhabitants will have greater access to safe and

direct cycling routes as roads are transitioned away from motorised transport. A pilot bike-sharing system, with 210 bikes spread across 12 bicycle stations, which represented an \$400,000 investment, will have also been implemented.

The recent declaration of the “hecho metropolitano” means that all these developments are legally enforceable for the entire Metropolitan Area. Hence, the three neighbouring city municipalities of Girón, Floridablanca, and Piedecuesta will have to be cycle-inclusive by 2030 at the latest.

Bucaramanga 

BUCARAMANGA

↑ 200

KILOMETRES OF CYCLING ROUTES by 2030

What can other cities learn?

Widespread bicycle integration is the key:

Successful integration of the bicycle with the city's other modes of transport is crucial for this scheme to be a long-term success and for the bicycle to become a go-to for Bucaramanga's residents. So, in addition to the cohesive, interconnected 200 km cycling network planned by 2030, ample bicycle parking infrastructure at bus stations, as well as facilitating bringing bikes onto public buses, are all goals the city plans to implement in the medium- (2025) and long-term (2030).

Create the space for new organisations to flourish:

Since the city's bicycle initiatives started in 2016, Ciclamanga – an organisation run by part-time volunteers – has also spearheaded the development of "Bicultura" (bicycle culture) throughout Bucaramanga. By taking the lead via visionary, long-term policy, the Mayor's office has helped foster a space for other organisations to help the transition towards sustainable and equitable forms of transportation.

What are the co-benefits?

Social:

Cycling is one of the most equitable forms of transport available due to the relatively low cost of bicycle acquisition and maintenance.

Health:

Increased physical exercise via urban cycling will likely lead to an overall boost in citizens' health, with a likely reduction in the number of cardiovascular cases in the Bucaramanga metropolitan area.

Economic:

Investing in cohesive, interconnected cycling networks often results in significant long-term return on investments due to increased economic activity from the local citizenry, as well as reduced costs related to health issues connected to excessive local air pollution.

Environmental:

Bicycles are one of the most efficient modes of transport from a carbon emissions perspective. Moreover, the greater the modal share of non-motorised transport, the lower the concentration of local air pollutants across the city.

An attractive, safe, and segregated 20 km cycling route network along Bucaramanga's main thoroughfares will be completed by the end of 2019.



BOGOTÁ:

City gets Bogotanos on the move with green commuting

→ Three years after Bogotá's city government introduced its comprehensive "Integral Sustainable Mobility Plans" (PIMS: the Spanish acronym), results are starting to gain serious traction, with **more than 150,000 people now actively commuting**. Being home to one of the highest population densities in Latin America, effective public policy through PIMS was the **crucial tool used by the city's policymakers to help ease the myriad problems connected to excessive, widespread private vehicle travel**. The initiative "Muévete Mejor" (Move Better), under which administrators coordinate and promote the overarching strategy, works by guiding and supporting participating public and private organisations, with implementation undertaken by the entities themselves.



What has the city achieved?

So far, 71 public organisations, 18 universities, and 77 private companies are actively involved in the network, though it is the involvement of the private sector that is key to successfully transforming the city. The 5,200 companies that each employ at least 50 employees – more than 1.9 million employees in total – are the entities this ambitious scheme hopes to inspire next. The largest 1% of organisations employ 48% of the population. By implementing a suite of strategies – from teleworking to increasing the share of employees commuting by bicycle – these companies could have an overwhelmingly positive impact on the quality of city life.

In addition to infrastructure investment, Muévete Mejor has demonstrated that to achieve long-term cultural change it is essential to provide frequent training workshops and events to inspire positive behavioural changes. The annual bicycle-to-work week led to 121,542 trips taking place over 2017 and 2018, with 649 tonnes CO₂ emissions avoided. The 40 monthly car-free days have led to 100,000 bicycle trips. This prevented 387 tonnes of CO₂ from being emitted in 2018.

Bogotá 

BOGOTÁ

↑ 150K

MORE ACTIVE COMMUTERS since the project's inception in 2016

What can other cities learn?

A multi-pronged approach:

By using different strategies over time, the city has inspired different people at different times of the year. Carpool week – involving more than 80 organisations – led to more than 2,200 trips with a shared private vehicle. In the 11th Bicycle Week 34,530 journeys took place. In the Bike and Pedestrian Challenge, 74 organisations mobilised 19,638 trips, of which 30% were pedestrian caravans. During the inter-city challenge – Bogotá vs Medellín – 2,600 public sector workers commuted by bicycle.

What are the co-benefits?

Social:

By positively changing people's habits, an increase in workers' quality of life is often achieved, with a greater sense of community being fostered thanks to the general interest prevailing over private interests.

Health:

Active commuters are exposed to significantly lower concentrations of air pollutants, which reduces the risk of developing respiratory and cardiovascular diseases. Average cycling commuters travel 8.9 km per trip, equating to approximately 35 minutes of physical activity.

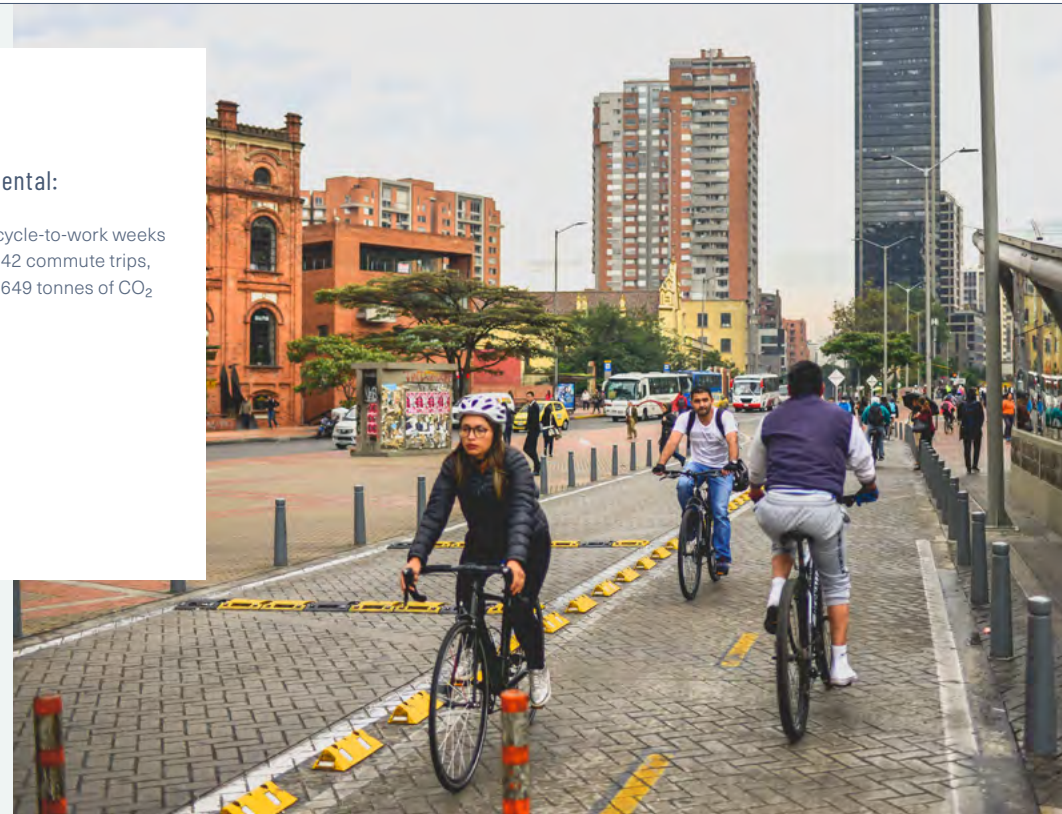
Economic:

Active commutes and/or public transport journeys result in substantially lower commuting costs for workers.

Environmental:

Just two bicycle-to-work weeks led to 121,542 commute trips, preventing 649 tonnes of CO₂ emissions.

The city's multi-pronged approach to promoting sustainable urban mobility has led to 150,000 more active commuters since 2016 when the project launched.



BENGALURU:

Re-designing a city to be people- and bicycle-centric

→ Since 2013, Bengaluru's project Tender Specifications for Urban Road Execution (SURE) has focused on **re-designing the city to prioritise active forms of transport, as well as public transport options.**

With more than 7.5 million registered motor vehicles, congestion has become an ever-increasing issue, thus **demoting motor transport options has been seen as an essential strategy.** Such has been the success of the project that 90 roads are already part of Tender SURE, with investments totalling \$137.3 million.



What has the city achieved?

Encouraging behavioural change towards more active forms of transport is not easy, which is why Tender SURE has constructed an array of infrastructure that makes public and active transportation a more pleasant experience. These measures include widened footpaths, an expanded cycling network, more bus bays and bus lanes, and improvements to make bus stops more enjoyable places to be. A far better integration of numerous public utilities within the city's re-design has been essential to reduce the disruption and economic costs associated with the maintenance and repairs of these roadworks, thereby aiming for long-term solutions instead of short-term fixes.

With more than 12 million citizens living in the metropolitan area, the average citizen spends more than 240 hours stuck in traffic every year. Certain Tender SURE sites have seen pedestrian volumes increase by 250%, as well as a likely reduction in transport-related air pollution. Safety has increased, too. In a country in which 37% of total deaths from road accidents are pedestrians, road accidents in Bengaluru have decreased from 6,024 in 2011 to 4,611 in 2018. Finally, the city's urban heat island effect – an increase of 2.5°C over the past 30 years – has been targeted by planting more vegetation.

Bengaluru 

BENGALURU

↓ 154 MILLION

REDUCTION OF CAR TRIPS per year are hoped to be seen through the project Tender SURE

What can other cities learn?

Seek the residents' advice:

As most of the works have taken place in the CBD of Bengaluru, in order to receive residents' feedback and advice two weeks of door-to-door campaigns with local residents and property owners took place. In addition, residents were informed with warnings of the planned upcoming major city works.

Inspire other cities:

So successful has the Tender SURE been thus far that other major Indian cities like Nagpur, Chennai, Hyderabad, Bhopal, Indore, and Vadodara have enquired about how to best go about developing their own respective sustainable urban mobility projects.

What are the co-benefits?

Social:

In India, pedestrians are disproportionately at risk of being involved in a road accident. Bengaluru's project has already demonstrated a reduction in the total number of traffic accidents.

Health:

The increased uptake of walking, cycling, and using public transport results in more active lifestyles, which improves the public's general health.

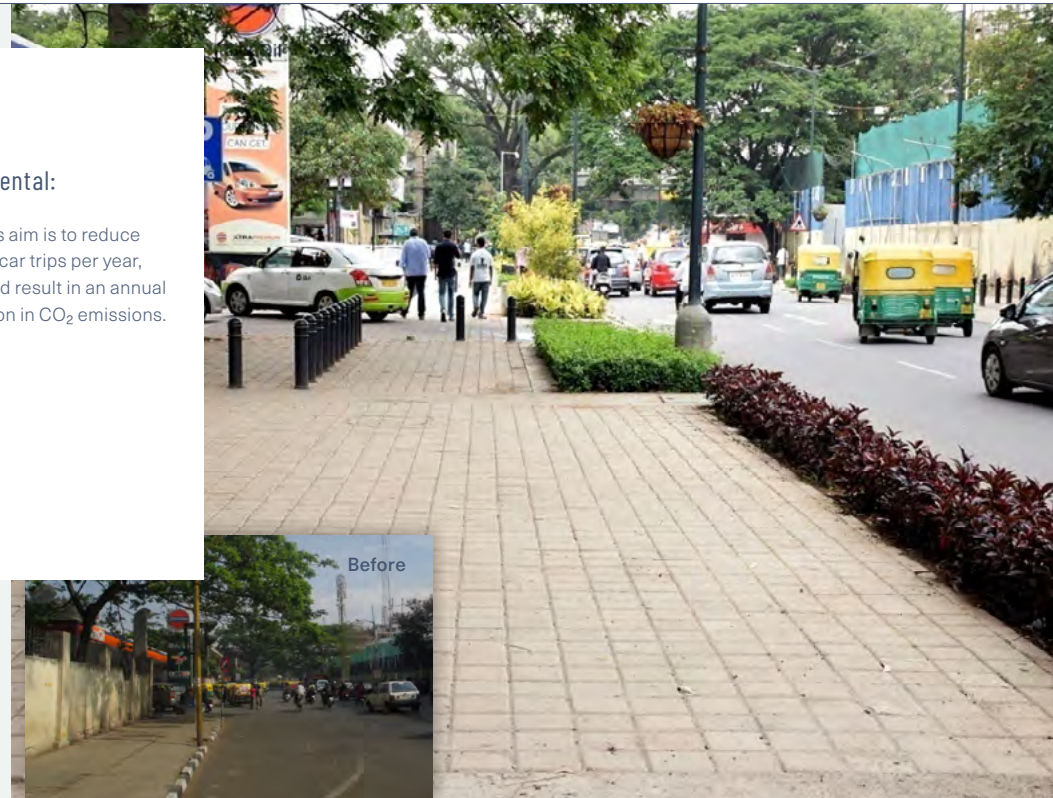
Economic:

Active forms of transport and superior public transport options are more equitable forms of transport, providing a greater segment of the city's population with access to transportation.

Environmental:

Bengaluru's aim is to reduce 154 million car trips per year, which would result in an annual 5% reduction in CO₂ emissions.

Increasing the total surface area of dedicated footpaths has been a key strategy of re-designing the city centre to be more pedestrian-friendly.



A photo prior to construction is pictured in the bottom left.

HALDEN:

Sustainable mobility meets the sharing economy

→ February 2019 was the month Halden Municipality **shifted its mobility policies**. It decided to lease 20 electric vehicles (EVs) and to purchase 20 electric bicycles for its 2,200 employees, in order to put its transportation funds to better use, as well as **significantly reduce its transportation sector air pollutants and CO₂ emissions**.

Outside office hours, the city's 30,000 residents and tourists are able to rent on an hourly basis any of this diverse mix of EVs from the private car-sharing provider Mobility Park via the public national mobility platform app Entur.



What has the city achieved?

After the municipality determined it had paid \$268,795 in employee travel allowances in 2017 for trips mostly using private fossil-fuel cars, it decided to research alternatives. Given that one-third of these trips were under 3 km, it opted to purchase 20 electric bicycles to fulfil the majority of all 5 km Halden-based employee trips.

The municipality has initially leased the 20 EVs until January 2020, after which time it can decide whether to extend the lease agreement for another two years, depending on the success of this pilot project. Halden Municipality hopes that by creating this consistent EV demand, the car-sharing provider can offer lower rates for all users,

thereby making it more attractive for citizens to rent rather than own a vehicle. The municipality has big hopes for this forward-thinking scheme. It points out that there are about 507,000 public sector employees across Norway. If similar schemes were scaled nationwide, it could reduce CO₂ emissions by 14,000 tonnes each year. On a grander scale, were all private workplaces – with their 2.7 million employees – to make similar solutions available, 73,600 tonnes of annual CO₂ emissions could be avoided.

Halden 

HALDEN

↓ 14K

TONNES OF CO₂ EMISSIONS potentially reduced
were all Norwegian Municipalities to implement
similar projects

What can other cities learn?

Make the most of national policies:

This project would not have been financially feasible without the national Climate Action Program fund "Klimastas," made available by the Norwegian Environment Agency. This \$195,627 was crucial for constructing the costly charging infrastructure supplied by private supplier, Schneider Electric Norge. The municipality does not expect a full return on investment for this project. The national fund has an overarching goal of mainstreaming sustainable solutions across a number of Norwegian municipalities, including Halden.

Short-term, reduced-risk pilot projects make good sense:

The initial leasing of the diverse 20 EVs is for an 11-month period, after which the municipality will decide whether to prolong the lease by an additional two years, depending on the success of the innovative scheme.

The car-sharing solution and charging stations required \$258,920 of investment. Each EV costs the municipality \$371 per month. The electric bikes and charging hubs demanded an investment of \$120,828, with the bicycles expected to last 5-10 years.

What are the co-benefits?

Social:

The municipality hopes this car-sharing initiative will reduce the social differences between its residents, as lower-income families now have access to a more affordable mobility option.

Health:

A Norwegian study indicated that each sharing car has the potential to take 10 private cars off the road, meaning this initiative will likely reduce air pollution in the city.

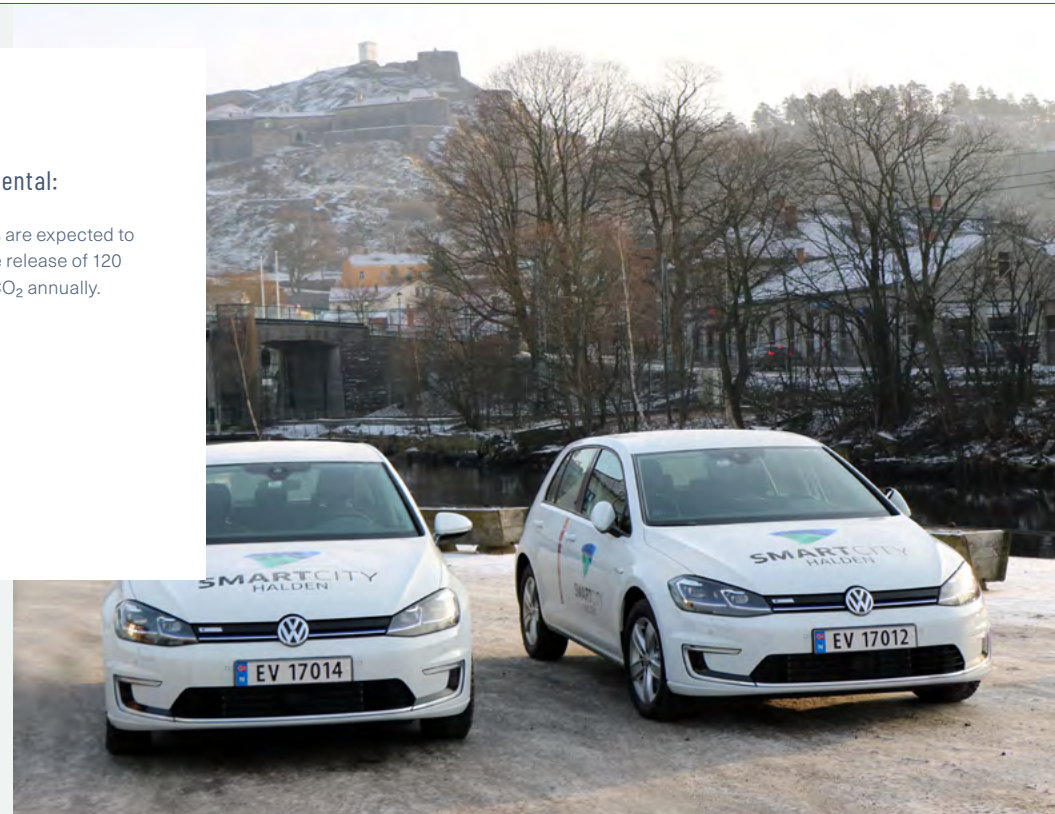
Economic:

Car-sharing solutions allow for more effective land-use planning, in effect lowering the demand for car parking spaces. 1,000 new homes are planned in the centre of Halden, with more in the pipeline.

Environmental:

The 20 EVs are expected to prevent the release of 120 tonnes of CO₂ annually.

By leasing 20 EVs and purchasing 20 electric bicycles, Halden Municipality expects to reduce its yearly transport-related CO₂ emissions by 120 tonnes.



FORTALEZA :

Prioritising public transport, cycling, and walking

→ Since 2013, the rapidly growing city of Fortaleza has promoted public transport, cycling, and walking at the heart of its urban mobility framework in order to **rapidly transition from a car-centric to a people-centric city**.

Once Fortaleza public officials discovered that transport-related greenhouse gas emissions were citizens' major CO₂ contribution, this coastal city, thanks to strong political leadership, decided to **prioritise city-wide urban mobility projects to reduce emissions** via a more equitable division and notable reorganisation of road space.



What has the city achieved?

The northeastern Brazilian city is the latest urban entity to transition from the unsustainable individual transport model. It has managed to do so by rapidly implementing a mix of low-cost – approximately \$5.4 million – yet highly impactful interventions by learning from cities that have successfully implemented urban mobility best practices.

Over six years, dedicated bus lanes have expanded from 3.3 km to 107.4 km, with another 42.6 km expected by 2020. Twenty shared electric cars have been introduced, as well as 800 shared bicycles. By the end of 2020, both these schemes will have been scaled up to 100

and 4,000, respectively. The cycling path network has been expanded from 68 km to 257.5 km, with the initial goal of 236.2 km already having been surpassed. The boost in cycling infrastructure has been particularly effective, as a recent survey about the shared bike system indicated that 12% of cyclists used to be car or motorcycle drivers. Finally, the city has benefited from a plethora of environmental benefits thanks to widespread urban tree planting.

Fortaleza 

FORTALEZA

↓ 266K

TONNES OF CO₂e are estimated to be reduced via the project by 2020

What can other cities learn?

Political vision and will instrumental:

The ongoing success of Fortaleza's urban mobility planning can be partly attributed to Mayor Roberto Cláudio's strong advocacy toward climate change issues and preference for evidence-based policy-making. The municipality's highly qualified technical staff, with ample support from key international partners, have also been instrumental in the rapid and effective implementation of myriad projects.

Private partnerships integral for quick roll-out:

The city's development paradigm has been significantly shifted with relatively few financial resources. Strong partnerships with private sector stakeholders have been pivotal for the swift implementation of certain projects, as well as keeping costs low for the municipality. Public hearings and workshops were organised to keep local communities engaged and informed over the projects' design and development.

What are the co-benefits?

Social:

These transport alternatives have promoted social inclusion and made the city more accessible to a larger segment of the population. Today, 93% of local people live within 500 metres of the public transportation system, while 40% are within 300 metres of the extensive cycling network.

Health:

The city's roads are safer. Road fatalities have decreased from 14.7 fatalities per 100,000 inhabitants in 2014 to 8.6 in 2018 – a 42% decrease. Over the same timeframe, there has been a 46% reduction in the number of serious traffic-related accident patients.

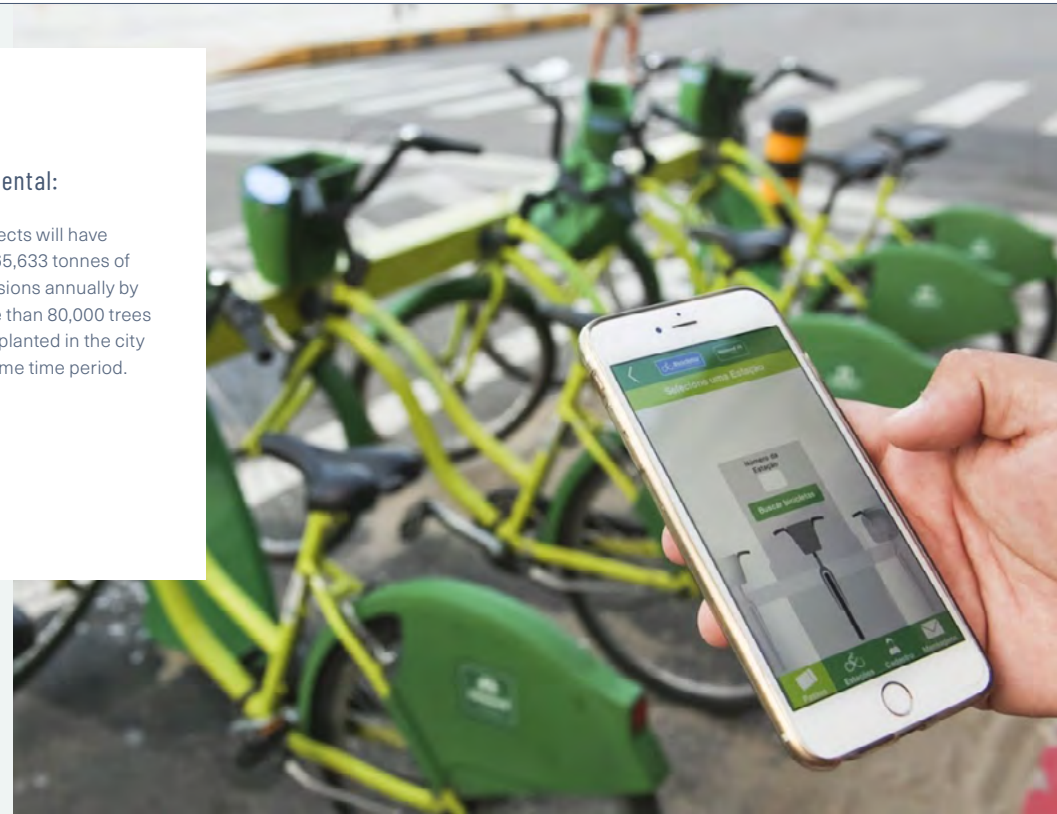
Economic:

Making roads safer has significant economic benefits for the municipality. Compared to 2016, the city saved \$34,123,164 – a 19% decrease – in costs related to traffic accidents in 2017.

Environmental:

These projects will have reduced 265,633 tonnes of CO₂e emissions annually by 2020. More than 80,000 trees have been planted in the city over the same time period.

As of 2020, 4,000 shared bicycles will be available to use across the city's 257 km of cycling paths.



2019

Cities100

SUSTAINABLE WASTE MANAGEMENT

→ Urban waste is no longer a wasteful matter, as cities are turning to innovation and the circular economy. From cities that are reducing waste via online tools or recycling, to transforming traditional landfills into ecological conservation sites and inventing ways to turn waste products into clean water, cities are re-imagining waste into valuable resources.



ZHENJIANG:

First Chinese city to treat food waste and sludge in one plant

→ A first in China, Zhenjiang has introduced **co-digestion of kitchen food waste from its restaurant industry** along with sludge from household sewage treatment plants.

Numerous synergies in the process **enables the city to save on resources and limit environmental impacts** from the treatment process. Its innovative approach enabled the pilot project to be named a national demonstration project for co-digestion.



What has the city achieved?

Home to three million people, Zhenjiang was dealing with the same issues that most large cities around the world face: How to best handle waste? Zhenjiang has a booming restaurant and catering industry with around 2,600 food service businesses that generate approximately 203 tonnes of food waste every day. Faced with large amounts of food waste, as well as domestic sludge from a growing urban population, the city initiated China's first project for comprehensive treatment of organic urban waste in one plant.

Zhenjiang is the first Chinese city to use anaerobic co-digestion of food waste and sludge in a municipal wastewater treatment plant. The city's project of co-processing kitchen waste and domestic sludge has a number of advantages as

it saves resources as well as construction and operation costs. In the digestion process, there are additional synergies, as the kitchen waste dilutes the concentration of heavy metals in the sludge and the sludge dilutes the concentration of salt from the food waste. This results in reduced amounts of toxic substances in the digestion process as well as lowered concentration of oil in the substrate. In phase two of the project, the plant will be able to handle 360 tonnes of waste per day and aims to have zero waste emissions throughout the process.

Zhenjiang ○

ZHENJIANG

↓ 153 MILLION

tonnes of carbon emissions reduced each year
once phase two is completed

What can other cities learn?

Acquired knowledge demands sharing with peers:

The project is run by Jiangsu Hongrun Biomass Energy Technology Company. Since thoroughly learning a set of technologies concerning the coordinated treatment of organic urban waste, the company has acquired 43 national patents concerning the techniques. To make sure this knowledge is widely shared, the company receives visits and has had guests from more than 100 organisations from Taiwan, Shanghai, Shenzhen, Zhuhai, Dalian, Xi'an, Suzhou, Wuxi, and other provinces and cities.

Near zero emissions in waste process through careful execution:

The process of treating the waste is carefully considered to make full use of the resources. The "raw materials" used are kitchen waste from restaurants and canteens and sludge from household sewage treatment plants. Through the treatment: biogas slag, fluid, and gas are made full use of, and the waste grease can be turned into biodiesel. The whole process has nearly zero emissions and recycles energy, water, and carbon.

What are the co-benefits?

Social:

In addition to the environmental benefits of co-digesting food waste and sludge, the project has created employment opportunities for the local community and migrant workers. Employment at the treatment plant increased from 43 to 105 with the co-digestion project.¹

Health:

The project pre-treats the waste at the source for minimum environmental and health impact. Kitchen waste is put into specific barrels, which are collected by professionals, and the waste is treated in vehicles, which means there is no air pollution from the waste which could otherwise have been harmful to humans and the environment.

Economic:

Phase one of the project produces 11,000 m³ of biogas and 30-40 tonnes of biochar per day and sends 3-4,000 m³ of biogas to the municipal gas pipeline.

Environmental:

Since the project was put into operation in June 2016, it now handles 210 tonnes of kitchen waste and 120 tonnes of sludge each day, reducing CO₂ emissions by 15,300 tonnes annually.

The company running the co-digestion plant has focused on minimising negative environmental impacts on the local community and placed the plant more than 650 metres from the nearest residential area and included pre-treatment in the process to reduce odours.

¹Source: Global Methane Initiative (2019)



SYDNEY:

Sydneysiders recycle and save their food scraps

→ Sydney is on a path to **divert its waste from landfill** and is starting the journey by taking a hard look at the waste in its buildings.


Introducing an ambitious plan to recycle and cut down on waste as well as implementing a programme to collect food waste, the city is beginning to see numbers heading in the right direction. After **extensive collaboration with all actors involved**, and by providing adequate help to residents and tenants, Sydney will soon be on track to reach its goal of diverting 70% of waste from city-managed properties by 2021.



What has the city achieved?

In Sydney, the city's portfolio of buildings generates more than 800 tonnes of waste each year. Currently diverting just 35% of waste from landfills, the city has a goal to increase its diversion levels to 70% from city-managed properties by 2021. One of the ways in which Sydney is tackling its new goal is via the introduction of a waste management programme for its buildings, aiming to cut down on generated waste and begin collecting wasted food as part of the Food Scrap Collection project. Starting with five sites representing all the building types in the city's portfolio, the waste profiles and service needs of the sites have been assessed and improved. The improvements made include redesigning the layout of waste stations, updating signs in the buildings, adjusting the service levels,

and introducing food waste collection in two of the properties. The collected food waste is sent to a facility that processes it to produce green electricity and high-quality compost. After the first four months of the food collection service, the average amount of food waste destined for landfill per month has dropped by up to 40% at both sites. Additionally, an increased resource recovery rate of 6% and 16% has been observed at the City's Town Hall House and at the participating food court, respectively.

Sydney 

SYDNEY

↑ 10

tonnes of collected food waste from just two properties

What can other cities learn?

Make it easy to recycle to achieve quick results:

At one of the city's community centres, waste management improvements included adding more recycling bins and updating the sign and explanations to make it easy to understand what to do as well as making the signs consistent throughout the building to avoid confusion. Furthermore, the staff at the centre also assisted in translation of some signs to help regular visitors from the local community better understand the recycling messages. The overall waste generated has dropped by 17% when compared to the same time last year and the average resource recovery rate has increased from 27% to 36%.

Collaborate to ensure efficient project delivery:

The uniqueness of this project was the collaborative elements that helped drive the project's efficient and effective outcomes. All actions were underpinned by tenant and stakeholder engagement throughout the project. A diverse working group represented by council members, cleaners, waste contractors, and tenants worked to implement the project in just over six weeks, and after six months the city has seen a significant overall reduction in waste sent to landfill, and an increased rate of resource recovery across the buildings involved.

What are the co-benefits?

Social:

More than half the respondents had initiated waste improvement measures in their own homes. The change in the social norms associated with workplace waste management practices could therefore encourage improvements in personal and home environments.

Health:

By reducing the generation of waste at the sites, the need for collection has been reduced as well, which means fewer transportation vehicles driving through the city from sites to landfills. Less transportation results in less pollution and cleaner air for Sydneysiders.

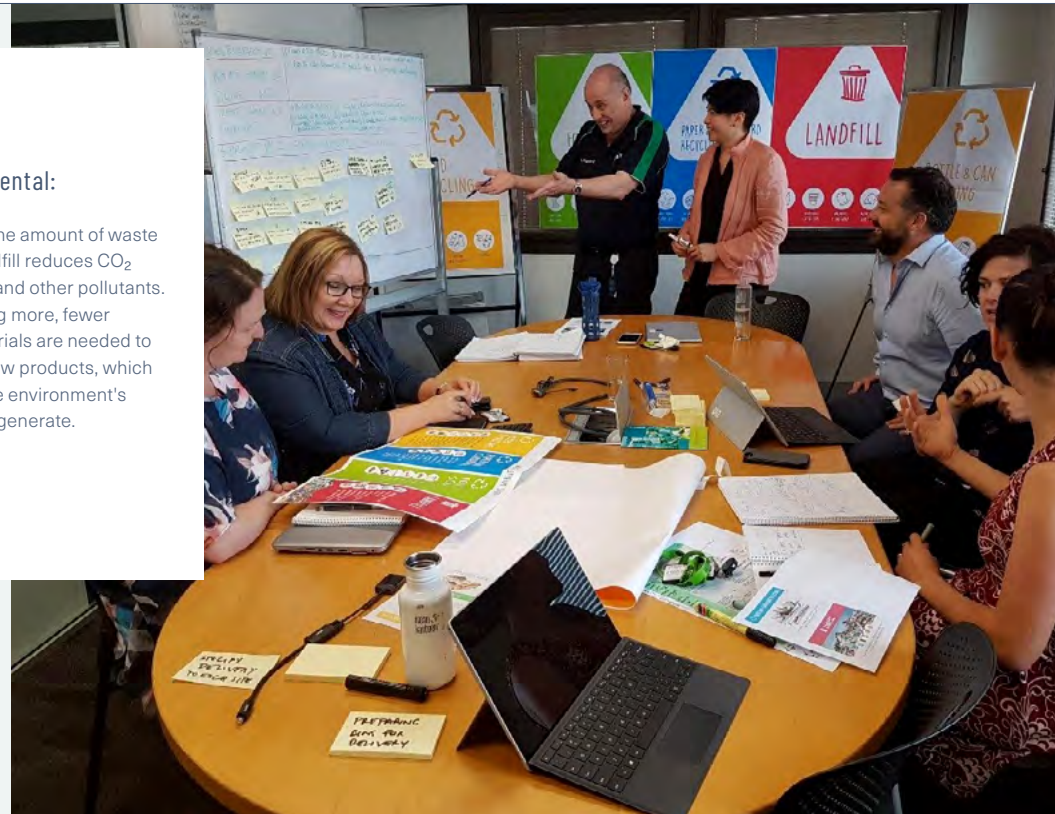
Economic:

There was no increase in costs associated with the reduction in landfill collection costs compared to the additional food collection service for each site. This project will help to quantify the economic impact of offering an alternative waste recovery service compared to sending food waste to landfills.

Environmental:

Reducing the amount of waste sent to landfill reduces CO₂ emissions and other pollutants. By recycling more, fewer virgin materials are needed to produce new products, which benefits the environment's ability to regenerate.

The city took the time to have face-to-face meetings with the buildings' tenants to ensure adequate participation and interest in partnering with the city to make the project a success.



SÃO PAULO:

Composting waste to boost circular economy

→ The City of São Paulo has tackled its issue of sending tonnes of organic waste to distant landfills by **constructing semi-local composting facilities** in the city.

Currently handling up to 50 tonnes of waste daily, the composting yards are not only **diverting waste from landfills, but creating compost that is then used in public spaces in the city or given to visitors for free**. The project also includes urban garden programmes in which citizens are incentivised to grow their own food and become more environmentally aware.



What has the city achieved?

In the most populous city of Brazil, street markets in the hundreds serve not merely as local vegetable and fruit providers but are also integral to the social lives of residents. Boasting 883 street markets in total, São Paulo generates 34,000 tonnes of organic green waste every year, which is on top of 39,000 tonnes from the city's tree and plant pruning. With the "Sustainable Street Markets and Gardens Program," São Paulo is combatting this waste issue by building five composting yards, each with the capacity to receive up to 10 tonnes of waste per day. By the end of 2020, the programme will provide adequate disposal of the organic waste from all its street markets as well as divert the city's pruning waste from landfills.

Every year, each of the composting units will recycle around 3,000 tonnes of organic waste and produce 600 tonnes of compost while reducing the use of landfills, reducing the movement of waste collection trucks, and minimising GHG emissions overall. The compost is used in and around the city, and visitors get compost for free. A part of the programme includes teaching citizens about growing food themselves and the urban garden programmes are proving popular with a rising number of visitors.

São Paulo 

SÃO PAULO

↓ 9.1K

tonnes of waste diverted from landfill since 2015

What can other cities learn?

Low tech solutions can solve large issues:

The city did not need to make large investments in major waste management facilities for this programme; they just needed to build the sheds for the composting, using only organic materials. Not only did this cost significantly less but it has also been a much quicker process due to avoiding a lengthy construction phase. In addition, the composting yards with their additional urban gardens are aesthetically pleasing and coexist well with the urban landscape.

Considering logistics can lead to big improvements :

The composting yards are located in urban areas surrounded by residents to reduce the distance from where the waste is generated to its disposal site. The shorter distances mean that the waste collectors are emitting fewer emissions and causing less pollution, leaving the air cleaner for the São Paulo residents. By considering the logistics of its waste management, the city has been able to provide a whole new approach to its management of organic waste and generated myriad co-benefits.

What are the co-benefits?

Social:

The composting yards also function as educational hubs enabling citizens to get to know the process of composting and farming and to discuss actions that can be applied in their own homes for better environmental awareness. Since 2015, the Lapa composting yard has received more than 750 visits.

Health:

The programme has significantly reduced the presence of vectors due to better cleaning and the amount of waste discarded on the ground. Vendors place fruit and vegetable waste in specific bags for its collection and subsequent forwarding to compost yards. This reduces the risk of diseases spreading and limits odour in the area.

Economic:

While just 4-5 people have been employed in the compost yards thus far, the city is already planning to expand the scope of the projects, which will lead to more employment opportunities. Furthermore, the yards provide environmental education in aspects such as separation of waste.

Environmental:

To reduce CO₂ emissions and air pollution from waste collection trucks, the city is carefully considering the logistics of the composting yards, placing them as close to the source as possible, a maximum of 25-40 km.

Applying the resulting compost to the soil is leading to greater carbon soil sequestration in the city. The final goal is to divert 170 tonnes of waste away from landfills every day.



PARIS:

Reducing, reusing, and revalorising to tackle waste

→ Aiming to implement a circular economy, **the City of Paris has adopted a zero-waste strategy**. With the goal of sending as little waste to incineration as possible, the three-pronged plan includes reducing, reusing, and revalorising.

Amongst many initiatives, Paris has begun extensive collection of bio-waste, opened city-wide “ressourceries” teaching Parisians how to repair things, and rolled out public recycling bins that enable recycling for all people regardless of where they live. **Aiming to cut food waste in half by 2025**, the city has rolled out numerous initiatives, such as requiring food markets to develop partnerships with nonprofits to organise redistribution of unsold food.



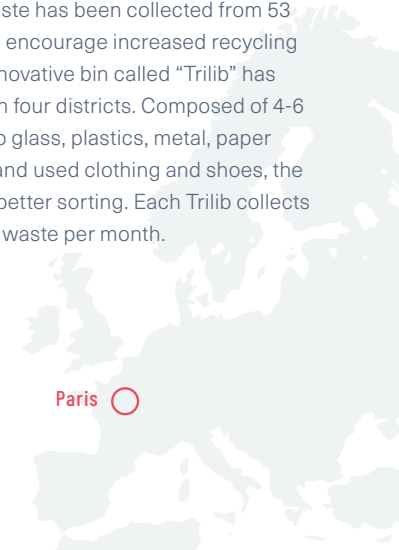
What has the city achieved?

On average, Parisians produce around 485 kg of waste a year, of which 37% comes from packaging and 22% from food waste. To combat this, Paris has set a number of targets as part of their zero-waste strategy: reducing food waste by up to 50% by 2025, reducing household waste by up to 10%, and ascribing value to every piece of waste and turning it into a resource. This strategy is included in Paris' Circular Economy Plan, in which the French capital is implementing ambitious initiatives to become more circular by 2020.

One of the key initiatives in Paris' zero-waste strategy is installing private door-to-door sorting and collection of bio-waste city-wide. The city is

also collecting bio-waste from restaurants and food markets. Since this collection began, 1,346 tonnes of bio-waste has been collected from 53 food markets. To encourage increased recycling in the city, the innovative bin called “Trilib” has been rolled out in four districts. Composed of 4-6 bins dedicated to glass, plastics, metal, paper and cardboard, and used clothing and shoes, the bins incentivise better sorting. Each Trilib collects about 1 tonne of waste per month.

Paris 



PARIS

↓ 80K

tonnes of waste has been reduced since the adoption of the zero-waste strategy

What can other cities learn?

Set up infrastructure to include local organisations in strategy:

Paris has selected 19 nonprofit organisations that will each receive \$547,000 to equip themselves with the logistics and supplies necessary to recover unsold food from supermarkets and redistribute the food to vulnerable or low-income communities.

A zero-waste strategy requires commitment:

In order to make sure that all waste is collected, the city has recently put up 30,000 new public bins, which essentially means a bin every 100 metres. In addition to the city's "Trilib" that are being rolled out, the 554 collective composting sites, and the 18 neighbourhood compost bins, the city is providing the waste management infrastructure needed to eventually obtain its zero-waste goals.

What are the co-benefits?

Social:

Paris has opened 15 ressourceries in each district, where unwanted objects are repaired and sold at low prices to low-income citizens. Yearly, the city organises recycling parties with comedy, music, and conferences to show how you can use the ressourceries. Citizens who bring faulty objects are taught how to repair them.

Health:

By enabling local nonprofit organisations to redistribute unsold food to locals in need, they are ensuring the most vulnerable in Paris can get free meals made of healthy fruit and vegetables.

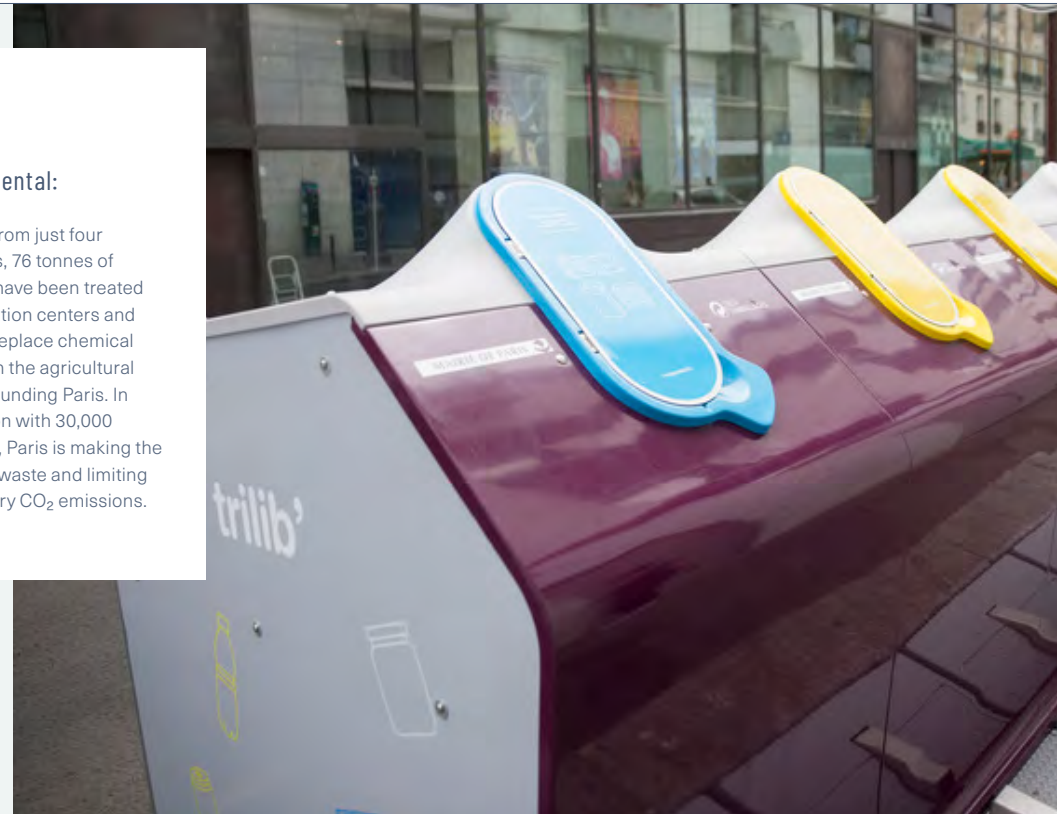
Economic:

The circular economy currently employs 66,500 people in full-time jobs, which represents 2.9% of Parisian jobs and produces annual value of \$7.8 billion.

Environmental:

Collected from just four restaurants, 76 tonnes of bio-waste have been treated at methanation centers and is used to replace chemical fertilisers in the agricultural fields surrounding Paris. In combination with 30,000 public bins, Paris is making the most of its waste and limiting unnecessary CO₂ emissions.

The "Trilibs" enables residents of parts of the city not currently able to recycle at home to separate their glass, metals, plastics, and cardboard in public bins. Citizens can even discard unwanted clothes or shoes, which enables proper reuse of valuable materials.



NÆSTVED:

How recycling glass leads to heat production and insulation material

→ In the southern part of the Danish island of Zealand, **Næstved Municipality has taken the circular economy to heart.** With the establishment of Resource City, Næstved is working to solve issues of sustainable waste management via reducing and recycling waste.

One of the ways it recycles waste is via its Glass Cluster, where two companies work together to **recycle 125,000 tonnes of glass every year.** The cluster not only produces new glass, but also creates insulation from byproduct glass and supplies a local city with 50% of its heating from surplus heat.



What has the city achieved?

Resource City is Næstved Municipality's ambitious climate project, which focuses on creating a cluster of companies working with circular economy principles. Resource City is a part of the municipality's strategy for recycling and waste reduction as well as business development and entrepreneurship. A part of the Resource City's Glass Cluster is Reiling Glasrecycling Danmark and Ardagh Glass Holmegaard showcasing best practice examples of circular economy. The glass cluster collects and sorts around 125,000 tonnes of glass per year, which is then recycled into around 800 million bottles and jars per year, reducing the need for virgin materials and avoiding 15,000 tonnes of CO₂ emissions per year. The Glass Cluster handles glass from all municipalities

and companies in Denmark. Surplus heat from the production is also distributed to the local district heating grid, contributing 14,000 MWh to district heating in the City of Fensmark. Næstved Municipality and Ringsted Municipality are collaborating with Danish Gas Distribution to install a biogas plant to supply Ardagh Holmegaard Glass with biogas to reduce the greenhouse gas emissions from natural gas. Finally, the latest undertaking is to turn byproduct glass, which cannot be recycled into bottles, into insulation to avoid any waste of materials and keep the resources in a continuous cycle of use and reuse.

Næstved 

NÆSTVED

↑ 90%

of collected and sorted glass in the municipality is recycled due to Resource City's Glass Cluster in Næstved

What can other cities learn?

Collaboration and partnerships enable innovative solutions:

The Resource City's Glass Cluster is an example of companies collaborating and continuously innovating to find solutions to turn waste into resources and to uncover opportunities for sustainable initiatives in their respective production facilities. Furthermore, Resource City and its Glass Cluster is an example of how a municipal project, working with private companies, can support each other in individual goals and sustainable development.

Sharing the project and results to increase knowledge-sharing:

One of the key activities of Resource City is to communicate about circular economy, the Glass Cluster, and Resource City's vision and projects. Resource City hosts four network activities a year and one yearly conference about circular economy. Resource City receives regular delegations of business professionals, politicians, and research institutions who are interested in learning more about their activities. Since 2016, Resource City has welcomed more than 2,200 visitors to the offices in Næstved.

What are the co-benefits?

Social:

Resource City has supported the establishment of one company and three new jobs in Næstved in the past year and is creating further employment opportunities for the local population.

Health:

If the Glass Cluster did not collect and sort waste glass for recycling, it would be sent to landfill or transported to other countries in the EU. As such, the Glass Cluster reduces transportation CO₂ emissions. In addition, recycling waste glass also reduces the emissions of nitric oxide and sulfur dioxide.

Economic:

Since 2015, surplus heat from Ardagh Glass Holmegaard's glass production has been distributed to the local district heating company Fensmark District Heating's grid. This collaboration has resulted in economic savings of approximately \$1.6 million for the district heating company.

Environmental:

Resource City is working on several projects focused on sustainable development: one example is the "Sustainable Urban Development" funded by the European Commission with the goal of creating 10 new green innovative products and solutions for SMEs to reduce the yearly energy consumption by 72,557 GJ as well as reducing CO₂ emissions by 1,914 tonnes.

The recycling of glass makes it possible to replace virgin resources, such as sand, soda, calcium, and other materials. By recycling glass, the energy usage in its production is reduced by 30%.



MILAN:

City tracks waste reduction efforts with online tool

→ In Milan, the city is working strategically to **include all citizens in its waste management efforts.**

By introducing the Environmental Meter, an online tool, the city is encouraging citizens to separate household waste by educating them in the environmental value of avoiding incineration. This is just one initiative of many that Milan is introducing to **transition to a city-wide circular economic system**, while also lowering CO₂ emissions and local air pollution and limiting the city's environmental footprint.



What has the city achieved?

For years, Milan has worked to grow its collection of waste, increase recycling, and reduce its production of waste. Along with 23 other cities, Milan has signed C40's "Advancing Towards Zero Waste Declaration", further accelerating the city's journey to zero waste. Milan's latest step on the zero-waste ladder is the Environmental Meter. Jointly developed by the city, its affiliated companies AMAT and AMSA, A2A Environment, and the national packaging consortium CONAI, the Environmental Meter is an online tool that shows the environmental and economic benefits of Milan's integrated waste management system, such as the reduction in CO₂ emissions, the quantity of water and electricity saved, the amount of spared raw material, or the number

of products that could be created from each portion of waste. Results from the Environmental Meter are displayed on the municipality's webpage to raise awareness of the importance of circular waste management in cities. As the engagement from the Milanese is vital to the success of the city's waste reduction efforts, the Environmental Meter specifically emphasises the significance of citizens' role to make Milan a more sustainable and liveable city, and provides data and practical examples of how to engage in waste reduction activities and improve recycling efforts.

Milan 

MILAN

↓ 350K

tonnes of CO₂ avoided due to increased waste separation in 2018

What can other cities learn?

Implement tracking tools to help the city stay on course:

The Environmental Meter enables Milan to rigorously monitor all waste management phases and track its progress in the mid- and long-term. This enables the city to know where to adjust or increase its efforts to make sure targets are reached.

Citizen engagement and outreach is vital:

In 2015, an earlier version of the Environmental Meter was reviewed in a questionnaire, which showed 61% of interviewees felt it was an effective tool to raise awareness on sustainability. The positive response led to the development of the current tool, which is solely focused on the entire waste management system. Along with a number of outreach initiatives targeting different stakeholders and types of waste in multiple languages, the Environmental Meter is part of a broader communication campaign to engage the Milanese in working towards SDG 12 on Responsible Consumption and Production.

What are the co-benefits?

Social:

By providing citizens with knowledge on better waste management, such as how to preserve food and avoid food waste, low-income families are better equipped to save money.

Health:

The improvement in quality of waste sent to the incinerator will avoid the release of large amounts of carbon dioxide as well as other pollutants. Consequently, residents' exposure to air pollution will decrease as will the associated risks of developing heart disease, respiratory disease, asthma, and emphysema.

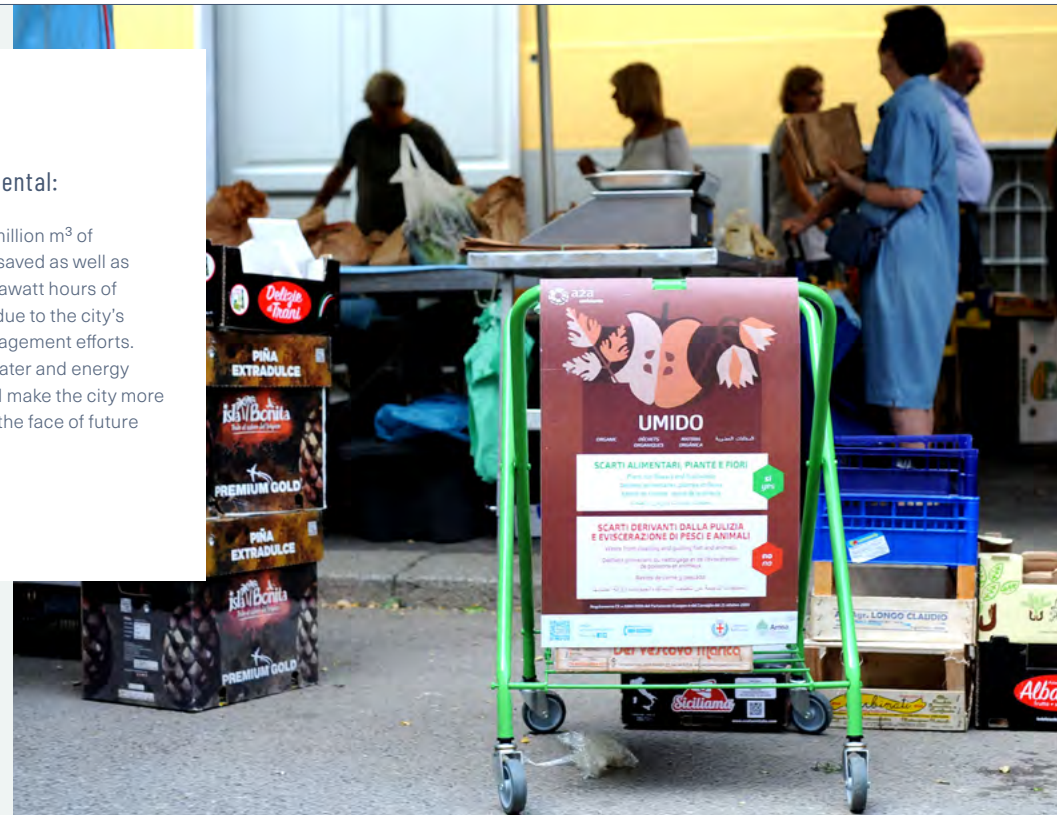
Economic:

Through the city's recycling efforts, a significant number of new products can be produced such as 14 million sweatshirts, 114 million bottles, 3 million wrenches, 419 million shoe boxes, and 224,000 benches, saving the city money from avoided costs of virgin raw materials.

Environmental:

In 2018, 3 million m³ of water was saved as well as 2,000-megawatt hours of electricity due to the city's waste management efforts. Enabling water and energy savings will make the city more resilient in the face of future adversity.

By changing people's perception on local waste management, the Environmental Meter aims to favour behavioural change, encouraging citizens to separate all waste and care more about the quality of separation.



LONDON:

City supplies free water to fight single-use plastic bottles

→ In the UK capital, citizens now have ample opportunities to refill their water bottles all over London, as **the city has taken on the mission to reduce single-use plastics.**

Since a large portion of the plastic waste used consists of plastic bottles, London launched **a city-wide campaign to persuade Londoners to refill their bottles** via the Refill London project, which offers refills in shops and cafés, and the #OneLess campaign, which aims to install more than 100 fountains throughout the city.



What has the city achieved?

Each year, Londoners buy around 1.2 billion single-use plastic bottles and only one-third of plastic is recycled in the home. Water accounts for 37% of all drinks sold in plastic bottles and most of those are consumed “on the go”. Research shows that more frequent and more accessible refill points are key to encourage people to reuse their water bottles. Refill London is a water refill scheme where shops, businesses, and other organisations offer free refills to the public. Today, more than 2,200 places offer water refills, the locations of which can be found via an app or the refill stickers in shop windows.

In addition to Refill London, the city has also established the London drinking fountain fund

in partnership with the Zoological Society of London’s #OneLess campaign, the Mayor of London, and MiW Water Cooler Experts. This pilot project will have installed 28 fountains across London by the summer of 2019. Building on this pilot, the city has made a \$6 million partnership with Thames Water, the London water utility company, to install 100 more fountains across the capital. Over the first 12 months, the first 20 fountains dispensed 77,000 litres of water, which amounts to 155,000 standard single-use plastic bottles.

London 

LONDON

↓ 775K

CO₂e emissions could be reduced over the next 25 years thanks to the newly installed water fountains

What can other cities learn?

Citizen mobilisation and online campaigns create awareness:

For Refill London, citizens were mobilised via volunteer days, where they went door to door, asking shops to sign up to be a refill station. In 2018, the city was able to encourage more than 300 volunteers for 19 "action days" and more than 300 businesses were engaged. In combination with an extensive online campaign that received more than 30 million engagements on social media, the city now has more than 2,200 places offering water refills.

Behaviour change requires functional infrastructure:

Combating a habit such as buying single-use plastic water bottles requires an infrastructure that gives citizens the ability to easily fill up their existing water bottles as they navigate through the city. Extensive campaigns were required to make people aware of the option to refill their bottles as well as ample opportunities to do so. With more than 2,200 refill stations dispersed throughout the city as well as nearly 130 fountains, the city has created the infrastructure needed to change the daily habits of the Londoners.

What are the co-benefits?

Social:

By providing free water in the city, London is not only significantly reducing the need to buy single-use plastic bottles, it is also enables at-risk residents to get enough water during heatwaves.

Health:

As London has some of the highest child obesity rates in Europe, a shift to healthy hydration will likely improve children's health. An effective water refill network will contribute to the target set by London's Child Obesity Taskforce to halve child obesity rates by 2030.

Economic:

With over a billion plastic bottles bought in London every year, the ability to get free water may result in significant money savings for Londoners. Decreasing single-use plastics also means fewer bottles ending up in water systems and the streets, saving the city cleaning expenses.

Environmental:

Plastic bottles are one of the most common items of litter found in the River Thames, which affects aquatic ecosystems. Reducing the number of disposable bottles consumed in London will also reduce the amount of plastic that makes its way into the sea.

As the average Londoner uses more than 175 plastic water bottles per year, London has launched the #RefillRevolution and aims to get the whole city to shift its habits towards refilling their water bottles instead of turning to single-use plastics.



DURBAN:

From traditional landfill to ecological conservation area

→ In Durban, what used to be just a landfill is now also a conservation site. Previously a sugar cane plantation, **the site has been transformed into coastal forest**, and the hundreds of thousands of indigenous plants recorded there are protected.

Thousands of trees have been planted via a community employment programme in collaboration with local NGOs, which have sequestered thousands of tonnes of CO₂. The Buffelsdraai Landfill shows that sustainably managed landfills can be improved and reforested, therefore providing value and benefits to the local community.



What has the city achieved?

In Durban, the eThekweni Department of Cleansing & Solid Waste (DSW) has partnered with the Environmental Planning and Climate Protection Department (EPCPD) of the eThekweni Municipality to work on the Buffelsdraai Landfill. By moving away from the traditional engineering approach of waste-to-energy and instead including sustainable green engineering solutions, the municipality has transformed a traditional landfill into an ecological conservation area and reforestation project with the added bonus of it functioning as a carbon sink. DSW rehabilitated the landfill site by using indigenous vegetation in the buffer zone areas to preserve local flora and fauna and to establish a natural ecosystem, while also enabling reforestation of 200 hectares of former sugar cane land. To date,

124 tree species have been planted, and the project has recorded a total of 762,572 indigenous plants on the reforested land. In a collaboration with the Wildlands Conservation Trust (WCT), local communities such as the Osindisweni and Buffelsdraai have been employed by the Treepreneur programme. The programme encourages local unemployed people to collect indigenous seedlings, which are propagated at local homesteads and eventually planted around the Buffelsdraai Landfill. The programme employs over 200 registered tree-preneurs, and has seen months where approximately 61,800 trees have been planted.

Durban 

DURBAN

↓ 10 MILLION

tonnes of CO₂e emissions are expected to be avoided over the course of the landfill's 50 year lifespan

What can other cities learn?

Strengthen projects with partnerships:

The municipality partnered with NGOs such as the WCT, which functioned as an implementing partner to undertake the required work. Their Treepreneur process served as a successful business model for the project. Several other partners and implementing agents were equally integral to the project. These include: a Reforestation Research partnership, established with the University of KwaZulu-Natal (UKZN) and an Environmental Education partnership with the Wildlife and Environmental Society of South Africa (WESSA).

Engage stakeholders to improve project outcomes:

In order to ensure the structured interventions improved land management and provided wider benefits for the community, DSW needed a partner with a common interest to develop programmes for adaptation planning and implementation. An essential partnership with the eThekweni Municipality's Environmental Planning & Climate Protection Department (EPCPD) was forged, which was vital to merge the waste management, conservation, and reforestation efforts needed for a successful project.

What are the co-benefits?

Social:

The landfill construction development has allowed for local employment and contract participation initiatives for unemployed community members or local sub-contractors. To date, there have been 10 construction contracts resulting in approximately 30 local subcontractors and 100 temporary job opportunities.

Health:

The integrated landfill management approach limits air pollutants emerging from the site as well as foul smells. Coastal forests are naturally cooling, which reduces the urban heat island effect and protects vulnerable citizens in times of extreme heat.

Economic:

By using onsite gravel and rock to produce drainage material for the leachate collection layer, gas collection drains, and similar applications, the city is saving money by not having to import these from elsewhere.

Environmental:

By extracting the gas and reducing methane emissions, the city is expected to avoid 10 million tonnes of CO₂e over the 50 year lifespan of the Buffelsdraai Landfill. The tree planting is expected to sequester about 45,000 tonnes of CO₂e emissions per year.

The large reforested buffer zones around the Buffelsdraai Landfill consists of thousands of local plant and tree species. The total recorded bird species in the area has increased from 91 to 170, indicating that the natural ecosystem is having a regenerative effect on the formerly heavily farmed land around the landfill.



BENGALURU:

New innovation turns waste product into clean water

→ In Bengaluru, a leachate treatment plant is using a new patented method of **turning harmful and contaminated leachate into water**, which in turn will be used to replenish groundwater reserves.

The project is beneficial on all accounts, as it saves the city money compared to conventional leachate treatment methods, reduces the risk of contaminating local water sources surrounding the landfill, and saves the environment from harmful pollutants and emissions. The project is already being expanded across the city and a local government grant is enabling more leachate treatment plants.



What has the city achieved?

One of the major challenges of managing solid waste is the production of leachate, a liquid that percolates from biodegradable waste while it is transported or processed. Leachate is a significant threat to surface water as well as groundwater, and Bengaluru was determined to find a sustainable way to treat it. The city adopted the Boom Tube Resonator, which is a patented technology called Fine Particle Shortwave Thrombotic Agglomeration Reaction (FPSTAR). The FPSTAR is the world's most advanced technology to convert landfill leachate and other industrial effluents into clean water, and therefore protects the environment and public health.

The FPSTAR technology does not use biological or chemical processes in the treatment and has been successfully piloted in harsh conditions. So far, the project has treated millions of litres of leachate generated at the Bellahalli Landfill in Bengaluru and the resulting freshwater is replenishing groundwater sources. This groundbreaking technology is being proposed to be used in all new and existing MSW processing centres where leachate formation is inevitable.

Bengaluru ○

BENGALURU

↑ 12 MILLION

litres of leachate is treated using the FPSTAR method in Bengaluru

What can other cities learn?

Invest in the future of local communities:

Water from the treated leachate is mainly used to recharge groundwater reserves in the area and a nearby lake. Not only does the treatment of the leachate prevent local communities from experiencing water pollution, it also ensures they will have access to clean groundwater in the future.

Exploring new technologies can pay off:

The city initially explored the more conventional methods of treating leachate such as lagoon treatment, aerobic and anaerobic biological treatment, and a combination of biological and chemical treatment. However, the city found the treatment methods were not efficient nor sustainable due to the variable characteristics of landfill leachate, which is 50 times more contaminated than sewage. Through the FPSTAR method, not only is the city getting cleaner water as a result of a more environmentally friendly process, they are also saving money.

What are the co-benefits?

Social:

The villages of Bellahalli, Kannur, and Mitiganahalli are located near the landfill site, and the 2,000 families residing there are now safeguarded from water pollution risks.

Health:

Due to the reduction in odour after the treatment of the leachate, the breeding of flies and mosquitoes is reduced, which minimises the risk of the spread of diseases to the surrounding population.

Economic:

The capital cost of this project is 30% lower than conventional systems and the operating expenses are only approximately 2 cents per litre.

Environmental:

Though the reclaimed water conforms to local potable water standards, the recovered water is currently mainly used for gardening and recharging groundwater resources.

The success of using the FPSTAR method to turn leachate into clean water means Bengaluru is already expanding the project to more places in the city. The state government has also provided a grant that funds the construction of leachate treatment plants.



2019

Cities100

BUILDING ENERGY EFFICIENCY

→ Powering, heating, and cooling buildings can account for up to 70% of a city's energy consumption, so increasing energy efficiency can yield significant cuts in both costs and carbon emissions. As cities introduce ever-more ambitious energy standards, the number of zero-carbon buildings, as well as deep retrofits to old buildings, is skyrocketing.



HONG KONG:

Keeping cool with seawater district cooling system

→ In hot and humid Hong Kong, the demand for cooling is rising alongside global temperatures, but in the new Kai Tak Development, **a district cooling system is keeping residents cool without warming the planet.**

The system uses seawater to supply 284 MW of centralised cooling to everything from schools and hotels to shopping centres and railway stations, achieving 35% greater efficiency than standard air-cooling systems.



What has the city achieved?

On the site of the old Kai Tak airport, Hong Kong is building its second central business district, with a district cooling system at the heart of its future-proofing strategy. In a city where air conditioning constitutes 30% of electricity demand, the centralised system – which uses seawater from the surrounding Kowloon Bay – is expected to achieve an annual saving of 85 million kWh of electricity upon completion. This is equivalent to an emission reduction of 59,500 tonnes of CO₂ annually.

More than 39 km of innovative leak-detection piping will pump coolant from two central chillers to almost two million square metres of floor space. Load diversity is achieved thanks to the multiple uses of the spaces being cooled, making

the system more resilient as peak demand differs from location to location.

For building owners and residents alike, the benefits of the system stretch far beyond the reductions in CO₂ emissions. In the construction phase, developers save on capital costs for cooling equipment, and pay competitive rates for cooling over the life of the building. Additionally, without the pollution, noise, and space taken up by conventional cooling units, residents can enjoy a more spacious and liveable district.

Hong Kong 

HONG KONG

↑ 1.73 MILLION

M² OF FLOOR SPACE will be cooled by the system

What can other cities learn?

Use the resources on your doorstep:

The use of seawater, which surrounds Kai Tak, is key to the project's ability to reduce costs and carbon emissions. It goes to show that sustainable solutions are sometimes right in front of us, if we are open to inspiration.

Invest in infrastructure:

While the initial funding for the project comes from Hong Kong's government, tariffs charged to building owners for cooling shall recover the capital and operating costs over a 30 year lifetime. This means that taxpayers don't foot the bill in the long term and building operators receive affordable cooling services.

What are the co-benefits?

Social:

Kai Tak's district cooling system frees up large amounts of rooftop space by removing the need for individual HVAC units, allowing the architects to think more creatively, designing roof gardens and green roofs that act as social spaces.

Health:

The switch from traditional HVAC systems not only improves local air quality, it also reduces the urban heat island effect, as well as reducing vibration and noise pollution, which can create health risks for Kai Tak's population.

Economic:

As the upfront costs of the district cooling system are paid by the city government, building owners face reduced capital costs during the construction phase.

Environmental:

Compared to air-cooled systems, the district cooling system will result in an annual reduction in CO₂ emissions of 59,500 tonnes. Additionally, by freeing up roof space, the district is able to have 30% coverage of greenery, a much higher rate than the average across the rest of the city.

Kai Tak's district cooling system achieves up to 35% efficiency savings thanks to economies of scale and the use of seawater as a coolant. The project has been so successful that plans are in place to expand it to other parts of the city.



HONOLULU:

Hawaii's concrete example of utilising captured carbon

→ Like almost every city, Honolulu's reliance on concrete for infrastructure projects comes at a significant environmental cost.

A new resolution in the city government is set to change this, however, by **encouraging the use of low-carbon concrete** that has undergone CO₂ mineralisation, utilising and storing captured carbon from local industrial emitters. The initiative is helping to **scale new carbon capture technology**, as well as reducing freshwater consumption and boosting the local economy.



What has the city achieved?

Without concrete, no city featured in this publication would look as it does today, but our reliance on the cheap and sturdy building material comes at a cost, as concrete accounts for between 4% to 8% of global CO₂ emissions. In Honolulu, the city government passed a resolution to promote the use of low-carbon concrete in the city's infrastructure projects – the first city in the world to take such a step.

CO₂ mineralised concrete utilises captured carbon emissions from industrial emitters, such as gas-fired power generators, in the production of concrete, resulting in a low-carbon building material that locks away carbon from the atmosphere. By using this in the city's infrastructure projects, Honolulu can reduce

the embodied carbon of the projects, with no implications for cost, quality, or scheduling. The required technology can be added to existing concrete plants via affordable and straightforward retrofits, meaning that once there is proven demand, it can be scaled significantly.

Thanks to the resolution, Hawaii's Department of Transport is using CO₂ mineralised concrete in a demonstration project at the city's Kapolei Interchange, becoming the first government body to work directly with the product.

HONOLULU

↓ 15K

TONNES OF CO₂ could be abated each year if Honolulu standardised CO₂ mineralised concrete across city infrastructure procurement

What can other cities learn?

Think beyond operating emissions:

While great leaps have been made in improving the efficiency of buildings to reduce the carbon they emit during their operation, emissions embedded in construction materials have seen limited improvements. The technologies exist to improve this but a lack of appropriate policies is limiting their potential to scale up.

Let public procurement lead the way:

As a developer of major infrastructure projects, the City of Honolulu is a major purchaser of concrete, with significant implications for its carbon footprint. With a resolution to always consider CO₂ mineralised concrete in public projects, the city government is helping to fuel this innovative new technology.

What are the co-benefits?

Social:

Hawaii's shift towards locally produced, low-carbon concrete will boost local green employment opportunities and future-proof skills among the state's workforce.

Health:

Climate-related health risks are increasing as the planet warms, particularly among vulnerable groups such as the young, the elderly, and the poor. By abating CO₂ emissions from concrete production, this policy will play a small part in reducing these risks.

Economic:

The State of Hawaii imports roughly 300,000 tonnes of cement annually from Taiwan, but this initiative will encourage the use of locally produced, low-carbon concrete, boosting the local economy while cutting emissions from transport.

Environmental:

Studies suggest that if the correct stimulating policies are put in place globally, carbon capture and utilisation technology in the concrete industry could reduce up to 1.4 billion tonnes of CO₂ emissions annually by 2030.

CO₂ mineralised concrete locks away recycled CO₂ and lowers the embedded emissions of buildings and infrastructure projects, which are often overlooked when it comes to making efficiency improvements in our cities.



LONDON:

Net-zero new builds put London ahead of the pack

→ Last year, 19 C40 cities signed up to the Net Zero Carbon Buildings Declaration, committing to all new buildings operating at net-zero carbon by 2030. London, however, is ahead of the curve and has **mandated zero-carbon new homes since 2016**.

All non-domestic developments are required to meet the standard from the end of 2019, **meeting their commitment 11 years early**. The policy is also creating locally managed carbon offset funds, spurring low-carbon investment in the capital.



What has the city achieved?

Tackling the 70% of London's carbon emissions that come from homes and workplaces is critical if the city is to meet its commitment of compatibility with a 1.5°C pathway and reaching net-zero emissions by 2050. While the UK's national government dropped its target of zero-emission homes in 2016, London is leading by example by keeping the pledge that all new homes should be zero-carbon. In a city currently building more than 35,000 homes each year, with targets to almost double that number, this policy is already adding up to serious emissions reductions – an estimated 15,000 tonnes in 2018 alone.

to reduce energy demand, be powered by renewables, and maximise renewable generation onsite to achieve net-zero operating emissions, which is 35% beyond the national regulation. If these requirements can't be met, developers must pay for an offset into a locally managed fund reserved for carbon-saving projects. More stringent reporting rules are also being brought in, with developers monitoring emissions for five years upon completion, with data verified and publicly available, strengthening understanding of the policy's impacts.

By the end of this year, the policy is expected to cover all non-domestic developments as well. As such, all new buildings in the city will be required

London 

LONDON

↓ 1.2 MILLION

TONNES OF CO₂e EMISSIONS will be averted each year by 2050, on top of savings from national regulation

What can other cities learn?

Give local authorities support and autonomy:

In London, where many local authorities are responsible for planning regulation, the Mayor's office has empowered local officials to manage their own carbon offset funds, but also offered them support through any difficulties in policy implementation.

Remain ambitious despite national context:

London's zero-carbon building policy goes above and beyond national standards, which were watered down in 2016, demonstrating how city-level policies can lead the way despite the national picture.

Net zero and affordability can go hand-in-hand:

To address concerns that net-zero requirements may conflict with policies on affordability of homes, the city conducted a large-scale, publicly scrutinised viability assessment to prove that all policies could be delivered in tandem.

What are the co-benefits?

Social:

The carbon offset funds are used to finance low-carbon improvements in local schools and social housing, freeing up money from energy bills to spend on equipment and activities instead.

Health:

By encouraging the installation of low-carbon HVAC systems, combustion in the city is minimised, improving air quality and reducing risks for respiratory health ailments.

Economic:

Residents living in zero-emission homes are estimated to save up to \$240 on their energy bills. Additionally, the carbon offset fund is expected to generate \$35 to \$50 million each year for low-carbon projects.

Environmental:

By 2050, London's net-zero policy is estimated to reduce CO₂e emissions by more than 25 million tonnes, compared to if it had stayed with national standards.

London aims to build 65,000 new homes each year to meet the demand for housing in the city, so an ambitious net-zero target for all new buildings is an important way to rapidly deploy low-carbon solutions at scale.



NEW YORK CITY:

Slashing skyscrapers' emissions via first-of-its-kind legislation

→ New York City passed the groundbreaking Climate Mobilization Act in May 2019, the centrepiece of which is the Buildings Mandate, which will require **50,000 of the city's largest buildings**, including major landmarks such as the Empire State Building, to take significant carbon-cutting measures.

Strict enforcement should ensure the policy's objectives of **eliminating 6 million tonnes of carbon emissions and creating 26,700 jobs by 2030** are met.



What has the city achieved?

The Buildings Mandate is a first-of-its-kind legislation, requiring large buildings (>2,300 m²) in the Big Apple to cut their carbon emissions in half by 2030, and by more than 80% before 2050. Given that these buildings make up only 2% of the city's real estate, but generate half of the energy demand, addressing their efficiency is vital if NYC is to meet its carbon neutrality goals.

Rather than a one-size-fits-all approach, the policy gives building owners the flexibility to pursue the best solutions for cutting carbon, meaning reductions can be achieved at the highest pace and lowest cost. A newly created office will be responsible for compliance and enforcement, and with a \$268 per tonne annual fine for buildings missing their targets, buildings such as Trump

Tower could face fines in excess of \$1 million if they fail to cut their emissions.

The city government is leading by example by investing \$3 billion in deep retrofits in its own buildings, and budgeting \$30 million to offer free customised assistance to building owners to help them to find solutions and meet requirements under the Buildings Mandate. Additionally, requirements differ based on occupancy type, with flexibility offered to hospitals and affordable housing given their critical social roles.

New York City 

NEW YORK CITY

↓ 6 MILLION

TONNES OF GHG EMISSIONS abated by 2030,
relative to business-as-usual

What can other cities learn?

Collaborate at the outset on desired outcomes:

Stakeholder engagement was extremely broad, with the real estate industry, local utilities, environmental justice organisations, labour unions, and city authorities all involved. Critical to aligning varied and often conflicting priorities was agreeing on specific policy objectives from the outset.

Public buildings lead by example:

To show what needs to be done, the city is investing \$3 billion in deep energy retrofits in public buildings, which aim to achieve emissions reductions of 40% by 2025 and 50% by 2030. To assist privately owned buildings, the city is also developing a programme for low-cost financing for energy efficiency retrofits.

What are the co-benefits?

Social:

More than 26,700 jobs will be created by the Buildings Mandate, with the city's workforce programmes ensuring the jobs are accessible to people from low-income and vulnerable communities.

Health:

As limiting the onsite combustion of fossil fuels in the city will reduce the presence of air pollutants like PM2.5, it is estimated that the Buildings Mandate will prevent 50 to 130 premature deaths and 150 hospital visits annually by 2030.

Economic:

The city set aside \$30 million to help building owners find the best solutions to meet the requirements. To ensure that rents remain affordable, alternative compliance paths are offered to affordable housing and rent-regulated buildings.

Environmental:

In New York City, buildings are responsible for nearly 70% of all greenhouse gas emissions, and the Buildings Mandate aims to deliver 6 million tonnes of emissions reductions by 2030, equivalent to taking 1.3 million cars off the road each year.

Intensive stakeholder engagement over several years was key to the development of an ambitious policy acceptable to all. In-depth consultations were held with many parties from affordable housing representatives to labour unions, with desired policy outcomes agreed at the outset.



PARIS:

Converting condominiums with energy-efficient retrofits



→ As the home of the Paris Climate Agreement, Paris has an obligation to lead by example when it comes to tackling emissions across the board.

To reach the city's goal of **retrofitting the entire housing stock within 30 years**, the Paris Climate Agency has established CoachCopro, **a collaborative platform linking the supply and demand side**, offering bespoke advice and services for both sides. The 12,000 properties retrofitted to date have generated \$137 million for local businesses.

What has the city achieved?

Energy use in homes typically accounts for 15% to 20% of a city's carbon emissions, making energy efficiency improvements a high-priority area. In Paris, where condominiums make up 87% of the city's private housing, the CoachCopro platform connects and supports condominium owners and building professionals to accelerate the uptake of energy retrofits.

CoachCopro links affiliated companies and condominium owners, and hosts matchmaking events to kickstart new projects. Owners can choose from the 250 (and counting) firms that have signed up to the CoachCopro charter of high social and environmental standards, and both sides are given the advice and resources needed to streamline the renovation process. Beyond

being simply a digital guidance tool, human intervention and events outside of the virtual realm are key to offering bespoke advice to both sides and overcoming obstacles in the renovation process.

Successful projects are also shared on the platform to offer homeowners concrete examples of renovation measures and to spread best practices. As the platform is web-based and requires a small operations team, it is proving to be a highly scalable model, and is already being rolled out in 22 other regions and cities in France.

Paris ○

PARIS

↑ 40K

APARTMENTS will be renovated each year by 2030

What can other cities learn?

Understand and target the obstacles:

To accelerate energy efficiency renovations in Paris, CoachCopro's human element targets specific obstacles for condominium owners and suppliers, for example by offering tailored advice on financing and organising site visits and face-to-face meetups.

Empower local leaders:

CoachCopro encourages condominiums to elect "energy leaders" to steer and represent local communities' needs and interests through the renovation process. Such empowerment of local figureheads in the process is key to fostering a sense of project ownership amongst residents.

Minimal intervention for cost-effectiveness:

CoachCopro's simple approach provides enough help to owners and suppliers, providing human intervention only when necessary, minimising the programme's costs and maximising scalability, whilst still enabling the acceleration of retrofitting projects in Paris.

What are the co-benefits?

Social:

Fuel poverty in France is felt more acutely by tenants in large urban areas.¹ CoachCopro renovations help the City of Paris address this problem by bringing down the cost of energy bills, with typical annual savings of approximately \$220 per apartment.

Health:

Energy retrofitting in homes has proven health benefits, thanks to improved indoor air quality. For residents of CoachCopro condominiums in Paris, this means reduced rates of respiratory illness, lung cancer, and heart disease.

Economic:

As well as reducing energy bills for residents in Paris' condominiums, the project has helped to generate revenue of \$137 million for firms working on retrofits in the city.

Environmental:

Retrofits under CoachCopro reduce energy use in homes by approximately a third, and since its launch in 2014, the programme has led to the renovation of more than 12,000 homes.

CoachCopro is the Paris Climate Agency's initiative to help decarbonise the city's housing stock. With 12,000 properties renovated since 2014, the project aims to renovate 40,000 condominiums each year by 2030 in a bid to complete energy efficiency retrofits in every Parisian home before the middle of the century.

¹EU Energy Poverty Observatory (2012)



QINGDAO:

Incentivising high-quality retrofits for an energy-efficient housing stock



→ In Qingdao, a retrofit incentive scheme is spurring investment in the renovation of the city's housing stock. More than 50 million m² of old residential buildings are in need of efficiency upgrades to **meet targets under the city's Low-Carbon Development Plan**.

With almost half of the required retrofits completed, an estimated **298,000 tonnes of CO₂e emissions have been abated**, as well as reductions in air pollutants, improving the air quality for Qingdao's residents.

What has the city achieved?

To reduce Qingdao's reliance on coal and shift towards a low-carbon future, reducing energy demand from the city's buildings is a must. More than 50 million m² of the city's building stock is in need of energy retrofits to bring it up to modern standards and reduce energy demand. Last year, Qingdao, along with three other Chinese cities, became part of the C40 Cities China Buildings Programme to accelerate action on energy efficiency in the city.

The initiative is designed to bring financial stability to energy retrofits by offering financial incentives to projects completed to a high standard. This not only encourages retrofits to take place, but maximises the energy demand reductions and improvements in living conditions

that stem from the projects. The result has been a thriving market for renovating the city's residential buildings, with the financial incentives adding to the benefit of reduced energy bills such improvements bring.

To date, more than 22 million m² has been renovated, delivering a reduction in CO₂e emissions of 298,000 tonnes. When the remaining 30 million m² is completed, a further 409,000 tonnes of CO₂e emissions will be abated. The impacts on air quality in the city have been noticeable, with an increase in the number of "good quality air days."

Qingdao 

QINGDAO

↑ 22 MILLION

M² OF RESIDENTIAL PROPERTIES have been renovated under the programme so far

What can other cities learn?

Team up with your neighbours:

Qingdao has teamed up with Beijing, Fuzhou, and Shanghai in the C40 Cities China Buildings Programme, committing together to make the necessary improvements to their building stocks and share best practices.

Encourage quality and quantity:

The city's financial incentive scheme rewards high-quality renovations more generously, encouraging energy retrofits that deliver the highest reductions in energy demand, strengthening the goals of the policy.

What are the co-benefits?

Social:

The scheme is improving living conditions for residents of Qingdao's oldest buildings, which are often inhabited by those in the lowest income quartile. Additionally, the incentives are boosting local green employment opportunities in the city.

Health:

Efficiency improvements lead to reductions in the emission of nitrous oxides and particulate matter across the city, improving air quality and reducing smog, particularly in the height of summer when air conditioning units are operating in full force.

Economic:

Once the entire retrofitting programme is complete, the total efficiency improvements will lead to an estimated \$3.5 million in annual savings on energy bills.

Environmental:

Renovation of 52 million m² of Qingdao's oldest buildings should lead to the abatement of more than 700,000 tonnes of CO₂e emissions, a significant contribution to the city's Low-Carbon Development Plan.

When completed, Qingdao's programme of energy renovations across its old housing stock is estimated to abate 700,000 tonnes of CO₂e emissions, and result in \$3.5 million in reduced energy bills annually.



STOCKHOLM:

Cooling the cloud combines with district heating for efficiency gains

→ One of the main obstacles in reaching Stockholm's goal of becoming fossil fuel-free by 2040 will be the provision of 100% renewable heat during the cold winter months.

Stockholm Data Parks is one of the city's initiatives to **recover and utilise excess heat from data centres** to warm the city's homes and offices via the district heating network. This provides **an economic and environmental win-win** for data centres and heating users, and is the largest such example of trading waste heat globally.



What has the city achieved?

As our lives continually move onto the cloud and our hunger for the digital economy explodes, the carbon footprint of the world's data centres is growing exponentially, and is already on par with the aviation industry¹. Much of the associated carbon emissions stem from the energy demand used to keep data centres cool. In Stockholm, a symbiotic relationship is being exploited to keep homes and offices warm and data centres cool.

With a goal to provide 10% of the city's heat demand from excess heat sources, Stockholm set up an open trading platform for excess heat in 2014. After discovering that data centres held great potential, the city launched the Stockholm Data Parks initiative to attract investment in new

data centres where heat exchange could take place. Heat pumps are used to exchange heat between data centres and the district heating network, with data centres paid per unit of heat provided. This generates a win-win with an additional revenue stream for data centres, and a low-cost heat source for the citizens of Stockholm. Last year, heat recovery increased by 30% to 113 GWh, which represents a reduction in CO₂ emissions of 7,000 tonnes.

Stockholm

STOCKHOLM

↑ 20K

MODERN RESIDENTIAL APARTMENTS
can be heated with excess heat from
one 10 MW data centre

What can other cities learn?

The circular mindset extends beyond materials:

Stockholm's circular economy strategy extends far beyond materials to how best to utilise waste heat resources, which is important in Northern Europe, where heating demand accounts for a large proportion of carbon emissions.

Create the business case:

Stockholm Data Parks' strength is in presenting an attractive business proposal to potential data centres by offering additional revenue streams from heat recovery. This presents a much better business case compared to other cooling solutions available to data centres today.

What are the co-benefits?

Social:

By reducing the need to purchase fuel for the district heating network, heating costs are reduced for all residents. Such costs account for a disproportionately large share of expenditures for those from economically disadvantaged backgrounds.

Health:

By eliminating the need to burn fossil fuels locally for Stockholm's heating system, the city will experience a significant improvement in air quality, which reduces the risks of respiratory illnesses among residents.

Economic:

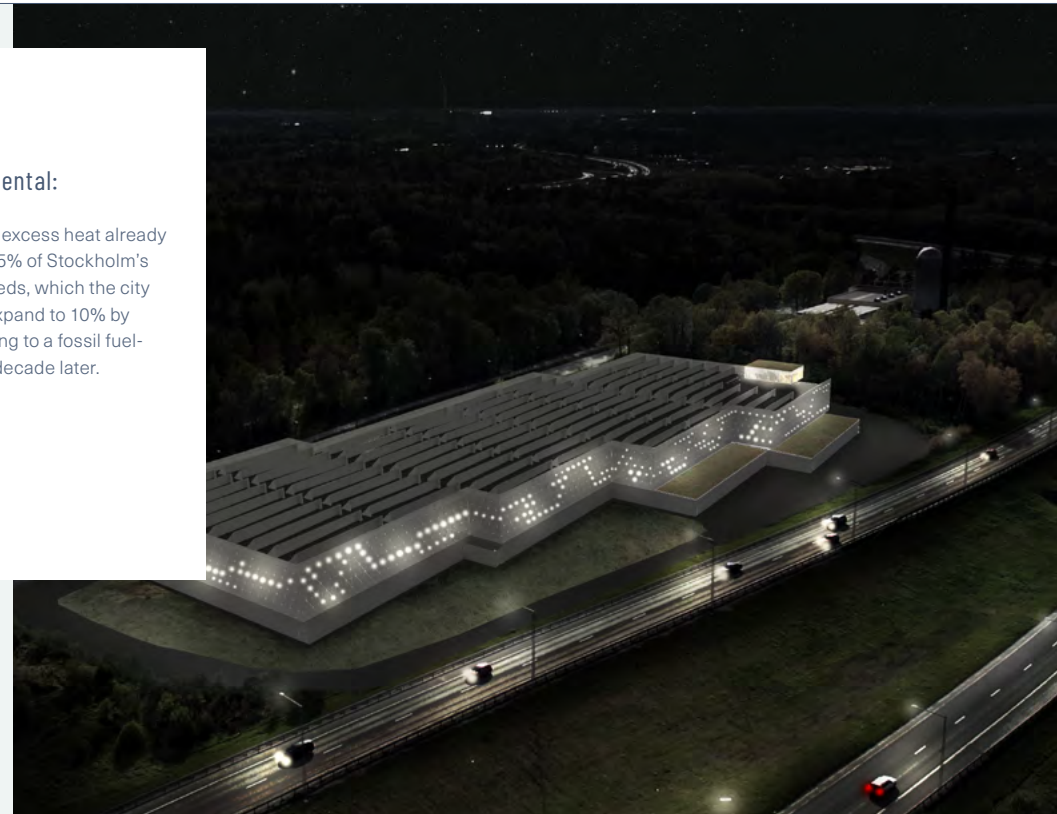
Stockholm Data Parks was set up to incentivise the installation of new data centres in the city, which will create jobs and boost the local digital economy, as well as establish a more circular heating system.

Environmental:

Recovered excess heat already supplies 3.5% of Stockholm's heating needs, which the city hopes to expand to 10% by 2030, leading to a fossil fuel-free city a decade later.

Stockholm Data Parks was set up to exploit the symbiotic relationship between the need for heat in Stockholm's homes and businesses and cooling in data centres. Data centres are able to sell their excess heat to the district heating system, thanks to an innovative trading platform for heat.

Photography credit: Stockholm Data Parks



TOKYO:

Ratcheting up ambition via an energy efficiency cap- and-trade scheme

→ Tokyo was **the first city in the world** to introduce a cap-and-trade scheme for building energy efficiency in 2010, covering facilities accounting for 20% of the city's total emissions.

Having achieved emissions reductions of 14 million tonnes in the first five years, **the scheme is ratcheting up ambition with stronger targets** and mechanisms to boost the use of renewable energy alongside efficiency improvements.



What has the city achieved?

In Tokyo, where buildings account for 70% of the city's energy consumption, large commercial and industrial buildings are covered by a city-level cap-and-trade programme that mandates emissions reductions year-on-year. The programme encompasses 1,200 buildings, which are required to meet their reduction targets via on-site energy efficiency measures or by purchasing credits from high-performing buildings. Buildings not meeting targets are subject to financial penalties.

The scheme operates in five-year phases, with ambition ratcheting up in line with the 2030 goal of a 30% reduction in total city emissions compared to 2000. Buildings have already reduced their emissions by 27% compared to the

baseline, significantly outperforming the targets set for this phase. This has been crucial to Tokyo's decoupling of economic productivity from energy consumption in the past 10 years.

Buildings are responsible for their own emissions accounting, which is verified by a third party before being publicly reported. As well as tackling demand through efficiency measures, a new mechanism has been introduced to encourage buildings to source their heat and power from renewable sources, extending the programme's influence into the supply side.

Tokyo ○

TOKYO

↓ 14 MILLION

TONNES OF CARBON emissions abated in the scheme's first five-year phase

What can other cities learn?

Increase ambition over time:

Having ambitious targets for a far-off date is one thing, but to get there it's important to have a clear pathway to follow. Tokyo's cap-and-trade scheme, with interim targets in five-year phases that ratchet up over time, helps building managers to see the long-term vision in easily deliverable steps.

Transparency means accountability:

Emissions data from all 1,200 buildings covered by the scheme is independently verified and publicly available. Such transparency increases accountability amongst Tokyo's buildings to take their emissions reductions obligations seriously.

Think holistically:

Whilst Tokyo's cap-and-trade scheme is primarily aimed at energy efficiency, it also rewards procurement of renewable energy, reduction of water consumption, and increased resilience to natural disasters, all interrelated issues when it comes to effectively tackling climate change.

What are the co-benefits?

Social:

A number of buildings under the programme are using energy efficiency improvements mandated by the cap-and-trade scheme to simultaneously increase resilience to natural disasters and extreme weather, threats that are growing thanks to climate change.

Health:

The scheme has particularly encouraged buildings to switch to more efficient cooling systems, helping to reduce the urban heat island effect in Tokyo, which can lead to serious heat-related illnesses and increased air pollution in summer.

Economic:

Thanks to increased investment in energy efficiency, Tokyo has decoupled economic growth from energy consumption since the cap-and-trade scheme was introduced. Additionally, efficiency measures help to significantly reduce buildings' energy costs.

Environmental:

Given that the buildings covered by the scheme account for 20% of the city's total emissions, efficiency savings by these buildings have had a serious impact on the city's carbon footprint, with 14 million tonnes of carbon emissions abated in the scheme's first five-year phase.

Tokyo's cap-and-trade scheme mandates vs by commercial and industrial buildings, covering 1,200 buildings accounting for 20% of the city's total emissions.



WASHINGTON, D.C.:

New legislation sets the standard for building energy performance

→ As part of Clean Energy DC, a roadmap to **cutting Washington, D.C.'s city-wide carbon emissions in half by 2032**, the city has recently enacted the Building Energy Performance Standards (BEPS) to target energy efficiency.

Starting in 2021, the city's largest and most energy-thirsty buildings must comply with ambitious new standards, with smaller buildings added to the scheme over time. The result should be a **21% reduction in energy demand, leading to GHG emissions reductions of 1 million tonnes each year.**



What has the city achieved?

As industry and transport have relatively low footprints in Washington, D.C., buildings account for 75% of the city's carbon emissions. With a low build rate of new properties, it is essential to tackle emissions from existing buildings if the capital is to meet its goal of halving city-wide carbon emissions by 2032, relative to a 2006 baseline.

The Building Energy Performance Standards (BEPS) is one of the flagship policies of the Clean Energy DC plan, and will mandate efficiency improvements across the city's housing and commercial buildings. Private buildings larger than 4,600 m² and government facilities have been reporting on annual energy use since 2014, and will be the first group to have to meet

the requirements from 2021. If the buildings are below the city's median ENERGY STAR rating for that building type, they will be required to put in place measures to improve efficiency and reduce energy use.

Over time, smaller buildings must also meet the standard, and it is estimated this will lead to a 12% reduction in emissions in the nation's capital. As well as a dedicated help centre for compliance and technical assistance, the city has allocated \$3 million towards an annual fund for affordable and rent-controlled housing to make efficiency upgrades.

Washington, D.C. 

WASHINGTON, D.C.

↑ 45 MILLION

DOLLARS WILL BE ALLOCATED by the city to D.C.'s Green Bank by 2025, which funds efficiency upgrades in buildings

What can other cities learn?

Tackle the big emitters head on:

Washington, D.C.'s largest buildings will be the first to meet the new standard, which will deliver results quickly as these buildings are extremely energy thirsty and account for a great portion of the city's energy demand. Bringing these buildings to a higher standard will have a green ripple effect on the city's building owners and operators.

Offer financial support for those in need:

While making energy efficiency improvements has a strong business case, in the long run, it requires upfront capital that may be a challenge for many building owners. Washington, D.C., has made sure to put in the financial resources to help with this, by allocating \$45 million to the city's Green Bank by 2025, on top of a \$3 million annual fund for energy improvements in low-income housing.

What are the co-benefits?

Social:

There are no exemptions in BEPS for low-income housing, as every resident must have the opportunity to live in high-performance, efficient buildings. To ensure that making improvements is not a burden, however, the city has set aside \$3 million annually for upgrades in affordable and rent-controlled housing.

Health:

Improving the energy performance of Washington, D.C.'s buildings also improves the indoor climate, creating healthier living conditions for the city's residents.

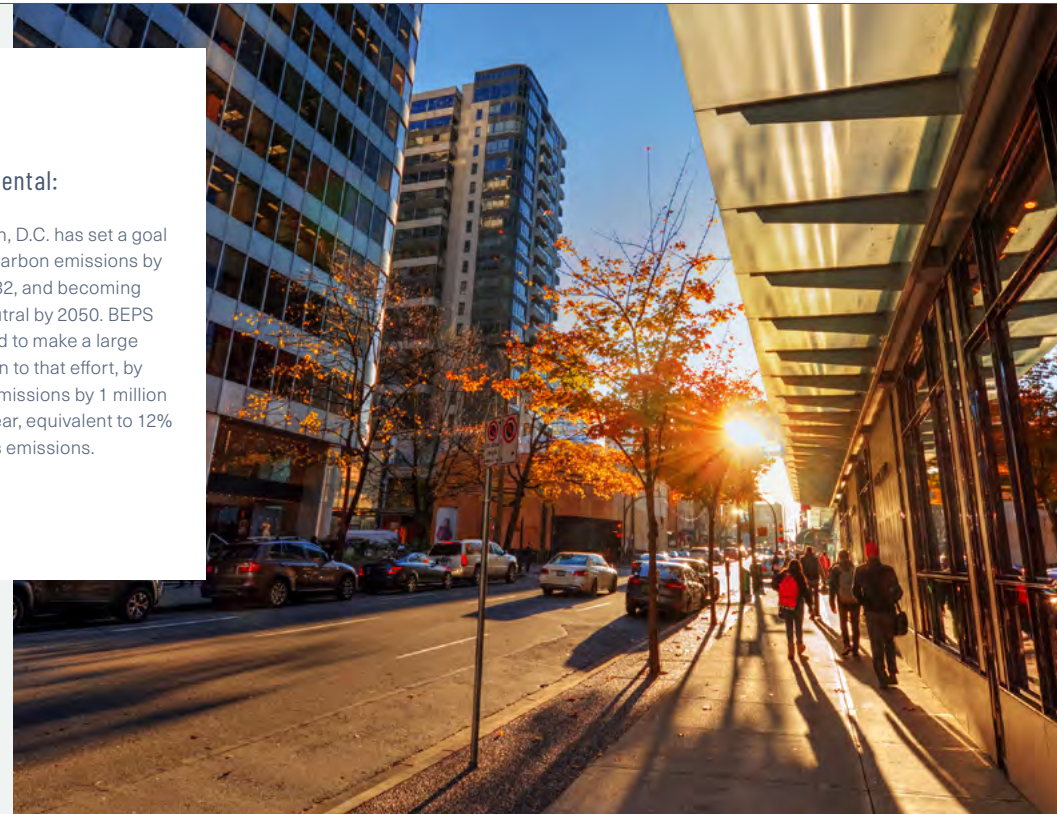
Economic:

The average return on investment for efficiency improvements in D.C. is three years, after which building owners will start to see savings in energy bills. The city government has also put aside various funds to assist developers in meeting the capital costs required.

Environmental:

Washington, D.C. has set a goal of cutting carbon emissions by 50% by 2032, and becoming carbon neutral by 2050. BEPS is estimated to make a large contribution to that effort, by reducing emissions by 1 million tonnes a year, equivalent to 12% of the city's emissions.

Washington, D.C.'s ambitious Building Energy Performance Standards legislation was signed into law in early 2019, and will target the city's largest and worst-performing buildings, raising efficiency standards and cutting carbon emissions in the capital.



2019

Cities100

CLEAN ENERGY

→ With energy use accounting for around 70% of global greenhouse gas emissions, accelerating the shift towards low-carbon energy systems has never been a more pressing issue. Fortunately, cities are rising to the challenge, boosting demand in renewables by making it easier for citizens and businesses to buy low-cost, low-carbon power.



BARCELONA:

Fueling a renewable transition while empowering citizens

→ Barcelona Energía (BE) is the first public electricity distributor in Spain, created with the goal of **promoting local and renewable energy generation**.

Its mission is to contribute to the **transition towards a sustainable energy model** by promoting local generation of energy and efficient energy use by citizens, as well as supplying customers with certified 100% renewable energy. BE empowers citizens via education, spurs participation via a council of users, and works to uphold its core principle of transparency.



What has the city achieved?

Barcelona Energía (BE) facilitates a transition towards a renewable and distributed energy model by supplying certified 100% renewable electricity to customers, teaching customers about energy efficiency, and offering personalised advice. BE has grown since it first started supplying Barcelona City Council with renewable energy in 2018, and has since begun supplying city residents as of January 2019. Currently, BE is delivering electricity to more than 5,000 consumers.

BE aims to increase the uptake of solar five-fold, employing strategies including offering an array of tools and services making it easier and more desirable for citizens to install solar on their rooftops, as well as educating them about energy

savings. For example, citizens can analyse the feasibility of installing solar generation via an online solar map. Citizens who have solar panels can use an energy calculator to optimise their consumption, or learn about the benefits of self-consumption, meaning using the electricity they produce directly rather than feeding it back to the grid. BE also covers the maintenance costs of solar installations, and customers have the opportunity to receive a solar tariff. When customers receive their energy bill, they are also given energy-saving tips as well as information about their consumption compared to the average.

Barcelona

BARCELONA

↓ 16.5K

TONNES OF CO₂e emissions are estimated to have been saved as a result of Barcelona Energía supplying renewable energy since 2018

What can other cities learn?

Build your toolbox:

The services provided by Barcelona Energía go beyond those of a conventional power company, and are specially designed to improve energy efficiency and promote renewable, local generation, either for self-consumption or for grid injection. The tools used by BE serve as inspiration for initiatives in other municipalities that spur the transition to a renewable energy model.

Seek the counsel of your users:

To involve users in the core of the organisation's decision-making, BE has developed a Council of Users, an advisory body of BE's customers. The council examines new proposals and projects and provides advice and guidance to the organisation. Through participation, users' interests and concerns are prioritised.

What are the co-benefits?

Social:

Barcelona Energía says that at the core of its operations is the intention to provide transparency and empower citizens. To achieve this, they work to inform citizens about efficient energy management in their home, to help them make the choices necessary to improve their consumption habits.

Health:

By supplying certified 100% renewable energy, the equivalent energy has not been produced with conventional generation sources such as coal or natural gas. The project is therefore reducing the particulate matter produced by the burning of fossil fuels.

Economic:

Barcelona Energía's commitment to promoting local and renewable energy development is expected to create new business opportunities and jobs. Through BE's strategy of promoting self-consumption, the organisation creates new relationships between energy generators and consumers.

Environmental:

By providing 100% renewable energy and encouraging citizens to install their own energy systems, as well informing them on strategies to reduce their energy usage, BE promotes the transition to a fossil-free energy system.

Barcelona Energía offers a wide array of tools and services to empower citizens to become more efficient energy consumers as well as generate their own electricity with residential solar PV installations.



CAPE TOWN:

Spearheading a shift towards a decentralised, renewable energy supply



→ South Africa's energy supply is dominated by coal, which supplies 85% of the country's electricity. To accelerate the low-carbon transition, the City of Cape Town has taken matters into its own hands and is developing **legislation to increase the share of renewables** in the system.

Cape Town's Small-Scale Energy Generation (SSEG) programme promotes the uptake of rooftop photovoltaic (PV) systems and small wind turbines in the commercial and residential sectors, allowing consumers to become producers and sell excess electricity generated back to the grid, **fostering a more decentralised and sustainable electricity supply.**

What has the city achieved?

Cape Town's Small-Scale Energy Generation (SSEG) programme is reducing the city's reliance on coal energy, promoting local resale of electricity, and diversifying the energy mix. Electricity "prosumers" can connect their renewable energy systems to the city's grid, exporting to the grid when they generate more electricity than they are using, in exchange for credit.

The city is promoting independent local power production by challenging the exclusive rights of the public utility to procure electricity for resale. The city has taken the case to the High Court to allow the city to procure electricity from independent power producers, which will make it more profitable for residents and small

businesses to install small-scale renewable energy systems and feed excess electricity to the grid. The project is a first step in triggering the shift from coal-based electricity generation in South Africa. In the absence of national legislation regarding SSEG installations and tariffs, the city assumed leadership by developing suitable tariffs, bi-directional metering systems, and automated billing systems that allow the purchase and sale of electricity. The city's legislation has been adopted by surrounding municipalities in the Western Cape Province, and is being incorporated into national legislation.

Cape Town 



CAPE TOWN

↓ 77.9K

TONNES OF CO₂e emissions are estimated to be reduced each year via approximately 50 MW of SSEGs currently installed in Cape Town

What can other cities learn?

Provide training opportunities:

To address the challenge of a limited capacity of trained installation technicians, the city partnered with a local NGO and industry association to develop a training programme for PV installers. The programme offers subsidies for male electricians (75% subsidy) and female electricians (100% subsidy). To date, 113 successful candidates have received the solar PV training, 66 of which were sponsored by the city under its SSEG programme.

Share knowledge:

When the programme started, there was no national legislation in South Africa regarding SSEG installation and tariffs, and therefore the city initiated research on the implementation of small-scale renewable energy systems within South African context. The project involved extensive collaboration with government bodies, an NGO, and a utility association. The results of which have been made open source for the benefit of other cities following in their footsteps.

What are the co-benefits?

Social:

As a city that suffers from frequent blackouts, the SSEG programme provides a solution by improving energy security for its residents and supporting the diversification of energy sources. Reliable access to energy enhances citizens' quality of life, access to technology and communications, and productivity.

Health:

The programme emphasises building citizen collaboration and capacity to ensure the energy systems are installed safely and legally, thereby reducing accidents and hazards.

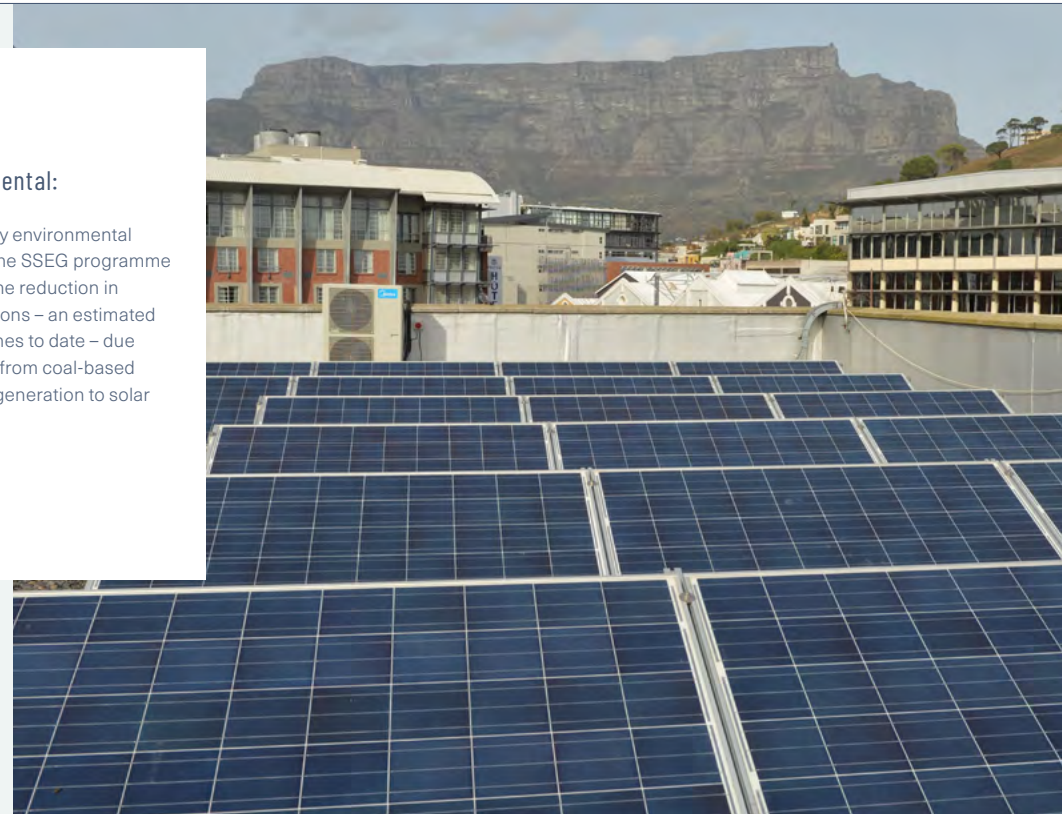
Economic:

Sourcing more electricity from renewable energy technologies is critical for Cape Town to build a more robust economy and create local jobs.

Environmental:

The primary environmental benefit of the SSEG programme has been the reduction in CO₂ emissions – an estimated 77,868 tonnes to date – due to the shift from coal-based electricity generation to solar and wind.

Under the programme, the city aims to achieve 120 MW of electricity supplied by rooftop PV installations by 2020.



COPENHAGEN:

New neighbourhood is a hotbed of innovation for smart energy systems

→ In the new district of Nordhavn, in Copenhagen, a large-scale integrated research and demonstration project – EnergyLab Nordhavn – has been established to **build the knowledge needed to operate the smart energy systems of the future.**

Taking a holistic approach and testing different smart technologies is **spurring low-carbon innovation in the city**, and is part of Copenhagen’s goal of becoming carbon neutral by 2025.



What has the city achieved?

Developing smart energy systems will be integral to successfully transitioning to a carbon-neutral economy, but to date efforts have mostly been focused on smart electricity grids. Copenhagen, however, is starting to look at the whole smart energy system, integrating electricity, heat, and transport. Through a research and demonstration project, the new neighbourhood of Nordhavn has become a living lab, testing solutions for a future-proof renewable energy system.

With wind power supplying more than 40% of Denmark’s electricity demand, many aspects of the EnergyLab Nordhavn project address the issue of how to increase flexibility in a system increasingly powered by intermittent sources. Energy storage is one part of this puzzle, and

the project is testing large batteries and EVs to reduce peak load on the grid. The project is also trialing intelligent heating of 85 apartments, shifting load on the heating network and improving indoor comfort, and has been so successful it was recently expanded to include 7,000 homes in a nearby district. Additionally, a heat pump and storage system is being used to improve flexibility and reduce required temperatures in the local district heating network, demonstrating how these technologies can be better integrated.

Copenhagen 

COPENHAGEN

↑ 21 MILLION

DOLLAR INVESTMENT in the EnergyLab Nordhavn project from a combination of public and private partners

What can other cities learn?

Get ahead of the pack:

The Danish capital hopes that by investing in research and development of smart integrated energy systems, it will get first-mover advantage on many innovative low-carbon technologies of the future, capturing that intellectual property, growing the local green economy, and exporting that knowledge around the world.

Think holistically:

EnergyLab Nordhavn is looking at the whole energy system as one, and testing new solutions that integrate heat, power, and transport in the northern district of Copenhagen. As all three sectors transition to renewables and electrification, it will be vital to understand how they can work better together to balance loads and manage intermittent supply.

What are the co-benefits?

Social:

To be a truly living laboratory for testing energy solutions and developing neighbourhoods fit for the future, EnergyLab Nordhavn has been keen to involve local residents in the tests, who offer their data anonymously to ensure that solutions are improving living standards as well.

Health:

The layout of the Nordhavn district is designed to encourage active and public transport, allowing residents to live car-free lifestyles with great benefits for their physical fitness and air quality in the city.

Economic:

Flexibility in the energy system, for both heat and electricity, will be crucial in reducing operating costs in the future, where intermittent renewables make up a greater proportion of the energy mix. These savings can be passed on to consumers to reduce energy bills.

Environmental:

EnergyLab Nordhavn is at the cutting edge of large-scale testing of low-carbon technologies, showing a pathway for an integrated, smart energy system, with successful solutions already being scaled into other neighbourhoods.

EnergyLab Nordhavn, in Copenhagen, is the city's testing ground for developing the knowledge and technology needed for an integrated, smart energy system of the future; all part of designing a modern, liveable neighbourhood on the city's waterfront and becoming carbon neutral by 2025.



DURBAN:

Roadmap leads the way to future powered by renewable energy

→ The future of renewable energy is becoming increasingly bright in Durban, part of the eThekweni Metropolitan Municipality in South Africa.

The municipality has embarked on a **strategic process to promote and procure renewable energy** via a roadmapping process and the creation of an integrated resource plan. These efforts are paving the way to achieve the municipality's ambitions of **40% electricity derived from renewable energy by 2030 and 100% by the year 2050.**



What has the city achieved?

As renewable energy becomes more affordable and feasible, Durban has set its sights on becoming carbon neutral by starting with decarbonising their energy supply. To facilitate the renewable transition, the eThekweni Municipality embarked on a strategic roadmapping process to evaluate suitable technologies and created an integrated resource plan to identify the best integrated energy mix. The process involved stakeholder engagement and public participation via a public meeting attended by more than 500 participants from academic institutions, industry, and local residents. Through the roadmapping process, solar, wind, small-scale hydropower, biomass, and waste-to-energy options were explored and found to be viable alternatives to the current fossil fuel-dominated system.

Durban has also taken a unique approach in piloting pre-feasibility studies investigating ocean thermal energy generation, which found the possibility of 52 GW of electricity that can be harnessed in the coastal areas of Durban.

The municipality submitted the eThekweni integrated resource plan to the national government in order to be granted permission to procure renewable alternatives and generate its own clean energy. Following this move, the city devised a municipal independent power producer procurement plan.

Durban 

DURBAN

↑ 40%

RENEWABLE ENERGY SUPPLY is the municipality's target to achieve by 2030 and 100% by 2050

What can other cities learn?

Share lessons learned:

Durban's membership in the C40 Climate Leadership Group, as part of the Clean Energy Network, has led to the funding of the strategic roadmap and integrated resource plan. In return, the city is sharing the lessons learned with other members of the network. In addition, the city has completed other renewable energy projects using their own budget, which they are sharing knowledge from as well, including a project to install solar PV panels across municipal buildings.

Identify opportunities through strategic assessments:

With the strategic roadmap in place, Durban had the opportunity to assess the possibility for renewable energy infrastructure and project the demand for electricity by 2030. The process found an opportunity in that the cost of solar technology has dropped by 83% in South Africa since 2010. The city therefore sees this as an opportunity to scale from the proposed 720 MW to 1,800 MW of renewable energy by 2050 in order to supply affordable electricity to a growing population.

What are the co-benefits?

Social:

The city is working to grant citizens the ability generate and feed to the grid their own electricity at the applicable residential tariffs, and thereby providing compensation to customers who generate surplus electricity.

Health:

The increased adoption of renewable energy shifts the city from a dependence on coal, improving air quality and reducing the risk of respiratory illnesses.

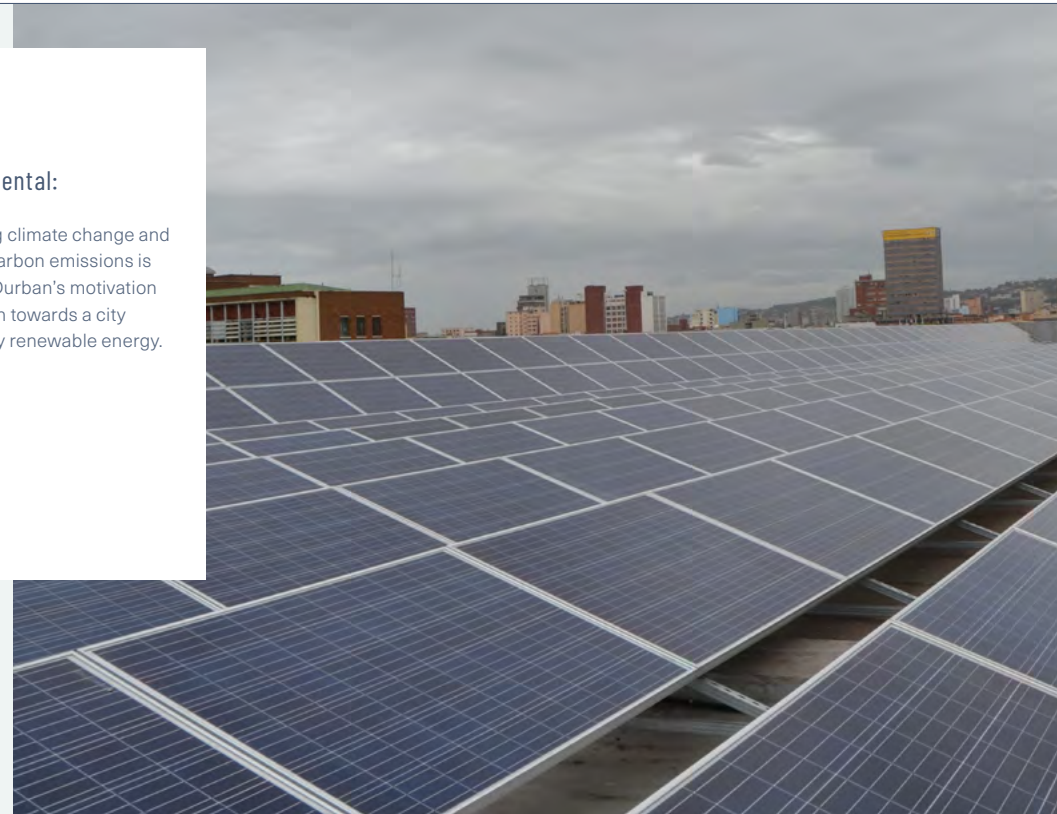
Economic:

The growth of the city's economy strongly relies on the availability of energy, and it is anticipated that an increasingly renewable power supply will improve the energy security of Durban and boost the potential for investment.

Environmental:

Addressing climate change and reducing carbon emissions is central to Durban's motivation to transition towards a city powered by renewable energy.

By expanding the municipality's capacity to generate renewable energy, Durban is working towards meeting the growing city's goal to achieve 100% renewable energy by 2050.



HONG KONG:

Pioneering approach turns wastewater into renewable energy



→ In the low-carbon transition in our cities, it's important to **maximise on all opportunities to generate renewable energy wherever possible.**

In Hong Kong, the Water Supplies Department is looking to their own reservoirs and flows of wastewater as renewable energy resources, **installing hydropower and floating solar power systems.** The various installations should generate 3.5 GWh of clean electricity, and abate 2,368 tonnes of CO₂ emissions, each year.

What has the city achieved?

Behind the scenes of our cities, a complex system works to provide fresh drinking water and pump away our wastewater. This requires infrastructure and consumes energy that is rarely thought of by residents. In Hong Kong, the Water Supplies Department has seen the opportunity to use their infrastructure to generate renewable electricity, installing hydropower systems within water treatment works and floating solar power systems on reservoirs.

In cities where space is often at a premium, large reservoirs represent an under-utilised area, which Hong Kong is beginning to make better use of via floating solar power systems. The photovoltaic systems afloat on the reservoir can achieve better efficiency than rooftop systems thanks to

low shadowing and cooling from the water, with additional benefits of reducing evaporation and algae growth.

Hong Kong's utilisation of wastewater flows for hydropower generation is a pioneering approach, and thus far the technology has been fitted to two plants in the city, generating more than 3 GWh of renewable power each year. These installations feed into the grid, powering operations at the wastewater treatment plants and reducing Hong Kong's reliance on fossil fuels.

Hong Kong 

HONG KONG

↑ 24

KM² IS TAKEN UP BY RESERVOIRS

in Hong Kong, indicating the scaling potential of floating solar power

What can other cities learn?

Ownership in every city department:

Action to encourage renewable energy generation and shift to a low-carbon future cannot be limited only to energy departments within city governments, but must be owned by all. Hong Kong's Water Supplies Department is taking matters into its own hands to generate renewables from their existing assets, cutting their energy costs and carbon emissions simultaneously.

Public bodies taking leadership:

While the city government's role in setting goals for renewable energy generation is key, it is important that public bodies also get their own house in order. This project demonstrates how a public body can show leadership and generate a ripple effect into the private sector.

What are the co-benefits?

Social:

Reducing the carbon intensity of Hong Kong's energy supply is a key piece of the city's plans to create a more liveable, equal city for its residents.

Health:

In compact cities such as Hong Kong, air pollution from fossil fuel-powered electricity generation can cause significant health risks, so projects such as these that help in the low-carbon transition also improve public health.

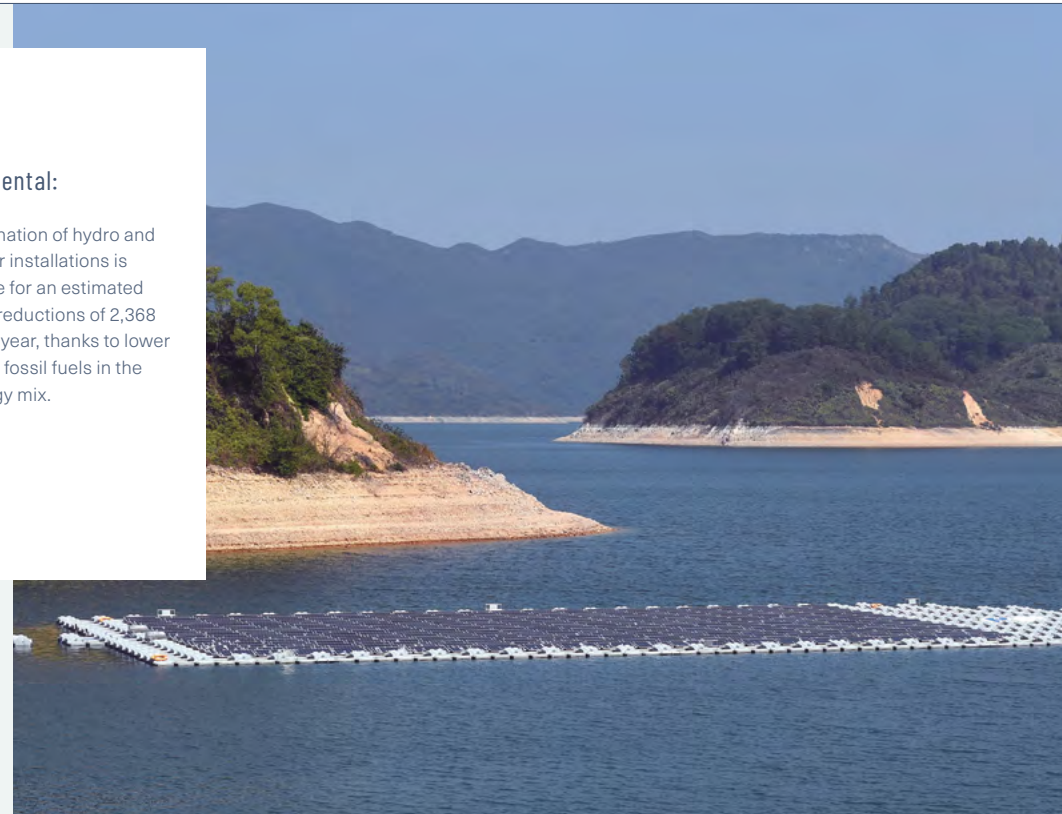
Economic:

Once the required infrastructure is in place, Hong Kong's Water Supplies Department receives free, renewable energy to power its processes, saving an estimated \$500,000 annually. These savings can be passed on to consumers or used to invest in further efficiency and low-carbon improvements.

Environmental:

The combination of hydro and solar power installations is responsible for an estimated emissions reductions of 2,368 tonnes per year, thanks to lower reliance on fossil fuels in the city's energy mix.

Hong Kong's Water Supplies Department has used existing assets to generate renewable electricity, fitting hydropower to wastewater flows and floating solar panels atop reservoirs. With 21 water treatment plants and 24 km² of reservoir under their management, there is good potential to scale up now that the concept has been proved successful.



LONDON:

Group-buying scheme makes it easier and more affordable for citizens to install solar

→ The Mayor's Solar Together London project is an **innovative group-buying scheme** to increase the uptake of solar photovoltaics (PV).

Via promotion with London boroughs, residents are encouraged to register their interest in having PV installed on their roofs, and pre-approved installers take part in **a reverse auction to offer their best price for this aggregated demand**. With group-buying, the project saves homeowners money and the hassle of finding a trusted installer, while making it more efficient for PV installers to find clients and helps boost demand for their services.



What has the city achieved?

The programme helps residents by taking away the "hassle factor" for households that want to play their part in London's green energy transition but are unsure who to trust with so many options available. The installer that can create the most efficiencies can offer the best price to registrants, with quality of materials and labour being guaranteed under the pre-approval process. Solar Together London offers residents the opportunity to buy high-quality solar panels at a competitive price, with support to help them to make an informed choice. The involvement of the Mayor of London and the boroughs lends assurance and credibility to the scheme.

To date, the scheme has been run with 14 boroughs over 2018 and 2019. The winning suppliers offered discounts up to an average of 35% below market prices, which is a savings of around \$1,800 for a common-sized system. The scheme resulted in 624 solar installations across London – reversing the decline in installation rates seen in recent years due to a watering down of national incentives. The new PV panels have installed clean energy capacity of nearly 1.5 MW, resulting in an estimated annual CO₂ reduction of 423 tonnes.

London 

LONDON

↓ 10.6K

TONNES OF CO₂ emissions are expected to be reduced over the lifetime of the 624 newly installed solar PV projects

What can other cities learn?

Political leadership earns residents' trust:

The participation of the Mayor and local leaders was key to the success of the project. Customer surveys demonstrated that the backing of these leaders was a large factor in their willingness to take part. While many Londoners reported a favourable view of solar, many had not acted previously due to a lack of trust in the market and confusion over the variety and reliability of installers. The Mayor set the goal of transitioning London to a zero-carbon city by 2050, and empowered Londoners to personally buy into achieving the goal.

Engage local leaders to build support:

Stakeholder engagement was also key to the scheme's success. Without gaining the support of leaders within London boroughs, such as elected councillors, senior directors, and officers to co-promote the scheme more locally to their residents, it is likely it would have been less successful. Similarly, engaging local NGOs to spread the word proved fruitful in furthering the reach of the project.

What are the co-benefits?

Social:

Participant households are now benefiting from generating their own clean electricity and the associated protection from energy price increases. Depending on household consumption, an average-sized PV system in London can offer between \$100-300 a year in energy bills savings.

Health:

Increasing the electricity produced by solar PV contributes to the phasing out of the fossil fuel industry, resulting in healthier and cleaner air for all.

Economic:

The UK's domestic solar industry has suffered a downturn in recent years from reductions in the government's feed-in tariff. The project sought to boost the industry, yielding an investment of \$2.9 million from London residents via the installation of household solar PV.

Environmental:

The Mayor has set the overarching ambition of becoming a zero-carbon city by 2050. This includes increasing solar capacity ten-fold by 2030, compared to 2018 levels. Solar Together London is one of many initiatives that will be needed to decarbonise the city.

Solar Together London has made it easier and more affordable for residents to invest in solar PV, while also providing a more effective avenue for installers to bid for contracts. The win-win approach boosted local investment in solar and helps put the city on the path to a renewable-powered future.



SAN FRANCISCO:

Green energy programme fuels the transition towards a renewables-powered city



→ Through the CleanPowerSF programme, the City and County of San Francisco is providing its residents and businesses **a new option to purchase their electricity from renewable and low-carbon sources** of energy at competitive rates.

By launching CleanPowerSF, the city is making progress toward its goal of reducing its greenhouse gas emissions by 40% by 2025 compared to 1990, as well as having **100% renewable energy by 2030**. The programme was created with extensive public input, and revenues are reinvested back into the community.

What has the city achieved?

CleanPowerSF is a financially independent, self-funded community choice aggregation programme operated by the San Francisco Public Utilities Commission (SFPUC). CleanPowerSF is unique in that it was formed to serve San Francisco exclusively, and benefits from being nested within a public utility, which allows it to leverage the utility's staff and infrastructure to further its programme's goals. With CleanPowerSF, the city now has more control over its ability to increase the scale and cost-effectiveness of renewable energy and demand-side energy management, and will exercise more local control over electricity prices, resources, and reliability. Since its launch in 2016, CleanPowerSF has saved San Francisco ratepayers more than \$3.5 million in reduced electricity costs while reducing

city-wide electricity supply-related greenhouse gas emissions by more than 60 tonnes a day. CleanPowerSF estimates that it reduced CO₂ emissions relative to 1990 levels by approximately 258,000 tonnes in 2018, and through the growth of the programme, a doubling of CO₂ reductions is anticipated in 2019. Revenues generated by CleanPowerSF will be reinvested into the community to lower rates, offer customer programmes designed to further decrease greenhouse gas emissions in the city, and spur the development of renewable energy projects and the creation of local jobs.

San Francisco 

SAN FRANCISCO

↓ 100%

DECREASE IN ELECTRICITY SECTOR EMISSIONS
is the goal by 2030 through the CleanPowerSF programme

What can other cities learn?

Listen to the citizens:

Citizen engagement prior to the launch of CleanPowerSF directly informed the product offerings. Based on customer feedback, CleanPowerSF provides two options: electricity priced equal to or less than the local utility's standard offering that includes approximately 50% renewable energy, as well as 100% emissions-free renewable energy at a slight premium of \$4 per month.

Investing in clean energy pays off:

San Francisco spent approximately 10 years developing and implementing CleanPowerSF, investing approximately \$10 million. In three years of operation, CleanPowerSF has already generated net revenue in excess of the city's initial funding, and is expected to generate net revenue in excess of 200% of the city's initial financial investment by the end of 2019. This net revenue is being used to fund programme financial reserves and repay start-up loans. Once this has been achieved, savings generated by the programme will go back to ratepayers in the form of reduced rates and fund the development of new local clean energy infrastructure.

What are the co-benefits?

Social:

CleanPowerSF increasingly aims to make participation accessible to all San Franciscans, regardless of income level. It plans to consider the obstacles individuals in low-income and underserved communities may face to join energy efficiency, demand response, and renewable generation programmes, and minimise the barriers to entry.

Health:

The programme primarily sources its power from renewable and greenhouse gas emissions-free energy sources that do not contribute negatively to air quality, thereby preventing air quality-related health impacts.

Economic:

CleanPowerSF plans to invest revenues in reducing residents' electricity bills and the development of new clean energy infrastructure. Analyses have shown these efforts have the potential to create 8,000 to 9,000 jobs between 2018 and 2030.

Environmental:

The programme's policies also prohibit the sourcing of power from coal, therefore preventing the emissions of damaging particulate matter and NOx emissions associated with this resource.

To celebrate the end of the CleanPowerSF enrollment, and the fact that the SFPUC provides clean power for nearly 80% of the electricity consumed in San Francisco, approximately 60 residents dressed up as Carbon Busters and carbon molecules to illustrate how the city is reducing greenhouse gas emissions thanks to its clean power programmes.



SEOUL:

Solar City powers a cleaner, greener, and more equitable future

→ Seoul is engaging citizens and businesses in a wide array of initiatives to **make solar more affordable, accessible, and in some cases mandatory**. The Solar City Seoul project has already added 64 MW of new solar PV systems in 2018, which generated 252,989 MWh of electricity and cut 116 tonnes of CO₂ emissions.

The project has even greater goals to deploy domestic solar PV panels to 1 million households, install solar PV systems on all municipal sites, and foster growth in the solar industry to **achieve 1 GW installed solar PV capacity by 2022**.



What has the city achieved?

Making solar more affordable for citizens is one way Seoul is speeding solar adoption. The city provides subsidies for solar panel installations on balconies and rooftops of apartment buildings. Despite the state government abolishing feed-in-tariffs in 2012, Seoul stepped up and launched their own feed-in-tariff, providing \$2.4 million to 228 power generators by the end of 2018. Seoul also provides low-interest loans to citizens that cover up to 80% of the cost of solar PV systems. Between 2012 to 2018, 99 loans were taken out to fund \$4.4 million of installation costs. Seoul also offers the unique option of leasing solar panels, lowering installation costs, and thereby increasing public interest in the technology. Citizens can

get informed via five Solar PV Support Centers, which provide one-stop service from general information to panel maintenance.

Seoul is also thinking outside the box to increase solar capacity, such as renting unused municipal land to private power generators and cooperatives for larger-scale PV power generation. For institutional improvements, solar is no longer an option, as Seoul can make installation of solar PV systems mandatory in the Seoul Environmental Assessment Standards and Green Building Code.

Seoul 

SEOUL

↓ 537K

TONNES OF CO₂ EMISSIONS are estimated to be reduced if Seoul is to achieve its goal of 1GW of installed solar capacity by 2022.

What can other cities learn?

Make the most out of publicly owned sites:

From schools to parking lots, Seoul is working with every division related to municipal infrastructure to install solar PV systems on all available municipal sites. By the end of 2018, 98 MW of solar capacity was installed on public buildings, with a goal of 244 MW by 2022. Seoul is the first city in South Korea to develop standards in an ordinance on rents of municipal sites to private solar power generators. Seoul is also planning to expand community-scale solar power generation by renting municipal sites, providing low-interest loans to lower installation costs, and offering municipal feed-in-tariffs. Already, 14 cooperatives are running 29 solar power plants (1.3 MW total capacity) on municipal sites.

Include citizens for effective public policy :

Solar City Seoul's target and action plan were jointly developed by the city government and the Citizens Committee on One Less Nuclear Power Plant, which consists of the Seoul Mayor, scholars, researchers, civic groups, businesses, and other experts who participate in Seoul's energy policy development and implementation. The committee and the city government has organised a Seoul Energy Forum seven or more times every year between 2012 and 2018, where 3,200 citizens participated to discuss the direction and the implementation of Seoul's energy transition policies.

What are the co-benefits?

Social:

Solar City Seoul worked in partnership with solar PV panel manufacturers to donate panels to households living on public pensions. Between 2015 and 2018, 13,125 households received solar panels, cutting their monthly electricity bills by \$8 on average.

Health:

Seoul is preventing air pollution and thereby improving public health by providing an alternative to coal-generated electricity. In 2018, Seoul's solar panels generated 252,989 MWh of electricity, cutting PM2.5 levels by 8.7 tonnes.

Economic:

Seoul foresees economic benefits, including promotion of the city's renewable energy industry and job creation, as a result of the project. Seoul expects \$1.4 billion in investment in Solar City Seoul, which the city has estimated will create 4,500 jobs from 2018 to 2022.

Environmental:

Solar City Seoul was launched to prevent the need to build centralised coal-fired and nuclear power plants, and the associated environmental consequences, by increasingly meeting the city's own electricity demand with renewable power generated within the city.

The success of Solar City Seoul is largely thanks to the strong support of citizens, as they generate most of the solar power by installing PV panels on their balconies and rooftops. From the launch of the programme until the end of 2018, 69,000 households have installed solar panels.



TEL AVIV-YAFO:

Wave power makes a splash in a rising tide of renewables

→ In Tel Aviv-Yafo, the city has established a **public-private partnership to develop wave power technology** on the city's shores.

After a successful pilot, the project is scaling up from 10 to 100 kW this year, and is planned to eventually be integrated into a **20 MW wave power system that can provide 2% of the country's electricity needs**. The project demonstrates how cities can power innovation in the energy sector and help new green technologies overcome barriers to market entry.



What has the city achieved?

Harnessing the power of ocean waves is an idea dating back to 1799, but despite the technology's potential to meet up to 10% of global energy demand¹, installed capacity worldwide is only around 25 MW², the equivalent of three large wind turbines. In a bid to better exploit this renewable energy resource, Tel Aviv is starting to put some of its 14 km coastline to use to generate green energy from the Mediterranean's waves.

In 2014, the city established a public-private partnership to install a 10 kW pilot wave power project on the breakwater at Jaffa Port. After five years of testing and R&D, the project is expanding 10-fold and connecting into the grid to contribute to Israel's shift towards renewables.

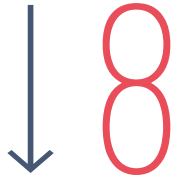
Wave power has benefits over other renewables as it is less intermittent, generating electricity both day and night. However, as this project was the first application of the technology in Israel, there were several regulatory hurdles to overcome, and new frameworks were established for permits and feed-in tariffs for wave power, allowing the technology to scale more easily in the future. Additionally, by building the system on an existing breakwater, it limits disruption to the marine environment and structural erosion to the breakwater, as well as reducing costs.

Tel Aviv-Yafo 

Sources: ¹Living with the oceans, World Ocean Review (2010)

²Ocean Energy Systems, Annual Report (2017)

TEL AVIV-YAFO



YEARS IS THE EXPECTED RETURN ON INVESTMENT,
which will come down as the project scales up

What can other cities learn?

Partner up to innovate:

To harness the power of the seas, Tel Aviv has partnered to harness the power of business to scale new innovations in the power sector. To scale the project, collaboration was required between the city government, the national energy ministry, Eco Wave Power, and EDF Energy.

Share to scale:

To help new renewable technologies scale, sharing results from R&D and pilot projects is key. Learnings from the project at Jaffa Port have been shared through numerous site visits and forums, with a great interest shown by other coastal cities and states from around the world.

What are the co-benefits?

Social:

As the home to many tech startups, Tel Aviv is an excellent location to spur innovation in the wave power sector. The next expansion of the project will create 10 new jobs, with a ripple effect on skills in the low-carbon power sector amongst the city's workforce.

Health:

As the majority of Tel Aviv's power system is derived from fossil fuels, steps to shift towards green resources will improve air quality in the city, leading to reduced risk of respiratory health problems.

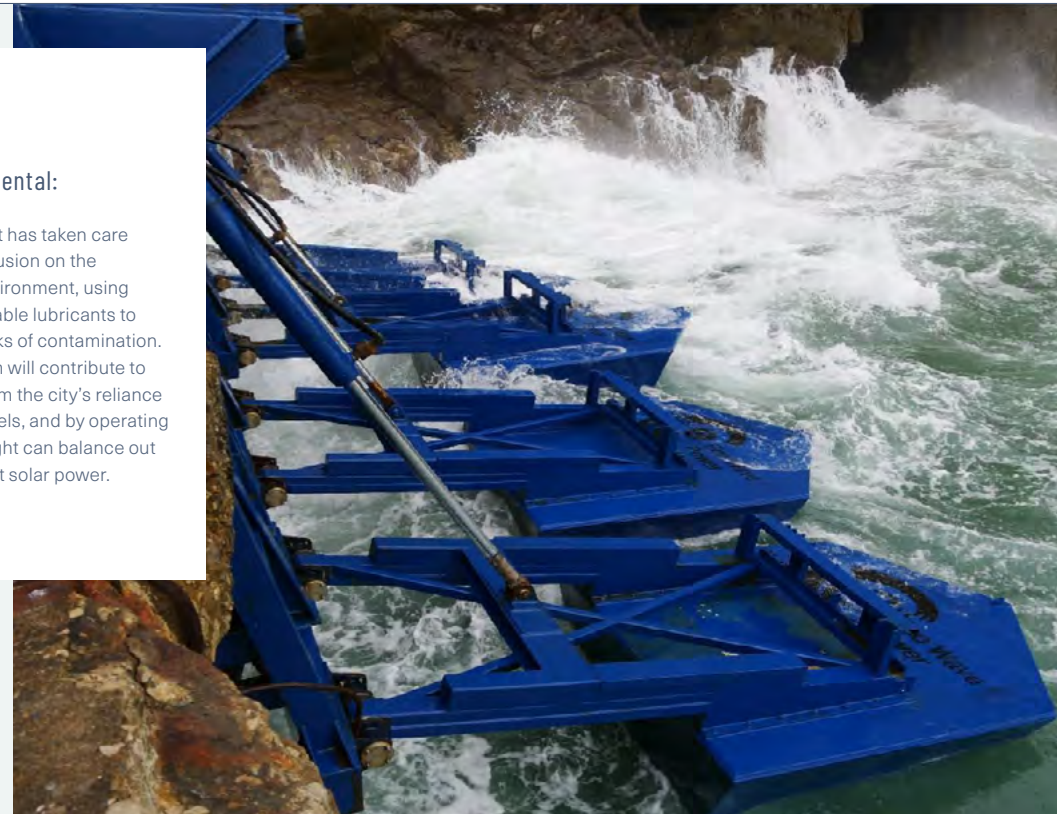
Economic:

The project is playing into the national blue economy strategy, to create smart and sustainable value from the oceans. Funding for the project came from a combination of innovation grants and private funding, with the city providing technical assistance and infrastructure.

Environmental:

The project has taken care to limit intrusion on the marine environment, using biodegradable lubricants to remove risks of contamination. The system will contribute to shifting from the city's reliance on fossil fuels, and by operating day and night can balance out intermittent solar power.

The wave power installation on the breakwater of Tel Aviv's Jaffa Port has provided a testing ground for the technology in Israel, and is now scaling up, with plans to eventually be part of a 20 MW wave power system on the country's Mediterranean coastline.



2019

Cities100

SUSTAINABLE FINANCE

→ With major cities harbouring key financial centres, financial instruments and divestment projects are increasingly being utilised to help accelerate the decarbonisation of the global economy. Unleashing the power of international markets, via green bonds for example, is enabling rapid build-out of green energy capacity.



MELBOURNE:

Lengthy power purchase agreement accelerates grid decarbonisation



→ As part of Melbourne's wish to **decarbonise its electricity supply**, in 2017, the city and its partners negotiated a 10 year power purchase agreement (PPA) with clean energy company Pacific Hydro.

In 2019, the new 39-turbine Crowlands Wind Farm began supplying electricity to myriad public and private sector buildings across Melbourne. Importantly, the project managed to develop a model for large electricity customers to **accelerate nationwide investment in renewable energy**.

What has the city achieved?

The Melbourne Renewable Energy Project (MREP) has accelerated Australian investment in carbon-free electricity, with more than 3,000 MW of new renewable energy generation capacity – and \$4.2 billion in investment – being underwritten by corporate PPAs in Australia since 2017. Melbourne's strong initial political will to push MREP through has been worthwhile: the annual renewable energy supply of 88 GWh equates to a reduction of 96,800 tonnes of CO₂e emissions per year, and the PPA electricity pricing is expected to be competitive over the 10 year period.

While MREP partners, including the city, did not invest capital into this renewable energy project, all 14 members did have to negotiate and agree

to a 10 year contract as opposed to the more common 2 to 3 year contracts. Instead of owning, operating, or having an equity stake in the new wind farm, the customer group committed to buy 88 GWh of electricity for 10 years, thereby keeping transaction costs lower. In all, launching MREP cost \$483,000, excluding staff time, with any further model replications expected to cost half that due to market shift and intellectual property created by the project. The \$138 million Crowlands Wind Farm was financed with debt provided by a consortium of Australian banks, while equity was invested by Pacific Hydro.

Melbourne 

MELBOURNE

↓ 1 MILLION

TONNES OF CO₂e EMISSIONS will be avoided by 2030 as a result of this long-term renewable energy power purchase agreement.

What can other cities learn?

Competitive pricing in short and long term:

While MREP partners had to settle for a more unusual 10 year contract, the price of electricity procured under the PPA is expected to be competitive throughout the period compared to business as usual.

Push on resolutely to drive development:

Now that the MREP's model has proven to be replicable, the city is making the most of its newly acquired skills and experience to work with a group of six companies intending to go to market for a PPA of 100 GWh of renewable electricity per year in late 2019.

What are the co-benefits?

Social:

The MREP created 140 jobs in regional Australia during the construction of Crowlands Wind Farm, as well as eight ongoing maintenance jobs. Where possible, Pacific Hydro sourced materials and skills from local businesses. Local wind farm tower manufacturer Keppel Prince, for example, was the farm's principal tower supplier.

Health:

With this long-term PPA, PM emissions will be reduced, improving public health. The improvement should continue as the city's grid becomes increasingly decarbonised.

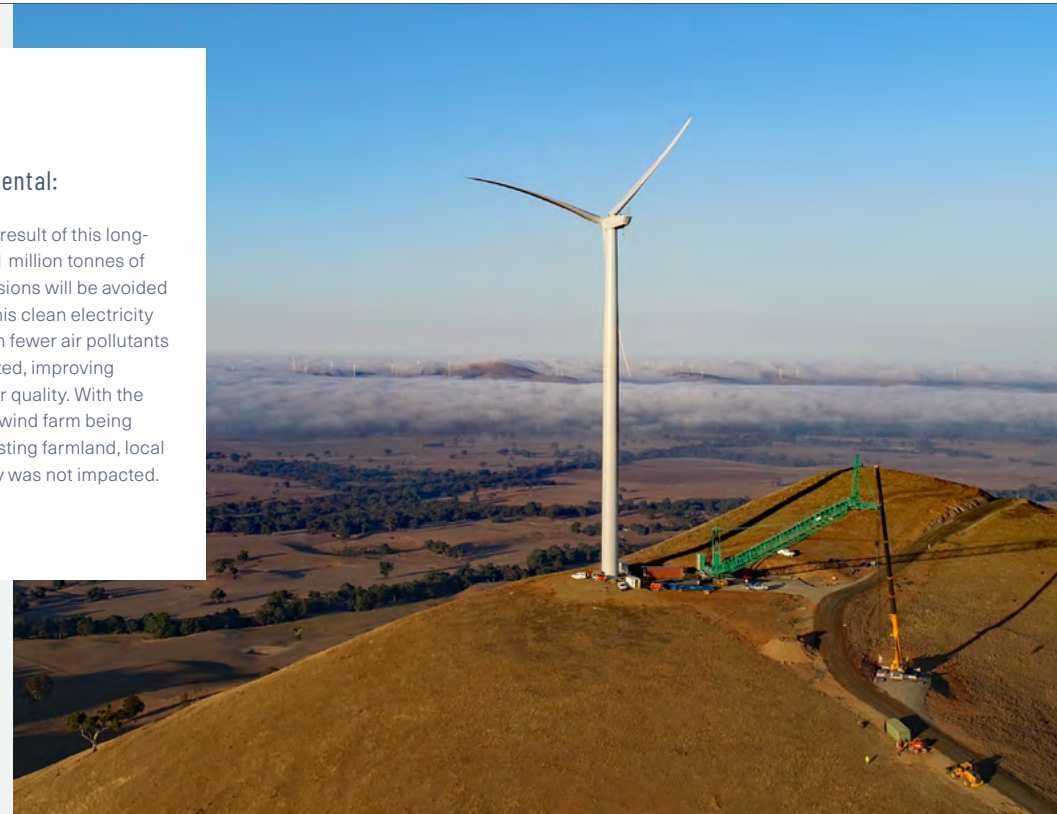
Economic:

The long-term competitive electricity pricing reduces businesses' operational costs, boosting their resilience in an increasingly uncertain global energy market. Pacific Hydro is contributing to a fund to give back to the community, supporting local health, environmental, and education initiatives.

Environmental:

As a direct result of this long-term PPA, 1 million tonnes of CO₂e emissions will be avoided by 2030. This clean electricity will result in fewer air pollutants being emitted, improving the city's air quality. With the 39-turbine wind farm being built on existing farmland, local biodiversity was not impacted.

The 39-turbine wind farm in rural Victoria is owned and operated by Melbourne-based clean energy company Pacific Hydro. Partners in the Melbourne Renewable Energy Project have collectively committed to buying 88 GWh of renewable energy annually through 2030, equating to a yearly reduction of 96,800 tonnes of CO₂e emissions.



NEW YORK CITY:

City divests 100% of pension funds from fossil fuels

→ To align financial markets with the Paris Agreement and send a market signal for a safe and sustainable future, New York City has made the move to divest its pension funds from fossil fuels.

This **\$5 billion divestment** will happen over the coming four years, and coincide with a doubling of investments in climate solutions to \$4 billion. While the move is making increasing financial sense, it has also kickstarted a global move to **place financial markets at the forefront of decarbonising the economy.**



What has the city achieved?

To meet the Paris Agreement's goal of staying well below a 2°C global average temperature increase, an estimated 80% of the world's remaining fossil fuels must stay in the ground¹. Despite that inescapable fact, annual fossil fuel investments rose to \$933 billion last year², with cities retaining significant financial holdings in the industry. New York City, realising the inconsistency with their vision for the future, is putting its money where its mouth is, and divesting the entirety of its \$189 billion pension funds from fossil fuels.

Around \$5 billion in the city's five pension funds is held in securities of more than 190 fossil fuel companies, which are becoming increasingly volatile and less profitable, as the risk of investing

in stranded assets grows. As such, NYC not only sees divestment as a strong market signal and political move, but also a financially savvy one in the long term.

In concert with the divestment move, the city is doubling its investment in climate solutions, to \$4 billion. Importantly, unlike other sustainable investment approaches, NYC is targeting this money at investments with high impact for emissions reductions such as renewable energy and zero-carbon transport, and has kickstarted large-scale fossil fuel divestment in cities around the world.

New York City 

NEW YORK CITY

↑ 189 BILLION

DOLLARS IS THE SIZE OF NYC'S PENSION FUNDS,
which from 2022 will be entirely fossil fuel-free

What can other cities learn?

From black to green means red to black:

Shifting financial holdings from black to green is making increasing economic sense, as fossil fuel stocks are increasingly underperforming on the market, and are subject to greater market volatility. Given the Paris Agreement's need to rapidly accelerate green investments, NYC sees keeping investments in fossil fuels as betting against their own future.

Take the bull by the horns:

The charging bull sculpture outside the New York Stock Exchange has become a symbol of financial markets around the world, but with this divestment initiative, the city's Mayor has taken the bull by the horns, and put NYC at the forefront of transitioning to a decarbonised economy. Taking such ambitious action has only been possible thanks to strong political will from the Mayor's office.

What are the co-benefits?

Social:

Decarbonising the economy is critical to achieving climate justice. In setting the divestment agenda, NYC has not only paired with pension fund managers, but also labour unions and civil society activists, ensuring that a just transition is considered in all decision-making.

Health:

Fossil fuel combustion results in significant health risks for people around the world. By funding the transition towards a cleaner society, NYC is also creating a healthier future for its citizens.

Economic:

NYC's approach to investing in climate solutions is innovative compared to typical institutional approaches, as it targets investments where there are tangible climate benefits on offer, putting capital to work to achieve the goals of the Paris Agreement, while also making a financial return.

Environmental:

NYC's divestment is sending a clear signal that the end is nigh for the extraction and combustion of fossil fuels, which is the primary driver of environmental degradation, carbon emissions, and air pollution around the world.

Many cities share NYC's vision for a fairer, greener, and safer future, but by divesting \$189 billion of pension fund holdings from fossil fuels, the city is putting its money where its mouth is and leading a global divestment charge.

Sources:

¹New York City to Divest Pension Funds of Fossil Fuels, UNFCCC (2018)

²World Energy Investment, International Energy Agency (2019)



PARIS:

The socially inclusive, environmentally sustainable Paris Green Fund

→ A law passed in 2017 enabled the City of Paris to create an investment fund the Paris Green Fund – to help **accelerate the ecological transition**, while also bringing about tangible, positive benefits to residents.

As a 10 year project, this \$221 million capital growth fund expects to finance five **ecologically sustainable, socially inclusive projects** annually, with a focus on supporting fast-growing small businesses.



What has the city achieved?

In line with the rules of the French national financial markets authority, the Paris Green Fund (PGF) is managed by an independent management company – Demeter – which to date has raised \$221 million in capital over two separate funding rounds.

Demeter is using this financial instrument to help innovative small- and medium-sized businesses on the cusp of rapid growth commercialise their solutions. Its priority sectors are extensive, covering construction, mobility, energy, circular economy, air quality, and digital solutions.

While the PGF was initiated by Paris, Demeter is responsible for raising and managing capital, while three core committees provide the

governance structure to steer this long-term project. The “strategic committee” provides the forward-looking insights into markets, as well as new technologies viable for the ecological transition. The “advisory committee” gives its opinion on all investment decisions submitted by Demeter. The “investment committee” ensures Demeter’s regulations and investment policy are abided by. This governance structure is key to successfully delivering on Paris’ aim for PGF to help the French capital meet its ambitious environmental and social targets.

Paris ○

PARIS

↑ 221 MILLION

DOLLARS IS THE CURRENT SIZE OF THE CAPITAL

GROWTH FUND to finance five sustainability focused European SMEs annually over the next 10 years

What can other cities learn?

Making the most of municipal and national legislation:

With passage of the 2017 law, the City of Paris initiated a territorial fund to hasten the much-needed, just ecological transition. Introduction of this new legislation was crucial in that it enabled the city to take action, while also bringing about notable benefits for the capital's inhabitants.

A successful mixed investment portfolio:

Investors in the PGF are mixed, with public institutions like City of Paris, Caisse des Dépôts, and Bpifrance all involved. From the private sector, participating organisations include Aviva, Pro BTP, Caisse d'Epargne Ile-De France, and Compagnie Européenne de Garanties et Cautions. In addition to a number of family-run businesses, several large corporations have invested, too, including Engie, Fayat, IFP Energies Nouvelles, and Suez.

What are the co-benefits?

Social:

While all projects financed by PGF must help accelerate the socially just, ecological transition, they must also bring about tangible, positive benefits to the citizens of Paris.

Health:

PGF's funding of projects that decrease air pollution will result in significant improvements in the general public's health.

Economic:

By transitioning Paris' economy to becoming less fossil fuel-dependent, the city's long-term economic outlook is stronger, as it will be less vulnerable to fluctuations in future fossil fuel prices.

Environmental:

The collection of sustainability projects funded by PGF will improve the air quality of Paris by preventing the release of local air pollutants, while the transformation towards greener energy will bring about a net reduction of long-term greenhouse gas emissions.

Paris Mayor Anne Hidalgo at the ceremony in July 2018 marking the raising of the first \$110 million in capital of the Paris Green Fund. Today, the PGF stands at \$221 million.



PHILADELPHIA:

Shifting electricity supply to solar via power purchase agreement

→ As part of a wider goal of cutting carbon emissions by 80% by mid-century, Philadelphia has committed to **powering 100% of municipal operations with renewable power by 2030.**

To meet that challenge, the city has entered into a power purchase agreement with a renewable energy developer who will build a large-scale solar power plant with enough generation capacity to **meet 22% of the city government's power demand.**



What has the city achieved?

Price volatility in electricity markets is often a barrier to accelerating the build-out of renewable energy capacity, as developers can't be sure on the return on investment. Power purchase agreements (PPAs), however, offer a solution by providing a commitment to developers to purchase a set amount of power at a fixed price over a predefined period. In its bid to power 100% of municipal operations with renewable electricity by 2030, the City of Philadelphia signed the largest such agreement of any city in the USA.

The agreement will lead to the construction of a 70 MW solar power plant, the largest in Pennsylvania by sevenfold. The PPA will provide

22% of the power supply for municipal operations, creating a significant leap towards the city's clean energy goals. As the agreement is fixed for 20 years, it provides a hedge against price fluctuations, meaning the city can plan effectively and the developer is offered long-term certainty.

An Economic Opportunity Plan was put in place for the project to ensure local community benefits from the city's low-carbon transition with the creation of a number of permanent green jobs and ample opportunities for trainees.

Philadelphia 

PHILADELPHIA

↓ 60K

TONNES OF CO₂ EMISSIONS will be abated
with the Power Purchase Agreement

What can other cities learn?

Look beyond your own assets:

With a commitment to fulfill 100% of its electricity demand from renewables by 2030, the municipal government must do more than install solar panels on its roofs. Philadelphia's PPA is the simplest way to accelerate the build-out of green energy capacity, while also ensuring a significant renewable power supply, providing long-term certainty for the municipality and the project developer.

Go big or go home:

Philadelphia's PPA, at 70 MW, is the largest any US city has made thus far. It was only made possible via close collaboration between the Energy Authority, the Mayor's office, and the Office for Economic Opportunity. The city is now examining the possibility of replicating the agreement to cover a greater proportion of its electricity demand from renewable PPAs.

What are the co-benefits?

Social:

The PPA is fuelling a green jobs future, with the creation of a number of permanent jobs at the solar plant. Additionally, the project will be used to provide further training opportunities in the rapidly growing solar industry.

Health:

While the shift from fossil fuels to renewables reduces many climate-induced and air pollution health risks, it also makes possible a shift from hazardous fossil fuel jobs towards healthier, safer green jobs.

Economic:

With the agreement covering 22% of the city government's electricity demand for the next 20 years, it acts as a hedge against future price fluctuations, ensuring the municipality can continue to purchase low-cost, low-carbon electricity.

Environmental:

The 70 MW solar project enabled thanks to the PPA displaces coal and natural gas from the energy mix, and will result in an estimated annual CO₂ abatement of 60,000 tonnes.

Philadelphia has signed a PPA with a local solar power developer, agreeing to purchase all of the power generated by a new 70-MW solar power plant outside of the city. This tactic is one of the most effective ways to accelerate the build-out of green energy, and will supply 22% of the city government's power demand.



SAN FRANCISCO:

City climate resilience financed via Green Bonds Program

→ As of 2018, San Francisco has \$1.7 billion in its Green Bonds Program, part of Mayor London Breed's **commitment to investing in climate-resilient infrastructure**.

The programme started in 2015 and was certified by the Climate Bonds Initiative, which finances renewable energy, public transportation, and resilient water and wastewater infrastructure projects. As a popular alternative to traditional bonds, **approximately a third of the city's capital budget - \$1 billion per year - is already financed via green bonds**, playing a key role in the city's \$35 billion investment in infrastructure over the next decade.



What has the city achieved?

The Green Bonds Program is central to supporting San Francisco's ambitions of becoming carbon neutral by 2050. As of 2017, the city has already reduced its CO₂ emissions by 36% compared to 1990 levels, surpassing its initial 25% target.

By working with the San Francisco Public Utilities Commission (SFPUC), low-impact development and green infrastructure technologies has been prioritised. Projects involving solar energy utilisation and green roofs, specialised landscaping, and permeable paving can provide a modest interest rate savings to investors compared to more traditional bonds. As the USA's second-largest municipal issuer of green bonds, San Francisco expects there to be a rapid

expansion of the green bond market and plans to be a leader in the market. Costs to issue green bonds range from \$10,000 to \$25,000 per bond for independent certification and verification, excluding staff time.

The largest San Francisco capital project financed with green bonds so far is the Sewer System Improvement Program (SSIP), which is a 20 year, \$6.9 billion investment to improve the city's aging sewer system, manage stormwater, and assure operational permit compliance.

San Francisco 

SAN FRANCISCO

↓ 36%

REDUCTION IN SAN FRANCISCO'S CO₂ EMISSIONS
compared to 1990 levels, surpassing the city's
initial target of 25%

What can other cities learn?

Support the Green Bonds market and reap the rewards:

San Francisco's leadership in the USA's green bonds market is pivotal. By supporting the market, the city increases investor demand for the bonds and ensures an ever-larger number of climate-resilient projects can be financed at a lower cost for all.

Embrace digital communications:

For public outreach, the city has distributed electronic newsletters and project updates to more than 6,300 subscribers. Its projects and programmes have been featured in nearly 40 news articles or video segments. The SFPUC has engaged with the public via social media platforms, with its Facebook and Twitter following totalling 6,000 and 15,000, respectively.

What are the co-benefits?

Social:

Projects financed by the Green Bonds Program ensure the city's economic vitality and resilience via the support and strengthening of its neighbourhoods, local businesses, and workforce.

Health:

The wide variety of projects funded by the programme are having a positive impact on people's health and quality of life thanks to a reduction in odours from wastewater treatment and excessive noise pollution, an increase in walking and biking accessibility, and increased access to healthy foods.

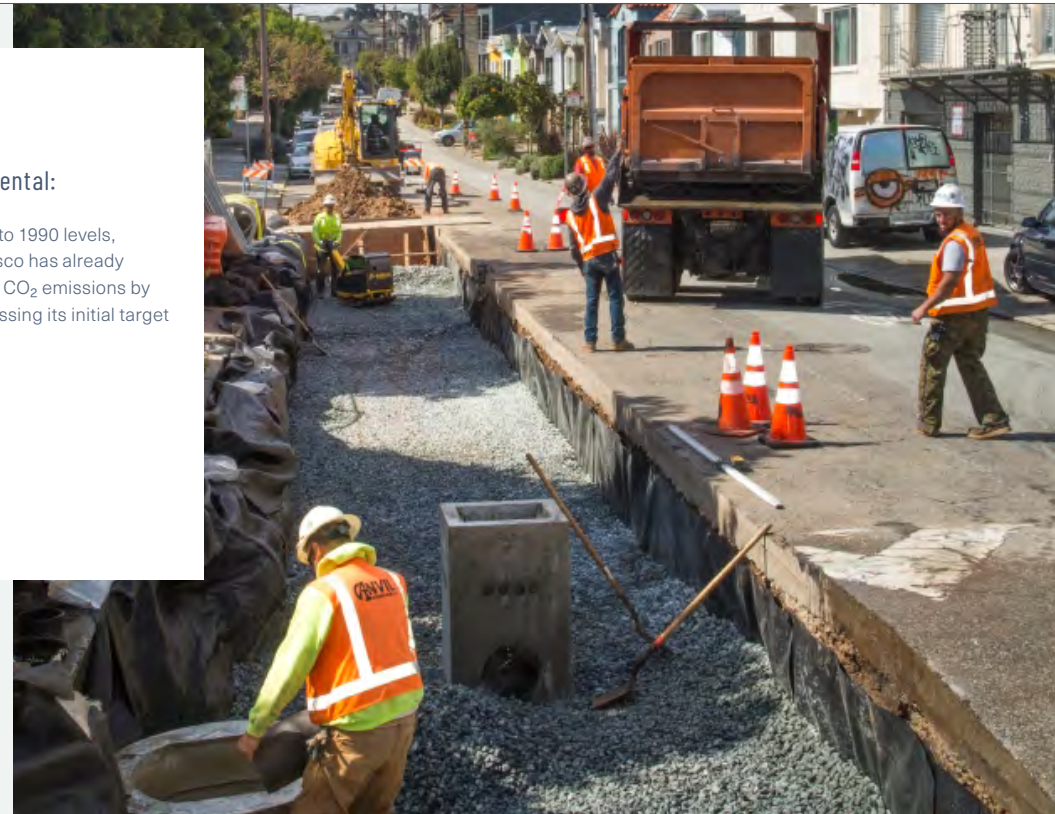
Economic:

Local workers have earned more than \$88 million in wages and benefits on green bonds projects. On SSIP projects, for example, local residents have worked 32% and 65% of all normal and apprentice hours, respectively, with both figures substantially exceeding the City Local Hiring Ordinance requirements.

Environmental:

Compared to 1990 levels, San Francisco has already reduced its CO₂ emissions by 36%, surpassing its initial target of 25%.

The Green Bonds Program aims to finance green infrastructure throughout San Francisco, with a significant proportion of the workforce made up of local residents.



SINGAPORE:

Growing sustainable bonds via innovative grant scheme

→ In 2017, Singapore introduced a six-year Grant Subsidy Scheme to grow the city Monetary Authority's Sustainable Bonds. The overarching aim is to **rapidly mobilise private sector capital** to meet the ever-growing green investment needs of the region, estimated to be \$200 billion annually through 2030.

While bonds are privately funded, the city grants up to \$73,000 towards obtaining an independent external review for the issuance of each bond, sending a strong market signal to **catalyse green investments**.



What has the city achieved?

By subsidising external reviews, Singapore is helping the Grant Subsidy Scheme overcome one of the key hurdles preventing potential first-time green bond issuers from partaking in the progressive scheme. As of today, more than \$2.9 billion of green bonds have been issued by local and foreign companies in Singapore, aiding Asia's sustainable economic development by supporting everything from green building projects in Singapore, to solar and wind farms in India, and geothermal projects in Indonesia. The city views sustainable bonds as a critical financial tool to tackle the global climate crisis and meet other environmental targets, which is why it is facilitating rapid market growth so that the scale and impact can be as far-reaching as possible.

Transparency and consistency are fundamental to the scheme's credibility, which is why each grant applicant must appoint a bond arranging bank, whose role is to work with the applicant (the bond issuer) to verify the bond's issuance will meet the scheme's social and environmental criteria. Promoting the use of standards, such as the Climate Bond Initiative's Climate Bonds Standard, enables the sustainable bonds to be internationally recognised by global investors as meeting high sustainability standards.

Singapore 

SINGAPORE

↑ 2.9 BILLION

DOLLARS OF SUSTAINABLE BONDS have been issued since the project's 2017 launch

What can other cities learn?

The problematic “no yield advantage”:

The project aims to attract first-time sustainable bond issuers so applicants can experience the underestimated potential of green bonds. While there are no significant yield differences between these and the more traditional financial bonds, forecasts for green bonds are often more positive in the long term as the global economy transitions toward sustainability.

What are the co-benefits?

Social:

By making use of international sustainability standards, like the Climate Bond Initiative's Climate Bonds Standard, this scheme ensures that any bonds issued are destined for sustainable and socially inclusive projects.

Health:

Thanks to funding projects like solar and wind farms in India, the initiative is contributing to improved public health by reducing dependence on coal-fired power plants.

Economic:

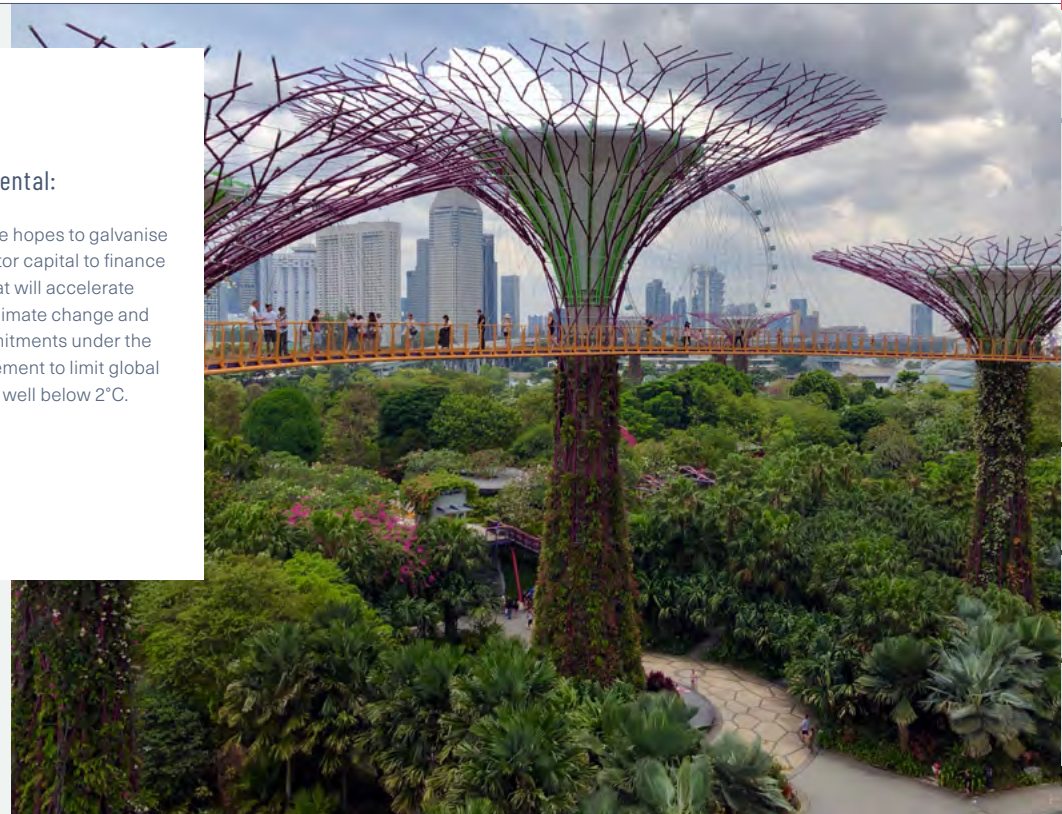
Singapore hopes to facilitate the rapid market growth of sustainable bonds, thereby harnessing the power of global markets to scale up projects with a positive climate impact, while also boosting prosperity in the financial hub of Singapore.

Environmental:

The scheme hopes to galvanise private sector capital to finance projects that will accelerate action on climate change and meet commitments under the Paris Agreement to limit global warming to well below 2°C.

Harbouring one of the planet's most important financial centres, Singapore has high hopes of accelerating the growth of sustainable bonds by subsidising up to \$73,000 in independent external reviews.

Photography: First page - Monetary Authority of Singapore Singapore Cityscape
Second page - Nick Fewings, Unsplash



2019

Cities100

ADAPTATION AND RESILIENCE

→ As the climate crisis brings rising sea levels, more floods, and greater heat, people and properties in cities are on the frontline. Fortunately, ever-more adaptation projects are boosting the resiliency of cities to such events, and while many innovative technical solutions are being deployed, there has been an increasing trend towards implementing nature-based solutions.



SALVADOR:

Rainforest recovery boosts climate resilience

→ Brazil's Atlantic Forest biome is under increasing threat from climate change and urban development-induced desertification, but in a restoration project the City of Salvador is **enhancing the resilience of this vulnerable ecosystem**.

The rehabilitation programme involves the creation of 39 conservation areas covering 19 km², and the planting of 30,000 trees, all the while making **a greener and more liveable home** for Salvador's residents.



What has the city achieved?

While the concept of desertification may conjure images of windswept sand dunes, it is an environmental challenge affecting cities around the world. In Salvador, Brazil, a combination of pressures from human activities and climate change are causing severe degradation, loss of precious natural ecosystems, and impacting the region's rich biodiversity. In response, the city has initiated a project to rehabilitate the native Atlantic Forest ecosystem and boost the city's resilience to climate change.

To integrate urban and environmental development, and create valuable green spaces in the city, Salvador has created 39 conservation areas covering 19 km², many of which are connected by ecological corridors. Citizens have

been involved in planting 15,000 trees as part of the project, with plans to double that number over the coming years.

The new green infrastructure provides accessible green space for residents, particularly in the city's poorest areas. In addition to increasing the resilience of the Atlantic Forest biome to climate change, the renovation project restores habitats and biodiversity in the region and extends to other biomes such as coastal dunes, with the creation of the city's first maritime park.

Salvador 

SALVADOR

↑ 30K

TREES WILL BE PLANTED in Salvador's parks under the project

What can other cities learn?

Leverage the power of private business:

To assist with funding the programme, the city government has allowed private businesses to "adopt" green spaces in the city. The private entity is responsible for funding the upkeep of the area and the community benefits from well-maintained green space in the city.

Priorities need not be in conflict:

In the fast-developing city of Salvador, the city government has many conflicting priorities when it comes to urban development and creating a safe and healthy city for residents, meaning that environmental initiatives are often left to one side. However, by appreciating the social value of restoring the Atlantic Forest ecosystem, the city is integrating urban and environmental development for the benefit of all.

What are the co-benefits?

Social:

As part of the rehabilitation of Salvador's Atlantic Forest, the aim is to increase the amount of green space available to the city's residents to 13.3 m² per person, thereby improving access to public green leisure space in the city.

Health:

With sedentary lifestyles and their associated non-communicable diseases taking over in our cities, providing green spaces that encourage sports and active lifestyles is critical to improving the health and fitness of Salvador's residents.

Economic:

The creation of new conservation areas, some of which are recognised by UNESCO, is bringing new tourists and researchers to the area, boosting local businesses and entrepreneurs.

Environmental:

In tackling land degradation and desertification, the project has developed 39 conservation areas in the city, protecting habitats and biodiversity, and creating a carbon sink for 200,000 tonnes of CO₂e over 20 years.

Salvador's citizens have been involved in planting 15,000 trees across 19 km² of rehabilitated Atlantic Forest in the city. This makes the biome more resilient to climate change-induced desertification, and creates a carbon sink and new green spaces for the city's residents.



AUSTIN:

Urban forestry programme builds deeply-rooted climate resiliency

→ In an attempt to make Austin more green and climate resilient, the City of Austin has developed a **City Forest Carbon Credits programme** to not only offset municipal carbon emissions, but also protect against flooding and drought.

The project has engaged local citizens in planting more than 1,000 trees on public land, **sequestering an estimated 515 to 615 tonnes of carbon**.



What has the city achieved?

Austin's City Council set the target of making all municipal operations carbon neutral by 2020, and while it has already achieved a 75% reduction in its carbon footprint, some emissions will have to be offset to achieve full neutrality. To keep those offsets close to home and ensure the city benefits directly, Austin launched a City Forest Carbon Credits programme in 2018.

In a collaboration between the city, several federal agencies, and a local NGO, the programme creates carbon offsets from tree planting on city-owned land. The first phase of the project involves planting 1,302 trees in 2019 in parks, along rivers and roads, and across floodplains. While

delivering climate mitigation benefits, the project also boosts Austin's resilience to climate change.

Austin suffers from regular flash flooding and extreme summer heat, but increasing tree cover in the city reduces stormwater runoff, protects water quality, and mitigates against the urban heat island effect. Thanks to the project's success, it will be scaled out to the wider Travis Country region, planting trees across 200,000 m² of land in the coming years.

Austin

AUSTIN

↑ 1,302

SAPLINGS ARE BEING PLANTED on city-owned sites to boost climate resiliency

What can other cities learn?

Put a price on it:

Austin is demonstrating that increasing climate resilience via tree planting needn't be seen as a burdensome cost for municipalities. Instead, the city is attaching a value to the trees via a carbon offset scheme and an ecosystem services approach.

Engage citizens:

Thanks to the partnership with a local NGO, volunteers have been mobilised to plant trees in community-led events, where residents not only help to green the city but also learn about the importance of the trees and how to care for and maintain them.

What are the co-benefits?

Social:

As part of the programme, the city has run several tree planting events, engaging local communities in the initiative, where they can become better connected with nature and each other.

Health:

The urban reforestation programme is expected to deliver two-fold health benefits for Austin's residents, as greening reduces the health risks posed by urban heat and air pollution.

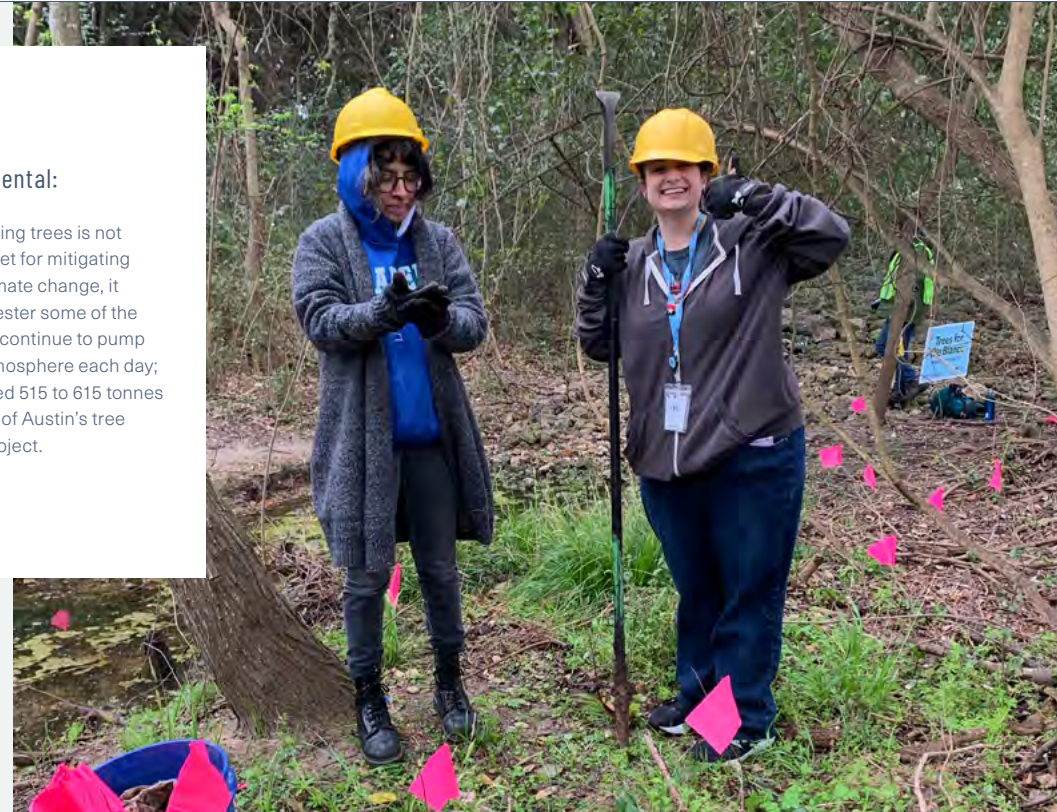
Economic:

For each dollar invested in tree planting in Austin, \$10 of ecosystem service value is delivered via improved stormwater management and reduced energy demand for heating and cooling, amongst others.

Environmental:

While planting trees is not a silver bullet for mitigating against climate change, it does sequester some of the carbon we continue to pump into the atmosphere each day; an estimated 515 to 615 tonnes in the case of Austin's tree planting project.

Austin has created a carbon credit scheme to encourage and fund the planting of more than 1,000 trees on public land across the city. The new trees not only sequester carbon, but increase climate resilience in the flood- and heatwave-prone region.



BOSTON:

Green, social spaces guard against coastal flooding

→ In response to the growing threat rising sea levels present to Boston's 75-km shoreline, the city has developed the Resilient Boston Harbor Plan, **bringing together climate resilience solutions between city stakeholders.**

The vision is to create a city more connected to its coastline and its citizens by creating **765,000 m² of new and regenerated open space** that protects Boston from storm surges and rising seas.



What has the city achieved?

As a warming climate melts ice caps and expands our oceans, coastal cities like Boston are already experiencing sea level rise, and an increased frequency of storm surges causing damage to buildings and infrastructure. By 2050, sea levels in Boston could be up to 40 cm higher than today, accelerating to almost a metre of possible rise by the end of the century. It is estimated that this would put more than 80,000 residents and \$85 billion of assets and infrastructure at risk.

To guard against this threat and reduce the city's vulnerability to coastal flooding, the Resilient Harbor Boston Plan is creating a network of elevated green spaces along the shoreline, investing \$3 billion over the next 30 years. Solutions have been developed in close

consultation with local residents, and central to the plan is that the new spaces should be open and accessible to all.

As a result of the green infrastructure plan, Boston should be protected from a 1-in-100-year flood, with a metre of sea level rise, and it will be possible to build higher in the future to meet higher seas. The project is making the city more resilient to the impacts of climate change, protecting homes and critical infrastructure, while creating a more liveable Boston.

Boston 

BOSTON

↑ 3 BILLION

DOLLAR INVESTMENT over the next 30 years in protecting Boston against the threat of sea level rise

What can other cities learn?

Internal coordination is key:

As the Resilient Boston Harbor Plan brings together the work of several departments within the city government, interdepartmental coordination is critical to the success of this project. With clear direction from the Mayor's office and frequent meetings between the responsible departments, work can be carried out in the most effective and efficient way, utilising the strengths of each team.

Be ready to scale up:

The new measures should be able to protect Boston against a 1-in-100-year flood with a metre of sea level rise. However, as sea levels will likely continue to rise, the elevated green spaces have been designed so they can be built higher in the future to protect against even higher water levels.

What are the co-benefits?

Social:

The plan will see the creation of more open, accessible green space along Boston's harbour, giving the city's residents – who have been heavily involved in the development process – more opportunities for social interaction and outdoor activities.

Health:

Increased greenery in Boston's cityscape will reduce the urban heat island effect and improve air quality, as well as provide spaces for the city's residents to live more active, healthy lives.

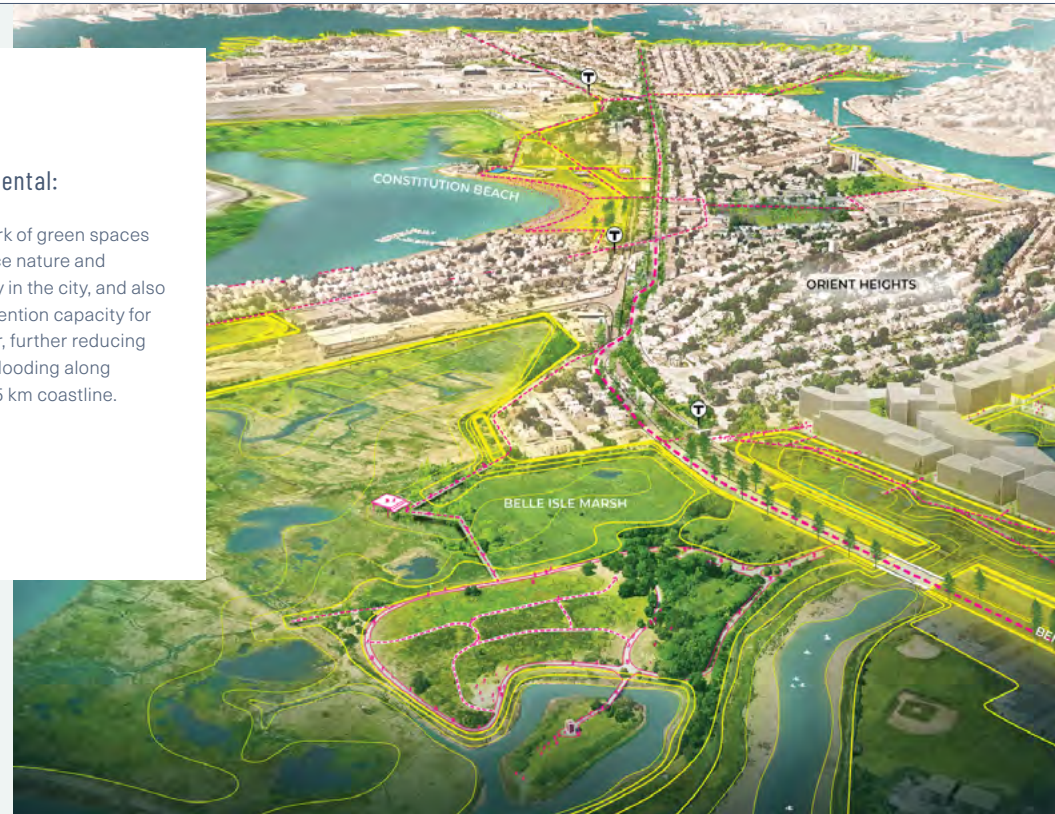
Economic:

Estimates suggest that assets and infrastructure worth more than \$85 billion will be at risk from floods and sea level rise by late century in Boston. The 30-year investment of \$3 billion in the Resilient Boston Harbor Plan is targeted to avoid long-term economic damage to the city.

Environmental:

The network of green spaces will enhance nature and biodiversity in the city, and also provide retention capacity for stormwater, further reducing the risk of flooding along Boston's 75 km coastline.

The Resilient Boston Harbor Plan is a \$3 billion green infrastructure project to protect Boston from coastal flooding and rising sea levels, which also creates new social and accessible space for the city's residents.



BUENOS AIRES:

Vegetation restoration and environmental education

→ Buenos Aires is transforming its cityscape by **converting what was once a landfill into a nature reserve**.

The Lago Lugano reserve has rehabilitated a landscape that was severely damaged by human activity, and restored a valuable wetland habitat. In addition to **improving the resilience of the city against floods and extreme heat**, the reserve is providing plentiful environmental education opportunities for the city's residents.



What has the city achieved?

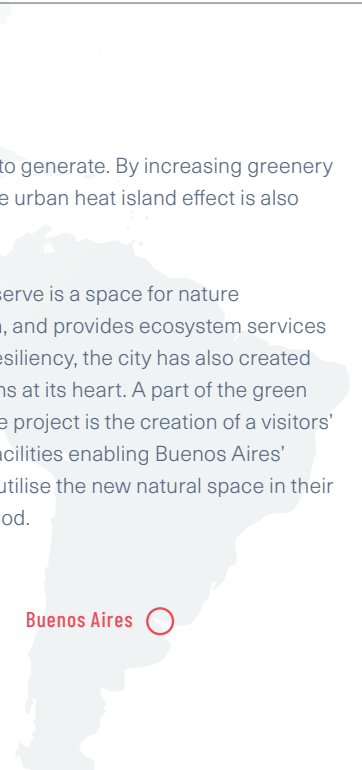
Until recently, almost all of the 6,000 tonnes of waste Buenos Aires produced every day piled up in landfills around the city. While waste management initiatives are underway to stem that flow, the city is undoing the damage done by dumps. The Lago Lugano is one such example, where a landfill has been transformed into a nature reserve, creating green public space, increasing climate resilience, and protecting biodiversity.

The reserve includes a 20 hectare lake and 16 hectares of regenerated green space, which are now home to more than 200 plant species and 99 bird species. Restoring the wetlands has created a natural reservoir to mitigate against flood risks, and prevented soil, air, and water pollution the

landfill used to generate. By increasing greenery in the city, the urban heat island effect is also limited.

While the reserve is a space for nature conservation, and provides ecosystem services via climate resiliency, the city has also created it with humans at its heart. A part of the green infrastructure project is the creation of a visitors' centre and facilities enabling Buenos Aires' residents to utilise the new natural space in their neighbourhood.

Buenos Aires 



BUENOS AIRES

↑ 99

BIRD SPECIES have been recorded
in the nature reserve

What can other cities learn?

Create, then educate:

Environmental education programmes are a big part of the Lago Lugano nature reserve, sharing knowledge amongst the local population – particularly visiting school groups – on the importance of conserving and regenerating the natural environment in cities.

Undo environmental damage via rehabilitation:

The landfill that once lay at the Lago Lugano polluted the air, soil, and water in the neighbourhood, but the rehabilitation project demonstrates it is possible to undo some of the previous damage done to our cityscapes, while also creating a better habitat for plants, animals, and humans alike.

What are the co-benefits?

Social:

The highly urbanised area surrounding Lago Lugano is almost entirely bereft of green spaces, but by transforming a rubbish dump into a nature reserve, the city has created new public green space, with a host of environmental education opportunities for the local community.

Health:

Situated in a highly urbanised part of the city, Lago Lugano reserve provides a space where residents can take respite from Buenos Aires' hot, humid summers, reducing heat-related health risks.

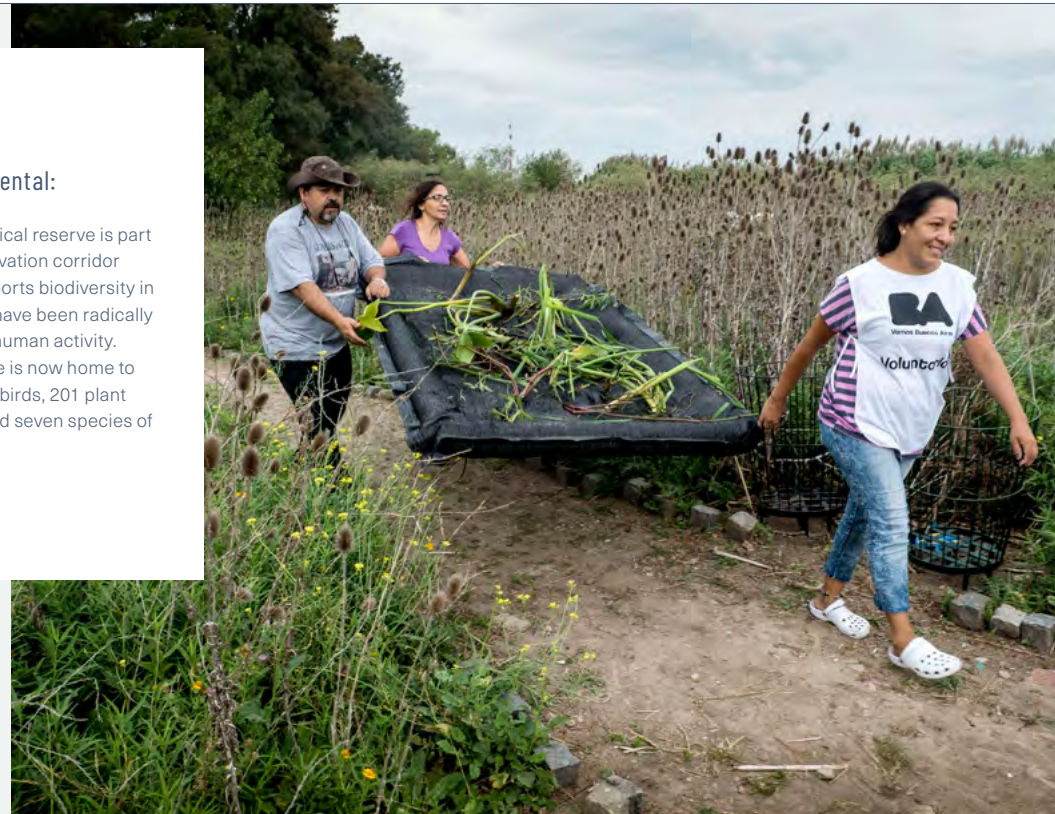
Economic:

Transforming a noisy, polluting rubbish dump into a space of natural serenity has dramatically increased prosperity and property values in the surrounding neighbourhood.

Environmental:

The ecological reserve is part of a conservation corridor which supports biodiversity in areas that have been radically altered by human activity. The reserve is now home to 99 species birds, 201 plant species, and seven species of mammals.

Establishing the Lago Lugano nature reserve has restored a former rubbish dump into a green haven for local residents and animals. As well as sequestering carbon, the reserve also boosts the Argentine capital's resilience to flooding and the urban heat island effect.



DURBAN:

Three-pronged approach to flood management in informal settlement



→ In Durban, **more than 226,000 households live in informal settlements**, where climate-induced flood risks are worsened by lack of governance and planning.

The Palmiet Catchment Rehabilitation Project is taking on the challenge with **a three-way approach that tackles the governance, social, and biophysical responses to flooding**. As well as increasing the climate resiliency of the neighbourhood, the project is improving coordination between the community and the local government.

What has the city achieved?

Urban flooding presents a hazard in many cities around the world, particularly for the poorest residents, who feel the effect of climate impacts most acutely. In Durban, South Africa, where a third of the population lives in informal settlements, these impacts are exacerbated due to a lack of integrated city planning and governance issues. The Quarry Road informal settlement in the Palmiet Catchment is one such area where the municipal government is taking a three-pronged approach to improving climate resilience via social, governance, and biophysical initiatives.

To tackle governance challenges around climate adaptation in the Palmiet Catchment, a “Community of Innovators” was created

between the university, local community, and city government, bringing together stakeholders to oversee the project’s implementation. One key physical aspect of the initiative has been to dramatically improve waste collection in Quarry Road, which prevents waste from blocking drains and amplifying the effects of flooding. On the social front, the project is using social media to better inform residents about flood risks ahead of time, allowing the local community to better prepare and respond in flood events.

Durban 

DURBAN

↑ 956

BAGS FULL OF WASTE were collected
in one cleanup operation in June 2018

What can other cities learn?

Involve third parties:

The local government came up against several challenges when engaging with the community at Quarry Road, but by developing an integrated partnership with a nearby university that had established connections in the community, they were able to more successfully bring in the needs and voices of all stakeholders into the project.

Don't be afraid to change course:

The city government's initial plans were to construct an artificial wetland to tackle the flood risks in Quarry Road, but after consulting with residents, they realised that this approach was inconsistent with the priorities of the local community. Instead, the project changed tack and took the three-pronged approach with the community's involvement and consent.

What are the co-benefits?

Social:

This project has helped to improve the relationship between the local community and the municipal government, allowing social benefits to be prioritised. Additionally, the project has created more than 30 short-term employment opportunities in the community.

Health:

The Palmiet Catchment Rehabilitation Project is tackling the inappropriate disposal of domestic waste, which can block drainage systems and exacerbate flooding impacts, including the discharge of raw sewage, which poses significant health risks.

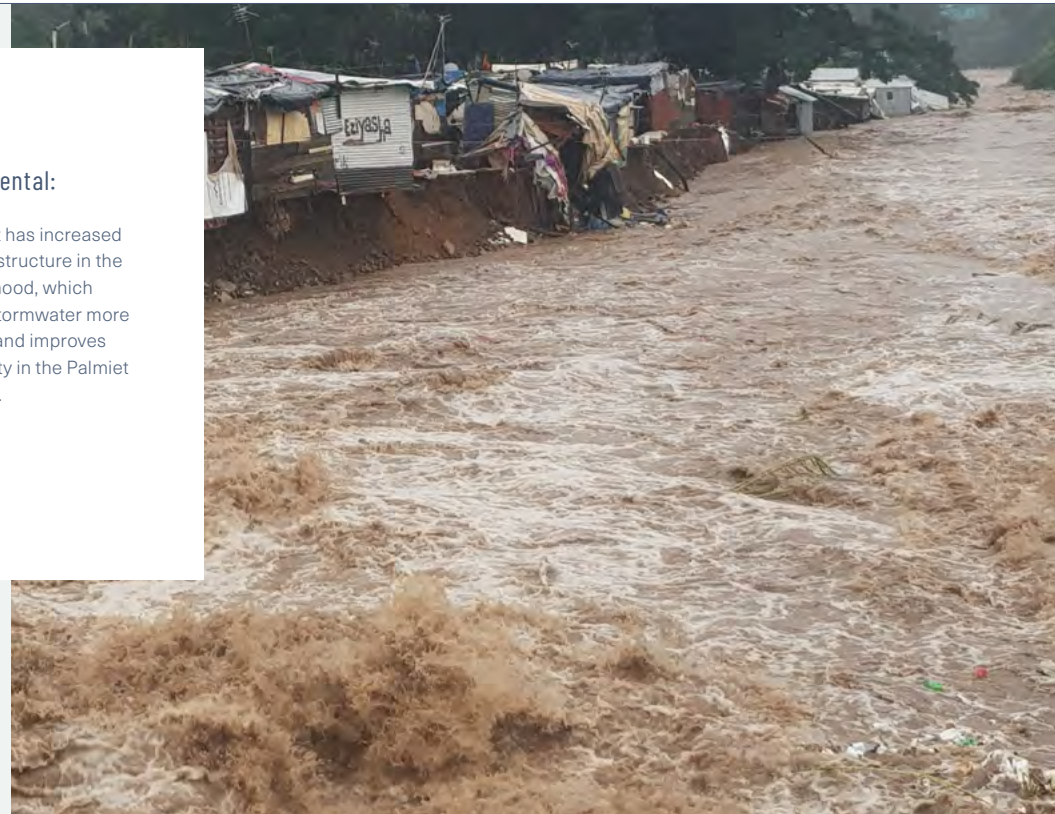
Economic:

In informal settlements, flooding can cause significant damage to the homes of the poorest in society. By increasing Quarry Road's resilience to flooding, the project helps to financially protect the most vulnerable from the impacts of climate change.

Environmental:

The project has increased green infrastructure in the neighbourhood, which manages stormwater more effectively and improves water quality in the Palmiet Catchment.

The Palmiet Catchment Rehabilitation Project is improving the resilience to flooding events in the informal settlement of Quarry Road, Durban, via an approach which not only improves green infrastructure, but also tackles the governance, social, and biophysical challenges that contribute to increased flood risk.



LONDON:

Going wild for world's first national park city

→ In 2019, London became the world's first national park city, a movement to make the city **greener, healthier, and wilder**.

To deliver on the aim of improving the quantity and quality of London's green infrastructure, the city government has introduced **a new planning policy and a first-of-its-kind digital mapping tool** to increase urban greening and maximise the benefits for climate adaptation, as well as wider environmental and social issues.



What has the city achieved?

Urban greening delivers many – often overlapping – benefits for climate adaptation, biodiversity, air and water quality, liveability, and a reduction in the urban heat island effect, to name a few. To look more holistically at urban landscape design, as well as track and quantify the benefits of greening, London has become the first place to apply a city-wide Urban Greening Factor. This is being paired with a Green Infrastructure Focus Map to enable designers to identify areas in need of improved green infrastructure.

The new planning rules mean that developers must quantify how they are contributing to greening and incorporating greening for the benefit of cooling and drainage management,

resulting in better project designs. These rules are aided by the mapping tool, which provides open access to high-resolution spatial data of London's tree canopy and blue and green cover for the first time.

Together, these tools help to ensure that London's growth is managed in a way that enhances the natural environment and reduces climate risks. This is especially important for managing surface water in heavy rainfall events, as the city is increasingly exposed to flood risks.

London 

LONDON

↑ 15K

SPECIES live alongside London's human residents

What can other cities learn?

Learn from others:

While London is the first city to implement an Urban Greening Factor on such a large scale, it has learned from the experiences of other cities that have used the tool, such as Helsinki, Southampton, and Berlin, and is better incorporating the quality and benefits of greening into the scoring system.

Target investments:

The Green Infrastructure Focus Map uses first-of-its-kind machine learning to map tree canopy, as well as green and blue cover, in the city, allowing investments in green infrastructure to be focused where they are needed most, maximising benefits across the city.

What are the co-benefits?

Social:

The mapping tool is unique in allowing planners and developers to identify areas that lack greenery and prioritise green infrastructure projects in those spaces, ensuring that all Londoners have access to local green spaces, even in densely populated parts of the city.

Health:

Increasing the amount of greenery in a city not only has positive climate benefits, but also improves mental well-being amongst the population. In London, providing access to green spaces is the perfect antidote to high-paced lifestyles, and reduces the need to treat anxiety and mental health conditions.

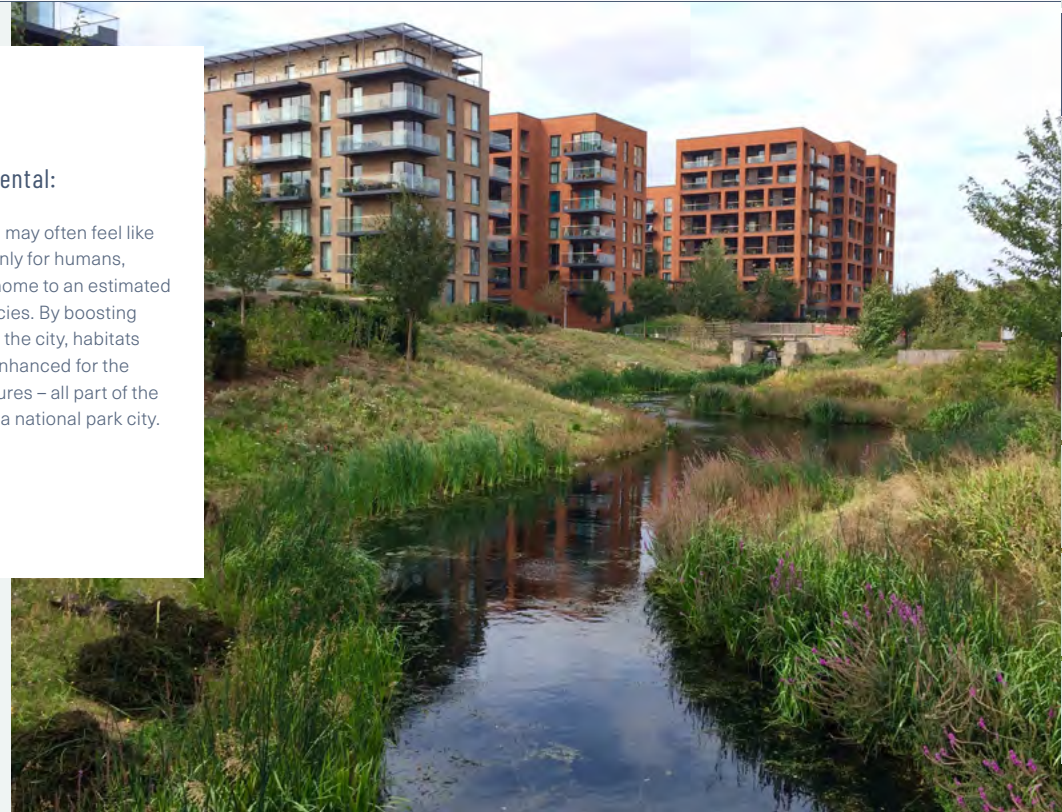
Economic:

London is becoming increasingly exposed to heatwaves in the summer months, which reduce productivity and raise costs for cooling. Greenery in the city can effectively reduce temperatures by several degrees, limiting the urban heat island effect and reducing the impacts of heatwaves on the city's economy.

Environmental:

While cities may often feel like they exist only for humans, London is home to an estimated 15,000 species. By boosting greenery in the city, habitats are being enhanced for the city's creatures – all part of the strategy as a national park city.

London has introduced an Urban Greening Factor and a high-resolution green mapping tool, which together ensure that as London grows it also becomes a greener, more climate resilient city, with high biodiversity.



MEDELLÍN:

The interconnected Green Corridors

→ Since 2016, Medellín's dynamic Mayoral team has created **30 "Corredores Verdes", an interconnected network of greenery across the city.** This ambitious initiative adds to and further connects existing green spaces, improves urban biodiversity, reduces the city's troubling urban heat island effect, soaks up busy streets' air pollutants, and sequesters a significant amount of CO₂ thanks to vigorous new vegetation growth.

The Green Corridors project demonstrates how **integrated, nature-based policies** like widespread urban tree planting can have a far-reaching impact on the local and global environment, as well as significantly improving citizens' lives and well-being.



What has the city achieved?

As a result of 50 years of rapid urban development, Medellín was experiencing a severe urban heat island effect. To negate this phenomenon, the Andean city implemented a three-year "A greener Medellín for you" programme, thereby significantly shifting its urban design paradigm. As part of the \$16.3 million initiative, 75 citizens hailing from more disadvantaged backgrounds were trained by Medellín's Joaquín Antonio Uribe Botanical Garden to become city gardeners and planting technicians. They have helped to plant 8,800 trees and palms in the 30 corridors that cover 65 hectares. In one of the city's busier thoroughfares, 596 palms and trees have been planted, as well as more than 90,000 species of lesser plants.

These Green Corridors provide Medellín with a host of ecosystem services: helped reduce average city temperatures by 2°C, enabled carbon uptake via formidable plant growth, achieved the capture of PM to improve air quality, and increased the urban biodiversity thanks to the creation of more wildlife-friendly habitats. These rapid effects demonstrate why nature-based solutions are rapidly increasing in popularity in the field of sustainable urban design.

Medellín 

MEDELLÍN

↓ 161K

KG OF CO₂ ABSORBED ANNUALLY in a single corridor during the period of significant plant growth

What can other cities learn?

Target busiest areas for greatest impact:

Oriental Avenue, one of the city's most polluted streets, with more than a million people passing through daily, has been targeted as one of the key Green Corridors. The more polluted the area, the greater the potential environmental returns, meaning that including these avenues in the green, interconnected, biodiverse network will reap great rewards for general city life.

Make the most of national and local legislation opportunities:

With the urban heat island effect significantly impacting local citizens, it made good sense to counter it. Colombian legislation dedicates a part of the mayoralities' budgets – Participatory Budget – to be invested in projects citizens help select via democratic votes. The Green Corridors received a popular mandate from the local citizenry so that it be implemented to improve Medellín as a whole.

What are the co-benefits?

Social:

As part of the "A greener Medellín for you" programme, 75 locals from more disadvantaged backgrounds were trained by Medellín's Joaquín Antonio Uribe Botanical Garden to be city gardeners and planting technicians to plant and maintain the 30 Green Corridors as part of their full-time work.

Health:

Three years after the programme's beginning, the urban heat island effect has been reduced by 2°C. In spite of climate change, city officials expect a further decrease of 4-5°C in 28 years' time. This reverses the insidious phenomenon that saw the city's average temperatures in 2010 6°C above average.

Economic:

\$16.3 million has been invested in this ecosystem services project, which has had a number of positive impacts most notably improving citizens' lives and well-being.

Environmental:

A bioclimatic study estimated that in just one corridor, the new vegetation growth would absorb 160,787 kg of CO₂ per year for the initial phase of the plants' lives. The study's 100-year projection is that around 2,308,505 kg of CO₂ would be taken up in the plants' biomass.

Medellín's 30 Green Corridors provide the city with a host of ecosystem services including dealing with one of its most pressing issues: the urban heat island effect. Three years after the project's inception, average city temperatures have gone down by 2°C.



PARIS:

Keeping a cool head to tackle city heat

→ As heatwaves increasingly grip cities in summer, Paris has created an interlinked network of cool islands where citizens can seek refuge from the heat of the summer.

In the city's fight against the urban heat island effect, the spaces are typically **2°C to 4°C cooler** than surrounding streets thanks to water or greenery, and offer **improved climate resilience and liveability** for the citizens of Paris.



What has the city achieved?

In summer 2019, the mercury in Paris soared to a record 42.6°C, part of a heatwave that killed an estimated 1,500 people across France¹. As the climate crisis brings more frequent and severe heat to our cities, exacerbated by the urban heat island effect, Paris is taking action to alleviate the troubles for its citizens by creating a network of accessible cool spaces across the city.

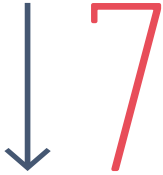
More than 800 spaces in Paris, from parks and woods to swimming pools and museums, make up a network of cool islands where residents and visitors alike can take a break from the city's summer heat. The islands are linked by naturally cool walkways, and as part of the city's climate

adaptation strategy, Paris' goal is that all residents should be able to reach a cool island or walkway within seven minutes.

The city has developed a mapping app EXTREMA to guide residents to cool islands, which in the first year of use was downloaded 6,000 times. The app allows residents to give feedback about the cool islands, allowing the city to identify where improvements can be made, and monitor use of the spaces.

Paris 

PARIS



7 MINUTES IS THE MAXIMUM TIME it should take any Parisian to walk to a cool area of the city

What can other cities learn?

In times of trouble, scale:

When temperatures in Paris soar, the city is able to take extra steps to keep people cool, deploying pop-up cool islands with misting areas from fire hydrants, and extending the operating hours of municipal swimming areas.

Hydration for the nation:

As a part of the plan, 1,200 drinking fountains have been installed in the city, allowing residents to keep cool for free in the summer heat, and reducing the use of plastic water bottles.

Seize the app-ortunity :

While creating an app is not the answer to all of our problems, digital tools can be a great help for city residents. In this case, the EXTREMA app allows Parisians to stay aware of heat risks, and know how and where they can go to cool off.

What are the co-benefits?

Social:

More than 7,000 Parisians have been identified as vulnerable during times of extreme heat, and this project aims to inform those residents of heat risks, and how and where to cool off.

Health:

With an estimated 1,500 deaths in France as a result of the 2019 heatwave, becoming more resilient to such events is a critical health issue for Paris officials. The cool islands can help reduce the risk of heat-related illnesses amongst the population.

Economic:

Heatwaves can significantly reduce economic productivity, by almost a third in some cases, but by creating a city more resilient to summer heat, Paris is mitigating against the economic damage caused by heatwaves.

Environmental:

By creating more green and blue spaces in the city, Paris is boosting biodiversity as well as reducing the impacts of air pollution and sequestering carbon. Additionally, encouraging residents to spend more time in these places will increase the value Parisians attach to nature.

Paris' cool islands are easily accessible spaces where residents and visitors alike can escape from the summer heat. More than 800 spaces form the network, which can be identified with the city's EXTREMA app.



PORTLAND:

Watershed restoration brings back thriving habitats and boosts climate resiliency



→ With several **wild species under threat of extinction** in Portland due to climate change and urban development, the city has undertaken a restoration project aimed at enhancing urban wetland habitats.

As a result of the programme, water quality and stormwater management have been improved, boosting the area's resilience to climate change. Crystal Springs Creek's enhanced green infrastructure has created a **thriving habitat for salmon and trout, and reduced the urban flooding risk for residents.**

What has the city achieved?

Like many cities around the world, much of Portland's development has taken place across floodplains, converting what was once wetland into urban landscapes. Such development has eroded habitats for wildlife and increased the city's vulnerability to flooding. As the impacts of climate change are felt ever more acutely, these impacts are being exacerbated.

In southeast Portland, the watershed along the 4 km long Crystal Springs Creek is being totally restored in an \$18 million project, around half of which is being funded by the city government. Via the replacement of eight culverts, the project is restoring Crystal Springs as a habitat for salmon, trout, and several bird species.

More than 7,220 trees and shrubs have been planted along the creek, creating a band of green infrastructure in the area that improves Portland's stormwater management and sequesters carbon. In addition to improving habitats for threatened species, liveability for the city's residents is enhanced via the creation of new park space, including a nature-based playground.

Portland ○

PORTLAND

↑ 7,225

TREES AND SHRUBS have been planted along the creek to improve habitat and boost the area's climate resilience

What can other cities learn?

Inclusion is no illusion:

For projects such as this to be a success, the local community has to experience a benefit as well. In Crystal Springs Creek, the restored parkland is now home to an annual salmon festival in partnership with the Native American community, with more than 23,000 participants over the past four years.

(Flood) plain and simple:

Portland has recognised the value that floodplains hold in protecting the city against flooding, and by restoring this area via a green infrastructure project, including innovations such as pervious pavements, the city is boosting its resilience to climate change, while enhancing habitats for threatened species.

What are the co-benefits?

Social:

Involving the local community has been a focus of this project from the outset. To ensure that the restoration benefits local residents – humans and animals – it includes the creation of new parks spaces and a nature-based playground.

Health:

The green infrastructure project of more than 4,000 m² has significantly improved water quality in the creek, and resulted in reduced temperatures locally.

Economic:

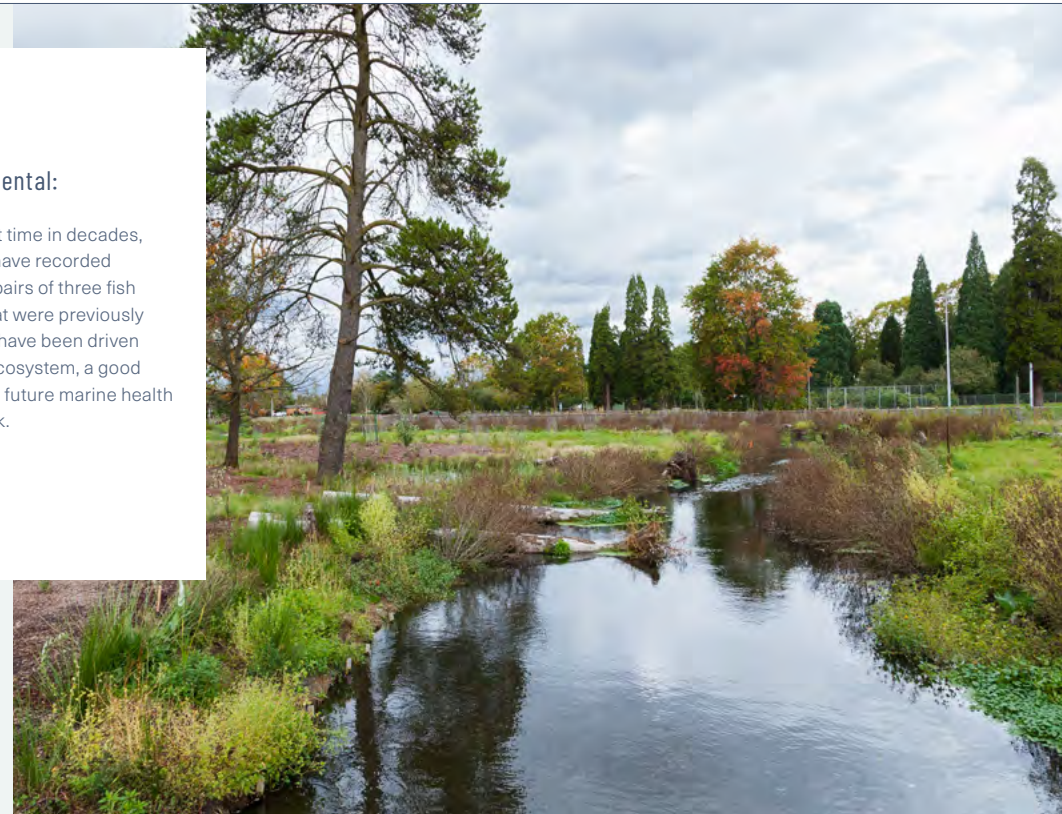
A study undertaken for this project estimated that the flood reduction benefits delivered are between \$160,000 and \$380,000 per hectare. Additionally, 141 jobs were created in the project's first year.

Environmental:

For the first time in decades, scientists have recorded spawning pairs of three fish species that were previously thought to have been driven from this ecosystem, a good sign for the future marine health of the creek.

The restoration project along the 4 km long Crystal Springs Creek in Portland has created a thriving habitat for fish species, and valuable social green spaces for the city's residents, all while improving stormwater management.

Photographer: Andrew Fedchenko

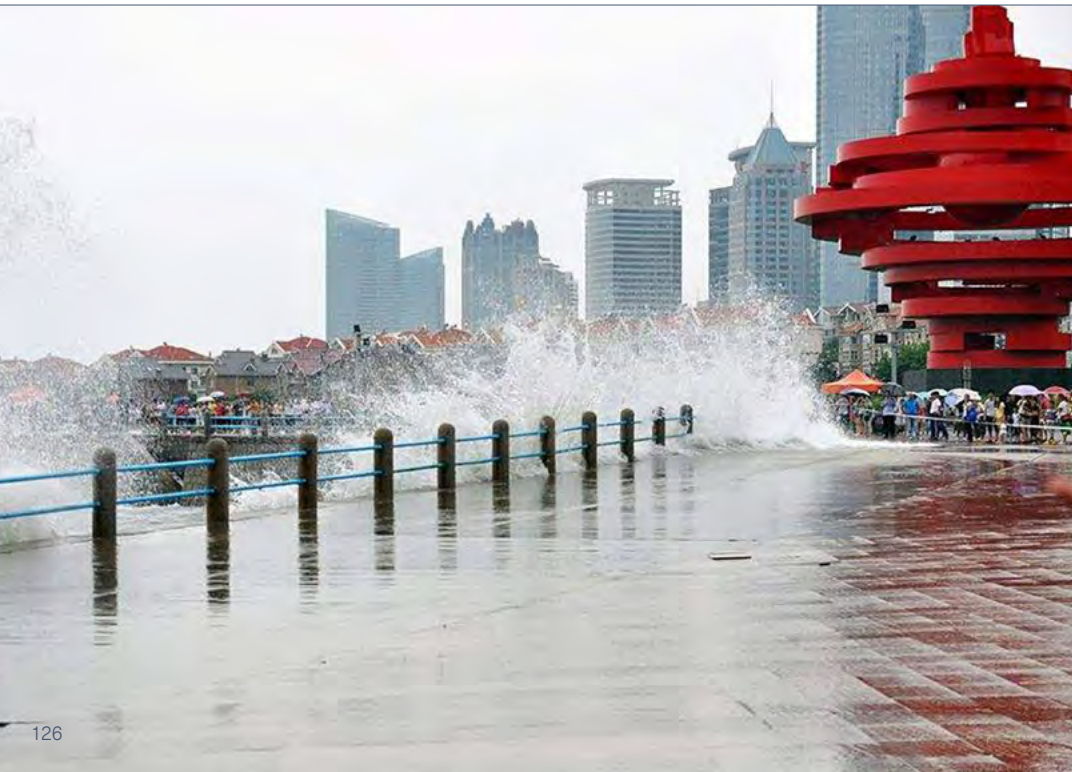


QINGDAO:

Adaptation plan strengthened with coastal risk model

→ Sea level rise, coupled with growing intensity and frequency of typhoons, is presenting an ever-growing threat to the City of Qingdao.

In a bid to develop an effective climate adaptation strategy that protects the \$600 billion of assets expected to be exposed to coastal flooding by 2070, the city has paired up with a local university to **develop a coastal risk system model** that combines natural and human factors to propose the most effective strategy for the city to employ, **reducing risk by 80% over the coming decade.**



What has the city achieved?

Compared to other Chinese cities, Qingdao has a modest population of 5.5 million, but that number is growing fast, by more than 2% each year. A city on China's eastern shore, it is estimated that by 2070, more than \$600 billion of assets will be exposed to coastal flooding in Qingdao as a result of climate change-induced sea level rise. To ensure that climate adaptation strategies in the city are targeted at the correct areas, the city has developed a large-scale coastal risk system model.

The model helps to map and quantify coastal flooding in the city, and simulates various adaptation strategies Qingdao could employ to combat the worst impacts of climate change.

This helps the city government to identify which areas to target with greater adaptation measures, and in what way.

The model not only includes projections on natural aspects such as sea level, storm surges, and typhoons, but also socio-economic factors including population growth and urban development. The result of the model is a proposed adaptation strategy for the city, based on sound scientific research, that will limit Qingdao's residents' exposure to the worst impacts of climate change.

Qingdao 

QINGDAO

↓ 80%

REDUCTION IN RISK from coastal flooding over the next five to 10 years if high-level adaptation strategy is enacted

What can other cities learn?

Burst out of the policy bubble:

To ensure the city climate adaptation policy is designed based on sound scientific research, Qingdao partnered with the local university to create the coastal risk system model. This process better integrates science and policy for outcomes that are environmentally, economically, and socially desirable.

Understand the challenge:

A rapidly growing population on China's east coast, combined with rising sea levels, sets up a serious challenge in the future for cities like Qingdao. By commissioning the model, Qingdao can understand the challenge in greater detail, and establish which adaptation measures will be most effective in the city.

What are the co-benefits?

Social:

By effectively designing and implementing a climate adaptation strategy in the city, Qingdao ensures that residents can go on with their lives despite a growing threat from coastal flooding.

Health:

By effectively modelling and properly planning for coastal flooding events in Qingdao, the associated health risks, such as water-borne diseases can be minimised.

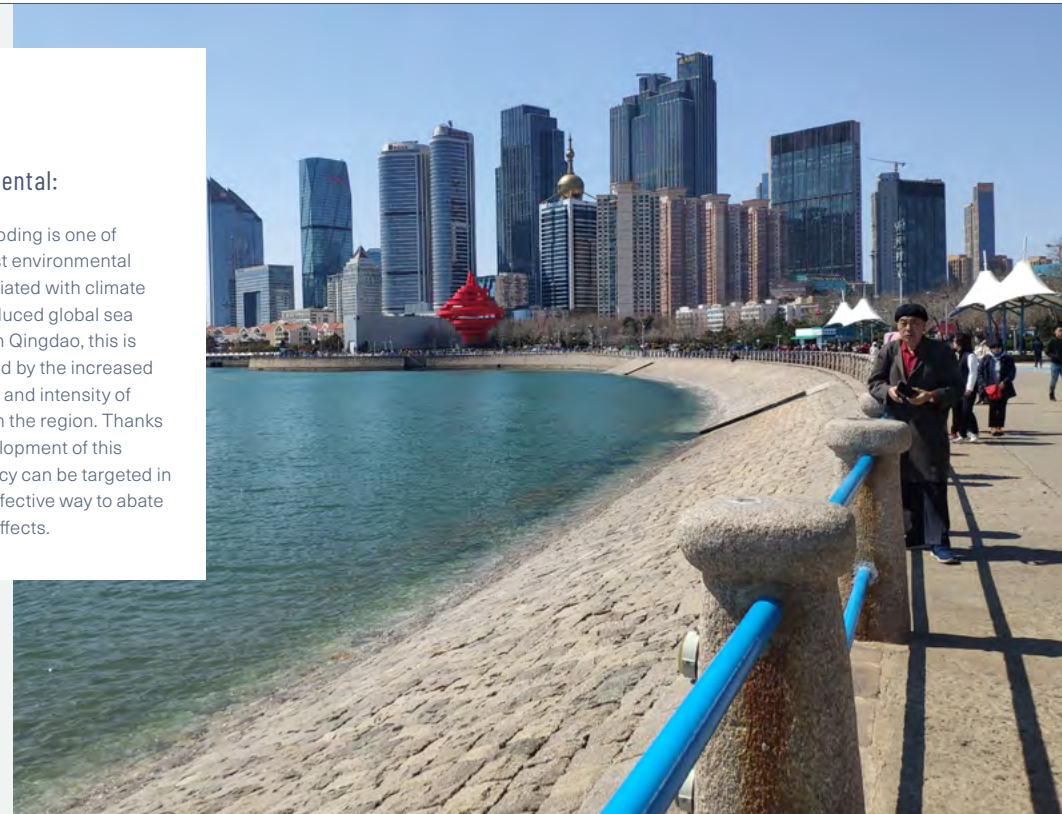
Economic:

By 2070, it is estimated that assets worth more than \$600 billion will be exposed to coastal flooding in Qingdao. By effectively identifying and planning adaptation measures with the city's model, risk of future economic damage from coastal flooding can be minimised.

Environmental:

Coastal flooding is one of the greatest environmental risks associated with climate change-induced global sea level rise. In Qingdao, this is exacerbated by the increased prevalence and intensity of typhoons in the region. Thanks to the development of this model, policy can be targeted in the most effective way to abate the worst effects.

With climate change-induced sea level rise increasing the risk of coastal flooding in Qingdao, the city has developed a high-level model to establish how best to target their climate adaptation strategy.



VENICE:

Ecosystem service approach enhances salt marsh protection

→ Since 1870, a combination of rising seas and a subsiding city have led to a relative sea level rise of 26 cm in Venice¹.

As well as being an existential threat to life in the city, climate change-induced sea level rise, in combination with human activity, is **threatening to severely damage the salt marshes** in the Venice lagoon. The Life Vimine project is the city's **\$2 million effort to protect these valuable habitats** against future climate impacts.



What has the city achieved?

Venice's salt marsh belt is the city's natural barrier against storm surges and waves, which exacerbate the impacts of flooding and sea level rise on the city. As Italy's most extensive wetland, the salt marshes are a unique Natura2000 protected habitat for several threatened species. Additionally, the salt marshes help to mitigate against the climate crisis by sequestering 466 tonnes of CO₂ each year.

Life Vimine is Venice's effort to protect and enhance the salt marshes, and the ecosystem services they provide. Bioengineered protection works, using only natural materials, are placed at strategic locations to prevent erosion to the marshes at low cost. The project embraces

circular practices by using waste wood streams from local forestry management to build the defences, which currently cover 95 hectares of salt marshes and 285 hectares of tidal flats.

The project has engaged local residents and businesses, providing more than 1,400 person-days of employment in constructing the barriers, and has formed an association of 22 local tour operators offering sustainable tourism services in the lagoon who have come together to design an eco-tourism map of the wetlands.

Venice

VENICE

↓ 14,362

TONNES OF CARBON is stored in the salt marshes; protecting them prevents that carbon from being emitted into the atmosphere

What can other cities learn?

Engage local residents and businesses:

Through Life Vimine, employment opportunities have been provided within the local community, and an association of 22 tourism operators with a mutual interest in protecting the salt marshes has been formed.

Appreciate ecosystems' economic value:

Venice has taken an ecosystem services approach to the salt marshes, which deliver economic value to the city by protecting against flooding, boosting carbon sequestration, and generating tourism opportunities.

Source locally:

With a circular approach, the project uses waste streams from local forest management as a source of materials to build fortifications. This means that protecting the salt marshes need not result in additional transport of materials and the associated emissions.

What are the co-benefits?

Social:

Conserving Venice lagoon's salt marshes is in the interests of the local community, who receive a host of benefits from the ecosystem. This is particularly true of local fishermen, who have been offered employment in constructing and maintaining the project.

Health:

Salt marshes act as a biofilter to Venice lagoon's air and water, improving water quality for residents and reducing the impacts of air pollution. Additionally, access to natural spaces in cities has mental health benefits for citizens and visitors alike.

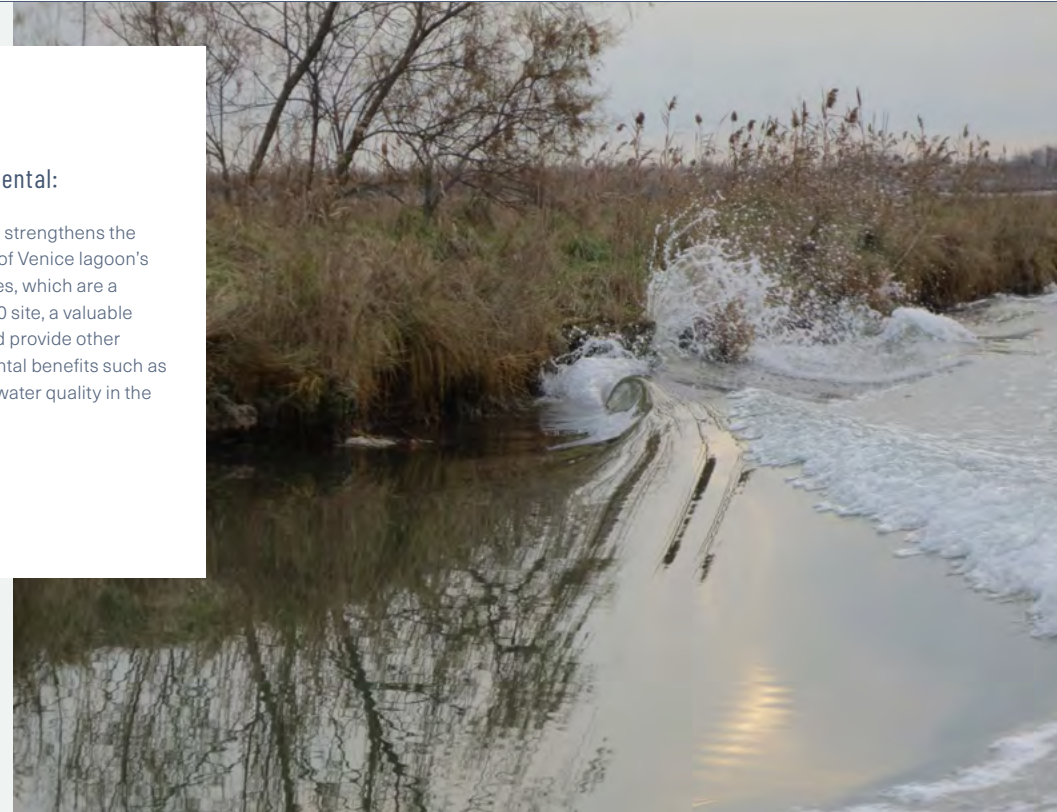
Economic:

Venice's iconic St. Mark's Square now floods up to 60 times a year, causing untold financial damage to the city's businesses, which are highly dependent on tourism income. This project is part of a plethora of policies to protect Venice against flooding, limiting the financial damages incurred.

Environmental:

Life Vimine strengthens the protection of Venice lagoon's salt marshes, which are a Natura2000 site, a valuable habitat, and provide other environmental benefits such as improving water quality in the lagoon.

Life Vimine is a project to increase the climate resilience of Venice lagoon's salt marshes, ensuring they can retain their multiple functions of protecting the city from flooding and high tides, sequestering carbon, and providing a unique habitat for hundreds of species.



2019

Cities100

CLIMATE ACTION PLANNING

- Cities are laying the groundwork to decrease their contribution to climate change and protect their citizens from future impacts. To create blueprints for a future without carbon emissions, cities are transitioning to renewable energy, greening their neighbourhoods, improving infrastructure, and much more.



AARHUS:

City halves emissions and forges ahead to fossil fuel-freedom and carbon neutrality

→ Aarhus is well on its way to reaching its goal of **becoming a carbon-neutral city by 2030**. Already, the city has slashed its emissions by 50% in the last 10 years.

Aarhus' Climate Action Plan and Strategic Energy Planning programme set out the next steps until 2020 towards carbon neutrality and a **future run on 100% renewable energy in all sectors**, supported via partnerships between the municipality and local stakeholders. The collaborative development process for the plan is based on full-scale city modelling and involved more than 250 stakeholders.



What has the city achieved?

Aarhus has undergone an energy transformation from being fossil fuel-based to cutting emissions by 50% by phasing out coal, installing heat pumps and electric boilers, and switching the majority of district heating and electricity to biomass. Now, the city has set its sights on 100% renewable energy, which Aarhus plans to achieve in part by increasing solar and wind power, boosting efficiency in buildings and industry, as well as decarbonising transportation.

Aarhus is increasing its energy efficiency, and the city has already renovated 121,000 m² of residential and commercial space, with the rest of the city's buildings planned to follow suit. It's already paying off, as Aarhus estimates up to \$19 million in energy savings for municipal buildings.

In addition, the city is scaling up its initiatives around circular economy in construction and climate-friendly procurement.

Moving towards 2030, Aarhus has identified the transport sector, and cars in particular, as the greatest source of emissions. Aarhus plans to tackle this challenge by increasing urban density, improving and electrifying public transport, and supporting bikes as a primary means of transportation. Already, since 2009 there has been a 20% increase in the use of bikes in the city.

Aarhus 

AARHUS

↓ 50%

REDUCTION OF CO₂ EMISSIONS has already been achieved in Aarhus in the last 10 years, with the ambition of becoming carbon neutral by 2030

What can other cities learn?

Local partnerships are key to success

From the beginning, Aarhus involved as many relevant parties as possible in creating the plan, including NGOs and via public-private partnerships. The city established a network for NGOs in Aarhus to create a space where they can work together towards solutions that support the city's sustainable transition. In addition, to create the Strategic Energy Plan, the city worked with the local district heating company. Under this partnership, unique approaches have been developed, including smart meters that collect data to optimise district heating and provide early leak detection.

Citizens give cities a hand in reaching beyond the low-hanging fruit:

Aarhus' Climate Plan recognises that they need broad social involvement to get further gains, since most emissions are beyond the reach of the city council's direct influence – for example, within citizens' homes and businesses. Aarhus has taken on the task of building awareness, ownership, and an opportunity mindset in regards to the city's sustainable transformation. One engagement strategy is the REUSE project, a recycling station that collects second-hand products while creating community culture around recycling and upcycling. The city also seeks to support community leaders who are already contributing to the sustainable transition.

What are the co-benefits?

Social:

Aarhus has actively engaged citizens in campaigns and education programmes about climate change and the Sustainable Development Goals, thereby working to create social change. One example is the UNLEASH programme, which gathered young people to collaborate on solutions that address the global goals.

Health:

Aarhus' Climate Action Plan seeks to create a city where bicycles are a main form of transportation. Keeping cars off the roads improves local air quality, while increased cycling supports more active lifestyles and better health.

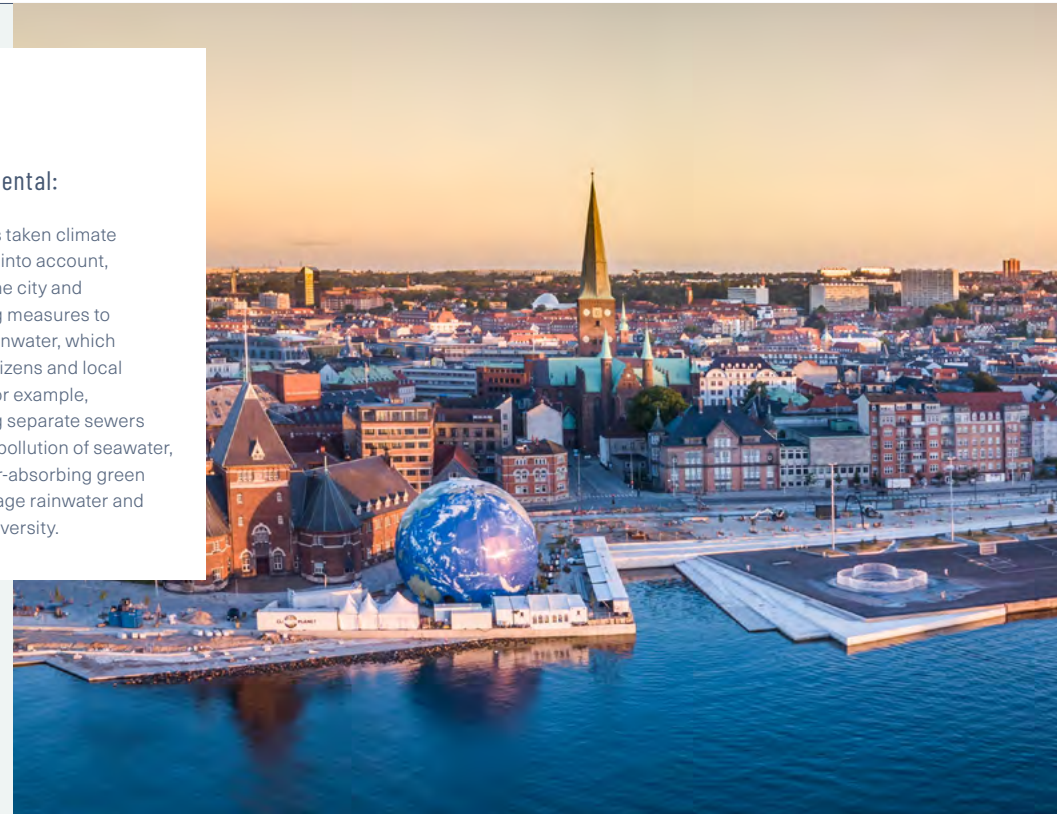
Economic:

Denmark has forecasted the cleantech export sector to be valued at \$7.5 million per year, and Aarhus is taking advantage of the opportunity to build its economy while fighting climate change. The city is setting itself up to lead in the green technology sector by developing cleantech solutions and building an international network.

Environmental:

Aarhus has taken climate adaptation into account, greening the city and introducing measures to manage rainwater, which benefits citizens and local ecology. For example, introducing separate sewers avoids the pollution of seawater, while water-absorbing green areas manage rainwater and boost biodiversity.

Aarhus' Climate Action Plan fostered the creation of The Climate Planet, a globe-shaped film theatre, which shared the story of climate change with more than 40,000 citizens from Aarhus. The Climate Planet then went on tour to Copenhagen, Bonn, and beyond, spreading the word about climate change and how citizens can take action.



BARCELONA:

Climate justice is at the heart of the city's journey to carbon neutrality

→ Barcelona has created the comprehensive Climate Action Plan (the Plan) that **puts the city on track for carbon neutrality by 2050**, co-produced by hundreds of the city's organisations and its citizens.

The plan addresses both mitigation and adaptation, promotes citizen-led action, and **focuses on climate justice**, putting those most vulnerable to climate change at the centre of related policies. Barcelona often refers to it as “the plan of plans”, as it has measures related to all major environmental issues, and includes five strategic axes, 242 concrete actions, and more than 100 monitoring indicators.



What has the city achieved?

Barcelona analysed how climate change will affect the city, and foreseeing a future of increased heatwaves, drought, and flooding risk, officials took science-based action in the creation of the Plan. Barcelona's ambition to limit warming to 1.5°C as outlined in the Paris Agreement is to be achieved by reducing emissions by 45% by 2030 from 2005 levels, and hitting carbon neutrality by 2050.

The Plan was created via a bottom-up public participation process, including the creation of a working group comprising 141 organisations and a network of citizens. Various sessions invited citizens to provide proposals, about 80% of which were included in the Plan.

The Plan puts people first, with special attention directed to those most vulnerable to climate change. For example, by increasing public green space by 1 m² per citizen, and ensuring no one is more than a five-minute walk from a “climate shelter,” a cool public space to retreat during a heatwave. In a city where 10% of the population is affected by energy poverty, the Plan addresses citizens' access to basic utilities as well as sustainability via grants and subsidies for energy-saving home improvements.

Barcelona 

BARCELONA

↓ 45%

PER CAPITA REDUCTION OF EMISSIONS is Barcelona's goal to be achieved by 2030, which puts the city on track to become carbon neutral by 2050

What can other cities learn?

Invest in citizen collaboration:

Barcelona demonstrates that it takes citizen involvement seriously by funding innovative citizen-driven initiatives. The Barcelona City Council has launched a new series of grants to implement the Climate Plan by promoting collaborative projects between the public authority and citizens. The Climate Plan provides \$1.3 million in funding until 2030, with a call for new projects every two years. More than 140 organisations, and a total of 49 projects on diverse themes, participated in the first call for climate grants, and the final 11 selected projects were endowed with a budget of \$22,300.

Get creative to maximise the public good:

Barcelona is committed to changing their energy model to mainly clean and renewable energy sources, which includes the goal of a fivefold increase in solar power generation. A creative way the city is making their energy goals a reality is taking advantage of public spaces to generate electricity. For example, a photovoltaic pergola was installed atop a children's play area, which generates electricity while providing shaded public space, which is increasingly important in a warming world. The installation generates 70% of the electricity needed to power the surrounding square's lighting each year.

What are the co-benefits?

Social:

Barcelona sees education and communication as vital instruments for increasing citizens' knowledge and awareness about climate change, and has therefore included in the Plan the creation of one cultural facility on sustainability per city district.

Health:

The Plan promotes access to healthy food, with the goal to triple the fresh vegetables consumed in Barcelona that come from the surrounding province. One way the Plan is being put into action is 97 out of 100 nursery schools offering local and organic menus.

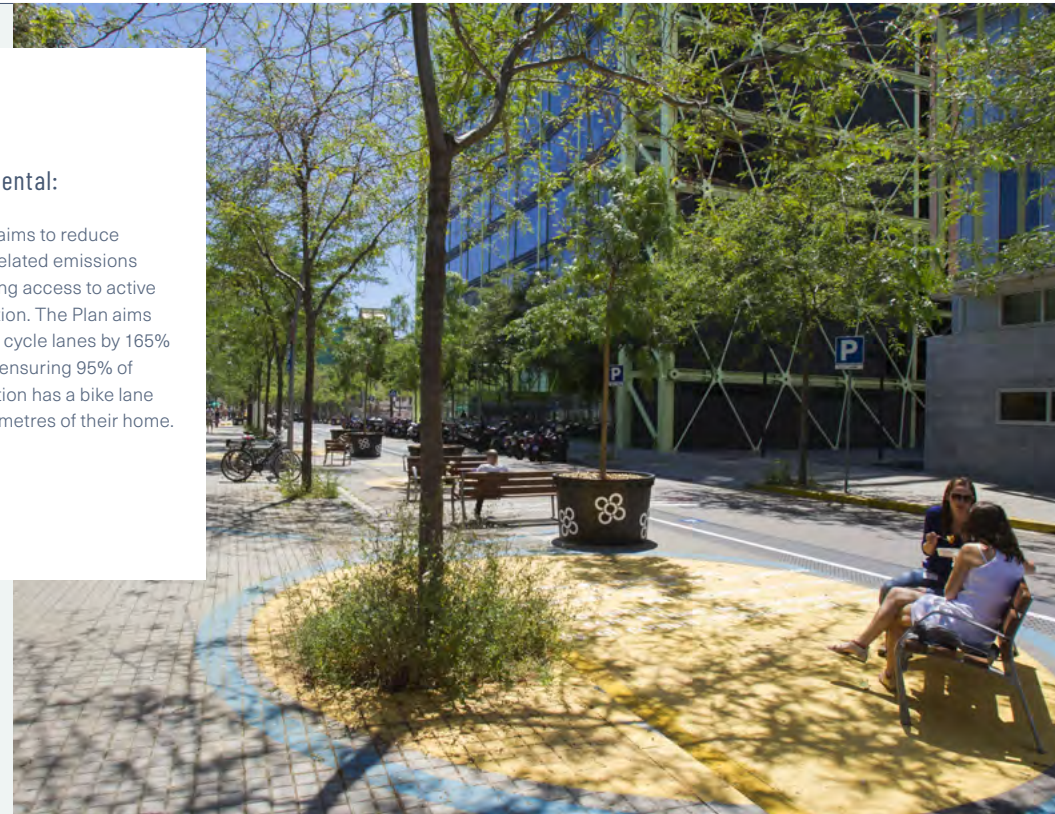
Economic:

The Plan promotes a shift to an economy that fosters the efficient use of resources, prevents waste, and facilitates subsequent recycling and reuse. Under the Plan's zero-waste strategy, the city is creating an estimated 4,500 jobs.

Environmental:

Barcelona aims to reduce transport-related emissions by increasing access to active transportation. The Plan aims to increase cycle lanes by 165% from 2019, ensuring 95% of the population has a bike lane within 300 metres of their home.

Transportation accounts for 30% of Barcelona's emissions, and one way the city is tackling this challenge is the creation of car-free "superblocks." These public spaces are reclaimed by pedestrians and cyclists, filling the streets with life.



LOS ANGELES:

Green New Deal puts city on track to meet Paris Agreement goals

→ Los Angeles has responded to the global climate emergency by integrating **1.5°C climate action planning** into a comprehensive city-wide sustainability plan.

L.A.'s Green New Deal includes long-range targets for a healthy, vibrant, and thriving city, which will be achieved via accelerated near-term greenhouse gas reductions and carbon neutrality by 2050. L.A.'s Green New Deal is a commitment to the Paris Climate Agreement to **act urgently with a scientifically-driven strategy**, while ensuring the transition is just, inclusive, and that every Angeleno has the ability to partake in the green economy.



What has the city achieved?

L.A.'s Green New Deal (L.A.'s GND), released in April 2019, ensures the city is on track to meet their commitment to the Paris Agreement, and updates their Sustainable City pLAN (pLAN) of 2015. L.A.'s GND was prepared with extensive stakeholder feedback and input over the course of 18 months. To ensure the strategy provides equitable benefits to all Angelenos and supports an inclusive, thriving, green economy, L.A.'s GND opens with environmental justice and equity initiatives, while analysing employment, economic, and public health outcomes throughout the pLAN.

The backbone of L.A.'s GND are the “5 Zeros”, meaning zero carbon emissions from the grid, buildings, on-road transportation, waste, and zero

wasted water. The city has created a strategy for a future with 100% renewable power by 2045, net-zero carbon buildings by 2050, increasing the percentage of electric and zero-emission vehicles to 100% by 2050, increasing landfill diversion rates to 100% by 2050, and recycling all wastewater for beneficial reuse by 2035. These targets are based on a city-wide and sector-based 1.5°C GHG pathway analysis, affirmed by third-party consultants as complying with C40's standards for 1.5°C climate action planning.

Los Angeles 



LOS ANGELES

↓ 25%

REDUCTION IN LOS ANGELES' EMISSIONS,
from 1990 levels, as of 2017

What can other cities learn?

Keep updated to stay on track:

If you fail to plan, you plan to fail, therefore committing to climate planning updates is key to successfully reaching targets. Los Angeles first released its Sustainable City pLAn in 2015, setting a comprehensive roadmap for protecting the environment, growing the economy, and improving equity. The Mayor committed to annual progress reports and a major update to the pLAn every four years. L.A.'s Green New Deal, released in April 2019, is the first four-year update to the 2015 pLAn and incorporates the Mayor's commitment to uphold the goals of the Paris Climate Agreement.

Think beyond your city:

Los Angeles is the largest of 88 cities in L.A. County. As such, the City of L.A. is participating in the development of a countywide sustainability plan. Under this collaboration, the city and county sustainability offices have worked together to align targets and coordinate on policy development so the plans are aligned and can have maximum impact. The City of L.A. also participates in periodic summits with the 87 other cities under the L.A. County process.

What are the co-benefits?

Social:

L.A.'s GND targets include ending street homelessness by 2028, in recognition of the intertwined nature of the economy, equity, and environment. This will be achieved by creating or preserving 50,000 income-restricted affordable housing units by 2035 and improving stability for renters.

Health:

L.A.'s analysis shows that the city's targets around zero-emission vehicles, building electrification, and industrial emissions combined will prevent 1,650 premature deaths per year, avoid 660 respiratory and cardiovascular hospital admissions, and save \$16 billion annually in prevented healthcare costs.

Economic:

L.A.'s GND includes initiatives to train and employ underserved populations, targets to create 300,000 green jobs by 2035 and an additional 100,000 by 2050, and to increase private sector green investments by \$750 million by 2025, and \$2 billion by 2035.

Environmental:

L.A. aims to reduce the urban heat island effect via urban greening, and "cool" roofs and pavement, which reflect sunlight and absorb less heat than traditional materials. The plan includes ecological restoration and increasing tree canopy, to achieve no net loss of biodiversity by 2035.

Through Mayor Garcetti's leadership and an empowered network of Department Chief Sustainability Officers, there has been a coordinated planning and implementation effort to make sustainability a priority across government. Local NGOs and community advocates supported the project through their engagement with the Mayor's office during the development of L.A.'s Green New Deal.



MANCHESTER:

A co-produced plan of action for climate neutrality

→ Greater Manchester is ensuring that its future doesn't follow the legacy of its past. From historical roots in the Industrial Revolution, the city has adopted a **science-based target in alignment with the Paris Agreement**.

Beginning in 2019, the five-year plan sets a carbon budget putting the city on track towards climate neutrality by 2038. The target includes emissions from energy-related sectors, with separate targets for aviation and shipping at national level. The plan was co-created over two years via **extensive citizen engagement**, and the development of a carbon analysis tool to plan city-scale carbon reduction pathways.



What has the city achieved?

In 2017, Greater Manchester set the city-regional target for carbon neutrality, and engaged in a collaborative process over the course of two years to develop a plan of action. The city ran workshops where national and local experts contributed to the creation of a carbon analysis tool. The tool has enabled the city to create greenhouse gas inventories with carbon reporting outputs, and was used in a series of workshops with policymakers to define a carbon pathway for Greater Manchester.

To grow the climate plan from the grassroots, the city organised 42 listening events, engaged more than 8,000 people, and conducted an online survey receiving 2,000 responses. The city used the responses to inform two Green

Summits. In the first, 700 participants provided feedback on the carbon target; in the second, 1,700 people discussed and agreed upon the results of the analysis. The cumulation of the stakeholder input and scientific analysis resulted in the 5 Year Environment Implementation Plan, from which relevant policies have subsequently been adopted in other cities' regional plans. For example, policies requiring zero-emission bus fleets, electric vehicle charging infrastructure, and the requirement for all new developments to be net-zero carbon.

Manchester

MANCHESTER

↓ 2038

IS WHEN THE CITY AIMS TO BE CARBON-NEUTRAL, in regards to CO₂ emissions from energy-related sectors including heating, electricity, industry, and surface transport

What can other cities learn?

Embrace the challenges of co-production:

Greater Manchester welcomed the challenge to co-produce their climate plan, despite it being a relatively new method within city-regional policy and strategy development strategy. For a co-production to be effective, it requires a degree of power sharing, which can bring challenges. However, the extensive process of the engagement of citizens, experts, scientists, and businesses led to the development of a plan that is not only science-based but also in the best interest of residents, who support the plan.

Modelling can be a helpful tool to inform strategy :

The carbon analysis tool developed through the project provided a foundation from which to inform the city's strategy for carbon neutrality. The results of the tool helped steer Greater Manchester's overall approach and priorities, including determining the most cost-effective ways of reducing emissions and the sectors where the most significant reductions in CO₂ emissions must come from. Furthermore, the tool will guide the city on how to monitor and track progress throughout their green transition. And it is not just Greater Manchester that has benefitted from employing the carbon analysis tool, it is currently being adopted by cities across the UK.

What are the co-benefits?

Social:

All citizens will have: access to green space in every community, more trees in urban areas, active travel networks, environmental education, and healthy and locally-produced food. These improvements are expected to increase residents' well-being and sense of community.

Health:

Improving air quality is a priority, as existing NO₂ levels exceed legal limits. The city aims to meet World Health Organization guidelines by 2030, which will be achieved in part via the goal of 50% of journeys to be made by active transportation by 2040.

Economic:

The plan will lead to an increase in the green job market, which will be supported via initiatives to upskill the local workforce. Retrofits and efficiency upgrades will lead to city-wide savings on energy bills of up to \$1,200 per household.

Environmental:

Greater Manchester's plan includes restoration of peatlands and planting up to five million trees by 2050, from which the city will enjoy the benefits of carbon sequestration, increased biodiversity, reduction of the heat island effect, and reduced flood risk.

A series of workshops and the public's vision are key to the formation of Greater Manchester's five-year plan. The city aims to continue to engage and educate residents, communities, and businesses in a collaborative approach to implement actions in the plan.



NEW YORK CITY:

City-wide climate action plan blazes a trail towards carbon neutrality

→ New York City created the first-ever city climate action plan to clearly articulate the pace, scale, and impact of actions that are necessary to bring a city's efforts **in line with the Paris Agreement's 1.5°C goal**.

The plan includes commitments to more than 30 major climate actions to begin by 2020. The actions will accelerate greenhouse gas emissions reductions, including commitments to legally mandate emissions reductions in all large buildings and to lead the development of the **first global protocol for carbon neutrality for cities**.



What has the city achieved?

New York City's plan titled, 1.5°C: Aligning New York City with the Paris Climate Agreement, sets an agenda towards 80% emission reductions below 2005 levels and net-zero emissions by 2050, while prioritising climate justice for more environmentally beneficial and economically inclusive outcomes for all New Yorkers.

New York took a landmark action in May 2019 by passing into law a requirement for large buildings to reduce their greenhouse gas emissions. The projected impact is a reduction of 6 million tonnes of CO₂e by 2030, relative to a present day baseline. To accelerate the decarbonisation of buildings, the city has committed more than \$3 billion to retrofit city-owned buildings, as

well as more than \$30 million for free technical assistance to private building owners. The 1.5°C plan also commits the city to create a Property Assessed Clean Energy (PACE) programme to support the transition in the private building sector with low-cost financing. This, paired with a commitment to pursue congestion pricing and to invest in bike and public transit, is expected to result in a transformation of the transportation sector in New York City. In pursuit of decarbonising transportation, the plan includes a \$10 million investment for electric vehicle charging infrastructure city-wide.

New York City 

NEW YORK CITY

↓ 10 MILLION

TONNES OF CO₂e is expected to be reduced by 2030 under action commitments in the plan. With accelerating action, reductions of up to 17 million tonnes of CO₂e is possible by 2030.

What can other cities learn?

Take a lead, and others will follow:

New York City was the first city to develop a plan of action in alignment with the Paris Agreement, and is unique in its leadership on mandatory emissions reductions in all large buildings. To share what the city has learned, New York City has published guidance on planning for and achieving city-wide carbon neutrality in partnership with C40 and with the support of 10 global cities. Through bold action and a willingness to share knowledge, the city has positioned itself as a global leader in climate action.

Adopt a long-term perspective to reach beyond low-hanging fruit:

A sustainable transformation doesn't come for free, and can require sizeable investments combined with strong political will in the near term for long-term gain. New York City has already achieved emissions reductions from low-hanging fruit and substantial additional investments are necessary to fully decarbonise the city, as the plan will cost more than \$10 billion across the public and private sector. However, the plan was made possible due to political will, the readiness to push for ambitious legislation to upend the status quo, and the acceptance of the latest scientific findings, regardless of how challenging their implications are.

What are the co-benefits?

Social:

The plan aims to create 26,700 good-paying jobs by 2030. The city's workforce programmes, including the Green Jobs Corps, will work to ensure that these jobs are accessible to people who are low income and from environmental justice communities.

Health:

Actions across all sectors, including buildings, transportation, and waste, aim to dramatically improve local air quality and health outcomes. The emissions performance standard for large buildings alone will prevent at least 100 premature deaths per year from air quality improvements.

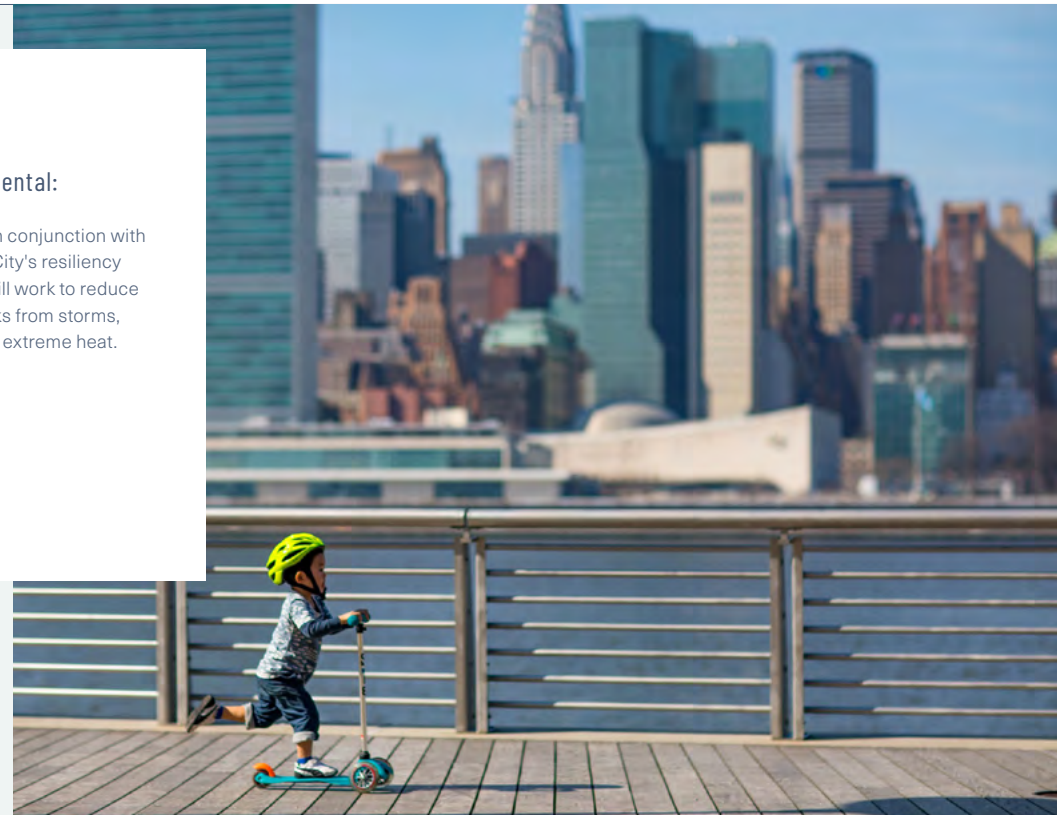
Economic:

Cost of living and housing will become more affordable because of sustainable transportation options, and investments in energy efficiency and clean energy. Furthermore, New York will become a hub for the green economy as firms innovate to provide decarbonisation services across buildings, energy, transportation, and more.

Environmental:

The plan, in conjunction with New York City's resiliency strategy, will work to reduce climate risks from storms, floods, and extreme heat.

New York City is tackling emissions from buildings via groundbreaking legislation for the health of New Yorkers today and future generations. The fossil fuels burned in buildings are the city's largest source of emissions, and contribute to air pollution that causes asthma, bronchitis, and premature death, particularly among children and seniors.



PARIS:

Birthplace of the Paris Agreement aims for carbon neutrality

→ The new Paris Climate Plan seeks to achieve a future below 2°C of warming, and **guides the city towards becoming carbon neutral by 2050.**

The long-term plan involves **halving the city's energy consumption** and achieving a supply of 100% renewable energy, and includes comprehensive targets for buildings, transportation, energy, food, waste, lifestyle, finance, and more.



What has the city achieved?

In a world of rising emissions, Paris stands out as already decreasing their carbon footprint by 10% in the last 10 years. Renewing their commitment to a 2°C world, the city has adopted the new Paris Climate Plan in 2018.

The city's ultimate goal is to be carbon neutral by 2050, produce zero emissions, and reduce the city's carbon footprint by 80% in comparison to 2004. The city takes a comprehensive view of their carbon footprint, including local and upstream emissions produced prior to energy consumption, emissions associated with the food and construction sectors, and from transport outside Paris, including air transport. In order to achieve the 2050 targets, Paris aims

to halve electricity consumption, ensure a 100% renewable energy supply, and offset residual emissions. To achieve these ambitious goals by 2050, the city will accelerate their action to meet the urgency of the energy transition by 2020, and defines an operational action plan from 2020 to 2030 to reduce emissions and energy consumption. The plan is integrated into all city policies and departments, and includes 500 measures around key themes including building efficiency renovations, sustainable transportation, circular economy, sustainable food, financing tools, and more.

Paris ○

PARIS

↑ 100%

RENEWABLE ENERGY will power Paris in 2050 according to the goals of their Climate Plan

What can other cities learn?

Bring on the challenge of thinking long-term and inclusive:

The difficulty of long-term planning is at the heart of the global challenge of climate action. However, Paris took on this challenge while also using a high degree of stakeholder involvement. There was 18 months of consultation, resulting in a vision co-created by economic actors, researchers, associations, and citizens. The process included 30 thematic workshops on transport, waste, air quality, more than 100 hours of debate, and meetings with 700 stakeholders. Input from civil society was elicited in part through the platform "Mrs. Mayor, I have an idea," which collected 280 proposals and ensured inclusion of Parisians in the Climate Plan.

Ensure your vision for the future doesn't leave anyone behind:

Paris envisions a transition to climate neutrality that is fair, inclusive, and resilient, and has therefore used the Climate Plan as a means to tackle social insecurity. The city conducted a study on the socio-economic impacts of the energy and climate transition in order to identify the impacts of the Climate Plan, whether positive or negative. The city sees the fight against climate change working to protect the most vulnerable populations. For example, by implementing measures that reduce household energy consumption, low-income households reduce their energy bills.

What are the co-benefits?

Social:

The City of Paris aims to achieve a fair and equitable transition to a low-carbon society, which does not exclude anyone. The city sees the emergence of new professions for a new economic model, for example energy facilitators and eco-managers.

Health:

Improvements to public and active transportation are included in the Climate Plan, including the goal of having more than 1,000 km of cycle lanes by 2020 and 100% carbon-free public transport by 2025. Citizens will have more opportunities to include activity in their day, as well as cleaner air to breathe.

Economic:

The city sees its carbon-neutrality strategy as boosting its economic attractiveness to investors and manufacturers. Furthermore, the development of green finance tools will help leverage foreign investment, helping Paris achieve its goal of becoming an international green finance hub and to accelerate the shift to a low-carbon economy.

Environmental:

To cool the city in the face of ever-increasing heatwaves, the Climate Plan includes bringing more nature into the city. The urban greening efforts include transforming schoolyards into green oases, and the goal of planting 20,000 new trees by 2030.

To ensure citizens are prepared for heatwaves, part of the Paris Climate Plan is to ensure no one is further than a seven-minute walk from a public space with shade, which has been deemed a "cool island" by the city. The city has developed an app called Extrema Paris that helps citizens find cool islands nearest to them.



RIO DE JANEIRO:

Aligning sustainable development and climate action



→ Rio de Janeiro is taking a unique initiative to **integrate and align the city's multitude of climate action and sustainable development efforts** with the creation of their City for Climate Program.

The programme will integrate the city's new Sustainable Development Plan with its Climate Action Plan. The city is **linking the governance structures** of the planning initiatives, aligning actions to support both the city's goal of carbon neutrality by 2050, and its work on the Sustainable Development Goals.

What has the city achieved?

In 2015, Brazil signed the 2030 Agenda for Sustainable Development, setting the country's commitment to take action on the 17 Sustainable Development Goals (SDGs). Rio de Janeiro's Sustainable Development Plan was created to ensure that the city's policies, strategies, and short-term plans are aligned with the long-term goals of the SDGs.

To ensure the city's efforts to address the SDGs also support its work to achieve the objectives of the Paris Agreement, Rio de Janeiro's City for Climate Program will define ways to implement and monitor the guidelines and actions defined in the Sustainable Development Plan in the context of actions related to climate change.

The programme will integrate the execution of projects with a view to the development of low-carbon solutions that mitigate and adapt to the impacts of climate change, as well as establish a monitoring strategy for the city's greenhouse gas emissions. The project will also create a new governance structure at City Hall engaged and committed not only to climate change issues, but also to sustainable development as a whole.

Rio de Janeiro 

RIO DE JANEIRO

↓ 2050

IS THE YEAR the city aims to achieve carbon neutrality, with an interim target for 2030

What can other cities learn?

Give citizens a platform to participate:

Key to the creation of Rio de Janeiro's Sustainable Development Plan was citizen participation, which was enabled via an online platform. The website was launched for the Sustainable Development Plan, but will continue to serve as a medium to gain citizen feedback on future projects. The first round of participation about the SDGs included 937 participants, and other topics of participation included gathering insights on city challenges and the city's vision for 2050.

Ensure alignment to ensure success:

When cities have a wide array of sustainability projects and initiatives across many departments, it can be easy to miss out on collaborative opportunities or avoid conflicting projects. By ensuring that the city's overall climate planning initiatives are aligned with sustainable development efforts, Rio de Janeiro can benefit from synergies and new opportunities.

What are the co-benefits?

Social:

A welcoming and inclusive society is envisioned in Rio de Janeiro's plans, one with less social inequality and more respect for diversity. The vision includes increasing access to cultural facilities and public services.

Health:

Rio de Janeiro's vision is to be a city that provides conditions for a long, healthy, and active life via increased active mobility and more accessible public spaces. In addition, the city aims to support sustainable local food production and ensure the population's access to healthy food by shrinking the distance between producers and consumers.

Economic:

In planning for a carbon-neutral future, the city foresees the growth of markets relating to the adoption of clean energy, low-carbon technologies, and construction. The city aims to excel in innovation and create an attractive business environment.

Environmental:

The city aims to achieve climate neutrality by 2050 and to be in line with the objectives of the Paris Agreement. Rio de Janeiro envisages itself as a leader in mitigating and adapting to climate change through planning, technological innovation, and citizen engagement.

Rio de Janeiro's partnership with UN-Habitat presented a series of four workshops related to open government aimed to strengthen the performance of public workers and civil society in achieving the Sustainable Development Goals. The workshops succeeded in training 1,312 professionals.

Photographer: First page - Alexandre Macieira / RIOTUR



UPPSALA:

A cross-sector, city-wide network with a common goal of becoming fossil fuel-free by 2030

→ Uppsala Climate Protocol is a cross-sectoral, **multidisciplinary collaboration** between the City of Uppsala, private companies, public organisations, academia, civil associations, and environmental organisations.


Together, they unite in working towards a **rapid, science-based transition** to meet the Paris Agreement and achieve a 1.5°C, climate-safe future. The protocol aims to ensure climate mitigation and adaptation go hand-in-hand and seeks win-win actions, to secure a future where both human and ecological boundaries are respected.



What has the city achieved?

Uppsala Climate Protocol (UCP) is an established arena for climate action and cooperation working towards the city's long-term goals to be a fossil fuel-free city by 2030, and climate positive by 2050. The network is democratically organised with decision-making executive meetings, a climate coordinators group, a steering committee, and a process management team. The practical work is concentrated in working groups, where both fee-paying members and non-members are welcome to participate. During every three-year period since 2009, working groups have challenged themselves to set ambitious short-term common climate goals, based on the contributions of each member and the long-term goals of UCP.

UCP already has a history of success, and in previous periods emissions reductions results were double the established goals, with emissions reductions of 11% between 2012 and 2015, and 10% from 2015 to 2018. However, it was decided in May 2019 to go beyond previous ambitions, with the goal of reducing emissions by 10% to 14% every year and halving emissions every decade. This ambitious reduction trajectory follows the idea of a just transition to meet the Paris Agreement, where it is the responsibility of developed cities and countries to accelerate their action.

Uppsala 



UPPSALA

↑ 40%

OF ALL EMPLOYEES IN UPPSALA work within the 37 member companies of the Uppsala Climate Protocol, leading to the broad support of city-wide climate action

What can other cities learn?

Use science-based targets:

UCP adopted science-based targets to move beyond doing what they can, and instead doing what we must. The targets follow the Carbon Law, a concept proposed by researchers at the Stockholm Resilience Centre to support a rapid shift towards a global economy in line with the Paris Agreement. The Carbon Law is inspired by Moore's Law in the computer industry, in that the processing power of computers doubles approximately every two years. The Carbon Law suggests halving emissions every decade, combined with an exponential development of renewables, to ensure carbon emissions peak in 2020 and reach zero by 2050¹.

Build strong and diverse alliances to fight climate change:

UCP illustrates that building strong alliances across city sectors is key to fostering a united front against climate change. UCP is built mainly on members' time and competences, as well as on member fees. The long-standing commitment from Uppsala's private companies is seen in their willingness to pay a membership fee of \$3,160. The ability for UCP to exceed their goals is credited to the spirit of friendly challenge between members asking each other: How much can you contribute? The city's experience is that cooperation does not happen by itself, it has to be encouraged, cultivated, and organised.

What are the co-benefits?

Social:

The work and results of UCP has inspired a shift in culture and behavioural change. For example, employees are made aware of the climate impact of their commuting habits, and they are actively encouraged to walk, bike, or use public transportation.

Health:

Projects initiated via the work of UCP's members have increased active transportation and the associated health benefits. For example, one project engaged 15 member organisations to increase sustainable travel methods, resulting in a 350-tonne reduction in emissions.

Economic:

Several projects resulted in innovative ways to decrease emissions while simultaneously pushing climate-driven business development. For example, a project on climate efficient plastic procurement, where seven partners minimised the use of plastic, improved waste separation, and supported the development of alternatives to fossil fuel-based plastics.

Environmental:

Work has been initiated on ecosystem- and nature-based solutions, which is a win-win solution for both reducing climate-related risks and increasing biodiversity and carbon sequestration.

A core purpose of Uppsala Climate Protocol is to foster cooperation between its members and facilitate the implementation of projects that slash emissions, improve citizens' well-being, and decrease the city's risks of climate-related impacts.

Source: ¹ Rockström, Gaffney, and Rogelj, Stockholm Resilience Centre (2017)
Photography: First page - Anders Tukler, Second page - Niklas Lundengard



VANCOUVER:

City responds to the climate crisis in 90 days



→ In January 2019, the City of Vancouver became **one of the first cities in the world to declare a Climate Emergency**.

This declaration was in direct response to the landmark IPCC report released in the fall of 2018 calling for urgent action to limit global warming to 1.5°C. Vancouver's City Council directed staff to report back in 90 days with **clear, ambitious, and achievable climate actions** that would align Vancouver with the IPCC's recommendations.

What has the city achieved?

In response to the Climate Emergency Motion, staff from the City Council created a suite of actions to meet the IPCC recommendations, developed via engagement with key stakeholders and community partners. The plan, which was approved unanimously by the Council, includes Six Big Moves and 53 accelerated actions. The Six Big Moves are city-wide interventions that will catalyse walkable, complete communities, increase active transportation, accelerate vehicle and building electrification, cut embodied carbon in new construction, and sequester carbon via a large-scale, long-term coastal, and forest restoration programme.

provide a means of early progress on the road to meeting the IPCC's recommendations. The plan also includes a carbon budgeting component, which will be developed in 2020. In addition, Vancouver's City Council voted to create a Climate and Equity Working Group to ensure engagement and support for systematically excluded and low-income populations during the transition from fossil fuels to renewable energy. The Climate Emergency Response report provides a comprehensive plan for Vancouver to accelerate its climate action and achieve the IPCC's recommendations while supporting equity and affordability for its citizens.

Vancouver 

These Six Big Moves are ambitious but technically feasible and push the city's limits of climate planning. The 53 accelerated actions

VANCOUVER

↓ 45%

REDUCTION OF CARBON EMISSIONS by 2030,
exceeding IPCC recommended targets

What can other cities learn?

Take the climate emergency seriously:

When the Climate Emergency Response was presented, Council members faced competing prioritisation of difficult government issues. The City Council's decision to prioritise climate action showcases Vancouver's commitment to the global environment.

Take action now to reap the rewards:

Vancouver rightly recognises the costs of reducing emissions fast enough to limit warming to 1.5°C are much lower than the costs the city will incur if more warming occurs, and the transition has added economic and social benefits. In Vancouver, the green economy employs 1 in 15 workers, well above any other North American city and has grown 7.8% per year on average for the past three years.

Sustainability attracts top talent:

Vancouver estimates its global recognition as a "green" city has translated into a "brand value" of \$31.7 billion. In a global economy where cities are competing for talent, Vancouver sees this quality as an advantage to help attract the best and brightest and build a thriving economy in all sectors.

What are the co-benefits?

Social:

Vancouver seeks to increase the city's "complete neighbourhoods," those in which residents have walking or biking access to daily destinations such as shops, services, jobs, parks, schools, and community centres. In doing so, the city seeks to reduce social isolation and build belonging and community.

Health:

Vancouver aims to transition to a walkable and transit-oriented city, which will have health benefits in terms of air quality and personal health. With a shift to active transportation modes and public transit, citizens will spend more time outside with access to nature as they walk or bike to their destinations.

Economic:

Via the low-carbon transition, Vancouver foresees growth in sectors including buildings, transportation, and forest restoration. For example, as the city transitions to zero-emission vehicles, there will be a need for technicians, engineers, and electricians.

Environmental:

Restoring coastal areas and increasing canopy cover will increase CO₂ sequestration while also improving soil retention, increasing the area of permeable surfaces, and reducing run-off. Coastal restoration will also provide numerous ecosystem services, while increasing biodiversity, coastal resilience, and improving water quality.

Vancouver has set a goal that by 2030, 90% of residents live in complete neighbourhoods, meaning communities where daily needs are within an easy walk or bike ride away. Complete neighbourhoods provide spaces for recreation and social gatherings as well as education and acceptance across cultural differences and income levels.



2019

Cities100

CITIZEN ENGAGEMENT

→ Cities are increasingly integrating meaningful citizen engagement, experimenting with creative ways to involve citizens in campaigns, projects, and planning processes. Not only can citizen participation contribute to the overall success of a project, it can amplify the project's impact, and trigger cultural and behavioural change.



DURBAN:

Youth show city officials climate change through their eyes

—> Art created by youth from Durban, which is part of eThekweni Municipality, is helping connect the dots between community environmental concerns and local government focus areas. Youth and communities in the local townships of Inanda Ntuzuma and KwaMashu (INK) have been asked to **express what climate change means to them.**


Through the process of Photovoice, they have interpreted the question through different art forms, including photographs, poetry, and stories. The project aims to **support youth engagement and understanding of climate change**, while increasing collaboration between citizens and the government.



What has the city achieved?

The project provided an opportunity for participants to develop their knowledge of climate change and voice their concerns about environmental issues, while the city identified knowledge gaps and areas for further engagement with communities around climate change. Youth were given access to digital cameras and provided with training to develop their photographic skills. From the resulting photographs, deeper meaning was gained via interviews with the participants, to enable them to communicate what they wished to express through photos. The project engaged 48 participants from three local township schools and resulted in the creation of a visual and easy-to-read Climate Change Booklet. The highlight of the project was an exhibition launch

event, attended by diverse members of the local community, government, and universities, which encouraged the development of partnerships for collective action on climate change. The photos were also exhibited at schools, offering the opportunity for peer-to-peer learning. A key finding was that students engaged more deeply in climate change learning by interpreting the work of their peers rather than that from municipal officials. Following the Photovoice project, students were engaged in environmentally positive actions such as clean-up campaigns, planting food gardens, and improving water quality.

Durban 

DURBAN

↑ 500

STUDENTS PARTICIPATED in an exhibition
sharing results from the Photovoice project

What can other cities learn?

A low budget doesn't mean low impact:

While the Photovoice project has a relatively low budget compared to many city solutions, the city was able to make the most of their resources by engaging students in experiential education and facilitating peer-to-peer learning. Through the immersive experience of gathering photographs and art works for the Photovoice project, students were engaged in a method likely to create lasting memories and personal connections to climate change. Furthermore, the students were empowered to educate one another, which facilitated integrating conversations around sustainability within their daily lives.

Collaborate for climate action:

The Photovoice project was part of a sister-city partnership between Durban and Bremen, Germany, which facilitates knowledge sharing between the two cities. The partnership has been ongoing since 2011, when the municipalities began their partnership focusing on climate and resource protection. The cooperation between the two cities has facilitated initiatives about environmental education and climate change adaptation¹.

What are the co-benefits?

Social:

The project has increased communication between citizens and the government. Young people were empowered to articulate their needs relating to climate adaptation, and were heard by those with the power to create change in their communities.

Health:

Awareness was raised about the negative impacts of using open fires in houses and the practice of burning unwanted materials, which leads to poor air quality and negative health impacts.

Economic:

The project helped students build their skills in creative arts and writing, increase their environmental knowledge, and boost their confidence in communicating with government officials. The experience they gained could help them receive employment in the future.

Environmental:

The students were educated about how their actions contribute to climate change, and the project further spawned community initiatives such as clean-up campaigns of local streams.

The Photovoice project engaged students in a method likely to create lasting memories and personal connections to climate change.



GLADSAXE:

Climate-adaptive neighbourhood created for the community, by the community

→ Gladsaxe Municipality transformed a rarely used 7,700 m² lawn and the nearby street into the vibrant, multi-purpose Kong Hans Garden and **a climate-adapted neighbourhood** connected to district heating, and with new cycle paths.

The features included in the garden were largely determined via **a participatory process influenced by the local community**. Not only does the garden help the neighbourhood weather extreme rain events and recharge groundwater, it also provides a local meeting place, an outdoor classroom, and brings nature into the city with a plethora of native wildflowers, perennials, and trees.



What has the city achieved?

Who knows what a community needs more than the people who live there? In this spirit, Gladsaxe Municipality facilitated the co-creation of Kong Hans Garden by actively engaging the local community and key stakeholders, and even piloted a participatory budget. Citizens were informed throughout the process, and invited to join a core group with direct planning influence. The key elements of the project were developed via a citizen-led idea workshop and decided upon via a community voting event.

The garden increases the region's resilience to the increasing threat of extreme rainfall events, while providing a host of social and ecological benefits. The project aimed to decouple stormwater from the combined sewer by

creating four catchments. The catchments appear to be a natural lake and wetlands, yet they are designed to relieve the drainage systems and reduce instances of flooding. Beyond these technical benefits, the garden includes many attractive features including a toboggan run, benches, and birdhouses. The garden brings nature into the city, with the planting of 6,500 m² of wild flower meadows, more than 3,000 perennials, and 327 shrubs and trees. This new habitat has attracted rich insect and animal life, including a nationally endangered butterfly species.

Gladsaxe 

GLADSAXE

↓ 29

TONNES OF CO₂ EMISSIONS PER YEAR are estimated to be reduced as a result of the project, through the installation of district heating, the planting of 276 trees, and improved cycling connectivity

What can other cities learn?

Adopt a flexible approach for co-creation and collaboration:

Collaboration between a wide variety of stakeholders was key in making the project a success, including several municipal departments, local stakeholders, politicians, citizens, and the utility company. Citizens were able to directly impact the planning process; the municipality had only set a start and end date of the process. The City Council had the courage to test a participatory budgeting process, which gave local citizens and stakeholders a unique opportunity to directly influence the project. Many ideas adopted by decision-makers came from citizens and municipal employees.

Plan ahead and think holistically:

Gladsaxe Municipality has taken an ambitious stance on climate adaptation and mitigation, with an overall goal of reducing CO₂ emissions by 40% in 2020 compared to 2007. The transportation and housing sectors each account for almost a third of the municipality's overall emissions. Therefore, it was decided to address all these high-priority areas, while saving both construction expenses and the mess of having several rounds of road construction. This was done by simultaneously constructing bike lanes, connecting houses to district heating, and creating a curb extension for rainwater flow.

What are the co-benefits?

Social:

Through the participatory approach, citizens gained ownership of the process, strengthening the dialogue between citizens and the municipality. The wildness of the native species has become a topic of conversation and inspired a shift towards incorporating more nature into the community.

Health:

The new public green space offers citizens of all ages and abilities an informal place to gather and enjoy social and physical activities. There are also greater opportunities for active transportation thanks to the new bicycle lanes and footpaths.

Economic:

While operating expenses have increased, the value is returned with the areas' use as rainwater management. In addition, the project is expected to improve the local real estate market.

Environmental:

The 276 trees planted will sequester an estimated 700 tonnes of CO₂ over the next 100 years. This is equivalent to the emissions of 300,000 litres of petrol or 146 car journeys around the Earth.

Transforming a flat soccer field into a diverse, hilly landscape planted with native species has created a beautiful and beneficial public space that doubles as habitat for wildlife. There is also opportunity for children's learning through the outdoor school, while the varied landscape improves children's motor skills.



LONDON:

From a concrete jungle to a National Park City

→ Beginning as a **grassroots movement and growing into a city-wide strategy**, London is addressing the climate and ecological emergency by working to make more than half of the city's area green and increasing tree canopy cover by 10% by 2050.

Protecting and promoting natural beauty, wildlife, outdoor recreation, and cultural heritage are the principles behind the National Parks movement, which are being **applied to a megacity for the first time** in London's strategy to become a National Park City.



What has the city achieved?

The strategic direction for the National Park City includes a policy framework, delivery of programmes, and citizen engagement activities to protect and enhance green infrastructure. Having emerged from a grassroots campaign, the Mayor is engaging public agencies, businesses, and Londoners to join the efforts to green the city, while funding programmes via the \$15.3 million Greener City Fund, which will be invested in planting trees and improving and creating green spaces.

The growing green space network has been planned and designed to deliver an array of environmental and public health benefits including storing carbon, providing shade, reducing the urban heat island effect and

surface water flood risk, improving air quality, supporting biodiversity, and enhancing well-being. To date, \$8.5 million has been spent on more than 200 projects that have created or improved 175 hectares of green infrastructure and planted more than 175,000 trees. As a National Park City, London is taking collective action to create a city where all residents can enjoy high-quality green spaces, clean air and waterways, where more people can choose to walk and cycle, and every child benefits from exploring, playing, and learning outdoors.

London 

LONDON

↓ 3 MILLION

TONNES OF CARBON are estimated to be stored by London's 8.4 million trees each year

What can other cities learn?

Grow from the grassroots:

By backing citizen-led movements, governments can increase local collaboration. The National Park City concept originated as a grassroots campaign led by a small group of citizens. While the Mayor's political leadership has been essential for taking the vision forward through strategic planning and delivering programmes, the goals of the programme could not be delivered without contributions from an array of local stakeholders.

Integrate across policy areas:

The strategic direction for the National Park City vision is embedded across multiple policy areas, contributing to the overall success of the project. For example, the Mayor's 2018 Transport Strategy adopts a "healthy streets" approach to building climate resilience, including an annual increase in street trees on major roads. Furthermore, the Mayor's Health Inequalities Strategy aims for all Londoners to have access to high-quality green spaces.

What are the co-benefits?

Social:

In 2018, the project awarded grants to more than 100 communities to plant trees, and improve and create green spaces. Many of these communities were deficient in their access to nature and open spaces, which provide places for locals to meet, and children to play.

Health:

Green spaces encourage cycling and walking, boost mental health, and improve air quality. The city estimates Londoners avoid approximately \$1.2 billion per year in health costs due to the city's public parks – \$727 million by being in better physical health and \$463 million by being in better mental health.

Economic:

London has quantified the value of their green spaces as having a gross asset value of more than \$114 billion, providing services valued at \$6.3 billion per year.

Environmental:

Increasing the extent of tree cover, green space, and green roofs is improving London's adaptation to climate change by reducing flood risk as well as lowering high temperatures during heatwaves. Meanwhile, the city's wild residents get the added bonus of an improved habitat.

Citizen involvement has been key throughout the project, with more than 26,000 Londoners having registered to take part in various greening activities. These activities ranged from a tree-planting weekend, where 15,000 Londoners planted 80,000 trees, as well as a giveaway of 29,000 trees for Londoners to plant at home.



NANJING:

Citizens commute their way to a more sustainable city

→ Nanjing recognised the need to take action as the number of private cars rose to more than a quarter of the city's population, resulting in congested roads and rising carbon emissions. To encourage the public to adopt low-carbon commuting habits, the city introduced **a green commuting platform** into the popular My Nanjing mobile app.

The app helps users plan their trip, while providing **incentives to engage in more sustainable forms of transportation** by calculating users' carbon emission reductions and crediting them with "green points." The points can be exchanged for goods in participating stores.



What has the city achieved?

The My Nanjing app helps citizens plan their route, compare modes of transportation, while incentivising low-carbon commuting. Depending on the user's travel mode – driving, public transportation, biking, or walking – the app can calculate carbon emission reductions according to the China Certified Voluntary Emission Reduction methodology. Users of the app can set up a personal carbon account, and are rewarded for choosing low-carbon transport methods with green points. Users are also awarded green points for other offline carbon-reducing behaviours, such as tree planting. The green points provide an incentive to users as they can be exchanged for gifts, or credited towards purchases at participating businesses and supermarkets. The mechanism of rewarding

users with green points is facilitated via the use of blockchain technology.

Users are provided the information they need to make it easier to choose active or public transportation instead of driving, including real-time updates on bicycle rental availability, traffic updates, and air quality information. The green commuting platform is widely used, reporting more than 1 million daily hits. The app has recorded monthly averages of 1.2 million bike rentals, 4.7 million subway trips, and 5.7 million bus trips.

Nanjing ○

NANJING

↑ 2.7 MILLION

PEOPLE HAVE PARTICIPATED in the green commuting platform overall

What can other cities learn?

Challenge a strong car culture:

Despite significant investments in improved public transportation, Nanjing faced the challenge that car owners simply preferred driving. Attempting to cope with ever-increasing traffic and vehicles on the road, the green commuting project was proposed as an incentive strategy to shift citizens' behaviour. To improve local air quality on forecasted heavy pollution days, car owners are warned and provided the opportunity to opt out of driving the next day. Provided that the car owner chooses to use public or active transportation instead, they will receive double the points.

Promote awareness of alternatives:

By incorporating the green commuting platform into the popular My Nanjing app, citizens are provided greater awareness of the alternative low-carbon commuting opportunities available to them. Features such as real-time data on the availability of bicycles at public sharing stations can remove barriers to making active transportation more convenient for more people. The project also raised awareness with events such as the "Golden Nanjing, Green Commuting" campaign, which reported more than 600,000 participants and awarded citizens 13.5 million green points.

What are the co-benefits?

Social:

The project worked to raise citizens' awareness of sustainable behaviour, and encouraged the public to take ownership in transitioning towards a greener city.

Health:

Choosing more active forms of transportation such as walking, public transportation, or shared bicycles instead of driving private cars, improves citizens' overall fitness and general well-being.

Economic:

The app and green point programme has seen an increased use of public transportation and fueled economic activity and partnerships, as it has already distributed more than 1.9 million green points, and recorded more than 100,000 transactions.

Environmental:

Creating incentives to reduce private car use prevents carbon emissions, and provides the added benefit of improving local air quality.

The green commuting platform makes it easier and more attractive for citizens to choose low-carbon travel, such as taking trains and other public transportation, cycling, or walking.



NEW YORK CITY:

Residents get a seat at the table in planning for long-term resiliency



→ The coastal neighbourhood of Edgemere, in New York City, still suffers from the aftermath of Superstorm Sandy and the 2008 housing crisis, and faces the existential threat of flooding as sea levels rise.

To address these social and infrastructural challenges, community members were engaged in the development of the **Resilient Edgemere Community Plan**. The comprehensive plan includes neighbourhood climate adaptation, addressing the risks of flooding and coastal storms, while **promoting long-term engagement between the city and the community**.

What has the city achieved?

The Resilient Edgemere Community Plan (The Plan) aims to create long-term resilience by protecting the neighbourhood's 5,235 residents from chronic flooding and storm events. The Plan includes 62 initiatives over the next 5, 10, and 15 years. These include moving households and providing relocation opportunities, while mitigating flood risk via the construction of a raised shoreline and transforming coastal areas into parks and wetlands. The Plan is part of New York City's commitment to an 80% reduction of carbon emissions by 2050. In part, this will be achieved via a \$50 million investment in infrastructure to improve walkability, public transport, and cycling connectivity. The Plan calls for 900 new units of affordable housing and 23,000 m² of commercial space, built with climate

adaptation in mind. All new buildings will meet ambitious energy efficiency standards, including Enterprise Green Communities and/or Passive House Solar design standards, which offer up to 70% savings in heating and cooling costs.

The Plan is exceptional in its investment in community partnerships, utilising the novel Neighborhood Planning Playbook approach. The people-oriented engagement approach sought to foster a more open and inclusive process by giving residents a key role in co-creating the Plan.

New York City 

NEW YORK CITY

↑ 400

STAKEHOLDERS ENGAGED VIA WORKSHOPS,
door-to-door contact, a survey, and a
Steering Committee over 1.5 years

What can other cities learn?

Frame planning initiatives as a shared goal:

The challenge of climate change requires that decisions around governance and public investments be made under significant uncertainty, while the associated environmental and socioeconomic risks do not necessarily align with the siloed funding and jurisdictional structures of city governance. These challenges have been overcome by framing the plan as a shared goal, and establishing the use of funds as a shared resource.

Build a shared understanding with residents:

The planning process helped build an understanding among residents about what it means to live at the coastal edge, and the realities of a future with sea level rise. Map graphics and facilitated discussions empowered residents to grapple with climate change projections. These methods are replicable elsewhere for other cities to build community awareness in regions vulnerable to climate change.

What are the co-benefits?

Social:

The community-driven planning process connected Edgemere residents and community organisations to one another and to city resources, such as training programmes and job opportunities.

Health:

The neighbourhood is considered a food desert, and is challenged by higher-than-average rates of obesity, diabetes, and mental health hospitalisations. The Plan offers increased access to quality food retailers, parks, and recreation areas and opportunities for active transportation.

Economic:

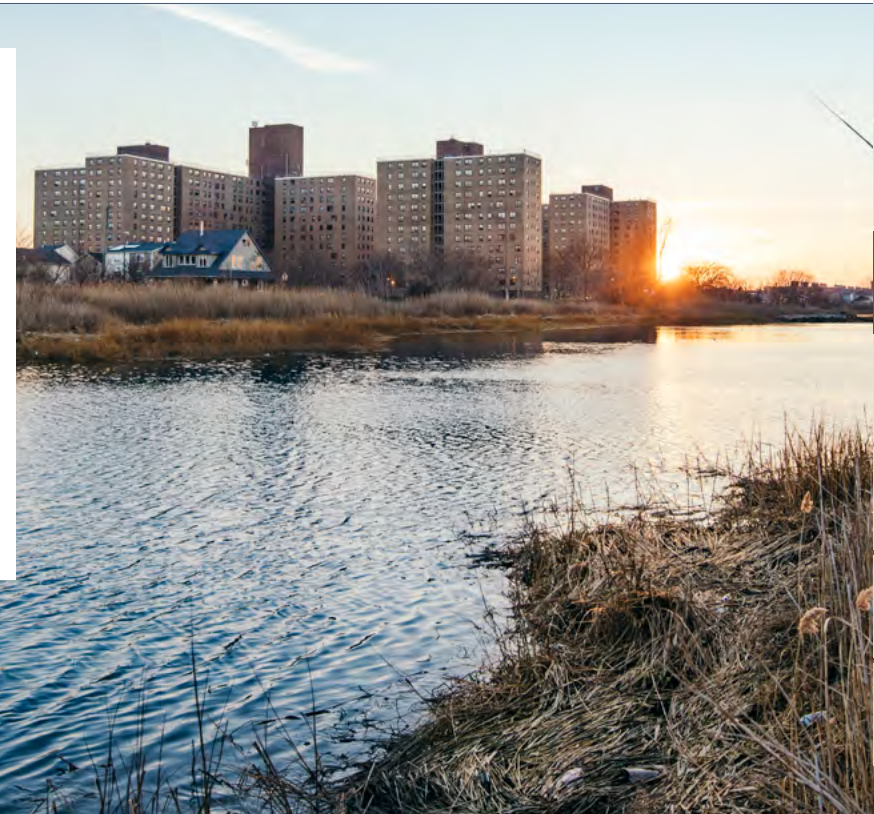
Proposed zoning changes facilitate commercial retail spaces close to transit with about 300 m² already developed and the possibility of up to 23,000 m² more. Overall, the development is expected to create 600 new jobs.

Environmental:

Vulnerable land currently in residential use will be transformed into open waterfront spaces and restored parkland, while 30 acres of existing parkland will undergo ecological restoration. Benefits include reduced stormwater runoff, improved wetland ecology, protection against shoreline erosion, and recreational opportunities.

The low-lying waterfront community of Edgemere is increasingly vulnerable to sea-level rise, and has historically been challenged by Superstorm Sandy and economic recession. The Plan provides a ray of hope, as it will work to protect the neighbourhood from future storms and coastal erosion, increase affordable housing, strengthen infrastructure, and create more retail and services.

Photography: First page - Albert Vecerka
Second page - Nathan Kensinger



SALVADOR:

Community centres in vulnerable areas protect lives and livelihoods against extreme weather events

→ Low-income communities living in Salvador are **at risk of flooding and landslides**, a danger which is increasing due to climate change.


Community Centres of Protection and Civil Defense were formed to **empower communities with the knowledge and capacity to protect themselves** and their families in the case of extreme weather. Workshops on disaster preparedness, first aid, and waste management have helped improve residents' well-being and reduce casualties from weather-related risks.



What has the city achieved?

In 2015, Salvador experienced a tragic event where 15 people died following a landslide in a low-income neighbourhood. Following this event, strong political will emerged to protect residents in vulnerable communities from recurrent extreme events. In response, the Community Centres of Protection and Civil Defense (Núcleos Comunitários de Proteção e Defesa Civil) have been built in areas at high risk of floods or landslides, in order to empower locals with the capacity to know the risks they are exposed to, and how to act to reduce those risks. The project's goal is to enable the community to choose their own course of action, once they are aware of the dangers and possible solutions.

The community centres have worked directly with communities living in vulnerable neighbourhoods by engaging community leaders and providing educational workshops. Infrastructure solutions have also been established including an alarm system with sirens warning communities to leave their homes and go to meeting centres in cases of high rainfall. Developments, including the improvement of digital maps, have enabled better management of risk areas. The project credits these initiatives with a dramatic reduction of casualties and injuries due to weather events.

Salvador 

SALVADOR

↑ 3X

MORE RAIN FALLS in Salvador than in London, and many communities are at risk of severe flooding and landslides

What can other cities learn?

Citizen engagement isn't easy, but it pays off:

The essence of this project is strong citizen engagement. However, engaging the local communities was challenging, as many residents have political issues with the current government, and are living in informal and illegally built homes. The success of this project has been to engage a broad diversity of people in the workshops, so city policies reach the most vulnerable residents. Residents were informed a week before the workshops, where a team led by social workers spent five days informing communities about the activities and topics of information that would be available to them.

Help the communities where they are:

The location of the low-income neighbourhoods and their informal construction make them especially vulnerable to climate change due to increased rainfall and the associated risks of flooding and landslides. However, this project has taken the approach to help the communities where they're at, and focus on building their capacity to protect themselves and make their own choices. The workshops aim to help participants develop a better understanding of the risks they face, and empower them with strategies that can help them take action.

What are the co-benefits?

Social:

Community resilience is increased by building capacity through education, empowering residents to make their own choices. The programme worked to engage participation of local leaders in the planning and implementation of action in their communities.

Health:

Disaster planning and first aid workshops, as well as warning systems, have increased residents' preparedness, and have been credited with reducing the number of casualties and injuries following extreme weather events.

Economic:

Preparedness efforts have reduced physical losses due to heavy rainfalls, such as homes and local infrastructure. When communities avoid physical loss, residents can continue earning their livelihoods.

Environmental:

The community centres have discouraged the common behaviour of disposing of garbage in the surrounding hillsides, which causes pollution and increases the risk of landslides.

First aid workshops are one of the many capacity-building activities promoted through the Community Centres of Protection and Civil Defense that help participants improve their own, and their community's, safety in the face of extreme weather risks.



SYDNEY:

Sydneysiders are giving their apartments climate-smart upgrades

→ **A shift towards sustainable living** is sweeping across high-density residential communities in Sydney as part of the Smart Green Apartment programme.

Apartment buildings house 80% of Sydney's residents, and they present an environmental and governance challenge, as they are among the fastest-growing segments of the property sector and use more resources than single-unit dwellings per capita. **Smart Green Apartments works with residents** to improve energy and water efficiency, reduce operating and maintenance costs, and increase building liveability and value.




What has the city achieved?

Since 2016, Smart Green Apartments has worked with more than 21,000 of the city's residents, and will continue to collaboratively engage a new cohort each year with the goal of reaching a minimum of 80,000 residents by 2025. The programme helps residents install efficiency improvements by reducing confusion around legislative approvals and overcoming a lack of technical expertise. For example, by implementing cost-effective efficiency upgrades and renewable energy projects, it has been possible to reduce common area energy consumption by at least 30%. Reducing water use is critical to mitigate climate change risks, as apartment buildings account for 40% of the city's total water use, and especially in light of persistent drought conditions in the region.

Simple interventions can be effective; for example, leak-reducing measures have achieved water use reductions of 35%.

Smart Green Apartments has an overall goal of a 7% reduction in emissions by 2030 through direct action and upgrades. The programme is tracking well above its target, as projects contributing to a 30% reduction in emissions have been consistently identified. Through this success, the programme is contributing towards Sydney's Paris Agreement target of net zero emissions for the local government area by 2050.

Sydney 

SYDNEY

↓ 12K

TONNES OF CO₂ EMISSIONS have been avoided via the implementation of energy efficiency and renewable energy initiatives identified through the Smart Green Apartments programme

What can other cities learn?

Build capacity amongst residential communities:

The governance model for multi-owned residential properties was first introduced in Australia and has since been adopted in many locations globally. Apartment buildings are primarily managed by volunteers, where owners act collaboratively as an owners' corporation. Challenges in engaging the sector can occur when stakeholders are unfamiliar with the legislative requirements needed for the uptake of environmental efficiency initiatives. To build their capacity to engage in long-term initiatives around the environmental performance of their buildings, Smart Green Apartments has delivered the first national sustainability training series for building managers, and a quarterly Leadership Network series.

Use programme findings to integrate a new rating tool:

Outcomes of Smart Green Apartments have provided an evidence base for broader sector improvements, including demonstrating the need for a new national rating tool for apartment buildings. The National Australian Built Environment Rating System (NABERS) tool enables tracking and recognition of action on efficiency, solar, and off-site renewables, and therefore helps residents plan into the future. The introduction of the tool was made possible through strong advocacy work on behalf of the city, and the support of Smart Green Apartments to promote uptake of this tool in the sector.

What are the co-benefits?

Social:

Smart Green Apartments seeks to increase citizen engagement, aiming to achieve 25% of residents having an active role in their apartment building's decision-making processes. Several buildings have established long-term community strategic plans, with accompanying mission and value statements that are informed by all residents.

Health:

The programme aims to increase connectivity within high-rise communities, promoting community well-being and reducing mental health issues including loneliness. In addition, the programme aims to reduce the urban heat island effect, which is critical to residents' quality of life during the summer months.

Economic:

Smart Green Apartments initiatives have resulted in cumulative cost savings of \$1.5 million for residents, as well as reducing operating costs for the apartment owners. In addition, implementation of the projects have stimulated market growth in the high-rise residential sector.

Environmental:

The programme also seeks to improve waste management and recycling across the city's high-rise residential communities. This will assist in the achievement of the city's targets of 90% resource recovery by 2030.

Programme interventions have improved waste and recycling outcomes. In participating buildings, reductions of up to 50% of recyclables being sent to landfill have been achieved. The installation of textile collection bins have resulted in over 10,000 kg of clothing being diverted from landfill annually.



UMEÅ:

Creatively empowering citizens to adopt low-carbon lifestyles

→ Umeå is becoming The Low Carbon Place by using creative ways to empower residents to make more sustainable lifestyle choices. The city undertook a comprehensive survey of the consumption habits of its residents, and created a wide range of activities to inform and **encourage citizens to adopt more resource-efficient lifestyles.**

From a biking campaign featuring a famous female rap artist, to a Living Lab that challenged 10 families to go car-free for three months, Umeå is using the city as a **testing ground for behavioural change** towards reducing the city's emissions.



What has the city achieved?

Umeå has opened residents' eyes to the carbon footprint connected to their consumption by surveying citizens, and creating an engaging website and campaign to share the results. In addition, the city has worked to research and test ways to support citizens in transitioning towards climate-friendly lifestyles. The city estimates that the projects resulted in a 330 MWh reduction of energy use, as well as countless changes in mindset and behaviour. The activities tested in the project spanned across three categories – mobility, housing and energy, and sustainable consumption and sharing. For example, the city ran a biking campaign named #Bryttupp, encouraging residents to “break up” (bryt upp) with their old habits, which resulted in 16% of participants using their bike more

often, and 63% reconsidering their travel habits. Other projects included engaging housing associations and restaurants in sustainability workshops and coaching sessions.

The project also included three Living Labs to support behaviour change around sustainable transport and mobility. One enticed 10 families to go three months without a car in exchange for an array of alternative options such as electric bikes and bus cards. The campaign succeeded in creating a media buzz and several of the families continued to be car-free following the project.

Umeå 

UMEÅ

↑ 1,475

RESIDENTS REPLIED TO A REPRESENTATIVE SURVEY of Umeå's population, creating the foundation for the calculation of a local carbon footprint

What can other cities learn?

Local carbon footprint - local engagement:

Umeå informed its campaigns on sustainable consumption by analysing data on residents' carbon footprints via a tool created in partnership with the Stockholm Environment Institute. The tool enables the results to be related to Swedish national averages, and to repeat the estimates in future surveys. The results have been made accessible via a website explaining the most significant findings, and visualising for residents how their actions impact climate change. The website illustrates how residents' carbon footprints vary according to each district of the city, and how they can address their unique challenges.

Don't shy away from gender considerations:

Umeå considered gender equality across all activities in the project as part of the city's long-standing commitment to equity between sexes. As men and women's consumption patterns differ, this was taken into consideration and explored further in the survey. For example, an earlier performed travel survey found that if men's travel habits were the same as women's, the city would have already reached its goal of 55% sustainable modes of travel. From this finding, a Living Lab was conducted where two male-dominated companies were engaged in initiatives to inspire their employees to commute by bike, car-pooling, and public transport.

What are the co-benefits?

Social:

Umeå has aimed to shift the conversation around climate change to a positive one. The creative campaigns aim to generate discussion at work and around dinner tables, and make climate action a part of everyday life.

Health:

A low-carbon lifestyle can offer residents better health by, for example, commuting by walking or biking, or eating more vegetables. Sustainable mobility also leads to improved local air quality.

Economic:

The project has included a focus on working with local businesses, such as restaurants, on transitioning their business models to more sustainable ones. This will help prepare businesses for the future, due to the expected increased demand for sustainable products and services.

Environmental:

Sustainable consumption is a leading challenge for Sweden if they are to reach their Paris Agreement goals, which requires widespread behavioural change.

Umeå's projects focus on facilitating sustainable lifestyles and consumption among its citizens. Umeå's outreach campaign #Brytupp, meaning to break up from old habits, inspired citizens to make biking part of their everyday lives.

Photographer: First page - Malin Grönborg,
Second page - Fredrik Larsson



ZAPOPAN:

An army of pint-sized “traffic wrestlers” are challenging car culture

→ Zapopan is putting a spin on a classic Mexican superhero (Luchador) to **engage children in triggering a cultural shift towards sustainable mobility** and greater road safety.

The character of Luchador Viales (traffic wrestler) features in plays for primary school children, which have been performed by a professional theatre company in every school across the city. Now, Zapopan is armed with a **league of small but mighty educators** to teach adults to reduce their dependence on cars.



What has the city achieved?

In Zapopan, cars are a leading cause of CO₂ emissions, and the city sought to devise a systematic way to create a cultural change. The result is a series of five plays that teach children the disadvantages of using cars for short trips, and invite them to teach their parents to walk or bike when possible. They learn about the advantages of public transport such as being able to read or draw while in transit. At the end of the intervention, every child receives a wrestler mask with the invitation to become a Luchador Viales. The mask is a symbol of rebellion against a persistent car culture and the fight for sustainability.

So far, 167,478 children under 13 have participated in the programme, and it has reached the classrooms of all elementary school children in Zapopan. Now, the project has set its sights on redesigning the play for an older audience of high school students, with the goal of reaching every boy and girl under 17 before 2021. The symbol of the Luchador is meaningful in any Mexican city, therefore the concept has the potential to be scaled across the country, and even adapted to cities around the world.

Zapopan ○

ZAPOPAN

↑ 500K

PEOPLE HAVE SEEN THE PLAYS performed at schools, events, and in public spaces

What can other cities learn?

Fund community projects to ensure wider reach:

The success of Luchadores Viales started from a humble beginning, and because of community persistence it was gradually able to gain financial support. The project began in 2015 without a budget, and with only volunteers performing a community service. In 2016, it received \$6,300 of funding, and finally received \$190,000 from the city's Department of Transportation, which was critical to achieving the goal of reaching every child in primary school. The programme was able to communicate its value by being a road safety campaign, even though the focus is mainly on sustainable mobility.

Think of the children:

Engaging children can be an effective strategy in creating cultural change, although it can be difficult to measure returns. In the early stages of the project, council members opposed to the project argued that children cannot drive and therefore doubted the project's effectiveness. Yet, children have the power to influence their families, and are expected to carry the experience into adulthood. In Zapopan, public policies have been focused to make it "the city of children," and this programme is one of the ways in which the children's well-being is being prioritised.

What are the co-benefits?

Social:

Walking and biking are sustainable modes of transport, but social ones as well. As a result, children and adults may develop greater connections with others as well as their neighbourhood when exploring the city on bike or foot.

Health:

People who engage in active transportation are more likely to meet the levels of daily exercise needed for them to be fit and to enjoy good mental well-being.

Economic:

A large portion of the city's residents live below the poverty line. Encouraging walking or biking, while improving access through updated infrastructure, is expected to help these citizens save at least a third of their transportation expenses.

Environmental:

Zapopan conducted a survey finding that 40% of citizens' car trips are less than four kilometres long; avoiding short car trips could significantly reduce emissions from transportation.

A classroom of children wear the Luchadores Viales wrestlers masks to empower them to act as climate warriors. The project hopes the children spread the word to their families by encouraging them to walk or bike. Meanwhile, the city is improving bike lanes and sidewalks, making it easier for families to get around without cars.



ZHYTOMYR:

Drop by drop, students are turning the tide on climate action

→ Students, teachers, and educational institutions across Ukraine are in a **climate-friendly competition** to reduce their carbon footprint with the goal of collectively slashing emissions by 1 million tonnes of CO₂. The Climate Drops Mobile Application **tracks the participants' progress and rewards climate-positive behaviour**. First piloted in Zhytomyr in 2017, the initiative has spread across Ukraine to 55 school communities in 15 cities, reducing 363 tonnes of CO₂ emissions in 2018 alone. While there is still a long road ahead to reach the project's ambitious goal, the initiative has made waves in the students' communities and resulted in countless inspirations and behavioural changes.



What has the city achieved?

The Climate Drops School Contest motivates students, teachers, and educational institutions in the race to become carbon neutral. For the purpose of the contest, carbon neutrality is defined as the positive difference between the CO₂ savings stemming from climate-friendly activities, and the school's carbon footprint. The school's emissions are calculated by the students with the help from the Climate Drops team, while the CO₂ savings are added up via the Climate Drops Mobile App. When participants engage in climate-friendly actions, they are converted into digital points in the app, called Drops (1 Drop = 1 kg of CO₂). The Drops are later exchanged for discounts at shops and the app's other partners. Drops are achieved via the activities of the individual participants, which include

biking, planting trees, waste recycling, and food waste composting. Additional activities that earn Drops include collective climate-friendly projects taking place within or outside of the educational institutions, which could include cooperation with local communities, businesses, and other stakeholders. For example, improving buildings' energy savings or the generation of onsite renewable electricity will earn the user Drops per kg of CO₂ saved. Students also receive lessons on climate change mitigation and adaptation from participating teachers with the use of the educational materials provided by the Climate Drops team.

Zhytomyr ○

ZHYTOMYR

↑ 85K

CITIZENS WERE INVOLVED in the Climate Drops Contest in 2018, with plans to involve 200,000 more in 2019

What can other cities learn?

Connect the dots between climate change and everyday life:

Climate change is a complex, far-reaching issue, and individuals can easily feel disconnected from the environmental impact of their everyday lives. The app helps participants understand and put a number on the environmental impact of their daily activities, while also empowering them to take control in reducing their personal impact. Cities can learn from the project to enlist the power of quantification, to help participants feel satisfied and excited about the difference they are making in their own lives and in their communities.

Enlist a variety of strategies to motivate behavioural change:

The app and contest provide motivation for climate-positive behavioural changes via elements of gamification, friendly competition, and discounts from participating retail stores. While the project is scheduled to last three years, it is possible that participants will turn the activities into stable habits and long-lasting behavioural changes following the positive experience of the contest.

What are the co-benefits?

Social:

By motivating participants to engage in climate-friendly activities, the contest could create lasting behavioural change.

Health:

In an effort to reduce emissions, participants are encouraged to shift their behaviour to active transportation such as walking or cycling to school, which can improve their overall health and well-being.

Economic:

The contest and app have created new networks and cooperation with climate-responsible businesses, academia, local communities, and municipalities.

Environmental:

Participants are encouraged to plant trees, whose cooling effect could reduce citizens' vulnerability to heatwaves in urban areas while also providing ecological benefits.

The winners of the Climate Drops Contest presented their achievements during the Youth and Future Generations Day at UNFCCC COP24 in Katowice, Poland.



COP24 · KATOWICE
UNITED NATIONS CLIMATE CHANGE CONFERENCE
POLAND 2018



2019

Cities100

INCLUSIVE CLIMATE ACTION

→ Around the world, inclusivity is increasingly becoming a prerequisite for climate action. As the impacts of the climate crisis disproportionately affect low-income communities, cities are including representatives from local communities in project development to ensure that city projects are all-encompassing and socially just, so that no one is left behind.



ACCRA:

Social inclusion of waste collectors reaps heaps of benefits

→ In Accra, **informal waste collectors collected more than 300 tonnes of waste daily**, which was disposed of at illegal dump sites with open burning, resulting in air and groundwater pollution.

In 2016, the Accra Metropolitan Authority (AMA) initiated a programme to integrate the informal waste collectors in the city's official waste management system to increase collection of waste, close the illegal open waste sites, and **ensure fair and inclusive employment**. The official recognition of Accra's informal waste collectors has increased collection of waste from 28% to 48% in just two years.



What has the city achieved?

The capital of Ghana was struggling with waste management, and more than 600 tonnes of waste were discarded in open dumps daily. This practice led to the challenges of fires spontaneously setting ablaze, increased GHG emissions, and soaring air pollution levels. To combat this, the AMA closed all open dumps in May 2017. Two of the dumps alone covered almost 100,000 m² and received more than 450 tonnes of waste every day. With the closing of the open dumps, the AMA instead opened Achimota transfer station, Kokolemie mini transfer station, and Ring Road West mobile transfer facility. The Achimota transfer station is located in Greater Accra and can handle 1,200 tonnes of waste per day.

The city adopted a strategy of including informal waste workers to sustain closure of the open dumps and expand waste collection coverage. Since Accra began the strategy, 601 informal waste collectors have been registered. The city provides waiting areas at the transfer stations for the waste collectors to sort the waste and store the recyclables, which they often sell to middlemen to increase their earnings. The three newly opened transfer stations receive more than 400 tricycles daily and more than 20,000 households receive waste collection service from Accra's informal collectors.

Accra 

ACCRA

↓ 300

TONNES OF WASTE diverted from open burning

What can other cities learn?

Enable dignified work for myriad benefits:

Prior to the inclusion of the waste workers in the city's waste management efforts, the informal waste collectors' work was illegal and they were regarded as a nuisance to society. Their work is now accepted by households, especially in low-income areas, which not only leads to more dignified work, but has also resulted in a significant increase in waste collected. In turn, this has reduced emissions of odour and gases, and lowered the risk of diseases spread in the communities.

Formalise waste management to increase efficiency:

Since the city closed illegal dump sites and opened transfer centres, salvaging of recyclable materials has increased from 5% to 18%, which not only reduces emissions but also creates more work for the people involved in recycling. Since the integration of the waste collectors, their numbers have increased from 350 in 2016 to more than 600 in 2018, which has led to an average of 650 tonnes of waste delivered daily to the three new transfer facilities.

What are the co-benefits?

Social:

By recognising the informal waste workers, more jobs have been created and their earnings have improved. Furthermore, they have become accepted by households in the city, allowing for more dignified work and increased collection of waste.

Health:

The reduction of more than 300 tonnes of daily waste burned in uncontrolled open dumps has significantly reduced air pollution. The increase in waste collection will also reduce the risk of disease, and the city has not recorded outbreaks of cholera since 2017.

Economic:

By integrating informal waste collectors, their numbers have increased from 350 to more than 600, which has increased salvaging of recyclables and is leading to more employment opportunities for people involved in downstream recycling efforts.

Environmental:

Closing Accra's illegal open dumps has reduced indiscriminate disposal of waste and reduced the city's carbon footprint due to fewer vehicles travelling to disposal sites more than 30 km from the city.

More than 600 waste collectors have been included in Accra's waste management efforts, providing dignified work, fair wages, and more waste collected in the city.



BARCELONA:

Energy poverty tackled via retrofits and job training

→ In Barcelona, dedicated **energy advisors are tackling energy poverty**, one vulnerable family at a time.

Energy Advisory Points spread throughout the city **help families understand their rights to energy**, make their homes more energy efficient to reduce emissions and save money, while also assisting the communities in getting better access to the job market. Community members gain professional skills, as 20 people are trained to be part of the team every eight months, which enables easier access to employment later on.



What has the city achieved?

In Barcelona, many vulnerable families suffer from energy poverty, such as having electricity and heat turned off unexpectedly, struggling to pay energy bills, and living in homes in dire need of efficiency retrofitting. Energy Advisory Points (EAP) is a project set up to improve the energy efficiency of homes in Barcelona, especially those of the most vulnerable. By working to guarantee the right to energy and access to basic supplies, the EAP have become integral for the less fortunate in the Catalan capital.

The EAP are a team of 40 energy advisors distributed at 11 points across the city. Their work has three main focus points: guaranteeing energy

rights and improvement of energy efficiency, helping to promote employability among the most vulnerable, and to empower citizens. Beyond their work to retrofit homes and make them more energy efficient, the EAP hires 20 people every eight months who lack access to the labour market and integrate them into the team of energy advisors, to make a team of 60. In total, 80 people have been trained and empowered to work as professional energy advisors under the EAP.

Barcelona ○

BARCELONA

↑ 1,108

PEOPLE ARE HELPED EVERY MONTH
by the Energy Advisory Points

What can other cities learn?

Financial assistance is key to help citizens escape energy poverty:

The main objective at an economic level is to enable the most vulnerable families to reduce the economic cost of energy in their home. To achieve this, the energy advisors reduce the fixed costs in their monthly bills by helping the families reduce their overall energy use. However, there is often the need for low-cost measures in order to improve the households' energy efficiency. By granting social bonds, 2,728 families were able to cut their energy bills by 25% to 40% in 2018.

Professional training changes lives:

By introducing 20 people every eight months to the Energy Advisory Points, people who were otherwise excluded from the job market are able to get the adequate training and experience that will allow them to move on after the eight months and receive employment elsewhere as energy consultants. By professionally re-qualifying people, they gain access to the labour market they would likely not have had the opportunity to.

What are the co-benefits?

Social:

The overall objective of the energy advisors is to empower the most vulnerable families to be better equipped to reduce their expenses. They also help inform families about their energy rights in relation to the energy suppliers, and help them cope if they struggle to pay their bills.

Health:

Focusing on vulnerable families, the energy advisors have been able to ensure that they can maintain an adequate temperature in their homes, all year round. This both helps to avoid issues such as respiratory diseases in children and elders, but also lessens effects on mental health due to stress from fear of having electricity and heating cut off.

Economic:

For 2018, advice provided to the families by the energy advisors resulted in 2,008 individuals reducing their energy use leading to more than \$100,000 in savings, which is roughly a \$50 saving per family each year.

Environmental:

The energy advisors work directly with families to help them gain new habits in their home electricity use. By working with their behaviour as well as helping to install low-energy lighting, insulation for doors and windows, and timers for example washing machines, the families were able to reduce their energy use by a total of 2,165 kW in 2018.

The energy advisors go from house to house to educate families on how to reduce their energy use and help retrofit homes in areas, such as around windows and doors, which will significantly improve the energy efficiency of the homes.



BUENOS AIRES:

Revitalising a marginalised neighbourhood into a green oasis provides opportunity for residents



→ The city government in Buenos Aires is working for the social and urban integration of marginal neighbourhoods to create the **same rights and opportunities for all citizens**.

In the neighbourhood of Barrio 31, a comprehensive plan to **guarantee access to education, health, and formal jobs** is being carried out. The plan will transform a noisy, polluting highway into an elevated park providing residents with green, recreational spaces as well as safe and sustainable homes.

What has the city achieved?

In the heart of Buenos Aires is Barrio 31, one of the oldest informal settlements in the city. Despite its central location, it has been separated from activities and opportunities that would otherwise go hand-in-hand with living centrally in a buzzing capital. Barrio 31 is not only separated by train tracks and a highway but also socially – lacking access to education, healthcare, and jobs. In 2016, the city commenced the Elevated Park project to integrate the area's 40,000 residents and provide the infrastructure needed to secure access to basic services and rights.

The city is now working to transform the highway into the Elevated Park, which will increase public space per inhabitant in Barrio 31 by 387% and

connect the neighbourhood with the rest of the city. The elevated park will incorporate green areas, electric public transport, and a biological corridor, while a 64,500 m² space underneath it will be used for recreational, sporting, and cultural activities. The city is providing safe and accessible housing to the residents, making improvements where possible and building new, sustainable housing where necessary.

Buenos Aires 



BUENOS AIRES

↓ 6,462

TONNES OF CO₂ will be absorbed every year by the 4,038 trees that will be planted in the park

What can other cities learn?

Consider gentrification in urban renewal projects:

A project such as this, which includes renewing and improving vulnerable urban areas, often triggers increased land valuation. Therefore, if no instruments are created to prevent locals from being displaced by higher-income residents from outside the neighbourhood, the final objective of the integration project would be compromised. To address this issue, Buenos Aires introduced anti-gentrification policies relating to property deeds, the options for selling properties in the future, and extra taxes for companies and people from outside the neighborhood wanting to purchase land or property in Barrio 31.

Take a holistic approach to development that leaves no one behind:

Although it could be a relatively simple task to create a park for environmental reasons, the holistic approach taken by Buenos Aires is resulting in a slew of benefits for the 40,000 residents in the area. The Elevated Park project has a number of objectives it wishes to obtain for every resident of Barrio 31, such as ensuring 1) access to public education, for which the city is building educational hubs, 2) quality healthcare close to every home, for which three healthcare centres have been built, and 3) economic development via access to formal jobs, training, and formalisation of the economic activities in Barrio 31.

What are the co-benefits?

Social:

Before the Elevated Park project, 1,000 families were living beneath the Illia Highway in inadequate and unsafe living conditions. The city is building new, sustainable housing for these families, providing them with dignified and healthy living circumstances.

Health:

Before the project, Barrio 31's residents were exposed to emissions from vehicles and above 80 dB noise from the highway's activity. The planned transformation will reduce vehicle emissions and particulate matter and therefore improve air quality and related health issues.

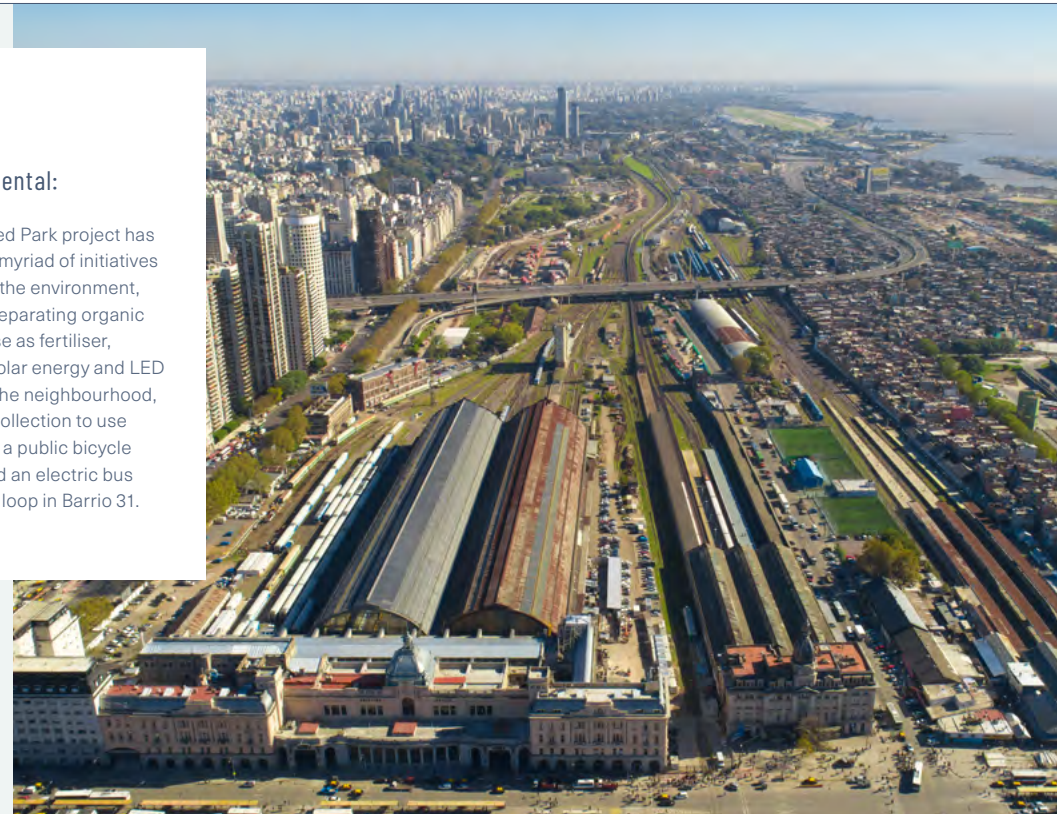
Economic:

The new park will serve as an attraction for recreation and tourism, which is favoured by residents and the city as it will lead to commercial development and increased economic opportunities for the residents.

Environmental:

The Elevated Park project has included a myriad of initiatives to improve the environment, including separating organic waste to use as fertiliser, installing solar energy and LED lighting in the neighbourhood, rainwater collection to use in the park, a public bicycle system, and an electric bus driving in a loop in Barrio 31.

The city created a campaign to inform the residents of the Elevated Park project and to ask them to share their own ideas for the project. In four days, 72 residents proposed 177 ideas for the project.



LOS ANGELES:

Local neighbourhood fights disparities and pollution

→ The Watts Rising Transformative Climate Communities project is a **community-driven vision** to transform one of Los Angeles' most disadvantaged communities.

The city conducted an extensive stakeholder engagement process including a host of local NGOs, which resulted in the launch of a comprehensive plan in April 2019, including **clean energy projects, urban greening efforts, and zero-emission transportation**. The project incorporates workforce development plans as well as displacement avoidance plans, making sure that Watts' existing communities will benefit from the initiatives.



What has the city achieved?

Situated in southeastern Los Angeles, the neighbourhood of Watts is surrounded by numerous sources of intense air pollution, faces some very serious health discrepancies, and has limited public transportation options. The Transformative Climate Communities (TCC) project aims to solve these issues with a suite of coordinated projects, which include affordable housing, low-carbon transportation options for residents, and planting more than 3,300 trees, to name a few. Additional strategies include weatherisation of 250 homes, safe and accessible walkways and bikeways that connect housing, amenities, and transit in the project area, and retrofitting of commercial businesses. The main climate change risks for Watts stem from exposure to additional extreme heat days.

Additional concerns include lowered water quality due to runoff that impacts watersheds. The TCC project will develop new green space and sustainable infrastructure in Watts, which will increase the number of children able to walk or bike to school and increase utilisation of parks and open green spaces. These efforts are expected to lower the number of severe injuries and fatalities from traffic collisions. Additionally, the project intends to reduce violent crime rates and increase neighbourhood perceptions of safety, which will lead to improved quality of life for the citizens of Watts.

Los Angeles 

LOS ANGELES

↓ 69K

TONNES OF CO₂ emissions expected to be reduced via the components of Watts Rising TCC project

What can other cities learn?

Introduce low-carbon transport options to solve multiple issues:

The TCC project includes fully electrifying the Watts DASH bus line with 10 battery-electric buses and creating a program that includes seven EV passenger vanpool vans and eight car-sharing EVs. While this decreases major sources of local air pollution, it also decreases congestion, which in turn will reduce economic losses and improve the quality of life for commuting citizens. Furthermore, the electrification will improve air quality and lower CO₂ emissions from the transportation sector.

Include grass roots organisations for maximum effectiveness:

The TCC project is based on years of successful stakeholder engagement and inclusion of local actors and the community. The project builds upon a decade of community planning, including 200+ community engagement activities, and outreach to 5,000+ individuals. The project also includes a wide array of NGOs and nonprofits, including Restore Neighborhoods Los Angeles, Grant Housing and Economic Development Corporation, From Lot to Spot, TreePeople, Los Angeles Cleantech Incubator, and many more. By making sure all voices in the communities are heard, the city can be sure it is tackling the appropriate – and most urgent – issues and challenges in the city.

What are the co-benefits?

Social:

By building 285 units of LEED-certified affordable housing units, while preserving and lowering operating costs of existing affordable and low-income housing opportunities for current Watts residents, the project prevents displacement and lessens economic stressors.

Health:

As a part of the TCC project, annual community surveys will track the project's goals of increasing residents' daily physical activity, healthy eating habits, and improved perceptions of individual and community health in Watts.

Economic:

The city is planning to create 340 temporary jobs and 170 new permanent jobs in the community. The Housing Authority of the City of Los Angeles and their development partners will continue to work on the Local Hire program, which requires that 30% of all construction and post-construction jobs are prioritised for Watts residents.

Environmental:

The city aims to strategically plant more than 3,300 trees, increasing canopy coverage by 50%, thus reducing the urban heat island effect and increasing energy efficiency via their insulating properties. More than eight acres of new parks and urban farming will allow for greater stormwater retention and the recharging of groundwater aquifers.

The Watts Rising TCC project is based on years of successful stakeholder engagement and inclusion of local actors and the community. The project builds upon a decade of community planning, including 200+ community engagement activities, and outreach to 5,000+ individuals.



MILAN:

Italy's first zero-carbon social housing project

→ A new social housing project in Milan is shooting for the stars: Aiming to be zero-carbon in 30 years' time. L'INNESTO is the recent project showcasing the city's ambitious sustainability strategies.

The buildings will use energy, heating, and cooling from renewable sources, 100% reused water, and be built with green roofs. The surrounding area aims for 60% green spaces and is accompanied by a green mobility strategy that has just one parking spot for every seven residents, as well as extensive goals to keep the air clean. Milan is showcasing what the blueprint for sustainable housing districts looks like.



What has the city achieved?

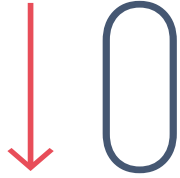
In recent years, Milan has significantly increased its ambitions and goals to become a more resilient city. One of its latest projects is L'INNESTO: the first zero-carbon social housing project in Italy. The project is a showroom for Milan's new sustainability strategies. One of these strategies is the development of an innovative, fourth-generation district heating system powered by renewable sources, which includes an urban wastewater heat-recovery system. This district heating system will enable the social housing project to be carbon neutral in 30 years.

an optimal bio-based material mix, allowing structures to be disassembled and 100% recycled at the end of their life. The aim is a long-term, responsible, resilient management of resources, spaces, and the community. Plans for the new district include building 400 units totalling 21,000 m², a residence for 300 students, 3,000 m² for commercial activity, and 45,000 m² of green areas including vegetable gardens, a nursery garden, green roofs, and edible landscapes.

The main plan for the district is the design of nearly zero-energy buildings combined with pre-assembled construction technology with

Milan 

MILAN



CO₂ EMISSIONS in 30 years' time

What can other cities learn?

Design a social housing district with climate change in mind:

The new social housing district is designed to mitigate the shock and stress caused by the impact of extreme weather events such as heatwaves and intense rainfall. The project will include sustainable water resource management for the entire water cycle: onsite reuse of rainwater for irrigation and interception of rainwater from extreme events thanks to green roofs and stormwater tanks. Green spaces and new spaces for biodiversity and urban reforestation will mitigate biodiversity loss and sequester carbon.

Values people over cars when designing new mobility strategies:

The project has an ambitious mobility strategy: limiting car parking spaces (only 100 spaces for 700 tenants) and including a 1,200 m² bike garage, 10 electric car charging terminals, and a shared neighbourhood car fleet. This comprehensive sustainable mobility approach will provide residents with solutions for all their mobility needs, promoting active mobility, public transport, sharing systems, and a drastic reduction of private parking areas. Overall, the project proposes an innovative system of active mobility together with an open central pedestrianised area and a sustainable mobility hub.

What are the co-benefits?

Social:

Despite the new housing district's innovative elements, L'INNESTO offers affordable housing, which reduces the demand for social housing in the city, and ensures that sustainable, quality living is open to all Milanese.

Health:

Green areas will cover 72% of the site, offering fresh air and mitigating heatwaves. Air quality will also be improved thanks to a 66% reduction of motorised travel in the area.

Economic:

Beyond reaching zero carbon, L'INNESTO is proposing the creation of a Circular Economy District. The district will focus on creating value-added shared spaces for sustainable economic activity as well as enabling relationships to be established between residents.

Environmental:

100% of the energy used for air conditioning in the summer, heating in the winter, as well as 100% of the electricity from shared use in the neighbourhood will come from onsite renewable resources, which will help the district achieve zero-carbon emissions and ensure a resilient, adapted neighbourhood.

The project has a 60% green space target. Greening the neighbourhood is supported by tree cultivation, horticulture activities, and local agriculture, to name just a few.



NEW ORLEANS:

Combining equity with climate action for a resilient, inclusive city

→ In response to the threat of climate change, New Orleans launched the Climate Action for a Resilient New Orleans in 2017.


Mindful of the fact that **challenges of climate change are heightened by social inequity**, the city introduced the Climate Action Equity Project (CAEP). The goal of CAEP is to engage residents of colour, low-income residents, and immigrant communities in **making equity a priority** in the implementation of New Orleans' climate action strategy.



What has the city achieved?

New Orleans has dealt with the brunt of climate change for years and has managed to recover from major urban emergencies, such as those brought by Hurricanes Katrina and Isaac. The CAEP was set in motion to ensure that New Orleans continuously considers the city's most exposed communities. With an advisory board at the heart of the project, New Orleans takes its responsibility to safeguard and include all strata of the city seriously. The advisory board is in charge of offering detailed recommendations on how to implement the climate action strategy in the most equitable manner possible. The advisory board includes six community leaders and four individuals with advocacy experience and expertise in the areas of the city's climate action plan. The community leaders were recommended

by community-based organisations serving residents of colour, low-income residents, and/or immigrant communities in each of the city's council districts. Through a range of public meetings, a venue was created for residents to learn about the recommendations made by the advisory board. The meetings enabled residents to express ideas about how to achieve equity in the plan, offered a safe space for conversations about potential barriers and feasibility of the recommendations, and supported residents in building an equity platform and gave them a voice on the city's climate change policies.

New Orleans 

NEW ORLEANS

↓ 50%

REDUCTION OF GHG EMISSIONS by 2030 pledged in Climate Action for a Resilient New Orleans

What can other cities learn?

Close the gap between residents and decision-makers:

CAEP aimed to develop a platform where community leaders and advocates can work with government decision-makers and implementers on climate and equity issues in line with the city's climate action strategy, giving agency and collecting input from traditionally marginalised groups. This not only helps New Orleanians understand how their daily life is impacted by climate change, and what actions they can take to mitigate their family's risk, it also enables the local government to more fully consider vulnerable communities in their climate action planning.

Set clear goals to ensure equity:

To make sure that no community was overlooked in the implementation of the Climate Action for a Resilient New Orleans, the city set itself goals to keep on track and to ensure equity. The goals include making sure that climate mitigation solutions such as community solar are benefitting vulnerable communities directly, to see to it that energy and transit solutions add to the economic security of vulnerable communities – such as lower electricity bills, transportation costs, and healthcare costs. This will increase their resilience in the face of climate change impacts.

What are the co-benefits?

Social:

The community meetings enabling residents to review the recommendations made by the CAEP advisory board offered free childcare, free food, and free parking to encourage high attendance by New Orleanians.

Health:

Part of the city's climate action strategy is to modernise energy use, improve transportation infrastructure, and reduce waste. Combined, these efforts will reduce concentrations of air pollutants and limit the spread of allergens, which exacerbate respiratory and allergy problems.

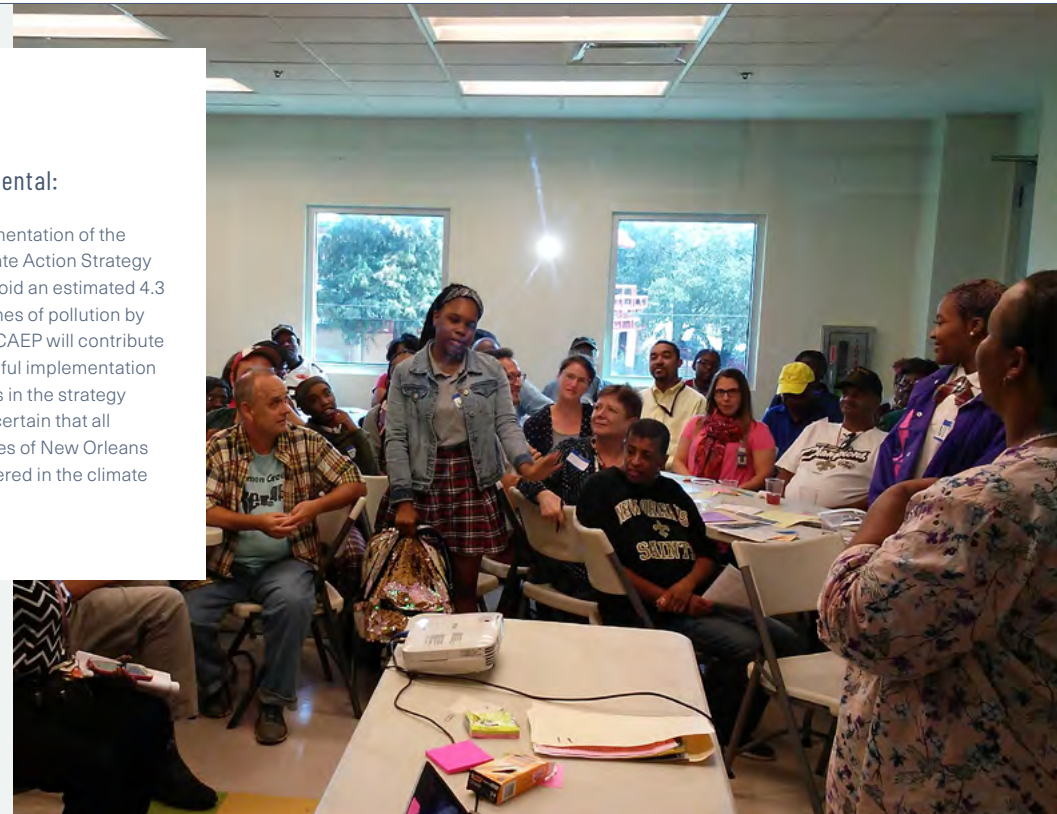
Economic:

New Orleans ranks second in the nation for highest energy cost burden on low-income households at 18.9%: more than five times higher than the national average cost burden of 3.5%. CAEP seeks to support small business opportunities in climate action that also supports economic growth and resilience and improve household energy affordability.

Environmental:

The implementation of the city's Climate Action Strategy will help avoid an estimated 4.3 million tonnes of pollution by 2030. The CAEP will contribute to meaningful implementation of the plans in the strategy and make certain that all communities of New Orleans are considered in the climate actions.

The goal of the Climate Action Equity Project is to engage residents of colour, low-income residents, and immigrant communities in making equity a priority in the implementation of New Orleans' climate action strategy.



NEW YORK CITY:

New strategy to secure a fair and safe city for all New Yorkers

→ New York is looking 30 years into the future and setting ambitious goals for how it wants the city to look in 2050.

The strategy OneNYC 2050 is a blueprint for inclusive climate action. Whilst setting the city on a path to **carbon neutrality and 100% clean electricity**, it ensures that every New Yorker is guaranteed an equitable future with healthcare, affordable housing, and access to excellent education. With 30 initiatives included in the strategy, New York City is **confronting the climate crisis by building a strong and fair city for all**.



What has the city achieved?

In developing OneNYC 2050, New York City launched a digital listening campaign, met with New Yorkers in their communities, and held pop-up events and community meetings. More than 16,000 voices were heard and their input shaped the strategy. Released in April 2019, the OneNYC 2050 strategy has eight goals that seek to set New York City on a path to achieve equity by creating good-paying jobs through climate action, expanding voting rights, and provide banking access to underbanked New Yorkers, to name just a few.

providing economic security via fair wages and benefits, increasing integration, diversity, and inclusion in New York City schools, designing a physical environment that creates the conditions for health and well-being. Although the OneNYC 2050 plan has only recently been released, results from the 2015 strategy include affordable housing for 275,000 New Yorkers, decreasing pedestrian fatalities by 45%, and creating more than 700,000 jobs, proving New York City has both the ambition and the will to create a prosperous city.

With 30 initiatives across the eight goals outlined in the strategy, New York shows that the future of the city is one of equity, inclusivity, and resilience. Some of the initiatives include

New York City 

NEW YORK CITY

↓ 100%

REDUCTION IN NET GREENHOUSE GAS EMISSIONS
by 2050

What can other cities learn?

Listen to citizens to discover unexpected issues:

Before developing OneNYC 2050, the city included thousands of New Yorkers from all communities to ensure all voices were heard. By listening to New Yorkers, the city ensured that all issues were taken into account, even those that might have been invisible to city officials and planners.

Make the strategy value-based:

New York City has based the OneNYC 2050 strategy on five values that inform all its goals and initiatives. By making “equity” and “diversity and inclusion” two of the five values, the city is ensuring that the future of New York City will not be one of inequality and exclusion.

What are the co-benefits?

Social:

New York plans to reclaim streets to meet the needs of the public. The city will create People Priority Zones, which restrict vehicular access, create more public spaces, and improve safety and air quality. The first zone will be in Lower Manhattan.

Health:

One of the 30 initiatives in the strategy is guaranteeing healthcare by creating the most comprehensive universal coverage in the country for uninsured New Yorkers, regardless of ability to pay or immigration status.

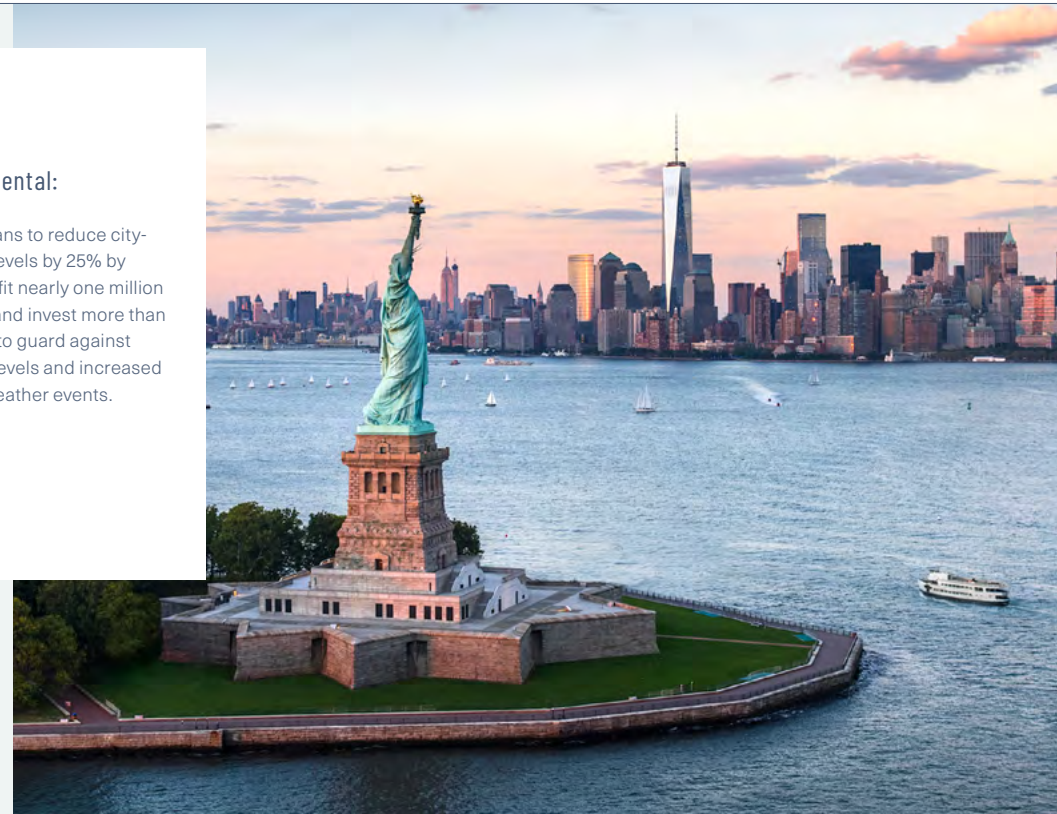
Economic:

The transformation to a liveable climate will create thousands of new jobs for New Yorkers. The mandatory building retrofit programme alone is expected to create 27,000 jobs in the city. In addition, New York City will divest city pension funds from fossil fuels and invest in climate solutions.

Environmental:

The city plans to reduce city-wide NO₂ levels by 25% by 2030, retrofit nearly one million buildings, and invest more than \$20 billion to guard against rising sea levels and increased extreme weather events.

The OneNYC 2050 strategy is underpinned by five values that inform all its goals and initiatives, with “equity” and “diversity and inclusion” as two key components of the city’s strategy.



QUEZON CITY:

Resilient communities to replace vulnerable, informal settlements



→ The most populous city in the Philippines, Quezon City, has transformed the lives of thousands of families living in vulnerable communities in the city.

As the city **grapples with homelessness and informal settlements** in high-risk areas, such as roadways, waterways, and in water pipelines, Quezon City's socialised housing programme was developed to **provide superior quality of life to residents** via affordable and secured human settlements. The informal settler families are assured well-built shelter in safe locations, mostly in the city, aiming to avoid dislocation from workplaces and current income-earning opportunities.

What has the city achieved?

About 4.5 million people are homeless or living in informal settlements in the Philippines, approximately three million of whom are in Metro Manila. Many people live in spaces that not only pose risks to their health but also to their safety with the added risk of eviction. Quezon City's socialised housing programme has enabled thousands of informal settler families who used to live in slum dwellings to now help build, own, and reside in decent and safe houses they can call home. The current programme finalised 37 communities and aims to complete 44 by the end of 2019. In earlier attempts to resettle families, financing has been an issue that was tough to solve for the local government. For Quezon City's socialised housing programme, the informal settler families were given three different options,

depending on their income status and capacity to pay. The financing options were facilitated and funded by the local city government. Strong policies, such as the 'Socialized Housing Tax Ordinance' and the landmark 'Comprehensive Socialized Housing Code', also backed the programme. This led to the successful relocation of 5,698 families that now reside in communities that adhere to the Green Building Codes, which established standards for safe, sustainable, and resilient structures, making sure the families can rest easy in their new homes.

Quezon City 

QUEZON CITY

↑ 5,698

FAMILIES HAVE BEEN PROVIDED SAFE AND PERMANENT SHELTERS between 2013 and 2019

What can other cities learn?

Innovative governance structure to help solve homelessness:

Through a process of several years, the socialised housing programme introduced innovative multi-sectoral and multi-stakeholder governance structures as well as innovative housing financing schemes to make the rehousing of thousands of families successful. The project included collaboration between the local government and the private sector, as well as private developers, non-government organisations, and local and international organisations in building capacity and empowering communities.

Providing safe and sustainable housing is possible:

Despite the need to build thousands of homes quickly, the programme has also ensured the new homes were safe, decent, and sustainable. As well as adhering to the Green Building Codes, Quezon City's socialised housing programme also complies with the requirements on indoor environmental quality which guarantees high-quality lighting, good indoor air quality, thermal comfort, and quality acoustics. The site development plan allocates 30% of the land as open space for parks and community facilities as well as promoting an urban gardening programme.

What are the co-benefits?

Social:

For the thousands of families now residing in Quezon City's socialised housing communities, they can feel safe and not worry about eviction or the demolition of their settlement. They are able to enjoy the economic advantages, mental, and emotional well-being that comes with owning homes that they can pass on to future generations.

Health:

The resettled families now live in areas with sanitation facilities, better air quality, and safer surroundings instead of living near waterways with the risk of flooding and disease or busy, trafficked roads.

Economic:

By increasing the proportion of the population with access to public transportation, schools, and workplaces, more people are able to receive a formal education, create better economic opportunities, and become part of the job market.

Environmental:

With many families moved away from the riverbanks and waterways, the city is able to mitigate urban flooding by restoring original river boundaries and clearing the waterways. This improves the resilience of the city and residents living in close proximity to the water.

In their new homes, the resettled families can enjoy quiet surroundings, safe spaces for their children to play, and a strong sense of community.



WASHINGTON:

Equity advisors help align climate plans with community needs



→ From January to June 2018, the Equity Advisory Group (EAG) – 13 residents representing the communities in the District – met monthly to develop recommendations that **provided guidance on taking equitable climate action** of interest to the local community.

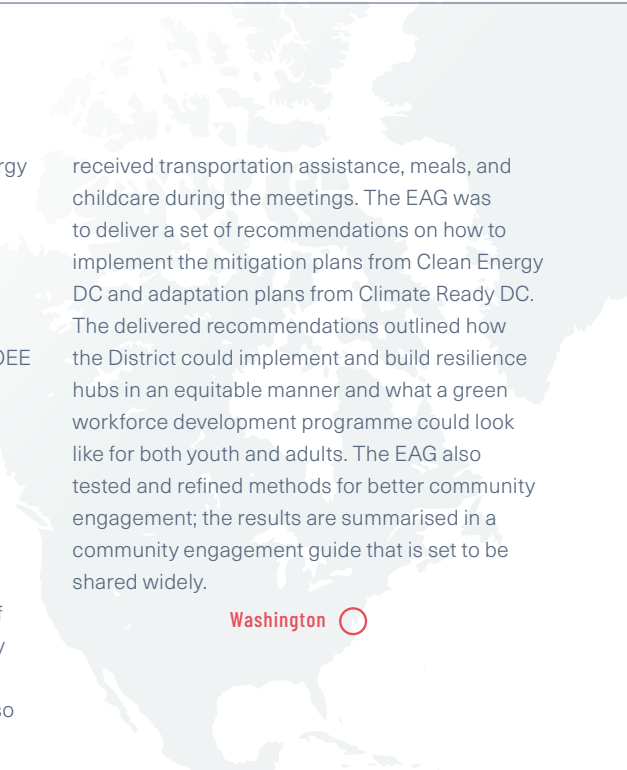
The core recommendations inform the District on how to implement the Clean Energy DC and Climate Ready DC plans while **aligning core community needs with climate resilience**.

What has the city achieved?

The District of Columbia's Department of Energy and Environment (DOEE) acknowledges that the impacts of climate change are not fairly disseminated and those bearing the largest burden are often already exposed to chronic stressors stemming from profound inequality and institutional racism. Consequently, the DOEE partnered with Georgetown Climate Center in undertaking a year-long project in which the focus was to support the residents of one of the most climate-vulnerable parts of the city. The support centered on how the residents can imagine a vision for a safe, resilient, and sustainable community. The project relied on an Equity Advisory Group (EAG) comprising of 13 residents, all chosen to be demographically representative of the community. Each EAG member received a stipend and, if needed, also

received transportation assistance, meals, and childcare during the meetings. The EAG was to deliver a set of recommendations on how to implement the mitigation plans from Clean Energy DC and adaptation plans from Climate Ready DC. The delivered recommendations outlined how the District could implement and build resilience hubs in an equitable manner and what a green workforce development programme could look like for both youth and adults. The EAG also tested and refined methods for better community engagement; the results are summarised in a community engagement guide that is set to be shared widely.

Washington 



WASHINGTON

↑ 13

COMMUNITY MEMBERS met monthly to help the District engage in equitable climate action

What can other cities learn?

Make citizen engagement community-centered:

In addition to providing valuable insights into the implementation of the District's climate and energy plans, the work of the EAG also informed a new model of community-centred citizen engagement. This model is being shared to help other cities engage with their citizens in a meaningful way. Takeaways from the model include realising that a community committee may reflect a democratic profile without speaking for the entire community and that dedicated funding towards community engagement can open doors for more equitable engagement.

Uncomfortable conversations necessary for equitable climate action:

The project sought to create an environment where residents could collaboratively work together. The project did not shy away from uncomfortable conversations about race and inequality, and specifically tried to make sure residents of colour were leading the conversation. Other innovative elements of the EAG include the support provided to enable diverse community participation, a neutral community facilitator, an evaluator who observed the process and provided key insights, and equity and diversity training provided to District agency staff to help embed considerations of diversity, equity, and inclusion in their work.

What are the co-benefits?

Social:

The EAG will have lasting social benefits, as it encouraged a shift in power to the community to be agents of change. As committee members become more knowledgeable and empowered to become champions of their own recommendations, they will engage with other residents to promote lasting neighbourhood resilience and success.

Health:

One of the key recommendations of the EAG is establishing community resilience hubs. These resilience hubs would help protect residents from physical hazards such as flooding, storms, and extreme heat as well as offer resources during a disaster such as power and essential provisions including medical services.

Economic:

The EAG recommended expanding workforce development programmes that lead to employment for the youth, especially those who may not pursue college. The programmes can provide a path to education in trades such as plumbing, as well as developing high school curricula to help youth prepare for green certifications after graduation.

Environmental:

Environmental causes often take a back seat to more pressing and immediate concerns like affordability, safety, and economic development. The EAG helped the District think about how it can focus on actions that provide important co-benefits while benefiting the environment, too.

One of the key lessons from the community-centred citizen engagement guide was acknowledging that co-designed recommendations are not compromises, but rather stronger recommendations informed by the expertise of community and grounded in the realities of government.



2019

Cities100

AIR QUALITY

→ Mayors around the world are increasing efforts to tackle air pollution, which causes 4.2 million premature deaths every year globally. By introducing emissions standards in city centres, car-free days, efficient public transportation, and initiatives to reduce idling, cities are improving air quality for the benefit of their citizens' health.



STOCKHOLM:

Air quality salvation through electrification



→ When vessels dock in Stockholm's Värtan port, a new \$4.7 million Onshore Power Supply **provides ships with renewable electricity**, meaning they no longer need to run their auxiliary engines in port.

As a result, air quality has improved significantly, with a 57 tonne annual reduction in NO_x emissions, as well as reductions in NO₂ and particulate matter. In addition, **CO₂ emissions from ships in port has been cut by 93%**, while Stockholm benefits from the sale of renewable power.

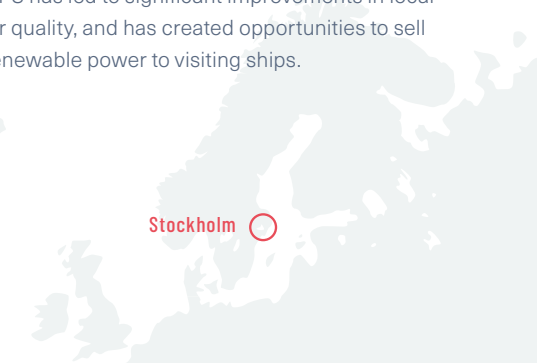
What has the city achieved?

Despite significant international policy efforts to limit air pollution from shipping, the sector still presents a serious threat to air quality, especially in port cities. When vessels are docked in port, they typically need to keep auxiliary engines running to power the ships' systems. This leads to NO_x, SO₂, and PM emissions, which poses a significant health risk because of the proximity to cities. In Sweden alone, an estimated 120 to 272 premature deaths occurred due to PM pollution from shipping.

a high-voltage connection, which is far more efficient and leads to much better results. The municipality-owned company, Ports of Stockholm, which runs the port, funded the installation of the \$4.7 million OPS with the help of an EU grant, and aims for all port operations to be fossil fuel-free by 2025, with a wider city target date of 2040. The OPS has led to significant improvements in local air quality, and has created opportunities to sell renewable power to visiting ships.

One way to enable ships to turn off their engines while in port is to connect them to an Onshore Power Supply (OPS), as is being done in the Port of Värtan in Stockholm. While the technology isn't new, this is one of the first applications of

Stockholm 



STOCKHOLM

↓ 93%

REDUCTION IN CO₂ EMISSIONS from ships when moored at the Port of Värtan

What can other cities learn?

Partner up to power up:

The Ports of Stockholm have collaborated not only with shipping companies, but also with ports in Helsinki and Tallinn to enable a wider impact for shipping in the Baltic region. On top of that, via a partnership with the Baltic Ports Organisation, Stockholm shares its experience of implementing an OPS.

Plan for the future:

While many ships still lack the infrastructure to be able to connect to a high-voltage OPS, the Ports of Stockholm's action plan lays out a pathway for more ships to connect in the future, scaling up the impact of the project.

What are the co-benefits?

Social:

With a reduction in noise and air pollution, the port has been transformed into a much more pleasant work environment for employees.

Health:

With ships at the Port of Värtan plugging into Onshore Power Supply and shutting off their engines, emissions of NO_x, SO₂, and PM are reduced by 57, 5.3, and 2.5 tonnes, respectively, reducing the risk of respiratory illness for workers and residents around the port.

Economic:

While ships are docked and connected to the onshore power supply, they can purchase low-cost, low-carbon electricity from the port. This not only provides a new revenue stream for the port, but reduces fuel costs for ships.

Environmental:

By enabling docked vessels to shut down their auxiliary engines and instead use renewable power from the local grid, not only is noise and air pollution reduced, but also 8,500 tonnes of CO₂ emissions each year.

The new high-voltage Onshore Power Supply at Stockholm's Värtan port enables ships to power down their engines in port and avoid burning fossil fuels while docked in Stockholm, leading to vast reductions in emissions of local air pollutants and CO₂.



NEW YORK CITY:

New Yorkers enlisted to stop vehicles from idling

→ Every day, **thousands of commercial vehicles of all sizes are kept running** despite not being in motion. While tackling idling vehicles is notoriously difficult, the effects are tangible as the majority of delivery trucks and buses run on petroleum diesel and emit CO₂ as well as large amounts of NO_x and PM_{2.5}.

The New York City Council decided to combat this issue by recruiting the citizens of New York, who now **receive at least 25% of the fine** when they file idling complaints for commercial vehicles.



What has the city achieved?

Restricting curbside idling is not a new phenomenon in New York City; it has been prohibited since 1972. However, as enforcing idling laws is notably intractable, the City Department of Environmental Protection (DEP) has worked with community representatives and the City Council to craft the Citizen Idling Complaint bill, which was passed in 2017. The bill enables citizens who file idling complaints about commercial vehicles to collect at least 25% of any subsequent fines related to the complaint. The city fines commercial drivers for leaving their engines on whilst being parked by a curb for more than three minutes or just one minute in a school zone.

The DEP developed a new web-based filing system that allows citizens to track their complaints in an efficient and user-friendly manner. The Citizen Idling Complaint Program helps New York City meet both health and greenhouse gas emissions reductions goals by reducing both CO₂ and local air pollutants, such as NO_x and PM_{2.5}, by reducing this widespread idling. The programme is innovative as it empowers and provides an incentive for citizens to genuinely help enforce environmental policies.

New York City 

NEW YORK CITY

↑ 1K+

COMMERCIAL VEHICLES IDLE in New York every day emitting pollutants and CO₂ to the detriment of the environment and New Yorkers

What can other cities learn?

Empower citizens to take climate action:

The Citizen Idling Complaint Program is innovative because it provides citizens with the ability and an incentive to help reduce vehicle idling across the city. This kind of citizen enforcement is a first-of-its-kind approach and has garnered interest for application in other policy and regulatory spaces as well as interest from other municipalities.

Work with citizens to craft legislation:

Citizens advocated for the Citizen Idling Complaint Program with the DEP and City Council members. The DEP engaged citizen advocates and City Council members to draw up legislation that would enable the growth of the Citizen Idling Complaint Program and be implementable under current city frameworks.

What are the co-benefits?

Social:

Including citizen advocates in the project allows the city's residents to have a say in how the city deals with environmental issues.

Health:

The overall goal of the project is to achieve air quality improvement by reducing particulate matter, nitrogen oxides, sulfur dioxide, and air toxins as they all cause significant harm to New Yorkers' health.

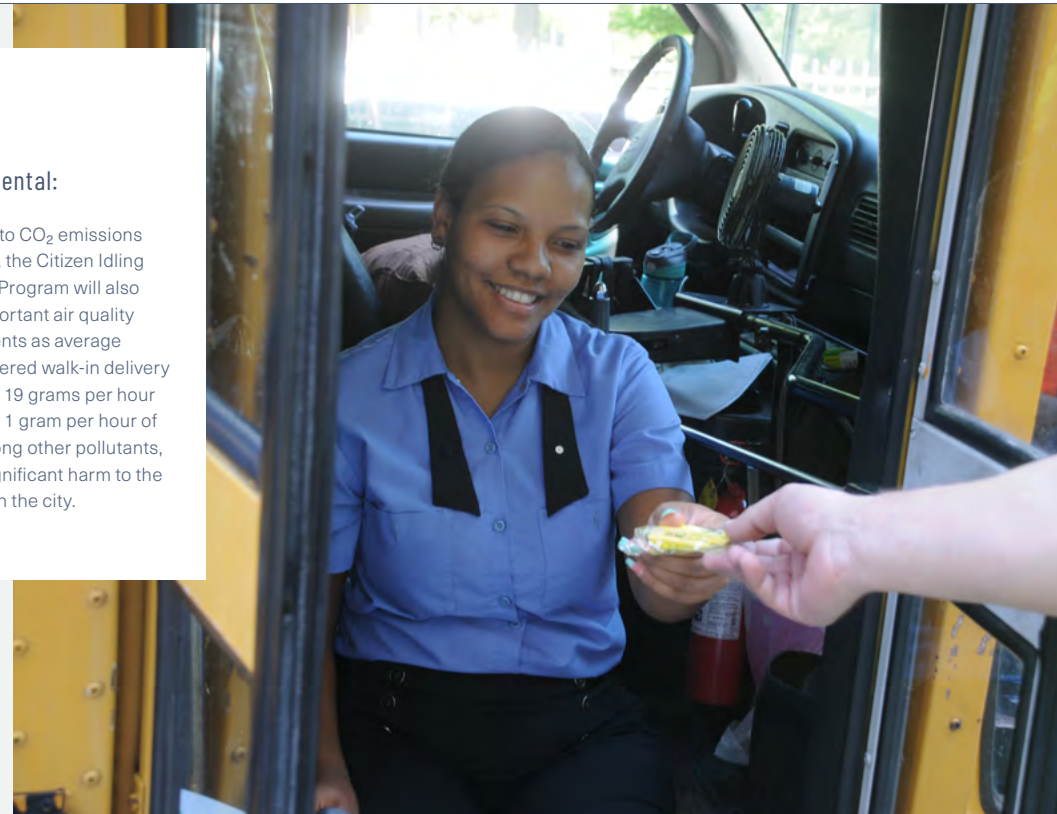
Economic:

Funding for the anti-idling programme is provided by a tax. This includes staff time enabling the necessary legislation, developing the online filing system for the complaints, and reviewing the citizens' complaints. The city expects to see a return of investment in the fees collected for vehicle idling complaints.

Environmental:

In addition to CO₂ emissions reductions, the Citizen Idling Complaint Program will also lead to important air quality improvements as average diesel-powered walk-in delivery trucks emit 19 grams per hour of NO_x and 1 gram per hour of PM_{2.5} among other pollutants, causing significant harm to the air quality in the city.

Buses parked in school areas are especially likely to be fined for idling as they are only allowed to keep the engine running for one minute in school zones. The DEP has therefore taken strides to educate the city's bus drivers on the idling laws.



MILAN:

Low-emission zone helps drive towards fossil-free streets

→ Milan's new Low Emission Zone, Area B, came into force in February this year, banning the most-polluting vehicles from **an area covering 75% of the city.**

The standard that vehicles must meet will progressively increase to 2030, by which time **all diesel vehicles will be banned.** Milan has some of the poorest air quality in Europe, but Area B will have a significant impact, cutting both PM10 and NOx pollution in half by 2022 and 2026, respectively.



What has the city achieved?

Despite improvements in recent years, air quality in Milan remains a serious problem, and by the end of February this year, the city had already exceeded the EU annual legal limit. The largest city in northern Italy suffers from notoriously bad traffic congestion, with car ownership at 51 cars for every 100 inhabitants, much higher than other major European cities. But Milan has now introduced a new Low Emission Zone (LEZ) covering 75% of the city's territory.

The Area B LEZ was launched in February 2019, and bans the most polluting vehicles, as well as vehicles more than 12 metres long, from entering the city on weekdays between 07:30 and 19:30. The standards vehicles will have to meet will ratchet up over time to 2030, when diesel vehicles

will be totally banned from Milan's streets. By the time that ban is fully in place, all of the cities' buses will be electric.

For the time being, all vehicles will still be allowed to enter Area B when traffic is quieter during evenings and weekends, which ensures that businesses located inside the LEZ are not negatively impacted. Additionally, a \$7.7 million fund has been established to help small- and medium-sized enterprises purchase less-polluting vehicles.

Milan 



MILAN



YEARS IS THE EXPECTED TIME

it will take to halve PM10 pollution
in Milan, thanks to Area B

What can other cities learn?

Build complementary policies:

While Area B is primarily a command-and-control policy, Milan has also introduced some incentive and subsidy policies, such as a \$7.7 million fund to assist small- and medium-sized enterprises with the purchase of low-carbon vehicles. This approach enables city governments to set stricter regulations, while offering financial support to those least able to comply.

Ratchet up ambition over time:

The standard that cars must meet to enter Area B will become progressively stricter between now and 2030, when Milan will have a total ban on diesel cars. The timeline for this plan has been published well in advance to allow businesses and residents to plan accordingly.

What are the co-benefits?

Social:

Under Area B's plans to reduce the number of cars in the city centre, space lost to the automobile can be reclaimed for public use, and residents can enjoy a more pleasant and liveable city.

Health:

Studies suggest that life expectancy amongst Milan's residents is shortened by an average of 2 to 3 years due to toxic urban air pollution. With Area B expected to result in a halving of PM10 pollution in the coming four years, health risks in the city will be minimised.

Economic:

An average Milan driver spends 226 hours each year stuck in traffic, making Milan's traffic congestion a significant economic cost in terms of lost time and productivity amongst the workforce. A reduction in congestion in Area B will bring down these costs.

Environmental:

Area B is a part of Milan's efforts to cut CO₂ emissions by 40% by 2030, and become carbon neutral by 2050. Between 2019 and 2026, the goals of the policy are to cut NO_x and PM10 pollution by 1,500 and 25 tonnes, respectively, as well as addressing noise pollution in the city.

Milan's Area B LEZ is the cornerstone of the city's efforts to cut air pollution from vehicles in the city. Additionally, the policy will reduce congestion and noise pollution in Milan, improving the quality of life for residents.



LONDON:

World's strictest standards for vehicles in inner city slash air pollution



→ A first in the world, London introduced the Ultra Low Emission Zone (ULEZ) in April 2019, requiring that vehicles must meet Euro emissions standards to drive in the central London area, **24 hours a day, all year round – or pay a charge.**

The ULEZ is the cornerstone of the city's plan to thoroughly clean up the toxic air for **the health of more than two million Londoners** living in areas where NO₂ levels exceed legal limits.

What has the city achieved?

The ULEZ will remain a permanent fixture of London's transport network, but will be rolled out in phases with central London ULEZ being the first. The zone will be expanded to cover a larger area of London, meaning a total of 3.8 million people will be covered by the ULEZ by October 2021.

The Mayor of London, Sadiq Khan, has also ensured that all London buses driving in the zone must meet or exceed the ULEZ standards and that all new taxis must be zero-emission capable. The amount of vehicles travelling into the zone that meet the ULEZ standards has increased by 80% between February 2017 – when the Mayor made a major policy announcement about the

ULEZ – and April 2019 when the scheme had been in place for one month. The measure is designed to encourage a shift towards more sustainable modes of transport, such as walking, cycling, or using public transit. Around 10% of those impacted by the ULEZ have said they have changed their travel behaviour (i.e. switched to walking, cycling, or public transport) as a result of the scheme. There has been around a 20% reduction in NO₂ emissions in the central zone over this same period.

London 

LONDON

↓ 15%

CO₂ EMISSIONS reductions expected from the ULEZ in the central London area

What can other cities learn?

Tackle the biggest issues head first:

Traffic emissions are the biggest source of toxic air in London. To protect London's children from lung damage, to reduce the risk of breathing illnesses and heart diseases in adults, and to improve the health of those exposed to the highest levels of pollution, there was no other way around it – London had to look to its traffic. By forcing vans, lorries, coaches, buses, cars, and motorbikes to meet the strict emission standards or pay the daily ULEZ fee – which the city then invests in the low-emission transport system – the city is able to tackle its largest source of air pollution.

All vehicles, all the time, (almost) no exceptions:

The ULEZ applies the strictest available standards for diesel vehicles (and similar standards for petrol vehicles), and is unique in operating 24/7, all year round, with very limited exemptions. It also captures a greater number of vehicles than any similar road-charging scheme anywhere in the world. As part of the ULEZ, the entire London bus fleet will meet or exceed the Euro 6 standard, which will be achieved via a combination of retrofitted and new buses. London's bus retrofit programme was the first to address both PM and NO_x emissions and is the largest in the world with nearly 5,000 buses retrofitted. To address taxi emissions, all new taxis licensed since 2018 have been required to be zero-emission capable.

What are the co-benefits?

Social:

The most vulnerable Londoners are exposed to about a quarter more air pollution and yet are the least likely to own a car. It is expected that the ULEZ, along with the Mayor's other air quality policies, will shrink the gap in air pollution levels between London's most and least deprived areas by around 70% by 2030.

Health:

Bringing forward the start date of the central London ULEZ means that more than 30,000 people in central London and 100,000 people across London will no longer live in areas exceeding NO₂ limits in 2019. As of the end of 2019, the air surrounding 19 schools in central London and 42 schools across London will be below the UK's national legal limit.

Economic:

The ULEZ has led to more than 2,000 buses being retrofitted, creating new supply chains. This technology is being adopted by a national certification scheme and is being rolled out elsewhere in the UK. New licensing requirements for London taxis has led to industrial opportunities, creating more than 300 jobs and securing foreign direct investment of \$380 million.

Environmental:

The ULEZ has already led to a 20% reduction in NO₂ concentrations measured at roadside monitoring sites. With its transport and air pollution strategies, London is supporting a shift from private vehicles towards more sustainable modes of transport. These efforts will support London's ambition to become a zero-carbon city by 2050.

With the ULEZ, London is expecting a 45% reduction in road transport NO_x emissions and a similar reduction in PM₁₀ exhaust emissions in central London. By 2025, when the ULEZ expands to cover a larger area, the number of schools in areas exceeding legal limits for air pollution are expected to drop from more than 450 today to zero.



DELHI:

Shifting to green power and saving lives



→ With some of the poorest air quality of any city in the world, Delhi has adopted **a holistic plan to clean up the air citizens breathe.**

By closing down the dirtiest power stations, subsidising the development and procurement of renewable energy, and boosting the uptake of EVs, the city is not only improving public health, but also working towards other Sustainable Development Goals by **increasing access to energy and abating carbon emissions.**

What has the city achieved?

Thanks to a reliance on coal power and gas-guzzling transport methods, India's capital, Delhi, ranks as one of the world's most polluted cities. However, under a holistic package of policies, known as Bijli Swaraj, the city is shifting towards renewable resources, and providing energy access and clean air in the process.

As 41% of PM2.5 pollution in Delhi comes from vehicles, one aspect of Bijli Swaraj is the introduction of 1,000 electric buses in the city and subsidies for rickshaw drivers to upgrade to electric models, reducing tailpipe emissions. However, it is equally important to ensure that the power supplied in the city is not contributing to poor air quality, and so the city has taken steps to shutter its dirtiest coal-fired power station,

Badarapur. This is a major step, as that one power station contributed 26% of Delhi's PM2.5 pollution.

To replace this power supply, Delhi is encouraging the uptake and procurement of renewable energy, as part of a goal to supply 20% of the city's electricity from renewables by 2020. Rooftop solar PV in particular is being targeted, with requirements for large municipal buildings to install the technology. There are incentive schemes for residential areas available, with financial assistance included.

Delhi ○

DELHI

↓ 26%

OF DELHI'S PM2.5 POLLUTION was emitted by Badarapur power station, which has now been closed

What can other cities learn?

Take a holistic approach:

With many residents of Delhi living in energy poverty, a holistic approach is needed to ensure energy access can be increased, while shifting to low-carbon power sources and improving air quality in the city.

Find the source and tackle it:

It is no secret that Delhi has an air quality problem, but to be able to effectively tackle the challenge, the city worked with academic bodies to accurately identify the biggest sources of pollution and target policies accordingly.

What are the co-benefits?

Social:

The rooftop solar programme increases access to clean energy and reduces the need for polluting backup diesel generators, which are common in Delhi. For certain low-income housing groups, assistance with capital costs has been provided under Bijli Swaraj.

Health:

The lungs of half of all children growing up in Delhi are irreversibly damaged as a result of the poor air quality, which causes the premature death of between 10,000 and 30,000 residents each year. The city's package of policies to clean up the air will go some way to reducing these numbers.

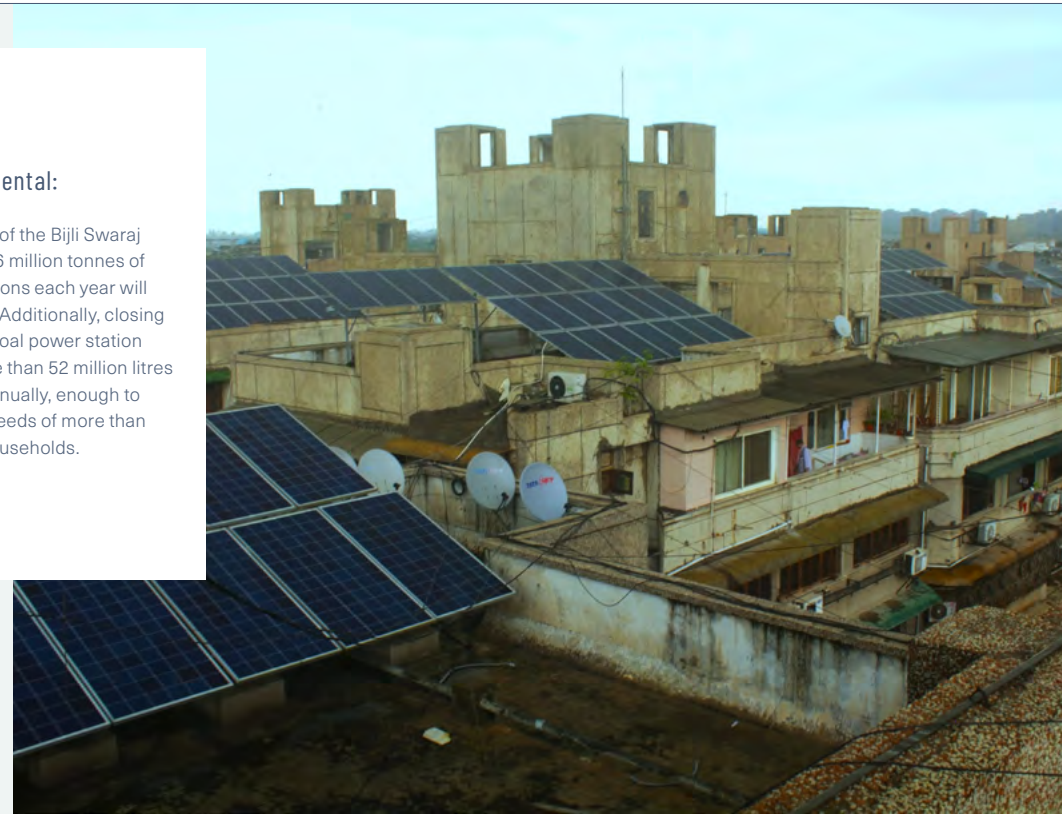
Economic:

The policies provide several economic incentives to make the low-carbon shift. For example, a subsidy of more than \$400 is available for individuals who wish to purchase an e-rickshaw, and participants in the solar rooftop scheme can purchase power six times cheaper than from the old coal power station.

Environmental:

As a result of the Bijli Swaraj policies, 1.6 million tonnes of CO₂ emissions each year will be abated. Additionally, closing down the coal power station saves more than 52 million litres of water annually, enough to meet the needs of more than 120,000 households.

Bijli Swaraj is Delhi's package of policies to transition to a greener energy and transport system, and clean up the city's polluted air, which caused between 10,000 and 30,000 premature deaths each year.



CHENGDU:

Prioritising pollution prevention with a five-point plan



→ Chengdu's five-year plan to reduce air pollution was introduced in 2013, and has **dramatically improved the city's air quality.**

The package of policies, aimed at reducing coal use and transport pollution, has meant that the occurrence of heavily polluted days has fallen by 38, with 96 more days classed as having good air quality. While air pollution in the city has had a negative impact on public health, the programme has led to **a 3.9 year increase in life expectancy** over the last five years.

What has the city achieved?

China's fourth-largest city, Chengdu, has experienced rapid growth since the turn of the century, with accompanying industrialisation and motorisation leading to a significant worsening of the urban air quality. As of 2013, transport-related air pollution in the city resulted in an annual economic loss of \$3 billion. In the same year, the city therefore released a five-year plan to tackle Chengdu's deteriorating air quality.

Now that five years has passed, it is possible to look back at the results of the project, which took a five-step approach that assessed the status quo; conducted scientific research; finally formulated and then implemented policies before assessing their effectiveness. While Chengdu's population grew by 12% over the 2013-17 period, the package

of policies implemented led to significant reductions in air pollution and GHG emissions. Notably, SO₂ and PM_{2.5} pollution fell by 54% and 35%, respectively.

Much of the improvement in Chengdu's air quality is due to a sharp drop in the city's reliance on coal in the power, heat, and industrial sectors. Additionally, the city has introduced policies under the five-year plan to shift towards cleaner forms of mobility, as well as control dust emissions from the expanding urban construction sector.

Chengdu ○

CHENGDU

↑ 3.9

YEAR INCREASE IN LIFE EXPECTANCY

in Chengdu over the last five-year period

What can other cities learn?

Prepare for the worst:

As part of the five-year plan, Chengdu developed an emergency action plan for particularly bad air pollution events. This involved identifying heavily polluting industries where emergency pollution reduction measures could be taken, and establishing a warning system to better inform residents in such events.

Trial and teach:

Chengdu has trialed a unique approach with the five-point plan that first identifies problem areas before conducting research, then designs and implements solutions, and finally monitors their effectiveness. This approach was then scaled out to the wider region and replicated in other cities thanks to knowledge sharing by the city government.

What are the co-benefits?

Social:

Prior to the implementation of this policy programme, air pollution in Chengdu was so severe it caused significant disruption to residents' daily lives. Now, emergency pollution events are dealt with in a way that minimises the impact on life in the city.

Health:

The policies implemented under the five-year plan have decreased the damage to public health caused by air pollution in Chengdu, with life expectancy increasing by 3.9 years between 2013 and 2017.

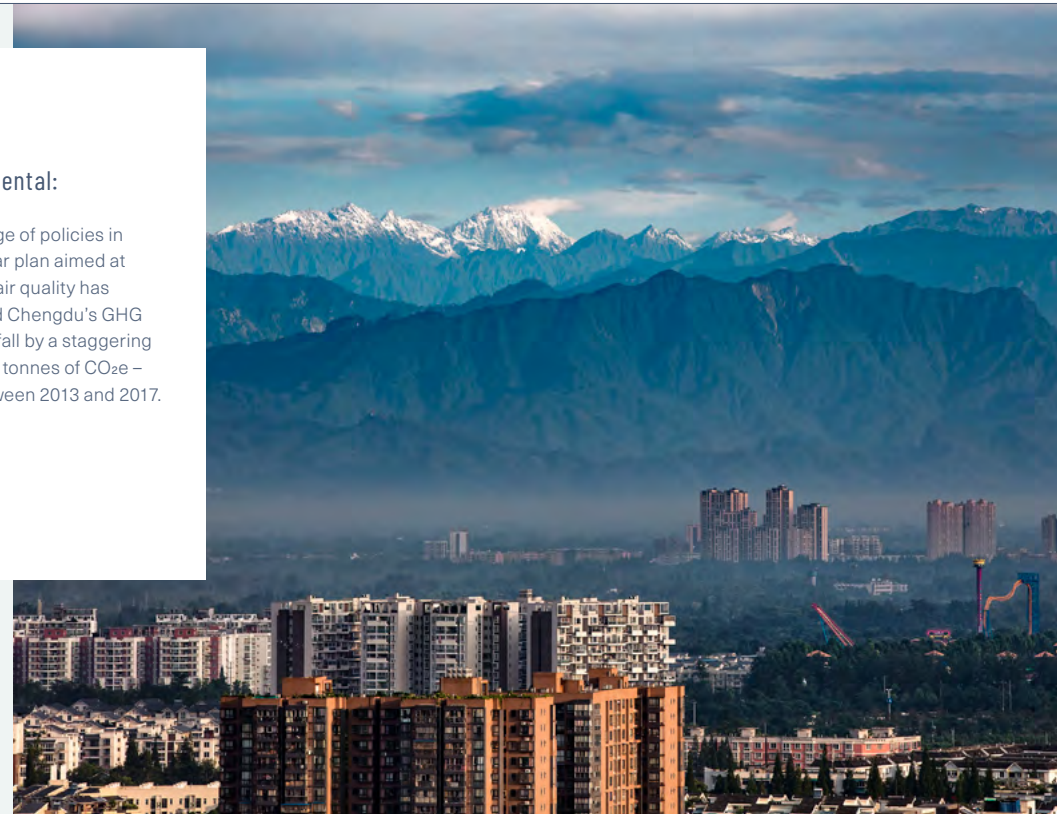
Economic:

Over the course of the five-year plan, Chengdu successfully decoupled economic growth from emissions and pollution, with GDP growing 8% each year between 2013 and 2017, while GHG emissions fell by 46%, and SO₂ and PM2.5 pollution fell by 54% and 35%, respectively.

Environmental:

The package of policies in the five-year plan aimed at improving air quality has also helped Chengdu's GHG emissions fall by a staggering 11.4 million tonnes of CO₂e – 46% – between 2013 and 2017.

Smog over Chengdu's skyline is an increasingly rare sight, thanks to the policy programme put in place under the five-year plan to reduce air pollution in the city.



BOLOGNA:

Participatory process pushes sustainable behaviour change

→ In an effort to better inform residents about air pollution, and **stimulate behaviour that can improve air quality** in the city, Bologna has partnered with institutions and communities to co-create the Laboratorio Aria initiative.

The cornerstone of this is the Che Aria É app, which **communicates air quality information to residents** and offers advice on how individuals can act to reduce air pollution in the city.

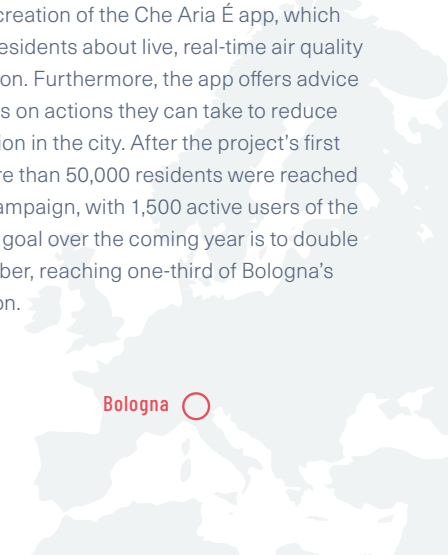


What has the city achieved?

Situated in one of Europe's most polluted regions, Bologna is feeling the impacts of air pollution, with an estimated 412 premature deaths and 1,150 hospitalisations in 2017 as a result of poor air quality. Despite this, only a small portion of the population understands the threat air pollution presents, and what can be done to combat it. Enter Laboratorio Aria, the city's new collaborative initiative to increase awareness, improve data utilisation, and encourage sustainable behaviour change. To achieve these aims, Laboratorio Aria has built a network of stakeholders to understand the needs and perceptions of air quality in the city in a co-creation process involving 2,000 residents.

A primary outcome of the process, apart from a citizen science project to gather air quality data, was the creation of the Che Aria É app, which notifies residents about live, real-time air quality information. Furthermore, the app offers advice to citizens on actions they can take to reduce air pollution in the city. After the project's first year, more than 50,000 residents were reached via the campaign, with 1,500 active users of the app. The goal over the coming year is to double that number, reaching one-third of Bologna's population.

Bologna 



BOLOGNA

↑ 2K

RESIDENTS WERE INVOLVED in the co-creation of the awareness campaign

What can other cities learn?

Salvation through co-creation:

Laboratorio Aria brings together the municipal government with local institutions and communities to create both a bottom-up and top-down approach to creating a healthier and more liveable city with better air quality. The initiative links institutions to expand data gathering and ensure better dissemination of existing information to the public.

Offline but on target:

In these digital-dominated times, it is easy to imagine that Internet-based tools can solve all our problems, but it is important to remember that not every city resident is online. As such, Bologna has ensured that some efforts of the Laboratorio Aria initiative exist offline as well.

What are the co-benefits?

Social:

Citizen science is a crucial aspect of the initiative, with residents getting involved in a bottom-up process of air quality data collection, giving Bolognians greater ownership in the project.

Health:

In 2017, air pollution in Bologna caused 412 premature deaths and 1,150 hospitalisations, demonstrating the potential health gains that could be reaped by improving air quality. Additionally, Laboratorio Aria is encouraging active transport, for a fitter, healthier population.

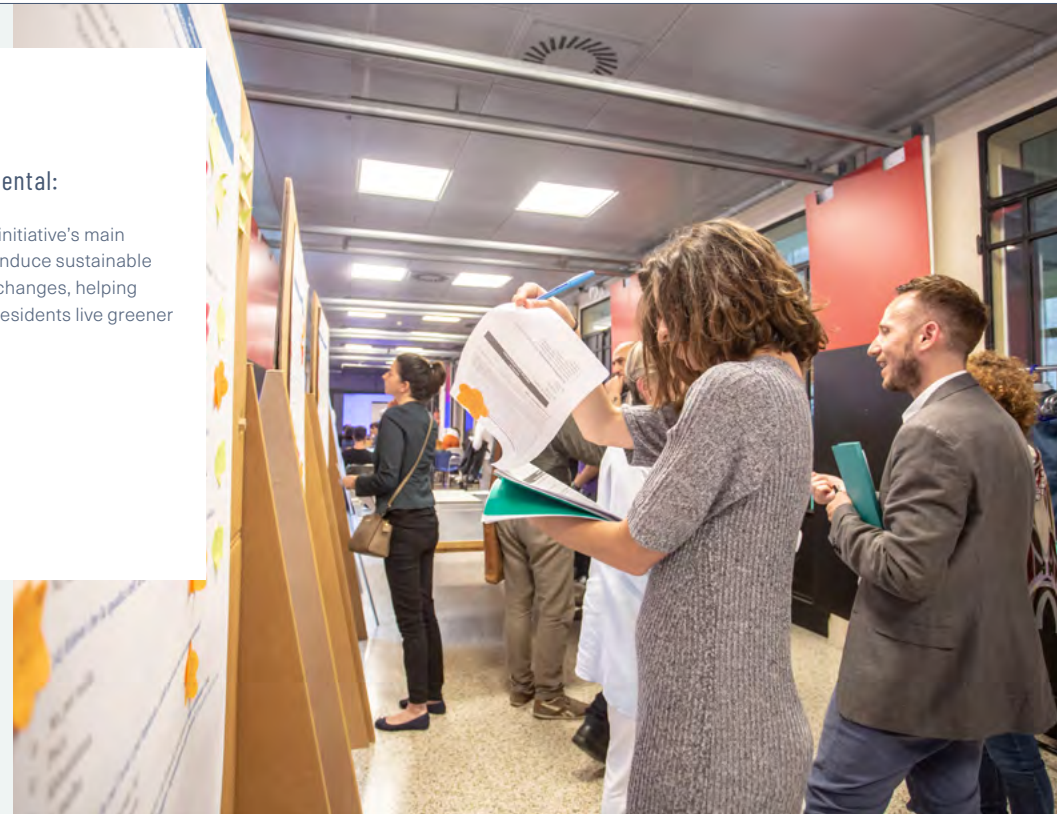
Economic:

When air pollution levels exceed legal limits, emergency actions have to be taken, such as placing limits on private transportation, which have significant economic impacts. By reducing the occurrence of these days, the city limits the economic damage caused by air pollution.

Environmental:

One of the initiative's main goals is to induce sustainable behaviour changes, helping Bologna's residents live greener lifestyles.

Bologna's Laboratorio Aria is an initiative to better inform the population about air quality in the city and encourage sustainable behaviour change that reduces the risk of air pollution in the city. In its first year, the campaign reached more than 50,000 people.



ADDIS ABABA:

Car-free days driving carbon-free ways

→ Addis Ababa's monthly car-free day programme, Menged Le Sew, is tackling the city's air pollution and showing **a vision of a future less reliant on motorised transport.**


Each month, **10 km of streets are transformed into open public spaces**, encouraging active transport and community-building events. The events improve air quality and drive sustainable behaviour change among residents.



What has the city achieved?

On a typical morning in Addis Ababa, as cars and minibuses shuttle workers around the city, a thick smog hangs in the air. Air pollution in the city is a major problem, with levels of particulates, NO₂, SO₂, and ozone far exceeding World Health Organization safe limits. The problem has become more severe in recent years, causing an annual growth rate in acute respiratory infection of 47%¹. To begin to counter the city's air pollution problems, and signify the value of open public spaces, Addis Ababa is embarking on a car-free streets programme. Menged Le Sew (Streets for People) began in December 2018, and once a month, every month since then, six neighbourhoods ban cars from 10 km of roads for half a day. This creates space

instead for pedestrians and non-motorised forms of transport. While the initiative has only a small direct impact on air pollution, it is aiming to drive behaviour change and paint a vision of a more sustainable future for the city. Citizens have been engaged from the outset in shaping the events to meet the needs of the community, with involvement at all stages of planning, implementation, and review. Thanks to the programme's success, the city is planning to scale up the frequency of the events to make them fortnightly and then weekly, and also cover a larger area of the city.

Addis Ababa 

ADDIS ABABA

↓ 60%

OF ETHIOPIA'S AIR POLLUTION is generated by cars, so removing them from the streets brings large benefits for air quality

What can other cities learn?

Seek inspiration from others:

Inspiration for Menged Le Sew was taken from other pioneering cities' car-free days. In particular, lessons were learned from the experiences of Bogotá, where a similar scheme has been run with great success.

Showcase a positive vision of the future:

With a government vision to improve bike and pedestrian infrastructure in the city, the car-free days show residents a positive vision of the future, and help to get buy-in from citizens in the city's plans.

Reclaim the city for people:

Like many cities, Addis Ababa still has a high reliance on motorised transport, but this initiative demonstrates the value in shifting from that model and reclaiming public space lost to the automobile.

What are the co-benefits?

Social:

Car-free days are, amongst many things, events that bring the community together. Menged Le Sew brings residents together in street art and music, football matches, and skateboarding competitions, building social cohesion in the city.

Health:

In 2017, a third of patients seeking medical treatment in Ethiopia were treated for respiratory illnesses, highlighting the importance of improving air quality. Additionally, Menged Le Sew creates new public spaces that encourage walking, cycling, and more active lifestyles.

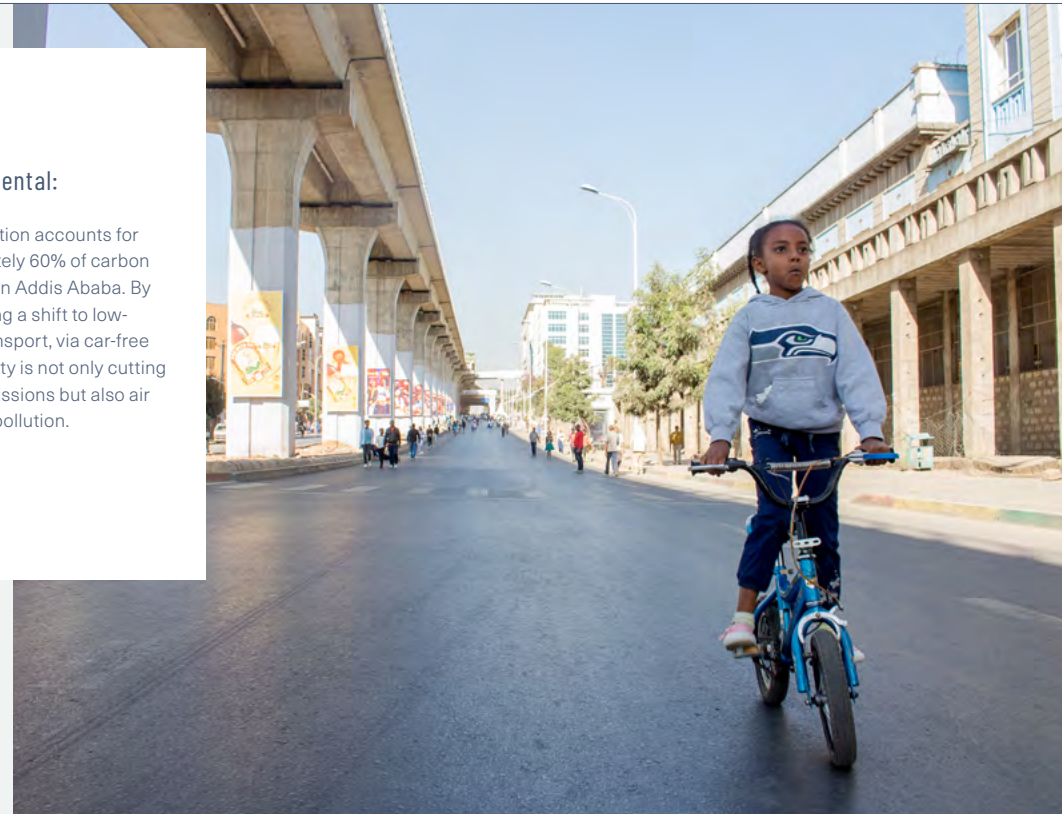
Economic:

By getting Addis Ababa's residents out of cars and onto the streets, local businesses are experiencing a boost in foot traffic on car-free days. The scheme should also result in savings thanks to reduced road traffic deaths and respiratory illnesses.

Environmental:

Transportation accounts for approximately 60% of carbon emissions in Addis Ababa. By encouraging a shift to low-carbon transport, via car-free days, the city is not only cutting carbon emissions but also air and noise pollution.

Menged Le Sew reclaims city space lost to the car for the public. During the events, citizens breathe cleaner air and use the streets for everything from music and art to sports. Free medical check-ups are also available, with more than 2,000 residents using the service at each event.



2019

Cities100

SUSTAINABLE FOOD SYSTEMS

→ With climate change expected to have significant yet uncertain impacts on the global food system, leading cities are making concerted efforts to reduce the problematic issue of food waste. By boosting organic waste collection and incentivising surplus food donations, cities are ensuring their least well-off citizens have better access to food, while leading to more circular, resourceful economies.



LISBON:

Increasing resource recovery to tackle urban food waste

→ Lisbon, alongside its partners, has developed a **multi-pronged approach to deal with food waste**.

This EU-funded programme diverts food waste from incineration and towards valorisation processes, such as energy derived from anaerobic digestion. The digitalisation of surplus food via a newly created app will **double the number of redistributed meals from 300,000 to 600,000** a year to help the city's less fortunate citizens.



What has the city achieved?

If food waste were a country, it would be the third-largest greenhouse gas emitter on Earth, which is why in 2016 Lisbon implemented a policy strategy to repurpose food waste. Through digitalisation and the increased organisation of surplus food, the city aims to double the total number of redistributed meals that have been voluntarily donated by city food sellers. To avoid incineration wherever possible, Lisbon has added a composting network and a new domestic bio-waste collection scheme to its waste management system, with the hope of closing the loop and moving toward a more circular, regenerative economy.

emissions of the waste management process, as well as the energy resources used for this food waste incineration. The bio-waste collection scheme will include 6,700 households, with the sorted waste producing biogas and compost at an anaerobic digester. So far, this programme – based on voluntary participation by local citizens and businesses – has diverted an estimated 455 tonnes of food waste from the incinerator. With more outreach on the way, the city hopes to raise even greater awareness of food waste and boost public participation.

By building 4,000 domestic composters, the city will avoid the significant transport-related carbon

Lisbon 



LISBON

↑ 600K

THE TOTAL NUMBER OF REDISTRIBUTED MEALS
the City of Lisbon is aiming for

What can other cities learn?

No need to reinvent the wheel:

The city has acted as a key facilitator between all 15 project partners. Its aim has been to build on existing knowledge and accelerate the sharing of solutions across the city in order to tackle food waste. For example, by developing a surplus food app with a key food redistribution stakeholder, the city hopes to double the total number of redistributed meals in Lisbon.

Build and tweak the model before scaling:

This EU-funded project – which sees Lisbon collaborate with Copenhagen, Genoa, and Hamburg – aims to share insights via best practices, helping each city learn from one another to address this urban food waste epidemic. Lisbon itself hopes to scale solutions within the capital before replicating certain solutions across 80 Portuguese municipalities.

What are the co-benefits?

Social:

By doubling the total number of redistributed meals from 300,000 to 600,000, the city, with its NGO partners, is delivering an important social service by ensuring the least well-off citizens are provided a free meal.

Health:

Citizens in need of food aid might see an overall improvement in their nutritional health thanks to this food redistribution. In addition, the reduction of local air pollution thanks to a decrease in food waste incineration will improve public health.

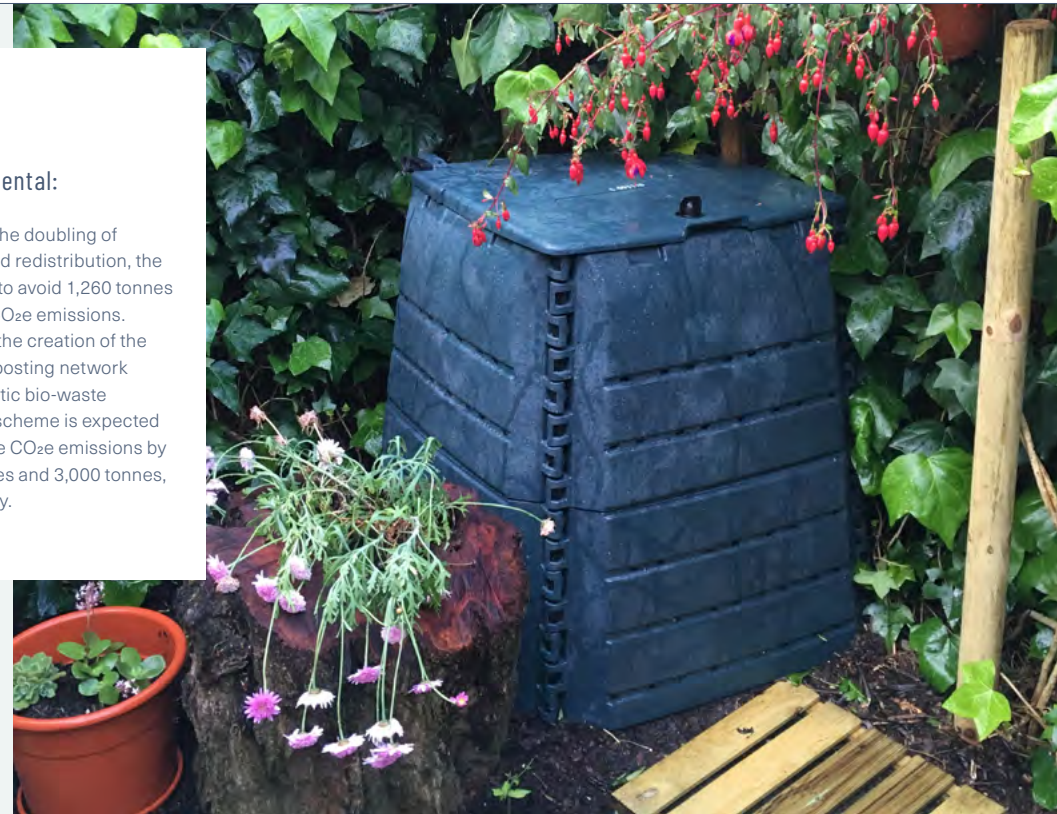
Economic:

By investing in citizens' composters, the city will save on waste management costs because of the reduction in transportation costs, which are normally 40% to 70% of the total incineration costs. There will also be a decrease in waste that undergoes treatment.

Environmental:

Thanks to the doubling of surplus food redistribution, the city hopes to avoid 1,260 tonnes of annual CO₂e emissions. Moreover, the creation of the initial composting network and domestic bio-waste collection scheme is expected to decrease CO₂e emissions by 1,000 tonnes and 3,000 tonnes, respectively.

Every Lisbon citizen has the option to install a composter at their homes. The city hopes to install 4,000 composting devices, thus substantially cutting down on the transport-related carbon emissions of the waste management process, as well as the energy resources used for food waste incineration.



MILAN:

Holistic strategy to make local food system more sustainable and resilient

→ When it comes to designing a just and sustainable food system, the City of Milan is leading the charge thanks to implementing **one of the most innovative urban food policies in Europe**.

The initial five-year programme – the Milan Food Policy – is taking a holistic and integrated approach by collaborating with all relevant societal actors. Its key short-term goal has been to target urban food waste **across the entire food chain**.



What has the city achieved?

With global food loss and waste emitting around 4.4 billion tonnes of CO₂e every year, cities around the world are starting to implement policies to tackle the significant social and environmental issues caused by urban food waste.

Milan is spearheading this movement and hopes to cut food waste in half by 2030. Thanks to myriad inter-departmental policies, its plans include: greater redistribution of food losses across private and public sectors; business waste tax reduction to incentivise surplus food donations; greater outreach on food waste; and a transition towards a circular economy.

After an analysis of data from the entirety of Milan's food system, policymakers have identified the main drivers of this urban food system, and have implemented policies to reduce food loss and waste. The city has managed to improve resource use by significantly boosting the collection of domestic biowaste, going from 5.3% in 2011 to 20.7% in 2018. The total biowaste collection amounts to 138,000 tonnes per year, reducing annual CO₂e emissions by 41,400 tonnes. This collection has created 7.4 million m³ of biofuel, 3.4 MWh of electrical and thermal energy, and 20,700 tonnes of high-quality organic compost.

Milan 

MILAN

↓ 5.9 BILLION

LITRES OF WATER is the total overall amount of water that has been saved thanks to total surplus food donated so far

What can other cities learn?

Make use of philanthropy, with environment high on the agenda:

As part of the plethora of inter-sectoral collaborations, Milan has teamed up with the Cariplo Foundation in its quest to transition to a more resilient food system. Over the course of the five-year programme, the foundation has allocated \$900,000 to cover the technical support for the Milan Food Policy.

Aid both public and private sectors for greater shift:

Food procurement within public school canteens has been shifted, while 106 out of 418 school canteens now donate their surplus bread and fruit to local food banks. In addition to local business waste tax reduction, other fiscal incentives have been introduced to increase private sector food surplus donations.

Share best practices to accelerate change:

Milan has shared its food system findings and innovations widely. Regionally, Bergamo, Brescia, and Sondrio have all launched their own food waste initiatives. Milan has communicated its best food waste reduction practices to the Milan Urban Food Policy Pact, Eurocities Working Group Food, and C40 Cities international networks.

What are the co-benefits?

Social:

With the total commercial value of surplus food donations estimated at \$48.6 million, a tremendous quantity of food has been redistributed to the poorer citizens of Milan. Around 14 million meals are thought to have been donated to Milanese food banks.

Health:

The redistribution of 14 million meals to food banks across this dense city has meant that many citizens may now have a more nutritionally varied and perhaps healthier diet compared to before the Milan Food Policy programme was introduced in 2016.

Economic:

In the Lombardy region of Italy, the standard cost for each tonne of food waste management is \$95. This means that the net yearly financial savings estimate stands at around \$6.6 million.

Environmental:

The holistic Milan Food Policy programme has had far-reaching environmental impacts. Milan estimates that 14,500 tonnes of yearly CO₂e emissions have been reduced, while the surplus food donations have saved 5.9 billion litres of water and 4,927 hectares of land that were used in the production of that near-wasted food.

In a bid to design a more just, resilient, and sustainable food system, the City of Milan has collaborated with relevant societal actors to implement one of the most innovative and progressive urban food policies in Europe.



NEW YORK CITY:

Public digital donation portal reduces landfill waste

→ The donateNYC Food Portal is a part of a growing food rescue network in New York City, enabling the donation of surplus food from businesses to local community organisations.

The portal is the first of its kind to be developed by a city government, and is designed to forge hyper-local connections, **simultaneously reducing food waste and food insecurity**. In the first six months of the initiative, it has resulted in the **diversion of 4.5 tonnes of food from landfill**.



What has the city achieved?

Each year, New York City sends more than a million tonnes of food waste – the weight of three Empire State Buildings – to landfill. Each day, the city's restaurants throw away enough food to fill more than 100 subway cars. The resulting GHG emissions from processing this waste and allowing it to rot in landfill is a problem for the city and the climate, but much of this unending stream of waste is perfectly edible, delicious food that needn't be squandered.

Enter the donateNYC Food Portal, a digital platform launched in March of this year linking the city's organisations and businesses and enabling the donation of surplus food that would otherwise have ended up in the dumpster. As the first food donation platform fully developed

and administered by a municipality, it has been designed with the city's many small community organisations and businesses in mind.

The ethos behind the platform is to enable hyper-local connections to be formed by enabling private companies to support community organisations in their neighbourhoods. To that end, the algorithms behind the platform are designed so that organisations are linked to food streams nearest to them, and only notified of opportunities meeting their needs.

New York City 

NEW YORK CITY

↓ 4.5

TONNES OF FOOD WASTE was averted from landfill in the first six months of the initiative

What can other cities learn?

Build hyper-local relationships:

The Food Portal is an excellent example of a human-centred climate solution, which uses social bonds in the community to limit waste streams, and ultimately carbon emissions. This points to a growing trend of utilising the community in designing solutions to the climate crisis.

Two birds with one stone:

Food waste and food insecurity are two contradictory problems, and in NYC there is too much of both. The donateNYC platform is another tool in the ever-growing ecosystem of food rescue to redress this imbalance, proving that initiatives can deliver on multiple goals at once.

What are the co-benefits?

Social:

Despite the vast amount of food waste in NYC, food insecurity remains a serious social problem in the city. However, it has been found that if just 25% of discarded food were rescued it would mitigate 53% of food insecurity in the city, which the donateNYC Food Portal is working to address.

Health:

Citizens suffering from food insecurity typically also have the least healthy and balanced diets, but thanks to the donation of food through donateNYC, the food insecure can receive nutritionally balanced and healthy food that would have otherwise gone in the bin.

Economic:

Businesses in New York City typically pay private contractors by weight for waste disposal, meaning that the more food they can divert away from waste streams, the lower their costs.

Environmental:

By rescuing food destined for landfill, donateNYC's Food Portal is reducing methane emissions, as well as air, soil, and noise pollution from landfill, as well as other carbon emissions associated with transporting and processing waste.

The donateNYC Food Portal helps to solve the dual problems of food waste and food insecurity by enabling the redistribution of food that would otherwise have been sent to landfill.



PARIS:

Boosting local food production for an equitable food system

→ In 2018, the City of Paris embarked on a 12 year project to shift to a more **equitable and sustainable food system**. For maximum impact, this all-encompassing food strategy – developed by all relevant food system actors including civil society – includes both food consumers and producers.

By promoting a more plant-based, flexitarian diet, Paris will reduce its food system-related GHG emissions by 40%, thus making this project a key component of the city's 2050 carbon-neutrality target.

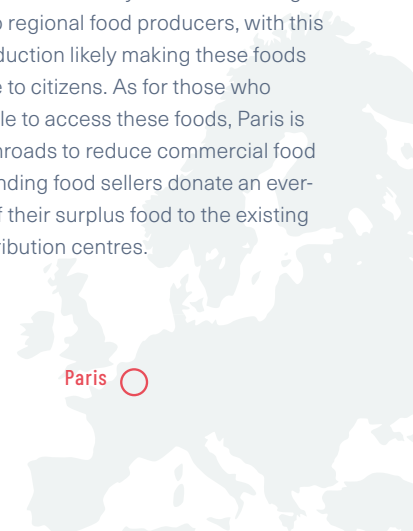


What has the city achieved?

With climate change expected to have significant, yet uncertain, impacts on the global food system, Paris has decided to increase the autonomy and resilience of its food system by becoming more self-sufficient. It plans to increase the total share of locally produced food consumed by Parisians from 25% to 50%, as well as making fresher, more nutritious foods more accessible to all citizens. In addition to the 19 hectares already dedicated to urban agriculture, under the “Parisculteurs” project, there will be a further 33 hectares as of 2020, creating an additional 18 permanent jobs. This food will be transported around the capital using increasingly electrified vehicles, as well as making more prolific use of Paris’ extensive riverine system.

By shifting 1,300 public sector canteens toward local, seasonal, organic production – with current procurement at 43% – the city has sent a strong market signal to regional food producers, with this increase in production likely making these foods more affordable to citizens. As for those who might not be able to access these foods, Paris is making major inroads to reduce commercial food waste by demanding food sellers donate an ever-greater share of their surplus food to the existing 130 food redistribution centres.

Paris 



PARIS

↓ 40%

REDUCTION IN GREENHOUSE GAS EMISSIONS
from Paris' food system by 2030

What can other cities learn?

Reconnect children with food:

As Paris aims to reduce its city-wide obesity levels from 11% to 5%, via the "Cultivate at school" initiative, it hopes to have fostered a greater sense of connection to food in the next generation. So far, there are vegetable gardens in 207 schools, as well as 1,170 newly planted fruit trees.

Transition to organic agriculture for myriad benefits:

By shifting a significant proportion of its local food production toward organic practices, Paris expects a host of positive results. This includes increased regional wildlife biodiversity; up to 30% greater on-farm employment; a surge in regional full-time farmers; reduced air, water, and soil pollution; and a stronger regional food culture.

What are the co-benefits?

Social:

As of 2016, an estimated 6.3% of Parisians were still food insecure. By boosting the production of local, seasonal, organic food production, the city hopes these healthier foods will be more accessible to a greater share of the population. Increased food redistribution also means those most in need can receive free meals.

Health:

A transition towards organic food production will increase the health of food producers across the region due to the omission of all artificial chemicals on farmland. Additionally, the electrification of food-related transport will boost air quality in the city, thereby leading to improved public health.

Economic:

The \$300,000 being invested each year to fund this transition is expected to reduce overall food system related expenditures. For example, if Paris' obesity levels are halved, as is hoped, this will significantly reduce public healthcare costs associated with this lifestyle disease.

Environmental:

By undertaking this radical food system transition, Paris hopes to reduce this sector's associated carbon emissions by 40% by 2030. Organic food production has a far lower impact on the local environment than more "conventional" growing methods, with biodiversity benefitting and regional water and soil resources less exposed to chemical pollution.

The significant increase in local, seasonal fruit and vegetables produced using organic agricultural methods is a crucial component of the city's target to reduce food system GHG emissions by 40% by 2030.

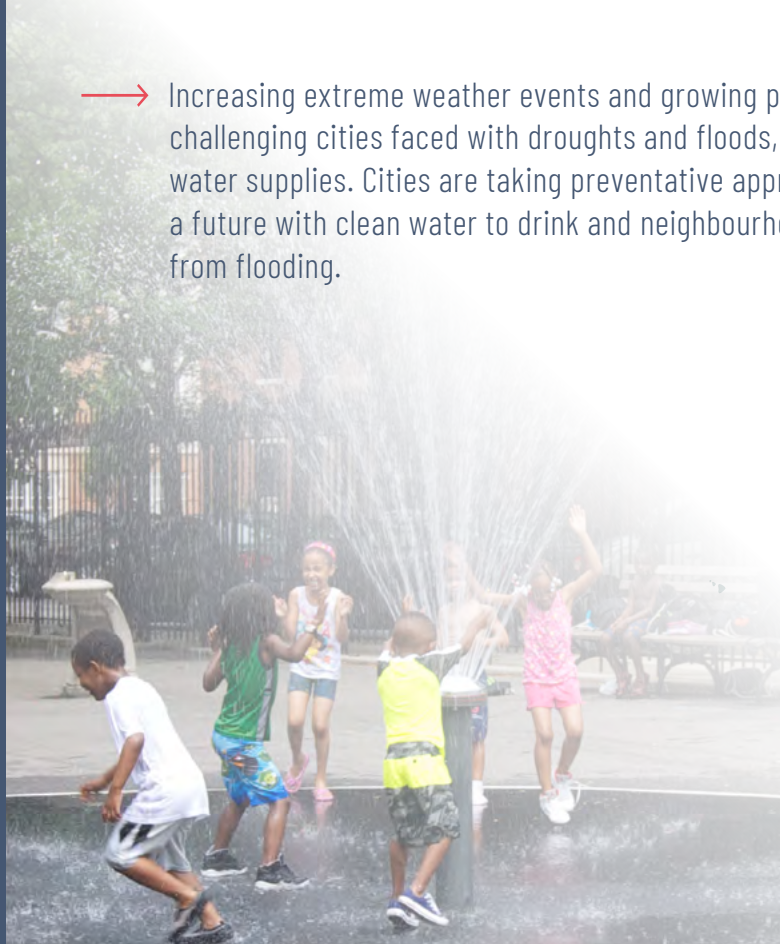


2019

Cities100

WATER MANAGEMENT

→ Increasing extreme weather events and growing populations are challenging cities faced with droughts and floods, and pressuring local water supplies. Cities are taking preventative approaches to enable a future with clean water to drink and neighbourhoods safe from flooding.



CHENNAI:

Framework guides effort to rapidly restore water bodies



→ Chennai has the dual challenge of a **high water stress and managing heavy rainfalls** in a city that has experienced rapid urbanisation. In 2015, a 100 year rain-fall event caused a tragic loss of life and the destruction of property valued at \$20 billion.

This event spurred the creation of the Chennai Water Restoration and Resilience Framework to **unify and scale the efforts of all organisations and citizens** working on water body restoration, which will serve to prevent future flooding and recharge aquifers.

What has the city achieved?

The Chennai Water Restoration and Resilience Framework is designed to be scalable in order to activate public, private, and community stakeholders in a joint effort to rapidly restore as many water bodies as possible. Currently, the project is restoring 210 publicly controlled water bodies in Chennai. Previously, almost a third of the sites were informal dumps, and now they are being transformed to collect stormwater and recharge groundwater. Ambitions are scaled in the project's next phases to restore 460 water bodies, and subsequently 1,200+ more upstream from the city.

The framework was created by the municipality in coordination with other state departments, and works to assign clear roles and procedures to make the most of the participation of the various

stakeholders. Ownership is clearly defined for each water body to ensure the responsibility of restoration. Technical expertise is drawn from researchers and engineers across government, academia, and NGOs. From which a customised and comprehensive restoration plan is created for each pond, involving both technical and physical improvements, engagement of the community and volunteers, as well as a maintenance and monitoring plan.

Chennai 

CHENNAI

↓ 420K

KG OF CO₂e EMISSIONS are estimated to be prevented each year from the restored informal dump sites

What can other cities learn?

Funnel funding into project goals:

The project is funded publicly, as well as privately by corporations and NGOs, via the “Adopt a Water Body” concept, whereby willing contributors are assigned specific works to be carried out. Even with private funding, the framework ensures implementation is completed according to the action plan.

Invest in the future:

The frequency of extreme weather events in Chennai is on the rise, and each year there are millions of dollars worth of damage. While the restoration requires an estimated \$15 million in investment, in only two years the city will likely see a return on investment via a reduction in damages.

Engage a willing public:

Devastating floods and droughts have summoned the common conscience of the public in a desire to contribute. Participation is encouraged via events that build community pride. Volunteer groups help maintain the water bodies, receiving training to check on water quality parameters and keep authorities updated.

What are the co-benefits?

Social:

The restored water bodies will serve as a shared space for socialising and exercise for all citizens, including the most vulnerable in society. Some of the ponds are situated in economically disadvantaged neighbourhoods, and will also serve to improve their resiliency in extreme weather events.

Health:

Chennai has some of the highest rates of diabetes in India. The restored water bodies will benefit citizens greatly by providing them with greater access to spaces for physical activity. More than half the restoration projects will include walkways around their periphery.

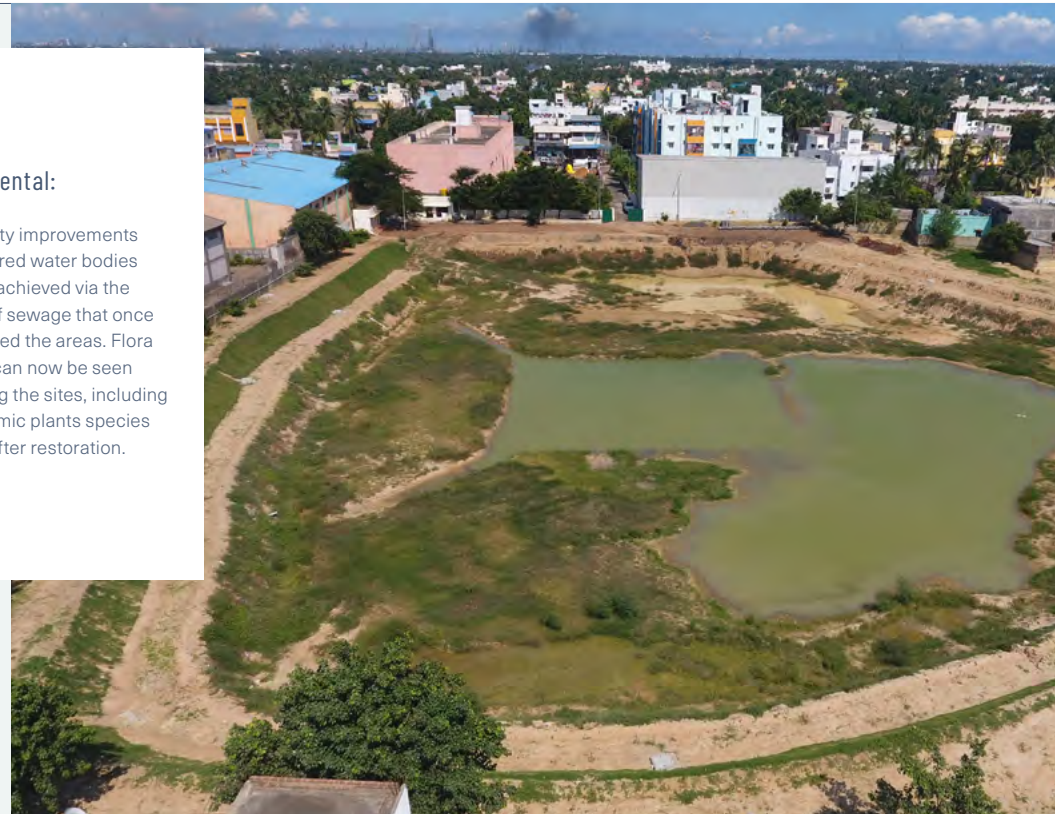
Economic:

The water bodies provide drainage for stormwater, protecting neighbouring properties during extreme weather events. Citizens and businesses can invest more in their property when the risk of storm-related damage is decreased, thereby boosting the local economy.

Environmental:

Water quality improvements in the restored water bodies have been achieved via the rerouting of sewage that once contaminated the areas. Flora and fauna can now be seen recolonising the sites, including three endemic plants species identified after restoration.

Many of the areas being transformed into storm buffering and drought-protecting public spaces were once dump sites. It is estimated that in the first year of the project, the public space created will be used by 1 million citizens.



DELHI:

Pledge provides clean and free water for all and invests in a water-secure future



→ Delhi took a political pledge to **provide access to clean drinking water to all its citizens** at an affordable price, and as a human right.

The comprehensive, equity-driven plan offers short-term relief by providing free lifeline water of up to 20,000 litres a month to households with metred connections, and **sizeable investment in improving water security for Delhi's residents in the future**. The improvements include expansion of water distribution infrastructure, wastewater treatment, and restoring water bodies to recharge and store groundwater.

What has the city achieved?

Delhi's pledge of "Jal Swaraj" (Self Governance of Water) comes amidst India's challenge of water insecurity, with many residents forced to buy water from private tankers operated by the water mafia. About 30% of Delhi's population lives in unauthorised colonies, which are historically lacking in access to water and sanitation infrastructure.

The city is addressing this challenge via an urgent plan of action aiming to connect all residents of Delhi with water and sewage, regardless of their legal status. Citizens are offered an 80% rebate for the installation of pipelines, contributing to the goal of city-wide coverage within five years, which will provide connections to 1.4 million households currently without a piped water supply. A network of small yet efficient decentralised sewage

treatment plants have been developed, primarily near unauthorised colonies, and work to treat wastewater and prevent the discharge of pollution into 281 water bodies. To address water security and recharge Delhi's low water table, the city is promoting citizen-based water management including water conservation, recycling, and rainwater harvesting. The Yamuna River will also be restored by preventing inflow of pollutants, re-naturalisation, and the creation of dams to store floodwaters for later use.

Delhi ○

DELHI

↑ 100K

HOUSEHOLDS have received up to 20,000 litres of free water a month

What can other cities learn?

Provide water for all, not just some:

Economically disadvantaged citizens are disproportionately vulnerable to water insecurity. The provision of free lifeline water, reduction of water and sewer connection charges by 80%, and reduction of pipeline development charges helps rectify inequality and systematically improve Delhi's water security for all citizens.

Make the most out of greywater :

Delhi is working to make the most of recycled water to relieve the stress on drinking water supplies. The city has set up decentralised sewage plants in residential colonies to prevent contamination of water bodies with sewage, and provide treated water for non-drinking purposes such as toilets and gardening. Dual water systems will be rolled out across group housing societies, optimising recycled water usage.

What are the co-benefits?

Social:

The government of Delhi is making water distribution systems more transparent, efficient, and accessible by expanding infrastructure to reach communities, including those that are unauthorised. By providing equitable access to water, the city is ousting the water mafia and creating happier neighbourhoods.

Health:

To beat the extreme heat, citizens will be provided with clean drinking water free of charge via hundreds of water dispensers installed in public places. Improved access to sanitation will also bolster citizens' health, so the city has built 100,000 restrooms, mostly in unauthorised colonies.

Economic:

By regulating private tankers, citizens will be protected from exorbitant prices. Changes in water tariff regulations will relieve small shop owners from paying commercial water prices, aiding local businesses.

Environmental:

Delhi comprises just 2% of the catchment area of the Yamuna River, but is the source of 80% of the pollution flowing into it. An investment of \$54 million has been made towards a comprehensive action plan to intercept and treat sewage.

Lake rejuvenation provides the practical benefits of rainwater collection and stormwater drainage, while the landscaped spaces around the lake offer citizens opportunities for recreation and community gathering places for religious rituals.

A photo prior to construction is pictured in the bottom left.



FREDERIKSBERG:

Innovative stormwater management approach takes advantage of synergistic opportunities

→ Frederiksberg is driving the creation of **bespoke stormwater management projects** that fit within the existing structure of the city's dense streets.

Frederiksberg is testing a new type of tendering, where the city and suppliers undertake a **co-creation process to create new and innovative solutions**. In addition, the city is implementing an array of stormwater management programmes in synergy with construction projects and natural infrastructure, which serve as a testing ground for projects to be scaled across Denmark.



What has the city achieved?

Anticipating cloudbursts of increasing intensity and frequency, Frederiksberg is taking a strategic approach to climate-proof the city. Frederiksberg announces tenders based on required criteria rather than known solutions, experimenting with a collaborative process to yield synergistic solutions. For example, the city is developing stormwater catchments that irrigate urban trees, sparing sewers during torrential rain storms, while reducing the task of manual watering. The city aims to couple all new urban trees with integrated rainwater management, where underground basins collect water that will be utilised to water trees during dry periods. Currently nine sites are planned to manage up to 1,295 cubic metres of stormwater, with ambitions to scale the project across the city.

The city also used the opportunity of construction work on a parking facility to include stormwater reservoirs beneath the building and surrounding roads, protecting the area from run-off and minimising combined sewer overflow. The project included revamping the city's public square, Langelands Plads, to manage stormwater and protect the neighbourhood from flooding exceeding a 100 year rainfall event. The project includes a digital monitoring system enabling the active control of when and how much water is released to sewers.

Frederiksberg 

FREDERIKSBERG

↑ 31.3K

CUBIC METRES OF WATER could be managed if stormwater catchment is paired with urban trees across the city, which is planned to be integrated over the next 20 years

What can other cities learn?

Target tech to the city's needs:

All too often, new technology is arbitrarily applied to projects. The digital control system at Langelands Plads is tailored to management needs rather than a technology push, and the result is a lean, replicable, and integrated system that saves the city money.

Collaborate across departments:

Frederiksberg is breaking down city department silos to find new opportunities. The strategy for the coupling of torrential rain projects and urban trees is created, maintained, and funded via collaboration between several city departments.

New challenges require new solutions:

The city's willingness to engage in a co-development process between city departments and private companies leads to unique solutions. While this is an unorthodox approach, the city finds it saves time, money, and improved the quality of infrastructure solutions.

What are the co-benefits?

Social:

The stormwater infrastructure doubles as a public space where people can meet and children can play. Langelands Plads features a green space with a playground and facilities that encourage social activity.

Health:

Frederiksberg is creating stormwater infrastructure in alignment with a strategy to create more greenspaces, which provide places for recreation and help citizens cool down during summer heatwaves.

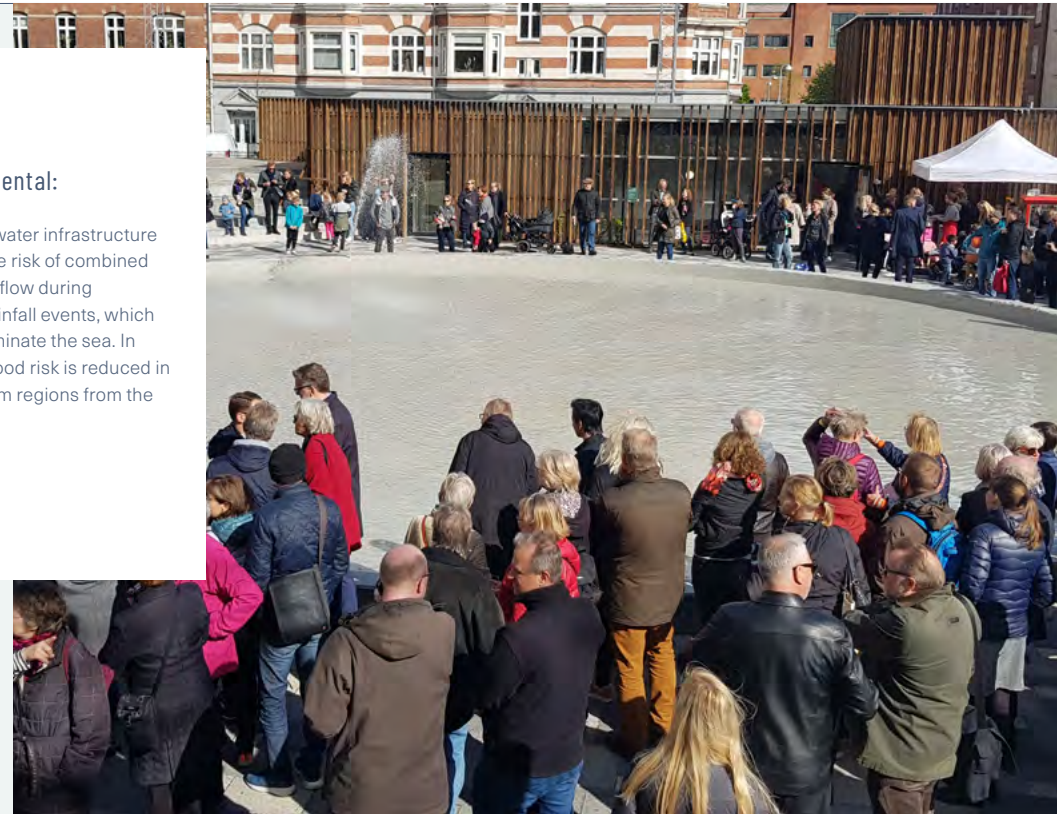
Economic:

Preventative stormwater management should reduce costs associated with future flooding events. In addition, Frederiksberg's strategic approach takes advantage of opportunities to reduce expenses, such as combining projects with scheduled construction and reducing urban tree maintenance with rainwater catchments.

Environmental:

The stormwater infrastructure reduces the risk of combined sewer overflow during extreme rainfall events, which can contaminate the sea. In addition, flood risk is reduced in downstream regions from the projects.

Frederiksberg's Langelands Plads provides an attractive public space while increasing the city's resilience. Beneath citizens' feet is infrastructure capable of retaining 670 cubic metres of stormwater. A digital display informs curious visitors, relaying information about climate adaptation.



LISBON:

Not a drop goes to waste with a recycled water programme and rain-fed greenspaces

→ Lisbon is future-proofing its water supply by **preserving drinking water reserves and using recycled water more widely** for myriad city uses.

Lisbon's ambitious efforts to utilise recycled water are driving policy nationally and within the EU, enabling smaller cities to follow its lead. In addition, Lisbon is **greening the city without increasing overall water use**, making the city more resilient to heatwaves, flooding, and reducing the urban heat island effect.



What has the city achieved?

Water scarcity events are becoming increasingly severe and prevalent in Southern Europe, with Portugal experiencing long periods of severe drought in recent years. Although Lisbon's water reserves are not under immediate threat, the city identified an opportunity for improvement given that 75% of its water consumption is for non-potable uses, such as street washing and irrigation. Rather than sending drinking water down the drain, Lisbon has devised a strategy to optimise the use of recycled wastewater for non-potable uses, which has the added bonus of contributing less than half the greenhouse gas emissions of potable water.

distribution network and a working group to ensure public safety with regard to water quality. The plan is part of a wider Water Efficiency Strategy, anchored in a vision of a city filled with resilient green infrastructure managed with minimum water needs. Greenspaces are planted using rain-fed native species, thereby limiting the need for irrigation. Where irrigation is used, a system is deployed to rapidly detect and fix water leaks and increase efficiency. Lisbon has already increased greenspaces by more than 10% in the last decade, with a goal to reach 20% by 2021.

Lisbon's Strategic Plan for Water Reuse includes the creation of a city-wide recycled water

Lisbon 

LISBON

↑ 30%

OF THE CITY is scheduled to be covered by the recycled water network by 2025

What can other cities learn?

Take a lead and set the standards :

Before the project, there was no existing legislation for water quality for re-use, nor a regulatory framework for the distribution and pricing of this new water product. A working group spearheaded these initiatives and comprised a broad range of public, private, and academic partners.

Invest in the future:

Previously, Lisbon had utilised recycled water via tankers; now it has implemented a more permanent and efficient solution. Including the initial \$18 million investment, the city is already saving 10% on the cost of recycled water in lieu of potable water, and will see greater savings as the project scales.

Be open minded to non-traditional resources:

Public acceptance of recycled water was an initial concern in the development of the project, which was addressed by a thorough analysis and an action plan to safeguard against all potential health hazards. As severe droughts become more frequent, the municipality foresees the project will be seen positively by the community.

What are the co-benefits?

Social:

More greenspaces will improve citizens' access to public spaces a short distance from home and work, offering them more places to meet and socialise.

Health:

Greenspaces provide citizens opportunities for exercise, improving mental health, and spaces to take shelter in during heatwaves.

Economic:

The city has proposed a new business model to introduce recycled water, creating opportunities for more affordable and sustainable water sources to be integrated in a wide variety of businesses such as car washes, heating and cooling solutions at airports, and construction sites.

Environmental:

By expanding the city's greenspaces without increasing water demand, the city will preserve its water reserves, while allowing for the use of green infrastructure as an effective tool for adaptation to heatwaves, reducing both the urban heat island effect and the likelihood of flooding.

Lisbon is embracing greenspaces populated with native species, such as rain-fed meadows. Native species require minimal maintenance and water, while improving the city's resilience to heatwaves and flooding, boosting biodiversity, and providing delightful public spaces for citizens to enjoy.



NEW YORK CITY:

Effective water management cuts costs and carbon, and boosts resiliency



→ Despite an abundant water supply and climate change projections reporting increased rainfall, New York City has taken action to **future-proof its water supply and reap the benefits** of the associated energy savings.

New York City's Water Demand Management Program will ensure the city **increases its climate resiliency, while hosting an ever-growing population**. The plan works to reduce water demand and costs, cut carbon and nitrous oxide emissions, and prevent combined sewer overflows.

What has the city achieved?

The One Water NYC: Water Demand Management Program has achieved savings of approximately 38 million litres of water per day since 2013, which is expected to double by 2023. The savings have been achieved via partnerships across eight NYC government agencies and 10 regional municipalities to facilitate six water-saving strategies across diverse sectors of usage. Examples of projects include the replacement of tens of thousands of inefficient fixtures; water efficiency projects implemented in parks, hospitals, and schools; and the city's partnership with the private sector to voluntarily conserve water.

energy nexus tool was developed to calculate the relationship between decreasing water demand and reducing greenhouse gas emissions. NYC estimates that these water efficiency programmes reduce energy used for pumping and treatment by more than 570,000 kWh each year, which avoids greenhouse gas emissions totalling more than 150 tonnes CO₂e and saves NYC more than \$60,000 in energy costs. By quantifying savings and linking the data to broader environmental issues, the city also promotes public awareness and behaviour change among citizens.

To integrate water demand management as part of the city's ambitious climate strategy, a water-

New York City 

NEW YORK CITY

↓ 38 MILLION

LITRES OF WATER saved per day since 2013

What can other cities learn?

Collaborate to amplify impact:

The funding body, New York City's Department of Environmental Protection, has direct ownership of a small percentage of the facilities targeted for savings. Therefore, citizen engagement and collaboration between other agencies and private building owners and managers has been key to the project's success.

Show off your wins:

By sharing information with the public, they can get behind the positive changes implemented by their local government. NYC created an interactive online map where the public can view the implemented projects and the associated water, energy, and greenhouse gas emissions savings for each drainage area.

Let challenges inform best practices:

"Water Challenges" were launched with hotels, restaurants, hospitals, and universities, where participants calculated baseline water consumption, tracked usage, and developed conservation plans. The results informed the creation of water efficiency guides for these respective sectors and identified sector specific saving opportunities.

What are the co-benefits?

Social:

Citizens benefit from free retrofits under the programme. For example, the Toilet Replacement Program offers citizens high-efficiency toilets at no charge, and will further save them money on their monthly utility bills.

Health:

Demand management also reduces flow to sewers and therefore the risk of combined sewer overflows, which can contaminate local waterways during periods of high rainfall. By preventing sewer overflows, citizens can enjoy local rivers and waterside parks without fear of illness.

Economic:

The city estimates that each year more than \$60,000 in energy costs for treatment of potable water and wastewater will be saved as a result of the programme.

Environmental:

By reducing water demand and wastewater flows, it is estimated that each year the programme avoids more than 150 tonnes and 77 kg of CO₂e and NO_x emissions, respectively.

NYC's Toilet Replacement Program engages members of the community, specifically multi-family residential building managers and owners, to retrofit fixtures. As part of the programme, NYC establishes contracts with local private plumbing vendors, and participants redeem their vouchers with the vendors to receive free, high-efficiency toilets.



ZHENJIANG:

Sponge city soaks up rainfall to boost climate resiliency

→ With the Yangtze River to the north, mountains to the south, and smaller rivers interlacing its boundaries, the City of Zhenjiang is **at a high risk of flooding**.

To address this challenge, the city is **soaking up rainfall via its Sponge City project**, designed to retain and release rainwater while reducing pollutants.



What has the city achieved?

Facing up to the major challenge of urban flooding, the Chinese national government is promoting the Sponge City concept to help cities soak up rainwater and improve their resilience to climate change.¹ Zhenjiang has embraced the approach, requiring under city policy that every new project started after October 2015 must conform to the Sponge City requirements. The municipality established a management method and office to promote Sponge City development in order to secure resources for future projects. The city has deployed a pilot project of approximately 19 km² focusing on one lake and three rivers.

The project sets a strategy to intercept wastewater discharge, purify rainwater, and protect the health of waterways. An analysis

was conducted to measure the sources of various pollutants, develop a plan for how they can be reduced, and calculate how much wastewater can be discharged according to the Total Maximum Daily Load. Via strategies, including separating wastewater and stormwater infrastructure and ensuring wastewater is treated before it is discharged, the Sponge City project will protect local water bodies such as the Yangtze River from contamination.

Zhenjiang ○

ZHENJIANG

↑ 2025

IS THE YEAR by which Zhenjiang aims to have their urban areas entirely compliant to Sponge City standards

What can other cities learn?

Sponge-ify your city:

The Sponge City concept is being widely adopted across Chinese cities, and for good reason. Urbanisation reduces permeable surfaces, further exaggerating flooding risk. Resilience is improved when cities are developed with rainwater infiltration in mind. Permeable pavement and naturalised spaces work to not only absorb water but also recharge groundwater and provide opportunities for grey water to be re-used during the dry season.¹

Leverage Public-Private Partnerships:

The city has raised around \$200 million via public-private partnerships, which the city will engage in over the 23 year lifespan of the project. The project has a capital fund of approximately \$62 million, with the government owning 30% of the equity share and the private partners owning 70%. The companies involved in Sponge City not only serve the projects in Zhenjiang but 10 others across China.

What are the co-benefits?

Social:

Greener and cleaner cities have improved public spaces, offering new opportunities for recreation, leisure, and meeting places.

Health:

Improving drainage and water quality is eliminating stagnant, foul-smelling, and polluting waterways, which could lead to reduced risk of waterborne diseases and improved quality of life.

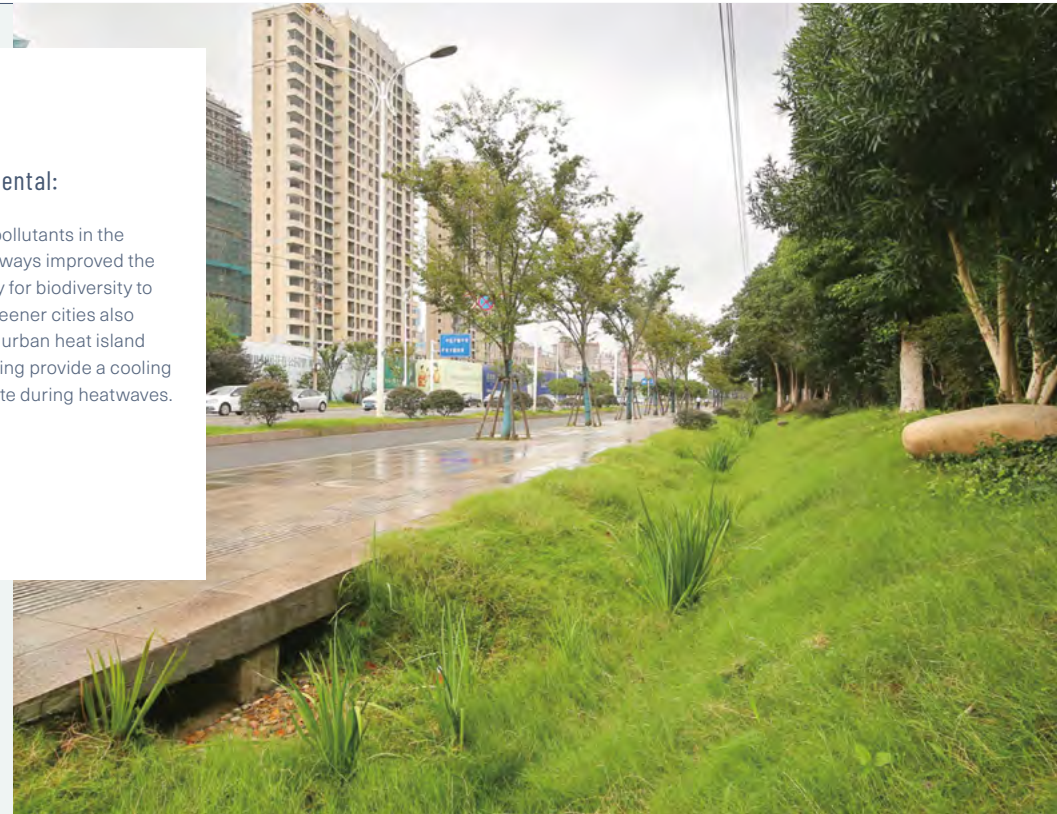
Economic:

Improving Zhenjiang's resilience to flooding and extreme weather events provides a more secure environment for businesses and residents to invest. The public-private partnership between the city and Sponge City industry partners will boost the local economy and create jobs.

Environmental:

Reducing pollutants in the local waterways improved the opportunity for biodiversity to flourish. Greener cities also reduce the urban heat island effect, helping provide a cooling microclimate during heatwaves.

While the unknowing pedestrian could pass it by without a second glance, modest yet effective green infrastructure provides a plethora of benefits including absorbing and rerouting stormwater, improving the water quality of runoff, recharging groundwater, while also improving public space, and fostering urban biodiversity.¹



Uncovering 100 of the world's most innovative climate action projects

Developing and creating the Cities100 report is a multi-pronged process starting with the conceptual development and ending up with a final report that includes 100 city climate action projects. As it is vital to keep the application and selection process transparent, the following outlines the methodology and seeks to ensure that readers of the report fully understand how the projects were sourced and selected.

Uncovering the front-runner projects

Throughout April and May of 2019, Nordic Sustainability and C40 Cities collaborated on a campaign to motivate as many cities to submit applications for their climate action projects as possible. The campaign included direct contact with city officials, desk research to uncover projects from cities not yet in our network, collaborating with WWF's One Planet City Challenge to obtain projects from their One Planet Cities, and conducting social media outreach. By the final deadline, 195 applicants from every region of the world had sent their application to the Cities100 project.

Which city projects were eligible?

This year's Cities100 report is the fourth of its kind. To make sure the report continuously features new, innovative, and operational projects, the report has a number of eligibility requirements for the cities' submissions. While the Cities100 is open for applications from all cities regardless of size or organisational affiliations, the below criteria have to be met:

1. Projects must have begun implementation in 2013 or later*.
**NOTE: If the submitted project was a part of a larger, long-term project, then the application had to focus on and discuss results of the stage that has begun since 2013.*
2. Projects need to have all, or a substantial amount of, project funds secured.

How were the projects evaluated and ranked?

Evaluating projects within 12 different sectors requires a scoring method that allows for the variety of projects to be scored fairly, while also being able to recognise their individual achievements. For this, a two-step evaluation model was developed.

METHODOLOGY

PART 1:

Initially, Nordic Sustainability reviewed all 195 applications and evaluated them on the basis of the following five criteria:

1. Climate action

CO₂e emissions reductions, climate risk mitigation, and/or air pollution reduction goals and results. Preference was given to results or goals that were measured and assessed quantitatively, and to documented results over future goals.

2. Co-benefits

Co-benefits (economic, environmental, health, and social) goals and results, with preference given to results or goals that were measured and assessed quantitatively, and to documented results over goals.

3. Innovation

The extent to which the project takes an entirely new or groundbreaking approach to address major environmental issues (one not applied similarly elsewhere). This included evaluating:

- The geographic scale of innovation. This comprises innovation at an international level and innovation at a city or regional level.
- The evidence provided to support the claim of the project's level of innovation.
- Description of the innovative elements of the project.

4. Governance

The extent to which the project has collaborated with other entities, engaged citizens, and whether the citizen engagement has influenced the project. This included evaluating:

- How well the project has collaborated with other entities in the city, such as other city departments, government agencies, NGOs, private companies, and so on.
- How the project has undertaken citizen engagement activities, and whether these have been quantified.
- How citizen engagement has influenced the development and implementation of the project.

5. Sharing and scaling

The extent to which the project experience is shared with other cities and regions, or is planned to be shared, and demonstrations of plans to scale the project within the city, or a suitable explanation as to why scaling is not possible.

PART 2:

Secondly, once the projects received their initial score, a team of C40 Cities sector-specific experts analysed all the projects within their given sector and provided detailed input for all evaluation criteria of every project based on years of hands-on knowledge and experience. The projects' initial scores were adjusted according to this input, yielding a final score for every project. The highest scoring projects in each sector were selected to be featured in Cities100.

Within each of the five evaluation criteria, projects were scored on sub-criteria (bullet points listed below each of the aforementioned evaluation criterion). For each sub-criterion, a project could score 1 (low), 2 (medium), or 3 (high). A project's overall score is the sum of their five criteria scores.

Writing notes

Monetary amounts provided by cities were converted to United States dollars. Distance and volume measurements were converted to metric system units. In regards to mass, we used tonnes i.e. "metric tons."

THE PARTNERS



About Realdania

Realdania is a Danish philanthropic association with 155,000 members. The mission of Realdania is to create quality of life for all through the built environment. One philanthropic target is to promote sustainable cities. Realdania is contributing to the prevention of the climate crisis – through international climate work, sharing of knowledge and promotion of innovative sustainable solutions. Cooperation is a central part of Realdania's philanthropic approach, and they cooperate with partners large and small in all of Denmark as well as partnering with numerous international organisations. Established in 2000, Realdania has financed more than 3,675 projects with more than €2.5 billion.

To learn more about Realdania:

Please visit their [website](#) or follow [Twitter](#), [Instagram](#), [Facebook](#) and [LinkedIn](#).



About C40

C40 Cities connects 94 of the world's leading cities to take bold climate action, leading the way towards a healthier and more sustainable future. Representing 700+ million citizens and one quarter of the global economy, mayors of the C40 cities are committed to delivering on the most ambitious goals of the Paris Agreement at the local level, as well as to cleaning the air we breathe. The current chair of C40 is Mayor of Paris Anne Hidalgo; and three-term Mayor of New York City Michael R. Bloomberg serves as President of the Board. C40's work is made possible by our three strategic funders: Bloomberg Philanthropies, Children's Investment Fund Foundation (CIFF), and Realdania.

To learn more about C40:

Please visit their [website](#), or follow them on [Twitter](#), [Instagram](#), [Facebook](#) and [LinkedIn](#).



About Nordic Sustainability

Nordic Sustainability is a value-based consultancy firm working at the intersection of strategy and sustainability with the ambition to have positive impact while staying accountable for our own actions. They help their clients by providing strategy processes, insights, and thought leadership based on deep sustainability knowledge and change management tools. Nordic Sustainability is the first Future-Fit Business Benchmark accredited consultancy in the Nordics. Clients include international organisations, foundations, and companies at a Nordic and global scale.

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Cities100

→ *100 city projects making the case for climate action*

The Cities100 report features 100 leading climate action projects from cities around the world. The report demonstrates that cities' leadership on the climate crisis provides the added benefit of creating safe, liveable, and equitable cities for all citizens.

The 2019 digital report is the fourth edition of Cities100 and features 12 different categories of climate action.

Cities100 is a collaboration between C40 Cities and Nordic Sustainability, and is funded by the Danish philanthropic association Realdania.

Read them all by visiting: cities100report.com



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We would like to specifically thank each and every city that submitted an application for Cities100. This report would not be without you and your dedication to climate action is admirable and impactful.

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