

The background of the top half of the cover features a photograph of several hands of different skin tones reaching up towards the center, as if holding a globe. The background is a dense canopy of green trees. A large green circle is superimposed over the image, framing the central text.

May 2022

CIRCULAR ECONOMY
in action
AROUND THE WORLD

Lessons for
Scotland



**Friends of
the Earth
Scotland**

Written by: Sarah Hunter and Kim Pratt

About Friends of the Earth Scotland

Friends of the Earth Scotland campaigns for a just transition to a sustainable society. It works in Scotland for socially just solutions to environmental problems and to create a green economy; thinking globally and acting locally, enabling people to take individual and collective action. It is part of Friends of the Earth International - the world's largest grassroots environmental network with two million members around the world. It is an independent Scottish charity with a network of thousands of supporters and active local groups across Scotland.

Report written by: Sarah Hunter and Kim Pratt

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Executive Summary

This report brings together case studies of the circular economy in action from around the world, divided into economically important themes from food systems to the built environment and electronics. These are compared to Scotland's position, indicating where progress can be made.

Consultation on a Circular Economy Bill in Scotland will begin in May 2022. This will be an opportunity for Scotland to show the true scale of its ambition and take action to reverse the environmental damage created by an economy based on growth and over-consumption. The case studies in this report demonstrate the potential of a circular economy to support a global transition to a more sustainable and socially just world. Scotland can use these examples to find inspiration and ensure we play our role in creating this future.

As well as practical examples of change, progress is also being made politically internationally. The Netherlands was the first country to set a circular economy goal. It is aiming for a completely circular economy by 2050 and 50% reduction in primary raw material use by 2030.¹ Last year, the European Parliament voted for science-based, binding targets to reduce material consumption by 2030.²

A carbon footprint target, which would focus on Scotland's global carbon impact, would complement Scotland's domestic emissions reduction goals. Decision makers would have a more complete understanding of Scotland's global climate impact and how to reduce this. Sweden committed to setting a consumption-based target for emissions in 2022.³ 82% of Scotland's emissions are associated with the consumption of goods and services (and more than 50% of these are imported).⁴ Creating a circular economy and reducing raw material extraction is the most effective way to reduce these emissions.

The material footprint and carbon footprint targets should be the driving force of the creation of a circular economy in Scotland. They should be central to the Circular Economy Bill, which should also enable the means to achieve these targets. The case studies in this report identify numerous measures, from across economic sectors, which could be part of a circular economy in Scotland. Friends of the Earth Scotland has previously identified the omission of remanufacturing initiatives, bans on unwanted stock going to landfill or incineration and the redistribution of unwanted textiles.⁵ The table below summarises potential opportunities for Scotland by circular economy theme, based on the international examples discussed here.

¹ Government of the Netherlands <https://www.government.nl/topics/circular-economy/circular-dutch-economy-by-2050>

² <https://www.europarl.europa.eu/news/en/press-room/20210122IPR96214/meps-call-for-binding-2030-targets-for-materials-use-and-consumption-footprint>

³ <https://www.climatechangenews.com/2022/04/08/sweden-set-to-be-worlds-first-country-to-target-consumption-based-emission-cuts/>

⁴ Scottish Government (2021) Scotland's Carbon Footprint

⁵ Friends of the Earth Scotland (2020). Response to Developing Scotland's circular economy: consultation on proposals for legislation. <https://foe.scot/resource/response-to-developing-scotlands-circular-economy-consultation-on-proposals-for-legislation/>

Table 1. Summary of circular economy opportunities for Scotland

Circular economy theme	Gap(s)/opportunities identified in Scotland	Examples of Circular Economy solutions
Food systems	<p>Early food supply chain stages</p> <p>Short, local, urban food production opportunities</p>	<p>Regenerative agriculture from the Balbo Group, Brazil</p> <p>Amsterdam's urban agriculture initiatives</p>
Built environment and transport	<p>Government buildings utilising circular economy principles</p> <p>Prevention and reuse of construction waste</p> <p>Material requirements of Scotland's net zero transport goals</p>	<p>San Francisco, Amsterdam and Venlo</p> <p>Denmark's selective demolition strategy; extending existing building life in Amsterdam</p> <p>Battery recycling initiatives in North America</p> <p>Successful bike share schemes in Chinese cities</p>
Municipal waste and recycling	<p>Scotland's recycling rates are the lowest in the UK</p> <p>Fragmented approach to recycling</p> <p>Opportunity to increase new green jobs by growing the domestic recycling industry and reuse hubs</p>	<p>Following the Welsh example, a moratorium on new incinerators and reducing waste exports, would turn recycling rates around</p> <p>Welsh and Irish strategies and funding examples. Advice to citizens and support for sharing communities</p> <p>Programme of green apprenticeships (Welsh government); replicating the Edinburgh Tool Library model elsewhere</p>
Textiles	<p>Sector specific targets and producer responsibility policies, particularly for the largest retailers, for textiles to reduce pollution and fast fashion</p> <p>Anti-waste legislation for unsold goods including textiles</p>	<p>The European and UK textile strategies include reuse and recycling targets</p> <p>Anti-waste legislation pertaining to textiles in France</p>
Electrical goods	<p>Access to electrical recycling and reuse schemes for households</p>	<p>e-cycle in New York City, the Edinburgh Remakery and Junk It are initiatives which could be applied across Scotland</p>

	Product design legislation around electronic equipment in conjunction with UK government	Extended Producer Responsibility schemes across the UK nations and the EU
Product design and manufacturing	<p>Need for a successful and comprehensive Extended Producer Responsibility (EPR) scheme developed across the UK and devolved governments</p> <p>Funding support for circular economy business models will end in 2022 and there are no plans for a replacement fund</p> <p>More repair and reuse of products manufactured in Scotland should be encouraged</p>	<p>Many examples of successful and ambitious EPRs exist, such as those in the Netherlands and Ireland</p> <p>There are examples of national funding for circular economy projects across the world. Japanese support for recycling batteries shows how policies around energy must be linked to material requirements</p> <p>The Renault Re:Factory shows how important systems level change is to creating a successful remanufacturing sector</p>
Biomass and bio-energy	Application of bio-energy production in urban settings. Such strategies must consider carefully about adding to competing pressures on land by creating bio-resource demand.	Kenya's urban organic waste collection and Costa Rica's promotion of bio-energy through waste infrastructure and urban design/construction (only once biodiversity issues have been fully considered)
Community consultation	<p>Whilst Scotland has a national Climate Assembly and children's parliament that consider circular economy issues, support for local initiatives is inconsistent across Scotland</p> <p>Extend local initiatives for community consultation</p>	<p>Consider the recommendations from the Climate Assembly and Children's Parliament in the Circular Economy Bill</p> <p>Examples from across Scotland could be applied more broadly</p>
Monitoring framework	Datasets exist but have not been brought together in a coherent framework for measuring progress	The Amsterdam Monitor

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Moving Forward

01 Introduction

A circular economy is a model of economic development that prevents waste, resource depletion and the use of finite resources. The phasing out of linear economies in favour of resource recovery has been increasingly incorporated and adopted in national strategies. Scotland released its first national circular economy strategy, *Making Things Last*, in 2016, and undertook a consultation in 2019 in a bid to introduce a Scottish Circular Economy Bill. However, the bill was postponed due to the COVID-19 pandemic. The Scottish Government committed to re-introduce the bill in the next parliamentary session, with an increased ambition to create a circular economy in Scotland. The revised Circular Economy Bill will be consulted on in May 2022 and must now create the framework Scotland needs to realise its potential for a circular economy.

What follows is a collection of circular economy case studies, including governmental strategies, private firms and community initiatives around the world. It is a tool for comparison and inspiration for policies and investments to be supported by Scotland's approach to circularity.

This report is structured according to the dominant themes within existing national strategies, for a direct comparison with Scotland's policies. These themes can be split into the following sectors: food systems, built environment and transport, municipal waste and recycling, textiles, electrical goods, product design and manufacturing, and biomass and bioenergy. Following this, chapters 10 and 11 depart from these sectors of interest. Instead, these latter chapters describe how community consultation and measurement frameworks have been incorporated into the design and implementation of circular economies. Each chapter includes key actions and targets set out by existing international strategies, legislation or initiatives. Local case studies are included as a direct comparison to how Scotland's policy approach compares to international examples or where Scottish community groups have used an approach that may be implemented more widely.

The reintroduction of a Circular Economy Bill will promote Scotland as a key international figure in climate action and provide a resilient long-term recovery. By embracing these international examples, Scotland can learn from global innovation to aid its own transition to a circular economy.



02 A Scottish Circular Economy

Defining a Circular Economy

A circular economy seeks to maximise the use and value of materials circulating in the economy via continuous recycling, reuse and repair. This stands in opposition to our current **linear economy** that follows a 'cradle-to-grave' system in which a products lifecycle ends with disposal and the creation of waste.

In a circular economy, cradle-to-cradle principles work to close material and energy loops by preventing the production of waste. The official [cradle-to-cradle certification](#) covers material reutilisation, renewable energy, water stewardship, chemical safety and social fairness. This means keeping materials and products in use for as long as possible through eco-design, repairing or remanufacturing them for further use or recycling their component materials. This also includes the transition from finite energy sources to renewable sources and water stewardship to protect natural resource reserves and lessen environmental impact whilst maximising resource efficiency.

In some of the following examples, the principle of biomimicry is also incorporated to a circular economy. This means using nature's systems as the archetype on which our production and construction processes are modelled after. Therefore, prioritising regenerative practices with no waste or pollution.⁶

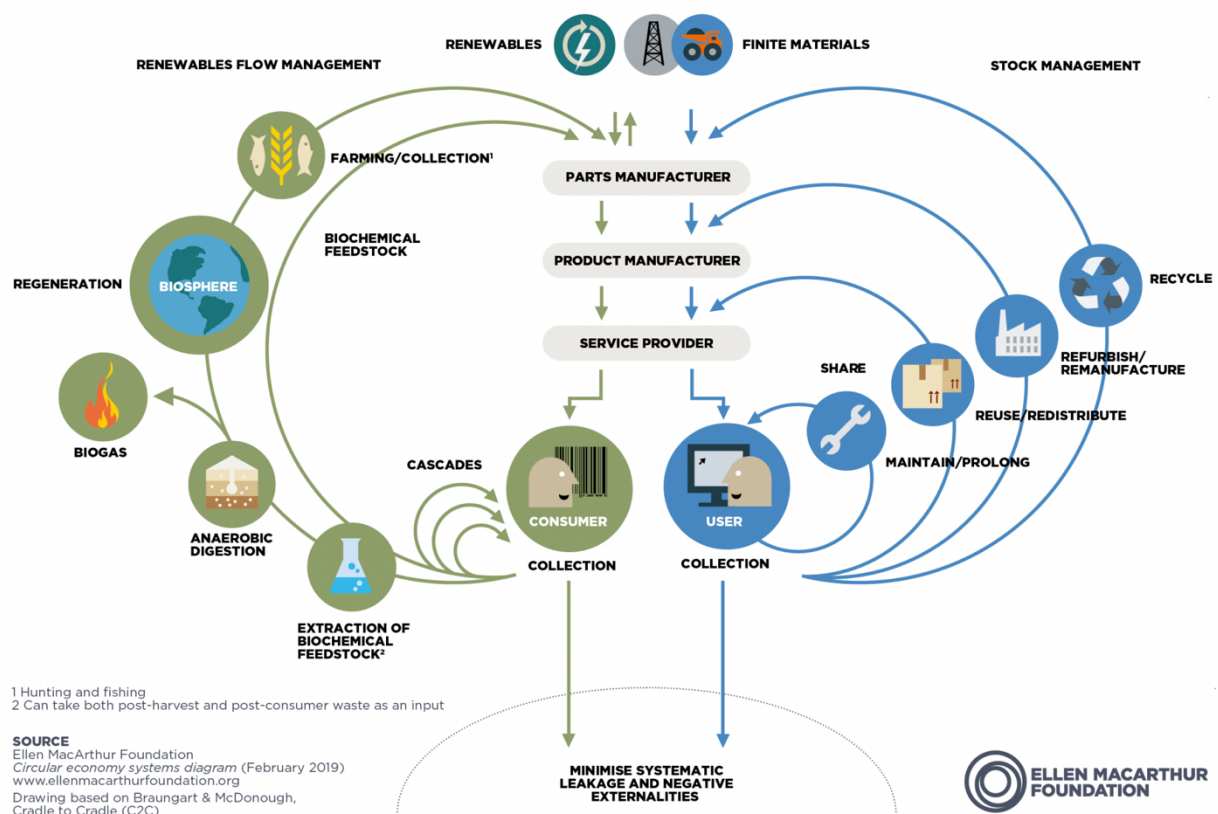


Figure 1. The Circular Economy

⁶ Ellen MacArthur Foundation (2017). *Schools of Thought*. <https://www.ellenmacarthurfoundation.org/circular-economy/concept/schools-of-thought>

Scotland's Circular Economy Bill

Public consultation of the Circular Economy Bill in Scotland will begin in May 2022.⁷ This will be an opportunity for Scotland to show the true scale of its ambition and take action to reverse the environmental damage created by an economy based on growth and over-consumption.

Friends of the Earth Scotland is calling for science-based and statutory targets to be included in the Circular Economy Bill. Both material and carbon footprint targets are required to ensure Scotland, and the world, reach our environmental goals. The material footprint target allows a measure of the economy's overall circularity. The carbon footprint ensures those materials which are required in smaller amounts but which are carbon intensive (such as critical materials like lithium and neodymium, which are required for the energy transition) are not overlooked.

The carbon footprint and material footprint targets should be the driving force of the creation of a circular economy in Scotland. They should be central to the Circular Economy Bill, which should also enable the means to achieve these targets. The case studies in this report identify numerous measures, from across economic sectors, which could be part of a circular economy in Scotland.

⁷ Scottish Government (2022) <https://www.gov.scot/news/reducing-waste/>

03 Food Systems



Amsterdam, Netherlands: Local Food Chains & Organic Waste

Amsterdam's city-wide strategy is focussed on shortening food chains and providing sustainable food in the city with organic waste streams. Local consumption is key in achieving sustainable food systems, by shortening the distance between consumers and their food and increasing the closure of nutrient cycles. The city is endeavouring to halve food waste by working across the food chain, the hospitality industry and residents. To deliver these ambitions, Amsterdam's approach covers public education/awareness and waste infrastructure.⁸

In its journey to circularity, Amsterdam is following the Doughnut Economics model, developed by economist Kate Raworth. The Doughnut model defines global boundaries of social and ecological wellbeing. The ecological boundaries include areas such as a stable climate, healthy oceans and abundant biodiversity. The doughnut's social foundations draw from the UN Sustainable Development Goals and outline 12 minimum standards of living required by all human beings (Figure 2). The bridge between the social foundation and the ecological ceiling is the space in which we can meet the needs of all people whilst living within the ecological boundaries of a healthy planet. With this conceptual strategy in mind, Amsterdam city defined its local boundaries for an ecologically and socially thriving city.⁹

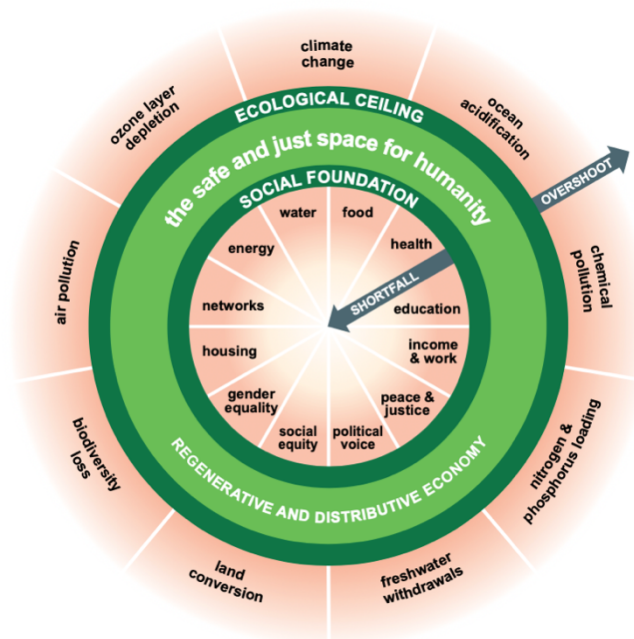


Figure 2. The Doughnut (with social boundaries and ecological ceiling)
[Source: Doughnut Economics Action Lab.](#)

⁸ City of Amsterdam (2020). *Amsterdam Circular Strategy 2020-2025*.

<https://www.amsterdam.nl/en/policy/sustainability/circular-economy/>

⁹ City of Amsterdam (2020). *The Amsterdam City Doughnut: A Tool for Transformative Action*.

<https://www.amsterdam.nl/en/policy/sustainability/circular-economy/>

Amsterdam's strategy works at multiple scales, exploring the ecological and social implications of a circular economy on a local and global level (Figure 2).



Figure 3. Amsterdam's Scales of Planning [Source: City of Amsterdam.](#)

In line with the doughnut model, Amsterdam's food strategy covers three main ambitions:

Ambition 1 – Short food chains

The increased production and consumption of **local produce** allows the city greater control over agricultural practices. This includes reduced fertiliser usage and closing local nutrient cycles. Amsterdam City emphasises **urban agriculture** as a key practice to encourage residents to grow their own food and reduce food waste. Collaboration with educational institutions is crucial to encourage urban agriculture practices.

Action 1 – Food production will have a place in the city.

This includes wider practice and implementation of urban agriculture. Amsterdam City supports residents and businesses in urban agriculture and regional food consumption via awareness and education.

Action 2 – Amsterdam City purchases regionally produced food.

It will financially support regional food producers to stimulate local production and consumption.

Action 3 – Sustainable chain parties will collaborate more in order to increase the consumption of regional food.

Amsterdam City will promote regionally produced food by working with food chains (including producers, distributors, processors and sellers). This includes developing markets and business models to finance any additional costs of sustainable, regional food.

Ambition 2 – Healthy and sustainable food

The implementation of healthy and sustainable food in the city includes the transition from animal proteins to vegetable proteins before 2023. In a bid to reduce the greenhouse gas and nitrogen emissions associated with livestock farming, Amsterdam wishes to increase consumption of vegetable proteins from 40% to 60% and reduce animal protein consumption from 60% to 40%. Additionally, **Amsterdam aims to reduce food waste by 50% by 2030.**

Action 1 - The people of Amsterdam change their eating habits.

Delivered through educational campaigns and policy for public space advertisements to discourage the consumption of food with a large ecological impact.

Action 2 – Amsterdam City is committed to reducing food waste.

Policy and educational campaigns that direct food surplus to those in need and discourage household food waste.

Action 3 – Initiatives against food waste and for more efficient production of food will be supported.

Food waste initiatives (private or public) will be supported logistically by the city, through the avenues of data, value retention, accessibility, community involvement and food technology.

Box 1. Closing the loop through education

The ADIDAS (awareness, interest, desire, action, satisfaction) campaigns are being implemented to incite behavioural change and increase the amount of household kitchen and waste correctly recycled.¹⁰

Ambition 3 – High-quality processing of organic waste streams before 2023.

To improve the collection and processing of organic waste, Amsterdam City is aiming to have separate kitchen and garden waste for 73% of households by 2030. Separate collection will enable more effective waste stream collection and close the nutrient cycle.

Action 1 – Working together to ensure the best approach for each city district.

Implementing a ranking system for residents, business and institutions of preferable processing routes for organic waste (vegetable, fruit, food and garden waste). This provides a waste collection system that is socially responsible and works with the needs of residents.

Action 2 – The people of Amsterdam are made aware of the importance of separating waste for uncontaminated waste streams.

Awareness and education campaigns on the importance of separating organic waste will be implemented to encourage behavioural change. Awareness will specifically target schools, associations, neighbourhood groups, shopping mall managers and business associations.

Action 3 – Amsterdam creates room and generates opportunities for reusing waste streams.

Amsterdam City will provide collection points for waste through deliberate spatial planning. Furthermore, it will support industrial and experimental initiatives in bioprocessing opportunities. For example, upcycling organic waste into high-grade products. However, the City's priority remains the prevention of organic waste where possible.¹⁰

Balbo Group - Brazil: Regenerative Agriculture

The Balbo Group (or Native) in Brazil has developed harvesting system 'Ecosystem Revitalization Agriculture (ERA)'. The system is a method of regenerative agriculture that aims to return organic matter to the biosphere. This improves soil health without harmful and costly chemicals, closing the nutrient cycle. The result is a sugarcane agricultural method that does not require chemical inputs or mechanical irrigation but produces a 20% increase in productivity.

¹⁰ City of Amsterdam (2020). *Amsterdam Circular Strategy 2020-2025*.
<https://www.amsterdam.nl/en/policy/sustainability/circular-economy/>

The group produced the first Brazilian cane harvester that cuts up cane whilst stripping the leaves and sprays them onto the soil, returning 20 tonnes of previously unused organic material per hectare every year.

Costly and harmful chemical fertilisers have been replaced by an Integrated Organic Fertilisation Programme, which utilises a natural pest and disease management system. Soil health is further enhanced with the use of high flotation tyres that reduce soil compression and encourages water penetration and soil health. To prevent organic waste at the point of food production, all materials are valorised. Any residue or ash for processing is collected and distributed in the fields.¹¹

Ireland: Food Waste (Prevention & Redistribution)

The Key Ambitions for Ireland's Food Waste are as follows:

- Halve food waste by 2030
- Provide a waste segregation infrastructure for apartment residents
- Provide sustainable food waste management options for all households and businesses¹²

Ireland's strategy uses the helpful **Food Waste Hierarchy** to set an order of priorities in waste management:

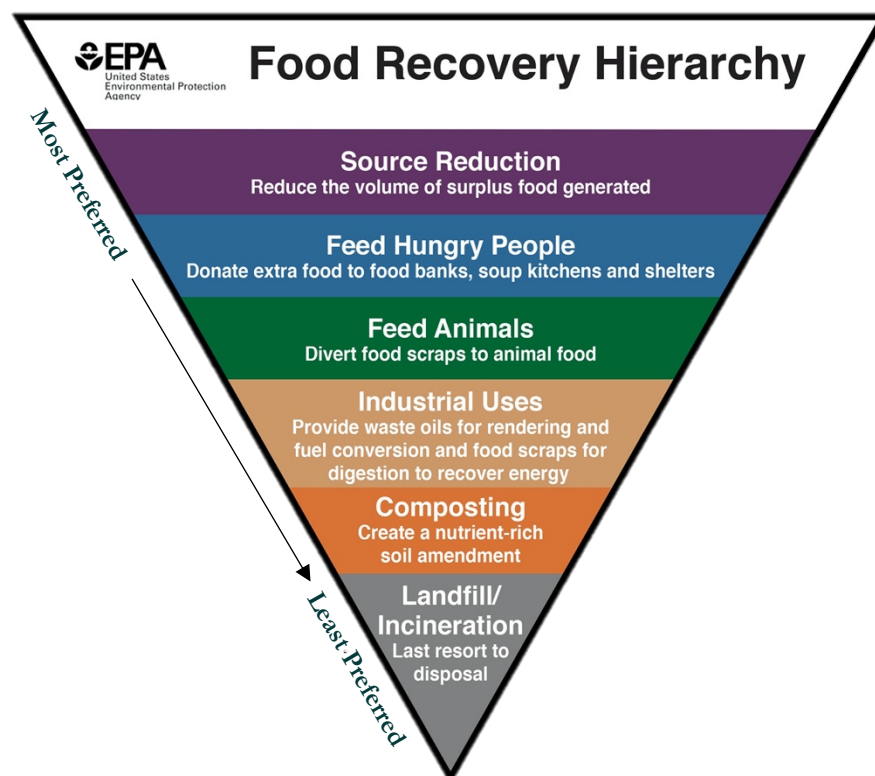


Figure 4. Food Waste Hierarchy [Source: USEPA.](#)

¹¹ Ellen MacArthur Foundation (2020). *Balbo Group: Regenerative agriculture at scale.*

<https://www.ellenmacarthurfoundation.org/case-studies/regenerative-agriculture-at-scale>

¹² Government of Ireland (2020). *Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025.*

<https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/>

The first priority is the prevention of food waste, with the second being the redistribution of any surplus food. For industrial uses (Figure 2), Ireland's strategy includes Anaerobic Digestion, a process of converting unavoidable food waste into bio-fertiliser and energy (see [Chapter 9](#) for further information on bioenergy). This is followed by compost production from unavoidable food waste. The very last resort for food waste is disposal via landfill or incineration.

Measures to prevent food waste:

- Developing a 'Food Waste Prevention Roadmap' that sets out the plan to halve food waste by 2030.
- Food waste prevention will be incorporated into the Green Government programme, which will allow the public sector to become a leader in prevention.
- Working closely with business sectors and the Retail Sector Action Group to reduce waste production at the various points in the food chain, including on farms, in food production and at the point of sale.
- Supporting industry in delivering packaging that supports food preservation without the generation of plastic packaging waste.
- Working with retailers to end multi-buy pack sales that prevents consumers from over-buying.

Measures to redistribute food waste:

- Supporting food donation and working with the EPA's Food Waste Charter, retailers and processing industry to increase the donation of edible food.
- Investigating methods to simplify the process of food donation for businesses.
- Investigating the impact of banning the destruction of edible food in advance of the 'use by' date.
- Investigating the regulation and legal barriers to 'Good Samaritan' acts of donation.
- Investigating the possibility of mandatory donations of edible food from retailers.
- Implementing Anaerobic Digestion and composting pathways for food waste. The ability for these measures to generate local energy and compost brings benefits to communities.

Box 2. France: Supermarket Surplus Food

In 2016, France introduced legislation that prevents supermarkets from disposing of unsold food. Instead, supermarkets and food retailers are required by law to donate the surplus food to local charities (including mandatory partnerships between larger supermarkets and a charity). If retailers or supermarkets continue to destroy unsold food, they can be fined up to 0.1% of the annual turnover. This law prevents food waste through surplus food distribution.¹³

¹³

Improving waste infrastructure:

- Providing every household and business with a reliable method of managing food waste through waste collection permits, in conjunction with the Local Authority sector.
- Working with planning and tenancy laws to ensure apartment residents are provided with ways to manage food waste correctly, in conjunction with the Department of Housing, Planning and Local Government.¹⁴

¹³ Zero Waste Europe (2020). France's law for fighting food waste. https://zerowasteurope.eu/wp-content/uploads/2020/11/zwe_11_2020_factsheet_france_en.pdf

¹⁴ Government of Ireland (2020). Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025. <https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/>

Box 3. New York City's Curb side Composting & Drop-Off

New York City's Department of Sanitation relaunched their [Curbside Composting Collection](#) service in August 2021. This service allows citizens to opt in to food and garden waste collection. They also offer an [online map tool](#) that allows citizens to track the location of their nearest food and garden waste drop-off site (where the organic waste is then composted).

Wales: Food Waste (Supply Chain)

The Welsh circular strategy has set the following food waste targets by year:

2025	50% reduction in avoidable food waste
2030	60% reduction in avoidable food waste
2050	Zero waste

Wales' strategy to reduce food waste targets the supply chain – “from farm to fork”. This means working closely with businesses at every level of the supply chain to minimise waste and maximise resource efficiency. Key measures to meet these targets include:

- Improving household management of food waste prevention and home composting by supporting and advising citizens.
- Setting up a working group (including food sector supply chain representatives) to explore best management to meet waste targets.
- Working with retailers to encourage consumers to reduce food waste and explore mandatory ‘Consumer Information Obligations’.
- Explore the need for a reporting tool for businesses on food waste quantities and the introduction of the requirement of retailers to redistribute edible surplus food.
- Provide support for food waste reduction to businesses.
- Increase the use of the established Anaerobic Digestion infrastructure to increase recycling and ensure food waste is used for renewable energy generation.¹⁵

Ostara – Vancouver, Canada: Nutrient Recycling

Canadian company Ostara Nutrient Recovery Technologies Inc. have developed technology to recover nutrients from industrial activity into agriculture practices. The product is being sold to growers and farmers as an effective and sustainable fertiliser that harnesses resources that would have been disposed of. At a resource recovery facility, the ‘Pearl® Nutrient Recovery Process’ transforms phosphorous from wastewater plants into plant fertiliser called ‘Crystal Green®’. Ostara's process uses phosphate-absorbing bacteria that absorb and expel phosphorous. Phosphorous is then processed through the ‘Pearl Process’ in which the phosphate is crystallised as a fertiliser granule.

This process reduces the CO₂ emissions of fertilisers by 10 tonnes per tonne of ‘Crystal Green®’ (in the agriculture sector that is responsible for around 17% of global carbon emissions) and

¹⁵ Welsh Government (2021). *Beyond Recycling: A strategy to make the circular economy in Wales a reality.* <https://gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf>

removes phosphorous from waterways. This system provides a circular sewage system to the benefit of public health and the closure of nutrient loops, brining key nutrients back to farmland.¹⁶

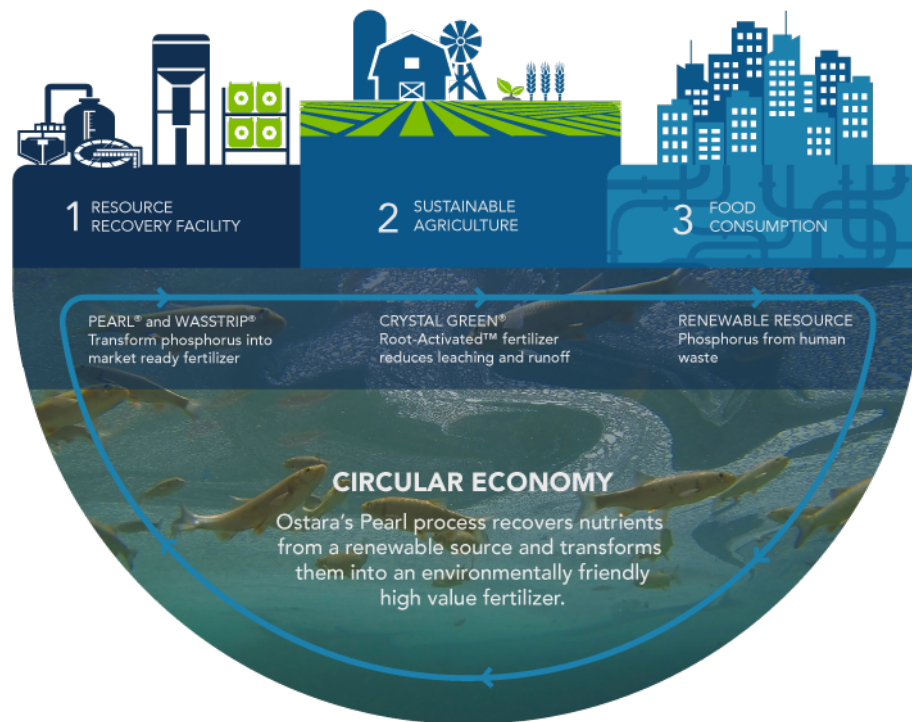


Figure 5. Ostara's nutrient recycling process

Source: [Ellen Macarthur Foundation](https://www.ellenmacarthurfoundation.org/case-studies/closing-the-nutrient-loop).

¹⁶ Ellen MacArthur Foundation (2017). *Ostara Nutrient Recovery Technologies: Closing the Nutrient Loop*.
<https://www.ellenmacarthurfoundation.org/case-studies/closing-the-nutrient-loop>

How does Scotland compare? Food systems

Scotland's Food Waste Reduction Action Plan aims to reach a 33% reduction in food waste by 2025.¹⁷ The plan includes improving collection and recycling infrastructure for every household, enhancing public communications to empower household change and coordination throughout the supply chain. As part of this strategy, the Scottish Food Waste Hub has been established to provide technical and financial assistance to businesses and promote innovation. The [Waste \(Scotland\) Regulations 2012](#) initially required all food businesses generating more than 50 kilograms in non-rural areas to recycle their food waste. In 2016, the Scottish Government extended the requirements to those generating more than five kilograms.

Scotland's approach, set out in the 2016 'Making Things Last' circular strategy,¹⁸ defines food and drink as a priority area. However, its plans focus on food waste prevention and collection whilst dismissing the earliest supply chain stages (i.e. agriculture and food production). In contrast, Amsterdam has prioritised shortening food chains by promoting local produce and suppliers and developing opportunities for urban agriculture. Furthermore, both Ireland and Wales have committed to working across the stages of the food chain, from food production to consumption. In Ireland, this includes waste reduction on farms and redistributing food waste to those in need. In Wales, a working group is being established with food sector supply chain representatives to reduce waste at every supply chain stage.

Like the Circular Economy Bill, the Good Food Nation Bill will also be introduced to the Scottish Parliament this session. It aims to improve access to healthy, local food and make the Scottish food industry more sustainable.¹⁹ In its response to the initial consultation on the Good Food Nation Bill, Scottish Environment LINK stated "this bill as drafted is significantly lacking, particularly from an environmental perspective, and it is worrying that the draft legislation makes no mention of the importance of our food system to efforts to address the nature and climate emergency. This bill should link with proposals for forthcoming legislation in this area, including the Circular Economy and Agriculture Bills".²⁰

¹⁷ Scottish Government & Zero Waste Scotland (2019). *Food Waste Reduction Action Plan*.

<https://www.zerowastescotland.org.uk/sites/default/files/Food%20Waste%20Reduction%20Action%20Plan.pdf>

¹⁸ Scottish Government (2016). *Making Things Last: A Circular Economy Strategy for Scotland*.

<https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

¹⁹ Scottish Government (2020). *Good Food Nation policy*. <https://www.gov.scot/policies/food-and-drink/good-food-nation/>

²⁰ Scottish Environment Link (2022). <https://www.scotlink.org/wp-content/uploads/2022/01/Good-Food-Nation-Bill-LINK-response.pdf>

04 Built Environment & Transport



Shenzhen, China: Electric Public Transport

Governed by the Shenzhen municipal people's government, in 2017 the city of Shenzhen, China became the first city to electrify 100% of all public buses. Over 16,000 e-buses and 23,000 e-taxis now provide for the citizens of Shenzhen, replacing fossil-fuel vehicles and cutting the source of 20% of Shenzhen's air pollution. In making this transition to electric transport, the city has invested in over 500 bus charging stations and 5,100 bus charging points. To meet the principles of a circular economy, the city of Shenzhen is investigating ways to transition all electric transport charging points to renewable energy sources to simultaneously reduce air pollution and resource efficiency.

National government and city government subsidies for bus manufacturers can reduce the equivalent of around £100,000 from e-bus prices. Furthermore, an eight-year rent scheme of the e-buses allows bus operating companies to implement the electric vehicles even if they can't afford purchasing a vehicle. Manufacturers are responsible for repair and maintenance during this rental period, encouraging circular product design for durability and opportunities for remanufacturing.

However, the costs will eventually subside as the industry expands. The implementation of e-vehicles in Shenzhen has expanded the industry to a worth of around £11 billion,²¹ exporting e-buses to 300 cities globally. The city is currently exploring options for technology that enables vehicle battery recovery and wider use for transport vehicles (Please see [Chapter 7](#) for an example of car battery recovery in Japan). Incentives for e-vehicle use have been implemented, including free license plates for drivers.²²

Amsterdam, Netherlands: Urban Development

A key dynamic of Amsterdam's Circular Strategy is in bio-mimicry (the emulation of nature's systems). This means incorporating natural solutions and design into the very fabric of urban buildings. Some examples of bio-mimicry incorporated in urban design includes bee-hotel bricks and green roofs that provide habitat for native species and produce pollinator corridors.

To reach circular urban design and construction, the city has set out the following set of ambitions:

Ambition 1: From 2022, all urban development and design will use circular criteria.

Action 1 – Incorporating bio-based and recycled materials by tightening Environmental Performance for Buildings regulations by 2030.

This will reduce the quantity of primary raw materials. To ensure buildings follow this ambition, the city will implement the Environmental Performance for Buildings assessment to tighten construction standards.

Action 2 – Develop criteria for a circular built environment.

In collaboration with market and knowledge institutions, the city will develop define the contours of sustainable construction.

²¹ Chinese Yuan Renminbi (CNY) 100 billion

²² Ellen MacArthur Foundation (2019). *Shenzhen: Switching to an electric mobility system in the city.*
<https://www.ellenmacarthurfoundation.org/assets/downloads/Shenzhen-Case-Study-Mar19.pdf>

Action 3 – Foster collaboration.

Consultation across municipal departments will be encouraged via a central municipal expertise centre, fostering knowledge sharing on circular construction practices to identify appropriate legislation and regulations.

Action 4 – Altering value assessments.

The city, in conjunction with market parties, are exploring the valuation of circular buildings and urban design with a view of increasing value retention (in other words, retaining the value of the built environment by keeping its materials in use).

Ambition 2: From 2023, Amsterdam will provide a socially responsible circular criteria for buildings and urban design. The criteria will cover the life cycle stages from construction and management until end-of-life.

Action 1 – Extending the life of existing buildings.

The city will explore alternatives to constructing new buildings or infrastructure, instead looking towards reusing municipal assets (such as street benches) and existing buildings.

Action 2 – Internal municipal processes to encourage circularity.

Local authorities will purchase real estate, public space and land according to circular principles, such as the proportion of recycled and renewable building material, creation of affordable homes to meet housing needs and encouraging green jobs.

Action 3 – Encourage research and innovation.

Local authorities will integrate market surveys before it organises tenders for buildings and determine if an alternative to new construction is available, including the extension or reuse of existing urban infrastructure and buildings.

Box 4. Sustainable Construction: Timber

Amsterdam City is exploring how using timber for construction can aid carbon emission targets. As a sustainable construction material that retains CO₂ and produces fewer emissions during production, wood may be used in the construction of future apartments and office buildings. The Vivaldi building (in the Zuidas district) is piloting this use of timber for the buildings' facade, with a concrete core.²³

Ambition 3 – From 2025, 50% of building maintenance and renovations will follow circular construction principles.

Action 1 – Extra-municipal collaboration.

Amsterdam city will collaborate with parties out with the City's administrative and legal institutions (including tenants, school boards and social and private landlords).

Action 2 – The provision of data.

Amsterdam City authorities are developing the 'circular toolbox' to provide data regarding technical, financial, social and legal issues and risks. The toolbox can be used as a reference point for material streams.

Action 3 – Encourage innovation.

The municipality will host competitions for companies, schools and housing corporation to promote circular activities and innovation projects.

Action 4 – Expand financial incentives.

²³ <https://www.dezeen.com/2008/06/14/vivaldi-tower-by-foster-partners/>

Amsterdam City is researching how financial and fiscal instruments can be implemented to encourage circular construction practices.²⁴

Denmark: Sustainable Demolition

In Denmark, the building and construction industry produces one third of the national waste, with very little resource recovery. To respond to the waste associated with construction, the Danish National Strategy looks to harness this surplus of waste material at the point of building demolition. The **end-of-life stage of buildings** is key for a circular construction chain. To produce the circular design of the built environment, building design must close the loop at the stage of demolition or decommissioning. This includes the separation of demolition waste for material recovery. The Danish strategy therefore promotes the expansion of **‘selective demolition’** to encourage the reuse of construction and demolition waste. This means exploring alternatives to building demolition by remodelling the interior and reusing built infrastructure. The government will further encourage this practice by developing standardised demolition plans and training and improving the traceability of construction waste.²⁵

San Francisco, US: Circular Carpets in City Buildings

The Mayoral Council of the City and County of San Francisco have passed legislation, in 2018, that all public buildings must contain circular carpets. The specification for carpets in city departments now includes Cradle to Cradle Certified Silver and free of antimicrobials, fluorinated compounds or flame-retardant chemicals. Carpet fibres and backing materials must be recyclable. The city of San Francisco implemented these regulations to counter the 80% of used carpets going landfill in the USA. The city uses the cradle-to-cradle certifications that indicate materials are safe for human health and the environment, whilst also allowing for continuous material reuse or recycling. Carpet materials are also required to contain a minimum content of recycled material and the city require manufacturers to disclose full transparency of manufacturing. [An online platform](#) has since been established to aid city departments seek circular materials in their flooring.

In pursuing this regulation, the city of San Francisco has developed new opportunities for suppliers by working with government departments to develop material specification. These efforts have led to the collaborative working relationship with suppliers who are now working towards further material recycling and reuse. This is intended to encourage the wider implementation of circular materials and material standards and transparency to enhance their circularity.²⁶

Venlo, Netherlands: Circular Public Buildings

In 2016, the municipal council Venlo in the Netherlands completed the construction of the Venlo City Hall, designed under cradle-to-cradle principles. In 2007, the city made a pledge that all new city buildings would follow the cradle-to-cradle specification.

²⁴ City of Amsterdam (2020). *Amsterdam Circular Strategy 2020-2025*.

<https://www.amsterdam.nl/en/policy/sustainability/circular-economy/>

²⁵ The Danish Government (2018). *Strategy for Circular Economy*.

https://circulareconomy.europa.eu/platform/sites/default/files/eng_mfvm_cirkulaer_oekonomi_as5_uk_final_web.pdf

²⁶ Ellen MacArthur Foundation (2019). *San Francisco: Cradle to Cradle carpets for city buildings*.

https://www.ellenmacarthurfoundation.org/assets/downloads/San_Francisco_-_Case-Study_Mar19.pdf

The final building's north wall contains over 100 different plants, supporting local quality and carbon sequestration (Figure 4). This plant facade also acts as noise insulation and provides bird and insect habitats. The incorporation of this plant coverage offsets the particulate matter emission of local traffic, absorbing 30% of sulphur and nitrogen oxides in the immediate environment. Biomimicry is integrated into the building's design, including rainwater collection on the roof which filters water for flushing toilets with a helophyte filter (a method of water filtration using planted reeds). 1,300m² of solar panels are fitted to the buildings' exterior and two solar chimneys that work to both cool and heat the city hall. The buildings material components are reported in the 'material passport' that logs all materials, and their capacity to be disassembled, recycled or remanufactured. Documenting the life cycle of all materials used allows for the building to become **material banks** for the future, in which the potential value and amount of material banked within the city hall can be quantified.

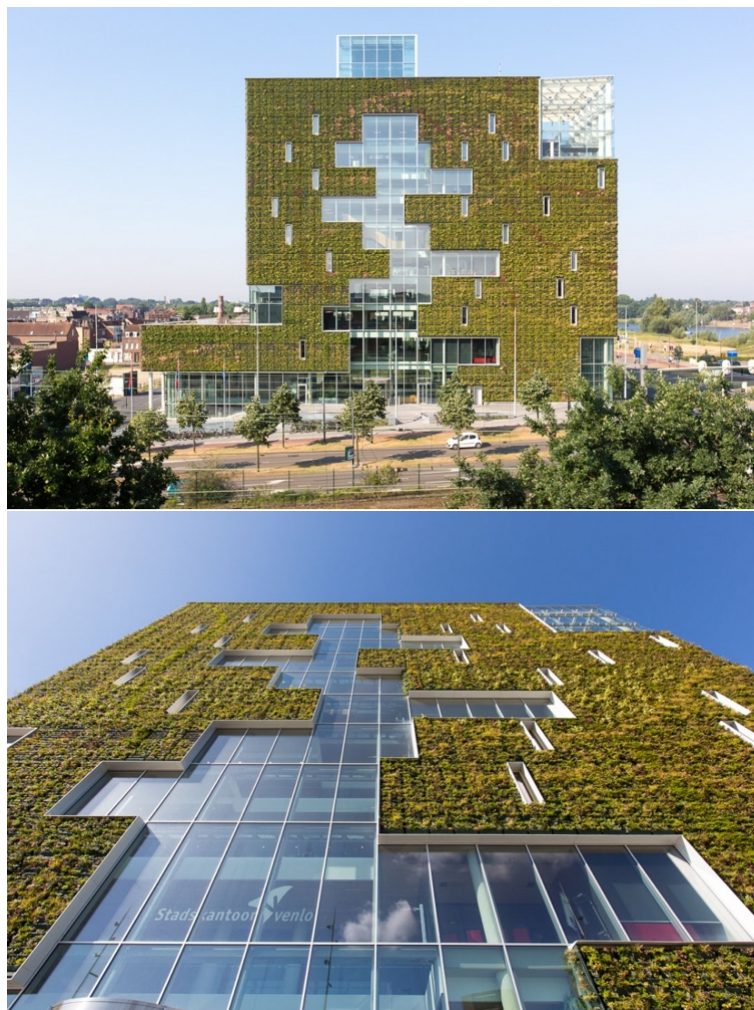


Figure 6. Venlo City Hall's plant façade

[Source: C2C Centre.](#)

All furniture items inside the city hall have been purchased under a 'buy and buy-back' scheme and are either returned to the manufacturer or recycled. All other interior materials do not contain chemical components such as paint and glue that may impede on their longevity and future recyclability of materials. Not only have the components of the city hall been carefully selected, but the buildings contribution to environmental quality is being monitored; including measurements of air quality, temperature, air moisture, fine dust particles and the impact the building's ecology has on employee health.

From a financial perspective, the design is predicted to bring a 12.5% return on investment by 2040 and the procurement of furniture has saved 18% of costs as some of the original investment is returned through the buy and buy-back arrangement.²⁷

China: Sustainable Bike Share Schemes

Like Scotland, China has had variable success at introducing urban bike share schemes. A comparative assessment of five Chinese cities with bike share schemes suggest that significant factors affecting the success of bike share schemes include:

- Understanding the diverse aspects of value for potential users of the system with participative planning processes;
- Invested resources in design and management of the system; and
- Initial public funding support with a transfer to profitable private business model once established.²⁸

Successful schemes were developed with initial funding support from government and sustained with advertising at service points. The management system (including monitoring, scheduling and information publishing) was key to operational success. Considerable resources were applied to ensure the service points were conveniently located, charge rules and fees were appropriate and the vehicles themselves were carefully selected.

Well established bike schemes, in the cities of Hangzhou and Zhuzhou, operated at a profit. In Zhuzhou, a participative planning process took place with citizens being invited to contribute to the decision-making on the positioning of docking points and on the system management and maintenance. The high-quality bikes in Zhuzhou, which have a no-chain design, aluminium frames, baskets for shopping and parent-child seats, have resulted in low maintenance costs.

North America: Battery Recycling Companies

Redwood Materials, in the USA, recycles batteries.²⁹ It creates a circular or ‘closed loop’ supply chain by retrieving, recycling and recirculating raw materials such as cobalt, copper and nickel from end-of-life batteries.

Redwood uses a combination of pyrometallurgy – burning batteries to remove unwanted organic materials and plastics – and hydrometallurgy, which uses leaching to soak lithium-ion cells in acids to dissolve the metals into a solution. In 2020, the company was on target to recycle more than 1GWh-worth of battery scrap materials, enough to power more than 10,000 electric cars.

Li-Cycle³⁰ is a Canadian company which describes itself as a closed-loop lithium-ion resource recovery company and, like Redwood Materials, wants to make EV batteries truly sustainable

²⁷ Ellen MacArthur Foundation (2019). *Venlo: City Hall from Cradle to Cradle*.

https://www.ellenmacarthurfoundation.org/assets/downloads/Venlo_-_Case-Study_Mar19.pdf

²⁸ Zhang et al. (2019) *Sustainable bike sharing systems: Characteristics and commonalities across cases in urban China*

<https://core.ac.uk/download/pdf/42477105.pdf>

²⁹ World Economic Forum (2021) <https://www.weforum.org/agenda/2021/05/electric-vehicle-battery-recycling-circular-economy/>

³⁰ <https://li-cycle.com>

products. It claims that a cumulative worldwide total of 1.7 million tonnes of lithium-ion batteries were due to reach their end of life by 2020. It expects this figure to rise to about 15 million tonnes by 2030. Li-Cycle bypasses the smelting process and uses only leaching to contribute to the circular economy by recovering more than 95% of all raw materials found in lithium-ion batteries.

South Africa: USE-IT's Rambricks

Pioneered by South African company USE-IT, rambricks produce construction material from construction waste. Rambricks make use of construction wastes including rubble and waste soils to compress into new construction blocks for housing. The final compressed block is made from 70% waste soils, 25% crushed rubble from building sites and 5% cement stabiliser. The rambrick is thermally efficient, sound-proof and 16% cheaper than concrete bricks and 45% cheaper than clay bricks. The production process requires no water.

This process diverts construction waste from landfill and repurposes building waste for building development, closing the material gap during construction.³¹

Box 5. Local Organisation – Energy Saving Trust

Energy Saving Trust, a UK-based organisation with offices in Edinburgh, is working to insulate and draught-proof homes to reduce heat loss.

Energy Saving Trust services include advice and support for home energy efficiency. Its education resources include measures to improve household energy efficiency and generating renewable energy. To reduce home heat loss, it encourages residents to explore options including cavity wall, solid wall, floor and roof insulation, as well as draught-proofing windows and doors. To aid the implementation of these measures, it offers a series of grants and loans for businesses and communities.

The interest-free Home Energy Scotland Loan (funded by the Scottish Government) offers a range of energy-saving measures in Scottish homes, including a range of insulation measure, solar water heating systems and biomass heating. By supporting heat insulation or renewable energy sources at home, the Energy Saving Trust and Home Energy Scotland are enabling residential buildings and neighbourhoods to reduce their carbon footprint. Furthermore, the Domestic Charge Point Grant offers up to £800 to install electric vehicle charging points and promote the transition from petrol and diesel transport.

³¹ Footprints Africa (2021). *The Circular Economy: Our Journey in Africa So Far*. <https://cdn.website-editor.net/1d19b3c8e4ec4cea997a5b973b37c28c/files/uploaded/Footprints%20Africa%20-%20Circular%20Economy%20Case%20Studies%20Report.pdf>

How does Scotland compare? Built environment and transport

Within the 'Making Things Last' circular economy strategy, Scotland identifies construction and the built environment as a priority area. The strategy proposes collaboration with the construction sector to promote recycling and reuse at the point of building design, construction and refurbishment. This will include collaboration with the Construction Scotland Innovation Centre. The strategy commits to supporting SMEs to pilot circular building construction to then be replicated on a larger scale.³² However, there are no commitments to public city and government buildings using circular criteria, as has been evidenced in the cities of San Francisco, Amsterdam and Venlo. For example, Amsterdam has committed to all urban development and design to use circular criteria from the year 2022 and Denmark's 'selective demolition' hopes to improve demolition standards practice for waste reduction.

Despite exceeding construction and demolition waste recycling targets, non-metallic minerals make up a larger proportion of Scotland's material footprint than any other category.³³ More must be done to reduce reliance on raw materials. The Scottish Circular Economy Bill must develop its commitment to the built environment to deliver practical targets in response to its designation as a priority area. Examples from Denmark and Amsterdam which encourage reuse and extending building life should be explored. These should take a whole life approach to the built environment, incorporating embodied emissions from material use, through to energy use and waste prevention and disposal.

The 2016 circular economy strategy acknowledges the role of transport in this transition and is supportive of existing proposals and new policies.³⁴ However, no proposals are made to close material loops in vehicle production and reuse to realise full circularity. Bike share schemes, such as those in the cities of Hangzhou and Zhuzhou in China, could play a role in reducing dependency on cars in urban areas. Plans to encourage electrification of the transport system should consider how metals in batteries can be recycled locally.

Scottish bus operator First Bus is replacing half of its 337 vehicles with electric buses by 2023. 160 electric bus charging points are being installed in Glasgow with 22 electric buses to be in use by autumn 2021.³⁵ This transition is a step towards decarbonising Scotland's transport. However, in meeting the SNP Manifesto timescale of 2023, further infrastructural changes will need to occur. In the transition to electric transport, Scotland's strategy may learn from Shenzhen's approach in which bus operators can rent electrical vehicles to ease the financial burden of transitioning and incentivise circular vehicle design. Additionally, the 5,100 bus charging points in Shenzhen indicate the infrastructural development required to sustain an electric public transport system.

³² Scottish Government (2016). *Making Things Last: A Circular Economy Strategy for Scotland*. <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

³³ Zero Waste Scotland (2021). https://www.zerowastescotland.org.uk/sites/default/files/ZWS1658%20Intro%20Scottish%20MFA%20doc%20v7_0.pdf

³⁴ SNP (2021). *Scotland's Future*. https://issuu.com/binksbrandwise/docs/04_15_snp_manifesto_2021_a4_document?mode=window

³⁵ BBC News (2021). *Bus depot bid to be UK's largest electric vehicle charging hub*. <https://www.bbc.co.uk/news/uk-scotland-57352972>

05 Municipal Waste & Recycling



Wales: Ambitious Recycling Targets

Wales' Recycling Target Timeline:

2025	26% reduction in waste; 50% reduction in avoidable food waste; and 70% recycling and zero waste to landfill.
2030	33% reduction in waste; and 60% reduction in avoidable food waste.
2050	62% reduction in waste; Net zero carbon; and Zero waste (100% recycling and zero waste to landfill or incinerators).

All of these targets are set against 2006-2007 levels.

In addition to these headline targets, Wales has introduced a **moratorium on new large-scale waste incineration**. The Welsh Government has committed to working with the UK Government regarding the possibility of an incineration tax to further support a circular economy.

Wales has pledged to increase funding from £6.5million to £43million to support 180 circular economy projects.

As part of their headline actions, Wales is committed to:

- **Phasing out single-use items**, especially plastic, reaching zero waste to landfill by 2025 and **a zero-waste nation by 2050**. This means that 100% of materials in the system are recycled, composted or prepared for reuse. This will be achieved through various policy reforms including Extended Producer Responsibility for packaging, a Deposit Return Scheme for drinks containers (including glass) and bans/restrictions on unnecessary single-use items.
- Increasing the **procurement of sustainable goods** to introduce sustainable consumption as the norm. Using public funds to purchase products and goods that are remanufactured, refurbished, recycled or made from low carbon, sustainable materials like wood.
- Reaching the **highest rates of recycling in the world** (household recycling reached 62.7% in 2019). Working across business, social enterprise, local government and communities to transform commercial, industrial, construction and demolition waste.
- **Reducing emissions from the waste collection process**. This includes the provision of ultra-low emission vehicles, infrastructure powered by renewable energy, and embracing digital and smart technologies to improve efficiency and sustainability of waste collection.
- **Reducing waste exports**. This includes ensuring local waste processing infrastructure is sufficient to reduce the international exportation of Welsh waste. Wales will also work with international partners to reduce the impacts of Welsh waste overseas.

Measures to increase waste prevention and reuse:

- Provide access to advice to citizens and businesses regarding reducing waste in homes and business resource efficiency, including the **eco-design of products and packaging**. For households, support by the government will provide advice on cutting down food waste, introducing **home composting, reusable nappies and sanitary products, and refillable products**.
- Promote a sharing economy to prevent waste and reuse initiatives. The public and third sectors will have access to **refurbished, recycled and remanufactured foods, and community sharing schemes** will be supported.
- Increase the donation of surplus equipment in the public sector.
- Reduce waste associated with construction, refurbishment and demolition of public sector buildings.
- **Invest in green apprenticeships** and other training courses to promote skills in reuse, repair and remanufacturing.

Measures to increase recycling capacity (and reaching zero-waste status by 2050):

- Develop recycling capacity for household materials currently not widely recycled, including absorbent hygiene products, wood, plastic film, rigid non-packaging plastic, cartons, textiles, mattresses, carpets and waste electronic equipment.
- Working with local authorities to deliver 70% recycling by 2025 and 100% by 2050.
- Introduce regulations that require all non-domestic buildings to separate their recycling materials.
- Introduce an **Extended Producer Responsibility (EPR) scheme** for packaging to ensure producers are financially responsible for their packaging.
- Introduce a Deposit Return Scheme to increase reuse or recycling of drinks containers.
- Raise awareness through 'Be Mighty, recycle' campaigns to mobilise citizen recycling practices and improving the My Recycling Wales website to allow citizens to track their local recycling and the end destinations of the materials.

Measures to improving waste collection infrastructure:

- Promote the **community infrastructure for waste reduction**. Supporting social enterprises, community initiatives and the private sector in reuse, repair and sharing economy endeavours. This includes repair cafes, zero waste shops, scrap stores, community fridges, water refill points and lending libraries.
- Wales have already introduced ultra-low emission vehicles for recycling and waste collection, including charging infrastructure to decarbonise fleet vehicles.
- Develop **eco-park hubs** with local authorities, where citizens can deposit materials to be recycled, reprocessed and remanufactured into new products (capitalising on the economic opportunities of a circular economy).
- Develop town centre hubs in their capacity for repair and reuse activities.

Wales has been supporting various innovations through the **Circular Economy Fund**. These case studies will be promoted within the public sector to encourage procurement methods such as leasing goods.³⁶ Wales has already committed £13million to support communities and town centre repair and reuse hubs.

Ireland: Municipal Waste Management

³⁶ Welsh Government (2021). *Beyond Recycling: A strategy to make the circular economy in Wales a reality*. <https://gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf>

Ireland's Municipal Solid Waste Recycling Target Timeline:³⁷

2025	55% will be recycled.
2030	60% will be recycled.
2035	65% will be recycled, with no more than 10% of Municipal Solid Waste (households and businesses) going to landfill.

Municipal (Household and Commercial) Waste Action:

- Improving waste segregation via awareness campaigns, uniform branding and enforcement actions including segregated waste bins and charges to incentivise correct segregation.
- Introduction of a Waste Recovery Levy of €5 per tonne, applied to landfill sites, waste to energy plants, co-incineration plants and the export of municipal waste.

Plastic and Packaging Action:

- Deposit Return Scheme for plastic bottles and aluminium cans.
- Ban on selected single-use plastic items from July 2021.
- Reduce single-use plastics on the market by 2026.
- All packaging will be reusable or recyclable by 2030.

All Packaging Recovery and Recycling Targets		
	By 2025	By 2030
Recovery	Nil	Nil
Recycling	65%	70%
Material Specific Recycling Targets (and prepared for reuse from 2025)		
Materials	By 2025	By 2030
Glass	70%	75%
Paper and Cardboard	75%	85%
Metal	70%	80%
Plastic	50%	55%
Wood	25%	30%
Aluminium	50%	60%
Packaging	65%	70%

Figure 7. Breakdown of Ireland's Packaging Recycling Targets by Material
Government of Ireland (2020).

Domestic Waste Management Capacity:

Ireland's strategy includes increasing treatment capacity at domestic facilities to prevent the overseas exporting of waste. To do so, the Regional Waste Management planning office is reviewing (and potentially streamlining) legislation and procedures for supporting domestic recycling infrastructure (including increasing waste segregation to aid domestic treatment facilities and improved labelling at street recycling points).

³⁷ Government of Ireland (2020). *Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025*.
<https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/>

Box 6. Local Initiative: [Edinburgh Tool Library](#)

The Edinburgh Tool Library is a lending library of over 2,000 household tools such as drills, sanders and streamers free of charge. In doing so, the tool library reduces waste by following the three R's – reducing, reusing and recycling. This means that the library repairs tools for future reuse and remanufacturing waste materials. However, the key pillar of the library is its reduction of waste, by reducing the need for households to purchase excess tools that are rarely used.



The library's Tools for Life programme supports youth employment by providing young people facing employment barriers with a mentor and trade skills. Various other community endeavours include community workshops for anyone to learn new skills and the volunteer assembly programme which allows citizens to pitch a project that requires tools and trade skills to benefit their community. Past projects have included community gardens, potting sheds and a workspace for [Bikes for Refugees](#).

How does Scotland compare? Waste management

The 2020 household recycling rate in Scotland was 42.0%, a 2.9% decrease from 2019 rates.³⁸ In comparison, Wales saw recycling rates increase 0.3% to 65.4% household recycling rate in 2020/21.³⁹ Scotland now has the lowest recycling rates in the UK.

The fragmented approach to national recycling has led to differing recycling regulations and varied success in recycling rates. For example, Glasgow's household recycling rates were at 29.6% in 2020, in comparison to 37.0% in Edinburgh and 45.6% in Aberdeen City.⁴⁰ Scotland's 2016 circular economy strategy set similar recycling targets to Wales with 70% of all waste to be recycled by 2025⁴¹. However, Scotland is currently not on track with substantial regional differences, whilst Wales is expected to meet this target.

In terms of waste incineration, the 2021 party manifestos saw Scottish Labour calling for a moratorium on incineration plants. The Scottish Government has commissioned a review of the role of incineration in waste management. A temporary moratorium is now in place for new applicants as a review into incineration capacity is conducted by an independent team. The review findings are due in May 2022. However, existing incineration capacity and planned plants, suggest that over-capacity will be a problem in Scotland by 2025.^{42 43} The Welsh government, has already committed to a moratorium on waste incineration.

In terms of recycling management, Ireland has included non-medical wet wipes and condiment sachets in their single-use plastic ban. These items are not currently included in the Scottish commitments. Furthermore, Zero Waste Scotland has cautioned against the 1.7 million tonnes of waste that was exported internationally in 2018. This includes 98% of plastic waste and 100% of scrap steel being exported for recycling outside of Scotland due to insufficient domestic recycling facilities.⁴⁴

With only 7.1% of Scottish circular economy jobs currently related to recycling, there is scope for Scotland to increase its domestic recycling capacity and provide new green jobs.⁴⁵ Recent research has shown that for 10,000 tonnes of waste can produce one job in incineration or six jobs in landfill versus 36 jobs if the waste is recycled or 296 jobs if waste is refurbished and reused.⁴⁶

Ireland has already made the commitment to increase domestic recycling by treating and processing materials locally. This will allow it to oversee that the full circularity of waste is

³⁸ SEPA (2020). *Scottish Household waste – summary data 2019*. <https://www.sepa.org.uk/media/532167/2019-household-waste-commentary.pdf>

³⁹ Welsh Government (2020). *Local Authority Municipal Waste Management, 2019-2020*. <https://gov.wales/sites/default/files/statistics-and-research/2020-11/local-authority-municipal-waste-management-april-2019-march-2020-628.pdf>

⁴⁰ SEPA (2021) *Household waste summary data* <https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/household-waste-data/>

⁴¹ Scottish Government (2016). *Making Things Last: A Circular Economy Strategy for Scotland*. <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

⁴² Rob Edwards, *The Ferret* (2021). 30,000 tonnes of recycling waste 'goes up in smoke'. <https://theferret.scot/waste-recycling-incinerators-30000-tonnes/>

⁴³ Friends of the Earth Scotland (2020). *Revealed: Scotland to burn an extra one million tonnes of waste a year*. <https://foe.scot/press-release/revealed-scotland-to-burn-an-extra-one-million-tonnes-of-waste-a-year/>

⁴⁴ Martin Williams, *The Herald* (2020). *Waste export scandal: revealed – Scotland ships out all its steel for recycling abroad*. <https://www.heraldscotland.com/news/18889554.waste-export-scandal-revealed--scotland-ships-steel-recycling-abroad/>

⁴⁵ Zero Waste Scotland (2020) <https://www.zerowastescotland.org.uk/content/future-work>

⁴⁶ RRReuse (2015) <https://www.rreuse.org/wp-content/uploads/Final-briefing-on-reuse-jobs-website-2.pdf>

realised and prevents overseas pollution due to Irish waste. Scotland's strategy has not yet included the development of domestic recycling capacity.

Friends of the Earth Scotland is calling for reuse and repair initiatives to be rolled out on a national scale. For example, Wales has committed to developing a community infrastructure helping citizens to reduce waste. This includes projects such as community fridges, zero waste shops, refill points and lending libraries. This community infrastructure will be supported in Wales by eco-park hubs and the uptake of town centre hubs for repair and reuse initiatives. The Edinburgh Tool Library offers a small-scale example of what is possible on a national level to keep items in use, but national rollout is currently not included in Scottish commitments.

06 Textiles



The textiles and clothing industries rely on huge quantities of non-renewable resources for production and directs more than half of global fast fashion quantities to landfill each year. The level of global textile waste is in part due to poor design and poor environmental practice at the point of production.⁴⁷

However, the repair, reuse and recycling of end-of-life clothing remains underdeveloped. Every year there is a global loss of \$460 billion due to the disposal of clothing that could still be worn.⁴⁸

Ireland: Textile Action Group

Ireland's Circular Economy Strategy signals seven key product value chains to be targeted:

Electronics and ICT
Batteries and vehicles
Packaging
Plastics
Textiles
Construction and buildings
Food, water and nutrients

In approaching the textile industry, Ireland has established the **Textile Action Group** that focuses exclusively on options for circularity in textiles. The Textile Action Group will explore how Ireland can capitalise (in terms of employment and resource value) on the textiles present, options for reuse and recycling and the potential for Extended Producer Responsibility schemes for textiles. Ireland's textile approach prioritises the **global impacts of international textile trade** and promotes **eco-design amongst local designers and retailers**.

Further measures to improve textile circularity:

- Prohibiting the disposal of textiles in general waste bins, landfill and incineration.
- Supporting local designers and retailers in developing eco-design for clothing and textiles.
- Implementing a textiles education and awareness campaign, targeting the Sustainable Development Goal 12 – Sustainable Production and Consumption.
- Developing proposals for separate textile collection, consulting with collection operators.
- Reviewing regulation of textile collection points.
- Exploring the impacts of levies and other economic instruments on fast fashion textiles (reducing the cost differential between local producers and supporting local designers).⁴⁹

⁴⁷ WRAP (2017). *Valuing Our Clothes: the cost of UK fashion*. <https://wrap.org.uk/sites/default/files/2020-10/WRAP-valuing-our-clothes-the-cost-of-uk-fashion-WRAP.pdf>

⁴⁸ Ellen MacArthur Foundation (2017). *A new textiles economy: Redesigning fashion's future*. <https://www.ellenmacarthurfoundation.org/publications/a-new-textiles-economy-redesigning-fashion-s-future>

⁴⁹ Government of Ireland (2020). *Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025*. <https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/>

Box 7. European Commission Textile Strategy⁵⁰

EU member states are required to separate the collection of textile waste by 2025. The European Commission will decide by the end of 2024 if textile reuse and recycling targets will be introduced. They are currently developing a reporting tool for textile reuse to improve data availability.

The European Commission's Second Circular Economy Action Plan (2020) prioritises textiles as one of the five priority product value chains. A specific EU Strategy for textiles is coming later this year (2021) to strengthen commitments to tackle fast fashion through circular textiles, new business models and textile reuse. European Commission proposed measures include the development of eco-design through raw material and hazardous chemical management during textile production. Textile waste will be better managed with the provision of reuse and repair services, innovative textile recycling and guidance to increase separate collection of textile waste. Increasing reuse and repair infrastructure, whilst encouraging businesses and consumers to choose sustainable textiles is hoped to provide incentives for circular textile management.

New York City, US: #WearNext Campaign

The City of New York (overseen by the New York City Department of Sanitation (DSNY), the New York City Economic Development Corporation (NYCEDC) and the Ellen MacArthur Foundation) launched the #WearNext campaign in 2019 to encourage the public to keep textiles in circulation.⁵¹ It encouraged people to keep clothes out of landfill and instead donate, repair, resell or swap them.

The hashtag #WearNext was featured on social media, city bus shelters and the LINK NYC communications network, and could be used by the public sharing their stories of reusing, donating or repairing their clothes. The campaign also collaborated with retailers such as ASOS, Gap, H&M and Zara to enhance branding and communications for the campaign whilst encouraging the retailers to transition to circular design (through textile durability and recyclability). The inclusion of these retail partners presented an opportunity to incorporate circular economy principles in their public relations strategies and have enhanced opportunities for future collaboration in textile recycling.

⁵⁰ European Commission (2022) https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12822-EU-strategy-for-sustainable-textiles_en

⁵¹ Ellen MacArthur Foundation (2021) <https://ellenmacarthurfoundation.org/circular-examples/the-wearnext-campaign-new-york-city>



Figure 8. The New York City Department of Sanitation's Textile Drop-Off Map

[An online interactive map](#) was launched as a tool to identify the location of over 1,100 public and private collection points for used clothes (note that the Department of Sanitation has produced a [similar tool for electronics collection points](#)). The campaign was an exercise in raising the engagement and awareness of this resource and the textile recycling infrastructure already in place.

The campaign ran for three months on social media and boosted site visits of the map from 3,000 to over 118,000 views. Clothing collection volumes in 2019 increased by 15% in seven collection points. The Ellen MacArthur Foundation has encouraged other cities to take on the #WearNext campaign and hashtag, which has taken on a clear identity on social media, to encourage people to recycle, repair or reuse their clothes.⁵²

Box 8. France: Anti-Waste Law

Following on from the 2016 French legislation banning supermarkets from disposing of food waste (see [Chapter 1](#)), France proposed similar regulation for textiles and other unsold items.⁵³ From January 2022, it is prohibited to dispose (via landfill or incineration) of unsold products including clothing, electronics and household appliances. This is the first piece of legislation to prohibit the disposal of clothing in the world.

On a household level, the new legislation commits to the provision of **plastic microfibre filters for all washing machines by January 2025**. This will filter the release of microfibres that occurs when clothes are washed. The microfibres would otherwise be released into wastewater treatment facilities with no way to filter the plastic pollution. This new legislation targets textile-associated waste during use and at pre-consumption stages.

⁵² Ellen MacArthur Foundation (2019). *New York City: The #WearNext campaign*.

<https://www.ellenmacarthurfoundation.org/assets/downloads/WEARNEXT-CASESTUDY3.pdf>

⁵³ <https://www.thelocal.fr/20211220/france-to-expand-its-anti-waste-laws-from-january/>

Rewoven – Cape Town, South Africa

The Rewoven initiative in Cape Town, South Africa works to collect **textile waste from manufacturers and retailers**. Instead of targeting consumer waste (as is the approach of the #WearNext campaign), Rewoven collects off-cut fabric, end-of-roll fabric and faulty or unsold from retailers and manufacturers. This targets textile waste further up the supply chain before any waste fabric is taken to landfill.

Collected fabrics are then recycled domestically and used in South Africa for purposes such as filling materials, construction insulation and disaster relief blankets through methods of mechanical recycling, in which the textile waste is shredded to produce a new fibre blended with recycled PET fibre for a 60% recycled cotton and 40% recycled polyester fabric.⁵⁵

⁵⁴ Ministry of Ecological and Solidarity Transition (2020). *The Anti-Waste Law in the Daily Lives of the French People, What Does That Mean in Practice?* <https://circulareconomy.europa.eu/platform/sites/default/files/anti-waste-law-in-the-daily-lives-of-french-people.pdf>

⁵⁵ Footprints Africa (2021). *The Circular Economy: Our Journey in Africa So Far*. <https://cdn.website-editor.net/1d19b3c8e4ee4cea997a5b973b37c28c/files/uploaded/Footprints%20Africa%20-%20Circular%20Economy%20Case%20Studies%20Report.pdf>

How does Scotland compare? Textiles

A 2017 report found that every year in the UK around 300,000 tonnes of clothing was sent to landfill.⁴⁷ Whilst the 2016 'Making Things Last' strategy has no specific targets for textiles,⁵⁶ it is a fast developing area of interest, with a huge global environmental and social impact. [Zero Waste Scotland](#) cites five areas of work with Scotland's textile industry.

In their 2021 manifestos, the SNP pledged to support a Circular Economy Bill that will include textile pollution and fast fashion. The Scottish Liberal Democrats were the only other party to include textiles, in which they support the development of a post-consumer textile waste infrastructure and increased use of recycled textiles in the fashion industry. Scottish Labour indicated their support of global campaigns to end human rights abuses in the fashion industry.

The Circular Economy Bill must prioritise increasing textile reuse and recycling. For example, Ireland is following the EU deadline to separate textile waste collection by 2025 and has established the Textile Action Group to deliver their circular targets. Its commitment to explore the use of economic instruments such as levies on fast fashion is a step towards tackling the impacts of the global fashion industry and trade. France's anti-waste law is the first piece of legislation to ban textile disposal and provide household measures to prevent textile pollution. The promotion and engagement with New York's online tool increases the accessibility and use of textile recycling. The inclusion of textiles within Scotland's Circular Economy Bill can draw from these international ambitions.

⁵⁶ Scottish Government (2016). *Making Things Last: A Circular Economy Strategy for Scotland*. <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

07 Electricals



Japan: Disassembly Plants

Japanese legislation requires a range of manufacturers to run disassembly plants simultaneously to production. This means that the businesses themselves co-own the manufacturing and recovery facilities. As companies are partly responsible for product recovery, this increases incentive to design a product that can be easily disassembled and readily recycle parts. Local authorities can request manufacturers to collect used IT equipment, either from via doorstep collection or returned via post. This system for returning used electronics is a routine practice in Japan, meaning the process is consumer-friendly, comprehensive and widely used.⁵⁷

Box 9: NiMH Car Batteries

In 2010, China announced restrictions on the export of rare earth metals. This trade restriction prompted the development of battery recycling by the national government in Japan, as there was a recognition that rare earth metals would be required to successfully shift the Japanese car industry to hybrid and electric vehicles.

The Japanese Ministry of Economy, Trade and Industry (METI) established a grant for Honda and the Japan Metals and Chemicals Company (JMC)⁵⁸. This funding developed technologies in rare earth recycling that allows Honda battery packs to be disassembled and the rare earth metals dissolved and precipitated out of acid. In 2015, this allowed JMC and Honda to recover 400 tonnes of rare earth materials.

The factors that enabled the new recycling process to be commercialised stretched across the supply chain:

- Government policy had supported recycling in industrial policy, in targeted innovation spending and in collection requirements;
- Corporations invested over a long period in collaborative research and design for recycling, long before resource security concerns prompted a push on rare earths; and
- Public expectations that recycling should be promoted underpinned both corporate and government drivers.

Wales: Legislation for Waste Electrical and Electronic Equipment (WEEE)

The Welsh strategy from 2021 commits to investing and developing additional infrastructure that

⁵⁷ The IES (2015). *The circular economy in Japan*. <https://www.the-ies.org/analysis/circular-economy-japan>

⁵⁸ <https://www.the-ies.org/analysis/circular-economy-japan>

includes recycling waste electrical and electronic equipment. This extends to increasing durability and the ability to disassemble at the point of manufacturing.⁵⁹

Belo Horizonte, Brazil: IT Recycling

Situated in Belo Horizonte in Brazil, the Computer Reconditioning Centre (CRC) provides electrical waste recycling and an upskilling programme. Within the CRC, donated used IT equipment is refurbished into working condition. The process of electronic refurbishing is part of an employment scheme that trains low-income communities in remanufacturing the IT equipment. The scheme specifically targets young people aged between 16-24 to provide them with electrical skills. These recycled electrical goods are then used in over 300 'digital inclusion sites' operated by local authorities which provide free access to computers and the internet for citizens. As a result, the digital inclusion sites contribute to a shared economy of computers (contributing to waste diversion) whilst giving all city residents access to the internet. The digital inclusion sites are also a social initiative, providing digital literacy courses for citizens and supporting them with online job applications.

The process of donating used IT equipment is moderated by the Ministry of Science, Technology, Innovation and Communications (MCTIC). Public or private institutions who would like to donate are required to provide detailed lists of the IT equipment and the MCTIC then directs the equipment to a CRC facility. Citizens can donate used equipment by contacting local authorities for a collection visit. This initiative is funded by the Brazilian Federal Government and established in 2008. In the first nine years of the CRC, the initiative refurbished 7,000 post-use IT products (including computer central processing units, printers and monitors). By 2018, the CRC had diverted 165 tonnes of electronic waste from landfill and trained 10,446 people in technology and computer remanufacturing skills.⁶⁰

Box 10. NYC Electrical Waste Pick-Ups

e-cycleNYC is the free electronic waste service in New York City for items including TVs, video game consoles, satellite boxes, computers, tablets, mobile phones and printers. The system works by citizens enrolling to the programme and the Department of Sanitation inviting them to training or a home visit to discuss the best option for the building.

The options for collection include an enclosed area for residents to store the electronics before collection or storage bins and outdoor recycling events.

To further aid electrical waste recycling, the Department of Sanitation have produced an **interactive map for residents** to view their closest drop-off point for electronics recycling. This tool works similarly to the map tool used for textile recycling discussed in **Chapter 6**.

⁵⁹ Welsh Government (2021). *Beyond Recycling: A strategy to make the circular economy in Wales a reality*. <https://gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf>

⁶⁰ Ellen MacArthur Foundation (2019). *Belo Horizonte: computer reconditioning centre*. https://www.ellenmacarthurfoundation.org/assets/downloads/Belo_Horizonte_-_Case-Study_Mar19.pdf

How does Scotland compare? Electrical and electronic waste

Electrical waste in Scotland comes under the UK Waste Electrical and Electronic Equipment (WEEE) Regulations. These regulations require retailers to provide in-store collection or to direct customers to the nearest WEEE collection points. Retailers can join the Distributor Take-back scheme which funds the collection points for consumer WEEE. However, current WEEE regulations do not provide free waste collection from households. Recent figures are not available, but a 2014 Zero Waste Scotland report found only 15% of Scotland's population have access to electrical reuse schemes⁶¹. As part of the action to tackle climate change, the Scottish Government has committed to a 2021 consultation on electronic waste tracking⁶². This is an opportunity to strategise for WEEE disposal that matches circular economy principles.

The 2016 'Making Things Last' Scottish strategy includes the expansion of Producer Responsibility to include batteries, electronic equipment and end-of-life vehicles⁶³. However, the strategy lacks in comparison to the Japanese legislation requiring disassembly plants to be run parallel to production, by manufacturers. The Welsh strategy indicates the need to improve product design regulation to enhance the durability and disassembly of electrical equipment. Similar regulation was acknowledged by the 2021 Scottish Greens Manifesto, in which the improvement of electrical good warranties and product longevity would be introduced in conjunction with EU and UK governments. The e-cycle NYC scheme in New York City is an example of an initiative which offers accessible recycling maps as well as residential collection points. The Scottish strategy is comparably lacking in an accessible and nation-wide electrical waste infrastructure.

Local community initiatives include the [Edinburgh Remakery](#), a social enterprise that works to divert landfill waste by repairing and refurbishing used IT equipment. They accept in-store donations and collections for donations of five or more items. [Junk-It](#) provides a similar WEEE recycling service for used IT goods to be refurbished in Edinburgh and Glasgow. However, these initiatives are currently localised to cities or neighbourhoods and require national rollout.

⁶¹ Zero Waste Scotland (2015). <https://www.zerowastescotland.org.uk/sites/default/files/WRAP%20WEEE%20Reuse%20Trials%20at%20HWRCs%20%28IMT005-013%29%20-%20Full%20Report%20%28Final%20V2%29.pdf>

⁶² Scottish Government (2020). Action to tackle climate change. <https://www.gov.scot/news/action-to-tackle-climate-change/>

⁶³ Scottish Government (2016). Making Things Last: A Circular Economy Strategy for Scotland. <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

08 Product Design & Manufacturing



Netherlands: Product Design & Raw Material Use

Aware of the growing pressure manufacturing industries are placing on raw material levels and surrounding ecosystems, the Dutch circular strategy commits to a dramatic reduction of foreign raw materials that will remain within Earth's boundaries. **By 2050, this will mean that Dutch production will only use sustainably produced and renewable raw materials.** Additionally, Dutch businesses will be working towards a European raw material infrastructure to meet the resource demand. By 2050, large scale upcycling of critical and rare earth metals will be established. Furthermore, raw materials used in urban environments will be used as an “urban mine” to explore secondary materials for use.

In terms of product design, the Dutch strategy includes extended producer responsibility schemes for recyclable products, including mattresses, fair ICT pact with buyer and supplier procurement groups and product passports for buildings, infrastructure and electronics. Meeting this target includes the enhanced longevity and value of plastic products and requires intervention at manufacturing stages.

The Raw Material Agreement, signed by both industry and government, sets out an economy-wide commitment to the Dutch national circular economy goals. This included a focus on five of the most important sectors to transform. These were plastics, consumer goods, manufacturing, construction and biomass and food. Designing plastic products at the stage of manufacturing prevents future raw material extraction at manufacturing stages or plastic waste at the end-of-life stages. As such, the Netherlands are aiming for plastic product **design that drives reuse or recycling**. This will also include enhancing bio-based and recycled plastics incorporated into product design and manufacturing. To deliver these goals, the government have developed **circular design guidelines** for the production of plastic products.⁶⁴

Ireland: Extended Producer Responsibility

To reduce waste before the point of sale and consumption, Ireland (in line with EU requirements) is introducing an **Extended Producer Responsibility** (EPR) scheme. This includes targets of mandatory EPR across all packaging before 2024. EPR schemes mandate producers take responsibility for their products beyond the point of consumption. This means taking the financial responsibility for waste collection, recycling or remanufacturing.

In Ireland, the EPR schemes cover waste electrical and electronic equipment (WEEE), batteries, packaging, end-of-life vehicles, tyres and farm plastics. To meet the target of 100% reusable or recyclable packaging by 2030 (see [Chapter 5](#)), changes will be made at the manufacturing stage. **By January 2023, this will mean producers will take on the full costs of litter management of**

⁶⁴ The Government of the Netherlands (2019). *A Circular Economy in the Netherlands by 2050*.
<https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050>

single-use plastics (including food containers, packets, wrappers, beverage containers, cup and carrier bags). Self-compliance will no longer be an option for producers, tightening the regulation and reporting of EPR schemes. This enhanced EPR scheme will provide improved producer guidance, measurable targets and data collection systems. Ireland will also be exploring the possibility of EPR schemes within textiles, medical and farm hazardous waste.

Additional waste reduction strategies (at the point of production), include the exploration of a virgin plastic levy to support the incorporation of recycled materials in packaging. The government will encourage and support **circular product design** that increases product durability/longevity, reusability and recyclability. Circular design will be incorporated in the rollout of the EPR scheme, requiring producers to foster circular principles at every stage of a product's life cycle.⁶⁵

Wales: Remanufacturing Training

The Welsh government has committed to renewed financial investment into **'green apprenticeships'** and other relevant skills development training. These programmes will provide training in product reuse, repair and remanufacturing, expanding these skills within the manufacturing and production industry.⁶⁶

Renault's Car Remanufacturing Factory, France

In 2020, Groupe Renault established 'RE:Factory', Europe's first dedicated circular economy factory for vehicles and mobility.⁶⁷ Located about 40km west of Paris, the aim of Groupe Renault's circular hub is to extend the life of vehicles and components, and keep materials in use, thereby reducing the use of virgin materials. The complex will be comprised of four interconnected and complementary areas:

1. Extend the life of vehicles - 'Retrofit'

Recondition vehicles, converting thermic vehicles to less carbon intense versions including a specialist 3D-printing service for the manufacturing of rare parts.

2. Solutions for the production, storage and management of green energies - 'Re-energy'

Optimise the first life of batteries, give used batteries a second life and manage end of life batteries and the exploration of new energy sources such as hydrogen.

3. Optimise the management of resources to support the ecosystem - 'Re-cycle'

Dismantling of end of life vehicles, the remanufacturing of parts and the reuse and recycling of materials.

4. Promote innovation and knowledge sharing - 'Re-start'

Accelerating research and disseminating knowledge about the circular economy.

The Re-Factory is aiming to generate employment for 3,000 people.

⁶⁵ Government of Ireland (2020). *Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025*. <https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/>

⁶⁶ Welsh Government (2021). *Beyond Recycling: A strategy to make the circular economy in Wales a reality*. <https://gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf>

⁶⁷ Renault Group <https://www.renaultgroup.com/en/news-on-air/news/station-flins-re-factorys-incubator-opens-its-doors/>

Reverse logistics play a key role in the factory's remanufacturing operations. Partner companies collect old parts, dismantles and check conformity, reassembles and then sell on as genuine and guaranteed parts within the Renault sales network. The parts are 40% less expensive than new but undergo the same quality control tests. Since 2012, 60% of gear box and engine components (185,000 items) have been renovated.⁶⁸

⁶⁸ <https://ellenmacarthurfoundation.org/circular-examples/groupe-renault>

How does Scotland compare? Product design and manufacturing

An Extended Producer Responsibility scheme is being introduced as a collaborative effort between the UK Government and the Scottish, Welsh and Northern Irish devolved administrations. These regulations are set to be in place by 2023, including the implementation of a plastic packaging tax. By 2024, the regulations are set to be operational across the UK in which producers will be required to meet annual recycling targets and financial responsibility for packaging. The scheme also includes mandatory recyclability labelling and potential for producers to take the financial responsibility for plastic film recycling by 2026/27.⁶⁹

The Netherlands has already developed product design guidelines and committed to 100% renewable manufacturing by 2050. Scotland and the UK's EPR scheme does not match Ireland's strategy, which will see the full financial responsibility of single-use plastic management transferred to the producers by 2023.

To enhance circular product design, the strategy includes the EU-funded circular economy investment fund to support Scottish Enterprise, Highlands and Islands Enterprise and Zero Waste Scotland. As part of a package for companies, the Scottish Government will foster collaboration between businesses and academic research and support business to transition to circular supply chains. However, this funding is due to end in 2022 and there has been no commitment from the Scottish Government to replace it.

Whilst the Scottish Government must work with the UK on Extended Producer Responsibility legislation, there are still opportunities to support remanufacturing by funding circular economy initiatives. Within the 'Making Things Last' 2016 strategy, the Scottish Government includes remanufacturing as a priority area. This includes enhancing product design for longer product lifespans and encouraging manufacturers to rent, repair or re-sell their products.

To encourage the repair and reuse of products by manufacturers, the Scottish Government established the Scottish Institute for Remanufacture to develop technology and partnerships to enhance the remanufacturing industry. The output of the institute is hoped to include revised industry standards and certifications for remanufacturing.⁷⁰

⁶⁹ DEFRA (2021). *Extended Producer Responsibility for Packaging*. https://consult.defra.gov.uk/extended-producer-responsibility/extended-producer-responsibility-for-packaging/supporting_documents/23.03.21%20EPR%20Consultation.pdf

⁷⁰ Scottish Government (2016). *Making Things Last: A Circular Economy Strategy for Scotland*. <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

09 Biomass & Bio-energy



Whilst Friends of the Earth Scotland believes there is a role for bio-energy in the circular economy, when there is no lower carbon alternative to waste management, care should be exercised in its application. Virgin biomass production can have negative impacts on nature and land uses, especially food production. Expert oversight at local, national and international levels is required to ensure the bio-based economy is allowed to develop in a sustainable manner.

Biomass refers to materials of biological origin, such as forestry, agricultural or fishery residues or material, used at different stages of food and textile production and manufacturing. A bio-economy, or a bio-based economy, is an economic system premised on the use of biomass and bio-technology that utilizes and conserves biological resources.⁷¹ A bio-economy contributes to a circular economy via the valorisation of renewable, biological materials as an energy source whilst utilising earth’s natural cycles and returning organic matter to ecosystems.⁷²



For ease, the following technical terms are used throughout national strategies:

Biomass	A circular raw material that can be used as a base material for construction, transport fuels, energy, plastics and agriculture. It is composed of organic wastes including agricultural, forestry and fishery residues or biodegradable municipal waste.
Bio-refining	The process of producing biofuels (can be conceptualised as the biomass equivalent of an oil refinery that processes crude oil for fuel).
Bio-energy	A renewable energy source formed from organic matter such as agricultural waste, food waste, wood and any other organic waste.
Biofuels	Fuels derived from biomass (any organic waste from plants or animals). Biogas is a type of biofuel produced from the anaerobic digestion of organic matter. Error! Bookmark not defined.
Anaerobic digestion	The biological breakdown of organic mass without oxygen. This process produces biogas and bio-fertiliser. ⁷²

Netherlands: Bio-based Economy

⁷¹ The Republic of Costa Rica (2020). National Bioeconomy Strategy: Costa Rica 2020-2030. <https://gbs2020.net/wp-content/uploads/2020/09/PolicyBrief-Bioeconomy-Strategy-Costa-Rica.pdf>

⁷² Ellen MacArthur Foundation (2017). Urban Biocycles. <https://www.ellenmacarthurfoundation.org/publications/urban-biocycles>

The Netherlands' national strategy commits to a Biomass Vision for 2020, which plans to **reduce the share of fossil resources in the Dutch economy to 70% by 2030.**

Strategic Biomass Goals:

- Optimise biomass use by closing loops.
- Replacing fossil resources with sustainably produced biomass.
- Supporting the development and use of biomass materials via production and consumption pathways.

This bio-based economy will replace fossil fuel sources with biomass. To achieve the Biomass Vision for 2030, the Netherlands will support cross-sector collaboration in bio-based businesses and between timber suppliers and wood-using sectors, support private initiatives in commodifying agricultural residues and developing revenue models for biomass cycles. These actions will support the closure of biomass loops and increasing recycled biomass material use.⁷³

Costa Rica: Bio-economy

The National Bio-economy Strategy 2020-2030 for Costa Rica envisions the widescale use of biomass in a way that promotes social equity, conservation and national competitiveness. In doing so, Costa Rica has named the bio-economy as one of its pillars of productive transformation. This includes the **protection of biodiversity and habitats** whilst expanding the biomass strategy and encouraging the fossil decarbonization of manufacturing and production. The Costa Rican strategy sets out three phases of implementation:

Impulse (2020-2022): Developing institutional bases and action plans of biomass strategy, including the identification of strategic projects.

Escalation (2022-2026): Move implementation forward by establishing the legal foundations of bio-economy initiatives and identify a second round of strategic projects, with a focus on high value-added sectors.

Consolidation (2026-2030): Consolidate Costa Rica as a model bio-economy, including fossil decarbonization whilst maintaining high biodiversity.

To deliver this biomass vision, Costa Rica has outlined the following thematic objectives to target:

Bio-economy for rural development	Promote the sustainable and inclusive development of agriculture fishing and forestry by increasing the value of goods and services.
Biodiversity and development	Use the sustainable management of ecosystem services as a measure to promote inclusive, sustainable development with a low emission economy. This includes bio-tourism, ecosystem services and digital technology applications on conservation activities.
Biorefinery of residual biomass	Promote the valorisation and use of biomass residues from agricultural, agro-industrial, forestry and fishing activities.

⁷³ The Government of the Netherlands (2019). *A Circular Economy in the Netherlands by 2050*.
<https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050>

Advanced bio-economy

Promote innovation in biotechnology applications that support biodiversity whilst expanding biomass use.

Urban bio-economy and green cities

Promote bio-economy activities in an urban context, in areas such as waste management, urban planning and construction.⁷⁴

The Compost Kitchen – Johannesburg, South Africa

In the urban setting of Johannesburg, South Africa, the Compost Kitchen collects household food waste every week (arranged via subscriber households). This initiative produces vermi-compost, which is compost produced from earthworms consuming organic waste and excreting organic compost. As such, the household food waste is transformed into this nutrient rich compost and returned to the same households. Citizens, who currently don't have access to municipal recycling or composting, can then use the vermi-compost for their own vegetable gardens.⁷⁵

Denmark: Biomass Production

Denmark's 2018 Strategy for Circular Economy includes the expansion of biomass to reduce food waste and reduce the costs of agricultural practices. The Danish Government has committed to exploring new market-driven value chains as a result of wider biomass production. A **think tank** is also being established to work exclusively on food waste prevention over a four year period to improve knowledge for public and private uses, and cooperation amongst value chain players.

As part of the promotion a bio-economy, the Danish government allocated DKK 8 million (around £920,000) in June 2017 to a pilot bio-refining plant. This plant uses biomass from clover grass, press cake and protein concentrate for a variety of agricultural uses, including juice for biogas and cattle feed. By piloting this plant, the Danish Government is able to vouch for the biorefining process in a bid to increase market demand (and lower the costs). Following this, in January 2018, the Danish Government allocated DKK 25 million (around £2.8million) to establish biorefining projects across the country. In addition, DKK 20 million a year (around £2.3million a year) from 2019-2025 has since been allocated to the development and production of biofuels.⁷⁵

⁷⁴ The Republic of Costa Rica (2020). *National Bioeconomy Strategy: Costa Rica 2020-2030*. <https://ghs2020.net/wp-content/uploads/2020/09/PolicyBrief-Bioeconomy-Strategy-Costa-Rica.pdf>

⁷⁵ The Danish Government (2018). *Strategy for Circular Economy*. https://circulareconomy.europa.eu/platform/sites/default/files/eng_mfvm_cirkulaer_oekonomi_as5_uk_final_web.pdf

How does Scotland compare? Bioenergy

The 2021 Bioenergy Update by the Scottish Government sets out a renewed bio-energy timeline. Within this, the Scottish Government plans to establish a working group to develop the Bio-energy Action Plan for Scotland. For the next two years, this working group will include policy experts, NGOs, sectoral representatives and pressure groups. As a work in progress, details of what the Scottish bio-energy strategy will look like are minimal. Currently, bio-energy contributes 3% to Scotland's energy consumption. Actions so far by the Scottish Government include the Renewable Heat Incentive and a biomass support scheme to support bio-energy uptake in supply chains. The Scottish Industrial Biotechnology Development Group have committed to increase bio-technology sector turnover from £190 million to £900 million by 2025. Research thus far has enhanced knowledge of Scotland's domestic availability of bio-energy feedstock and land availability for the expansion of bio-energy crop production. However, the Scottish Government is planning the publication of a Bio-energy Action Plan in 2023.⁷⁶

The 2016 circular economy strategy includes exploring the opportunity for local bio-refining hubs, supporting technical development in anaerobic digestion. The power of public procurement will also be used to phase out non-renewable biological resources (e.g. peat) in public sector purchasing.⁷⁷

Aspects of the bio-economy not currently developed by Scotland include the promotion of bio-energy production in urban and peri-urban settings. This is incorporated in Kenya's strategy to increase urban organic waste collection and in Costa Rica's strategy to promote the bio-economy through waste infrastructure and urban design/construction. However, such strategies must consider carefully about adding to competing pressures on land by creating bio-resource demand.

Friends of the Earth Scotland has previously called for Scotland's Circular Economy Bill to include a biomass strategy that protects biodiversity and habitats whilst biomass demand increases. For example, an increase in demand for timber in construction (replacing concrete and steel) will need to be met with conservation measures and protections for forestry.⁷⁸

⁷⁶ Scottish Government (2016). *Making Things Last: A Circular Economy Strategy for Scotland*. <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

⁷⁷ Friends of the Earth Scotland (2020). *Response to Developing Scotland's circular economy: consultation on proposals for legislation*. <https://foe.scot/resource/response-to-developing-scotlands-circular-economy-consultation-on-proposals-for-legislation/>

⁷⁸ Scottish Government (2021). *Bioenergy: update – March 2021*. <https://www.gov.scot/publications/bioenergy-update-march-2021/>

10 Community Consultation



Amsterdam, Netherlands: Citizen-led Transition

The Amsterdam City approach to circularity includes the strategy ‘Voices of the city’, in which residents are included in city and policy planning, ensuring their needs are sufficiently met. This is particularly key in satisfying the doughnut model in which social prosperity is to be met with ecological wellbeing (see [Chapter 3](#) for further detail on the doughnut model).

Workshops with residents, across seven diverse neighbourhoods, took place in preparation for the city’s circularity strategy. The result was a series of resident visions and priorities across domains such as nature, housing and a just transition. The community consultation prompted discussions around public desires for more urban green spaces, affordable housing and transport in the transition to circularity.

Importantly, these workshops revealed the need for the city to support community groups and networks. There was a drive amongst residents to open dialogue with city planners and these community networks to produce circular systems that are effectively implemented, followed and serving public needs.⁷⁹

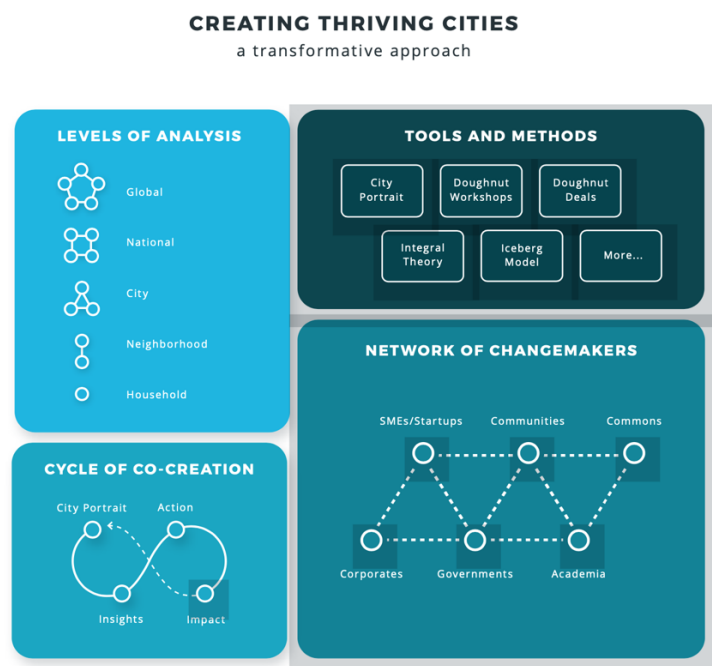


Figure 9. Amsterdam’s Strategy, incorporating communities in the network of changemakers and within tools and methods. [Source: Doughnut Economics Action Lab.](#)

⁷⁹ City of Amsterdam (2020). *The Amsterdam City Doughnut: A Tool for Transformative Action*. <https://www.amsterdam.nl/en/policy/sustainability/circular-economy/>

Box 11. Local Initiative: Sustaining Dunbar



Sustaining Dunbar⁸⁰ is a Community Development Trust for the Dunbar and East Linton ward, aiming to reduce local emissions and enhance local climate resilience. One of its projects, 'Zero Waste Dunbar' earned Dunbar the title of Scotland's first Zero Waste Town.

Sustaining Dunbar's vision for 2050 and action plan were based on survey results with over 1,500 residents in the Dunbar and East Linton ward. These interviews formed the vision for community and environmental health. The surveys revealed key community desires such as locally produced food, energy efficient homes and walkable streets. Crucially, the community consultation revealed potential barriers to solutions that are ecologically sound, but socially inaccessible. For example, households growing their own food is hindered by a lack of knowledge and land, and locally produced food is not consumed due to low supermarket stock and unclear labelling. With these barriers in mind, the food action plan directly targets challenges such as access to land and access to locally produced food. Likewise, the transport action plan responds to barriers to active and public transport.

If such methods were implemented for the national strategy, community voices will not only indicate priority areas but measures likely to be the most well-received by public action.

⁸⁰ <https://sustainingdunbar.org/>

How does Scotland compare? Community consultation

Scotland has a Climate Assembly⁸¹ and a Children's Parliament⁸² which includes circular economy principles within its remit. The 2021 Climate Assembly report included suggestions on sustainable business loans, reducing high carbon construction materials and targets to sell local produce. The level of support and consensus for circular economy issues is striking in both the Climate Assembly and the Children's Parliament. The statement "Reduce consumption and waste by embracing society wide resource management and reuse practices" was voted for by 97% of the Climate Assembly members. Recommendations included support for sustainable manufacturing, a ban on single-use packaging and the introduction of a reuse charter. Recommendations from the Children's Parliament climate report included making sure new houses are built to be environmentally friendly and creating sharing libraries.

Community consultation methods have been deployed elsewhere to form Edinburgh's green space policy. As part of the [Thriving Green Spaces project](#), the City of Edinburgh Council has been collecting community survey data. The survey collects data on how Edinburgh residents use urban green space and their vision for these spaces. The data will be used to inform the 30-year strategy to enhance Edinburgh's parks and green spaces for ecological and social wellbeing. Extending this methodology of policy making to the circular economy strategies will provide key information about the holistic needs of Scotland, including housing, city planning and community infrastructures.⁸³



⁸¹ <https://www.climateassembly.scot/full-report>

⁸² <https://www.climateassembly.scot/childrens-parliament>

⁸³ Scottish Government (2019). *Developing Scotland's circular economy: consultation on proposals for legislation*. <https://www.gov.scot/publications/delivering-scotlands-circular-economy-proposals-legislation/pages/3/>

11 Monitoring Framework



Wales: Circular Indicators

The 2021 Welsh Circular Economy Strategy outlines a set of circular economy indicators to aid its journey to zero waste and net zero carbon. These indicators will measure performance, success and inform evidence-based policy making. Key indicators include:

- Local Authority Municipal Waste Management (in tonnes), this quantity is then further represented as a percentage of waste sent to landfill, incineration with energy recover and reused/recycled/composted.
- Annual Waste by Household and Annual Waste by Industrial & Commercial Sectors are also charted over time.
- Net zero carbon public sector (aiming to reach net zero by 2030 via buildings, transport and supply chains in the public sector)

Further activity data includes food waste, schools committed to the Eco-Schools programme, sustainable procurement, plastic waste imports, businesses adopting sustainable practices, carbon emission reductions via recycling activities and remanufactured items by repair cafes.^{84 85}

Amsterdam, Netherlands: The Monitor

The Circular Strategy 2020-2025 for the City of Amsterdam incorporates the Monitor, a measurement system to track the level of circularity already achieved and areas of improvement.

In a bid to measure the environmental impact of the city, the Monitor will calculate the weight of raw materials and materials consumed and disposed of. Tracking the weight of consumed materials enables Amsterdam's circular economy by measuring if the city meets its 2030 target to halve its consumption of primary raw materials. These measurements can contribute to the calculation of Amsterdam's carbon footprint and calculate greenhouse gas emissions using the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

The Global Protocol for Community Scale Greenhouse Gas Emission Inventories (GPC) has also been adopted to calculate municipal level emissions. This GPC measures three areas:

⁸⁴ Welsh Government (2021). *Beyond Recycling: A strategy to make the circular economy in Wales a reality*. <https://gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf>

⁸⁵ Welsh Government (2021). *Beyond Recycling Indicators report*. <https://gov.wales/sites/default/files/publications/2021-03/beyond-recycling-indicators.pdf>

Scope 1	Direct CO ₂ emissions – from the burning of fossil fuels in Amsterdam.
Scope 2	Indirect CO ₂ emissions– from Amsterdam’s energy consumption.
Scope 3	Indirect emissions in the production and waste chains. External (to Amsterdam) CO ₂ emissions caused by consumption in Amsterdam.

The monitor also measures the social cost, through equality, health and education indicators. This ensures the city meets the needs set out by its doughnut economics approach (see [Chapter 1](#)) to balance ecological protection with social welfare.

The Monitor is described as a “precondition for the success of the circular economy” in Amsterdam’s strategy, providing visibility of Amsterdam’s socio-environmental impact and how it can achieve its circular targets.^{86 87}

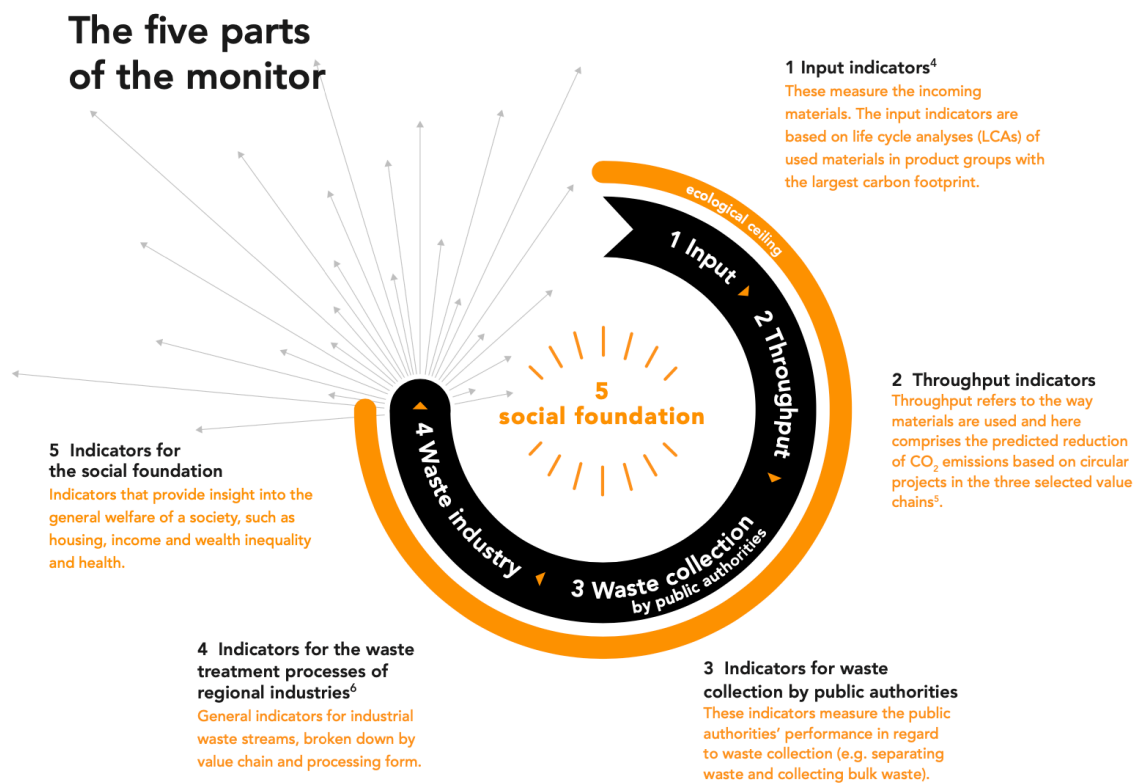


Figure 10. Amsterdam’s Monitor [Source: City of Amsterdam.](#)

⁸⁶ City of Amsterdam (2020). *Amsterdam Circular Strategy 2020-2025*

<https://www.amsterdam.nl/en/policy/sustainability/circular-economy/>

⁸⁷ City of Amsterdam (2020). *Amsterdam Circular: Monitor.* <https://www.amsterdam.nl/en/policy/sustainability/circular-economy/>

Peterborough, England: Measurement Framework

The city of Peterborough, England has established the Circular Economy Maturity Model and Key Performance Indicators alongside the Urban Material Flows measurements. In an endeavour to meet full circularity by 2050, this three-pillar measurement framework (see below) aids the city and its businesses to track their progression quantitatively and qualitatively. Peterborough consulted with the Sustainable Cities and Communities ISO 37120 standard to select 75 indicators to clarify city progress. Improving the visibility of progress for local businesses works to encourage wider circular practices and recognise existing circular practices. The city has also partnered with Cranfield University and University College London to develop these measurement frameworks.⁸⁸

Circular Economy Maturity Model (qualitative)

The Maturity Model uses the 7 Rs (rethink, redesign, repurpose, repair, remanufacture, recycle and recover) to track the behavioural and operational successes and actions within local businesses. Due to concerns that the 7 Rs model would not provide a good measure of the level of circularity at the city level, the Socio-Technical Systems Thinking (STST) framework was also adopted. The STST framework collects qualitative data across 7 areas: people, culture, infrastructure, digital technology, processes and procedures, goals and metrics.

Key Performance Indicators (quantitative)

These quantitative indicators measure the extent of circularity across city waste, transport and energy production. For example, quantifying the volume of waste sent to landfill, recycled material and the volume of renewable energy used. These indicators were previously tracked by city administrators meaning existing structures could be utilised for the expansion of circular economy.

Urban Material Flows (quantitative)

To further aid the city-wide picture of circularity, Peterborough is quantifying the city's material inputs and internal material flows. This measurement will track the city progress of material circularity by identifying on major suppliers in the supply chain and the nature, volume and movement of materials.

⁸⁸ Ellen MacArthur Foundation (2019). *Peterborough: developing a measurement framework for the city and local businesses*. https://www.ellenmacarthurfoundation.org/assets/downloads/Peterborough_-_Case-Study_Mar19.pdf

African Circularity Database

This pan-African database⁸⁹ is an online resource and tool (hosted by Big Circle) to explore community and business initiatives that are pushing innovation in circular and sustainable projects.

The database allows users to filter through projects in a range of sectors, across numerous African countries, with website links and contact details for each project. The online library becomes a space for sharing innovative entrepreneurial projects or community actions. Whilst not a measurement tool for tracking the success of circularity, the database does serve as a tool for community and governmental inspiration, communicating best practice and networking.

Circularity Gap Metrics

The Circularity Gap Reporting Initiative is run by the Amsterdam-based not-for-profit Circle Economy. It aims to support business and government stakeholders in achieving circularity by measuring current levels of circularity and supporting the transition to a circular economy based on these findings.

The national metrics used to inform stakeholder strategies consists of **“the share of cycled [meaning cycled back into the economy] materials as part of the total national material consumption every year”** (Equation 1). In cases where cycled (secondary) materials such as wood and metals are undocumented in their (re)use for local industry inputs, Circle Economy suggests Equation 2 to estimate the quantity of cycled material used for consumption. To finally calculate the total of cycled material, Circle Economy uses the global average of material cycling (9.1%) or the nation’s secondary use of materials if this data is available.

Equation 1 Cycled Materials for Consumption/ Consumption Footprint (total upstream primary and secondary materials used for consumption).

Equation 2 $((\text{Consumption Footprint} / \text{Total Footprint}) * \text{Total Cycled Material}) / \text{Consumption Footprint}$

Equation 3 $((\text{Consumption Footprint} / \text{Total Footprint}) * \text{Domestically Cycled Material} + (9.1\% * \text{Import Footprint})) / \text{Consumption Footprint}$

*Total footprint = Consumption footprint and Export footprint.

At time of writing, they have completed analysis for Norway, Austria, the Netherlands and the province of Quebec, Canada. For example, the national analysis of the Netherlands found its circularity metric at 24.5% but makes strategic suggestions to raise circularity levels to 70%. The Circular Gap Reporting Initiative accepts requests to undertake country scans to analysis current circularity [here](#).⁹⁰

⁸⁹ <https://www.bigcirclestudios.com/african-circularity-database>

⁹⁰ Circularity Gap Reporting Initiative (2020) National Circularity Gap Report https://assets.website-files.com/5e185aa4d27bcf348400ed82/5e247840992bfa79a82cfec0_Website_short_GCM_for_nations.pdf

How does Scotland compare? Measurement framework

Scotland publishes a number of useful datasets which could be used as the basis for a monitoring framework for the circular economy. These include the Material Flow Accounts⁹¹ published by Zero Waste Scotland in 2021 for the year 2017. The intention is to update annually. This publication includes a material footprint for Scotland and a breakdown by material type. The methodology is comparable to Material Flow Accounts published in the UK and EU.

The Scottish Government publishes Scotland's carbon footprint and has done annually since 1998.⁹² The most recent update was in 2022 for the year 2018. This is comparable to other national carbon footprint publications including the UK. Amsterdam's Monitor has adapted its carbon footprint data to monitoring circular economy progress.

Waste indicators are published annually by SEPA⁹³ and a Carbon Metric for Waste is published by Zero Waste Scotland.⁹⁴ Furthermore, the strategy includes the uptake of an electronic 'edoc' system to track Scotland's waste.⁹⁵ Error! Bookmark not defined.

Within the 'Making Things Last' circular economy strategy,⁹⁶ Scotland has acknowledged the importance of tracking progress through material flows and environmental costs. To deliver the measurement of progress, Scotland's strategy outlines key indicators.

Whilst there are several promising datasets and strategies already in existence, it is notable that these have not been brought together in the monitoring framework which can measure the progress towards a circular economy in Scotland in a holistic way. The Circular Economy Bill must therefore enhance its plans for tracking progress and providing public transparency. An effective monitoring method is essential as a performance indicator to hold ambitious goals to account.

⁹¹ Zero Waste Scotland (2021) <https://www.zerowastescotland.org.uk/research-evaluation/material-flow-accounts-mfa>

⁹² Scottish Government (2022) <https://www.gov.scot/news/scotlands-carbon-footprint-1998-2018/>

⁹³ SEPA <https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/waste-data-for-scotland/>

⁹⁴ Zero Waste Scotland <https://www.zerowastescotland.org.uk/our-work/carbon-metric-publications>

⁹⁵ <https://www.gov.uk/government/groups/edoc-electronic-duty-of-care>

⁹⁶ Scottish Government (2016). *Making Things Last: A Circular Economy Strategy for Scotland*. <https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/>

12 Moving forwards

This report details a series of circular economy case studies from around the world. It compares these to Scotland's current rate of progress to identify strategic gaps in policy and activity.

Based on the case studies collected in this report, the targets or projects to be considered for Scotland's Circular Economy Bill include:

- Community infrastructure (e.g. town hall reuse hubs) (Wales)
- A Textile Action Group (Ireland)
- Circular criteria for public building construction/renovation (Venlo & San Francisco)
- 50% renewable construction by 2050 (Amsterdam)
- Anti-waste legislation for food and textiles (France)
- Shortened food chains (Amsterdam)
- Remanufacturing training (Wales)
- Mainstreaming Scottish initiatives, such as the Edinburgh Remakery, at a national level.

The case studies presented in this report can form the basis for a new circular economy strategy for Scotland, as it prepares to introduce its Circular Economy Bill.