

CIRCULAR CITIES

Holland Circular Hotspot

Accelerating the transition towards Circular Cities



PREFACE

In a city, everything comes together; the vast majority of us live in cities. Holland Circular Hotspot and Circle Economy dedicate this brochure to the domain of cities, because these are the places - where we live, work and recreate - that can determine our common future. Cities and the circular economy are essential in achieving our climate goals, and SDG's. Cities are places of action, and time is running out.

Much has been written about cities from different viewpoints: smart cities, sustainable cities, resilient or climate adaptive cities. The most important urban policy topics - from the built environment, to energy and mobility - are interlinked. Finding answers to these big questions demands that we take a systemic approach.

That is why this brochure is written from the perspective of the circular economy, an inspiring concept that is, concerned with effective scaling of sustainable economic models within planetary boundaries. The principle of extending the lifecycle for materials - to keep the value of products and materials in the loop as high as possible for as long as possible - is central to this vision. So too is the transition to renewable energy, respect for biodiversity, societal balance and social inclusion.

The myriad ways that people and businesses interact are ripe with opportunity. In cities, the circular economy can start small and deliver results 'close to home', creating new pathways for collaboration to preserve and create value. Examples such as revitalised building, meaningful jobs, improved mobility can become powerful drivers for innovation. Inspiration strikes. Demand spreads. Good ideas can jump from neighbourhood to neighbourhood, each in their own context and with their own local hero.

In this brochure, Holland Circular Hotspot and Circle Economy have included many circular examples from our home base of the Netherlands. We believe that many of these concepts can work, and have potential to scale in both developed and developing countries. Examples from the built environment, mobility, energy, food and water management are included next to cross-sectoral topics such as consumer goods and plastics. We do not aim to be complete or comprehensive, only to inspire you to find ideas that can be adapted to your reality.

Technology is an important theme, but other challenges lie in the realm of social innovation, design and coalition building. Transition to the circular economy requires systemic change, and asks for collaboration. A local government can set the ambition (urgency), boundary conditions and nurture experimentation. Researchers and knowledge institutes can develop new insights and tools, validate ideas and boost awareness. Local entrepreneurs have the guts and imagination to take risks, accelerate change and deliver scale. Meaningful participation for citizens and residents is crucial too: so is educating the leaders, and consumers, of the future.

The Netherlands is at the forefront of many of these processes. The Dutch inhabit challenging terrain, a delta, where successive generations have worked hard to create a vibrant society in a densely populated and early-industrialised country. This environment made us innovative and collaborative: a living lab to pioneer city solutions for global challenges. Over 150 years, we have learned what government interventions works and what doesn't work. Often, we have learned the hard way - from experience. In our last chapter, we share some of our lessons and tools. The intention is not just to exchange ideas, but to show how ideas become actionable.

By joining forces, Holland Circular Hotspot and Circle Economy have shared our insights, networks and resources. We hope this brochure can help you to kickstart circular development in your city. Please don't hesitate to contact us for further information.



Freek van Eijk
CEO Holland Circular Hotspot



Harald Friedl
CEO Circle Economy



INDEX

- 5** Introduction
The growth of cities and the circular economy
- 8** Circular City
Key systems of a circular city
- 10** The Netherlands as a Circular Living Lab
Pioneering the Transition towards Circular Cities
- 12 Dutch Solutions to Global Urban Challenges**
 - 12** Housing & infrastructure
 - 14** Mobility
 - 16** Consumer goods
 - 18** Plastics
 - 20** Energy
 - 22** Food & Nutrition
 - 24** Water
- 26 How to create a Circular City**
 - 27** 8 actions for cities to accelerate circularity
- 36** References
- 38** Colophon

INTRODUCTION

CITIES: A GROWING POPULATION AND A GROWING IMPACT

Cities are the centre of human activity. Today, over 55% of the global population lives in cities¹, generating 80% of global GDP.² As the 21st Century progresses, the majority of global population growth is expected to occur in cities. By 2050, the share of people living in cities is expected to reach 68%¹. Without effective management, this rapid growth of cities can aggregate and aggravate key societal challenges, from unemployment and inequality, to pollution and climate change.

Cities consume 75% of resources in the world

Despite occupying just 2% of the Earth's surface, the impact of cities spans far beyond their boundaries. Approximately 70-75% of global resources are consumed by urban activities³ while accounting for 70% of global greenhouse gas emissions.² With global urban populations expected to increase by a further 2.5 billion people by 2050¹ and continued improvements to living standards, it is estimated that resource consumption of cities will more than double by the middle of the Century⁴. Yet, with a mere 9% of resources in the global economy currently circulated,⁴ cities are in a dangerous position to widen the global **circularity gap**.⁵

Cities are the confluence of human activity and have a huge role to play in the realisation of all 17 Sustainable Development Goals (SDGs) within 1.5°C of atmospheric warming. Sustainable cities and communities (SDG 11) are vital to the reduction of food insecurity (SDG 2), the realisation of equality (SDG 6 & 10) and promotion of sustainable consumption and production (SDG 12).

55% of global population live in cities

With the majority of the 21st Century's population growth expected to occur in cities, and an estimated 75% of global infrastructure by 2050 yet to be built, particularly in Asia and Africa,⁶ effective management of the urban spaces is key, through a new global system that works for all.



Our struggle for global sustainability will be won or lost in cities.

- **Ban Ki-moon**, Eighth Secretary-General of the United Nations

A CIRCULAR ECONOMY TO TACKLE URBAN CHALLENGES

In response to the global challenges of the 21st Century, the circular economy has emerged as a viable alternative to the unsustainable linear (take-make-waste) status quo. In a circular economy, resources are not consumed, but recovered in a system that is continuous and long-lasting, with the goal of keeping them functioning at their highest potential.

Instead of destroying value after the use phase, value is retained through cycles of reusing, repairing, remanufacturing or recycling (see figure below). For this, we need new business models and innovative product design that makes use of non-toxic materials that can be endlessly cycled. The circular economy shifts wealth and prosperity from our current means of consumption to a system that is continuous and long lasting. In essence, it is a system that is regenerative by design, where the needs of all citizens are provided within the natural means of the Earth.

The circular economy could save Chinese households and businesses USD\$11 trillion by 2040¹⁹

A WORLD BELOW 1.5°C WARMING CAN ONLY BE CIRCULAR

Evidence is stacking up that a world within the Paris greements' of 1.5°C warming can only be a circular world. The circular- and low-carbon agendas are complementary and mutually supportive.⁸ At the same time, cities are key actors in pursuing a low carbon and circular future, while being heavily vulnerable to impacts of climate change. A circular world is both an opportunity as well as a necessity, and potential benefits of a circular economy are numerous and becoming clearer. In Europe alone, the Ellen MacArthur Foundation has estimated that the circular economy could generate €1.8 trillion each year in economic benefits each year,¹⁰ create 700,000 new jobs.¹¹ At the same time, raw material consumption can be reduced by almost a quarter.¹⁰

CITIES ARE THE CATALYSTS OF A CIRCULAR FUTURE

Although cities are driving many contemporary environmental challenges, they also hold the key to realising a circular future. The huge concentrations of people and activities within cities provide the spark for innovation and collaboration, making cities the ideal ecosystems to create circular solutions. Combined with the huge environmental footprints that are urban systems are responsible for, cities can have huge impacts on the global scale.

Transitioning towards a new circular paradigm also puts cities in a prime position to reap the rewards, to become more healthy, resilient and comparative. New circular materials, technologies, business models and collaborations, have the potential to transform each element of the urban system.

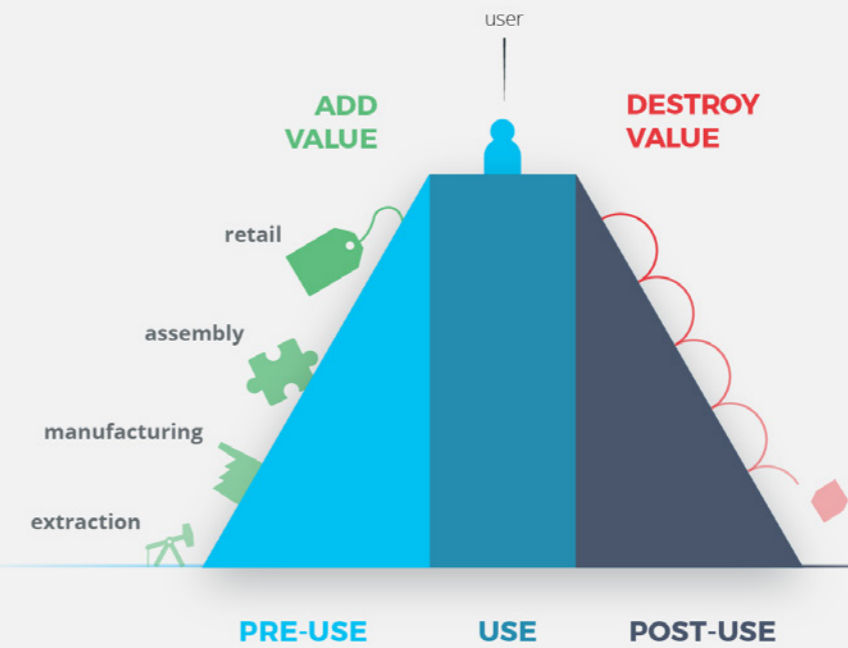
v700,000 additional jobs can be created in Europe in a circular economy²⁰

From the provision of flexible and affordable housing through circular design, to the halving on traffic congestion and air pollution in China's cities through circular mobility¹⁷, and the potential to create 12,000 new jobs in London¹⁴, the circular economy provides cities with the means to meet the societal needs of their citizens within the natural boundaries of our planet.

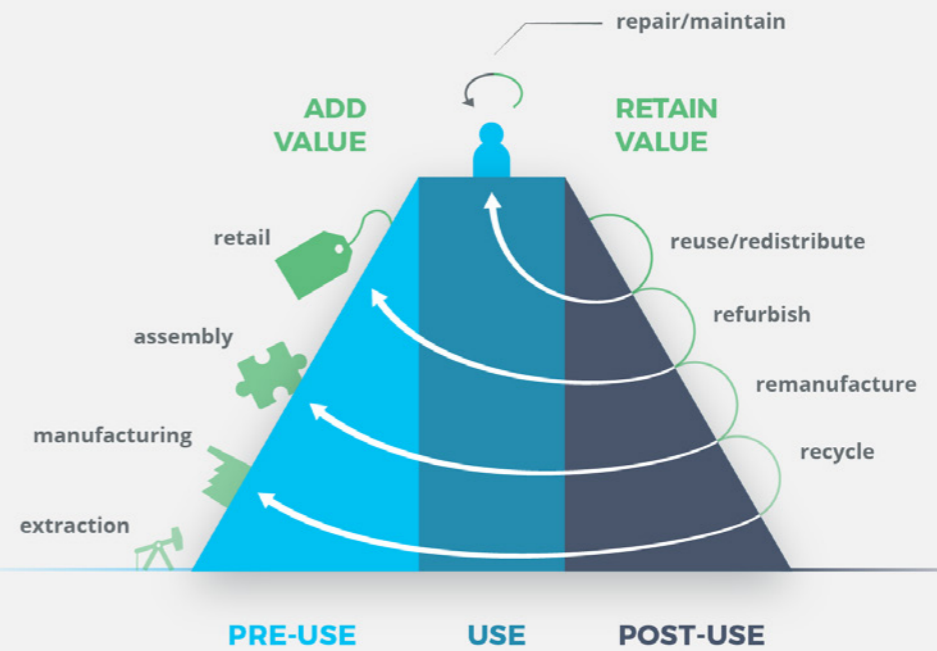
The circular economy can cut Indian greenhouse gas emissions by 44% by 2050 compared to current pathway¹³

Throughout the world, cities are embracing the potential of a sustainable and circular paradigm. Harnessing this growing transformative momentum, a number of international organisations, such as C40 and ICLEI, are bringing together pioneering cities from all corners of the world to share knowledge and build capacity towards a thriving future for people and planet. Throughout low(er) and high(er) income countries, the transition towards a more circular economy is a valuable prospect. However, with the wide-ranging economic, political and regulatory landscapes, important first steps may differ depending on the context.

LINEAR ECONOMY



CIRCULAR ECONOMY



The value hill model proposes a categorisation based on lifecycle phases of a product in pre-, in- and post-use, and clarifies the systematic differences between the current linear economy and the circular economy that we are striving for.⁹

CIRCULAR CITY

A circular city is a resilient, healthy and competitive; able to provide for all the societal needs of its citizens within the natural boundaries of the Earth. Core elements of circularity are embedded within each key urban system; from water, to housing and infrastructure, to food and nutrition. Much like in a circular economy, in a circular city, resources are kept at their highest potential for as long as possible, through sharing, reusing, repairing, remanufacturing and recycling. Yet a city is inherently a human place; fostering collaboration and innovation to test and scale the solutions to create a truly inclusive, healthy and thriving place for all.

HOUSING & INFRASTRUCTURE

Linear: Buildings are responsible for 45% of global resource consumption.²³

Circular city: Buildings and infrastructure are constructed from renewable, secondary and low carbon materials. Elements of the built environment are also designed from the ground up to be adaptable to increase utilisation, as well as easily deconstructed at the end of their life to enable reuse.

MOBILITY

Linear: 40% of all transport-related emissions are produced in cities.²¹

Circular city: Circular mobility will tap into new circular business models that enable sharing and reduce the need for personal vehicles; transforming parking lots into parks. All transport, from personal to logistics, will be powered by clean and renewable energies.

FOOD

Linear: The global food system accounts for 20-30% global GHG emissions, and cities by 2050, cities will consume 80% of food produced.¹⁶

Circular city: All citizens have access to healthy and nutritious food, that is produced locally, enabled through new technologies and practices that minimise water and energy consumption. Avoidable food wastes are eliminated, while all unavoidable food losses are captured as new raw materials.

ENERGY

Linear: Cities account for 75% of global energy demand.²

Circular city: A circular city is powered entirely by renewable sources of energy, increasingly from smaller-scale and decentralised local generators. The energy that is produced is managed and distributed via 'smart' systems to avoid any energy losses.

INDUSTRIAL PARKS

Linear: Cities consumed 40 billion tonnes of materials in 2010, which is expected to rise to 90 billion tonnes by 2050.⁴

Circular city: Circular industrial systems mimic ecosystems found in nature. Enabled by design and industrial symbiosis, the byproducts or waste (both materials and energy) of one process is transformed into inputs of another.

PLASTIC

Linear: ~250 million tonnes of plastic waste is produced each year.¹⁹

Circular city: In a circular city, single-use plastics are a thing of the past. All plastics are designed, manufactured and collected to increase their life-span for as long as possible while fundamentally eliminating the pollution of land and waterways.

CONSUMER GOODS

Linear: Between 2015 and 2030, cities will be responsible for 91% of global consumption growth.¹⁸

Circular city: New products utilise new circular design such as modularity and renewable and secondary materials, is incorporated into all consumer goods to minimise environmental impacts. Circular business models enable sharing economies that change notions of ownership to reduce the overall consumption of materials, energy, and generation of waste.

WATER

Linear: 250 - 500 million m3 of drinking water is lost each year in the world's megacities due to leakage.¹⁷

Circular City: Water in a circular city is cycled in closed loops to minimise extraction and pollution of local waterways. Wastewater is a valuable source of secondary raw materials which are captured through circular technologies while increasing resiliency to the risks of climate change.

THE NETHERLANDS AS A CIRCULAR LIVING LAB: PIONEERING THE TRANSITION TOWARDS CIRCULAR CITIES

Recognising the potential that the circular economy can make towards creating a resilient and sustainable future, the Netherlands has positioned itself as a living lab where solutions and approaches are pioneered that can be adapted internationally to global challenges. In 2016, a government-wide programme 'A Circular Economy in the Netherlands by 2050' was launched, which sets targets for the country to halve its primary raw material use by 2030, and become fully circular by 2050.²⁰

The Netherlands is situated in a delta. The Dutch had to work together to keep their feet dry; shaping the environment as much as it shaped its citizens. The continual struggle against encroaching water instilled the importance of a collaborative and innovative approach, and positioned the country as one of the global leaders in water management. The Netherlands is approaching the circular economy with the same mentality as water management. It makes sense for an early industrialised and densely populated country, poor in national resources to keep materials in the loop and to make economy and sustainability meet in circular business models.

To accelerate the transition, the Government selected key economic sectors and value chains that will lead the circular transition in their [Transition Agendas](#). Each of the selected focus areas is important to the Dutch economy and that also have a large environmental footprint.

Action-driven and impact-focused, cities in the Netherlands are taking a leading role in making the circular economy a reality, through urban design, material management and tendering practices. In 2016, nine municipalities signed the [Green Deal: Circular City](#), a joint agreement that commits each of the municipalities to become fully circular by 2050. The map highlights the Dutch cities that are leading the circular transition, and highlights the pioneering approaches of the two largest cities of Amsterdam and Rotterdam, agreement that commits each of the municipalities to become fully circular by 2050.

ROTTERDAM

By 2030, circularity will be regular in Rotterdam. To foster the City and the Port's transition, [a vision for a circular economy by 2030](#) was created in 2017, setting ambitious targets to halve the primary raw material consumption and eliminate residual waste streams, while creating 3,500-7,000 new jobs in the circular economy.²²

To further the transition, Rotterdam also commissioned [a study to explore the current circular state of the city](#). The biomass, construction, consumer goods and healthcare sector were identified as key impact sectors in Rotterdam. Combined they consume a total of over 800,000 tonnes of materials each year.

Rotterdam is a living-lab; a space where circular innovations can be tested, pioneered and embedded into the fabric of the city. Only by doing is it possible to learn. Through initiatives like [Rotterdam Circular!](#) are continually sharing circular knowledge, and inspiration to position the City and the Port as



GREEN DEAL : CIRCULAR CITY

[The City Deal: Circular City](#) brings together nine cities, three National Ministries and three knowledge partners, with the aim of achieving fully circular cities by 2050 at the latest - in parallel to the ambition outlined in the National Government Programme Circular Economy.

The City Deal: Circular City encourages access to the new market for the circular economy for stakeholders on the supply and demand side, by sharing knowledge and best practices via joint (digital) platforms, and placing pioneers in the spotlight. Through the initiative, each of the nine municipalities have implemented a number of circular pilot projects to showcase the potential and benefits of circular cities of the future.

The nine participating municipalities are highlighted on the map below.

AMSTERDAM

The City of Amsterdam is world-leading when it comes to the circular economy, and has committed to becoming fully circular by 2050 at the very latest. By carrying out the first [Circle City Scan](#) in the world, Amsterdam identified that a circular economy could generate €230 in value-added, create over 1,900 jobs and reduce CO₂eq. emissions by 1.4 million tonnes (more than 12% of the city's current emissions) by 2040.²¹

With these potential benefits ready for the taking, Amsterdam has prioritised turning the concept into reality, now with [11% of employment being in the circular economy](#). As a global frontrunning city, the Dutch capital has adopted an integrated learning-by-doing approach, prioritising collaboration between municipal departments, knowledge institutions, businesses and citizens, to ensure that circularity works for the whole city.

Amsterdam's circular programmes have led to the implementation of more than 70 circular projects which are transforming the city's urban systems, from which a full [evaluation](#) was commissioned to further direct the [Circular Journey of Amsterdam](#).

HOUSING & INFRASTRUCTURE



Buildings are often the defining image of a city; from towering office-blocks to homes, and shops. Yet, buildings constitute a significant share of a city's environmental footprint, responsible for ~45% of total resources consumed globally.⁵

The circular economy holds an important potential to reduce the environmental footprint of the existing building stock, as well as avoid a linear lock-in for new construction. With an estimated 75% of global infrastructure by 2050 yet to be built,⁶ particularly in Asia and Africa, cities have both a great responsibility and opportunity to transform their built environment so that it works for both all people, as well as the planet.

Amsterdam established itself as an early pioneer in circular construction, through its integrated approach, collaborating between municipal departments, research institutes and businesses to facilitate circular innovation. Circular construction could create €85 million in the city by 2040 while saving 500,000 tonnes of materials.²¹



CIRCULAR RE-DEVELOPMENT - BUIKSLOTERHAM, AMSTERDAM

The City of Amsterdam is facilitating the development of the circular economy throughout its built environment by prioritising the circularity in tenders, such as for land development. Since 2017, the Municipality of Amsterdam has been working with many local partners to redevelop the former industrial area of Buiksloterham into a circular residential-work neighbourhood that finds harmonises healthy living, resources, and biodiversity. Turning the area into a living-lab, where businesses, the city, and citizens can continually experiment with new techniques, technologies and business models, has turned the idea of a circular district into reality.

- 25% - 75% recycled materials in developments
- 20% reduction in total material consumption expected²³

Leading the transition, Amsterdam has developed a roadmap for circular buildings, which challenges businesses to integrate circularity into land (re-) development tenders ([Buiksloterham](#)).

The proactive approach of the city has seen housing and infrastructure projects throughout the city are now incorporating circular materials ([Park 20|20](#)), recycling technologies ([SmartCrusher](#)), business models ([CIRCL](#)) and innovative digital-technologies such as material passports ([Madaster](#)) into housing and infrastructure.

More examples of the circular solutions in construction can be found at [Holland Circular Hotspot](#).



DESIGNED FOR CIRCULARITY - PARK 20|20, HAARLEMMERMEER

Park 20|20 has been designed from the ground-up to be Cradle-to-Cradle optimised. The site has been designed from the ground up to maximise the ecological benefits and well-being of people. All buildings have been designed to be disassembled at the end of their life so that materials can be either biodegraded or reused in other products or buildings. As such, the buildings have higher a residual value.²⁴

- Largest collection of Cradle-to-Cradle certified products worldwide²⁵
- 18% reduction in initial construction costs²⁶
- 2,500m² of solar panels contribute towards 100% consumption of renewable energy²⁷
- On-site agriculture produces over 20 species of fruit and vegetable²⁸

MOBILITY

Urban mobility is crucial for a thriving city. It is the blood that keeps our cities running. Yet, the dominance of the car over the past half-Century has transformed cities to favour the car over people, with some 20-60% of urban surfaces dedicated to mobility; turning city parks into car parks.^{28 29}

Without accessible and convenient alternatives, urban dwellers opt for gas-guzzling cars that emit vast quantities of CO₂ and other toxic pollutants into the streets (and yet spend over 90% of their time unused and taking up space).³⁰ What is more, the ever-increasing trend of internet shopping is adding more and more courier vans into city streets to meet this growing demand for last-mile logistics, further clogging up and polluting the arteries of cities.

Innovative solutions in the circular economy are offering cities the ability to take back their urban space from the dominance of dirty mobility. Shared and sustainably powered platforms are offering mobility-as-a-service, minimising the footprint for the individual ([GreenWheels](#)) and inner-city logistics ([CityHub](#)).

Amsterdam has taken a proactive approach to sustainable mobility throughout the years, investing efforts in becoming one of the most cycling-friendly cities in the world. Yet, Amsterdam is increasingly recognising the opportunities that new circular business models can play in the creation of a healthy and competitive city.

The City has developed dedicated programmes that are proactively creating the right conditions for circular and shared modes of mobility ([Vehicle sharing programme](#)), that are taking back urban space from the parked car and giving it to the people. From the implementation of necessary charging infrastructure, to the creation of favourable regulations, the city is making room for new circular innovations and collaborations that are phasing out polluting vehicles, and replacing them with clean, electric and shared alternatives, covering areas like last-mile logistics ([Foodlogica](#)), and reverse logistics ([WEEElectric's](#)).



URBAN SHARING PROGRAMME FOR ELECTRIC VEHICLES - CITY OF AMSTERDAM

To combat traffic congestion, air pollution and the amount of unused personal vehicles clogging up the streets of Amsterdam, the city has focused on making conditions more favourable for shared electric vehicles. Throughout the city, support has been provided to electric vehicle sharing initiatives, and investments been made to create a thorough charging infrastructure and dedicated parking spaces.

- In 2016, there were in excess of 2,000 charging spaces, with more added each year
- 350 cars are rented 10,000 times weekly by its 25,000 members
- Over 300 members had sold their own cars a year after the launch of the programme

CONSUMER GOODS

From household appliances, to the clothing on our backs, consumer goods touch every part of our urban lives.

Traditionally, cities are engines of consumption. Increasing levels of urbanisation and raising living standards are set to make cities responsible for 91% of the global growth of consumption between 2015 and 2030.¹⁸ Yet, the growing trend towards shorter-lived and disposable products are causing vast societal and environmental damages, exemplified by the rise of fast-fashion, and our disposable society. If the footprint of a city is expanded to include all of the impacts that go into making these goods and services consumed in cities, Yet, consumption-based accounting of cities can raise their carbon footprints increases by up to 60%.³¹

In a linear system where it is easier and cheaper to throw away products for a brand new replacement, more consumption means more waste. Cities produce 2 billion tonnes of waste each year, and by 2050, this quantity is expected to increase by 70%

Recognising the key role that consumer goods have in a circular economy, the Netherlands have made the value chain one of its five circular [Transition Agendas](#).

Circular solutions can improve every part of the chain, from designing durable and modular products from renewable materials ([Fairphone](#)), to creating more sustainable consumer behaviours that favour access to high-quality products-as-a-service that increase use, and end-of-life utilisation ([Bundles](#)), rather than relentless material consumption. As well as innovative technologies that are increasing the ability to cycle end-of-life materials into secondary raw materials to maintain the highest value for as long as possible ([Fibersort](#)).

Dutch cities are now making this ambition a reality. For Rotterdam, consumer goods were chosen as a focus area, commissioning a [Scan](#) to identify where the best circular opportunities lie. Yet, city authorities themselves have huge potential to stimulate circular innovation through incorporating circular principles into their procurement practices, such as the [Municipality of Venlo](#) procuring circular furniture in their City Hall. What's more, circular incubators in the city ([like BlueCity](#)) are providing creating an ecosystem enable disruptive businesses to design new circular products and business models.

More examples of the circular solutions for consumer goods can be found at [Holland Circular Hotspot](#).



CIRCULAR CLOTHING AS A SERVICE - MUD JEANS

MUD Jeans have developed a circular product-as-a-service business model for their clothing. Through a circular product-as-a-service model, the customer does not own the product, they lease the product for a period so, when they are not wanted, they can be effectively reused and recycled. MUD Jeans are also created fabrics that contain 40% recycled denim, with the aim of reaching 100%.

- When turned in, old jeans are upcycled into 'vintage jeans'
- Jeans are created using 40% recycled denim
- MUD Jeans reduce water consumption and CO² emissions by 78% and 61% respectively compared to conventional jeans³²

PLASTICS

Each year, around 250 million tonnes of plastic waste is produced¹⁹ while a mere 9% is recycled. If we continue with this linear system, there will be more plastic in our oceans than fish by 2050.³³ With cities being accountable for 70% of global resource consumption³, they hold huge potential to transform our toxic relationship with plastic through new circular business models, materials, design, and management systems.

Transitioning towards a circular plastics chain is supported and emphasised by the Dutch Government in the [Plastics Transition Agenda](#). The Agenda sets the focus for the circular plastics revolution in the Netherlands and aims for the country to use only renewable plastics by 2050, and technologies are already being developed in the Netherlands for recycled ([Bollegraaf](#)) and biobased plastics ([Phario](#)).

Yet, a circular plastics chain asks for a collaborative approach by designers, municipalities to organise collection and communicate to inhabitants, sorters and recyclers to ensure the quality that industry requires, and multinationals and packagers to innovate and take more responsibility through Extended Producer Responsibility (such as for [packaging waste](#)).

Today, the Dutch have reached > 50% recycling of packaging, and initiatives (such as [WastedLab](#)) are helping to further increase the recycling rate of urban households by incentivising them for doing so(!).

Rotterdam is becoming a beacon for the Dutch plastics revolution. Both the City and the Port are embracing the promise of a circular plastics economy and are actively supporting the innovations towards a regenerative and restorative plastics chain by design ([Recycled Park](#)). Particularly, initiatives [Plant One](#) in the Port of Rotterdam are creating an ecosystem for circular businesses to experiment and scale ([loniqa](#)).

Circular plastics initiatives are also finding viability, and creating impact in countries throughout the world, co-creating a recipe for success towards the local empowerment of communities ([Sweep Smart](#)).

More Dutch solutions for an international circular plastics chain can be found at [Holland Circular Hotspot](#).



PLASTICS TO PLASTICS - [IONIQA](#)

Ioniqa Technologies discovered the key to create 'an everlasting PET bottle'. The company developed an innovative process to convert all kinds of colours of plastic PET waste into a high-quality and colourless raw material, while making use of residual heat from cities. This process can be endlessly repeated, making the recovered raw material competitive, both in terms of quality and costs. Incubated at Plant One in the Port of Rotterdam, Ioniqa has now entered a partnership with Unilever and Indorama Ventures to pioneer their new technology at industrial scale and help these companies achieve their environmental commitments.

- Transforms all types and colors of PET waste into valuable resources for 'virgin-quality' new PET
- Reduces dependence on scarce resources like oil

ENERGY



Cities account for 75% of global energy demand and generate 80% of all greenhouse gas emissions.² With continued urbanisation, cities face a great challenge to meet the energy needs of all households, businesses and infrastructure without increasing concentrations of greenhouse gasses. Yet, energy is a crosscutting theme and is key to the functioning of all urban systems; from fueling mobility, to powering buildings and appliances, compounding the complexity of the transition towards a low-carbon system.

Embracing principles of the circular economy is helping Dutch cities to transition towards a sustainable and economical energy system. The benefits are numerous and clear. Street lighting, for example, typically accounts for 25-50% of the municipal energy bill, and circular solutions can make clear economic and environmental sense.³⁴ New and circular business models are reducing the overall energy cost and consumption of cities ([Phillips' lighting-as-a-service](#)).

Innovation is also spurring the generation of new forms of renewable energy, that are able to valorise the vast quantities of urban organic waste into green and renewable fuel ([Orgaworld](#)). What's more, these growing networks of decentralised (and often small scale) producers of renewable energy are able to be effectively connected and distributed to the demand ([Vandebron](#)), and distribution, through a smart and shared infrastructure that means that minimal energy is wasted.

The [City of Eindhoven is striving towards becoming a citizen-centred smart city](#), with the goal of reducing energy consumption and associated CO₂ emissions by 67%.³⁵ To help the city's transition towards a circular energy system, Eindhoven has adopted a number of programmes that encourage a collaborative and joint-ownership approach towards the creation of smart-city initiatives.



CIRCULAR LIGHTING-AS-A-SERVICE - PHILIPS AT SCHIPHOL AIRPORT

Through a new and circular business model, Schiphol has achieved a 50% reduction in electricity consumption when compared to their conventional lighting. Philips' circular lighting-as-a-service allows Schiphol to just pay for the light that it uses, with Philips retaining ownership of all fixtures and installations, and also retaining responsibility for the end-of-life reuse and recycling of the lighting system. With street lighting accountable for 3% of global energy demand,³⁶ these applying these strategies to street lighting can lead to significant overall reductions in energy demand.

- 50% reduction in electricity consumption
- Fixtures last 75% longer thanks to circular design ³⁷

FOOD & NUTRITION

The global food system is vastly unsustainable. As well as being responsible for 20-30% global GHG emissions,³⁹ every dollar that is spent on food costs society two dollars in environmental, economic and health-related impacts.¹⁶ With the continued growth of global urbanisation and living standards, cities will be responsible for 80% of the food consumed in 2050.¹⁶

In the Netherlands, food and biomass is recognised as crucial for a resilient and circular future and has been prioritised as one of the country's key circular [Transition Agendas](#). Ambitions have been set to sustainably produce biomass as well as and greening Dutch cities. A growing number of urban agricultural projects tick both boxes, supplying local, healthy and sustainably produced food, while providing green spaces to help reconnect urban citizens to their food supply ([The Dakkaker](#)).

Dutch cities also generate huge quantities of food waste each day. The circular economy is helping cities change their relationship with food waste, diverting surplus foods into new meals ([InStock](#) and [Kromkommer](#)) as well as transforming unavoidable food wastes into valuable raw materials ([Waste to aromatics](#)).

With almost half of the world's arable land is located mere 20kms from urban areas, cities hold a huge role in influencing the demand of locally sourced and circular food.¹⁶ Globally, the Netherlands is a shining beacon of innovative and resource efficient agricultural practices, developing techniques that significantly reduce the consumption of water and chemical pesticides.⁴⁰ The City of Wageningen is positioned at the very heart of the Dutch [Food Valley](#) (think Silicon Valley for Agri-tech), with the top agricultural university in the world, [Wageningen University & Research](#), driving the practical thinking of circular food systems, both in the Netherlands and throughout the world, in Africa Asia and the Americas.

More Dutch solutions for an international circular plastics chain can be found at [Holland Circular Hotspot](#).



Feeding cities arguably has a greater social and physical impact on us and our planet than anything else we do

- **Carolyn Steel**, Carolyn Steel, British architect and author of 'Hungry City'³⁸



FARMING THE CITY - [THE DAKAKKER, ROTTERDAM](#)

The DakAkker, located on the top of a 6 storey office building in the centre of Rotterdam, is Europe's first large-scale rooftop farm, and an international example of innovative urban agricultural practices. . The collaborative project is home to six beehives that provide an important boost to the city's biodiversity, while the various fruits and vegetables that are produced on the rooftop are sold to local restaurants. The rooftop farm is also equipped with a smart roof, which offers greater water storage capacity than conventional green roofs, with DakAkker using this water in the farm.⁴¹

- 1000m² - the Netherlands largest rooftop farm.
- Smart roof provides 60m³ water retention capacity
- Fresh fruit and vegetables are sold to local restaurants
- Aromatic herbs and six beehives boost urban biodiversity

WATER

Water is key to the functioning of cities. Growing urban populations and their increasingly water-intensive lifestyles are putting strain on local water sources - contributing to the ~2 million tonnes of sewerage and pollution that enter water courses each day⁴² - while over a third of the population still lack access to improved sanitation.⁴³ At the same time, climate change is increasing the likelihood of severe flooding in cities throughout the world. Circular strategies are increasingly showcasing the potential to ease the complex relationship between cities and water throughout the world.

Rotterdam recognises that (waste)water is a resource, and is a key part of becoming a circular city. By 2050, the city wants to have a closed-loop water system. A global pioneer towards water management, Rotterdam has implemented a number of programmes to future-proof the city, such as Project RoSA, which to facilitate cross-chain collaboration to close resource loops, as well as furthers research into a circular urban water system.

Rotterdam also recognises that a circular city is also water-resilient city and has proactively facilitated innovative stormwater management systems throughout the city ([Benthamplein water plaza](#)) that transform a potential hazard into a source of value.

What's more, circular solutions that are creating a more sustainable and resilient water system can often offer the potential to generate cross-cutting benefits for cities. For example, [Smartroof 2.0](#) not only combined rainwater management, but also helps to increase biodiversity while reducing urban heating through green roofs. While [Heijmans Hydra](#) provides piping solutions that can recover the latent heat of sewerage as a sustainable source of energy.

More examples of circular solutions in the water system can be found at [Holland Circular Hotspot](#).



FERTILISER FROM WASTEWATER - [FOSVAATJE](#)

FosVaatje turns Wastewater into valuable raw materials. Implemented by Waternet - water management organisation for Amsterdam, the FosVaatje project works with major events and venues to collect urine. Rather than requiring large quantities of energy and chemicals to transport and purify this wastewater, FosVaatje uses a biological process that is able to capture phosphates and biogas. The biogas is used as a supply of energy, and the phosphate is recovered as a fertiliser.

- Collecting all wastewater in a whole year could **save a city €400,000**
- 1,000 tonnes of fertiliser can be produced per year, able to **fertilise 10,000 football fields**



HOW TO CREATE A CIRCULAR CITY?

PRACTICAL INSIGHTS FROM A GLOBAL TRANSITION

Transitioning towards a circular city is a complex journey that involves collaboration and coordination between local government, businesses, local organisations, technologies and resources. In cities the world over, the diverse benefits of circularity are increasingly being recognised, however, local governments are commonly faced with the same question; what tangible actions can be taken to accelerate the transition towards a more circular economy?

The lessons and experiences that are being collected from pioneering cities throughout both the Netherlands, and the around the world can provide important insights and guidance, and serve as an action agenda for aspiring circular cities of the future.⁴⁴

8 practical actions are presented that can serve as an action agenda for cities throughout the world, both in low(er) and high(er) income countries. To support many of these steps, practical tools have been developed in the Netherlands, and can be scaled and applied internationally to assist in the creation of circular cities. The following pages provide more details to each of the actions, and present the supporting tools.

8 ACTIONS FOR CITIES TO ACCELERATE CIRCULARITY

- **Provide a platform to showcase best practices in your city**
- **Discover the circular potential of your city and set priorities and ambitions**
- **Involve businesses from the start and give room for experimentation**
- **Understand the barriers to circularity and start addressing them**
- **Facilitate interdisciplinary and cross-sectoral collaborations**
- **Lead by example and building on successes**
- **Introduce and mainstream circular thinking into all education and trainings**
- **Monitor, adjust and scale**

PROVIDE A PLATFORM TO SHOWCASE BEST PRACTICES IN YOUR CITY

No city starts its circular transition from scratch. A wide range of businesses and projects will already be 'closing loops' in every city. However, some are more hidden than others. Cities throughout the world have been able to easily provide support and boost these existing initiatives by providing a platform by which to showcase circular successes.

Platforms such as Rotterdam Circulair, and the Knowledge Hub have given space to celebrate local success stories and share experiences and best

practices. Creating an inventory of ongoing circular initiatives in a city provides a face and voice to local circular champions, facilitating connection and collaboration, as well as providing inspiration, both within the city, and throughout the world.

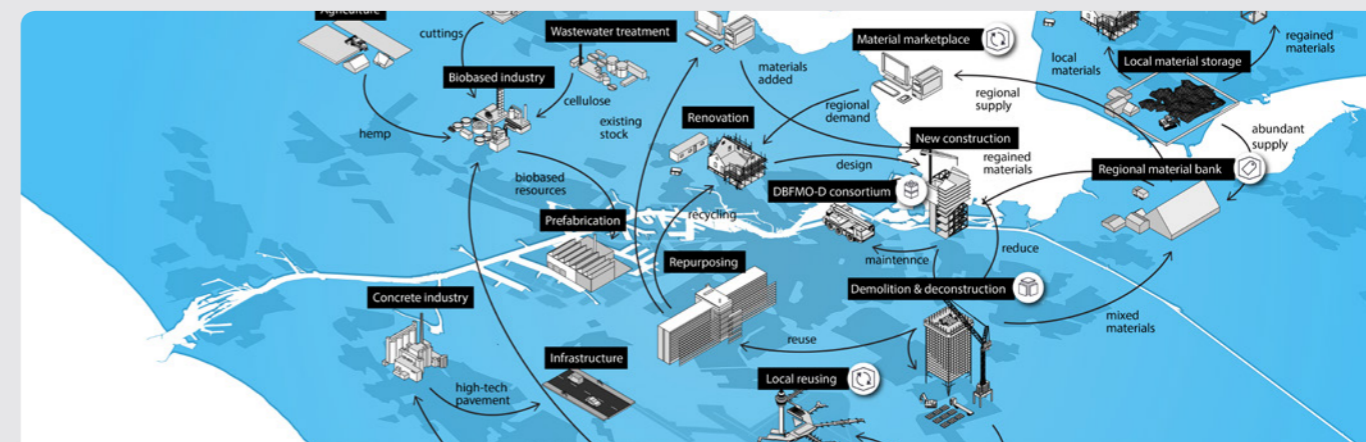
City-to-city networks (such as C40, ICLEI, and the CE100) are also providing [platforms] for cities to share their experiences, learnings and best-practices from each stage of their circular transition.

DISCOVER THE CIRCULAR POTENTIAL OF YOUR CITY AND SET PRIORITIES AND AMBITIONS

There is not one set path towards the creation of a circular city, and cities are often faced with the question of 'where to start?'. Each city throughout the world holds a different answer to this question. Thus, it is important for the circular economy to be integrated into the existing character, history and ambitions of a city. From healthcare and manufacturing in Glasgow,⁴⁶ to area

development in Basel,⁴⁶ to wholesale and metallurgy in Bilbao,⁴⁷ the creation of circular cities builds on existing strengths and momentum to deliver tangible impacts.

Establishing an inspiring roadmap that sets out a clear vision of a circular future, as well as identify which sectors of a city have the greatest transformative potential to kick-start the transition allows the city's community of businesses and citizens to focus their energy around a common focus.



CIRCLE CITY SCAN

THE TOOL :

The Circle City Scan is a visual roadmap that identifies opportunities to foster a circular economy and presents practical and scalable strategies to begin implementation based on each city's context, using a combination of material flow analysis, and circular strategy ideation. The *Scan* guides city changemakers through four-phases, *from orientation to implementation*, to kickstart the circular journey.

HOW CAN IT BENEFIT YOUR CITY?

The Circle City Scan is an important first step for cities is to understand the best starting point for their journey towards a circular economy. Using analyses such including socio-economic and material flow analyses, the *Scan* effectively builds and focuses momentum to each city's strengths to accelerate the practical implementation of circular projects.

WHERE HAS IT BEEN USED?

The City of Amsterdam commissioned [the world's first Circle City Scan in 2016](#), which has helped to guide the implementation of over 70 circular projects in the city. The Circle City Scan has since been used to further kickstart the circular journey of many other Dutch cities and regions, including [Rotterdam](#), as well as internationally, such as [Glasgow](#), [Basel](#), [Bilbao](#), and [Almati](#).

WHAT ARE THE REQUIREMENTS?


Robust data on material consumption and waste management within a city.


WANT TO FIND OUT MORE?


Contact: [Circle Economy](#)

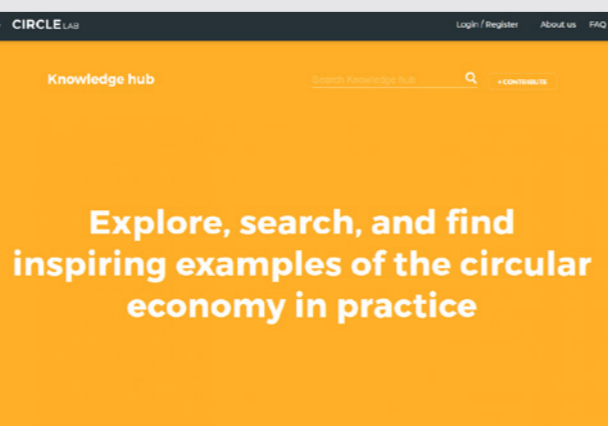
CITY NETWORKS

Globally, a growing community of cities are embracing notions of the circular economy in pursuit of a prosperous future. City networks offer an invaluable resource for city change-makers to accelerate the circular transition by facilitating the sharing of practical knowledge and innovative examples, facilitate collaboration, and provide access to expertise to enhance capacity. Listed below are three frontrunning city networks:

 [ICLEI - Local Governments for Sustainability: Green Circular Cities Coalition](#) - The Coalition provides a platform to connect cities, experts, businesses, and other relevant stakeholders to foster urban circular economy transition through knowledge and experience exchange, mutual learning and technical support.

 [C40](#) - Working across multiple sectors and issues, C40 convenes networks that provide a range of services in support of cities pursuing topics of sustainability. C40 networks help cities replicate, improve and accelerate sustainable action.

 [Ellen MacArthur Foundation - CE100](#) - The Ellen MacArthur Foundation initiated a network (the CE100), aiming to exchange knowledge on circular economy issues among the members of the network. Members are mainly corporates, regions and governments.



KNOWLEDGE HUB

THE TOOL:

Knowledge Hub is the world's largest open-access case study library of circular initiatives, technologies and policies. The platform provides an open-access platform for cities, businesses and citizens to connect and further share their experience and expertise on the practical implementation of the circular economy.

HOW CAN IT BENEFIT YOUR CITY?

By sharing practical examples of circular initiatives and policies, cities and businesses throughout the world can share their knowledge, expertise and best practices to overcome the barriers and support the wider acceleration towards a circular future.

WANT TO FIND OUT MORE?

[Explore the Knowledge Hub](#)
Contact: [Circle Economy](#)

INVOLVE BUSINESSES FROM THE START AND GIVE ROOM FOR EXPERIMENTATION

A circular city is created through innovation and experimentation. Often the ideas and entrepreneurs that are needed to develop new circular products and services are already present within a city; they just need to be activated and supported. Dedicated city-side programmes, such as Amsterdam's [Circular Innovation Programme](#) and [Start-up in Residence](#), have created a dynamic environment that actively facilitates experimentation of new innovative circular strategies that work towards specific sustainability challenges of the city; providing spaces to test, fail, learn, and iterate.

Cities can also have an active role in planting the seeds for circular innovation throughout local industries and communities. For example, the Dutch province of Overijssel provided 100 local companies the opportunity to participate in a series of workshops centred specifically around circular design and business models.



CIRCO - DESIGN THINKING FOR CIRCULAR OPPORTUNITIES

THE TOOL:

CIRCO facilitates organisations and companies to develop circular products, services and business models by connecting them to circular design principles. In addition to the classes and tracks, CIRCO acts as a platform for sharing knowledge and experiences, debating challenges and solutions and facilitating networking and collaboration within its community.

HOW CAN IT BENEFIT YOUR CITY?

CIRCO can help stimulate a community of local businesses to develop circular designs and business models that can make the notions and benefits of a circular city a reality.

WHERE HAS IT BEEN USED?

CIRCO can help stimulate a community of local businesses to develop circular designs and business models that can make the notions and benefits of a circular city a reality.

WHAT ARE THE REQUIREMENTS

An enthusiastic community of local organisations that want to unlock the potential of circularity

WANT TO FIND OUT MORE?

Contact: [CIRCO](#)

UNDERSTAND THE BARRIERS TO CIRCULARITY AND START ADDRESSING THEM

Breaking away from the current linear status quo is no easy process, and there each urban context presents its own makeup of drivers and barriers towards circularity. To most effectively boost the transition towards circularity, it is important for a city to make an inventory of the barriers (not just regulatory, but economic, social, and technical too) that circular frontrunners are facing and why resistance exists from linear businesses.

More specifically, tight regulation can often hinder innovation and experimentation in cities throughout the world. Recognised as a specific barrier in Amsterdam, the city established specific locations with relaxed regulation or 'living-labs' such as De Ceuvel, or Buiksloterham,⁴⁹ that are providing the space and freedom for circular initiatives and entrepreneurs to experiment and innovate on new strategies.

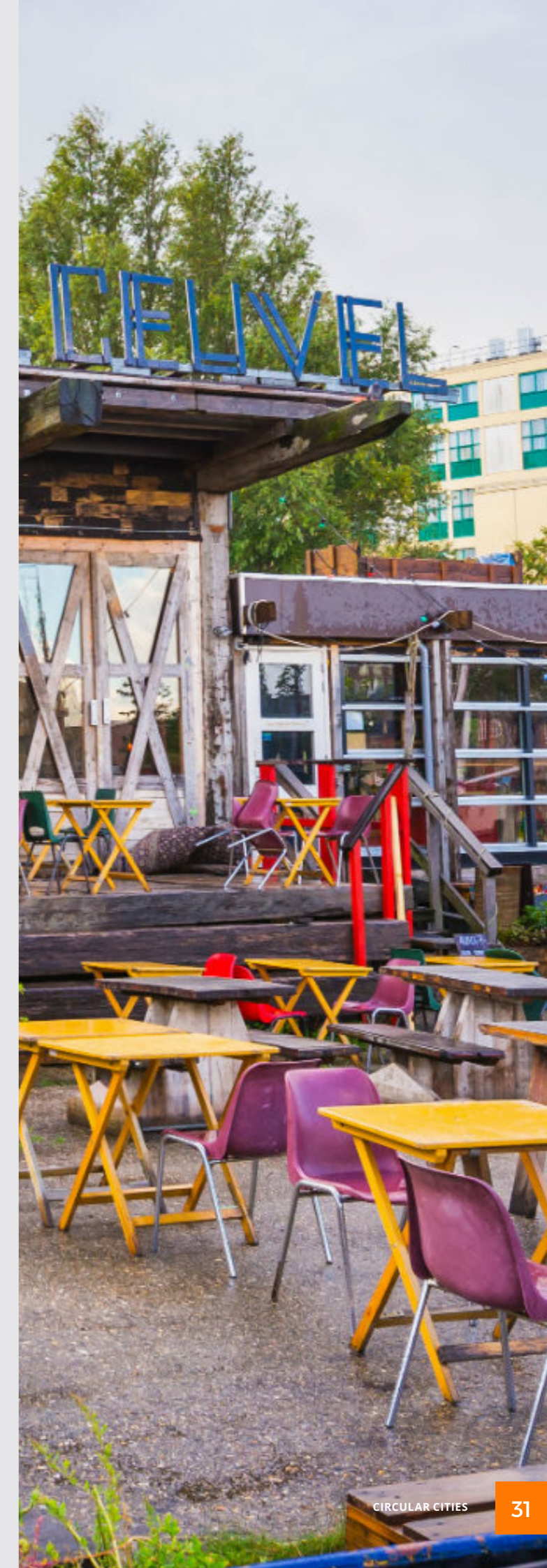
FACILITATE INTERDISCIPLINARY AND CROSS-SECTORAL COLLABORATIONS

The circular economy is an inherently holistic concept. Advocating for systemic change, circularity influences each and every element of a city, from mobility, health and innovation, to civil society, businesses and education. Such change cannot be created in silos, rather demanding new forms of partnerships and collaborations.

Pioneering cities are forging bridges between local public sector departments that all too often operate separately from one another. Using the concept of Doughnut Economics⁷ as a tool, the City of Amsterdam has brought together public sector officials from 18 different topic areas, from real estate to innovation, to co-create circular strategies and ambitions that ensure synergies and balance trade-offs to maximise the impact of the transition.

What is more, local governments often hold an invaluable linking role within society, which can be leveraged to facilitate new forms of collaboration and coordination between businesses, by acting as impartial mediators. The potential such a role is illustrated by Cape Town's Western Cape Industrial Symbiosis Programme (WCISP) which connects companies with expertise and resources.⁴⁸

However, cities must also be aware of the inevitable resistance to change from the established linear system. With much at stake for stakeholders in the linear economy, it is also important for cities to understand the barriers and risks, to effectively support the broad transition towards circularity.



LEAD BY EXAMPLE AND CREATE THE DEMAND THROUGH PROCUREMENT

Cities are not just regulators that set the rules of the game, but can also be the leaders who serve as an inspiring example of the practical application of the circular economy, by which businesses and citizens alike can follow.

Using the significant purchasing power of the public sector, which is typically around 20% of national GDP, cities can stimulate the demand for, and engender trust in, the circular economy. Public procurement practices, from buildings, furniture and even uniforms can be

aligned with the concepts of the circular economy and create the demand for businesses for new, innovative and circular products and business models.

In the Netherlands, the power of the circular economy in public procurement (or circular procurement) has demonstrated through the Green Deal: Circular Procurement programme which worked with 45 public and private sector participants over three years to pilot and understand the process and benefits of circular procurement.⁵⁰ Lessons learned from the programme already being disseminated throughout the world, enabling the mainstreaming of circular procurement practices.

CIRCULAR TENDERING IN THE BUILT ENVIRONMENT

THE TOOL:

Metabolic and SGS Search have collaborated to develop a set of tools that make it easier to drive circularity in building construction. Through four distinct phases, the tool can help to integrate circularity into tendering processes, looking at a wide range of circularity goals within the themes of materials, adaptivity and resilience, water, energy and ecosystems.

HOW CAN IT BENEFIT YOUR CITY?

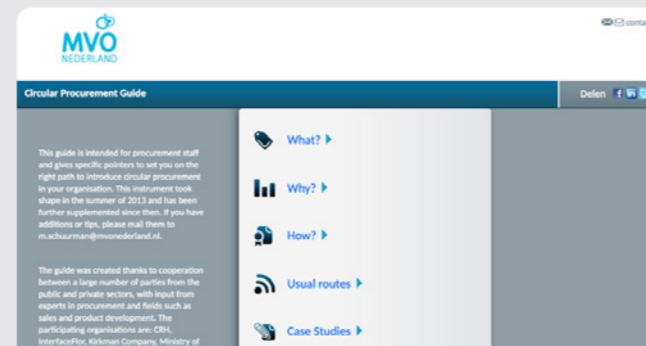
This process can enable city changemakers to translate circular ambitions into measurable criteria that can be integrated into tendering processes for new housing and commercial developments. The approach can further be applied to future tenders, as well as use it to begin to build steadfast circularity principles into the DNA of the city more broadly.

WHERE HAS IT BEEN USED?

Circular tendering has already yielded positive results throughout the Netherlands. For example, the [City of Amsterdam has developed a roadmap for circular tendering methods](#), and are applying them to a number of sites throughout the city.

WANT TO FIND OUT MORE?

Contact: [Metabolic](#), [SGS Search](#)



CIRCULAR PROCUREMENT GUIDE

THE TOOL:

The Circular Procurement Guide is a collection of available knowledge, tips and examples in the field of circular procurement. The guide is therefore intended for everyone involved in the purchasing process. In order to make circular procurement a success, it is important that not only purchasing but the other departments are involved and that there is broad support for the circular procurement processes.

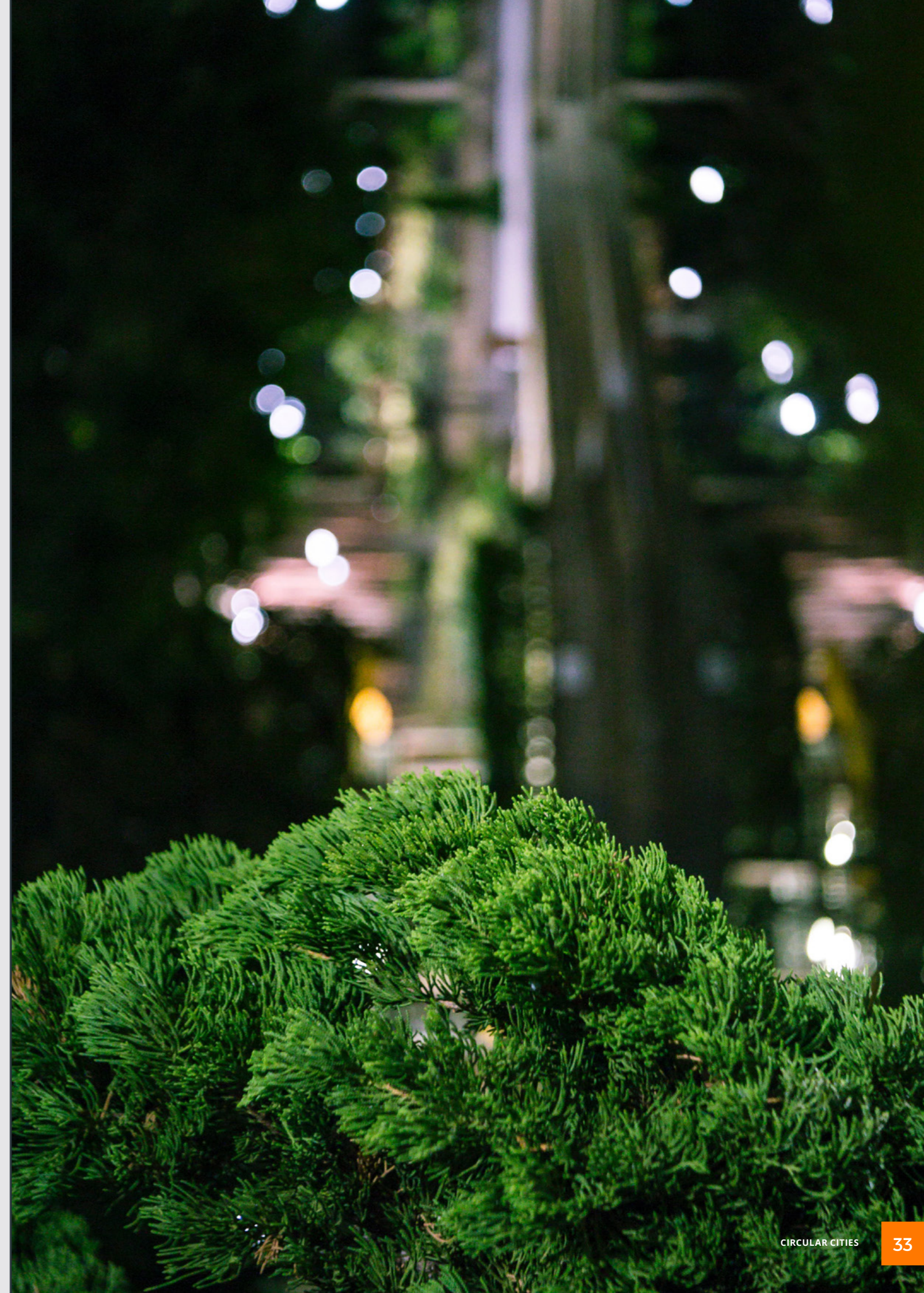
HOW CAN IT BENEFIT YOUR CITY?

Incorporating principles of the circular economy into a city's tendering process can initially be daunting. The circular procurement guide, therefore, breaks down the barriers and provides important knowledge, advice and examples of how to integrate circularity into the tendering process.

WANT TO FIND OUT MORE?

[Explore the circular procurement guide.](#)

Contact: [PIANOo](#), [MVO Nederlands](#)



INTRODUCE AND MAINSTREAM CIRCULAR THINKING INTO EDUCATION AND TRAINING

The circular economy will fundamentally change the types of work that is being done, and the skills required to do it. At the same time, rapid advancements in artificial intelligence, automation, and bio- and digital-technologies are already driving seismic shifts in the labour market.

Core concepts of the circular economy can be integrated into school programmes to inspire the leaders of tomorrow, and ensure that they are equipped with the necessary, and future-proof, skills to thrive in, and drive the growing circular economy. At the same time, new trainings and workshops can help to develop necessary skills and re-skill employees to enable a workforce that is future-proof as well as circular.

Local governments, such as the Amsterdam Metropolitan Area, are already gaining a greater understanding of the key skills required for jobs within the circular economy,⁵¹ to be able to adapt education and training to ensure these demanded skills are developed.

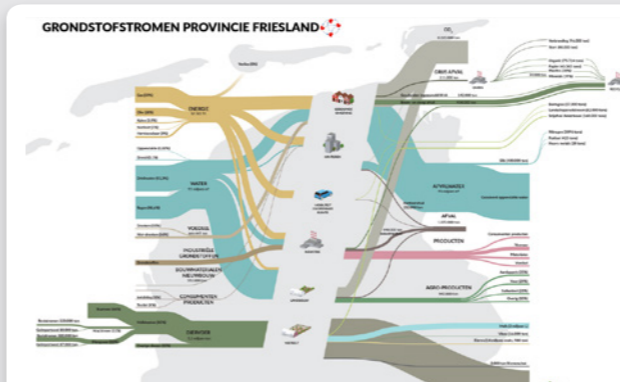
MONITOR, ADJUST AND SCALE-UP

A city's transition towards a circular economy does not occur overnight. Rather, it is a multi-year, multi-stakeholder journey with no set path to follow. Insights from pioneering cities throughout the world highlight the importance of a learning by doing approach.

Cities should not aim to become 100% circular immediately, but rather pilot circular initiatives, measure their success and iterate, all the while keeping in mind the targets and ambitions set by the city to provide a guide to the overall process.

Corresponding to the breadth of the concept, there are many ways to measure the circularity of a city. From tracing the quantities of materials, energy and water that flow through a city,⁵² to identifying a city's total carbon footprint through consumption-based embodied emissions,³¹ to quantifying the share of employment within the circular economy,⁵³ as even tracking circular economy related patents to measure eco-innovation,⁵⁴ each method of measurement provides insights by which to steer a city's transition towards a more circular direction.

Ultimately, It is important to continually measure and monitor progress to understand how cities can most effectively influence each phase of the circular transition. Insights from the evaluation of Amsterdam's municipal policy have supported the targeted support of circular initiatives throughout the city's broad transition.⁵⁵ Through committed and targeted monitoring and support adjustments can be made to the circular transition and successful initiatives can be scaled to generate large-scale transformation.



METABOLIC ANALYSIS

THE TOOL:

A metabolic analysis provides an essential basis for qualifying and quantifying a region's current state and future potential for a circular economy, pinpointing the key flows of materials and their associated environmental impact.

HOW CAN IT BENEFIT YOUR CITY?

Illuminate key material, water and energy flows within a city or region, which can help to prioritise which impacts to focus on and understand the economic and environmental impact of different opportunities

WHERE HAS IT BEEN USED?

The Material Flow Analysis has been applied with the Dutch province of Friesland to stimulate circular innovation in the local industrial sector. Metabolic analysed five transitional directions, worked with over 50 local entrepreneurs, and helped stimulate plastics, construction, and agrifood sector.

WHAT ARE THE REQUIREMENTS?

Robust data on material consumption and waste management within a city.

WANT TO FIND OUT MORE?

Contact: [Metabolic](#)



CIRCULAR EMPLOYMENT

THE TOOL:

The transition towards a circular economy will fundamentally change the type of work that will be done in cities, and who it will be done by. Circle Economy has developed a method to quantify and map circular jobs within a city to provide an understanding of the current circular job landscape, indicating present- or lacking expertise.

HOW CAN IT BENEFIT YOUR CITY?

Understanding the character of circular employment within a city provides important insights into a city's strengths and opportunities for the local labour market to anticipate, and even drive, the transition to the circular economy.

WHERE HAS IT BEEN USED?

Circular employment has been mapped for [the whole of the Netherlands](#), as well as zooming into the city scale, such as for the [city and metropolitan area of Amsterdam](#).

WHAT ARE THE REQUIREMENTS?

Detailed data regarding employment by activity and company within a city or region.

WANT TO FIND OUT MORE?

Contact: [Circle Economy](#)

REFERENCES

1. United Nations. (2018). "World urbanisation prospects: The 2018 revision". United Nations. Available online via: <https://population.un.org/wup/Publications/Files/WUP2018-KeyFacts.pdf>
2. The World Bank. (2018). "Urban Development Overview". The World Bank. Online via: <https://www.worldbank.org/en/topic/urbandevelopment/overview>
3. UNEP. (2017). "Resilience and resource efficiency in cities". United Nations Environment Programme. Available online via: https://wedocs.unep.org/bitstream/handle/20.500.11822/20629/Resilience_resource_efficiency_cities.pdf?sequence=1&isAllowed=y
4. UNEP. (2017). "The weight of cities: Resource requirements for future urbanisation". United Nations Environment Programme. Available online via: https://citiesipcc.org/wp-content/uploads/2018/03/Summary-for-Policymakers_Global-Weight-of-Cities-1.pdf
5. Circle Economy. (2019). "The Circularity Gap Report 2019". Available online via: <https://www.circularity-gap.world/>
6. Ecos. (2014). "Sustainable Infrastructure as an Asset Class". Available online via: http://www.gib-foundation.org/content/uploads/2014/03/Sustainable-Infrastructure-as-an-Asset-Class_V7.1.pdf
7. Raworth, K. (2017). "Doughnut Economics: Seven ways to think like a 21st-Century Economist". Chelsea Green Publishing, UK.
8. Material Economics. (2018). "The Circular Economy: A powerful force for climate mitigation". Sitra & Material Economics. Stockholm. Available online via: <https://www.sitra.fi/en/publications/circular-economy-powerful-force-climate-mitigation/>
9. Achterberg, E. (Circle Economy & Sustainable Finance Lab), Hinfelaar, J. (Nuovalente) & Bocken, N. (TU Delft). (2016). "Master Circular Business with the Value Hill". Available online via: <http://www.circle-economy.com/wp-content/uploads/2016/09/finance-white-paper-20160923.pdf>
10. McKinsey & Company. (2015). "Growth within: A circular economy vision for a competitive Europe". Available online via: <https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/growth-within-a-circular-economy-vision-for-a-competitive-europe>
11. Cambridge Econometrics, Trinomics, and ICF. (2018). "Impacts of circular economy policies on the labour market". European Commission. Available online via: <http://trinomics.eu/wp-content/uploads/2018/07/Impacts-of-circular-economy-on-policies-on-the-labour-market.pdf>
12. EMF & ARUP. (2018). "The circular economy opportunity for urban and industrial innovation in China". Ellen MacArthur Foundation & ARUP. Available online via: <https://www.ellenmacarthurfoundation.org/publications/chinareport>
13. EMF (2016). "Circular Economy in India: Rethinking growth for long-term prosperity". Ellen MacArthur Foundation. Available online via: <http://sites.ellenmacarthurfoundation.org/india>
14. LWARB. (2015). "Towards a circular economy - Context and opportunities". London Waste & Recycling Board. Available online via: https://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report_web_09.12.15.pdf
15. COM (2006). Communication from the Commission to the Council and the European Parliament: Keep Europe moving – Sustainable mobility for our continent. Mid-term review of the European Commission's 2001 Transport White Paper. COM(2006) 314. Brussels.
16. EMF. (2019). Cities and Circular Economy for Food. Ellen MacArthur Foundation. Available online via: https://www.ellenmacarthurfoundation.org/assets/downloads/Cities-and-Circular-Economy-for-Food_280119.pdf
17. UN. (2010). "Water and Cities: Facts and Figures". United Nations. Available online via: http://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/facts_and_figures_long_final_eng.pdf
18. McKinsey & Company (2016). "Urban World: The global consumers to watch 2016". Available online via: <https://www.mckinsey.com/global-themes/urbanization/urban-world-the-global-consumers-to-watch/~media/57c6ad7f7f1b44a6bd2e24f0777b4cd6.ashx>
19. World Bank. (2018). What a Waste 2.0: A global snapshot of solid waste management to 2050. Available online via: http://datatopics.worldbank.org/what-a-waste/tackling_increasing_plastic_waste.html
20. Government of the Netherlands. (2016) "A circular economy in the Netherlands by 2050". Available online via: <https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050>
21. Circle Economy & TNO (2016). "Circular Amsterdam: A vision and action agenda for the city and metropolitan area". Available online via: <https://www.circle-economy.com/wp-content/uploads/2016/04/Circular-Amsterdam-EN-small-210316.pdf>
22. Rotterdam Circulair. (2017). "Rotterdam gaat voor circulair: Visie en aanpak 2017". Available online via: https://www.rotterdam.nl/wonen-leven/circulaire-economie/Rotterdam-Circulair-Visie-en-plan-van-aanpak_DEF.PDF
23. van der Leer, J. (2016). "Zero Waste Buiksloterham: An integrated approach to circular cities". Available online via: https://www.researchgate.net/publication/310984670_Zero_Waste_Buiksloterham_an_Integrated_Approach_to_Circular_Cities
24. Nederland Circulair! (N.d.) Online via: <https://www.circulairondernemen.nl/solutions/park-2020-worlds-first-cradle-to-cradle-working-environment>
25. Delta Development. (N.d.) Online via: <http://www.deltadevelopment.eu/en/project-development/projectdevelopment/park-2020/>
26. Better Buildings Partnership. (N.d.) Available online via: <http://www.betterbuildingspartnership.co.uk/park-2020-cradle-to-cradle-action>
27. Park 20|20. (N.d.) Online via: <http://www.park2020.com/>
28. Ordnance Survey. (2018). "People, place and mobility: The Connected and Autonomous Vehicle opportunity". Available online via: <https://www.ordnancesurvey.co.uk/business-and-government/smart/intelligent-mobility-transport.html>
29. Available online via: <http://oldurbanist.blogspot.com/2011/12/we-are-25-looking-at-street-area.html>
30. Circle Economy. (2018). "City-as-a-Service". Available online via: <https://www.circle-economy.com/city-as-a-service/#.XHuv5ZP0IQI>
31. C40 Cities. (2018) "Consumption-based GHG emissions of C40 cities". Available online via: <https://www.c40.org/researches/consumption-based-emissions>
32. Mud Jeans. (N.d.) Available online via: <https://mudjeans.eu/about-us-sustainability-water-and-co2/>
33. World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company (2016). "The New Plastics Economy: Rethinking the future for plastics". Available online via: (https://newplasticseconomy.org/assets/doc/EllenMacArthurFoundation_TheNewPlasticsEconomy_Pages.pdf)
34. ACEEE. (2015). "Reducing energy use in public outdoor lighting". American Council for an Energy-Efficient Economy. Available online via: <https://aceee.org/partnerships-reduce-energy-use-public-outdoor>
35. Triangulum. (N.d.) Available online via: https://www.triangulum-project.eu/?page_id=2137
36. Phillips (2012). "Answers in energy efficient lighting!, Responding to Climate Change 2010".
37. Phillips. (N.d.) Available online via: <https://www.phillips.com/a-w/about/news/archive/standard/news/press/2015/20150416-Philips-provides-Light-as-a-Service-to-Schiphol-Airport.html>
38. Small, M. (2011). "Social Ecology of Food". New Compass Press. Available online via: <http://new-compass.net/articles/social-ecology-food>
39. Mohareb, E.A.; Heller, M.C.; & Guthrie, P.M. (2018). "The Role of Cities in Mitigating US Food System Greenhouse Gas Emissions". Environmental Science & Technology. Vol.52(10), pp.5545-5554
40. National Geographic. (2017). This Tiny Country Foods the World. Available online via: <https://www.nationalgeographic.com/magazine/2017/09/holland-agriculture-sustainable-farming/>
41. Urbanlab. (N.d.) "De DakAkker - The first large-scale rooftop cropland in Europe". Available online via: <http://urbanlab.eu/project/dakakker/>
42. UNDP. (2016). "Human development report". United Nations Development Programme. Available online via: <http://hdr.undp.org/en/2016-report>
43. World Health Organization and UNICEF. (2012). "Progress on Drinking Water and Sanitation: 2012 Update". External United States: WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation.
44. De Groene Zaak. (2015). "Governments going circular". De Groene Zaak and WBCSD. Available online via: <http://www.govsgocircular.com/media/1354/governments-going-circular-dgz-feb2015.pdf>
45. Circle Economy. (2016). "Circular Glasgow" Available online via: <https://www.circle-economy.com/wp-content/uploads/2016/06/circular-glasgow-report-web-low-res.pdf>
46. Circle Economy. (2018). Implementing Circular Strategies in Switzerland's Iconic Cities. Available online via: <https://www.circle-economy.com/implementing-circular-strategies-in-switzerlands-iconic-cities/>
47. Circle Economy. (2018). "Circular Bilbao". Available online via: <https://www.circle-economy.com/wp-content/uploads/2018/04/Circular-Bilbao.pdf>
48. Climate-kic. (2018). "Municipality led circular economy case studies". Available online via: <https://www.climate-kic.org/wp-content/uploads/sites/15/2018/12/Municipality-led-circular-economy-case-studies-compressed-ilovepdf-compressed.pdf>
49. Amsterdam Institute of Advanced Metropolitan Studies (AMS). (2017). "Urban Living Labs: A living lab way of working". Available online via: https://www.ams-amsterdam.com/wordpress/wp-content/uploads/AMS-Living-Lab-Way-of-Work_pages-II.pdf
50. Green Deal on Circular Procurement Project Group (2017). Added Value: Reaping the benefits of 3 years of the Green Deal on Circular Procurement". Available online via: http://www.oneplanetnetwork.org/sites/default/files/eng_green_deal_circular_procurement_magazine_0.pdf
51. Circle Economy. (2018). "Circular Jobs and Skills in the Amsterdam Metropolitan Area" Circle Economy. Available online via: <https://www.circle-economy.com/wp-content/uploads/2018/12/Final-Circular-Jobs-and-Skills-in-the-Amsterdam-Metropolitan-Area.pdf>
52. Metabolic. (2018). "Circular Charlotte: Towards a zero waste and inclusive city". Available online via: <https://www.metabolic.nl/projects/circular-charlotte/>
53. Circle Economy. (2017). "Circular Jobs: Understanding employment in the circular economy in the Netherlands". Available online via: <https://www.circle-economy.com/wp-content/uploads/2017/03/goldschmed-ing-jobs-report-20170322-lite.pdf>
54. European Commission. (2018). "Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions On A Monitoring Framework For The Circular Economy". European Commission. Available online via: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:29:FIN>
55. Circle Economy. (2018). "Amsterdam Circular: Evaluation and action perspective." Available online via: <https://www.circle-economy.com/wp-content/uploads/2018/10/amsterdam-evaluation-EN-20180328.pdf>



COLOPHON

This publication was created by Circle Economy in co-creation with an order of Holland Circular Hotspot.



Circle Economy

Circle Economy (CE) works to accelerate the transition to a circular economy. Our mission is to close the circularity gap by empowering a global community of cities and businesses with tools and on the ground support to create circular cities while driving economic and social prosperity, respecting the boundaries of our planet.

Contributors

Max Russell (CE)
Jurn de Winter (CE)
Freek van Eijk (HCH)

Design

Nicolas Raspail (CE)
Inge ter Laak (CE)
Long Wu

April 2019



Holland Circular Hotspot

At Holland Circular Hotspot (HCH) we believe that creating a circular economy calls for a profound transformation in the way we work and produce, and the way we design, teach, invest, and buy. That's why we strive to connect the global circular community, by inspiring cross-sectoral collaborations, stimulating the exchange of knowledge and innovations, and boosting circular entrepreneurship.

Website

www.hollandcircularhotspot.nl

Email

info@HollandCircularHotspot.nl

Office Locations

C-Bèta

Rijnlanderweg 916
2153 MN Hoofddorp, The Netherlands
www.c-beta.nl

Supporting Partners of Holland Circular Hotspot

TNO