C40 CITIES
CLIMATE LEADERSHIP GROUP

Municipality-led circular economy case studies

In partnership with the Climate-KIC Circular Cities Project

eit Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

An urban circular economy is one in which cities keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end their life. It is a more efficient and environmentally sound alternative to the traditional linear economy in which we make, use and dispose of resources.

Foreword

How can cities create prosperity for growing populations whilst transitioning through systemic change to low-carbon economies?

How can cities achieve continued prosperity whilst preserving and reducing their demands on natural resources, like building and construction materials, food and fossil-fuels, that are fuelling conventional economic growth and global warming?

Cities across the world are looking into the circular economy concept, as it is being recognized as a key driver for the much wanted green transition, simultaneously enabling greater energy and material efficiency, lower pollution and GHG emissions and job creation. Cities echo that it is time to accelerate the "reduce, reuse, recycle" mantra by rethinking the approach to development. With their high densities, cities hold the potential to adopt circular, restorative economies where we no longer consider anything to be waste.

The EIT Climate-KIC Orchestrated Innovation Ecosystem program is specifically looking for initiatives that promote and catalyse the sharing of circular economy innovation between cities, regions and networks on a global basis, which is the essence of the Climate-KIC Circular Cities project.

The Circular Cities project has several outputs, including toolkits and the creation of tangible circular city hubs where different circular concepts can be tested, validated and implemented. This first project publication provides a unique overview of concrete circular economy initiatives from cities through 40 examples from around the world. It showcases how cities today are viably putting the circular economy concept into practice to realise systemic change on a district and city level, which can then be scaled-up, not only regionally, but internationally as well. I sincerely hope that cities around the world will be using these 40 case studies and be inspired.

I therefore encourage Mayors and city practitioners, businesses and academia across the world to join this journey to zero waste cities, utilising the circular economy toolkit, and other resources from this Climate-KIC project and wider networks, to unlock the cities' potential to create truly circular city districts through practical application.

Anders Wijkman,
Chairman of the Governing Board for EIT Climate-KIC
November 2018

Climate-KIC's Circular Cities Project

Fast-tracking zero-waste city systems

Cities across Europe now unite in a project working towards a shared circular economy, aiming to identify best practice to follow in the fast track to circularity.

In contrast to the traditional linear economy supporting short-sighted design, conspicuous consumption and the storage or attempted destruction of the resulting waste, a circular economy is all about closing the loop with a holistic and regenerative perspective on design, production, consumption and disposal. The United Nation's Sustainable Development Goal number 12, "Responsible Consumption and Production," clearly addresses the need for a circular economy, and the concept is high on the European Union's political agenda, being the subject of the ambitious action plan "Closing the Loop" from 2015.

Cities and municipalities increasingly recognize the potential of the circular economy in serving as a catalyst for both efficiency and innovation, thereby providing benefits of both an operational and strategic nature. Urban areas lend themselves particularly well to a circular economy system due to their close proximity of citizens, producers, retailers and service providers. Initial research suggests that the circular economy could lead to more jobs and entrepreneurial activity within the areas of remanufacturing, repair, logistics and services.

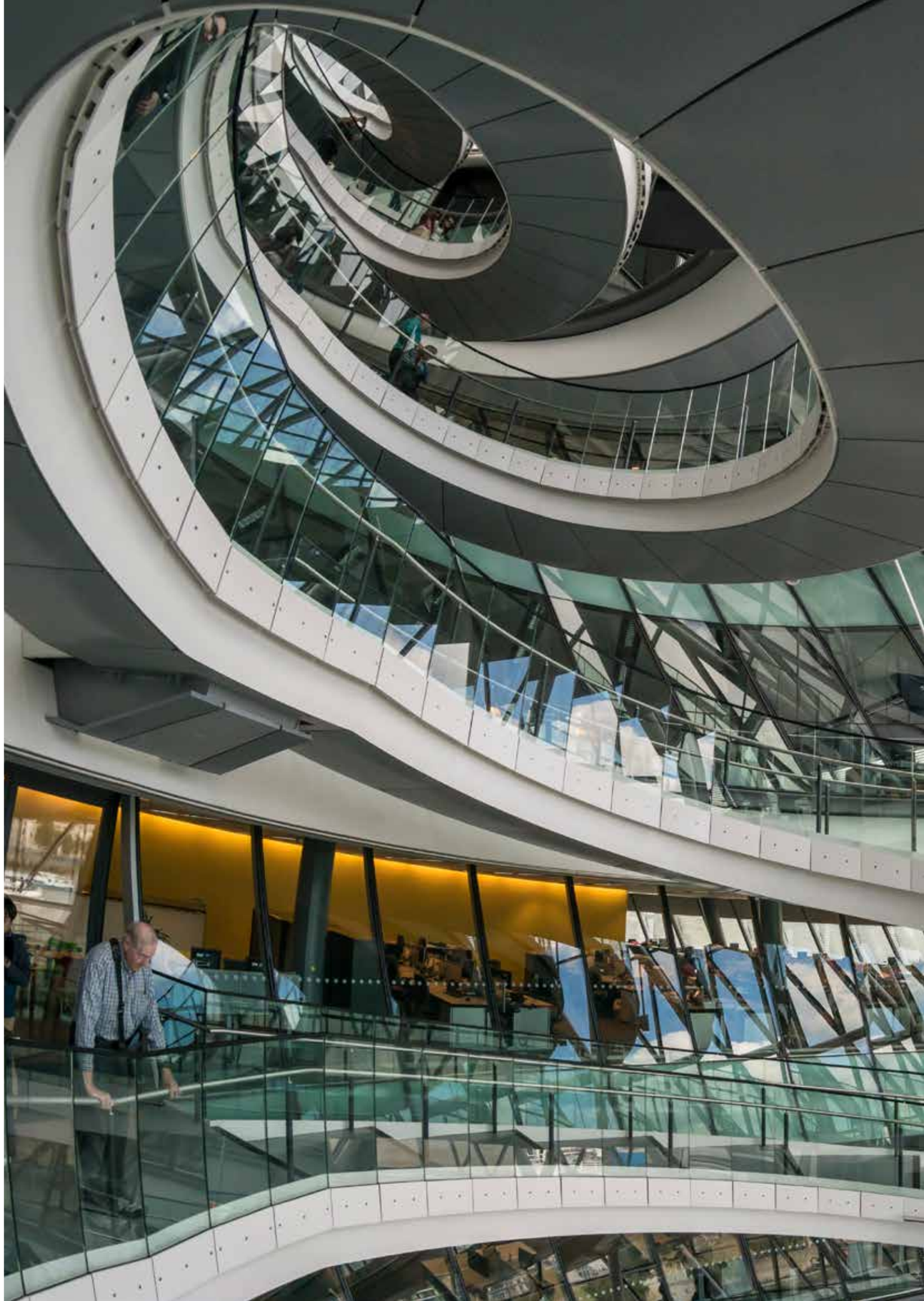
Municipalities' way of measuring success is well established within conventional areas, such as healthcare, education and transport. Here, the applications of specific goals and indicators are often deeply embedded and give them prominence in operational matters. When it comes to circularity and sustainability, however, things are not as clear cut.

Thus, upon identifying the crucial need to define strategies, goals and indicators for sustainability, four pioneering cities have now united to work on a circular economy project under the leadership of the City of Malmö, Sweden: Copenhagen, Denmark; Helsinki, Finland; Sofia, Bulgaria, and Utrecht, The Netherlands. Beyond strengthening the connection between these cities, the goal of the project is to be able to provide input and feedback to cities' long-term strategies by highlighting how processes can be made easier, smarter, cleaner and more resource efficient. The four pioneering cities are closely followed by the cities of Swakopmund, Namibia; New Delhi, India; Lusaka, Zambia; Kristiansand and Stavanger, Norway; St. Petersburg, Russia; Maribor, Slovenia, Singapore, and C40's global network of 94 cities.

The Circular Cities project therefore offers a knowledge exchange platform for both pioneering first mover cities, and cities closely following behind, with regards to embedding circular economy principles into their urban operations.

The Circular Cities project will work to identify the effects, both positive and negative, of incorporating circularity into the cities' planning instruments, as well as how these can be assessed. The outcomes are meant to help policymakers, investors, businesses, consumers and civil society to find the most promising transition pathways.

The formal outcome of the project will include a circular economy toolkit for cities, outlining how cities can effectively incorporate circular economy into municipal planning and strengthen their capacity for systemic innovation. In this way, the municipalities, universities and utility companies engaged in the project will act as inspiration for others and form the basis for possible adjustments to local and national government regulations.



Mapping municipality-led, circular economy case studies

This publication is the first in a series for this Climate-KIC Circular Cities project and provides 40 thorough examples of practical circular economic initiatives from cities around the world, for inspiration and replications by other cities.

C40 Cities managed and delivered this publication, which showcases how circular economy initiatives are implemented within the urban environment.

This reports highlights the growing number of cities taking action. It provides examples of many different and novel approaches that municipalities are beginning to take to move to a more circular economy. Notably, cities are taking the new approach of facilitating innovation, such as initiating living laboratories to test new concepts in regeneration districts and renting rather than purchasing goods through public procurement to uncover operational savings and promote new business models by contractors.

Comprehensive and cross-departmental approaches are creating ecosystems of change, increasing the potential to endure across political cycles, such as through encouraging citizens and large corporates to join the movement, alongside entrepreneurs to become early adopters.

An increasing number of municipalities have an ambitious vision and strategy to become minimal or zero waste cities in the near future. These visions are utilized to help shape and direct to more specific plans and policies, both at a city as well as district level. A well-written and defined vision makes it clear to all departments of the administration what they need to keep in mind when putting their development strategies into practice on a daily basis.

Municipalities usually quantify their success through the application of specific goals and indicators, generally designed and selected to match their overall strategies. For strategies within conventional municipal fields – i.e. education, health, and transport – goals and indicators are well engrained into the municipal psyche. Something which grants them de facto prominence in operational matters. For strategies concerning the relatively new fields of sustainability and the circular economy, goals and indicators are less defined.

The critical questions for cities are: what needs to be done on a municipality level to turn theory into practice, and what hurdles need to be overcome? How can city municipality engage business and civil society to contribute to the transition? Which areas within the city should be focused on to begin the transition towards a circular economy? What are the key benefits of incorporating circular economy principles? In order to become a circular economy, it is vital to identify and initiate change in areas where there is strong political and economic rationale. This publication identifies such areas.

In its essence, the circular economy is about how things can be made smarter, cheaper and more resource efficient.

The circular economy is a strategy that can be applied to help municipalities achieve their overall vision and top-level goals regarding the city's economy, environment, and quality of life for citizens. Furthermore, due to its sustainable nature, the circular economy principles can provide a city's strategic overview with a greater element of long-termism and an opportunity to collaboratively form and implement solutions with citizens, for the future of the city. In its essence, the circular economy is about how things can be made smarter, cheaper and more resource efficient. It can create savings, new income streams, jobs and social cohesion.

In this publication, C40 Cities have mapped out areas under municipalities' jurisdiction, where there is significant potential to embed circular economy principles into systems and value chains in the urban environment. The case studies are themed in the following categories: city-level strategies, urban refurbishment, public procurement, utilities and civic waste. Through this presentation of successful case studies – as well as providing the context for these successes – we anticipate that further opportunities can be identified in urban areas.

Over 130 city-led circular economy initiatives were identified through online research, Climate-KIC's project partners and C40's network and resources. A warm thanks to all individuals from the city municipalities, C40 and other project advisors who contributed to these 40 detailed case studies selected for this catalogue.

Peter Vangsbo
Climate-KIC Nordic

Charlotte Breen
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EIT Climate-KIC is a European knowledge and innovation community, working to accelerate the transition to a zero-carbon economy. Supported by the European Institute of Innovation and Technology, Climate-KIC identify and support innovation that helps society mitigate and adapt to climate change. They bring together partners in the worlds of business, academia, and the public and non-profit sectors to create networks of expertise, to create the innovation that can lead to systemic change.

C40 Cities connects 94 of the world's greatest 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.

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City-wide circular strategy

Urban refurbishment

Procurement

Utilities

Civic waste

CITY-WIDE CIRCULAR STRATEGY

Amsterdam, The Netherlands

Amsterdam's circular economy roadmap and projects in the construction value chain

What is the vision?
The national goal is for the Dutch economy to be fully circular by 2050, using 50% fewer primary raw materials by 2030.

The 2015 Sustainability Amsterdam Agenda set the ambition to be a global leader in the transition to the circular economy. The City aims to prove the circular economy is a realistic and profitable concept.

Who is the team?
The Municipality of Amsterdam lead their circular program. Many stakeholders, including those from the public, private and academic sector contributed, as well as many city departments, including: spatial planning, purchasing, real estate and economic development.

The City of Amsterdam has a 10-year partnership with Amsterdam Institute for Advanced Metropolitan Solutions (AMS) for research support.

What is the local waste recycling context?
Despite the fact that the application of circular principles is technically possible and occurs at a project level, non-circular construction remains the standard. When considering the reuse of construction waste, Amsterdam found businesses showed a focus on low-grade reuse of demolition waste in their everyday practices e.g. for reinforcement under new roads.

What was the approach?
In 2015 Amsterdam commissioned the world's first city-wide circular economy scan to gain an overview of the key material flows in the City and understand the potential economic and environmental benefits of keeping these materials in higher value uses. These included job and GDP creation, lower GHG emissions and waste disposal.

A focus on two concrete value chains – Construction and Biomass and Food – rendered the concept tangible. Next, the program 'Learning by Doing' and the 'Circular Innovation Program' were published.

'Learning by doing' aims to prove in practice that the circular economy is profitable in all aspects through 20 individual projects, including procurement and land development. The Circular Innovation Program led to 30 projects including support for circular start-ups.

What was done?
Amsterdam has multiple initiatives in relation to the built environment, notably they have:

1. **Created a roadmap on circular buildings:**
   A Roadmap Circular Land Issue describes 32 criteria for incorporating circularity in a land issue process and help, yet also challenge, the private sector. These criteria cover five themes: materials, energy, water, ecosystems and resilience.

2. **Applied circular criteria successfully to four development tenders:**
   Amsterdam included circular criteria when leasing public land for three housing development projects (up to 1,500 homes) and a retail development project. These locations are called: Buiksloterham; Centrumeiland; Zuidas; Sloterdijk.
   When applying the roadmap, the most relevant criteria are selected for each development project, in line with local ambitions, area characteristics, and urban planning frameworks.

3. **Created networks for partnerships and training for the supply chain:**
   In recent years, several networks have been set up in which the municipality takes an active role and knowledge on circular construction is exchanged: A Concrete Value Chain Network encourages use of granulated/recycled concrete being mixed with new for example.
   'Cirkelstad' brings parties from different parts of the construction chain together and developer OVG actively shares its knowledge on a circular transformation project in the South of Amsterdam.
   Large contractors have attended a training on circular procurement and construction, organised with a financial contribution from the municipality of Amsterdam.
   Amsterdam also Chair the Circular Economy Task Force of Eurocities and are active in the C40 cities network to share their work more widely.

4. **Commissioned research and established 'living labs':**
   A unique study into the City's future material stock was carried out on 'urban mining in building materials (PUMA),' including available metals in the built environment (steel, copper, aluminium), and a second study into the costs and benefits of circular construction.
   Living labs, such as FabCity, AMS and AUAS Living Lab, help demonstrate the number of circular buildings and methods.

5. **Incorporated into procurement requirements:**
   For example, as of January 2018, the municipality will reuse old baked bricks for 100% of public realm works as it's clear this provides a financial and material saving.

What was achieved?
The initial city circle scan showed that the implementation of material reuse strategies have the potential to create a value of €85 million per year within the construction sector through increased efficiencies.

700 additional jobs can be created, out of 75 thousand people currently employed in Amsterdam's building

CITY-WIDE CIRCULAR STRATEGY

Summary
Amsterdam was the first city to carry out a comprehensive scan of the city's material flow and economic benefits of becoming more circular. Over 70 projects have since commenced, and this case study focuses on those related to the built environment, including a roadmap, knowledge networks, living labs and procurement criteria.

Time period
2015-2018

Municipality levers
Research; Procurement; Provision of information; Knowledge networks; Planning policy

Scale
The initial city-wide circle scan showed that the implementation of material reuse strategies had the potential to create a value of €85 million per year within the construction sector through increased efficiencies.

Under the Construction value chain, Amsterdam include all activities related to demolition, renovation, transformation and new construction of buildings, civic and hydraulic engineering and the public space, within the City's boundaries. The chain of subcontractors also falls within scope, even if they are located outside Amsterdam.

CO_2 reduction
The initial scan estimates that in the construction chain alone, material savings of 500,000 tonnes are possible, which is significant when compared to the current annual import of 1.5 million tonnes of materials. This would save half a million tonnes of CO_2 per year – or 2.5% of the current annual CO_2 emissions of the city.

sector. For the most part, the additional jobs would be for low- to medium skilled personnel.

An overall evaluation of all 73 projects' progress to date, released in 2018, found the transition to a circular economy to be realistic and profitable. There is technical capability to close the loop on material chains and generally circular projects are financially more competitive than traditional ones, when external costs are taken into account.

Although research has demonstrated that the initial construction and investment costs of a circular building are higher, in the longer term, large benefits will be possible through the residual value of parts and building adaptability. The expectation is that with a growing demand for circular buildings, a decrease in the additional costs of circular buildings will occur.

Amsterdam won the World Smart Cities award in November 2017, partly in thanks to their circular strategy.

What were the challenges?

A specific challenge for Amsterdam related to the built environment is that legally it is not allowed to locally set requirements for construction and demolishing projects that surpass the requirements of the national Construction Act. Amsterdam is therefore in dialogue with national government and appealing through the Crisis and Recovery law.

For other cities at the start of their circular journey, Amsterdam has the following recommendations:

- Since circular economy projects rely on a cross-sectoral approach, it is essential to involve the entire city administration from the very beginning.
- A clear starting point for every city is to get an in-depth insight into their city's make up. Then, based on clear criteria, leaders must choose the most relevant value chains, from both an economic and an ecological perspective. A good method to achieve a circular economy is to use existing strategies, such as green procurement.
- The importance of intensive cooperation with all stakeholders should not be underestimated.
- Because of local characteristics, each land issue project is unique. Chances of success are highest when both generic and area-specific ambitions are formulated early in the development process. Plenty of time in the tender process is required as circular principles can be complex to apply, such as adaptability for future uses or modular build.
- The circular economy concept must be made tangible and practical, for both professionals and citizens.

Next steps

An in-depth evaluation combined with strategic advice for the next political term from 2018 to 2022 is underway to help focus the upscaling of these projects and will include short-term achievable goals.

Amsterdam will be continuing to evaluate and fine-tune the 'Roadmap circular land issue' and is encouraging standard definitions and guidelines for circular construction at the national level, for example the DGBC (Dutch Green Building Council) aims to introduce criteria from the circular roadmap in the BREEAM system. The Netherlands Standardization Institute (NEN) is also working on a standard for circular construction. Many municipal departments across the Netherlands are now launching their own projects.

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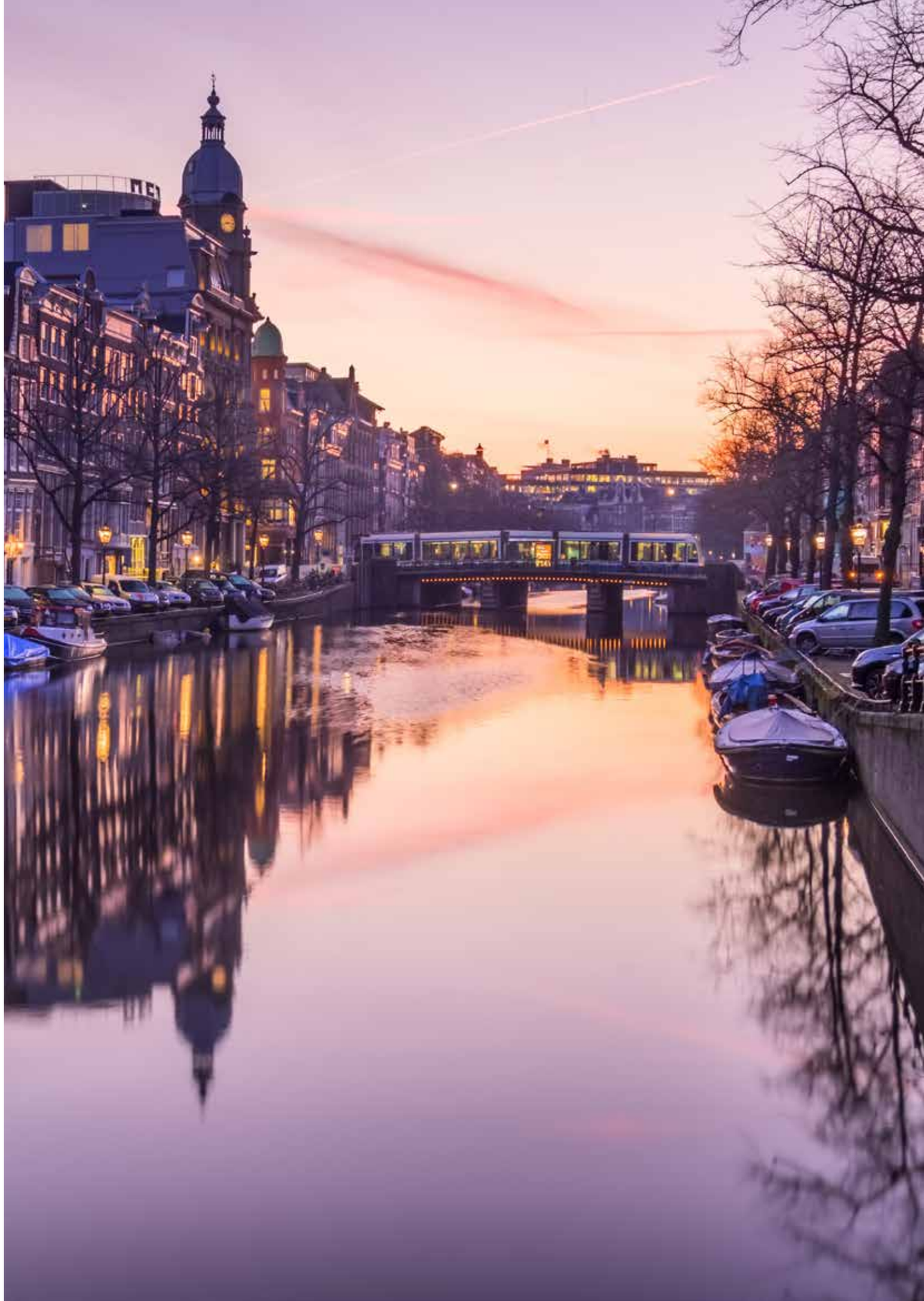

Brussels, Belgium

Regional program for a circular economy: 'Be Circular'

What was the vision?
Be Circular's vision is for these environmental aims of resource efficiency to help stimulate the economy, maximising local resources to boost entrepreneurship and create new employment opportunities with Brussels.

Specifically, the Be Circular program aims to support 50 new retail businesses and 200 start-ups/existing businesses to adopt circular economy principles. The program also aims to train 2,000 economic operators in the city through events in-person and 20,000 through online information.

Who was the team?
This program spans 15 governmental administrative departments and over 60 stakeholder organisations from public, private and academic sectors.

What is the local context?
The Brussels-Capital region has 1.2 million inhabitants, and the fourth highest GDP per capita (Eurostat 2018) though 18,5% unemployment, mostly amongst the low-skilled and young population. Due to its geographical situation, the region is highly dependent on resources from outside the region.

The City municipality has areas of authority greater than usual as it stretches into the regional governance.

Approximately 1,670,000 tonnes of waste are collected annually in the Brussels region, which corresponds to a total of 1.4 tonnes per inhabitant per year.

Brussels already exceeds the (2008/98/EC) European Waste Directive's construction and demolition recovery target of 70% by 2020, at 91%, and is close to reaching the 2020 household waste recovery target of 50%, being at 40% in 2014. Regarding waste from professional activities, including businesses, non-commercial organizations and public authorities, 473,000 tonnes per year is produced, of which 49% is recycled. All remaining waste is incinerated for energy.

What was the approach?
Brussels' 'Employment Environment Alliance' program, 2010-2014, established a formal collaboration for the first time between the Minister of Environment; Energy, Housing and Quality of Life and the Minister of Economy, Work and Training. This provided a strong foundation for the Be Circular strategy, which also includes the Minister of Research & Innovation and Waste Collection.

Brussels already exceeds the European Waste Directive's construction and demolition recovery target of 70% by 2020, at 91%.

Be Circular was one of the first of 18 objectives of the overarching 2025 strategy for the Brussels region, launched in 2014. A steering committee ensures alignment with this overall strategy, and a coordination committee ensures effective working between the 15 public administrations involved.

A careful approach was taken to balance the top-down vision with bottom-up stakeholder workshops. Also, to ensure this program complements existing environmental policies and plans.

What was done?
In 2014, an urban metabolism study was completed with support from the architecture and engineering department of Brussels' University and the consulting company Ecores. This identified the main material flows in the city, key challenges to reduce them and thus enabled a better-informed dialogue with relevant stakeholders.

A series of co-creation workshops followed, including 60 stakeholders from the public, private and academic sectors, to define the levers for change. Thematic coordinators were appointed as ambassadors to help create a link between public and private sector and this resulted in a comprehensive list of 111 actions, which were subsequently approved by the Government.

The workshops included those focused on five sectors: Food; Waste; Retail business (the third sector in terms of job creation in Brussels); Construction (which consumes 20% resources entering Brussels, 12,000 business and 20,000 workers in Brussels); Logistics (as it produces 1/3 of the city's GHG emissions). Cross-functional, territorial and governance were also focus areas.

An online platform enables all the stakeholders involved in these consultations to exchange information online and report on progress.

As well as direct financial support for businesses, indirect municipal support includes awareness raising, guidance for transitioning businesses to more circular use of materials and subsidised collaborative work spaces, with wider services such as on-site lawyers, through the 'Greenbizz' program.

Actions related to the built environment include:
- Training.
- Pilot project for reversible construction.

CITY-WIDE CIRCULAR STRATEGY

Summary
Multi-disciplinary regional program integrated across three government departments and 15 administrations, with 111 actions co-created with businesses and academics to promote a circular economy and job creation.

Time period
2016-2020

Municipality levers
City strategy; Financial investment; Training and awareness raising; Stakeholder engagement

Scale
The program spans the entire Brussels region of 161km^2.

The annual Be Circular program budget is €13 million. Businesses applying with a circular project for the existing regional budget of €27 million of investment aid will also receive an additional percentage of aid.

Within this, the Be Circular fund for providing grants to circular economy business projects is €1.5 million annually, and another fund of €1.5 million, called BruCircle, will be tested for 3 years to grant loans between €70,000 and €100,000.

CO_2 reduction
This circular program will enable lower carbon emissions by the City and its citizens. This overall reduction is intended to be tracked as part of macro indicators at the regional level that the City is working on with a UN Environment Program and academics.

- 10 priority development sites encouraging increased use of temporary buildings.
- A business park dedicated to circular economy companies.
- An assessment of the current level of circularity of the construction sector and proposing a pathway for the sector to progress towards a circular economy during the next 30 years.

Achievements to date

After 18 months of implementation, the average rate of progress of the Be Circular measures is 45%, with over two years left for the program.

Progress of business guidance and funding measures:

- 222 companies have been coached and supported in the implementation of a circular economy approach.
- 139 business or research projects have been financially supported for a total budget of €8.3 million.
- 1,423 people (workers and students) have been trained through the measures dedicated to training and education.

Be Circular has received two innovation awards:

- The Regional Innovation award (2016) organized by the Assembly of European Regions (AER).
- The Eurocities award (2017) for innovation.

Challenges and lessons learnt

As Be Circular breaks with the traditional configuration of government ministries and administrations working in silos, this ensures more consistent policy implementation and an enhanced resilience of the projects initiated across political cycles.

In practice, collaborations have emerged that were inconceivable a few years ago: Brussels public administrations, which used to work in silos, are now developing common work programs and budgets; public administrations collaborate with federations and businesses to develop common projects; the scientific community, public and private players are connecting to foster a systemic perspective on the transition of the Region.

This multi-stakeholder governance can naturally be more time-consuming to reach consensus, but engagement is an essential part of the program to for implementing the aims. The municipality observes that all players are gradually agreeing on the fact that transition to a more sustainable economy will not happen without support from the diversity of players that composes our economy.

This cross-functional and collaborative approach will be key to one of the most important challenge the Be Circular program is facing, which is translating circular economy principles into urban planning. The working group recognises this will be a complex process which will entail, above all, a longer-term approach.

Next steps

This program aims to continue to refine the metrics to better monitor progress, with a planned revision process every 18 months and welcome new actors.

Simultaneously, the Region of Brussels is collaborating with the Global Initiative for Resource Efficient Cities, (GIREC) working group of UN Environment Program, to design a list of circular economy macro indicators to be able to monitor Brussels', and other cities', progress towards a circular economy.

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Cape Town, South Africa

Industrial symbiosis program

What was the vision?
The Western Cape Industrial Symbiosis Program (WISP) provides business members with time and technical expertise, connecting companies with unused or residual resources such as materials, energy, water, assets, logistics and expertise. Through the sharing of resources, this enables businesses to:

- Cut costs and increase profit
- Improve operational efficiencies
- Create new revenue streams
- Learn from us and each other
- Operate more sustainably
- Divert industrial waste from landfill

Who was the team?
GreenCape is delivering the program with technical support from the City of Cape Town and further financial supporters. GreenCape is a non-profit organisation that drives the widespread adoption of economically viable green economy solutions from the Western Cape.

What was the approach?
WISP reaches out to businesses and industry to set up meetings and site visits to better understand the overall operations, mechanisms and waste streams to ultimately identify unused and/or underutilised resources.

Executive Mayor, Patricia De Lille, of the City of Cape Town, commented: "The City of Cape Town is a proud WISP supporter and funder. The program is an amazing celebration of innovation, resilience and creativity by local firms in Cape Town."

What was done?
Through workshops lead by the City of Cape Town and GreenCap, alongside an online database called SYNERGie™, potential matches between businesses in the network are uncovered. As a result, more than 4,000 potential synergies between the 486 companies in the network were identified.

WISP then facilitates engagements and resource exchanges between businesses that have matching operations. In exchange for this free of charge service, the organisation asks for feedback on the financial, social and environmental benefits of the match to further improve future matches.

The program also developed an international standard carbon calculator to measure emissions savings from materials saved from going to landfill and emissions avoided from reduced production and transportation of new raw materials. Over the following three years, WISP forecasts the synergies will generate 64,500 metric tonnes of CO_2 equivalent savings.

More than 4,000 potential synergies between the 486 companies in the network were identified.

What was achieved?
The cumulative impact of WISP over the last five years is as follows:

- 27,436 tonnes of waste diverted from landfill.
- 46,700 tonnes greenhouse gas emissions saved (equivalent to nine 2.2MW wind turbines installed in South Africa).
- R43.08 million (€ 2.8 million) generated in financial benefits through additional revenue, cost savings and private investments.
- 143 jobs created in the economy (25 directly in member companies).

The program has received multiple award nominations, including being a three-times finalist for various circular economy awards.

What were the challenges?
South Africa faces challenges with respect to resource use, including its reliance on fossil fuels for energy, water scarcity, and high landfill rates. Industrial symbiosis aims to address this by promoting reuse and recycling of industrial water.

Next steps
The success of the WISP has catalysed the development of other industrial symbiosis programs in other South African provinces such as Gauteng (GISP), KwaZulu Natal (KISP) and demonstration activities in the Eastern Cape, and is seeking to expand further.

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CITY-WIDE CIRCULAR STRATEGY

Summary
An industrial symbiosis program in Cape Town reduces CO_2 through saving resources going to waste in the industrial sector by matching businesses to share their inputs and outputs, underused assets or expertise, which can save money, develop new business opportunities and create jobs.

Time period
Since 2013

Municipality levers
Convening businesses; Financial contributions; Technical assistance

Scale
The program was the first industrial symbiosis program established in Africa and stretches across the Western Cape that covers six districts, including the City of Cape Town.
It receives funding from the Western Cape Government, the City of Cape Town, and the British High Commission.

The project has more than 300 members in the network and have identified over 3,000 resources. 43.08 million ZAR (2.8 million €) has been generated to date in financial benefits to businesses, through additional revenue, cost savings and private investments.

CO_2 reduction
46,700 metric tonnes of CO_2e saved over four years since the program launch.

Over the following three years, the synergies are expected to generate 64,500 metric tonnes of CO_2e savings.

Copenhagen, Denmark

Circular Copenhagen – resource and waste management plan

What is the vision?
The City of Copenhagen aims to be the world's first carbon neutral capital by 2025.

The plan targets 70% of municipal waste to be recycled by 2024, equating to 59,000 tonnes CO_2 reduction, and therefore supports the headline vision. Another goal is for Copenhagen to become a leader in the circular economy through further targets, such as tripling the amount of goods re-used by municipalities.

Who was the team?
The Circular Copenhagen Resource and Waste Plan 2024, primarily concerns municipal waste from households and light industry waste. Construction and demolition waste initiatives are also included. The resource and waste management plan particularly relates to Climate Plan 2025 and must be viewed in conjunction with this as well as the municipality's other plans and visions.

Public hearings are a part of the process of making the plan. Citizens, organizations and industries are playing a crucial role, since they are concerned in many aspects of the initiative.

What was the approach?
It is established in the regulatory framework that a new waste-and resource plan must be made every six years. The current resource and waste management plan started in 2013 and ends in 2018.

The City of Copenhagen has been in dialogue with the Danish Environmental Protection Agency during the preparation of the plan and the expectation is that the national waste plan will contain elements of the EU's circular economy package.

What was done?
City of Copenhagen has a leading and executing role in terms of implementing this new plan.

The plan contains a number of concrete initiatives, which are gathered in six themes. Additional efforts ensure that Copenhagen meets the objectives during the planned period, such as developing new technological solutions for waste management, promoting more dialogue and action to recycle and embrace circular principles.

The plan expects wider benefits of the various initiatives promoting more circular practices, including the creation of jobs, new materials for the industry, raising the quality of recycling and investment into new technologies.

The City of Copenhagen aims to be the world's first carbon neutral capital by 2025.

What are the challenges?
The key challenge is to organize a system with information and infrastructure that supports source separation. The quality of the source separation – collecting as pure fractions as possible – is essential for the final recycling and upcycling of the resources.

Furthermore, a challenge has been to develop new solutions not seen before. This has required comprehensive preparation in developing an ambitious and feasible plan.

Specific risks and challenges are considered for each initiative in order to be aware of these during implementation.

Next steps
This plan is seeking sign-off in mid-December 2018, to then commence implementation.

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CITY-WIDE CIRCULAR STRATEGY

Summary
A new Resource and Waste Management Plan raises the level of ambition for Copenhagen to progress towards a circular economy.

Time period
2019-2024

Municipality lever
Strategy; Action plan

Cost
The implementation is forecast to amount to 851 million DKK or approximately €114 million in total.

CO_2 reduction
If the goals are achieved, there will be a reduction in CO_2 by 59,000 tonnes from an increased recycling rate to 70%, which is almost 5% of the city's total carbon footprint.

Glasgow, Scotland

Inspiring businesses to innovate and become future-proof

What was the vision?
The City of Glasgow's vision is to become one of the world's first circular cities, creating a movement to inspire businesses of all sizes to innovate and become future-proof by adopting circular strategies. Connecting companies across the city, Circular Glasgow helps them to open up new revenue streams, increase competitive advantage and realise financial savings using a range of practical initiatives.

Who was the team?
The Glasgow Chamber of Commerce hosts Circular Glasgow and is responsible for delivering this program alongside key stakeholders: Zero Waste Scotland; Circle Economy (consultants based in the Netherlands); Glasgow City Council; The University of Strathclyde.

What is the local context?
Glasgow is Scotland's largest city, and nationally, the Scottish Government has set a zero waste to landfill plan, including 70% recycling and composting for all waste by 2025.

What was done?
In 2015, the City took its first steps to creating a stronger more sustainable economy by completing a pioneering Circle City Scan. Commissioned through a partnership between Glasgow Chamber of Commerce, global experts Circle Economy, Zero Waste Scotland and Glasgow City Council, the scan showed that adopting circularity can spike job creation, increase resource efficiency and reduce CO_2 emissions throughout the city.

Through analysing Glasgow's economic and political landscape and by mapping the city's resource flows from consumption to waste, the scan identified leading industries through which the city's economy can become more 'circular.' The study also brought into focus ways the Chamber could directly support local organisations in adopting circular models; including new collaborations, market opportunities, significant financial savings and generating increased profits.

The food and beverage sector was highlighted as having great circular potential with strong consumer influence. As a result, a number of practical and scalable pilot studies were identified, including aquaponics, heat recovery and the creation of a new local beer made from left-over bread rolls. Aulds Bakers supplies its bread on a sale or return basis to retailers, and through a new partnership, surplus is now given to Jaw Brew brewery to ensure any waste is reused.

Circular Glasgow's online challenge reached over 600,000 people globally.

Following recognition from the World Economic Forum for its initial phase of work, Glasgow Chamber of Commerce is now working directly with local businesses, supporting the adoption of their own circular ambitions. Whether organisations are just starting their journey to circularity or already have circular processes in place, 'Circular Glasgow's' suite of programs and tools have been tailored to facilitate each organisation in implementing their own ideas and plans. No matter which sector, the range of support offers businesses endless possibilities in terms of integrating circularity into their day-to-day work practices.

Engagement activity has been steady and consistent and is well on its way to achieving engagement targets for the program (9,260 out of a target of 10,000 online users).

In March 2018, Circular Glasgow was the first city to host an online challenge via Circle Lab, inviting individuals and businesses to contribute circular ideas to universal challenges within the events sector. The challenge reached over 600,000 people globally and saw 60 ideas submitted from 13 countries. Work is now underway to support the implementation of resultant ideas and solutions.

Circular Glasgow has also directly engaged with over 500 individuals and organisations through a range of face-to-face support mechanisms, including Circle Assessments, workshops, open forum information events and stakeholder engagement conferences – both locally and international.

Specific invite only events have also included a range of engagement opportunities for small and medium enterprises. From 'Showcase Events' bringing to life local best practice, to the construction and finance summit, where over 70 key business leaders in the city were brought together to explore how the city could adopt circularity in both existing and future urban projects. With many major infrastructure projects underway in the city, this summit provided an opportunity to embed circular thinking in the construction sector and the supporting finance sector.

What was achieved?
Circular Glasgow has seen many local businesses adopting tangible and practical pilot projects. As a result, this movement has helped to illustrate the real benefits of transitioning towards a more circular economy, including economic growth, prosperity and security by reducing the city's dependency on scarce natural resources.

Not only has this thinking inspired local businesses, it has also played a key role in ensuring Glasgow City Council's commitment to a circular economy at a city level.

CITY-WIDE CIRCULAR STRATEGY

Summary
Circular Glasgow is a program of activities aimed at businesses of all sizes, to provide support, tools and expert knowledge for more circular operations. It connects companies across the city by helping them to open up new revenue streams, increase competitive advantage and realise financial savings using a range of practical initiatives.

Time period
2015 onwards

Municipality levers
Provision of information, Events, Financial and tailored business support.

Scale and Cost
Circular Glasgow complements the Zero Waste Scotland strategy and the Scottish Government's nationwide support for small and medium enterprises to develop circular economy business ideas, including its £18 million (€20 million) Circular Economy Investment Fund and Circular Economy Business Support Service.

Both are supported by the European Regional Development Fund through the €82 million Resource Efficiency Circular Economy Accelerator Program.

CO_2 reduction
CO_2 reduction results are due to be available mid 2019.

Scotland's 2010 zero waste plan estimates that 2,000 jobs could be created through working towards being zero waste. The impact and measures of success created directly from Circular Glasgow's work is being measured by the University of Strathclyde on an on-going basis. The impact study will look at the impact of the program to date, and focus on key impact indicators of: business engagement; potential carbon reduction and potential job creation. Results will be available on conclusion of this phase, mid 2019.

What were the challenges?

The biggest challenge for Circular Glasgow is continuing to ensure it can demonstrate real business benefits and scalability of circular business models through its work, and a replicability to alternative sectors.

Maintaining 'buy in' to the circular economy from business leaders is key, particularly around understanding the concept of circularity and their ability to assess the direct opportunities and benefits this can bring to their business.

A maintained political focus on the circular economy, currently evidenced by the Scottish Government, is also crucial.

Next steps

Glasgow sees this new approach as a solution to create improved product quality, economic growth, jobs and ultimately a future proof, more resilient city. Through strengthening partnerships with leaders and key influencers of Glasgow City Council, Circular Glasgow aims to take on an increasingly central role in positioning the city as a front runner in circularity, serving as an example for cities around the world.

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Gothenburg, Sweden

Circular Gothenburg

What was the vision?
To transition Gothenburg from a linear to a circular economy, moving from a society with unsustainable consumption to a society of reuse, sharing, repairing and preventing waste. Gothenburg aims to do this by transforming its own departments and strengthen the City´s ability to push, co-operate, communicate and support this transformational work required to achieve the desired results together with many stakeholders.

Specifically, the City of Gothenburg aims at reducing the amount of household waste per Gothenburg citizen by 30% between 2010 and 2030 by preventing waste and encouraging reuse. Recycling of waste is not included in this target.

Who was the team?
The circular strategy has the following stakeholders: Gothenburg City's own operations, business, other municipalities, civil society and universities and colleges.

Fixotek partners comprise: Bostadsbolaget, Familjebostäder, The Tenant Association and Chalmers University of Technology

What is the local waste recycling context?
The average Gothenburg citizen produces almost 400 kg of waste per year. Whilst recycling rates are relatively good, it is recognised there is a need to focus on more reuse and waste prevention to reach environmental and climate goals, reducing waste and promoting more sustainable production and consumption.

What was the approach?
The Circular Gothenburg administration is located in the City´s Consumer and Citizen Service department and works alongside many other City departments, who provide time and resources, to achieve results together.

The team bid for central resourcing from the City's environmental fund called Miljöstimulansmedel (MIST), and sought funding from other sources for the individual initiatives, including the Fixotek projects.

Through collaborative working, the team established the Circular Gothenburg vision to drive and coordinate ideas and initiatives that create real conditions for increased sharing, reuse and repairs. The team holds a strong belief that the municipality can have several important roles in this transformation to a more circular economy, and the Circular Gothenburg program works to strengthen and develop each of these roles – from the City's own resources that it has control over, to fostering cooperation and support from many other actors to impact the wider city.

What was done?
The City's circular initiative, Circular Gothenburg, is focused on resource efficiency to reduce climate change and achieve circular material flows. It has three target groups: citizens, the City's own departments and businesses. For all three target groups, the goal is to make it simple, clear and attractive to participate in transformational circular work.

The goal is to make it simple, clear and attractive for citizens, the City and businesses to participate in transformational circular work.

The City's own departments:
1. Giving the City departments clear goals, guidelines and simplified conditions for circular transformation.
2. Providing assistance in purchasing and procuring circular products and services.
3. Communicating the possibilities and benefits of circular products and services.

The citizens:
4. Stimulate and help the City's departments to use their own resources to help citizens consume sustainable by:
5. Supporting civic society´s sustainable consumption activities and developing the departments own function.
6. Collaborating, testing and scaling up new circular activities together with other actors.

Businesses:
7. Collaborating to find attractive working relationships between sustainable production and consumption.
8. Helping to develop constructive and clear requirements and needs for circular products and services that can contribute to the transformation.
9. The Fixotek projects are one of many initiatives and involved establishing the finance and physical space in the city for four repair and reuse centres. The centres employ a total of 23 people and are currently undergoing an evaluation of progress.

What were the challenges?
It has been challenging for the team to work horizontally across municipal departments, in broad collaboration, and sometimes dealing with issues that are not directly linked to the main tasks.

The transition from the project planning phase to operational and upscaling phases, as well as obtaining permanent funding for central coordination of the program, have all been challenging aspects of the program.

Next steps
The team aim to expand their initiatives to further reduce and reuse materials within Gothenburg.

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CITY-WIDE CIRCULAR STRATEGY

Summary
A circular strategy for the city that includes multiple stakeholders and initiatives, such as the 'fixotek' repair and share centres

Time period
2016 onwards

Municipality levers
City vision; Action plan; Subsidised community centre

Scale and Cost
The city-wide circular strategy has a budget of approximately 2,400,000 SEK per year (circa 230,000 €), mostly from the City's environmental fund, which provides for three dedicated full-time city official and other operating expenses.

The four 'Fixotek' projects total 8,000,000 SEK or about €750,000 and has various funders, such as the Swedish Energy Agency, Research Councils and the National Research and Development Agency, Vinnova.

CO_2 reduction
The team is currently exploring ways to measure overall carbon reductions of the project.

Helsinki, Finland

The Kalasatama district's urban laboratory

What was the vision?
The primary goal was to speed up the development of smart services in a traditionally slow urban context. Another goal was to offer small operators the chance to test their solutions in an authentic environment. The companies should have the possibility to get market references, gather genuine user feedback, and co-develop their services with the city and residents.

The aim was to find, co-create and demonstrate innovative, practical solutions that were climate-positive, smart with resources and improve people's wellbeing. The pilots chosen for the program were solutions for future challenges and are closely linked to the City of Helsinki's strategy.

The district aims to have services that are so efficient each resident would gain an extra hour of free time every day. This extra hour could then be used for doing something more rewarding than just taking care of everyday chores.

Who was the team?
Smart Kalasatama project is coordinated by Forum Virium Helsinki, the City of Helsinki innovation unit. It develops new digital services and urban innovations in cooperation with companies, universities, other public sector organizations and Helsinki residents.

Essential stakeholders for this initiative to succeed:
- Startups & SME's (100+)
- Companies (25+)
- Residents (1000+)
- Academia
- Public Sector
- NGO's
- Innovation visitors (1700+)
- The funders

The local context
The Helsinki region is growing rapidly and expected to house an additional 490,000 people in the next 35 years. To boost new sustainable urban solutions, in 2013 Helsinki City Council decided to make one of the new neighbourhoods under construction, Kalasatama, a model of smart city development. A former harbour and industrial zone on the waterfront east of the city centre, will be home to 25,000 people, and the site of 10,000 jobs by 2035.

In 2016, municipal waste averaged 313 kg/person/year, with 50% recycled.

The district aims to have services that are so efficient each resident would gain an extra hour of free time every day.

How was it approached?
This project required a completely new approach. Usually the City procures a service or a product. In this case the City procured innovative pilots, in order to generate as many learnings as possible and value for all the stakeholders. The solutions that were pilot tested might have significant influence in reducing emissions in the future. These pilots were in a very early stage, and this opportunity gave the start-ups a great possibility to develop the idea with the citizens.

The biggest obstacle at first was to use the European Regional Development Fund money for this because the EU-funds are usually not very flexible and the end results have to be stated in an application. But the team managed to find a way to convince the regional authority. The model itself was innovative and has been scaled up in cities across Finland. During a pilot round focused on wellbeing, other approaches, including corporate partners as sponsors for the pilots, were also explored.

What was done?
In Smart Kalasatama, the entire neighbourhood works as an innovation platform, an urban laboratory, where new solutions can be developed and tested. This 'Living Lab' environment includes the area's key infrastructure, such as the Kalasatama school, the vacuum-based pipeline waste collection system, the energy network and the health and wellbeing centre. A co-creation space is located in the area, offering a site for meetings and networking.

Smart Kalasatama and its partners procured, facilitated and were involved in running 20 pilots between 2015 and 2017, several of which were circular and sharing economy related, including:

1. Yhteismaa (Nifty Neighbour and Mesenaatti.me) – a map and location-based social web service. Nifty Neighbour explored how the service can help residents of Kalasatama to generate and test ideas to improve the neighbourhood and to enable initiatives by crowdfunding. In addition, the platform enables residents to offer or request the sharing of goods and services in the neighbourhood

2. Link Design Oy, Foller – reducing food waste by making use of internet-of-things technologies and sharing food with neighbours.

3. Witrafi Oy, Rent-a-Park – a peer rental service for parking space that connects space providers with drivers. Parking space owners can rent their spaces to others when they do not need them.

CITY-WIDE CIRCULAR STRATEGY

Summary
The Smart Kalasatama pilot procures prototype technologies for rapid testing in an urban environment, many of which adopt circular principles. Through the process of co-creation, solutions to urban challenges are trialled for up to 6 months in the Kalasatama development district, to learn by doing and help accelerate innovation.

Time period
2015-2017

Municipal levers
Planning policy; Procurement; Living lab; Co-creation competitions

Scale and Cost
The harbour, a former industrial district, will develop homes for 25,000 people and 10,000 jobs by 2035. Over 125 start-ups and enterprises have participated, alongside over 1,000 residents and many other stakeholders.

The average annual costsm, covering two, six-month pilot rounds with 8 technologies tested, totalled €214,000.

Smart Kalasatama is funded by the European Regional Development Fund, the City of Helsinki and the Ministry of Employment & the Economy.

CO_2 reduction
This urban laboratory enables lower carbon emissions and many initiatives create direct carbon savings, such as those part of the 'smart & clean' themed pilot round.

4. Innogreen's vertical outdoor solution – tackles with greywater and supports biodiversity in the area under construction with a modular solution.

Cost breakdown
The average annual cost for two, 6-month pilot project, with 8 technologies tested:

- Personnel costs: about €100,000
- Research and evaluation: at least €20,000
- Workshops, communications and other operating costs: €30,000
- Procuring pilots: 8 experiments, each costing €8,000: €64,000
- Total: €214,000

What was achieved?
The program for agile piloting is a model to engage the whole urban community in the development of everyday solutions for the future. The model generates learnings and value for all stakeholders. The program also provides a neutral platform for collaboration. The thematic pilot rounds support the identified goals linked to city strategy ranging from resource-wise and climate positive solutions, to promoting wellbeing and health. The City receives insights on future use cases, as well as understanding to help with future development and procurement processes.

The residents can contribute as initiators, testers and co-developers of the services they are interested in. The large corporations can participate by providing their technologies or platforms and gain valuable user insights, as well the possibility to collaborate with start-ups and the City. Start-ups gain their first market references, experiences, a valuable network and visibility.

What were the challenges?
The short 6 month pilot length is a challenge, though this supports the City to become more agile, as well as identify the barriers that arise with each experiment and theme.

Sometimes the small players of the agile piloting have limited resources, to take their service model to the next level during the piloting for example. The financial support from the City for each procurement (€8 000), could be deemed as relatively small.

Start-ups gain their first market references, experiences, a valuable network and visibility.

Next steps
This urban laboratory model is already being replicated across other areas in Helsinki and more widely across other cities in Finland.

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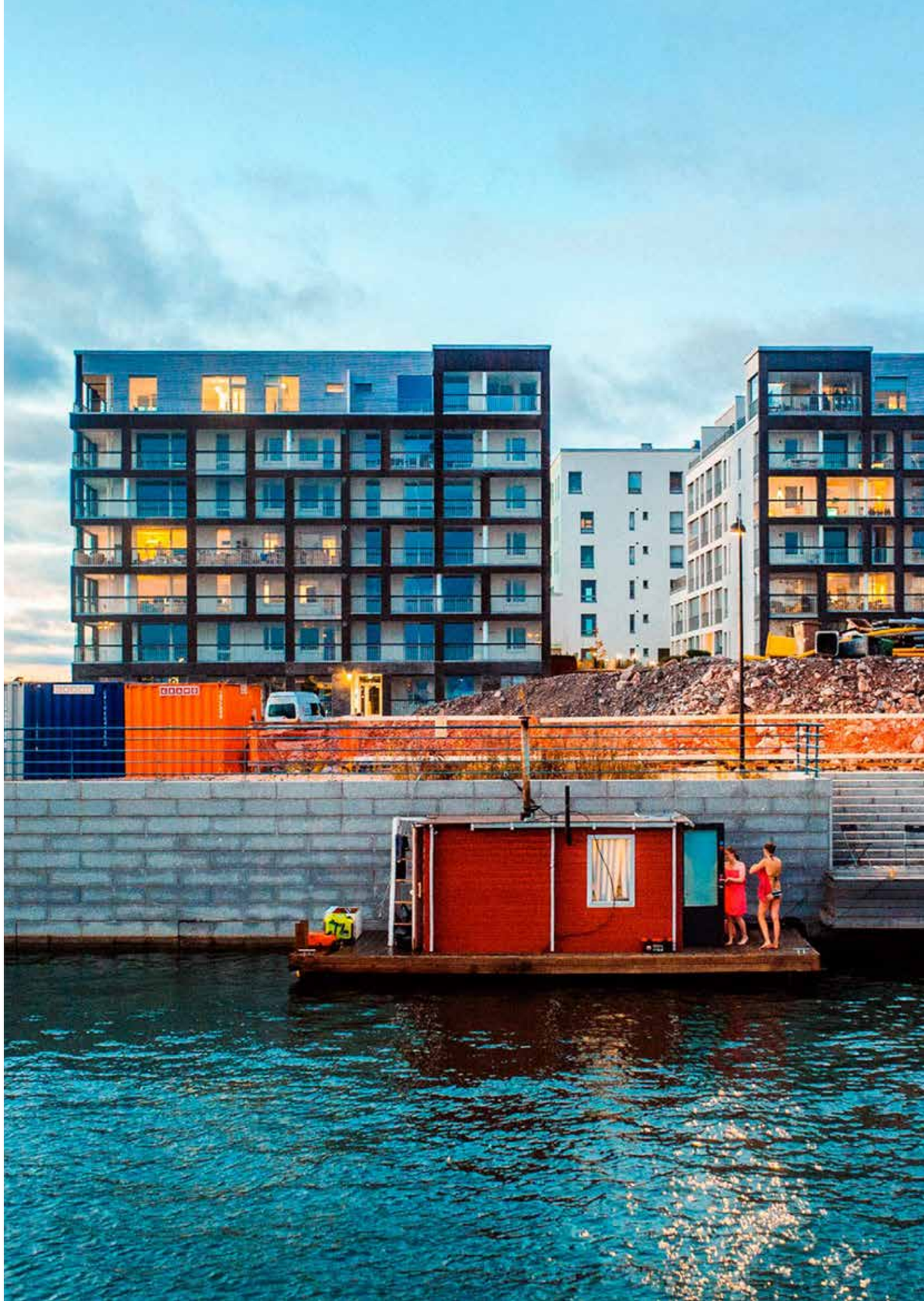

Kristiansand, Norway

Green business idea competition and growth support

What was the vision?
Kristiansand's masterplan for 2030 has underlined a few overall goals to be a green and innovative city. The City aimed to have more focus on sustainable new business ideas for a stronger business community and for future competitiveness, applying technology for green and sustainable businesses and a low carbon economy.

Who was the team?
This initiative was started by the Urban Development Planning department of the City of Kristiansand, and in 2017 responsibility was transferred to the Business Region Kristiansand (BRK). BRK is responsible for the organisation, financing, collaboration with partners, panel of judges, the event, prizes, and follow-up after the awards, collaborating with Climate-KIC.

Further partners include: Vest Agder fylkeskommune (County Council), Innovation Norway, Knowledge fund, DNB (Bank), Climate-KIC, innovation centres in the region, entrepreneurial centres, municipal partners and of course the start-ups who are the core foundation of this initiative.

What was the approach?
The competition required a new approach for the City.

The City Council approved a strategic business development/economic growth plan for the city and its neighbouring municipalities in December 2014. Some members of the City Council called for a program with a focus on sustainable business ideas, circular economy or green growth. In 2014, the City had already designated an advisor for the task and the Green business idea competition became a project. The City and the partner funders were all very influential in helping the realisation of the program.

The competition is focusing on start-ups with the ambition to succeed and which the City can support.

What was done?
The Green business idea competition is the responsibility of the City of Kristiansand. Every year around late August, the annual business competition is launched in the whole of the Agder region. The City of Kristiansand connects with all municipalities in the region and contacts for start-ups. This includes connecting with innovation centres, incubators, entrepreneurial centres for the purpose of promoting the business idea competition in all 30 municipalities in the county of Agder.

The competition required a new approach for the City... connecting with incubators and the Climate-KIC accelerator.

Some important criteria are developed each year for the candidates of the competition. Typically, it is all early stage ideas competing. During the global entrepreneur week in November, the team stages the finals and awards. Three of the start-ups are awarded prizes and the winners have the opportunity to travel to a tech conference in Helsinki, called SLUSH, and participate in a workshop for green start-ups. The City also assists the start-ups in trying to qualify for the Climate-KIC accelerator program.

What was achieved?
The business ideas are in varying stages of development and to date, two of the competitors and winners from earlier years achieved grants from the Climate-KIC accelerator program.

Most of the winners from 2017 and 2018 can be categorised as circular economy initiatives:

1. SCT Biotech – reproduce fluid waste from land-based fish farming facilities and turn it into energy, feedstock for fish and distilled water.

2. Scanwatt – through scientific methods, transform fly ash from incineration plants to building materials, including road construction. Fly ash constitute 80% of all toxic waste in landfills in Norway. Fly ash constitutes more health hazard than other ash because it contains high concentration of heavy metals such as lead, cadmium, copper, and zinc, as well as small amounts of dioxin and furans.

3. HTTech – an alternative to composting, this solution better controls all gases produced to create fuels and 'deactivates' or extracts heavy metals.

Other circular solutions ideas include the reuse of organic waste fish skin and replacing concrete by cellular glass as building materials in road tunnels.

What were the challenges?
The team have worked hard to raise awareness about the competition in all municipalities in the region to attract sufficient interest of the start-ups and people with ideas. It has also been challenging to manage to attract sufficient funding every year from partners of the competition. A key element is to help to attract investors to finance growth of the green start-ups.

Next steps
The City would like to strengthen the competition, the promotion and organisation around it. By repeating the competition every year, the team hope to attract more attention from people with ideas, start-ups, angel businesses and investors.

CITY-WIDE CIRCULAR STRATEGY

Summary
The City of Kristiansand initiated a business idea competition 5 years ago in conjunction with a cleantech conference. The competition raises awareness of business ideas that contribute to more sustainable development, circular resources, and low or zero emissions in the city. Ideas with the most growth and international potential are identified.

Time period
2015-2019

Municipal lever
Program supporting entrepreneurs

Scale and Cost
The initiative started in City of Kristiansand but now covers the whole of the Agder region.

Funding originates from the public and private sector, and also Innovation Norway. The initiative costs 40,000 Norwegian Krone (€4,100) per year.

CO_2 reduction
All of the start-ups in this competition, if they succeed, will save greenhouse emissions and reduce the negative effects on the environment.

Ljubljana, Slovenia

A national roadmap leading to specific city-level actions

What was the vision?
A Vision for Slovenia in 2050 and Slovenian Development Strategy 2030, as well as in Slovenia's Smart Specialisation Strategy, contain the long-term objectives for Slovenia. The overall aim is to increase the quality of life for all citizens.

Who was the team?
The National Roadmap was commissioned by the Ministry of the Environment and Spatial Planning of the Republic of Slovenia with supporting partners including:

- The Slovenian Chamber of Commerce
- The Association of Municipalities and Towns of Slovenia
- SPIRIT Slovenia
- SRIP
- Government Office for Development and European Cohesion Policy

Specific programs were subsequently led by Ljubljana municipality, local businesses and community groups.

What is the local context?
Ljubljana is Slovenia's capital and largest city with a population of around 280,000.

What was done?
Specific national recommendations across four sectors were co-created with stakeholders across business, government and citizens through both regional consultations and individual meetings that took place from October 2017 to March 2018.

The four sectors are:

1. Food systems
2. Forest-based value chain
3. Manufacturing
4. Mobility

Within Ljubljana, a variety of innovative initiatives are underway:

Urban refurbishment

- When re-surfacing asphalt roads, the waste products, millings and chippings, are then reused in construction/renovation of streets and sidewalks, as added volume for banks in the unbound bearing layers, and/or for the sub-base layer.
- Old bus seats are used for children's playground equipment.
- Ljubljana is among the first in the world to produce paper out of Japanese knotweed at a semi-industrial level. This weed is a pest, illegal in most countries, and causes serious damage the foundations of buildings.

Ljubljana is among the first in the world to produce paper out of Japanese knotweed at a semi-industrial level.

- An urban culture construction site has been designated, where different community groups can test out designing circular objects, such as sports groups making outdoor work-out equipment.
- Traffic signs are re-furbished by the publicly owned manufacturer for reuse.

Civic waste:

- A public vehicle spare parts centre keeps parts from old public transport vehicles for restoring the current vehicle fleet.
- Citizens are encouraged to bring old containers (ceramic, plastic or metal), to fill with compost produced by organic waste, in which to grow plants that repel and help to prevent the spread of the tiger mosquito, at the same time as greening the city.
- Free rental platform of Slovenian designed clothing.
- Library of things that can be used at home, in the garden, for playing, sports and many other items.
- Farmers selling direct to restaurants and hotels, with support from the City Tourism Office.
- Repair and refurbishment centre, which opened at the end of 2013, offers work to hard-to-place job-seekers. The concept of the Repair Café, operating within the framework of the Reuse Centre, is to have experts in different professions (electricians, seamstresses, carpenters ...) and volunteers available once a month to help repair and refurbish products.

Utilities:

- The public waste management company Snaga is cleaning the city's pavements in Ljubljana with machines which recycle water and they are using a biodegradable detergent. The machine has five floating brushes for wet cleaning which vacuum up the cleaning water. For street rinsing Snaga uses mostly rainwater collected on the roofs of its building complex at Barje.

Next steps
Specific recommendations from the national roadmap will be further adopted, these include:

1. Promoting local food consumption and self-sufficiency,
2. Buildings constructed in wood, reviving Slovenian furniture businesses,
3. Industrial symbiosis, ecological design,
4. Promoting car sharing, cycling and electric vehicles.

CITY-WIDE CIRCULAR STRATEGY

Summary
A national Circular Roadmap established, focusing on food systems, forest-based value chain, manufacturing and mobility. This has been translated to a range of unique and innovative projects within the City of Ljubljana.

Time period
2016 onwards

Municipality levers
Local action plan; Community engagement

Maribor, Slovenia

Circular economy strategy working closely with the public utility companies

What is the vision?
Maribor's 2018 strategy includes the vision to transition to a circular economy, to promote fair access to goods and services, sharing and more resource efficiency, rather than ownership and linear material flows.

This consciously aligns to the United Nations' Sustainable Development Goals: 11 Sustainable cities and communities, 12 Responsible consumption and production, 6 Clean water and sanitation, 7 Affordable and clean energy.

Specific targets from the Wcycle Foundation project:

- By 2030, recycle 70% of municipal waste and 80% of packaging waste
- From 2025, prohibit the dumping of waste in landfills, which can be recycled
- By 2025, reduce marine and food waste by 30%
- Improve the traceability of hazardous waste
- By 2030, increase the resources productivity by 15%

Who was the team?
Maribor City Council leads on the city's circular economy strategy, working closely with the public utility companies, who founded the Wcycle Institute:

Snaga d.o.o. – public waste management company
Nigrad d.d. – public utility company
Energetika Maribor d.o.o. – public energy company
Mariborski vodovod d.o.o. – public water company
Marprom d.o.o – public transport company

What is the local context?
Maribor is the capital of the province of Styria, an 850-year-old university town and the second largest urban area in the country with 115,000 inhabitants.

The City of Maribor does not have an active landfill site nor wishes to have one, it also aims to minimise waste disposal by incineration. The city has low environmental pollution, such as high-quality water. The city generates 61,000 tonnes of waste each year, of which 77% is recycled, and 9% is incinerated for energy recovery.

What was the approach?
Multiple stakeholder workshops initiated the process for writing the City's circular strategy. The overall strategy includes:

1. Sorting plant for the mechanical treatment of mixed municipal waste
2. IT support for circular economy projects
3. A factory of composites for the treatment of construction and industrial waste

The strategy consciously aligns to the United Nations' Sustainable Development Goals.

4. Preparation of technical specifications for the production of materials and soils
5. Investment in wood-fuelled biomass
6. Plant for the treatment of compostable waste
7. Biological treatment of residual mixed municipal waste
8. Management of mobility services
9. City chain of cooperative economy
10. Urban return water cycle for recycling water

The Maribor 'Wcycle project' was also established 18 joint projects identified for the City and public utility companies over the following years, aligned with these focus areas: Material waste – construction, organic waste and soil; Lost energy; Waste water; Unused space; Improvement of social collaborative and the sharing economy.

The Wcycle project includes 2 areas of land identified for waste recovery plants:

1. Tržaska, which is 5 hectares for a mixed municipal waste plant, including material processing of waste into new useful materials, composites and soils.

2. Dogoše – 10 hectares, with three phases – to accommodate all other necessary facilities for the treatment of waste from population and public utilities, from construction and other industries, and from agriculture and water, with a goal to produce new materials, soils and energy. The location is logistically and spatially favourable, since it is close to the highway and there are no residents in the vicinity. Phase 3 includes plans to remove existing municipal waste landfills, covering an area of 5 hectares, to recover and reutilize the materials through a process of so-called "waste mining".

What was done?
2014: the start of design of the Wcycle project

October 2016: start of Interreg Alpine Space Green cycle project

April 2017: establishment of the Wcycle Institute by five public utility companies

December 2017: start of UIA, a European Urban lab's soil 4 food project

June 2018: start of operation of sorting plant for municipal waste in Maribor

CITY-WIDE CIRCULAR STRATEGY

Summary
A holistic strategy, and 'Wcycle' project in partnership with the public utility companies, with 18 goals including two material recovery plants that go far beyond a typical recycling plant, and objectives to eliminate historic landfill sites in the area through 'waste mining'.

Time period
2014-2020: Wcycle project
2018-2030: Maribor's circular waste strategy

Municipality levers
Vision and action plan, Partnering with public utility companies

Scale and Cost
Project Wcycle is funded by the City's own funds for co-financing EU projects, the public utility company and EU funds (UIA, Horizon2020, Interreg), with a total of €50 million for phase 1 (excluding real estate investment).

CO_2 reduction
This will be assessed project by project basis.

June 2018: start of Horizon 2020 Cinderella project, a circular economy project by the European Commission's Research and Innovation fund.

June 2018: adoption of Strategy for the transition to circular economy in the Municipality of Maribor.

June 2018: start of Winpol Interreg Europe, a network of 9 European cities learning and implementing new waste innovation technologies.

Measures of success
Overall, the strategy is aiming for new opportunities for the City to develop by setting a clear strategy and being a first mover signalling commitment.

The measures of success established to monitor performance include: creation of new green jobs; reduction of the use of natural resources; increase in the use of recovered materials, energy and water savings; use of new technologies from research and development.

What were the challenges?
Challenges include: stakeholder cooperation, governance (relations between local and national level), and effective communication of the circular economy concept to citizens.

Lessons learnt: it is a long-term process, a systems approach is necessary but not sufficient, communication to key decision-makers, such as the City Council, Mayor and CEOs of the public utility companies, is important for top down support.

Next steps
In 2018, the Maribor participated in the World Economic Forum's Platform for Accelerating the Circular Economy (PACE) initiative.

Since becoming the first city in Slovenia to join the Sharing Cities Alliance network in 2018, Maribor has the opportunity to share experiences with peers.

Phase 3 plans to remove existing municipal waste landfills, to reutilize the materials through a process called "waste mining".

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Paris, France

City-wide circular economy strategy

What was the vision?
The circular economy is a practical response to the main challenges of our time. As a low-environmental-impact economy, it promotes new forms of production and consumption, as well as sociability, while opening up avenues for the creation of jobs that are sustainable and cannot be offshored. Adopting a more circular economy is a way of helping to provide a better living environment for Parisians and designing the city of the twenty-first century: fairer, more inclusive and more sustainable.

Who was the team?
The City of Paris' Environmental Department is in charge of overall coordination to drive the circular economy strategy.

16 departments (out of the 20 city departments) are carrying out actions from the Roadmap specifically connected to their skills, and all departments are involved as partners.

External stakeholders include: ADEME as financial partner for the launch of the strategy, OREE and INEC (National Circular Economy Institute) as technical partners.

Many additional players: government authorities, business, associations, NGOs, academia and research support to define and lead the actions.

As the scope of actions may be very large, all stakeholders are very important to make the policy succeed. Above all, the involvement of municipal departments is a key for success.

What was done?
Throughout 2015, the City of Paris carried out major work, in collaboration with twenty or so local authorities in Greater Paris, to organise the General Assembly on the Circular Economy. This event brought together and mobilised many of the city's actors, with more than 120 organisations from the non-profit, industrial, economic, institutional and academic sectors.

This resulted in the publication of a White Paper on the Circular Economy in September 2015, which proposed a set of 65 actions and as many forms of leverage to be used to promote the growth of the circular economy. The Pact of Greater Paris local authorities for the circular economy, the Call of Cities for Circular Economy (as part of preparations for COP 21 – Conference of the Parties on Climate Change) and the Charter of Commitment for the development of the circular economy in the academic sector were also adopted.

Adopting a more circular economy is a way of designing the city of the twenty-first century: fairer, more inclusive and more sustainable.

A report of this participative work was given on the closing days of the General Assembly, organised in September 2015 at City Hall, during which more than 2,000 participants visited conferences, debates, project presentations and non-profit stands.

Achievements to date
The 65 proposals of the White Paper on the Circular Economy have been studied with all municipality departments, to make a choice between actions that could be carried by the municipality. That means that a large part of the 30 actions of the City roadmap directly come from the ideas of the General assembly, previously described.

The following indicators have been set for evaluating the circular strategy, and the first measures of success are currently being collated: material recovery (from exchange, repair, reuse and recycling), money saved, CO_2 avoided, waste reduction, networking of actors, synergies between actors, awareness-raising/information sharing and job creation.

It has been critical to involve, from the very beginning, all the local players to make it the basis of global policy but also to take an approach tailored to a dynamic local context.

CITY-WIDE CIRCULAR STRATEGY

Summary
A governance committee was set up in 2015 to promote methodologies for circular practices. Following many circular economy stakeholder meetings, the Paris Circular Economy Strategy was launched in 2017 and 30 concrete actions are now being implemented.

Time period
2017-2020

Type
Strategy; Action plan; Convening partners; Research

Scale and Cost
The cost for leading and implementing the overall strategy mainly comprises studies on specifics topics and annual meetings with stakeholders, has been financed by the municipality of Paris since 2015 with an average spend of €230,000.

Actions carried out by all the supporting city departments have not required the allocation of extra operational costs.

Cost savings are expected to be known from 2019.

CO_2 reduction
4 out of the 30 actions agreed will have a direct impact on reducing greenhouse gases, and will be measured in due course.

Phoenix, USA

Redefining waste through a Resource Innovation Campus

What was the vision?
The City of Phoenix aims to achieve zero waste by 2050, despite Arizona law prohibiting mandated recycling. In particular, the City aims to improve the diversion rate of waste to landfill from 20% in 2013 to 40% by 2020. Through a physical innovation campus, the City aspire to promote public-private partnerships to help achieve this goal and support local economic growth.

Who was the team?
Developed by the Public Works Department, Arizona State University is a key partner in the Reimagine Phoenix Initiative; numerous businesses and several non-profits have had an active role in developing emerging products and technologies.

What was the approach
City leadership, including Mayor Stanton, Council, City management and staff were the primary initiators of the Reimagine Phoenix Initiative, which collaborates with departments to assist with communicating a unified message about the City's diversion goals.

Together, the Public Works Department and Community and Economic Development Department identified public and private partnerships as an integral component to changing the way the City and its residents view discarded materials and meet the diversion goal.

The 20-hectare Resource Innovation Campus was established adjacent to the city's landfill and waste processing facilities, inviting businesses of all sizes to make better use of the waste materials of the city. This includes the opportunity to set up re-manufacturing processes on the site of the city's waste disposal, to creating new products that can be reinjected into the local economy.

The Campus supports research and development, and in particular through a business incubator. This led to a variety of initiatives and businesses, including a state-of-the-art city compost facility, all aiming to reduce the volume of waste being sent to landfill.

A 20-hectare Resource Innovation Campus, adjacent to the city's waste processing facilities, invites businesses of all sizes to make better use of the waste materials.

What was achieved?
The city's waste diversion rate has increased to 30%, and therefore is on track for 40% by 2020. Carbon emissions and air pollutants have also reduced, including NOx, which is a major contributor to ozone in the area.

A notable example from the Innovation Campus involves palm fronds that have been manufactured into livestock feed materials, creating 12 new jobs and generating an estimated $10 million USD in sales annually.

The advanced gas capture and control system on the city's active landfill has avoided 2,300 metric tonnes of CO_2e, since it opened in 2006.

The City has presented at a variety of national conferences to share expertise from this program.

The technology solutions incubator has:
- Created 26 full time jobs, 4 part time jobs, 19 internships
- Raised US$1.345 million capital
- Generated $3.15 million in revenue
- Launched 10 products
- Filed 2 patents

What were the challenges?
Two key challenges have been outlined by the City:

1. Public Works staff needed reliable data about which materials in the waste stream truly had economic value, who was using these materials and what new products might be made, what it would take to attract innovators to Phoenix to use the materials, and what benefit would be reaped by attracting the innovators. To secure this information, the City issued the "Call For Innovators" and received more than 100 responses from around the globe.

2. Public Works customers need readily accessible information about the City's diversion programs. To educate residents on the City's waste and recycling programs, the City is contracting with Recyclebank to provide community outreach and awareness services. Although the City anticipates that the cost of the community outreach and awareness services will eventually be offset by increased recycling revenue and decreased contamination fees, the City needed to achieve operational efficiencies to initially pay for these services.

CITY-WIDE CIRCULAR STRATEGY

Summary
The Reimagine Phoenix Initiative aims to meet the City's zero waste goal through new solid waste programs and public-private partnerships at the Resource Innovation Campus, a circular economy hub. This campus is home to a state-of-the-art composting facility and a technology solutions business incubator, leading to a variety of initiatives all supporting the reduction of waste sent to landfill.

Time period
2013 onwards

Municipality levers
Public-private partnerships; Planning policy; Business incubator; Infrastructure investments; Provision of information

Cost
$2 million USD was invested by the City Council to initiate the Resource Innovation and Solutions Network (RISN). Subsequent funding has been through event sponsorship, consulting services and various levels of government philanthropy. In 2017, the RISN received $812,000 USD.

CO_2 reduction
The City's waste diversion rate has increased to 30%, and therefore is on track for 40% by 2020. Carbon emissions and air pollutants have therefore also reduced, including NOx.

Next steps
The City will develop infrastructure to support expansion at the Resource Innovation Campus as partnership and collaboration efforts continue, as well as expanding solid waste services like the pilot curbside green organics program that will roll out citywide.

The Compost Facility initially can accommodate up to 55,000 tonnes of organics diverted from the city landfill per year and will quickly grow capacity to 110,000 tonnes per year. In the future, the facility has the potential to grow capacity to 220,000 tonnes per year.

The team in Pheonix has commenced the Resource Innovation and Solutions Network (RISN) through setting up two similar schemes internationally in Lagos, Nigeria, and Antigua, Guatemala. Several entities have expressed interest in creating similar initiatives across the United States. Other international collaborators are considering joining the network.

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The team in Pheonix has set up two similar schemes internationally, in Lagos, Nigeria, and Antigua, Guatemala.

Samsø, Denmark

Circular economy for the whole island

What was the vision?
In 1997, Samsø set the goal to be 100% self-sufficient in energy within 10 years and reached this ahead of time in 2004.

The subsequent goals set are to be an island free of fossil fuels and an island in balance for parameters wider than just energy, by 2030. Notably, the island strives to have a more circular economy.

Who was the team?
The process has been driven by civil society and the elected municipal board with deep engagement and involvement from local businesses and the wider community.

New organisations formed: the Samsø Energy and Environment Office; the Samsø Energy Company; The Samsø Energy Academy.

Samsø Municipality was particularly involved on EU funded projects, often working closely with the Energy Academy, including the biogas, waste recycling and circular procurement strategy, climate adaptation, repowering wind turbines and agricultural planning.

What is the local waste recycling context?
A new recycling collection system, due to be in operation by 2020, will require each household to separate waste into four fractions. This will reduce the volume of waste incinerated for energy.

What was the approach?
In 1997 Samsø was selected by the Danish Government to partake in an ambitious project to take the conventional energy infrastructure in place and outfit the entire island's electricity production with renewable sources.

Significant efforts enabled the funding targets to be reached and the Samsø Energy Academy has played a key role in this journey – binding together the local people, the NGO's, the farmers, the business and the politicians in a strong network.

Samsø took a unique bottoms-up approach using public outreach and local ownership to increase public acceptance and involvement. This has then been stipulated in municipal plans and strategies.

What was done?
The community and private investors placed eleven 1-MW wind turbines on-shore, which provide enough power for the island's consumption and ten 2.3-MW off-shore for distribution and export to the mainland and neighbouring nations. These cost around 316 million DKK (€42 million).

In 1997, Samsø set the goal to be 100% self-sufficient in energy within 10 years and reached this ahead of time in 2004.

Three district heating plants were implemented, supplied by straw-fired power plants. This district heating infrastructure cost 45 million DKK (€6 million). The Danish Energy Authority allocated a grant fund called "From the ground up" for district heating projects.

This enabled half of the financing required to be provided by government grants. The plants are either privately or cooperatively owned.

A further 4.5 million DKK (€600,000) in subsidies were provided to the public for investing in energy conservation, such as home insulation, 3 million DKK (€400,000) subsidized renewable energy units in homes and businesses, plus grants were given to energy consultants for their free advice to homeowners. Successful uptake of these subsidies were achieved through outreach work through numerous public meetings and private consultations with individual homes. People who lived in the outskirts of town were encouraged to convert to district heating and worked with energy advisors to do energy auditing and calculate costs of conversion and efficiency increasing strategies. These services were free and sponsored by the government.

Samsø Municipality then carried out the preparations for renewable energy infrastructure in other sectors of the island, with a longer-term vision to 2030. For example, in 2012, the Municipality decided to nationalise the main ferry and start its own shipping company. In addition, all ferries were ordered to be fuelled by liquified natural gas (LNG) with the intention to be replaced by liquid biogas produced locally. This concept, 'From Field to Ferry,' is now ready to be procured.

Through considering how the loop can be closed on other value chains, new dimensions to the former strategy are being incorporated, notably biogas is being produced from organic material flows and by-products on the island (sewage, biowaste, slurry etc), and connected with water and nutrient flows in the island.

What was achieved?
Overall the island succeeded in becoming self-sufficient through a combination of windmills, biomass district heating plants and improvements on transportation and energy conservation.

CITY-WIDE CIRCULAR STRATEGY

Summary
After achieving full self-sufficiency in energy early on, the island is now aspiring to have not just circular energy flows, but be a 'Bio-circular island' including other natural material flows.

Time period
1997-2007: Renewable Energy Island
2007-2017: Preparing for a fossil-fuel free society
2017-2030: Samsø 3.0

Municipal levers
Infrastructure investment; Community engagement; Strategy; Action plan;

Scale and Cost
The transition of the island energy system was around 425 million DKK (€57 million), about €16,000 per capita, funded by the national government, international funding sources, and private enterprises, including many local investors.

CO_2 reduction
The island has calculated its carbon footprint to include greenhouse gases released from arable and pastoral farming, solid waste and biomass combustion compared to the amount sequestered by forestry and generated in renewable energy.

In the early 2000s, the island's remaining carbon emissions were completely offset by renewable energy produced and the surplus exports.

A net positive balance was established in 2011, with 26,460 tonnes of carbon effectively sequestered from the atmosphere.

Critical factor for success
Community empowerment has been a key factor for these changes, with broad stakeholder involvement in the decisions.

Islanders have a strong sense of coherence: we can do it – together! The changes have been made possible through meaningful and clear dialogue with the relatively small community.

Next steps
The community of Samsø is working on going from "best practice" to "next practice" in sustainable development: Samsø 3.0.

The island has therefore agreed on the common goal, that coal, oil or gas used for any energy/ transportation will gradually be phased out towards 2030. Furthermore, every transportation to the island will be powered by renewable energy and substantial savings on heat and energy should be made.

The next goal is for the island to be free of fossil fuels and in balance on broader parameters than 'just' energy by 2030, i.e. towards a circular island economy. Although this is regarded as more complicated, it's deemed highly relevant for inspiring the next generation of progress.

An Island bio-resource plan will be prepared and politically discussed, defining the next steps towards circular agriculture, peak-shaving of power (smart energy systems, batteries), water consumption and production, waste recycling etc.

The team remain motivated with international acknowledgement of their efforts from around 5,000 'energy-tourists' who visit the island every year.

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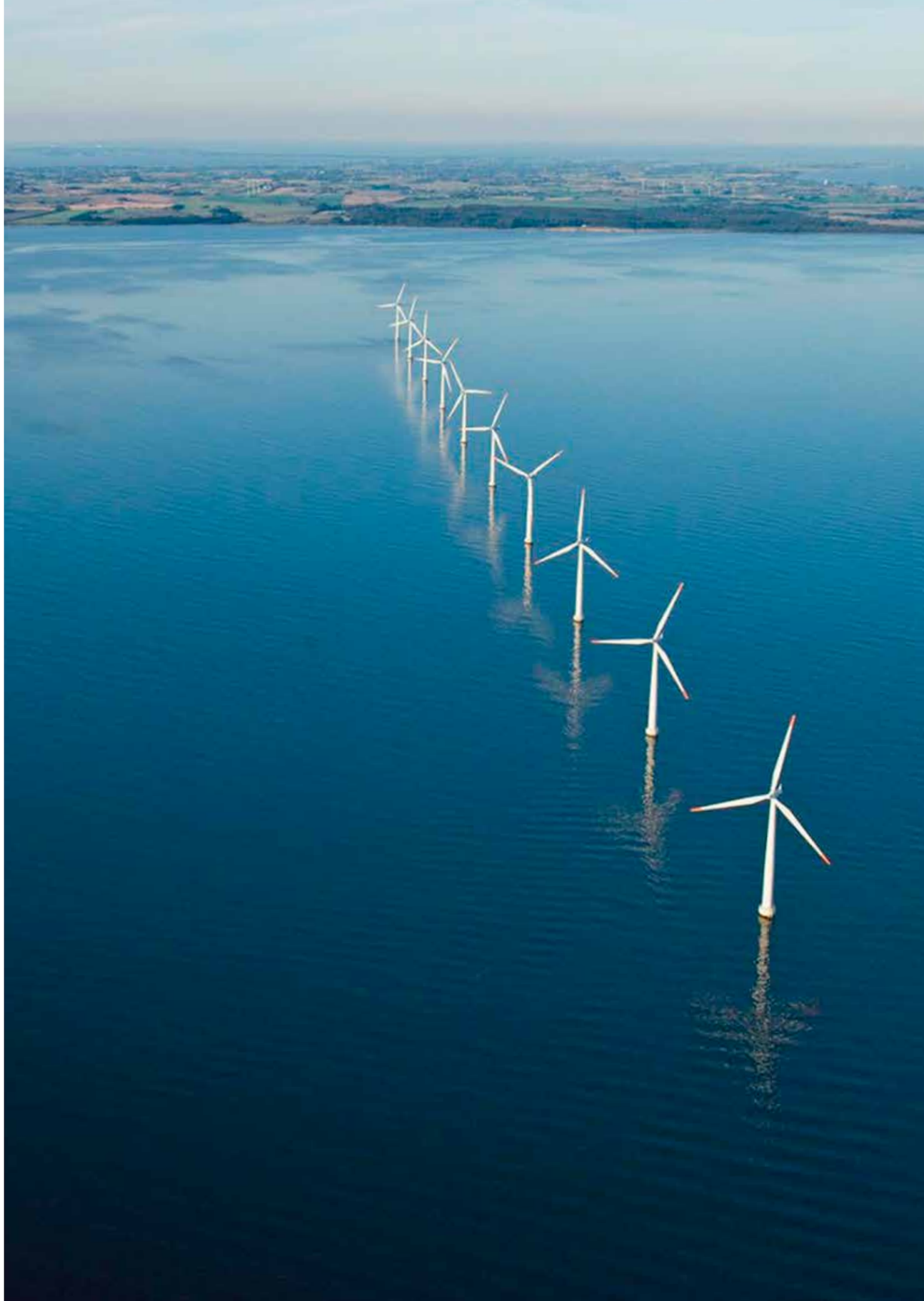
5,000 'energy-tourists' visit the island every year.



Seoul, South Korea

Sharing City Seoul, aiming to engage all 10 million citizens

What was the vision?
Seoul sees the Sharing City Seoul project as social innovation measures that have been designed to create new economic opportunities, to restore reliable relationships, and to reduce the waste of resources, with a view to resolving urban economic, social, and environmental problems altogether.

Seoul's policy for becoming a sharing city aims to encourage the private sector to lead the way in exploring different areas for sharing, while the City is endeavouring to create infrastructures for the Sharing City Seoul Project and to promote and support sharing activities that are undertaken by the private-sector.

Who was the team?
The Metropolitan Government of Seoul established a Seoul Sharing Promotion Committee, as a public-private governance mechanism, comprising personnel from academia, legal circles, the press, businesses, non-profit private organizations, and research institutes. Also, directors and general officials who are responsible for economic, welfare, transportation and innovation affairs.

What is the local context?
The city's super high-speed broadband is reportedly the highest in the world with 97% of the population connected. Seoul has wide-spread use of smart phones (>60%) and high population concentration (twice that of London and almost 5 times New York's), providing favourable conditions for developing more of a sharing economy.

Korea has a tradition called "Pum-a-si," where people share food with neighbours, borrow and lend tools, equipment or other goods with others, and exchange labour at harvest time. Technology and city policies help to revive this tradition in a modern-day context of a global city.

This Sharing City Seoul project is being implemented as part of a wider program of Seoul Metropolitan Government's "Community Building Project".

What was the approach?
The Seoul Sharing Promotion Committee undertakes the devising of policies for the promotion of sharing, to advise on how to improve various laws and systems, and to review the designation and support for organizations and enterprises that promote a sharing economy.

The online Seoul Sharing Hub is set to not only produce, archive, disseminate, and deliver such information, but also to network with the relevant domestic and overseas organizations, enterprises, media, and other social areas, and to connect them with various institutes. It also conducts citizen campaigns; and educates business starters, citizens, and government officials about sharing.

Technology and City policies help revive a tradition called "Pum-a-si," where people share food with neighbours, borrow and lend tools.

Furthermore, Seoul is integrating the channels for presenting proposals on sharing and for improving the system into its Office of Social innovation in order to effectively support the relevant organizations and enterprises. Also, in conjunction with the central government ministries, it improves the laws and systems that are hampering sharing.

What was done?
To launch Seoul Sharing City, a series of lectures were held in 2013, engaging over 1,200 citizens. The municipality also organised events for businesses to exchange knowledge on sharing models and to network. In addition, the municipality led an exhibition with over 10,000 attendees to further engage businesses and citizens in this new sharing economy.

Further launch events to raise awareness and promote the program and attract media attention include the involvement of the City's Mayor, Park Won Soon, alongside an arranged 'flash mob' of citizens reading books on the subway to promote the new book-sharing scheme. Also, Sharing City Seoul Expo in Gwanghwamun Square in 2014 was visited by 50,000 people.

The City government supports new start-up businesses and larger corporate companies to increase their sharing services, including the provision of co-working space that is municipality-owned. To date, Seoul has tracked support for 108 sharing projects in the city and subsidises of 1,536 million KRW (€1.2 million).

Regular sharing 'festivals' take place and in 2016, the City hosted a Sharing City Seoul International Conference.

What was achieved?
A central online hub provides a map and collated information on all the Seoul Sharing initiatives, many successful examples have emerged, and these include:

- The Seoul Car Sharing Program includes the City subsidising 50% of car parking spaces for car sharing services, booked through an app. This supported the

CITY-WIDE CIRCULAR STRATEGY

Summary
Seoul Metropolitan Government launched the Sharing City Seoul program in 2013. The initiative leverages technology to design and support sharing businesses to minimise waste and underused capacity, cut municipal costs and encourage new business opportunities and relationships.

Time period
2012 -

Municipal levers
Provision of information; Events; Financial subsidies; Open data access; Online platforms

Scale and Cost
This initiative is city-wide, aiming to engage the 10 million citizens of Seoul. The initiative's slogan translates literally to "Sharing ten million things, ten million happiness", which means creating happiness for the ten million population of Seoul.

This initiative aims to cut municipal spending in the long-term, as sharing enables more benefits with fewer resources. Therefore, the government can provide more services to the citizens with a smaller budget e.g. open up underused municipality buildings to the community rather than build new spaces.

CO_2 reduction
The Seoul Car Sharing program alone is estimated to have saved 486 tonnes of CO_2, due to reduced car ownership.

membership from 373,513, in 2014, to 2.3 million by mid 2018 and tripling of user rates.

- The Seoul Bike Sharing Program is the most popular and well known sharing initiative, with over 11,000 daily users recorded in March 2018.

- A Children's Clothes and Toy Sharing Project enables citizens to send items by parcel service or arrange a home-pick-up service from the 'green libraries'. By the end of 2017, 180,00 children's clothes and almost 50,000 toys had been shared between citizens. A similar tool rental scheme for adults had 17,000 uses in 2017.

- Sharing of public community centres, including the City hall at over 800m² for 140 Korean won (€110) per hour. 1,250 shared spaces are registered for use and over 600,000 citizens have benefited since 2014.

- The 'One roof, two generations' project connects elderly citizens with spare rooms to young students, winning a national inter-generational community prize.

- Seoul's Open Data Plaza discloses almost 5,000 types of public data across 12 categories.

Overall these initiatives help to create new jobs, bring new income streams to citizens renting out their spare resources, builds community trust and reduces demand for new natural resources.

Multiple awards have been received, including Sweden's Gothenburg Award for Sustainable Development, known as the Nobel Prize in Environment, and the 'Place Marketing Award' of France.

What were the challenges?
Encouraging and facilitating citizens to adopt new lifestyles of sharing goods and services more is a key challenge.

Programs of educational events to raise awareness aim to continue, to ensure interest, participation, and efforts from all levels are ongoing and not just a passing fad.

Next steps
Seoul is set to implement other policies that will respect and promote private-sector capabilities, as well as policies that will require the public sector to open up more public resources for sharing with citizens.

Seoul's Open Data Plaza discloses almost 5,000 types of public data across 12 categories.

In 2017, Seoul was a founding member of the Sharing Cities Alliance, alongside New York, Toronto, Amsterdam and Copenhagen.

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Tel Aviv, Israel

Commencing the journey for the City to reach 10 circular projects

What was the vision?
Tel-Aviv is a very dense city with high-level development, meaning it needs to manage its scarce resources wisely and efficiently. Furthermore, it is considered to be the start-up city of Israel and tops global rankings, as such, is always looking for innovative ways to manage its agenda.

With the aim of reducing material-use and further minimizing pollution with various sustainability tools, the circular economy concept was considered as a financially viable mechanism, that might also appeal higher-up the ladder, and could create quantified local benefits.

Who was the team?
The Environmental Authority of Tel Aviv municipality is the driving force behind this program, in collaboration with various municipal departments: the Strategic Unit, Department of Engineering, and the Operational Division.

National public sector partners include Israel's Environmental Protection Ministry, the Danish Embassy's Innovation Department and Israel Green Construction Council.

University partners include Textile Research Centre at Shenkar College and Afeka Institute of Circular Engineering and Economy, alongside a variety of private sector representatives.

What is the local waste recycling context?
Amounts of municipal waste per-person are averaging at 2.6 kg per day, per capita (among the highest in Israel); recycling rates were 17% in 2016, and rose to 33% in 2017, mostly due to central processing, rather than recycling at the source.

What was the approach?
The circular economy concept was first discussed as part of the overall agenda of the Environmental Authority, and its wish to further implement reduction of material-use and consumption throughout the city.

As a first step, a session on the topic was initiated at the 'DLD' conference in September 2017, an international innovation event that is co-led with the private sector, to which global experts from various sectors were invited, as a means to share best practices and learn from other municipalities.

Circular economy is often confused with recycling or plain waste management, thus missing-out on its potential environmental and financial benefits.

Thereafter, and as part of the strategic plan update that took place in 2017, an entire strategy chapter was dedicated to the topic, in which pilot projects and specific fields for implementation were suggested.

What was done?
Five focus areas have been established, as follows:

1. Textile Flow Analysis: Research is being carried out in collaboration with the Textile Research Centre at Shenkar College, aiming to get a clear picture of textile waste and consumption patterns in the city, to see what circular opportunities there are for municipality and for the businesses.

   This workstream is in the Pre-feasibility Study Phase.

2. Circularity in Construction and Demolition: a 2-day workshop on the topic was held for municipal managerial-level employees, organised by the Environmental Authority, in collaboration with the Israeli Green Construction council and the Engineering Department at the municipality. Ideas for pilot projects include: (1) an online material bank; (2) a municipal training system to further develop lost professions such that refurbishing of old construction materials; and others.

   For this workstream, Tel Aviv are in Pre-implementation Phase.

3. Innovation and Acceleration: in the effort of harnessing innovation and knowledge from the private sector, and as modelled off of other cities globally (such as Phoenix Arizona or London UK), an acceleration mechanism for start-up companies is being built in the city, focusing on circular economy solutions and with the goal of bringing circular ideas to solve various municipal problems. This mechanism is created in collaboration with Afeka Institute of Circular Engineering and Economy and is aimed to include bi-annual hackathons, as well as include a year-long mentoring process. The final result should be an opportunity both for a new start-up company and for the municipality to collaborate and allow for innovative solutions to be implemented in the city.

   Tel Aviv are in the Pre-feasibility Study Phase for this workstream.

4. Circularity in Water: a joint venture with the Danish embassy's innovation centre, trying to allow for implementation of circular methods within rainwater management in the city (which is currently

CITY-WIDE CIRCULAR STRATEGY

Summary
Detailed example of how to commence circular economy thematic action plans for a municipality, with a focus on innovation and supporting start-up companies, such as workshops or the 'hackathon' format.

Time period
2017-2018

Municipality levers
Strategy; Action plan; Convening partners; Engaging businesses; Research with universities; Start-up competitions

Scale and Cost
Scoping and feasibility studies are currently taking place. The Circular Economy strategy is viewed as a potential income driver, be it by adding new jobs or by creating additional value. Tel Aviv hope to articulate these benefits as the strategy is implemented.

hardly captured). The work includes Clean Cluster, which are assisting with consultation and creating partnerships with Danish and global private-sector companies and start-ups. The final goal is to create a Copenhagen-Tel-Aviv twining-city project that will allow both cities to share best practices, as well as use Copenhagen's experience with rainwater management, and perhaps allow for future expansion into other fields as well, i.e. waste management.

Tel Aviv are in the scoping phase for this workstream.

5. Circularity in food: first attempts to promote a food-rescue system that can minimize amounts of food waste, via the creation of second and third circles for the consumption and use of soon-to-be-wasted food from supermarkets and street-markets, and possibly hotels and major caterers.

Tel Aviv are in the scoping phase for this workstream.

Expected benefits
The Circular Economy strategy can also be viewed as an income driver, be it by adding new jobs or by creating additional value. Much like other municipalities, Tel Aviv hope to articulate these benefits as the strategy is implemented, so that financial and economic development departments (and others) will also use circular economy principles in their models.

Challenges to date
A key challenge is presenting circular economy principles as an actual opportunity to lead game-changing strategies, rather than another nice-to-have sustainability-tool, while differentiating it from more commonly known of waste management strategies. The concept of the circular economy is often confused with recycling or plain waste management, thus missing-out in its potential financial and environmental benefits. Once given the chance to prove otherwise, other challenges may un-fold themselves, such as getting the private sector on-board or looping in the industrial areas around the city, but this challenge is both early still and seems less immanent.

Next steps
Looking towards 2019, the team hope to implement circular economy principles as a strategic tool to be used by different municipal departments. Inspired by other city municipalities – such as Amsterdam and London – the team hope to include circular economy concepts as an integrating mechanism designed to close loops of various material supply-chains in the city and within various sectors.

In terms of numbers, the goal is to have at least 10 projects or pilot-projects lined up by the end of 2019.

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URBAN REFURBISHMENT

Houston, USA

Re-use warehouse for construction materials

What is the local context?
Houston, Texas, is the fourth largest city in the United States with an estimated population of 2.3 million in 2017. According to a 2006 Council study, construction material accounts for 38% of the waste stream in the area.

What was the team?
The project began as an initiative by the Mayor's Environmental Programming team and included key stakeholders from the City's Solid Waste; Public Works and Planning Departments. Local non-profits working in the reuse and deconstruction arena were also involved.

Construction and demolition companies were consulted about the waste within the industry, and it was found there was a significant amount of material available for reuse being landfilled; and many user groups who could make use of the material but had no means of connecting with the generators. The City sought to close that gap by establishing the Reuse Warehouse.

What was the approach?
Inspiration came from the neighbouring municipality, the City of Huntsville, which operates a similar initiative at their local transfer station. The Huntsville TIPS warehouse was established with the help of a Texas builder, artist and leader in reuse. The TIPS warehouse differs from the Houston Reuse Warehouse by its ability to provide material to individuals who meet given criteria. While the City of Houston Reuse Warehouse accept materials from individuals, supply companies and builders, the free take-away is limited to non-profit organizations, schools, universities, or government agencies.

What was done?
The City of Houston Building Materials Reuse Warehouse now forms part of a network of local community organizations working to keep reusable building materials out of the landfills and to put them into the hands of those that can use them. Whilst the Reuse Warehouse focuses on providing materials free of charge to non-profit organizations, many other local organizations also make materials available to individuals.

How does it work?
The facility is open to anyone in the greater Houston area for donation, and open to any non-profit organization for collection.

The Reuse Warehouse has given away 90% of diverted construction materials to over 700 non-profit organizations, schools, universities, and government agencies.

Both donations and collections of material are free. The Warehouse has also renovated a nearby building, incorporating reused materials, to provide a reused materials workshop, gallery, and meeting space to promote further reuse and sharing of resources between public, private, and not-for-profit entities.

The Reuse Warehouse was originally funded in part by a grant from the Houston Galveston Area Council, a region-wide voluntary association of local governments in the 13-county Gulf Coast Planning region of Texas. Since 2009, it has been managed through a team in the City of Houston Department of Solid Waste Management.

The start-up grant, of around $150,000 USD, helped with the purchase of equipment; restoration of existing City property; and partly covered personnel costs for the first year. Further small grants have since been secured.

What was achieved?
As of November, 2018, the program has diverted 4,500 tonnes of material from landfills. The Reuse Warehouse has given away 90% of diverted construction materials to over 700 non-profit organizations, schools, universities, and government agencies. Apart from helping with waste diversion, the project also brings the Houston community together and allows individuals, businesses, and other reuse facilities donating material to free-up their storage space.

What were the challenges?
The team's greatest challenge is to increase public awareness of the program with limited advertising resources. With the existing building plant, equipment, and staff, they can double the current amount of landfill diversion and material distribution without exceeding capacity.

A slightly less critical challenge is to manage and document collections and qualifications of the family of shoppers. A natural occurrence of the program is that more time is spent managing collections than seeking donations.

A key lesson learnt is to dedicate time to increase collaboration between for-profit, not-for-profit, and public stakeholders by augmenting awareness, enabling access to new resources, and increasing efficiency.

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Summary
The City of Houston Reuse Warehouse accepts donations of reusable building material, diverts it from landfills, and makes it available to non-profit organizations, schools, universities, and government agencies for free.

Time period
Established in 2009

Municipality levers
Online marketplace; Start-up grant; Planning

Scale and Cost
The program has diverted 4,500 tonnes of material from landfills and involved over 700 non-profit organisations.

A start-up grant was approximately $150,000 to help with the purchase of equipment; restoration of existing City property; and cover part of one-staff person for the first year. The City continues to support this initiative, which is free to users.

CO_2 reduction
The net impact on greenhouse gas emissions is unclear. However, with documented historical and monthly tonnages of diverted and reused materials in 12 categories, e.g. ceramics, concrete, wood, the team are seeking published industry sources that will lead to accurately measured savings and sequestration of greenhouse gases and embodied energy.

Paris, France

3D mapping project supporting policies for low carbon buildings

What was the vision?
The City has an aspirational target for all new urban projects launched from 2030 onwards will be carbon-neutral throughout their entire life-cycle, from the extraction of the raw materials for construction through to waste disposal. Within the three 'planning and construction' actions of the first road map of Paris' Circular Economy plan, the City wants to develop the recovery and the reuse of building materials by implementing experimental projects on sites that are representative of the diversity of construction modes and buildings in Paris. The aim is also to lay the foundations of new economic models for circular construction.

Paris has signed the C40 Cities 'Advancing towards zero waste' declaration and set the following specific targets to reduce waste from building construction and renovation:

Before 2020, the City of Paris will develop a three-dimensional Geographic Information System (GIS) in the framework of the "3D Paris" project.

Target of 50% "zero landfilled-waste construction sites" by 2030 and 100% by 2050.

Target of 30% of development projects having dry process operations by 2030 and 50% by 2050.

What is the local context?
Construction and renovation projects generate large flows of materials and waste that have an impact on greenhouse gas emissions and air pollution. However, these materials can be re-used in many different ways; for example, old plaster can be recycled to produce new plaster, rubble can be used in embankments and earthworks for roads, etc. These opportunities are therefore being embraced with the support of GIS mapping technology.

Who is the team?
The City of Paris is leading this initiative, and is also taking part in different knowledge-sharing working groups, such as the deconstruction business club with the OREE association or the DEMOCLES collaborative project for improving management of construction and demolition waste.

What is the planned approach?
The 3D GIS will facilitate the development of digital models of buildings and neighbourhoods integrated into their urban environment. In this way it will provide support for urban project consultation and joint development tools. These tools will also support the next revision of the Local Land-Use Plan and its application. The City will examine the feasibility of incorporating all relevant data concerning networks and flows (energy, water and materials), in addition to digital models of buildings and structures (Building Information Modelling - BIM), into the 3D GIS, especially for development projects, in order to make the 3D GIS a tool to facilitate the energy and ecological transition.

Paris has signed the C40 Cities 'Advancing towards zero waste' declaration.

This study will set out to determine which are the most appropriate tools to accompany the "3D Paris" project by helping to assess the environmental impacts of urban projects and facilitate the participative design of projects by means of the 3D views and opportunities to interact with stakeholders, inhabitants and residents.

It will also contribute to the definition of data-sharing obligations, in particular via the BIM, which will help commit the stakeholders to performance obligations. The data disseminated will concern actual energy performance (taking account of uses, practices and comfort), greenhouse gas emissions throughout the entire life cycle and other environmental impacts (air quality, acoustics, materials used, work site, water cycle, etc.) and should be used to commit the operators involved to meeting specific obligations.

Additionally, to minimise the environmental impact, the possibility of renovation must be systematically considered before resorting to demolition.

All development projects will be encouraged to adopt circular economy principles, promoting the use of materials that emit fewer carbon emissions throughout their life cycles, such as locally produced wood.

Next steps
The proposed general amendment to the City of Paris Local Urban Planning scheme seeks to reinforce the regulatory provisions that privilege resource conservation and, more generally, quality of the environment.

Notably, regarding the energy and environmental performances of construction sites, an Article 15 is to be introduced, pursuant to the law, which covers rainwater management, waste collection, the greater use of thermal energy in mixed development zones (ZAC), and incentives to use renewable or bio-sourced materials.

URBAN REFURBISHMENT

Summary
All new urban projects launched from 2030 onwards will be carbon-neutral throughout their entire life-cycle, from the extraction of the raw materials for construction through to waste disposal. A 3D digital mapping exercise will support this goal.

Time period
2018-2030

Municipality levers
Fiscal policies; Land use planning; Digital information provision; Geographic Information System mapping

Sydney, Australia

Co-creating industry guidelines for circular office refurbishments

What was the vision?
Overall the Better Buildings Partnership (BBP) aims to work collaboratively to improve the sustainability of Sydney's commercial and public sector buildings and to help facilitate the achievement of Sustainable Sydney 2030 goals. This includes the City of Sydney's target to reduce greenhouse gas emissions by 70% by 2030 (from 2006 levels).

The real estate members are publicly committed to 60% recycling rates in refurbishment projects, as well as an aspirational 80%.

Who was the team?
The Better Building Partnership Australia comprises:

- 1 government entities – the City of Sydney
- 12 commercial landlords
- 2 Universities
- 5 industry bodies
- 5 property management companies

What is the local waste recycling context?
Before the tenant fitout waste guidelines were published, it was calculated that an average of 20% of office fitout waste in Sydney was diverted from landfill, 18% through recycling and 2% through re-use.

This represented around 25,000 tonnes of materials including glass, metals, plasterboard, ceiling tiles, carpet and furniture that could be reused or recycled each year in Sydney's central business district alone. These office furniture materials being sent to landfill were regarded by the BBP as being relatively predictable in composition and supply, and inherently high in value.

What was the approach?
The BBP uses a collective impact model for change to tackle the problems that are too large for any individual organisation to approach alone. It is a collaboration of government and the private sector. It uses a co-creation process and prioritises data to generate evidence-based project responses.

It is relatively unusual for city officials to be closely involved in a cross-industry real-estate working group (the BBP). This working group comprises commercial landlords that have 2.5 million square meters in their portfolios, 50% of all available in Sydney, in terms of net lettable area.

The Better Building Partnership has a process that guides its work, to enable collaborative systematic changes to improve the environmental sustainability of buildings in Australia:

1. Problem identification
2. Gap analysis
3. Defining best practice
4. Iterative co-creation
5. Implementing best practice
6. Benchmark progress
7. Transition to standard practice

The Better Building Partnership (BBP) is resourced and facilitated by the City of Sydney. The City funds the secretariat and provide an operating budget. This is supplemented through a membership fee structure, whereby the real estate landlords also make an annual contribution to support the delivery of the program's projects. This fee helps ensure active engagement from participating companies. The fit-out guide was a contribution of time by members with particular expertise.

What was done?
Test projects and stakeholder workshops were undertaken to understand the issue and where the operational failures occurred. Learnings were gathered and distilled into a set of guidelines.

The guidelines were produced through iterative reviews by experts in the BBP. Alongside an associated workbook, these provide a framework to improve retrofit operations, procurement processes, and ensure consistent measurement and reporting.

The guidelines and workbook provide a range of templates, suggested targets, and a reuse and recycling facility directory e.g. local schools and charities open to receiving furniture. This directory includes contact information, pricing and waste criteria. Most importantly, the guidelines include a set of contract clause templates recommended for inclusion in fitout contracts.

The resources include a case study demonstrating how high landfill diversion rates can be achieved at no extra cost, as even with the cost of appointing an external consultant to manage furniture recovery, this can be more than offset by a reduced demolition scope.

Roles and responsibilities are outlined in the guidance book, so it is clear to each of the tenant, owner/investor, asset or facilities manager, contractor and waste facility operator.

The guide includes reporting tools and advocates an inventory list to be compiled for each project, with an online resource matching platform to support optimal re-use of goods.

The demolition/waste removal contractors have four recommended options:

1. Store and re-use
2. Re-home to charities and schools
3. Remanufacture and refurbishment – connecting back to the manufacturers of the office furniture
4. Resell as second hand

URBAN REFURBISHMENT

Summary
Through an established consortium of large commercial landlords covering 50% of the commercial buildings in Sydney, with the City of Sydney as secretariat, an office refurbishment waste guide has been created to enable a minimum of 60% of waste diverted from landfill at no extra cost.

Time period
2015-2018

Municipality levers
Provision of best practice guidelines; Public-private partnership

Scale and Cost
The guidelines have been launched city-wide through a partnership of landlords owning 2.5 million m^2 of real estate in Sydney.

The City of Sydney funds the secretariat and provides an operating budget for the Better Buildings Partnership. This is supplemented through a membership fee by the real estate landlords.

CO_2 reduction
A greenhouse gas emissions calculator has been issued to the real estate sector to account for the reduction of waste going to landfill. So far, 8,000 tonnes of materials have been recovered.

These BBP guidelines are also aligned with the Australian environmental certification for buildings, 'Green Star', through its Interiors and Performance rating tools, and can be utilised as part of the evidence used to earn credits.

What was achieved?
So far, an average of 60% of office fitout waste has been diverted from landfill from 15 refurbishment projects. This equates to over 8,000 tonnes of materials being recovered and 100 tonnes of furniture redistributed.

Furthermore, the implementation of the guidelines is opening up new market opportunities through these new ways of working, including: new viable product lines made from the furniture waste; identified new furniture recovery partners; new market intermediaries; procuring with the end in mind.

What were the challenges?
The following challenges were outlined by the City:

1. Understanding the chain of custody for materials in a "make good" where there are multiple owners of the waste and a diffusion of responsibility.

2. Using procurement clauses to move value up and down the chain and swap disposal costs for labour to improve management.

3. Building a directory of reuse materials receivers when the receipt of goods is unpredictable and irregular e.g. willing to receive 1,000 chairs one week but maybe not the following.

The working group comprises commercial landlords that have 2.5 million m^2 in their portfolios, 50% of all available in Sydney.

Next steps
A number of next steps are planned:

1. Continue promoting further uptake of this guidance document to keep office fit-out materials in higher value uses.

2. Extend impact of current work and network of responsible providers to other locations.

3. Continue to work on reuse through promotion of fitout as a service, i.e. retention, and education of specifiers.

4. Develop a materials exchange platform to increase the pool and diversity of circular economy market players and streamline material flows and trades.

5. Provide additional benefits and employment opportunities to the social impact sector.

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Vienna, Austria

Supporting dismantling services for large industrial buildings

What is the vision?
To develop a range of services for the dismantling of large-scale buildings, as a standard method for demolition, following Austria's increased standard promoting greater material re-use.

Who is the team?
The following departments from the City of Vienna support this initiative: Municipal Department 22 Environmental Protection, Municipal Department 48 Waste Management, Road Cleaning and Fleet.

BauKarussell works as a consortium of social enterprises, an architect, an ecological consultancy and an umbrella organisation for social enterprises. The consortium provides different perspectives and expertise. This includes: RapaNet, ROMM/MISCHEK civil engineering, Caritas Vienna SÖB (job seekers' support service), DRZ (the Dismantling and Recycling Centre), the Wr.Volkshochschulen, pulswerk GmbH (a Consulting company of the Austrian Institute for Ecology).

What is the local context?
The Recycled Construction Materials Regulation and the Standard ÖNORM B3151, which is defined by the Austrian Standards Institute, require dismantling in accordance with this standard when more than 750 tonnes of waste arises.

Previously there was no practical experience of re-use in the large-scale construction sector in Austria, and although some neighbouring countries had experience, often it was for re-use of materials from relatively small-scale buildings rather than large residential blocks and industrial buildings, for example.

What is the approach?
The City municipality supports the demolition consortium, BauKarussell, financially and organisationally. This takes places within the 'less waste' framework as part of the 'Clean city' campaign Vienna and is supported by Vienna's environmental councillor. The consortium is in close contact with the City department MA22, whose role is the control authority for building sites in the city. This secures that the development happens in line with the legal framework.

Together with property developers, the consortium plans the process for the building demolition. In the operational phase, the team removes selected materials and products to make them available for new buildings/users. The operational work is performed by disadvantaged workers from social enterprises. These former unemployed people gain work, a qualification, training and support to find their way back to the labour market.

In Austria, 9,000 jobs could be created by projects like BauKarussell and help marginalised people back into work.

What has been achieved so far?
The first pilot started with the dismantling of a former bottling plant of an international beverage producer in Vienna which was carried out by social enterprises and primarily involved disadvantaged workers such as the long-term unemployed. The demolition focused on manual dismantling, allowing for the reuse of building components and high-value recycling. It resulted in a turnover of €100,000 and prevented 450,000 kg of waste. The amount of waste prevented corresponds to nearly 1% of the total demolition mass, which is a remarkable amount for a pilot project.

In a second pilot project, the former data centre of the City of Vienna, was demolished in August 2017. In 3,450 operative hours, almost 74,000 kg of materials were dismantled and recycled; a turnover of €50,000 was generated.

The team estimates up to 10% of the demolition mass could be diverted from waste by reuse. In Austria, 9,000 jobs could be created by projects like BauKarussell and by engaging work integration enterprises, marginalised people can be put back into work.

What were the challenges?
Project developers have to include a new partner into the value chain of demolition. Therefore, BauKarussell has to provide a clear range of service to ensure the building owner can see waste reduction is compatible. Taking into account the increasing legal framework and the mandatory steps leads the opportunity to create a win-win situation. It is crucial to have early contact to set-up an appropriate process of demolition planning from the beginning.

Next steps
The next steps for BauKarussell include an aim to integrate the projects' results into a green procurement scheme of Vienna and link the project findings further with the demolition activities of the municipality itself.

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URBAN REFURBISHMENT

Summary
BauKarussell, supported by the City, provides recovery-oriented demolition with a particular focus on reuse for large-volume properties, enabling new regulations to be met. In cooperation with large Viennese property developers, reusable components are dismantled and made available for reuse. This work is carried out by workers from social enterprises.

Time period
2016 - ongoing

Municipality levers
Organisational support; Financial contributions; Framework guidelines

Scale and Cost
One of the pilot projects involved the dismantling of a former bottling plant of an international beverage producer covering an area of 3,000m^2, and another was a former data centre in Vienna.

Financial contributions cover initial efforts for the development of this new business model. Further support comes from the Federal Ministry Digital and Economic Affairs and the funding scheme for waste prevention in Austria.

CO_2 reduction
Due to extension of the lifetime of products, this supports a significant reduction of greenhouse gas emissions.

PROCUREMENT

Berlin, Germany

Ecological criteria embedded in the public procurement process

What was the vision?
Germany aims to achieve almost total high-quality recovery, at least of municipal waste, by 2020.

Berlin's Waste Management Strategy includes ambitious climate protection targets, featuring an additional annual reduction of 1.1 million tonnes of CO_2e by 2020. This equates to about 25% of the reduction in total Berlin's GHG emissions over 2010-2020. This is to be achieved not only through high quality recycling and cleaner recovery of waste, but also through an improved, environmentally responsible public procurement process.

It is recognised that public bodies and businesses can and should become an engine for innovation in many product and service sectors by promoting the use of durable, energy-efficient products and environmentally sound services.

Who was the team?
The Berlin municipality was fully responsible and led this initiative.

What is the local context?
Germany has the highest recycling rate in Europe of 66% (Eurostat 2016). Germany is the third largest producer of municipal waste in the EU.

What was done?
In 2010 the Berlin House of Representatives passed the Berlin Public Procurement Act (BerlAVG). This obliged all public purchasing offices in the state of to apply ecological criteria for their procurement, including the lifecycle costs.

In 2013, the "Decree on the application of regulations for environmentally-friendly purchases and order placements for deliveries, construction work and services" came into force. The regulation contains demanding environmental criteria, including for: office materials, office equipment, cleaning agents and cleaning services, road vehicles, large-scale events, tenders for power supplies, the planning of the office buildings, and for the recycling of commercial waste.

What was achieved?
The size of the Government, as the largest purchasing entity in the city, makes it a strong agent of change, which can spread the benefits to all stakeholders in the production chain.

Results include a 12-tonne reduction in diesel soot, bringing associated health benefits from cleaner air.

Based on the environmental and financial benefits of 15 product groups and services, a study was carried out to extrapolate all the public procurement benefits per year for Berlin:

- Particulate reduction by around 12 tonnes of diesel soot, bringing associated health benefits from cleaner air.
- Greenhouse gas reduction by 47%, or 350,000 tonnes of CO_2 equivalent.
- Wood savings of 9,300 t of wood.
- Natural stone saving of 2,000,000 tonnes.
- Cost savings of around €38 million.

Next steps
In the next few years, environmentally friendly procurement is to be expanded further in Berlin.

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Summary
Established example of a municipality driving more circular considerations by businesses through using ecological procurement criteria to direct its own expenditure.

Time period
2010 -

Municipality lever
Fiscal policy

Scale
The sustainability criteria applies to all of the City government's procurement worth around €4-5 billion each year. (Berlin's GDP was €125 billion in 2016).

Cost savings of around €38 million per year.

CO_2 reduction
The annual greenhouse gas emissions of the product groups and services examined decreased, an estimated, 47%, or 355,000 tonnes CO_2e, compared to the former conventional procurement. Green procurement can therefore reduce greenhouse gas emissions related to the products and services in the country.

Helsinki, Finland

Coordinating the reuse of excavated land mass in construction projects across the city

Who was the team?
A coordination group was established with 10 experts from the Urban Environment Division in the City. It includes technology and environmental experts, engineers and landscape architects.

Other stakeholders that were essential for this initiative to succeed were the Helsinki Region Environmental Services Authority (HSY) and private sector.

Businesses had a very important role in this initiative as long distance transportation naturally costs them more money than utilizing most of the land masses on the spot.

New businesses and business models have been generated from this initiative. For example, Maapörssi Oy has established its position as an active national operator in the trading of land masses.

What is the local context?
In Finland, the use of natural resources in building and construction works per capita is 2-3 times greater than the average in EU countries. The resource use of rock and land masses has been recognized to be a key way to reduce CO_2 emissions in urban planning and design. CO_2 emission reductions in construction can be achieved with help of resource wisdom and by changing routines in planning and operations.

How did you do it?
This initiative required a completely new approach. The decision to start this project came from the City Board and so the engagement of politicians, municipal organizations and public utilities was relatively easy.

The mass coordination group (founded in 2009) had a significant role in this initiative, as well as the City of Helsinki land mass coordinator (named in 2014). One of the main tasks of a land mass coordinator is to follow, supervise and coordinate the flow of land masses inside of Helsinki.

What was done?
City of Helsinki had a coordinating role in this initiative.

Key action points were:
1. 8 temporary land mass storage areas in urban area in Helsinki for managing and processing land masses.
2. Mapping the network of storage areas in Helsinki for managing and processing land masses. Input to the City master planning process.
3. Coordination and utilization of land masses considered in master-planning phase.
4. Utilization of land masses in street and park planning (coordinating land mass surpluses and needs between projects and construction sites and defining the quality of the soil).
5. Collaborating with neighbouring cities and the Helsinki Region Environmental Services Authority (HSY).

The City of Helsinki has saved €32 million, 4.5 million litres of water and 11,300 tonnes of CO_2 emissions.

6. Collaboration with national and regional level programs to promote the use of recovered materials in groundworks.
7. Environmental Impact Assessment of infrastructure planning and construction. Identifying the most relevant process phases from the environmental perspective and promoting sustainability in procurements.
8. Promoting the CO_2 calculations in infrastructure projects.

What was achieved?
Excavated land masses are being re-used through better coordination. This initiative creates significant cost savings due to no longer needing to purchase new land massing for the foundations of public construction projects. Carbon is saved as new soil storing carbon is not disrupted and brought into the city for land massing use. During the program, the City of Helsinki has saved €32 million, 4.5 million litres of water and 11,300 tonnes of CO_2 emissions.

In 2017 total of 1,100,000 tonnes of excavated land mass is produced inside City of Helsinki borders. In 2017, 87% of the excavated land mass is utilized inside the city of Helsinki and 13% is carried elsewhere.

What were the challenges?
The key challenge was to get the land mass coordination established after neighbouring City of Vantaa refused to receive Helsinki's surplus landmasses from 2011 onwards. It is challenging to schedule the reuse of low-quality soil masses, as the permitting process for their final utilization destinations can take many years.

Next steps
The City of Helsinki is compiling principles for the use of land masses, rocks and demolished materials in groundworks to incorporate into the second phase of the program (2018-2021).

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Summary
Construction works in Helsinki produce annually over 800,000 m^3 of unspoiled surplus landmass, and the neighbouring city no longer had demand for it. By better utilizing and reducing the amount of surplus landmasses it has been possible for the City of Helsinki to save 5 to 10 million Euros annually and achieves notable reductions in CO_2 emissions.

Time period
2014-2017: first phase
2018-2021: second phase

Municipality lever
Action plan; Development projects coordination

Scale and Cost
This land massing reuse action plan is city-wide and is led by Helsinki municipality.

CO_2 reduction
The scale of earth kept in circular use rather than being disposed of is equivalent to saving 11,311 tonnes of CO_2.

Paris, France

Transnational responsible procurement working group

What was the vision?
Sustainable purchases is one the actions in Paris' first road map for a circular economy. The aim of this action is to increase the proportion of ecologically friendly products in public purchases and develop a functional economy approach in public procurement contracts.

What is the local waste context?
Paris has signed the C40 'Advancing towards zero waste' declaration, which comprises:

1) reducing the municipal solid waste generation per capita by at least 15% by 2030 compared to 2015; and

2) reducing the amount of municipal solid waste disposed to landfill and incineration by at least 50% by 2030 compared to 2015, and increasing the diversion rate away from landfill and incineration to at least 70% by 2030.

What was done?
At the end of 2015, the City of Paris had already initiated a transnational procurement group with several other European cities. This is unprecedented for a French local authority: Paris was the first to have approved the introduction of a responsible public procurement scheme at the Paris City Council in February 2016. The circular economy forms a very important part of this.

The responsible public procurement scheme engages the City in an innovative approach, with the creation of an environmental footprint indicator for its purchases, new resource-efficiency criteria for future procurement contracts, as well as prior consideration of needs.

What was achieved?
By 2017, 39% of the contracts awarded by the finance and purchasing department include a circular economy dimension and 61% of the contracts include an environmental clause and/or criterion.

At the end of 2015, the City of Paris initiated a transnational procurement group with several other European cities.

Summary
The City of Paris, and several other European cities, have committed to defining new criteria related to resource efficiency (both material and human) for its future public procurements, as well as to reassessing its needs prior to procurement. Paris is one of the first to adopt a responsible procurement policy.

Time period
2014 -

Municipal levers
International collaboration; Best practice guidelines; Procurement policy

Scale and Cost
Public procurement by the City of Paris alone is worth €1.6 billion. Paris is the world's fourth-ranked city in terms of economic power and attractiveness. This therefore represents a potentially powerful means of leverage for the ecological transition of the economy and creation of sustainable local jobs.

Tokyo, Japan

Circular initiatives within the Tokyo 2020 Olympic and Paralympic Games' Sustainability Plan

What is the vision?
Recognising that 'sport has the power to change the world and our future', the Tokyo 2020 Games aims to be the most innovative in history.

The sustainability concept of the Tokyo 2020 Games is 'Be better, together – for the planet and the people' which stand for the vision of sustainability; the Olympic, and Paralympic Games, showcasing a model of a sustainable society which humankind pursues, and working integrally on sustainability challenges.

Based on this concept the Tokyo 2020 Games set the five main themes:

- Climate Change: Towards Zero Carbon
- Resource Management: Zero wasting
- Natural Environment and Biodiversity: City within Nature/Nature within the City
- Consideration of Human Rights, Labour and Fair Business Practices: Cerebrating Diversity – Inspiring Inclusive Games for Everyone
- Involvement, Cooperation and communications: United in Partnership & Equality – Inspiring Inclusive Games for Everyone

The Tokyo 2020 Games contribute to realising the Sustainable Development Goals, Olympic Agenda 2020 and the Paris agreement's goals by working these themes.

The Tokyo 2020 Games advocates the four sustainable development governing principles of Stewardship, Inclusivity, Integrity and Transparency regarding to the ISO 20121 (Event Sustainability Management System).

Who is the team?
An Urban Planning and Sustainability Commission was established within the Tokyo 2020 Organising Committee, to enable cross-sector framework.

25 out of the 43 venues required for the Games will be in existing venues in the city, saving around 80,000 tonnes CO_2.

The Tokyo 2020 Organising Committee works actively with the Tokyo Metropolitan Government, the Government of Japan (including the Ministry of the Environment), relevant regional/local governments, sponsors, and other delivery partners and stakeholders.

Typical waste generation for Olympic and Paralympic Games
According to the past Olympic and Paralympic Games:

- Waste generated from the installation and demolition of venues: 60,000 tonnes*
- Waste generated from operation activities during the Games: 10,000 tonnes*

*These figures are not calculated for the Tokyo 2020 Games

What was the approach?
Firstly, a high-level Sustainability Plan for the Games was written in 2016. In January 2017 an overarching Sustainability Plan version 1 for the Tokyo 2020 Games was published and version 2 in June 2018. A Sustainability Policy was published in May 2018. These were developed under discussions of expert committees, public comments, and opinions of NGOs.

The Tokyo 2020 Organising Committee has been adopting management systems in accordance with ISO 20121 and aims to achieve third party certification in 2019.

The Tokyo 2020 Games has 12 climate-change goals, including maximising the use of existing venues in the city. For venues that will need to be constructed, they are targeting high environmental performance, including passive design for lighting and ventilation, as well as use of recycled materials, and even rental, leasing or re-selling materials after the games, with 99% recycling and volume reduction of construction waste from new permanent venues (see targets of Climate change and Resource Management).

Following on from these aims, for the Village Plaza, Japanese municipalities will provide their local timber for its construction and have also been asked to take action or implement events related to the project to engage their local community.

The Tokyo 2020 Organising Committee will manufacture approximately 5,000 gold, silver and bronze medals for the Olympic and Paralympic Games from 100% recycled content, extracting almost 7 tonnes of pure metal from consumer electronics, such as used mobile phones. This initiative engages citizens across the nation, and partners for the Games, raising awareness of the importance of resource efficiency as well as individual participation for the success of the Tokyo 2020 Games. Collection points have been established by supporting companies, bodies, events and approximately 90% of municipal authorities in Japan are taking part in this project.

Summary
The Sustainability Plan includes the Village Plaza being built from timber sourced from 63 municipalities in Japan, to be redistributed after use, and recycled metal for the Olympic and Paralympic medals.

Time period
2016-2020

Municipality levers
Major sporting event; Infrastructure investments; Procurement policies

Scale and Cost
Number of the Olympic and Paralymic Games venues: 43 (25 of which are existing venues)

Games budget: € 10.5 billion

CO_2 reduction
Carbon reduction of the Tokyo 2020 Games will be measured and reported to the public accordingly.

What was done?
Regarding the timber Village Plaza: Yamagata, Gifu and several other municipalities have already held events to engage their local communities with sustainable forestry management. It has been agreed that after the Games, the Plaza will be dismantled, and the timber returned to the municipalities across Japan for them to reuse.

Regarding the medals, approximate 55% gold, 44% silver and 100% of the bronze required for the medals was already gathered by June 2018, well on track for completing before it closes in spring 2019.

Progress on wider sustainability initiatives to follow in the Pre and Post Games Sustainability Reports.

Achievements to date
Already, 24 out of the 43 venues required for the Games have been identified as using existing venues in the city. Therefore building 60% fewer venues equates to a saving of approximately 80,000 tonnes carbon emissions that would otherwise be incurred.

What were the challenges?
In order to manage the huge amount and broad range of goods and materials, the Tokyo 2020 Organising Committee is taking measures of 3Rs (reduce, reuse, and recycle) at the both phases of input and output in the limited schedule, including developing a guideline to promote rental and leasing when procuring.

Next steps
3 Sustainability reports will be published to communicate the progress of the Tokyo 2020 Games:

1. Progress Report in Spring 2019
2. Pre-Games Report in Spring 2020
3. Post-Games Report in Winter 2020/2021

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After the Games, the Village Plaza will be dismantled and the timber returned to the municipalities across Japan for reuse.

Toronto, Canada

Journey towards circular economy procurement

What is the vision?
Toronto set an aspirational Zero waste goal in 2016, as part of the masterplan called the Long-Term Waste Management Strategy (LTWMS). It also introduced the ambitious goal of making Toronto a circular economy city. Developing the LTWMS took two-years of consultation with over 40 events, public meetings and approximately 3,400 survey responses.

This Circular Procurement project aims to drive waste reduction, economic growth and social prosperity, and to leverage the City's purchasing power to foster leadership in various sectors.

Who is the team?
The City of Toronto, Solid Waste Management Services (SWMS) Division, together with the Purchasing and Materials Management Division (PMMD), are co-leading this procurement initiative.

In 2018 the Unit for Research, Innovation & Circular Economy was established within SWMS. This unit's core team is comprised of five City staff (a manager, senior engineer and project managers) who support innovation and economic growth, and both internal and external circular economy training and capacity building.

This Circular Procurement pilot is carried out by a total of ten City Divisions that participate in a cross-division working group established in early 2018. Participating Divisions include: SWMS, PMMD, Parks, Forestry & Recreation, City Planning, Facilities Management, Economic Development & Culture, Transportation Services, Environment & Energy Office, Toronto Water, and Toronto Public Health.

What is the local waste recycling context?
Toronto is Canada's largest city, the fourth largest in North America, and home to a diverse population of about 2.8 million people.

20% of Toronto's carbon emissions are from waste.
Toronto already had the following examples of circular initiatives taking place ahead of the masterplan's introduction of proactive circular economy efforts:

Provide colleagues with examples of circular procurement already in action so it doesn't feel like a huge shift, such as small clauses in contracts, which do not even need to refer to 'circularity'

1. Urban wood rescue for local businesses - Salvaged wood from urban trees taken down (e.g. due to strong winds, poor health), are upcycled for use by local furniture and cabinetry businesses, rather than being disposed of.

2. Curbside bins reuse and repair scheme – Since 2008, contracts for the provision of household waste and recycling bins have required durability and repairable features, including replaceable lids, wheels and lift bars. Citizens are also able to request a change of bin size and removed bins are washed and redeployed. Consequently, about 75% of bins are successfully retained over their 10-year lifespan and any bins that are not re-deployable are recycled. Over 5,440 tonnes of resin from out-of-service bins has been incorporated into new bins throughout the duration of the contract.

3. Introduction of Biofuel for waste collection fleet – Organic household waste is anaerobically digested and the City is able to provide the biogas output to the local natural gas distributor. At the same time, the City has invested in transiting waste collection trucks to Compressed Natural Gas and has installed fuelling stations in City yards.

What was the approach?
The initial direction for circular procurement principles came from a City government management body, different to the one the SWMS Division usually works with. As it is would be uncommon for the City's SWMS Division to lead a procurement exercise for the entire city, working closely with the PMMD was essential.

The timing matched PMMD's Supply Chain Management Transformation program, which is in the process of implementing Category Management and Strategic Sourcing (CMSS). CMSS will focus on key goods and services in order to drive lower total cost of ownership and other benefits. Circular economy integration into procurement processes can also send a harmonized message up and down the supply chain concerning the value of resources, including incentives for using waste previously requiring disposal as material for new production cycles.

To establish the cross divisional working group, in the first quarter of 2018, the SWMS Division:

- Sent letters to all division heads and City managers for cross-division working groups, to get support and buy-in from the top and to request all City Divisions take the time to actively participate in the cross-division working group.

Summary
Ten City Divisions working collaboratively to pilot test a circular economy procurement framework, with a clear set of evaluation metrics and an aspiration to scale-up to apply to all City procurement.

Time period
2018-2021 Circular Economy procurement pilot

Municipality levers
Vision and strategy setting; Convening and partnering; Capacity and awareness building; Public procurement

Scale and Cost
Initially developing a Framework to pilot Circular Economy principles in procurement. Broadly, adoption has the potential for significant impact, as the total value of contracts awarded by the City each year is approximately $2bn CAD.

$1.8 million CAD has been allocated to the Unit for Research, Innovation and a Circular Economy over the next five years to cover staff, studies, grants, partnerships, pilots, conferences, membership fees and travel.

CO_2 reduction
Toronto will aim to measure the GHG reductions through the procurement pilots by tracking metrics like: reduced miles travelled, alternative fuels used, etc. in close dialogue with suppliers.

- Provided information and capacity building to ensure all had a good understanding of 'circular economy'. Then held 1:1 discussions to explore how it could impact each Divisions' procurements.
- Held a cross-divisional workshop, facilitated by an external expert, to collaboratively develop the Circular Economy Framework for Toronto.

A key action for the successful development of a Framework was sharing examples of existing and potential circular economy procurement practices.

The rate of implementation of the Framework will correlate with the timing of contract renewals and new procurements. To begin, the City may focus on low risk pilot procurements in the following target categories: Food and Catering; Waste management; Information and Technology; Textiles and Clothing; Construction and Engineering.

What was done?

The cross-divisional team established three Framework goals:

1. Increase the amount of goods and services that are regenerative by design, have lower GHG emissions, are less toxic, and rely less on raw materials.
2. Increase in contracts procured through a process that considers full value, lifecycle impact, resource potential, and maximum utility of goods and services.
3. Introduce the requirement for the re-examination of contracts from a circular economy lens prior to issuing solicitations, when contracts come up for review.

The following guiding principles were also established:

1. Mitigate climate change and achieve a resilient low-carbon future, considering both operational and lifecycle emissions, and advancing community resilience in alignment with TransformTO.
2. Minimize both the full lifecycle impacts and maximize the full utility of goods and services.
3. Achieve aspirational goals of zero waste, and to treat any remaining waste produced that cannot be reused or recycled as resource that has value.
4. Align with the City's Supply Chain Transformation and be strategic, transparent, and encourage innovation while adhering to all City purchasing legislation and By-laws.
5. Align with City Council approved strategies aimed at improving environmental (i.e. reduction in greenhouse gas emissions), social (i.e. community health, wellbeing, employment) and economic (i.e. fiscal sustainability) outcomes.
6. Collaborate with relevant partners and sectors, including relevant local industry associations, to help drive innovation towards more circular services, products, and mutually beneficial solutions.

In addition to the Circular Economy Procurement Framework, Toronto has also formalised an Extended Producer Responsibility policy that integrates Circular Economy principles; hosted workshops for local agencies, municipalities and small-to-medium businesses from Toronto's key economic sectors to identify priorities for a City-wide Circular Economy Roadmap Strategy; and developed an Artist-in-Residence pilot program, as an innovative way to create awareness about waste management.

Pilot evaluation metrics

A number of preliminary metrics have been identified for potential capture in the pilot project:

Environmental metrics:

1. CO_2 savings as a result of procurement activities
2. % waste diversion as a result of procurement activities
3. % recycled content used in materials
4. Number of city contracts evaluated using Circular Economy principles
5. Raw materials avoided/displacement factor

Social

6. Number of green jobs created and secured
7. Number of City staff trained on Circular Economy procurement principles
8. Asset utilization rates/ Asset sharing activities

Economic

9. Cost savings
10. Waste reduction savings
11. Degree of productivity

What were the challenges?

Measuring the baseline of circularity in the city is a challenge, and an especially complex one because no established methodology exists.

Key areas of advice:

1. Circular procurement begins with those who are drafting specifications to buy goods & services – education is a key part of the success.
2. Timing is critical – know when the big contracts are coming up as they need extra planning.
3. Pre-procurement planning involves a high level of engagement both internally and externally.
4. Understanding buying power is fundamental to pre-procurement planning.
5. A major capacity building procurement workshop has benefits – have participants speak about their Division's procurement and waste diversion activities.
6. Provide colleagues with examples of circular procurement already in action so it doesn't feel like a huge shift, such as small clause examples in contract, which do not even need to refer to 'circular.'

Next steps

The team is looking for further pilot procurements to complete and will review their success, with the hope that Circular Procurement principles can eventually be applied to all municipal procurement.

Engagement with contractors is currently being prepared with the aim of helping key suppliers build capacity in their sectors to meet the increased procurement requirements. Capacity building across the City Divisions and in external organisations will also continue, along with sharing progress to date.

Updates on the implementation of the Circular Economy Framework will be reported back to City Councillors in 2019, with a final recommendation on how to integrate Circular Economy principles into the City's existing procurement policy in 2021.

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UTILITIES

Aguascalientes, Mexico

Water fund to support the City's water shortage

What was the vision?
The aim is to stop the reduction trend of the aquifer, which is posing a significant challenge for the future of the city. This follows a scientific assessment of the aquifer evolution by TNC and Veolia.

Who was the team?
The core team comprises Veolia, Danone and The Nature Conservancy, with the local municipality providing some co-financing for the Livelihoods Fund for Family Farmers, and the State Government providing support. The consortium of farmers is a key stakeholder group.

What is the local context?
Aguascalientes is a semi-arid state a few hours from the north of Mexico City with a population of around 1.3 million. Year by year, the aquifer is going down, mainly due to intensive agriculture but also due to the local population growth. As the water level reduces, Veolia has to collect water deeper every year to distribute it to the local population. However, in doing so, the water quality becomes worse, the water temperature also increases with geothermal heat, which has an impact in term of energy and water treatment. 80% of the state population is in the city but 80% of the water is utilised by the local farmers.

What was the approach?
Veolia Mexico took operational control for the City's water supply more than a decade ago. In the early 1990s, the coverage for available drinking water by the population was 65%. Today it stands at 99.5% and with a 50% leakage reduction.

Further efforts are planned to improve the city's fresh and waste water networks in light of the continued challenges. This includes monitoring equipment to ensure real time data on the level of water in the city's wells, alongside the proposal for a water investment fund.

Veolia and TNC is working on a fund to test a technical agricultural process with Livelihoods Fund for Family Farmers who have the highest demand for the water. Veolia is also working at the State scale as the aquifer goes beyond the limit of the City and their municipal contract. Changing the water usage by a drip irrigation system reduces the water consumption of the farmer by 50% - 70%. If all 5,000 of the local family farmers adopt this system through the new fund, it's been calculated that 2/3 of the aquifer pressure will be erased.

Achievements to date
Firstly, a technical and scientific study was completed by Veolia and The Nature Conservancy to identify the actions to be done. Then, thanks to dedicated funds Veolia and Danone organised a pilot project to test the water usage change of 250 farmers and measured the impact. 1/3 of Family farmers have since confirmed their engagement for the project just as it has started.

In the meantime, Veolia and The Nature Conservancy are working alongside the City and the State to create a single structure to tackle this aquifer level issue.

What were the challenges?
Building a public-private-NGO project has been a challenge. Securing blended finance for the farmers (private-public funders) has been key.

Next steps
The next steps are to create a fund that will benefit the population of the city, supporting 80% of the total state population to reduce their consumption. Also, to contribute to the funding of further initiatives adjacent to the city boundaries.

If all 5,000 of the local family farmers adopt this fund's new system, 2/3 of the excess demands on the aquifer will be erased.

Summary
Considering the aquifer's water level decrease, Veolia, in partnership with The Nature Conservancy and local municipality, is proposing the creation of a water fund to finance local changes in the water-catchment and uses.

Time period
2018 -

Municipality levers
Infrastructure project; Public-private partnership; Water utilities management; Finance provision

Scale and Cost
The water network is state-wide, comprising 2,700km of potable water networks, over 200 wells and 2,100 km sewage networks.

The project has been founded by Danone and Veolia on a 6-year contract with the City.

Arras, France

Heat recovered from waste-water treatment for a public aquatics centre

What was the vision?
Arras is a city 175km North of Paris and has a long-term strategy for energy reduction.

Who was the team?
They key players for this project are Veolia, the Arras Municipality and the Aquatics centre.

How does it work?
Technology enables heat to be extracted both from waste-water, such as the residual heat from inhabitants' hot showers, and waste sewage. The waste-water flows into a spiral heat extractor, heating a transfer liquid, which in turn connects to the heat pump system for the public Aquarena Aquatic Centre. This provides both the heat required for the swimming pool water and the Centre's indoor air.

What was achieved?
This new heating system now covers 80% of the energy required to heat the public swimming pool. This stabilises the cost of energy for the municipality and enables the municipality to save financially, approximate €40,000 per year.

The return on investment is currently forecast to be <9 years; it will decrease as a carbon tax on natural gas increases.

Challenges
Waste water is generated in the nearby network at a rate averaging 30 litres per second, and from a maximum distance of 300m. Matching the rate of the production and consumption of heat energy has been a challenge, especially as the aquatics centre is a constant user of heat.

UTILITIES

Summary
Veolia uses the heat of the City's waste-water and sewage networks to heat the air and water at a public aquatics centre through a technology called Energido.

Time period
Completed in 2015

Municipality lever
Renewable energy investment

Scale and Cost
The Arras aquatics centre covers 4,000m^2.

The capital expenditure for the renewable heating infrastructure was €600,000 (pre-tax).

With 40% subsidies, the return on investment is currently forecast to be < 9 years and will decrease as a carbon tax on natural gas increases.

CO_2 reduction
The reliance on fossil fuels by the aquatics centre is reduced by 80% each year through this renewable energy system, resulting in about 230 tonnes of CO_2 per year no longer being released into the atmosphere.

Basel, Switzerland

Gold award winner for Basel's progress towards a low-energy city

What was the vision?
With its national energy plan 'Energy Strategy 2050', Switzerland is facing major changes ahead and Basel is leading the way for the rest of the country.

The City authority aims to get its own municipal emissions down to net zero by 2030. Going even further, the Basel City authority passed a law in November 2016, which came into force in August 2017, with the headline target to reduce CO_2 emissions per person from 4 tonnes today to 1 tonne by 2050.

Who was the team?
The publicly-owned energy company Industrielle Werke Basel (IWB) and the City of Basel.

What is the local energy context?
IWB is not permitted to purchase nuclear power and is required to provide certificates proving to electricity consumers in the local district that the electricity they purchase comes from renewable sources, since 2010.

What was the approach?
The canton (or state) Basel-Stadt uses financial tools such as tax levies and incentives to boost clean energy production and energy efficiency projects across the region.

Promotional tax:
Basel-Stadt strongly encourages building renovation. To this end it has been providing finance sourced from the promotional tax for over 20 years. In 1984, the canton passed an energy law which placed a surcharge on all electricity bills in the canton. Today this tax yields about 10 million francs (€8.86 million) annually. This money is available for energy saving measures, such as insulating old buildings, fitting well insulated windows or measures to improve the efficiency of ventilation and lighting installations.

Incentive tax:
A further pillar in Basel-Stadt's energy policy is the incentive tax. When energy prices fell in the mid-nineties, Basel took a somewhat alternative route. Although the price of energy dropped, an incentive tax was raised to the same amount, to prevent people having a false incentive to waste energy. All money raised from this tax flows back into industries and households in Basel.

The City of Basel has a proven track record of reaching their targets and is willing to go the extra mile when it comes to climate action.

What was achieved?
The majority of the city's electricity is generated from hydropower, with 10% from wind and smaller contributions from biomass and solar. Basel's publically-owned energy company, IWB, therefore only offers electricity from renewable sources, and it also has a district heating system run on waste incineration, woodfired-powerplant, geothermal and biomass.

Basel was re-awarded the European Energy Gold Award in 2018 that it has held since 2006.

What were the challenges?
Political will, support and endurance is crucial; the City of Basel started its energy policy late in the 1970s. A significant impact can be achieved when applying solutions that combine efficiency, renewable sources and easy measures, such as an incentive tax to strengthen sufficient behaviour.

The City of Basel has a proven track record of reaching their targets and is willing to go the extra mile when it comes to climate action, ensuring solutions are found to meet the ambitious targets.

Next steps
The City authority aims to get its own municipal emissions down to net zero by 2030. A second wood-fired power plant will further support emissions reductions of the City.

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Summary
The City of Basel has been very active with regard to developing, expanding and ensuring the provision of clean energy to residents and businesses. For example, Basel is one of the few cities with 100% renewable electricity, has been installing charging stations for electric cars, and a second wood-fired power plant will soon create a net saving of 19,000 tonnes of CO_2 emissions per year.

Time period
100% electricity from renewable energy since 2010

Municipal levers
Financial taxes and incentives; Renewable energy infrastructure

Scale
Renewable electricity is provided to both the city and surrounding region within the state of Basel-Stadt.

CO_2 reduction
The CO_2 emissions from energy in Basel has reached 3.8t of CO_2 per citizen each year, and targets 1t CO_2 per person by 2050.

Helsinki, Finland

The largest heat-pump plant in the world to produce heating and cooling

What was the vision?
This scheme contributes to Helsinki's goal to be a carbon neutral city by 2035.

Who was the team?
Initiative lead: The Finnish utility company called 'Helen', based in Helsinki. Helen is 100 % owned by the City of Helsinki.

Long-term planning by the City of Helsinki was essential for this initiative to succeed because the location reservation for the plant was already made during the 1980s. Collaboration with the City of Helsinki was also essential for the infrastructure works (tunnels etc.) to succeed.

Furthermore, close collaboration with HSY (Helsinki Region Environmental Services Authority) was a critical factor for success.

What is the local context?
More than 80% of the waste resources the plant uses would be left unutilised without it.

How does it work?
A rock cave for the heating plant was excavated under the Katri Vala Park, a few kilometres from Helsinki city centre. The cave is at a depth of 25 metres from the ground level. The location is ideal due to the fact that an outflow tunnel for purified wastewater and a multi-utility tunnel, through which the heat and cooling energy produced at the plant is transmitted to customers, intersects under the park. The technology is therefore able to utilise heat energy that would otherwise go unused.

A high volume of purified wastewater, the heat of which is utilised in the district heat production, flows in the wastewater outflow tunnel 24 hours a day. Heat energy is obtained with heat pumps from purified wastewater, which is led from the Viikinmäki central waste water treatment plant to the sea.

All year-round heat energy is transmitted from the return water in district cooling, and therefore the heat pumps produce both district heat and district cooling.

What was achieved?
2017 saw production increase to a total of 570,000 MWh, 8% of the heating needed for the city.

Include co-benefits and measures of success
The plant has won multiple national and international awards, including from the Global Covenant of Mayors.

What were the challenges?
Collaboration with new and different stakeholders, including the wastewater purifying organisation, was incredibly important for the success of this capital investment.

Next steps
A sixth heat pump will be commissioned in 2021 and will enable the plant's production volume to increase by up to 30% (compared to 2017). Space for this additional heat pump was set aside in the plans for the original plant completed in 2006.

This new investment is worth €20 million and is forecast to reduce the carbon emissions further by 65,000 tonnes per year. The new pump will also improve the ability of the plant to operate more through periods of cold weather.

The technology utilises heat energy that would otherwise go unused.

Summary
The Katri Vala Heat Pump Plant, located underground, recycles waste heat from purified wastewater, as well as excess heat from buildings such as data centres.

Time period
Completed in 2006

Municipality levers
Renewable energy capital investment; Planning policy

Scale and Cost
In 2017 Katri Vala Heat Pump Plant produced 90% of the city's cooling and 8% of heating requirements.

A sixth heat-pump will be commissioned in 2021 at the cost of €20 million, and will increase production volume by up to 30%.

CO_2 reduction
Carbon dioxide emissions are 80% lower than alternative heat production using heavy fuel oil.

Lille, France

Biointensive micro-farming in the Concorde district

What is the vision?
This project aims to test new ways for quality, local food production to be achieved and scaled-up as a solution to meet the growing population and food consumption in cities globally. The project will help bring further benefits for the inhabitants in Lille, in terms of food quality, employment, as well as for enhancing biodiversity and reducing city pollution.

Who is the team?
Veolia and Sodexo lead the project with support from the municipality of Lille.

What is the local context?
Located near the northern border between France and Belgium, Lille has an urban population of around 1.2 million, making it the fourth largest urban area in France after Paris, Lyon and Marseille.

The municipality has an action plan comprising 200 projects to support the sustainable development of the city.

According to Eurostat, the average municipal waste generation across France is 511kg/person/year or 1.4kg per day.

What is the approach?
The project was fortunate to have 1 hectare of land, uncultivated, and non-contaminated, near the city centre. The City wanted an innovative way of making this district a better place for its inhabitants and launched a call for expressions of interest.

Implementing intensive organic farming on this land, including 300 types of fruit and vegetables, has been welcomed by the city and gained substantial support from the Mayor.

This urban farming project converts 11 hectares in the Concorde district into urban farmland, and the team recognise that the area is the 5th poorest district in France, and therefore aim to create significant local employment opportunities through implementing this initiative.

This project aims to test new ways for quality, local food production to be achieved and scaled-up, as a solution to meet the growing population and in cities globally.

What was done?
The implementation of the farm, infrastructure and formation have commenced and the farm aims to be in full operation by 2020.

Although it is too early to evaluate, circular material use, in terms of organic waste, circular water irrigation and energy savings are expected.

There are further projects supported by the municipality of Lille within this same theme of promoting local food, including a new urban regeneration project called Fives Cail, where the community are invited to join in the food preparation and communal dining in this new central redevelopment.

What were the challenges?
This system requires a significant amount of technical knowledge and therefore to enable this project to endure into the future, the new employees from the district have to learn at least all the basics of biointensive micro-farming. A farming course is currently being developed.

Next steps
The urban farm is currently under construction.

Summary
Biointensive micro-farming uses the principles of permaculture to produce high quality products on a very small area. The objective is to maintain an intensive production while keeping the soil alive and fertile without chemical entrants, during all seasons. It also has a social impact as it provides employment and training opportunities to the neighbouring communities to work on the farm, prepare and sell the food locally.

Time period
2018-2020 and beyond

Municipality lever
Infrastructure investment

Scale and Cost
A pilot scale urban farm has already been created next to Lille. The final project will cover 11 hectares of land in the middle of Concorde district.

CO_2 reduction
This type of farming enhances the capacity of the soil to absorb carbon dioxide by up to a 10% increase in carbon sequestration in the ground per year. The local consumption of the food supports lower carbon emissions from transportation.

Malmö, Sweden

Industrial symbiosis in the harbour area

What was the vision?
The ambition is to work towards more sustainable development by creating synergies between industries and businesses, finding mutually beneficial opportunities for businesses to conserve natural resources. Through promoting circular flows and reducing waste volumes, this supports the creation of attractive sustainable cities that endure into the future.

The knowledge and networks created should support more resource-efficient and circular economy models scalable in other regions and countries.

Who was the team?
The Malmö municipality owns the harbour area and is therefore a key player in its development. Several city departments were involved, including the Environment Department responsible for the project's coordination.

Further key team members include:
E.ON, Copenhagen Malmö Port, Linköping University, WSP, Sustainable Business Hub.

What was the approach?
A dialogue was initiated by CMP (Copenhagen Malmö Port) and the energy company E.ON, primarily concerning the residual heat flows in the port area and how they could be utilized. In turn, they contacted the City's Environmental Department, and together the project 'Shared Energy' was formed and external funding was secured.

The project then sought funding from Vinnova's Challenge-Driven Innovation program, a national research and development fund. The concept was to try new ways to promote innovation and create symbiotic links between companies in the harbour area. It required both the City and the companies to take a new approach and initiate dialogue between each other that is not common in ordinary business as usual.

What was done?
Concrete visions, plans, agendas and project ideas for collaborative innovations were drawn up through workshops and bi-lateral interactions led by a core working group that included: industry operators, public bodies, knowledge institutions and real estate institutions. Various matchmaking approaches were therefore tested and refined, supporting the building of trust between various businesses, helping partnerships to start to form.

A vision for the development of the harbour area was also drawn up, including an ambition for a future energy system that stretches beyond the harbour to support the wider City of Malmö.

A vision for the development of the harbour area includes an ambition for a future energy system that stretches to the wider City of Malmö

Residual heat flows in the port area were mapped in detail, helping to develop a new district heating system with private-sector partners trialling types of hybrid 'ecto-grid/smart-net pilot,' as ways to support energy recovery and the development of low temperature heat network solutions.

Progress was made towards new food production systems based on residual flows, including technological and economic assessments for an aquaponic systems, which gained positive results.

New branding of the harbour area as a green port has commenced and is attracting interest from companies aligned to the principles of a circular economy.

What was achieved?
This new approach for the City has led to an increased and wider understanding of the value of collaboration towards a green and circular economy in Malmö through a systems approach, both within different departments of the municipality as well as the many stakeholders in the industrial harbour area. For example, a business stakeholder commented: "We entered the project with a very clear focus on energy questions. However, as we moved along, we recognised that value chains of different systems are even more interlinked than we thought. As a result, we concentrated on formulating solutions that connect energy and waste flows in a much more concrete way."

The project has enabled the development of new structures and routines for systemic support to symbiotic developments through significant uplift in relational, knowledge, and mobilisation capacities for collective action among local actors.

What were the challenges?
A key challenge was the initial operational outcomes being lower than desired due to the feasibility of new businesses synergies requiring further analysis and problem solving.

Next steps
A third phase of the 'Shared Energy' project is commencing, aiming for two designated test sites and a commitment to a longer-term symbiosis program.

City contact details
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Summary
Although still in its early stages, the industry players in the harbour of Malmö City are collaborating in new ways, particularly with a focus on innovative utility systems that have the potential to support the wider City of Malmö. Concrete plans, new trusting relationships and enhanced understanding set the foundation for the future phases of the program.

Time period
2015-2017: Phases 1 & 2

Municipality levers
Public-private sector collaboration; Planning policy; Financial support; Technical support

Scale and Cost
City-wide, focusing on the industrial harbour area, which is owned by the City.

Total cost 19.3 million Swedish Krona (€1.87 million)

Financed 50/50 by the City of Malmö and Vinnova, a national agency that administers state funding for research and development.

CO_2 reduction
Industrial and urban symbiosis enables lower greenhouse gas emissions due to natural resource efficiency gains.

Pécs, Hungary

One of the largest generators of energy from biomass in Europe

What was the vision?
The Minister for National Development of Hungary clearly outlined in the National Energy Strategy 2030, for increased use of renewable energy and waste to energy. As a short-term goal, the country aims for 15% of renewable energy supply by 2020. The project, which aimed to turn Pécs into the greenest city in Hungary, fits this strategy.

Who was the team?
Dalkia Energia invested in the construction of the biomass plants, which Veolia subsequently acquired and provide the technical capability to operate the plants, working closely with Pannonpower and the municipality.

What is the local context?
The population of Pécs is growing, currently 155,000 and the fifth largest city in Hungary. Fuel switchovers to more renewable energy sources was required in Hungary's Renewable Action Plan pledges to the EU.

What was done?
A woodchip-fuelled boiler was inaugurated in 2004. This was achieved through converting an existing coal-fuelled boiler to become suitable for the fluidized sand-bed technology, which is able to produce as much as 185 tonnes of steam per hour.

For this first biomass plant, in 2004 a 28-meter-high oven was built, which utilises 600 tonnes of materials each day to convert into heat and electricity. Sufficient agricultural by-products are available as inputs for the biomass plant, from within a 100km radius and used within less than 5 days. These comprise mostly wood waste, including outputs from local saw milling.

A second biomass plant with the capacity of 35 megawatts of energy from the straw-fired units was built by the operator of the power plant, Dalkia Energia. Inputs include straw, as well as by-products from corn and sunflower production. The Town of Pécs endorsed the decision and signed a long-term heat supply contract with the power plant.

Long-term contracts to supply the two power plants were established with farmers and forestry and sawmill operators in the region, involving 20 farms in the region.

In 2015 the biomass co-generation plants opened a visitor centre. After one year, 1,300 visitors had already discovered its circular model. The centre aims to engage citizens and visitors in this type of renewable energy, disseminating, as widely as possible, information that is often reserved for scientists. Using visual media and interactive games, visitors are able to understand the circular renewable energy model.

Extra overall income of 4 billion Hungarian Forints (€12.4 million) for farmers in South western Hungary.

What was achieved?
The energy supply for Pécs is fully provided by wood-biomass and straw. Overall, contributing to 6% of Hungary's overall energy demands.

Using biomass in district heating is a profitable and advantageous opportunity for all stakeholders involved:

1. The biomass-fired units provide 100% of the heat demand for the district heating system of 31,500 flats and 460 institutions in the South western Hungarian city of Pécs.
2. Extra overall income of 4 billion Hungarian Forints (€12.4 million) for farmers in South western Hungary.
3. Transportation and collection of the straw packed in bundles or bales has created 170 permanent jobs. A further 500 seasonal jobs provide supplementary and repeat income for local farmers.
4. The ash produced from the combustion at both plants, makes excellent fertilizer and provides bio-nutrients for the soil. It returns to feed the earth with the potassium, magnesium and phosphorus it contains.
5. Independence from international energy price fluctuations, as the second biomass plant decreased the natural gas imports of Hungary, by 80 million cubic meters a year.

In 2014 the second biomass plant received an award from COGEN, the European co-generation trade association, which voted it the best plant Europe in the "market development" category.

What were the challenges?
The realisation of implementing this new technology, not previously known in Hungary, naturally required a cultural shift. For example, the most significant challenge for the second straw biomass plant was creating a baled fuel base because this method of straw baling was not usual in this area. It took five years to fully organise the whole supply chain.

Next steps
Owing to important experiences of Pécs biomass power plant, Veolia continued to support the country's renewable energy generation through the acquisition of Szakoly and Ajka power plants fuelled by wood-chips.

Summary
One of the largest scale examples in Europe of energy generation from biomass; two biomass energy plants using agricultural and forestry by-products, generate 100% of Pécs town's district heat demand and 100% of electricity needs of Baranya County.

Time period
2004-2023: 1st wood-chip biomass plant in operation.

2013-2029: 2nd straw biomass plant in operation.

Municipal levers
Public-private partnership; Infrastructure investment; Planning policy

Scale and Cost
The biomass-fired units provide 100% of the heat demand for the district heating system for 155,000 people in the South western Hungarian city of Pécs.

At a cost of €80 million investment, a 35 MW power plant fuelled by straw and a 50 MW power plant fuelled by wood waste, consume 180,000 tonnes of straw and 400,000 tonnes of wood from the region annually.

CO_2 reduction
1st biomass plant: 150,000 tonnes CO_2e avoided per year.

2nd biomass plant: 400,000 tonnes CO_2e avoided per year.

CIVIC WASTE

Austin, USA

Online marketplace for re-using materials

What is the vision?
The City of Austin is aiming to reduce landfill waste by 90% by 2040, and to be net-zero carbon by 2050.

Who is the team?
Austin Resource Recovery, a City of Austin service, provides funding and contract management, as well as encouraging customers to utilise the program. The non-profit U.S. Business Council for Sustainable Development (US BCSD) runs the program. Hundreds of businesses, non-profits, and institutions are involved as participants who trade materials through the program and attend networking events.

What is the local context?
Austin, Texas, has a population of around 1 million inhabitants and in 2017 was estimated to be the fastest growing city in the USA.

Austin has a 42% waste diversion rate as of 2015 and an estimated 1.12 million tonnes are disposed of each year.

What was done?
The program's growth and scale is enabled by the Materials Marketplace platform, a cloud-based marketplace for posting, finding and exchanging underutilized materials. The users can post an advert listing the type of materials they are looking for or have to discard-- either giving them away for free or selling at a proposed price. The storage and transportation of the materials is organised by the users. The types of materials typically exchanged include: construction materials (lumber, insulation foam, flooring, and more), furniture pieces, decor items, office supplies, and electronics.

Staff at the US BCSD actively facilitate the trades based on information posted by users on the online platform, such as through organising trade events.

The program helped to inspire the [Re]verse Pitch Competition, a social innovation program from the City of Austin and community partners including the US BCSD, to help turn valuable raw materials that are currently waste by-products from local businesses, non-profits, and institutions, into the inputs for new social enterprises through re-purposing the material. This annual, two-month competition, approaching its 4th year, has helped launch new start-ups in the Austin area, with seed funding and support, and has saved businesses money by diverting their waste – in one case saving a business an estimated $1 million USD per year.

What was achieved?
Over 435 local businesses, non-profits, educational institutions and community organizations have signed up to share resources through the program. 600 transactions have taken place to date.

960 $MTCO_2e$ is estimated to have been saved to date, and 1,300m^3 of resources (or 420 tonnes) diverted from landfill. The net value produced through these trades is approximately $638,000 USD, thus supporting economic development.

960 $MTCO_2e$ is estimated to have been saved.

This initiative has won awards from the World Economic Forum, Environmental Leader, and the International Economic Development Council.

These recovery activities also generate significant cost savings, energy savings, create new business opportunities.

What were the challenges?
A key challenge is shifting from a 100% City-funded program to one that generates its own revenue. US BCSD introduced a participation fee ranging from $200-$1,000 a few years ago, but subsequently made the fee optional to avoid losing too many users. US BCSD is currently working on a software update that would allow for more communication with users about the value of trades at the time of the transaction and is planning to implement a percentage-based transaction fee in the near future.

Transportation and storage are also challenging for the marketplace. The US BCSD intentionally does not have dedicated storage space, as this could make them and the City legally liable for the goods. It can also be challenging to transport the materials. The US BCSD is therefore working with third party shipping providers to integrate a "fee-for-service" transportation option.

In addition, a challenge was generating a market for certain by-products. Though not exclusively for the Austin Materials Marketplace participants, [Re]Verse Pitch fills a gap identified by this program.

Next steps
The program is engaging with large events by providing temporary up-cycle areas and coordinating with marketplace users in advance so that materials can be quickly diverted at the end of the show. Marketplace projects are underway or in development in several other cities around the country (Ohio and Tennessee), as well as a nation-wide market place.

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Summary
The City of Austin has adopted an online materials exchange platform for enabling businesses and other organisations to re-use and re-manufacture materials. Through the cloud-based platform, traditional and non-traditional industrial waste streams are matched with new product and revenue opportunities. A supporting competition helps to create new market demand, overall shifting the city to a more closed-loop economy.

Time period
2014 - present

Municipality levers
Online marketplace; Provision of information; Seed funding; Entrepreneur support; Start-up competition

Scale and Cost
Over 435 organisations are registered to participate online and almost 600 transactions have occurred to date.

The initiative was fully-funded by Austin Resource Recovery, a municipality department, for the first two contract years ($350,000 USD total for these two years), 2014-2016, before starting to transition to a self-funded model with annual costs decreasing to around $55,000 USD for the City, depending partly on trade volume and whether targets are met.

CO_2 reduction
960 $MTCO_2e$ is estimated to have been saved to date.

Eskilstuna, Sweden

The world's first circular shopping centre

What was the vision?
Eskilstuna Municipality strives to be a green role model. In its environment-related development work, the idea came about to open a shopping centre that had "regular" shops, but with a reused and upcycled range of products. The centre aims to attract a broad target group, spread knowledge about sustainability and the circular economy.

Who was the team?
ReTuna Återbruksgalleria and Retuna Återvinningscentral are run by the municipality-owned company Eskilstuna Energi och Miljö (EEM – translating to Energy and Environment).

EEM is a municipal company tasked with running competitive organizations in the energy and environmental sector. EEM shall deliver optimal benefits to customers and residents – with minimal impact on the environment.

The private retailers within the shopping centre have a key role. Citizens also play an active role, since it is mainly those who contribute with waste to the recycling centre, which is then turned into new/recycled products that are being sold in the shopping centre.

What was the approach?
EEM took the initiative and created the project plan. Anna Bergström, the Project Manager, has previously been responsible for conventional shopping centres and had experience from opening up different businesses. Anna has also been working in the cultural sector within municipalities. These experiences, with the combination from two very different sectors, made it possible for her to successfully establish the shopping centre.

The project was indeed pioneering, as nothing like it had been done in the city before. A significant amount of cooperation, passion and work was required from all involved.

How does it work?
Visitors are able to easily donate reusable toys, furniture, clothes, decorative items, and electronic devices in the shopping centre's depot, called "Returen".

In the depot, staff from AMA (Eskilstuna Municipality's resource unit for activity, motivation and work) perform an initial culling of what is usable and what is not. The items are then distributed to the recycling shops in the centre. The shop staff then perform a second cull, where they choose what they want to repair, fix up, convert, refine and ultimately sell.

A significant amount of cooperation, passion and work was required from all involved.

What was achieved?
In addition to offering sustainable shopping and serving as a public educator in relation to environmental issues, ReTuna Återbruksgalleria has generated over 50 new jobs.

In 2015, the ReTuna Recycling Gallery won the Prize of the Year at the Swedish Recycling Awards competition.

What were the challenges?
The following challenges have been shared by the team:

1. To find the right kind of entrepreneurs to fit the concept of the shopping centre. It has been hard to find those who have the right combination between being able to profit from their business and to have a sustainable business idea.

2. To actually make a reasonable profit is a crucial challenge for all of the businesses in the shopping centre. At the moment, all of the entrepreneurs have to work very hard and are not able to hire many more staff.

3. To make citizens change their view on waste; to make them see it as a potential source for reuse is a challenge. At the moment, those who visit the shopping centre mostly see it as an interesting and cool idea but are not as keen to actually buy the products, since they are made of reused items.

4. To make the shopping centre a real alternative to the conventional.

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CIVIC WASTE

Summary
Revolutionising shopping in a climate-smart way, old items are given new life through repair and upcycling. In connection with a materials recycling centre, everything sold in the shopping centre is recycled, reused, has been organically or sustainably produced. The 'ReTuna' shopping centre has attracted 300 study visits from all over the world.

Time period
2015 onwards

Municipal levers
Real estate investment; Recycling infrastructure investment; Citizen engagement

Cost
80 million Swedish Kroner (€7.75 million) to set up the centre and the recycling central (40 million SEK each). The municipality contributed 5 million SEK directly (€0.5 million) and the municipality-owned utility company, Eskilstuna Energi och Miljö, 75 million SEK (€7.25 million).

CO_2 reduction
The exact net impact on emissions is unclear, but the turnover for the project is 20 million SEK (€2 million) per year, indicating the amount of material that in being reused instead of being turned into waste.

Kristiansand, Norway

Citizen and business collaboration centre

What was the vision?
To provide a space where the private sector and the community can engage in activities that will foster knowledge around sustainability topics, ranging from composting to solar panels and recycling.

The Green Centre works closely with an organization call Climate Partners. Climate Partners support local partners to become fossil free within 2030. That means phasing out all fossil vehicles and fossil energy use in own buildings.

The municipality believe that the cooperation with the industry sector and the private sector has to be improved. This is one of the main tasks that the City want to continue working on in the years to come.

Who was the team?
This initiative was established by the Municipality of Kristiansand, operated together with the Eco-Lighthouse Foundation and Climate Alliance.

Climate Alliance is a local environmental organization that is working for action change in Kristiansand. Climate Alliance aims to be an inspiration source for an environmentally friendly lifestyle by encouraging and facilitating concrete action options for both individuals and businesses. Climate Partners are Norway's largest private-public partnership network focusing on how regions can reduce greenhouse gas emissions and develop a green economy.

The Eco-Lighthouse Foundation develops and administers Norway's national green building certification scheme.

How does it work?
The City provides the space, the funding and are an active partner in the Green Centre. It means that the City takes responsibility and the lead for some of the activities, meetings and courses that are organized in this community centre.

It creates a physical location where a community of enthusiastic experts and citizens work together to progress the green economy.

All events have an environmental focus. Courses related to compost, solar panels, urban farming, community recycling and repair initiatives, second hand use of goods among others have been given.

Events were also organized with representatives from the private sector sharing how they work to reduce CO_2 emissions and wider sustainability goals within their company or industry sector.

What was achieved?
This initiative has reached a wide audience, conveying the message and highlighting the importance of sustainability, climate change and the circular economy.

It has created a physical location where a community of enthusiastic experts and citizens work together to progress the green economy in Kristiansand.

What were the challenges?
The team aim to develop an evaluation scheme to capture all the key impacts of the activities and courses held at this community centre, such as job creation.

Next steps
This is an initiative that the team aim to have for many years. Efforts have commenced to strengthen the Green Centre and align to the municipality's new and ambitious environmental and climate goals.

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Summary
The City has a dedicated centre for citizen and business engagement, raising awareness through public lectures, courses and debates around more sustainable behaviours, including promoting the circular economy.

Time period
2016 onwards

Municipality levers
Community centre; Events; Convening partnerships; Sustainability training

Scale
195 events were held in 2016 alone with almost 5,500 participants, approximately 6% of the local population.

Kristiansand, Norway

Secondhand store led by the municipal waste company

What was the vision?
The four municipalities behind the waste company, Avfall Sør, cooperated to raise the ambition of keeping consumer goods circulating in the local economy and reduce waste, whilst encouraging job growth and training opportunities.

Who was the team?
Four municipalities have joint equity ownership of Avfall Sør: Kristiansand, Songdalen, Søgne and Vennesla. Avfall Sør is the regional waste company responsible for collection and treatment of solid waste from approximately 130,000 inhabitants from four municipalities in the southern part of Norway.

Citizens have an active role donating goods and as customers to the shop.

What was the approach?
The project has developed a new approach to the previous practise of citizens leaving their goods at the recycling plant where others could pick it up for free. This was challenging for staff and customers due to anti-social behaviour from those wanting the most valuable goods.

Local politicians resisted the thought of the waste company competing with other charity shops in the area. Meetings were held with key politicians, and the team presented another important issue about the shop – the possibilities for work-experience. This convinced them.

What was done?
In October 2017, "Avfall Sør" opened its first second-hand store located together with the biggest recycling plant in the region. "Mjåvann" Secondhand Store sells furniture, household stuff, books, sports equipment, toys etc. Everything sold in the store is either donated by customers or rescued from being thrown into waste containers. Local citizens donate directly to the shop. Re-usable, hard rubbish items are rescued from waste containers.

From the very beginning, the store has had a vision of being more than the ordinary second-hand store. All items sold are washed in advance, and goods are arranged in displays with various themes.

The program has been an excellent way to facilitate work-experience for people for marginalized citizens.

Critical method for success: Facebook has turned out to be an excellent median to promote the different displays and goods in the shop.

What was achieved?
Job creation was larger than anticipated and the program has been an excellent way to facilitate work-experience for people who are out of work due to health reasons or other, therefore providing vocational training opportunities for marginalized citizens. In the beginning, the store had 2 full-time employees, but after one year 6 people work full-time and 4-7 people are in training. The sales figures are increasing every month, even though prices are deliberately held very low.

In 2018, 200 tonnes of waste were diverted from incineration.

What were the challenges?
Politicians wanted to protect charity shops from competition, and Avfall Sør invited the charities to a meeting in advance.

The charity shops have since confirmed that they do not suffer at all from the new competition, "there is enough room for all of us".

A key factor for success is efficient management of the shop, including themed displays and a nice environment, with a focus on cleanliness.

The need for storage-facilities is much higher than expected.

Next steps
The store itself was of paramount importance as the centre of a 'reuse week' initiative led by the City in November 2018.

After a successful first year, the team aspire to scale up the centre further and has several ideas on how other activities may increase reuse: sale of used building materials, reparation of bicycles, redesign of clothes, DIY events and more.

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Summary
The regional waste company Avfall Sør, owned by four municipalities, opened a second-hand shop for furniture and consumer goods either donated or rescued from waste disposal. The shop focuses on cleanliness and quality.

Time period
2017 onwards

Municipal lever
Waste reuse centre; Partnership with utility company

Scale and Cost
The store covers 700 m^2 including storage facilities. Volume of goods sold is 2 million Norwegian Krone (€200,000) in 2018, 200 tonnes by weight, which amounts to about 2kg per citizen.

Excluding rent, the store's income covers 80% of the operational costs and is expected to cover 100% by 2020.

CO_2 reduction
Approximately 216 tonnes of CO_2e have been saved through the reuse rather than incineration of goods.

New York, USA

Donation online market place and supporting initiatives

What was the vision?
The City of New York aims to be zero waste by 2030 and minimise the environmental impact of the city's waste.

Overall, New York aims to reduce its CO_2 emissions by 80% by 2050. DonateNYC contributes to these aims.

Who was the team?
New York City's Department of Sanitation oversees and operates this initiative.

As part of its goal to increase waste diversion through reuse, it aims to raise the profile and capacity of NYC's non-profit reuse sector and thus supports a growing network of donateNYC Partners engaged in materials reuse, including 'Rebuilding Together NYC', a non-profit organisation providing repairs and modifications to low-income homes and non-profit facilities. The donateNYC Partnership program currently has around 70 members.

What is the local context?
New York is the most populous city in the United States and the centre of the New York metropolitan area. The City generates around 6 million tonnes of waste in total from homes, schools and businesses. Waste management activities (collection, transport, treatment, disposal) generate more than 2 million tonnes of CO_2e each year.

What was done?
The NYC Department of Sanitation has provided funding for materials reuse research and programming based at an NGO since the early 2000s.

In 2015, responding to the City's goal to send zero waste to landfills by 2030, consolidation began for all existing reuse programs under the donateNYC umbrella; in 2016, donateNYC launched as a program of the Department of Sanitation's Bureau of Recycling and Sustainability.

donateNYC is overseen and staffed by Department of Sanitation New York personnel. This department has integrated donateNYC into its strategic plan and fully funds it.

What was achieved?
Since the inception of the program, 111,865 tonnes of goods have been diverted from landfill via the donateNYC Partnership and 2,528 tonnes have been donated through the donateNYC online portal (comprising a website and phone application).

It is crucial to make any donation and reuse-related digital resources as inclusive and user-friendly as possible.

Pilot projects executed by members of the donateNYC Partnership program include re-distributing paint through mixing left-over paint into a series of key colours that can be purchased through a tap system. donateNYC also creates educational programs such as one encouraging students to have 'zero waste dorms' when they change accommodation at the end of the academic year.

The donateNYC program has successfully formed partnerships with local NGOs that share their vision, such as charity shops. donateNYC offers training to partners throughout the year, such as into how to avoid bedbugs and control of other similar pests that can arise in second hand goods. donateNYC has demonstrated it is a key initiative for NYC's goal to send zero waste to landfills by 2030.

What were the challenges?
In a large urban centre like New York City, logistical issues such as lack of transportation and storage for donations will always present obstacles to potential donors and potential recipients. With this in mind, the team advocates the importance of focusing resources on encouraging behavioural change regarding donating. Residents must understand the meaning of the "zero waste" message, why it is important, how it fits with the goals of the City and within the life of a typical household, why it is not unattainable, as well as the benefits of donations and reuse both on a large-scale level and on a personal level.

On a technical level, it is crucial to make any donation and reuse-related digital resources as inclusive and user-friendly as possible. The technological platform must be accessible to people across many levels of digital competency, whilst providing the robust communication and notification systems necessary for donations to go smoothly. Listings of donation venues and resources must also be checked and updated regularly.

Next steps
donateNYC is currently expanding to include a food donation portal that connects generators of excess food (restaurants, grocers, etc) with social service organizations that can accept and redistribute food to their communities.

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Summary
'donateNYC' is a program facilitating the donation and redistribution of materials through an online reuse directory and materials exchange, accompanied by a non-profit reuse partnership program and a series of supporting initiatives. This initiative is for both residents and businesses.

Time period
2015-2030

Municipality levers
Partnerships with non-profit organisations; Events; Information provision; Research and pilot projects

Scale
The program is in its third full year and is city-wide in scope. It covers 23 categories of goods, including building products and has over 70 partners.

It is funded entirely by the City of New York's Department of Sanitation.

CO_2 reduction
In 2017, donateNYC Partners diverted 44,500 tonnes of usable goods from landfill, reducing greenhouse gas emissions by 175,500 tonnes of CO_2e. These savings more than double when calculated from the program's inception.

Paris, France

Local production, repair and re-use initiatives

What was the vision?
Reduction, reuse and repair are priority actions of the first road map of the City's Circular Economy Plan, as well as responsible consumption. The City of Paris aims to promote the growth of responsible consumption by supporting actors offering goods and services based on short supply chains, that require little energy and generate little waste during use, as part of a circular economy approach. Reuse and repair activities, cooperative supermarkets and food waste recovery initiatives promote responsible consumption and help to develop local activities and production in Paris.

Specifically, Paris is aiming to have 20 reuse centres with associated repair workshops for household waste, and is commissioning a review for remanufacturing, and exchange scheme/links to private sector for re-using municipality waste e.g. furniture, paving stones. The City is also supporting the implementation of bulk sale shops.

Paris also aims to increase local production of goods through the creation of two new logistics centres on the edge of the city.

What is the local waste context?
Paris has signed the C40 'Advancing towards zero waste' declaration, which comprises:

1) reducing the municipal solid waste generation per capita by at least 15% by 2030 compared to 2015; and

2) reducing the amount of municipal solid waste disposed to landfill and incineration by at least 50% by 2030 compared to 2015, and increasing the diversion rate away from landfill and incineration to at least 70% by 2030.

What was done?
In order to reduce the production of waste at source substantially, the City of Paris is supporting the development of new distribution methods, including bulk, deposit and packaging-free systems, etc. Furthermore, the City is supporting the combatting of food waste, advocating the development of urban compositing and encouraging event organisers to adopt exemplary behaviour.

For a number of years, the City has introduced public policies to encourage the development of local production that is better adjusted to local needs and consumes less materials and energy.

The City of Paris is creating many networks that bring together economic actors, such as the "Paris Esprit d'Entreprise", the business and employment centres, and the Groupement Jeunes Créateurs Parisiens.

The City has launched two projects for logistics centres on the doorstep of Paris and encourages innovation by supporting business and research projects with financial assistance, technical support and property mobilisation.

There are 15 reuse centres in Paris at the end of 2018. The reuse centres have already diverted 2,651 tonnes of waste from incineration or landfill (+ 17.1% compared to 2016).

The City of Paris has supported the creation of the first zero waste house, where Parisians can find real solutions to avoid waste, including reusable products and by participating in workshops.

Achievements to date
So far, and as part of a re-industrialising Paris plan - by organising the event "Paris, City of Makers" at the City Hall and announcing its desire to double the number of production spaces in the capital, including fab labs and makerspaces, etc., the City of Paris has put itself on the global map of city makers.

The measures of success for evaluation the program in due course will include the amount of waste avoided (in tonnes).

It is recognised that these local initiatives will have a positive economic impact on the number of jobs created, that cannot be offshored. Therefore, the number of jobs created in the responsible consumption sector is also an indicator for success in the first road map of the circular economy plan.

What were the challenges?
Regarding efforts for more local production, certain types of waste, such as industrial waste, is very varied as it originates from a wide range of activities (shops, industries, private and public services), and is collected by private operators. As a consequence, the City of Paris lacks clear information about the typology and volume of this type of waste. In turn, this makes it more difficult to organise dedicated collection and processing systems, encourage the organisation of sectors concerned with the processing, recycling and/or the re-use.

The mechanisms suggested by ADEME, for a household waste removal charge, has received feedback from local authorities that have implemented such systems pointing towards the great complexity of any possible implementation in the Paris area.

Next steps
To optimise the management of all types of wastes, the City of Paris will ask the Île-de-France Regional Waste Observatory (Observatoire Régional des Déchets d'Île-de-France – ORDIF) to create a waste barometer specific to each business sector by 2030, which will allow for the identification and quantification of waste flows to facilitate the development of specific and adapted collection and processing systems.

In the same perspective of optimisation, the City will negotiate with the Grand Paris metropolitan authority, with a view to initiating the collaborative mapping of waste in the metropolitan area for economic operators in order to facilitate their waste management and reduction.

Summary
Local production policies, repair workshops for citizens and re-use centres for municipalities. This includes support from the City of Paris to create the first zero waste house, where citizens can find real solutions to avoid waste, including reusable products and by participating in workshops.

Time period
2017 - 2020

Municipal levers
Programs and fiscal policies; Financial support; Technical support; Infrastructure investment

Scale and Cost
City-wide, including pilot projects

Quezon, Philippines

Regulations on the use of plastic bags to help curb ocean plastics

What was the vision?
After China and Indonesia, the Philippines is the 3rd largest contributor to ocean plastics in the world. Within the Southeast Asian region, the Philippines has one of the highest waste collection rates. The plastic pollution is leaking into the environment increasing flood risks in sensitive areas with blocked waterways thus aggravating disastrous weather events. The Filipino Government is determined to take more action, with the Quezon City Government's policy becoming a pioneering example in the country.

Who was the team?
The Quezon City Plastic Bag Reduction Task Force was established to ensure the successful implementation of an Ordinance and oversee the implementation of the rules and regulations. The Task Force consists of the Environmental Protection and Waste Management Department (EPWMD) Members:

- League of Barangays in the Philippines (association of Philippine local government units)
- Market Development and Administration Department (MDAD)
- Business Permits and Licencing Office (BPLO)
- Barangay Operation Centre (BOC)

The Task Force is responsible to keep track records, report on compliance and encourage awareness through large-scale information, education and communication campaigns.

What is the local waste recycling context?
Waste generation in the Philippines averages 0.5kg waste per person per day. 15% of which is plastic waste and 1.88 million tonnes of plastic waste is mismanaged per year.

What was the approach?
The Quezon City Government allowed a three-month grace period from the date of enactment of the Ordinance regulating plastic bag use, for the conduct of a large-scale information campaign informing business owners and the general public. An additional grace period of three months was given for a warning violation with no penalties and other charges. Thereafter, the ordinance and its implementing rules and regulations have taken full effect with monetary penalties for non-compliance and with the possibility of losing business permits after three or more offenses.

What was done?
The policy intervention promotes the reduction of the use of plastic bags and imposes collection of environmental fees for each plastic bag used within the city. Penal provisions apply where violations will be charged

After China and Indonesia, the Philippines is the 3rd largest contributor to ocean plastics in the world.

for an infraction and a monetary penalty will be given to the offender.

A comprehensive, in-depth consultation with the business sector was undertaken to create the plastic bag recovery system and the plastic bag recovery fee. Since this was not primarily a revenue generation scheme, the plastic recovery fee was not remitted to city's funds. Instead, it remains with the retail stores and is utilised to fund various environmental initiatives, subject to prior approval of the City government. To monitor progresses, each retail business has to submit a self-monitoring report on a quarterly basis to the Quezon City Government, detailing the quantity of recovered plastic bags and the amount of collected plastic recovery fees.

Type 1 retailers (Shopping Malls, Supermarkets, Department Stores, Grocery Stores, Fast Food Chains, Drug Stores, Pharmacies) impose a Plastic Recovery System Fee (PRSF) of two pesos (4 cent in Euros) for plastic bags having a thickness not lower than 15 microns.

The establishment of plastic recovery system fees were put in place to change consumer habits and raise awareness, encouraging the use of reusable bags. The measure seeks to curb the amount of plastic bags in the waste stream, institutionalise a more efficient and convenient recovery system for plastic bags in line with the 3Rs principle (reduce, reuse, recycle).

What was achieved?
Financial savings:

- Since its implementation in 2012 and up to the first quarter of 2018, a total amount of at least PHP 285 million (€4.8 million) was reported by 68 Type-1 Relevant Retailers (shopping malls, supermarkets, fast food chains, etc.) throughout the City as a result of the Green Fund that was established alongside the ban through fees on plastic bags.

Additional benefits:

- This policy intervention is contributing to a shift in consumers behaviour towards a more reuse-oriented attitude, as well as institutionalizing a revenue

Summary
In Quezon City, plastic bags have been found to amount to 12% of the total waste composition and a primary challenge faced was improperly discarded bags ending up in the waterways, landfills and the environment. Regulations have therefore been enforced.

Time period
2012 - ongoing

Municipal levers
Fiscal policy; Tax

Scale
This city-wide regulation has raised at least PHP 285 million (€4.8 million) in fees for plastic bag use for Green Funds held by the retailers that must be put towards community environmental initiatives in the city.

generating system that directly benefits the local communities and contributes to the City's objective of becoming a low carbon and sustainable city.

- A number of establishments have already implemented their "green fund" projects. For instance, one establishment utilised the revenues to donate 11,000 chairs made from converted soft plastic to various schools across the city. Another example is the donation of several eco-bicycles to the City's police force.

Measure of success:

- Business compliance in relation to the green fund adds credibility and success to the Plastic Recovery Fee System.

- The revenue from the green funds are resulting in positive actions, giving back to the community directly through the green projects support. All projects must be implemented within Quezon City and benefit the city's residents.

- Manila has implemented a similar approach as an offshoot of Quezon City's initiative.

What were the challenges?

Criticism by some environmentalists calling the initiative 'green washing' and demanding higher fees on the plastic bags.

Effective communication remains a challenge; making consumers aware of the problem and continue to prompt for positive behavioural change, as it appears that still a lot of shoppers chose to pay the fee over bringing their own recyclable bag (convenience issue).

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Stockholm, Sweden

The world's first large-scale 'biochar' urban carbon sink

What was the vision?
As climate change is one of the greatest threats of our era, Stockholm aims to become a fossil free city by 2040, and citizens want to help – with 80 percent of them saying they want to be more active in the fight against climate change. Still, the City wanted more tools that engaged residents or provided them with a way to directly contribute to the City's goal.

Stockholm's Biochar Project aims to reduce carbon emissions by enabling citizens to be part of carbon sequestration.

Who was the team?
Within the municipality, the core team comprise the Head of Planning and Development, from the Waste department, who was the Stockholm Biochar Project owner and responsible for setting up and evaluating the pilot plant, technical and general project managers and a dedicated communications expert.

The City Tree Officer initiated the project through testing biochar with his colleagues to get away from finite resources for soil production (sand, peat and clay) and to optimize growing conditions in an often-problematic urban environment.

The City's energy company, Stockholm Exergi, also support this idea to grow.

What is the local waste recycling context?
There are approximately 8,000 tonnes of suitable garden waste collected in Stockholm each year (including Christmas trees!). The pilot plant is able to process 1,200 tonnes of garden waste into biochar, per year.

What was the approach?
The initial idea was pitched in 2013 to the City's Waste Department, and together garden waste from households was identified as a potential input. Also, energy recovery from the production process was highlighted and the City's energy company was successfully approached to support this program.

The team knew how important it was to get buy in from their key stakeholders, both within the municipality and externally. Many information campaigns were carried out in different media and on locations around the city to promote the idea and help people understand what biochar is, even before they had a plant in operation.

The team built up clear evidence that it worked, calculating the climate benefits and cost saving, as well as how much better city trees grow when planted with biochar in the soil. Other auxiliary benefits, such as improved local stormwater infiltration to reduce flooding, improved soil structure and plant growth were articulated.

This initiative empowers all citizens to be able to contribute to a carbon sink for Stockholm in the fight against climate change.

What was done?
After winning the Bloomberg Philanthropies prize in late 2014, this enabled the pilot plant to be built and in operation by March 2017. Initially the team had to buy a machine not built for purpose and transform it to fit their needs.

Residents provide garden waste to the City, which is turned into biochar – a charcoal-like product that can sequester carbon in soil for thousands of years. This biochar is used as a soil conditioner in public and private plant beds, therefore creating a vast carbon sink.

The by-product of the biochar production process, pyrolysis gas, is used to help generate energy for the City's district heating system.

What was achieved?
The pilot plant is able to process 1,200 tonnes of organic materials each year, which in turn produced an estimated:

- 300 tonnes biochar
- > 1,000 CO_2 equivalent carbon sink
- > 1,000 MWh generated in renewable heat production

This initiative empowers all citizens to be able to contribute to a carbon sink for Stockholm in the fight against climate change. Storm water management and wider ecosystem services enhancement have been a bonus.

The City has already received nearly 100 requests from cities and organizations that are interested in replicating the program. As a result, the team has published a replication manual and checklist for reference. This includes considerations for cities at the start of their journey, to advice operating the plant and engaging citizens to help increase inputs (see information sources at the back of this booklet).

What were the challenges?
Creating a circular system around a new product, biochar, had its challenges. It was crucial to have the stamina and efforts from the original core project team to initially navigate and coordinate three organisations' different needs and drivers, in order to win positive support from the City Hall.

CIVIC WASTE

Summary
Using citizens' garden waste, a type of charcoal, which removes CO_2 from the atmosphere and improves soil, is generated through an innovative process. Renewable heat energy is produced too. Storm water management and wider ecosystem services enhancement have been a bonus. Many cities are now replicating globally.

Time period
2013-2020: Pilot phase

Municipality levers
Capital investment into new technology; Civic engagement

Scale
The scale of the pilot-phase is city-wide. Subsequent regional scaling is planned by project partners who, together with Bloomberg Mayor's challenge team, are sharing knowledge to promote adoption internationally.

Cost
The plant equipment to process the garden waste is the key capital investment required. As a winner of Bloomberg Philanthropies 2014 Mayors Challenge, the Stockholm Biochar Project was awarded €1 million, contributing towards the implementation funding, of which Stockholm forecast to see a return above this investment amount within 8 years due to the revenue streams from the outputs of the biochar and heat energy. As an indication, the pilot project machinery cost €400,000.

CO_2 reduction
> 1,000 tonnes CO_2e carbon sequestration achieved to date. 25,000 CO_2e forecasted for total carbon sequestration by 2020.

Early engagement with the City's Vice Mayor, responsible for climate and environment, was very important for driving the process forward through adding actions supporting the project to administrations' budgets, promoting the project on a city scale and making the process of producing and using biochar a part of the City's Climate Action Plan.

Next steps

The next steps are to scale up the program further through investing in equipment that will process all of the City's garden waste, increasing capacity approximately six whilst in place.

The City anticipates additional plants will produce around 1,800 tonnes of biochar annually, sequestering 6,800 tonnes of CO_2 (the equivalent of taking 4,400 cars off the road) and producing a corresponding 6,800 megawatt hours of energy, enough to heat 500 homes.

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Vienna, Austria

Initial government support helped to create Austria's largest independent repair and service centre for electrical goods

What was the vision?
The vision of R.U.S.Z is to reverse planned obsolescence and provide 'broken' products an extended life duration. Also, to promote electrical goods as a pay-as-you-go service rather than ownership.

R.U.S.Z aims for greater resource efficiency, support of the circular economy and the post growth economy, waste diversion, social inclusion, consumer protection, fighting planned obsolescence and waste prevention. The organisation aims to make it more affordable to repair the likes of dishwashers instead of a common phenomenon of being advised to replace for goods of shorter life-spans.

Who was the team?
The founder and R.U.S.Z were commissioned by the Public Employment Service Vienna (AMS) for 10 years (1998-2007). Long-term unemployed people were given the chance to be trained in new skills to be able to participate in the labour market again. More than 300 elderly, long-term unemployed and disabled were able to be transferred into regular jobs within these 10 years, on behalf of the Viennese Adult Education Centres (Die Wiener Volkshochschulen).

R.U.S.Z was successfully transformed into a social business in 2008, now operating on a cost-recovery basis and employs 25 people (mostly former long-term unemployed people).

How does it work?
The municipality of Vienna, department for environmental protection, supports R.U.S.Z´s donation program which feeds its re-use centre.

Private households, which are willing to donate their old washing machine, are supported with two thirds of the transportation costs.

Many other municipal and public institutions, including the Austrian Climate and Energy Fund and federal ministries, commission R.U.S.Z as technical practitioners with scientific background and awareness raisers.

What was the approach?
The organisation has significantly expanded its reach, trainings and visibility over the past 20 years. New concepts have been introduced, such as repair cafés, where people can come in and learn how to fix their items instead of replacing them with new ones.

In 2005, R.U.S.Z created the "Ö3 Wundertüte", a highly successful mobile phone collection system, in cooperation with Ö3 (the most widely popular radio station in Austria) and the NGO Caritas Austria.

From 2006 to 2007, experts from R.U.S.Z supported the development of the Austrian repairability standard, ONR 192102, 'Sustainability mark for electric and electronic appliances designed for easy repair (white and brown goods)' in cooperation with the Ministry for Agriculture, Forestry, Environment and Water Management, the Austrian Standards Institute and other partners.

The vision is to reverse planned obsolescence and provide 'broken' products an extended life duration.

What was achieved?
R.U.S.Z has received the Vienna Environmental Award twice, in 2013 for its work on Planned Obsolescence, and 2018 for its Product Service System Clean Laundry. Further achievements include:

- Prevented 15,000+ tonnes of e-waste since 1998.
- Increased electronic equipment 'lifespan' by an average of 25%.
- Reduced water and energy consumption by 20% in older washing machines.
- Repair approximately 400 tonnes of appliances annually.

Additionally, R.U.S.Z has provided employment opportunities for people with disabilities and/or were long-term unemployment. Overall, their job training has resulted in more than 70% of its trainees finding employment afterwards. The store is also changing the thinking around the 'throwaway culture' by raising awareness with the general public on the waste problem, such as through their mobile phone collection campaigns.

Further initiatives
R.U.S.Z also founded the Repair Network Vienna with around 80 SME members and was among the initiators of the Austrian umbrella organization RepaNet and its EU equivalent RREUSE, which gather social enterprises with activities in re-use, repair and recycling. Today, R.U.S.Z is Austria's biggest independent repair centre for electrical and electronic appliances, for all kinds and brands, and a centre of excellence for the fight against planned obsolescence, for consumer protection and social businesses. Moreover, R.U.S.Z is working for the transformation of the current linear economy into a circular economy.

Currently, the R.U.S.Z CEO is leader of the Austrian delegation, and of a working group, commissioned by the European Commission until 2019, to develop standards for durable, repairable and re-usable products. This is the CEN-CENELEC European Standardisation Organisations' Joint Working Group 10 'Energy related

Summary
Originally commissioned in 1998 by the Public Employment Service in Vienna to support long-term unemployed back into the market, R.U.S.Z offers repair services for electrical and electronic appliances mainly for private households and city-wide re-use of white goods. It runs national campaigns for combatting electric goods obsolescence and founded an EU-wide network to support the transition to a circular economy.

Time period
1998 - ongoing

Municipality levers
Long-term unemployment initiative; Electric goods recycling standards

Scale and Cost
Since transferring to a social enterprise in 2008, it is financially self-sufficient.

This organisation has prevented 15,000 tonnes of e-waste since 1998, and repairs 400 tonnes of electric goods annually.

CO_2 reduction
Approximate saving of 15,000 tonnes of CO_2 since 1998.

Note, up to 60% of CO_2 emissions occur during the production phase for electronic and white goods.

products – Material efficiency aspects for eco-design', and has a key role to put the Circular Economy Concept in place. This aligns with Article 11 of the European Waste Framework Directive (2008) that states: "Member States shall take measures, as appropriate, to promote the re-use of products and preparing for re-use activities, notably by encouraging the establishment and support of re-use and repair networks."

Media campaigns and interviews, particularly counter planned obsolescence of electronic goods by the owner, has led to many regarding R.U.S.Z as a centre of excellence not only for repair, but also for political activism against planned obsolescence and for resource efficiency.

What were the challenges?
In 2007, the support from the Public Employment Service Austria ceased and the founder had to reconsider the structural underpinnings of his organisation. He privatized R.U.S.Z transforming it into a not-for-profit association for the promotion of social entrepreneurship.

Next steps
Social franchising of the general business model of R.U.S.Z, or elements of it, will soon be offered, and the team are currently testing a social franchising handbook by running a new branch in the City of Graz in southern Austria.

Currently R.U.S.Z is running a parliamentarian petition for resource efficiency and the negative externalities of new electrical and white goods to be reflected in the price, in order to support independent repair by small and medium enterprises.

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Published December 2018 for distribution of limited copies at the United Nations' Climate Change Conference, COP 24 in Poland.

FSC www.fsc.org MIX Papir fra ansvarlige kilder FSC® C009089

SVANEMÆRKET Miljømærket tryksag 5041-0492

This CO_2 neutral catalogue was printed at Cool Grey, who are certified with the Swan, Denmark's official eco-label, and ISO 14001, for their environmentally friendly procedures such as using vegetable dyes, FSC paper and offsetting their remaining carbon footprint.

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