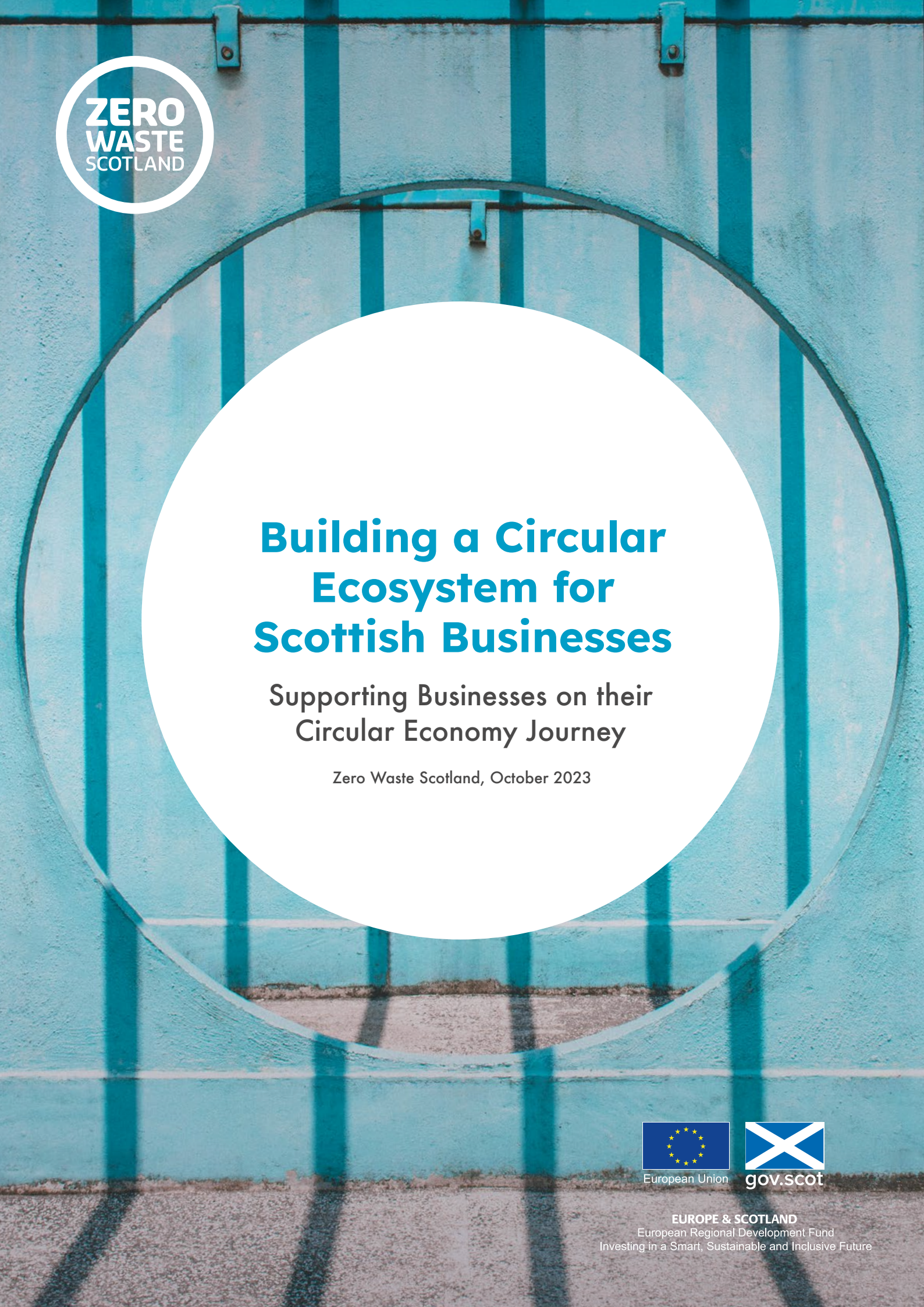

ZERO WASTE SCOTLAND

Building a Circular Ecosystem for Scottish Businesses

Supporting Businesses on their Circular Economy Journey

Zero Waste Scotland, October 2023

European Union

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EUROPE & SCOTLAND
European Regional Development Fund
Investing in a Smart, Sustainable and Inclusive Future

Building a Circular Ecosystem for Scottish Businesses

Foreword by Iain Gulland

Scotland is on an ambitious journey towards embracing a circular economy, and to get there we need to harness the unique innovation and dynamism of our country's businesses.

Now, more than ever, the need for this transition is vital. Every day around the globe, we're seeing evidence of the damage our current linear economic system causes - including pollution, climate change, and biodiversity loss, not to mention the enduring issue of inequality prevalent in possibly every part of our global community. This amounts to what the World Economic Forum calls a 'polycrisis': a simultaneous combination of crises. It's clear that if we don't act now, the results will be catastrophic for all of us.

Fortunately, there is a real solution and we're making progress towards it every day. The circular economy will end our unsustainable consumption and replace it with a system that moves away from our current attitude of "make, use once, and dispose" to one where we "make, use, recycle and remake" instead. By valuing everything, harnessing the full potential of our planet's resources, and phasing out waste wherever possible, we can end this period of polycrisis and replace it with a new era of sustainability.

All of us have an important part to play on this journey, but the role of Scotland's businesses is undeniably crucial. As a nation, we're fortuitous that our business sector is a source of endless innovation and creativity, constantly coming up with new and sustainable solutions, products, and methods that will help accelerate our journey to circularity. It's why we're recognised worldwide for our efforts. But we understand that their progress is fragile, and fraught with challenges.

Rising costs across the economy present one such challenge. Energy and fuel prices have risen substantially and all businesses – SMEs in particular - are feeling the effects. Amidst such inflationary pressures, resource constraints present another critical challenge, given that exploring circular opportunities and initiatives can be time-consuming and resource-intensive. And even when they are realised, some businesses then face a stigma against circular products which are presumed to be of lower quality to more traditional, linear products.

Zero Waste Scotland has played a pivotal role in helping businesses with these challenges. Through the Circular Economy Investment Fund, they've been provided with financial support, mitigating price rises that might have otherwise stifled investment in circular projects. And through our Circular Economy Business Support service, we've provided technical advice to firms that has proved invaluable in enabling them to address resource constraints and continue to move forward on their circular journeys. These initiatives were both made possible in part thanks to the European Regional Development Fund. Additionally, Zero Waste Scotland works to encourage behaviour change across the country, to shift citizens away from buying liner products towards circular alternatives – encouraging them to turn to these businesses for their needs.

But we know that more can always be done. Businesses require ongoing support to expand the ecosystem of circular enterprises that's taking shape across Scotland. This report will now set out what has proved effective in the past, and how to address the challenges that remain, so that we can continue to galvanize Scotland's businesses in their circular efforts.

Contents

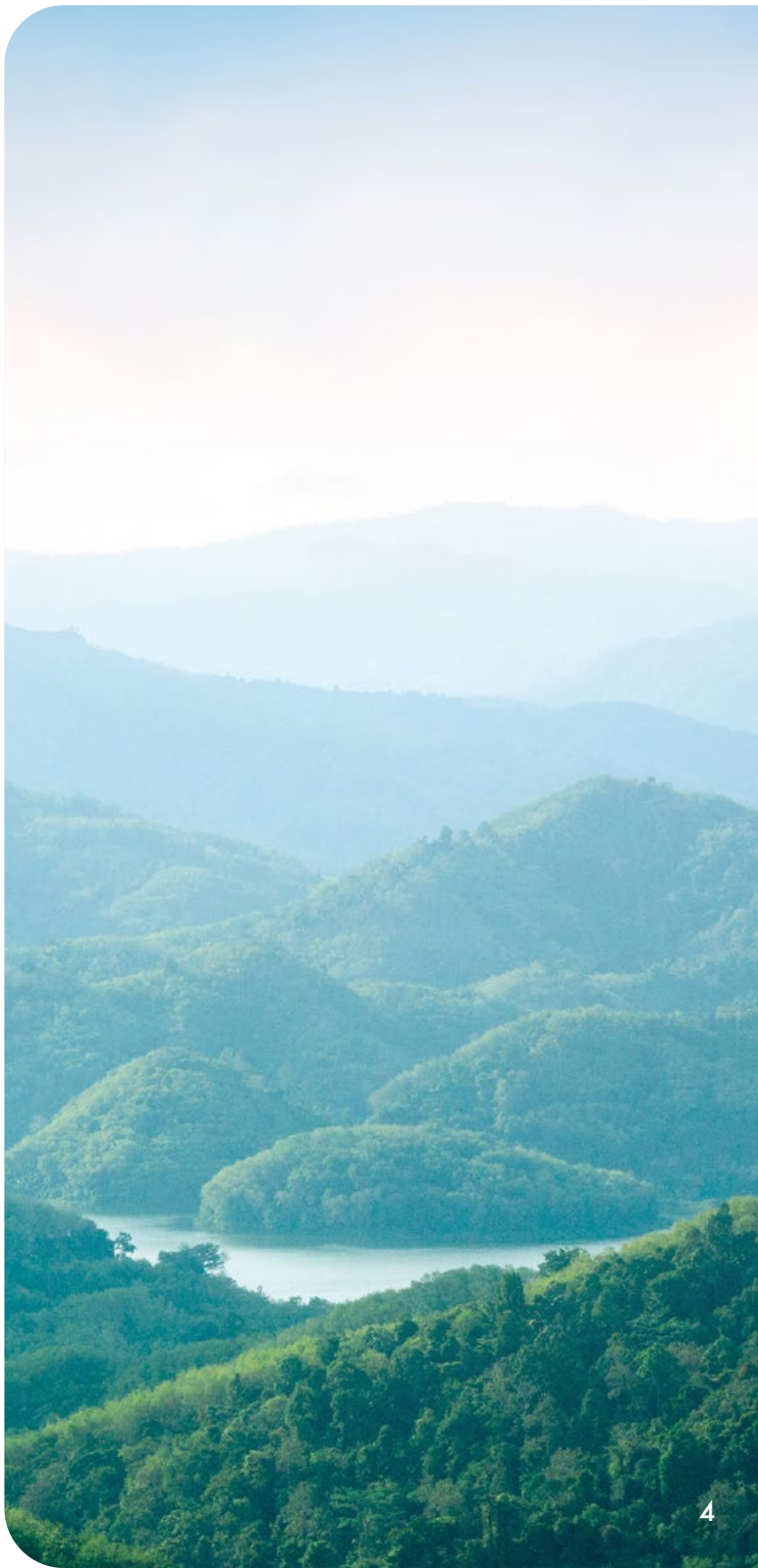
1 Introduction

The production and consumption of products and materials accounts for roughly 80% of Scotland's carbon footprint, which includes the heat and energy required to grow, make, process, transport and provide them.[1] Globally, our overconsumption of resources is responsible for 50% of greenhouse gas (GHG) emissions, and over 90% of biodiversity loss and water stress.[2]

Embracing the circular economy in Scotland is a key part of the solution to the global climate emergency and biodiversity crisis. Imagine a world where products are designed and manufactured with the intent of being used and reused for as long as possible, minimising waste and maximising value.

That world is within our reach if we have the courage and support to achieve it.

Creating a system where by-products can be re-used will build a healthier relationship with consumption. It will create high value resources from waste, building a virtuous cycle of waste-reduction, value-add, and the regeneration of our planet.



[1] Zero Waste Scotland (2021) What are the effects of Climate Change in Scotland https://www.zerowastescotland.org.uk/resources/what-are-effects-climate-change-scotland

[2] IRP (2019) Global Resource Outlook: Natural Resources for the Future We Want https://www.resourcepanel.org/reports/global-resources-outlook

Beyond its environmental benefits, the circular economy offers significant economic opportunities for Scotland by fostering the implementation of circular practices across industries, generating new jobs and enabling existing businesses to work in innovative ways.[3] The circular economy also provides a safeguard against supply shocks - most recently witnessed during events like the Covid-19 pandemic and the fallout of Russia's invasion of Ukraine[4] - by localising supply chains and resource production.

Research also suggests that the circular economy can deliver wider benefits to society in terms of increased jobs and opportunities, and improvements to human health and wellbeing.[5] In this sense, the circular economy provides Scotland with a pathway for delivering a wellbeing economy[6] within the finite resources of our planet.[7]

Since 2016, Zero Waste Scotland has been working closely with the business community in Scotland to accelerate circular transformations.

This report aims to shed light on the key achievements of Zero Waste Scotland's business support services, showcasing how Scotland's circular businesses are helping to address sustainability challenges across six key sectors (Bioeconomy, Built Environment, Energy, Retail, Manufacturing, and Recycling and Reprocessing) while delivering environmental and social value. The report also aims to draw out key lessons learned and recommendations to support circular businesses in the future.

[3] Scottish Government (2022), Delivering Economic Prosperity: Scotland's National Strategy for Economic Transformation https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2022/03/scotlands-national-strategy-economic-transformation/documents/delivering-economic-prosperity/delivering-economic-prosperity/govscot%3Adocument/delivering-economic-prosperity.pdf

[4] Ellen MacArthur Foundation (n.d.) Building resilience: the impact of the circular economy on global trade and supply chains https://ellenmacarthurfoundation.org/articles/building-resilience

[5] Circle Economy (2023) Measuring What Matters: The Indicators needed to Drive Social Benefits with the Circular Economy https://www.circle-economy.com/blog/measuring-what-matters-the-indicators-needed-to-drive-social-benefits-with-the-circular-economy?mc_cid=8f35314d92&mc_eid=803466c266

[6] Wellbeing Economy Alliance Scotland (n.d.), What is a Wellbeing Economy? https://www.weallscotland.org/what-is-a-wellbeing-economy

[7] Scottish Government (2022), Delivering Economic Prosperity: Scotland's National Strategy for Economic Transformation https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2022/03/scotlands-national-strategy-economic-transformation/documents/delivering-economic-prosperity/delivering-economic-prosperity/govscot%3Adocument/delivering-economic-prosperity.pdf

2 Zero Waste Scotland's Business Support Proposition

The Resource Efficiency Circular Economy Accelerator Programme (RECEAP), delivered by Zero Waste Scotland, on behalf of the Scottish Government, was able to establish two key business support propositions: Circular Economy Business Support (CEBS) which provides advice and guidance to businesses beginning their circular journey and the Circular Economy Investment Fund (CEIF) which funds innovative SMEs looking to scale their circular business.

The RECEAP programme was originally funded by the European Regional Development Fund (ERDF) and focused mostly on SMEs. The investment fund was covered by ERDF to the end of the programme in December 2022. The business support aspect was removed from the ERDF-funded RECEAP programme at end of March 2021 and has since been supported by the Scottish Government. This allowed CEBS to change the programme and expand beyond SMEs to include larger companies. In addition, the Circular Economy Development Grant (CEDG) was a smaller grant fund introduced so businesses could implement small, short timescale projects to get them ready for CEIF funding. Further to the support offered through Zero Waste Scotland, the Scottish Government's long-term commitment to nurturing and investing in the plans set out in the Circular Economy Route Map.[8]

[8] Scottish Government (2022) Delivering Scotland's circular economy - route map to 2025 and beyond: consultation https://www.gov.scot/publications/consultation-delivering-scotlands-circular-economy-route-map-2025-beyond/pages/7/

3 Circular Economy Investment Fund (CEIF)

A key objective of the CEIF was to direct significant investments towards pioneering projects that already had established proof of concept and were now seeking to scale up their commercial operations.

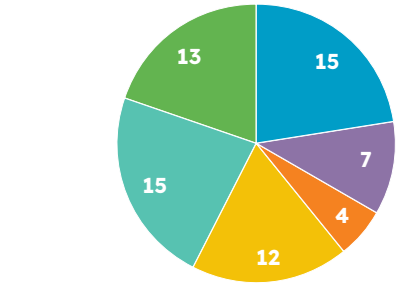
The CEIF has invested £12m in more than 60 innovative circular projects. The most popular areas for funding include: resource recovery, reuse and repair, and remanufacturing (Piechart 2).

The CEIF monitors projects operational for three years starting from when they start to see the impact of their plans. Businesses are at various stages in the cycle, but the investments so far have demonstrated noteworthy carbon reductions, amounting to approximately 65,000tCO2eq, equivalent to taking 38,000 cars off UK roads for one year.[10]

The investments have resulted in the reported creation of 70+ Scottish jobs. Beyond the initial £12m provided, these innovative businesses have also secured £35m in match funding, showcasing the economic potential that circular economy presents.

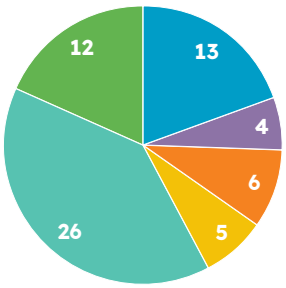
The CEIF and the CEBS teams work cohesively together. For example, where a funding proposal was faltering or risks were identified, the business support team provided an intermediary service to help develop the idea and provide market research to mitigate risks.

Piechart 1
Sectoral Distribution of CEIF businesses



Bioeconomy
Built Environment
Energy
Manufacturing
Retail
Recycling/ Reprocessing

Piechart 2
Circular Strategies pursued by CEIF businesses



CEIF – total 66

Circular design
Enabling technologies
Product as-a-service
Remanufacturing
Resource recovery
Reuse & repair
Sharing economy

[10] The average impact of one car on the road in the UK for one year is estimated to be approximately 1.7 tonnes CO2e. This is calculated by dividing the total emissions from passenger cars in 2021 [https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2021] by the total number of licensed cars at the time [https://www.gov.uk/government/statistics/vehicle-licensing-statistics-2021/vehicle-licensing-statistics-2021#licensed-vehicles-overview]

4 Circular Economy Business Support (CEBS)

Since 2016, Zero Waste Scotland has been providing an expert one-to-one consultancy service to SMEs and, since 2021, to non-SMEs across Scotland through its CEBS services.

Zero Waste Scotland offers tailored support to Scottish companies looking to be more circular and to start-ups looking to develop circular businesses.

In 2020, the service introduced a revised approach with three phases of support based on feedback from service-users:

1. **Primer (knowledge and guidance)**
2. **Activator (market engagement and business/product development)**
3. **Implementation Support (access to additional resources for actioning circular initiatives)**

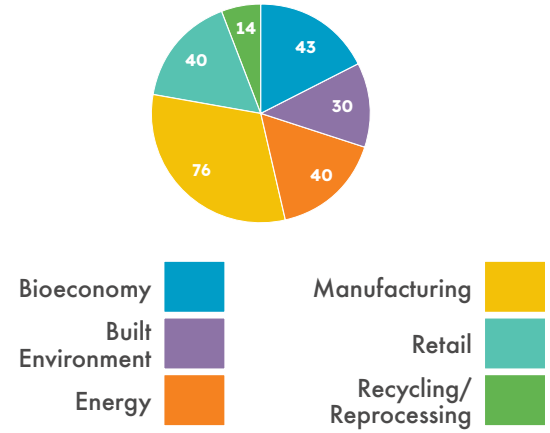
This approach replaced Zero Waste Scotland's original model which was based broadly around supporting a company on their circular journey. After initial feedback and learnings we re-designed the service to be more targeted and help each business create more defined outcomes.

Support provided through CEBS varies based on business requirements but can include elements of market research and feasibility studies as well as more technical elements including product design, prototyping, and user testing.

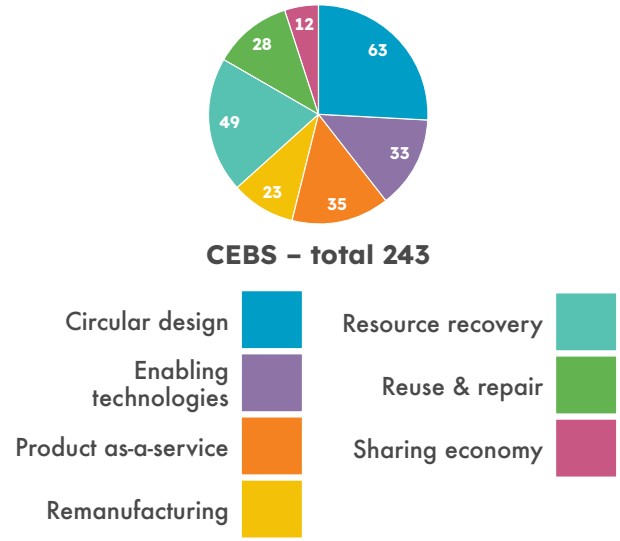
The CEBS programme has supported businesses to take the risk out of exploring circular strategies and to help them quantify the benefits including new income streams, expanding into new markets, making the most of staff resourcing to make cost savings, growing a customer base and safeguarding against price-shocks and supply chain disruption.

Through its support services, Zero Waste Scotland has worked with more than 200 companies across Scotland representing key sectors such as Bioeconomy, Built Environment, Energy, Manufacturing, Retail, and Recycling (Piechart 3).

Piechart 3
Sectoral Distribution of CEBS businesses



Piechart 4
Circular Strategies pursued by CEBS businesses



As the circular economy encompasses a wide range of strategies to limit the use of resources and reduce waste, businesses have approached becoming circular in line with their business model and product offering.

Common things put in place include circular design, resource recovery, product-as-a-service and enabling technologies.[9] (Piechart 4).

These strategies serve as a starting point for innovation, providing a consistent framework for businesses to start thinking about how circularity could apply to their business before investing time and money in adapting their operational and commercial approaches.

[9] Fifield & Medkova (2016). Circular Design - Design for Circular Economy (Pg 3) Varjani et.al (2020). Chapter 1 - Resource recovery from waste: an introduction

Circular Strategies

Circular Design:

Requires product designers to consider the entire life cycle of a product, including its materials, production process, use phase, and end-of-life options. The goal is to create products that are durable, repairable, and recyclable, thereby minimising waste and maximising resource efficiency.

ACT Blade, a wind turbine manufacturing company based in Edinburgh, has received backing from Zero Waste Scotland for its innovative design aimed at promoting sustainability. The turbines are engineered to be partially recyclable and incorporate recycled materials, helping to address the end-of-life waste challenge facing the wind energy sector.

Resource Recovery:

Resource recovery is a circular strategy that focuses on extracting value from waste or by-products generated during the production or consumption process. Recovering resources reduces the need for extracting virgin materials and decreases waste sent to landfill.

Maclean's Highland Bakery and Windswept Brewing Co worked collaboratively to reduce waste from the brewery by using a by-product to develop a new cracker. Zero Waste Scotland provided support to model practical and commercial elements, and then the funding to develop the new crackers from the brewery's spent grain into a commercial product.

Enabling Technologies:

Advanced tools and systems like data collection, sharing platforms, machine learning, asset management, tracking systems and dynamic modelling can support the transition to a circular economy. We supported Reath, a company offering a digital-app solution providing traceability for circular systems. The Reath platform can track anything from packaging to electronics; using Digital Passport technology to capture asset-unique data (e.g. status, timings, locations, number of uses, repair history) and unlock the analytical and predictive capabilities needed to scale reuse. Enabling tech solutions is key to supporting circular models including take-back, reuse, remanufacturing and can also support the circular principles of asset life extension by preserving the integrity of valuable equipment.

Product-as-a-Service (PaaS):

This is a business model where products are offered as a service rather than being sold as individual items. Instead of purchasing a product, consumers pay for use or access to a product, and the responsibility for maintenance, repair, and end-of-life management remains with the provider. PaaS promotes resource efficiency and circularity by encouraging product longevity, repairability, and reusability, as the provider has a business interest in maximising the product's lifespan.

Reuse & Repair:

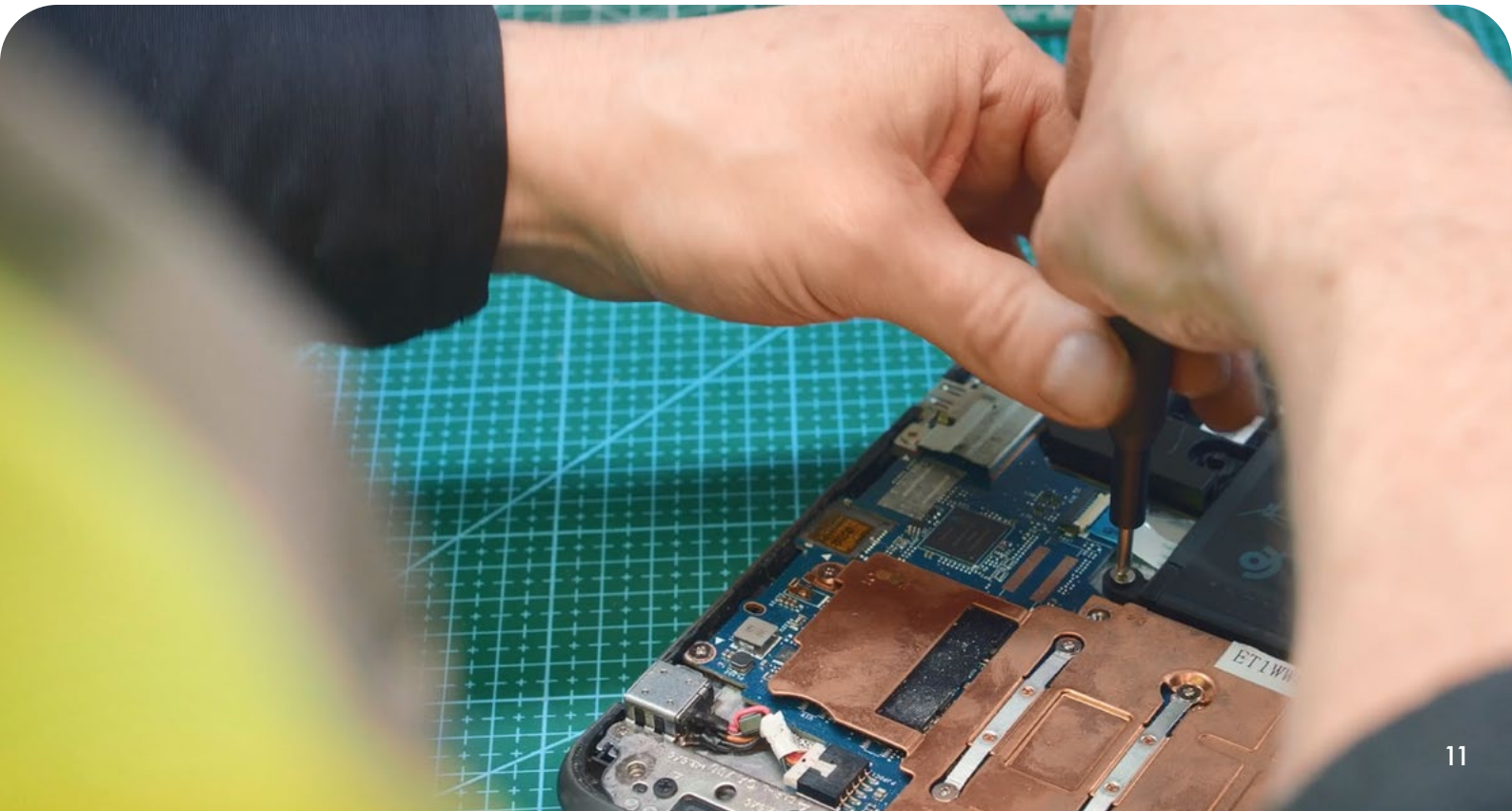
These strategies focus on extending the lifespan of products by encouraging their reuse or repair instead of disposal. Reuse involves finding new ways to utilise products or components, either through refurbishment, repurposing or finding a second-hand market for the product. Repair involves fixing products to extend their functional life. This strategy reduces waste generation and conserves resources that would otherwise be used to produce new products.

Transition Stirling received funding to set up a reuse & repair hub in collaboration with the local authority. They take unwanted or oversupplied goods, repurpose and re-sell them to the community at low prices. In the first nine months of operation, they were able to reuse 100 tonnes of product. The Transition Stirling Reuse Hub also offers 12 'Makers Spaces' which can be used by residents to create beautiful, niche products from 'waste'.

Remanufacturing:

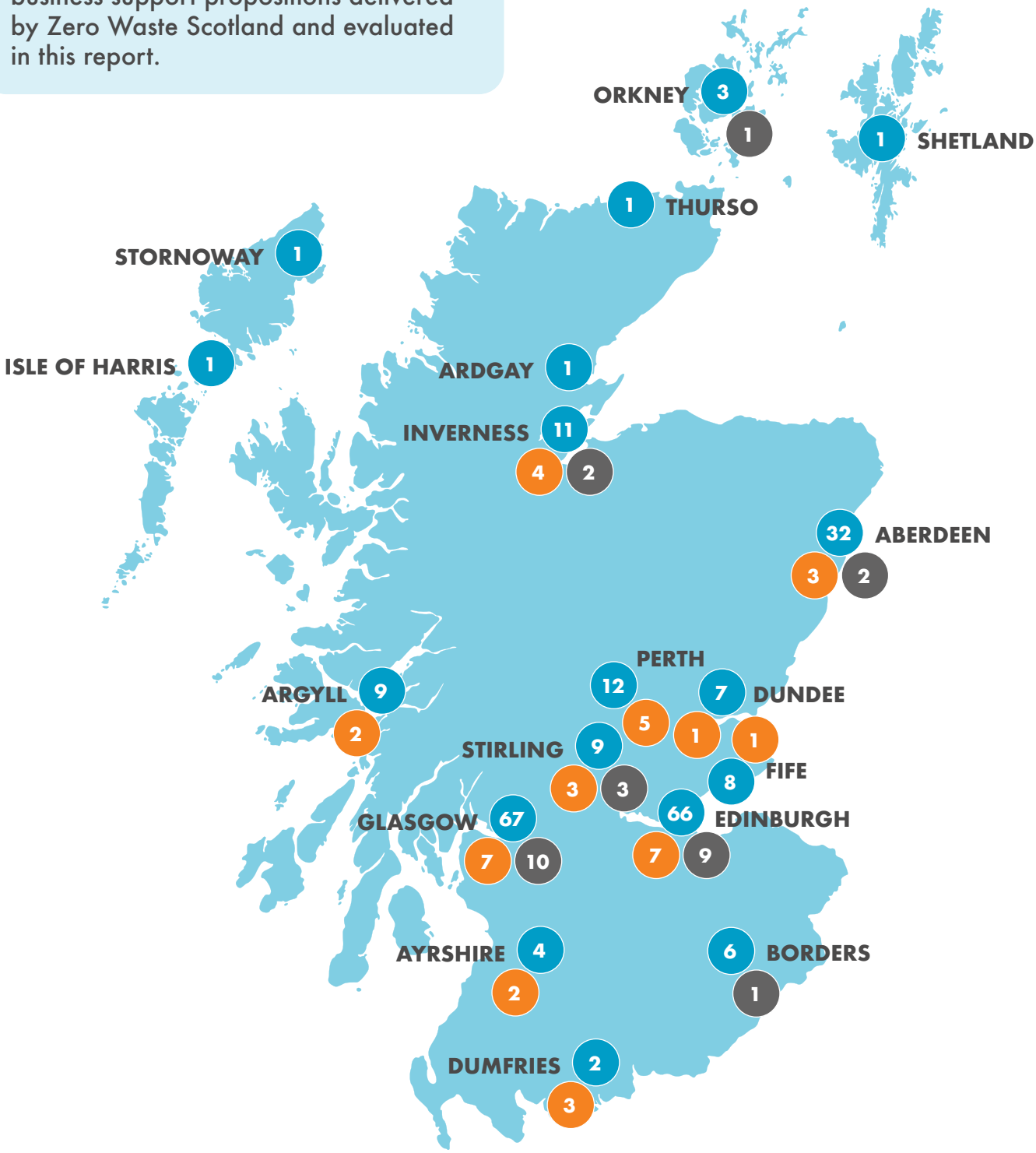
Remanufacturing is going beyond repair by employing advanced techniques to inspect, disassemble, clean, repair and replace worn-out parts in a process of restoring used products or components to a like-new condition. Remanufactured products offer the same functionality as new ones but with a reduced environmental footprint. Remanufacturing helps to conserve resources, reduce waste, and lower energy consumption in comparison with production of entirely new products.

ILM Highland, a social enterprise, received funding for its project to convert old laptops into Chromebooks. This has the potential to save 26 tonnes of carbon and provide accessible electrical equipment to schools and local community groups.



Supporting Scottish businesses

This map shows the number of businesses supported across Scotland thanks to the business support propositions delivered by Zero Waste Scotland and evaluated in this report.



246 CEBS

38 CEIF

28 CEDG

5 Report Methodology

To achieve the objectives of this report, a desk-based review of internal Zero Waste Scotland documents and existing data was conducted to establish a foundational understanding of the impacts of the support provided by CEIF and CEBS and identify gaps in the existing knowledge. From this background research, **18 case studies of businesses** (listed in Appendix A) were selected to showcase the environmental, social, and economic impacts which have resulted from Zero Waste Scotland's business support.

To provide additional insights, semi-structured interviews were conducted to gather more detailed information on the practical barriers and challenges faced by businesses and key lessons learned from their circular economy journey. **Eleven businesses across the six sectors** (listed in Appendix A) were purposefully selected to gain deeper insights, perspectives, and personal experiences related to the support services offered by Zero Waste Scotland. However, to provide a broader overview of the range of businesses covered by the investment fund and business support, internal data was also used to construct a few case studies of businesses not interviewed. Two internal colleagues that manage the fund and business support services respectively were also interviewed to broaden the authors' understanding of the common challenges and barriers faced by circular businesses.

The interview data was analysed using thematic analysis and the findings are compiled in this report. Thematic analysis was conducted in-line with Braun & Clarke's six-step methodology[11]. Responses were collated by question and the data was then coded according to the pertinent emerging themes.

These themes informed the conclusions made in the 'Lessons Learned' section which explores the challenges to, and benefits of, circular business practices in Scotland at the time this report was written.

The methodologies for measuring carbon reduction differ somewhat from business to business and may serve as a limitation to this, and similar, research. The assessment of potential savings and effects arising from early-stage circular economy business models presents several challenges owing to their innovative nature and dependencies on various external factors such as regulations and partnerships.

[11] Braun, V. & Clarke, V. (2006) "Using thematic analysis in psychology" Qualitative Research in Psychology, Volume 3, 2006 - Issue 2, Pages 77-101 | Published online: 21 Jul 2008

6 Driving the Circular Economy in Scotland

The circular economy has already shown promise in Scotland and has the potential to provide a pathway to a greener, more resilient future for the nation. Through analysis of businesses working across six of Scotland's largest economic sectors (Bioeconomy, Built Environment, Energy, Manufacturing, Retail and Recycling), we found innovative circular approaches which are being adopted to tackle key environmental challenges, while also unlocking economic, and social benefits.

Business Circular Economy Ambassadors

ACT Blade Ltd

Balfour Beatty

BEAUTY KITCHEN
EFFECTIVE·NATURAL·SUSTAINABLE

bike for good

CIRCULAR COMMUNITIES SCOTLAND

EGG LIGHTING

IndiNature
Bio-based construction systems

Hamilton
Giving waste new life

LM HIGHLAND

keenan recycling ltd

KR BON REDUCTION

Maclean's
- HIGHLAND BAKERY -

MiAlgae

MOVE ON
WOOD RECYCLING

NORKRAM
Pipe Protection Supplies

origin

reath

REBLADE

Renewable Parts Ltd

Scottish Water
Trusted to serve Scotland

TENNENT'S
EST° 1556
PROUDLY SERVING SCOTLAND

transition Stirling

7 Bioeconomy

Overall, Scotland generates over 10 million tonnes of organic waste annually[14].

Bioeconomy refers to parts of the economy that use renewable biological resources from land and sea and converts them, for example, into food, feed, energy, and materials[12]. The bioeconomy has potential to aid in replacing fossil fuels and other non-renewable materials that currently contribute to global carbon emissions.

However, due to the globally entrenched linear system of production, manufacture and waste management, the use of bio-based resources can still lead to significant carbon emissions and waste generation. For Scotland, in 2018, the decomposition of food waste in landfill accounted for 2.648 million tonnes of CO_2eq emissions, 3.8% of our total carbon footprint[13].

Achieving a more circular bioeconomy in Scotland will not only reduce waste but will also reduce carbon emissions and add significant economic value. It is estimated that by integrating circular approaches to the beer, whisky, and fish sectors alone, £500-800 million pounds could be added to the Scottish economy[15].

The bioeconomy lends itself to circularity through carefully considered design and management.

Biological nutrients can be recovered and regenerated to support and enrich further processes, keeping resources in circulation for as long as possible without depleting quality or affecting their intrinsic value. Therefore, it is critical that the Scottish bioeconomy uses this opportunity to transition to a circular model that minimises carbon emissions and avoids waste. Zero Waste Scotland has provided support to almost 60 businesses working to innovate and lead the way for Scotland's flourishing circular bioeconomy.

[12] Zero Waste Scotland (2023) Accelerating Circular Bioeconomy https://www.zerowastescotland.org.uk/resources/accelerating-circular-bioeconomy

[13] Scottish Government. (2022). Delivering Scotland's circular economy - route map to 2025 and beyond: consultation, 'Package 2: Reduce Food Waste' https://www.gov.scot/publications/consultation-delivering-scotlands-circular-economy-route-map-2025-beyond/pages/7/

[14] Zero Waste Scotland. (2023). 'Accelerating the Circular Bioeconomy'. https://www.zerowastescotland.org.uk/resources/accelerating-circular-bioeconomy

[15] Zero Waste Scotland. (2023). 'Accelerating the Circular Bioeconomy'. https://www.zerowastescotland.org.uk/resources/accelerating-circular-bioeconomy

Case study: **MiAlgae**

MiAlgae is an SME that has developed innovative technology to utilise co-products from the whisky distillation process to cultivate algae. On average, for every litre of whisky produced, 10-15 litres of co-products are also generated which are typically used in animal feed or energy generation.

MiAlgae has developed a process that enables some co-products to be converted into a bio-based product that can be used as a source of Omega-3 oils, providing a sustainable aquaculture feed ingredient, pet food additives, and human health products.

With a third of global fish stocks fully depleted and overfishing in Europe on the rise again[16], sustainable sources of Omega 3 oils are vital to securing the health of both people and animals. With funding from the CEIF to purchase the bioreactors required for the cultivation process, MiAlgae was able to scale up its bioprocessing technology and produce Omega-3 oil ingredients at a competitive market price, while also making a potential 18,000 tCO2eq emissions savings per year[17].

[16] UNFCC (2022) Plenty of Fish? https://unfccc.int/blog/plenty-of-fish

[17] Zero Waste Scotland. 2023 CEIF Status Report. (Internal Zero Waste Scotland calculations)

Case study: **Scottish Water**

Zero Waste Scotland has supported **Scottish Water** (a statutory corporation that provides water and sewerage services across Scotland) on its journey to embed circularity principles in its operations. A flagship project worked with both Scottish Water and a small cohort of SMEs to investigate solutions to the issue of grit found in the wastewater system.

Typically, the grit is viewed as a waste product and is removed during filtration then sent to landfill. The project found a promising answer to the problem by uncovering the value of grit for the construction industry, where it can be used as an alternative to virgin aggregates that would otherwise be sourced from energy intensive quarrying.

In comparison to traditional aggregate materials, the recycled grit offers a **carbon saving of up to 70%**[18].

Additionally, Scottish Water is now implementing a change to its procurement system to discourage the purchasing of new materials and encourage the maintenance of current assets. There has also been an emphasis placed on eco-design principles being integrated into any further development of assets.

"Re-purposing the grit will save waste from landfill and contribute to meeting our net zero emissions target."

Tasmyn Kennedy – Scottish Water

Case study: **Tennent's**

Zero Waste Scotland has also worked with **Tennent's**, a large lager brewing company with long-standing operations in Scotland. Tennent's used the CEBS services to conduct a business-wide circular economy assessment. The findings from this assessment have been used to shape Tennent's circular approach moving forward, as well as providing validation to some of the projects already underway in the business.

A key milestone of this project has been the creation of an internal circularity strategy, representing a cultural shift within the organisation and increasing employee awareness of the circular economy.

[18] Project Scotland (2020) Scottish Water Creates Building Material from Wastewater Grit https://projectscot.com/2020/07/scottish-water-creates-building-material-from-waste-water-grit/

8 Built Environment

The Built Environment refers to the man-made or constructed physical surroundings in which people live, work, and interact. It encompasses buildings, infrastructure and spaces created by people.

The Scottish construction industry contributes around £21.5 billion to the country's GDP, employing one-tenth of the workforce. At the same time, it is also a sector with substantial environmental impacts.

Extracting, processing and transporting construction materials results in significant emissions, along with further impacts resulting from actual construction operations, maintenance and eventual demolition activities (all of which are referred to as embodied carbon).

The large volumes of waste created by the construction sector present challenges for waste management systems. Finally, when materials are wasted instead of being reused, it drives the need for further production, leading to further depletion of virgin resources and increased emissions.

Globally, construction and operation activities account for well over one-third all carbon emissions[21], 40% of energy use and 25% of solid waste generation[22].

In Scotland, 40% of emissions come from the built environment[23], and up to 70% of these emissions are embodied in construction materials[24].

60% of total UK waste is generated from construction, demolition and excavation[25].

In response to these challenges, Zero Waste Scotland has supported over 30 businesses in the sector to implement circular construction principles.

Circular construction principles start with planning and design. Designing buildings with low-carbon materials and technologies can significantly reduce carbon emissions and other environmental impacts further downstream. Planning for emissions resulting from maintenance and demolition can help to reduce the environmental impacts of construction projects across their entire life cycle.

[19] Construction Scotland. (2019). The Scottish construction industry strategy 2019-2022

[20] Federation of Master Builders. (FMS). (2021). Building Scotland's construction industry

[21] World Green Business Council (WGBC). (2019). Bringing embodied carbon upfront. London: WGBC

[22] Yeheyis, M., Hewage, K., Alam, M. S., Eskicioglu, C., & Sadiq, R. (2012). An overview of construction and demolition waste management in Canada: A lifecycle analysis approach to sustainability. Clean Technologies and Environmental Policy, 15(1), 81-91. doi:10.1007/ s10098-012-0481-6

[23] Adams, M., Burrows, V. and Richardson, S. (2019) Bringing Embodied Carbon Upfront. rep. World Green Building Council, p. 7.

[24] Clark, G. (2021) RIBA Sustainable Outcomes Guide. rep. London: Royal Institute of British Architects, p. 29.

[25] Defra and Government Statistical Service (2019). UK Statistics on Waste. https://assets.publishing.service.gov.uk/government/ uploads/system/uploads/attachment_ data/file/784263/UK_Statistics_on_ Waste_statistical_notice_ March_2019_ rev_FINAL.pdf

Case study: **Balfour Beatty**

Zero Waste Scotland has provided guidance and support to **Balfour Beatty**, the UK's largest construction company, enabling it to work across its supply chain to apply circular best practice in its sourcing of materials for its Fife College new Dunfermline Campus contract, which comprised the delivery of one of three buildings spanning over 20,000m^2.

One of the circular solutions enabled by Zero Waste Scotland's support was the sourcing of green delta beams made from 90% recycled steel.

Another project being trialled is a packaging reduction project - a significant challenge in the sector - with their lighting suppliers. The project involved two key aspects. Firstly, the supplier provided equipment in boxes containing everything needed for a specific area, reducing issues around over purchasing and waste. The second aspect relates to a return scheme for the packaging to the supplier so that they can reuse again for different projects, again reducing waste.

Case study: **Move On Wood Recycling**

Another important circular strategy involves re-using secondary materials in construction projects.

Move On Wood Recycling is a social enterprise operated by the charity Move On, which collects waste wood from construction sites around Edinburgh and redistributes them to SME builders as an alternative to buying new. The company also developed an upcycling project for any waste wood which isn't fit for reuse, creating high-value furniture items which are then sold to customers in its shop. Through this project, 883 tonnes of wood have been saved from landfill through reuse.

Move On Wood Recycling has used the wood reuse project as a means for delivering significant social value in the community. Through the project 86 young people have received training in skills ranging from joinery and carpentry to forklift driving and logistics, while volunteers have contributed 2,912 days of help to the project. By providing opportunities to those who need them most (for example, young people or those with physical/ mental barriers preventing them from joining the mainstream workforce), people can gain skills and confidence which equip them for life.

DID YOU KNOW?

Move On also re-distributes surplus food through the nationwide charity FareShare. It prevents 20-30 tonnes of food entering landfill each week.

Case study: **KR Cladding**

KR Cladding is an SME which provides cladding for construction projects. The business received funding and advice from Zero Waste Scotland for a project that strips unwanted external cladding from buildings, cleaning and re-sizing it for direct reuse in other construction projects. KR Cladding decided to pursue its circular project when it was clear that there was no responsible way to dispose of old cladding panels.

Traditionally, cladding panels are sent to either landfill sites or waste-to-energy plants. After doing research and development, KR Cladding was able to deliver a cost-effective and commercially attractive way to repurpose the panels.

Through the sales of re-purposed insulation, the business has diverted 201m^3 of waste from landfill, equivalent to approximately 80T Co_2eq[26]. Through the project KR Cladding has also delivered social benefits by offering 'back-to-work' opportunities, developing the skillset of young people by providing experience in the construction sector while also engaging them in the circular economy.

[26] KR Cladding. Figures supplied directly from the company

9 Energy

Decarbonising the energy sector by shifting away from fossil fuels and towards renewable technologies is vital if Scotland is going to reach Net Zero carbon emissions by 2045[27]. Scotland already has a commendable record in renewable energy development. In 2020 alone, Scotland generated the equivalent of 97% of its electricity consumption through renewable sources[28]. The Government's Net Zero Strategy looks to build on these efforts, scaling renewable energy production to secure a just transition for Scotland.

Nonetheless, even within the renewable energy sector, significant sustainability challenges remain. To meet the increasing renewable energy demands in Scotland, up to 241 million tonnes (Mt) of materials could be required[25]. This would be at least 12% more material each year by 2050 than were consumed across all sectors in Scotland in 2018.[29] Most of the required materials are extracted outside of the UK where mining activities pose environmental and social challenges.[30] Heavy dependence on foreign supply chains presents issues for energy security. The Scottish Government recognises the value of embedding circular economy strategies within the renewables sector.[31]

Zero Waste Scotland has supported more than 40 businesses to become more circular within the energy sector.

[27] Scottish Government. (2020). Securing a green recovery on a path to net zero: climate change plan 2018–2032 – update. https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/pages/2/

[28] Zero Waste Scotland (2023), Energy Infrastructure Materials Mapping https://cdn.zerowastescotland.org.uk/managed-downloads/mf-mtasacuu-1688475446d

[29] Zero Waste Scotland (2023), Energy Infrastructure Materials Mapping https://cdn.zerowastescotland.org.uk/managed-downloads/mf-mtasacuu-1688475446d

[30] World Bank (2020). Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition. Available at: https://pubdocs.worldbank.org/en/961711588875536384/Mineralsfor-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf

[31] Scottish Government (2022) Onshore Wind Policy Statement 2022 https://www.gov.scot/publications/onshore-wind-policy-statement-2022/

Case study: **Renewable Parts**

Renewable Parts is one of those companies with a unique circular offering for the wind sector. The company remanufactures wind turbine components when they reach the end of their lifecycle. Zero Waste Scotland helped scale the operation by providing the initial capital investment in infrastructure and equipment.

Renewable Parts has been able to normalise remanufacturing within the wind sector, due to its competitive pricing, short lead-times, strong operational performance, and significant sustainability credentials compared to buying new. By offering an end-end service that is consistent and convenient for customers, alongside the assurance of checked and warrantied high-quality components, Renewable Parts has been able to convince this traditionally risk-averse industry of the benefits of circularity. Meanwhile, refurbishing turbines has also diverted around 198 tonnes of material from landfill over the same time period - that's the equivalent of 130 Olympic -sized swimming pools.

By refurbishing and repairing existing turbines and reducing the demand for new production, Renewable Parts has so far saved 579 tCO2eq since 2018[32] - the equivalent of a double-decker bus circumnavigating the globe 11.5 times.

Renewable Parts has a recirculation centre of excellence based in Argyll and Bute (along with an operation centre in Renfrewshire) which has brought 15 specialised engineering jobs to Lochgilphead. Due to a skills and knowledge gap in the remanufacturing sector, Renewable Parts has chosen to invest in homegrown talent. It has introduced both a graduate and modern apprenticeship scheme to encourage young people to develop the skills needed for this rapidly growing, highly skilled industry. They are deeply involved in the local community: offering alternative pathways to school leavers, engaging younger students through school prizes for engineering projects, and sponsorship in the local community.

[32] Renewable Parts. figures supplied from organisation

"Our employees see a future in renewables and the wind industry, and they see in Renewable Parts a business that will develop them and provide an enjoyable and satisfying career."

James Barry – Renewable Parts

Driving Circular Competitiveness:
Strategies for making circular products a force in the market

Price:
In competitive markets, circular products/services need not be the cheapest on the market, but companies can take advantage of low-cost inputs (by-products from other production processes), economies of scale and technological efficiencies to ensure competitive pricing.

Availability:
Unlike linear products and services which often involve long global supply chains which are subject to external shocks, circular products/services which localise their offering, for example through re-use and refurbishment models, are often able to deliver shorter lead times and be more responsive to customer requests.

Performance:
Circular products/services can often outperform competitors in terms of quality and reliability, as they have been designed with end-of-life considerations in mind. Circular businesses can make use of product warranties/guarantees to reassure customers of product quality, particularly when offering repair/refurbishment services.

Sustainability:
Unlike other products/services on the market, circular products/services can demonstrate their environmental and social benefits. Any company that has committed to Net Zero, in principle, has committed to supply chain decarbonisation and they need to be sourcing circular products with evidence of carbon reduction impacts.

Case study: **ReBlade**

In a similar field is **ReBlade**, which developed the first specialist wind turbine and nacelle decommissioning service in the UK. ReBlade's pioneering processes are designed around maximising the potential for making a more circular solution to blades when they reach the end of their traditional lifespan.

With the help of Zero Waste Scotland's CEBS, ReBlade became the **UK's first** company to decommission turbine blades without the use of landfill, pioneering innovative approaches to blade handling that enable circular end-destinations for blade waste.

Case study: **Norkram**

Norkram has been pioneering a circular economy across Scotland's oil and gas industry for almost 30 years. Based in Peterhead, the manufacturer produces plastic thread protectors to cover oil and gas drilling pipes. Since its establishment in 1994, the company has used mostly old, recycled plastic material, which would otherwise be thrown off oilrigs or go to landfill.

Zero Waste Scotland's funding enabled Norkram to invest in new machinery to process large amounts of recycled plastic to fit into different moulds, creating various models of thread protectors. As a result of the new thread protector products, the manufacturer moved operations to two rotational shifts, five days a week, and employed four new members of staff to keep up with product demand. With the new machinery in place, Norkram calculated a carbon saving reduction of 66 tonnes CO2eq over the first quarter.

10 Manufacturing

The manufacturing sector in Scotland accounted for 6.9% of national employment and contributed £12.5 billion in Gross Value Added (GVA) to the economy in 2018[33]. The scale and breadth of the sector ranges from food & drink, space, textiles, chemical science and more recently electric vehicles, and demonstrates the vital role of manufacturing businesses for Scotland's present and future. However, they are also accountable for emissions produced through the industrial operations that make most of our physical goods, from textiles to pharmaceuticals, to energy technologies and beyond.

There has already been promising commitments and improvements made by many within the industry to rethink the traditionally energy-intensive manufacturing processes that often rely on raw material extraction.

The Scottish Government published a Manufacturing Action Plan in 2016, 'A Manufacturing Future for Scotland', which reiterated the importance of manufacturing for Scotland's future.

One of the key actions identified as fundamental to the Plan's overall success was to establish a centre of manufacturing excellence and skills academy.

That centre based next to Glasgow Airport is now complete and known as the National Manufacturing Institute Scotland (NMIS) and grew out of the University of Strathclyde's Advanced Forming Research Centre (AFRC) and includes the Lightweight Manufacturing Centre, Digital Factory, Manufacturing Skills Academy and soon-to-be opened Digital Process Manufacturing Centre.

Further support for the Manufacturing sector comes in the form of the Low Carbon Manufacturing Challenge Fund (LCMCF). It was announced in the Programme for Government (PfG) 2020-21, as part of a wider £60 million investment for industrial decarbonisation. It is a £26 million capital fund, to be delivered over 5 years, to support manufacturing businesses to play their part in the transition to a net zero carbon emissions economy.

The LCMCF will support development of new business models; lead to new products that will drive low carbon transition in the Scottish manufacturing sector; drive collaborative development across supply chains of new manufacturing processes and technologies; develop options to enhance capacity in growth sectors; and exploit opportunities in support of the transition to a circular, net zero carbon economy.

By applying circular principles, from design through to waste management, manufacturing has great potential for significantly cutting its carbon impact, reducing resource extraction, and minimising waste, all while expanding its social and economic benefits.

The following businesses are just a few examples of the 80+ businesses that Zero Waste Scotland has supported to shift away from linear manufacturing systems.

[33] Scottish Science Advisory Council (n.d.) The Environmental Impacts of the Scottish Manufacturing Industry https://scottishscience.org.uk/sites/default/files/article-attachments/SSAC%20Report%20-%20The%20Environmental%20Impacts%20of%20the%20Scottish%20Manufacturing%20Industry_0.pdf

Case study: **EGG Lighting**

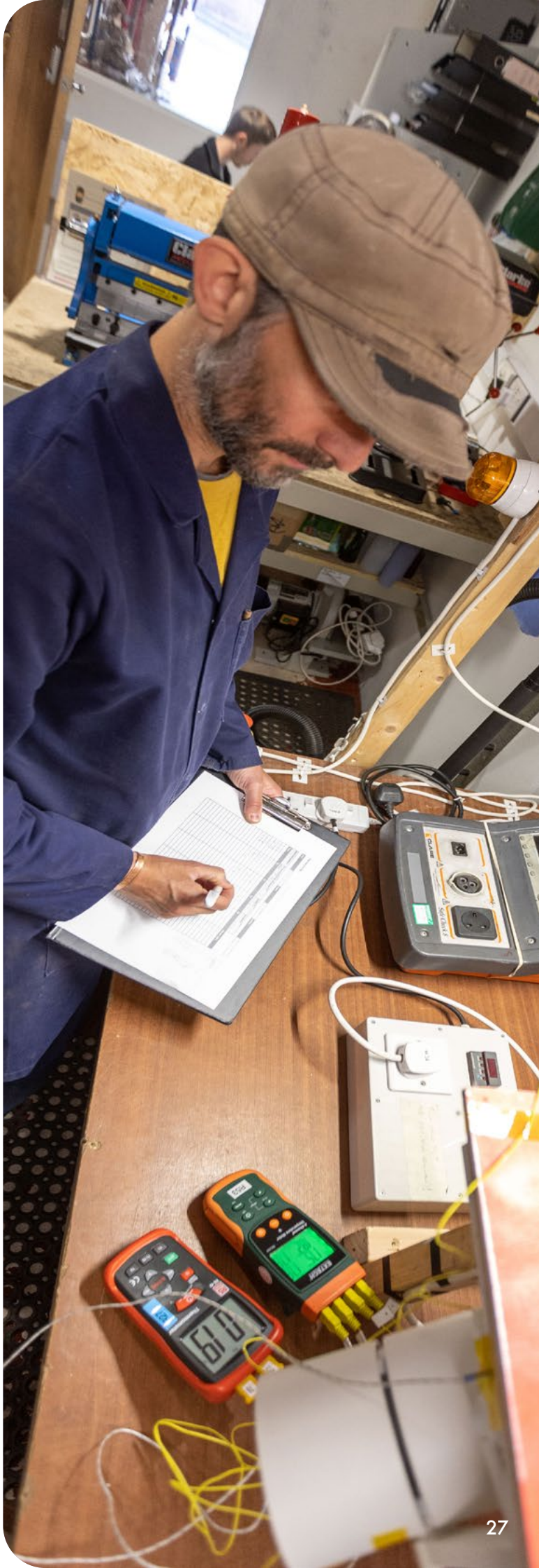
EGG Lighting is a circular business that develops and produces sustainable lighting products which prioritise energy efficiency and reusable materials. EGG's business model is based on a service provision, rather than the typical 'buy-use-dispose' model generally used by manufacturers.

With its lighting-as-a-service model, EGG is responsible for the long-term maintenance and repair of its products. Profitability is based upon how long the company can keep customers' lights running for, rather than how many products can be sold in a short timeframe. EGG is therefore incentivised to ensure that products last longer.

Incorporating circular economy design principles, smart maintenance and remanufacturing across its product and service range generates less waste by keeping assets in use for as long as possible – key pillars of a circular economy. EGG's remanufacture service has delivered energy and material savings for UK businesses. In 2022, they remanufactured 1,155 fittings, reusing 3,653 kg of materials.

With aid from the CEBS service at Zero Waste Scotland, EGG gathered data which was used to develop a business tool that can evaluate the costs and potential profits of catering its service for each customer. Additionally, with funding from a development grant the company could demonstrate the benefits in a live setting to secure sales.

In the five years since implementing this transformative business model, EGG Lighting has taken on eight new employees, upskilled staff in circular economy practices, and continuously pushed for a better supply chain based on circular design and local business engagement. While EGG is focused on fostering its domestic supply chains, it is also working with manufacturers in China to promote circular practices across international markets.



Case study: **IndiNature**

IndiNature is another excellent example of circular manufacturing for the benefit of environment and people, this time in the production of sustainable and affordable insulation for homes. By using hemp fibres and shiv core to produce innovative insultation products as an alternative to conventional products like glass and rockwool, IndiNature redirects this natural by-product towards an effective use.

The insulation products IndiNature manufactures can reduce homes' carbon emissions by an estimated average of 25%[34]. Rather than entering landfill post-use, it can be easily repurposed or biodegraded, contributing towards a lower environmental impact. Its social impacts are equally impressive. The insulation's natural 'breathability' reduces the risk of damp and mould that can endanger people's health, while effective insulation ensures money saved on heating bills for every home.

IndiNature initially benefited from CEBS in the development of its proposition and was then awarded a Circular Economy Development Grant to build a small demonstration 'house' intended to prove the effectiveness of its products to potential customers. Securing the funding from the CEIF allowed the business to progress towards bringing its product to market. IndiNature is now pioneering what it calls the "natural industrial revolution."

[34] Zero Waste Scotland. 2023 CEIF Status Report. (Internal Zero Waste Scotland calculations)

Case study: **ILM Highland**

The independent charity and social enterprise, **ILM Highland**, provides home improvements, electrical recycling and retail services by refurbishing goods that range from washing machines to microwaves. All profits made from sold refurbished goods are reinvested in charitable services to support the elderly and community groups living across the region, helping them to live at home independently for longer.

Zero Waste Scotland specifically supported ILM Highland with a laptop refurbishment scheme which came to life through a partnership with the University of Strathclyde. Students were tasked with developing sustainable income generation strategies that fed into ILM Highland's circular business model.

The students came up with a solution: to refurbish 804 old laptops, the equivalent to one tonne of landfill waste, into state-of-the-art Chromebooks.

ILM Highland also worked with local recycling plants as well as third party recycling suppliers to source the old laptops. Once the laptops were refurbished into fully functioning Chromebooks, the business launched the project with a full marketing campaign to generate sales. In addition to project funding, Zero Waste Scotland provided ILM Highland with support to calculate the carbon reduction from refurbishing the laptops. Overall, the 804 refurbished laptops resulted in a reduction of 26 tonnes of CO2eq.

11 Retail

The Scottish retail sector was the source of 13.7% of all employment in 2020[35], and had a total turnover of £23.1 billion in 2019[36]. Given the linear pattern of manufacture, sale, use, and disposal that underpins our modern understanding of retail, it is clear that business models must embrace the circular economy to transform its supply chain.

As retail often relies on supply chains that stretch across the globe, most of its emissions tend to sit within 'Scope 3' [36]. The amount of control that retailers have over their environmental impacts varies depending on their business model. While some are manufacturers who sell directly to their customers; others act instead as intermediaries between producers and consumers. From small local enterprises to international chains, the scale of operations will affect a business' ability to assess and improve the circularity of their product offerings.

Therefore, significant emissions variations between businesses will emerge due to the raw materials, manufacturing processes, packaging and transport used throughout the supply chain. Additionally, in a traditional retail model, businesses have little say over how customers use and (potentially) dispose of their products.

However, Zero Waste Scotland has supported the innovation and development of more than 60 retail projects that reimagine how businesses provide customers with valuable goods and services.

By localising supply chains, extending the period of interaction with customers, and taking responsibility for a product's end-of-life phase, new retail models are leading the way in transforming the sector for the circular economy.

Scope 1, 2 & 3 emissions – What are they?

Scope 1: Emissions from sources under a business's direct control. For example, fuel use by company vehicles.

Scope 2: Emissions accounted for by purchase and use of energy, e.g., electricity, heating, and cooling.

Scope 3: The many sources of indirect emissions in a business's supply chain, and from subsequent use and disposal of products after they change ownership. This includes material extraction, manufacture of goods, waste management, transport by third parties, and more.

[35] Scottish Government (2022). Getting the Right Change – retail strategy for Scotland. https://www.gov.scot/publications/getting-right-change-retail-strategy-scotland/pages/9/

[36] Scottish Government (2022). Getting the Right Change – retail strategy for Scotland. https://www.gov.scot/publications/getting-right-change-retail-strategy-scotland/pages/9/

[37] The National Retail Federation (2023) The Carbon Footprint of Retail Products https://cdn.nrf.com/sites/default/files/2023-02/The_Carbon_Footprint_of_Retail_Products.pdf

[38] Carbon Trust (n.d.) What are Scope 3 emissions? https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/briefing-what-are-scope-3-emissions

Case study: **Bike for Good**

Bike for Good is a social enterprise based in Glasgow that works to expand and enhance access to cycling. Its services include bike repair and refurbishment, bike maintenance classes, cycling training for people with little or no prior experience, and outreach programmes for marginalised groups (e.g; Afghan women, mental health patients, and low-income communities).[39]

Bike for Good received a development grant and support from Zero Waste Scotland to develop and pilot a bike subscription service, called SWITCH UP. The aim of the project was to build a circular business model around cycling, in which bikes, a repair service and additional support are all provided through the affordable subscription model that increases access to active travel for citizens of Glasgow.

This model means that all bikes remain within the ownership of Bike for Good, keeping them accountable for product safety and longevity. In this way, bikes are used for longer, replaced less often, and when no longer required by one customer are easily moved onto another. Additionally, SWITCH UP can be accessed through a low-income scheme that ensures the service is available to as many people as possible. Bike for Good is now focused on scaling up this project and expanding to other locations throughout Scotland.

[39] Bike for Good, (2022). Our Work in the Community. https://www.bikeforgood.org.uk/blog/our-work-in-the-community-march-2022/

Case study: **Circular Communities Scotland**

Circular Communities Scotland is a membership body of over 250 social enterprises and charities supporting the development of a circular economy in Scotland. Circular Communities Scotland received funding from the CEIF for its Reuse Consortium which consists of nine social enterprises and now supplies seven local authorities and a Housing Association with reused furniture and white goods. The project has many positive impacts on the people it reaches and staff are trained in a range of practical and technical skills. 13,000 households from 2016-2023 were given a greater choice of high-quality furniture, and the social enterprises comprising this network have their own social impact missions (e.g., supporting homeless communities).

Circular Communities Scotland has been challenging social stigmas attached to second-hand goods, which are often a barrier to implementing sustainable and circular programmes. By demonstrating the high quality and durability of furniture that the Circular Communities Scotland provides to local authorities, the group is leading the case against the fiction that 'new is always better'. The point is proven by reports that the 28,161 furniture items reused through the consortium between 2016-2023 diverted 1.2 million kg of waste from landfill, saving 3,200T of CO2eq emissions from polluting the earth's atmosphere.[40]

[40] Consortium Impact Report 2016-2023

"You may think that the Reuse Consortium sells furniture and white goods. We don't. We sell environmental and social responsibility. They are the means, not the end."

Michael Cook, Circular Communities Scotland

Case study: **Beauty Kitchen**

Beauty Kitchen is a pioneer for sustainable beauty products based in Glasgow, with a product range that includes skin, body and hair care using ethical and natural materials. Through engagement with the CEBS service at Zero Waste Scotland, they assessed different circular packaging approaches and developed a circular model by piloting Reposit – a packaging service that supplies QR-coded reusable bottles to high street brands like Marks and Spencer. Customers who buy their products from these vendors are encouraged to return the bottles in-store. From there, they're cleaned for reuse, again and again. This closes the loop by keeping containers in use for longer and reduces the demand for production of new packaging. Zero Waste Scotland also supported Beauty Kitchen by helping to build their business case, and appointing an intern to help research and verify their circular business model. Their high standards for social and environmental care were recognised when Beauty Kitchen became one of Scotland's first B Corp certified companies.

12 Recycling and Reprocessing Services

Recycling continues to play a key role within the circular economy. For those products where there are limited opportunities for reuse, remanufacture or repair, recycling component materials is often the preferable option, and prevents valuable resources ending up in Energy-from-Waste or landfill sites.

Case study: **Hamilton Waste**

Zero Waste Scotland has worked with over 20 projects in the recycling/reprocessing sector. **Hamilton Waste** is a family-owned SME which has grown significantly over the last 20 years, now employing over 100 people within its recycling activities. The company predominantly works in recycling of construction and demolition waste, however, with funding from Zero Waste Scotland it was able to launch a commercial recycling solution for mattresses.

Mattresses are difficult to recycle. The National Bed Federation estimates that only around 24% of mattresses in the UK are recycled with the rest ending up in landfill, placing significant costs on local authorities due to their weight and bulky nature. Hamilton Waste used funding from Zero Waste Scotland to invest in the capital equipment needed to shred the mattresses and prepare the component parts as a range of marketable products. As a result, the company saves 1,500 tonnes per 50,000 mattresses processed from landfill.[42]

[41] National Bed Federation, (2022). End of Life Mattress Report 2022. https://www.bedfed.org.uk/nbf-green/nbf-recycling-reports/

[42] Hamilton Waste- Figure supplied directly by the organisation

[43] Keenan Recycling, Interview by Carly McKinley & Hannah Clark, 26/07/23

Case study: **Keenan Recycling**

Keenan Recycling is the largest food waste collector in the UK, lifting 1 million bins per year. Rather than investing in a conventional anaerobic digestion (AD) plant, of which there are already many in the UK, Keenan used a CEIF grant to introduce an innovative de-packaging process for food waste from commercial outlets, liquidising it, and then selling it on as high-quality biofuel for AD plants.

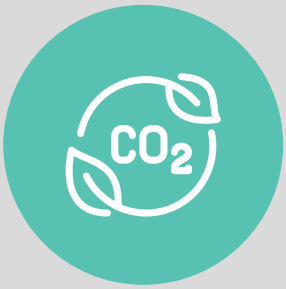
This intervention reduces the contamination rates in digestors, resulting in more efficient energy production and yields high quality fertiliser. In 2021 alone, Keenan processed 60,000 tonnes of organic waste, resulting in a net carbon saving of approximately 34,000 tonnes of CO2 equivalent [43]. Keenan Recycling is making efforts to further close the loop, aiming to use the biofuel produced in AD plants instead of conventional diesel across its fleet by 2024[44].

The funding from Zero Waste Scotland allowed Keenan Recycling to take on two extra staff members at the new plant and has helped to rejuvenate the industrial estate it sits in. As Keenan Recycling is one of the pioneers in food waste management, there is a skills gap in the field which it is tackling by bringing in education and training programmes for staff.

[44] Keenan Recycling, Carly McKinley & Hannah Clark, 26/07/23

Did you know?

1 tonne of food waste in landfill produces approx. **650kgCO2**eq.



While 1 tonne of food waste in an anaerobic digestion (AD) plant only produces **9kgCO2**eq.

The AD process creates two valuable products; **biofuel** which can be used as a transport fuel and energy for the grid, and natural **fertiliser** which can replace synthetic fertilisers in food production.

Case study: **Origin**

In Aberdeen, the circular business, **Origin**, has developed technology to recycle materials and design new products that are made at the source of waste, with no travel required. The team is made up of staff and students from Gray's School of Art who take 'waste' plastics, design new products out of them, break down and shred them, and mould them into new products to sell.

Zero Waste Scotland supported Origin to engage with Orkney Island Council (OIC) to identify ways to reduce waste plastic. Origin is now working with other organisations including Historic Environment Scotland (HES), where the company produces a recycled plastics product range for HES's store at Edinburgh Castle. HES sells a high number of fridge magnets each year which were previously sourced internationally and included significant transport carbon costs. Origin has enabled HES to be a part of the circular solution, by taking plastic from its sites to produce products which now sell in HES shops, demonstrating a true circular loop.

13 The Road Ahead

As showcased in the first section of this report, Scotland has started to develop a circular business ecosystem in which innovative start-ups, social enterprises and large corporations are delivering environmental, economic, and social value through the lens of the circular economy.

These businesses are pioneering the Scottish circular economy, and are a shining example that other businesses can and should follow. To allow others to follow their example, we need to understand the challenges they have faced and deliver essential support for businesses to transition to circular operating models.

The following section outlines some common lessons learned from the businesses that we interviewed, while also drawing attention to the significant challenges that still prevail.

14 Lessons Learned

14.1 Investing in people

One common theme among the businesses interviewed was the value of having a mission-driven ethos and strong organisational values.

Disrupting the linear system, which is so deeply entrenched across all sectors of the economy, requires a lot of hard work, commitment, and loyalty from employees. In many cases it is about winning over hearts and minds and shifting mindsets away from business-as-usual scenarios.

Several of the companies we spoke to explained how the expertise, investments, technology, and infrastructure needed for circular transitions do not appear overnight and instead require businesses to have a long-term vision.

Attracting talent and building effective teams which believe in this vision and feel a strong sense of purpose in their work has been a key component of many companies' success. Most businesses interviewed also explained that developing effective circular business models requires significant technical knowledge. As many of these industries and technologies are new, there is a considerable skills gap. To overcome this, some of the participants in this report are investing in local talent, upskilling, and training them on the job, providing them with the expertise and skillset needed for the future.

Ultimately, it is people who drive change. We need to invest in attracting the best people to power Scotland's transition to a circular economy.

Did you know?

Over 77% of adults across four countries (the United States, UK, France, Germany) would consider a company's culture before applying for a job there, and 79% would consider a company's mission and purpose before applying.[45]

"Everybody in this company has bought into it. You need to get people invested in the idea. It means that people will see it through, take the setbacks, and have enough drive to push it forward."

Brian O'Reilly, EGG Lighting

[45]Reference: Glassdoor (2019) Mission & Culture Survey https://www.glassdoor.co.uk/employers/blog/mission-culture-survey/

14.2 Demonstrating environmental and social credentials

Unlike businesses operating in the linear economy, circular businesses are using their products and services as a vehicle for delivering social and environmental value. For example, Bike for Good, through its subscription model, has been able to reduce inequalities in access to cycling. Through its Bike for All project, it has provided active mobility access to vulnerable/disadvantaged groups including refugees[46] and people experiencing homelessness.

Providing sustainable mobility options has had transformative effects on the opportunities available to these groups, delivering financial savings and significant health benefits. Overall, it has been shown to be a cost-effective solution to a range of societal and sustainability challenges.

Circular businesses are working hard to track and quantify this additional value, from tonnages diverted from landfill to their community engagement efforts and the number of jobs and upskilling opportunities they provide.

While quantifying this value is not a simple task and can often be resource-intensive for SMEs and social enterprises, we repeatedly heard that demonstrating the wider environmental and social value that their businesses bring and communicating it to relevant stakeholders has been vital for positioning their circular products and services.

For example, Circular Communities Scotland's Reuse Consortium risked losing one of the local authorities which it provided with re-use furniture due to price competition. However, by demonstrating the significant environmental and social benefits Circular Communities Scotland also provides through its services, it changed the local authority's mind.

In another competitive market where linear products can outcompete on price, Renewable Parts explained how important it is to showcase the extra value it brings to the economy, which is not always captured in financial terms.

> "The product is not the washing machine or the sofa, the product is the impact report that says we diverted this much from landfill, the carbon equivalent is 'this', you've created these jobs, and you've helped this many families. That's our product. Our means to do it is furniture and white goods."
>
> **Michael Cook, Circular Communities Scotland**

[46] The Herald (2023) Refugee women from Iran and Afghanistan in Glasgow learn to cycle https://www.heraldscotland.com/business_hq/23608621.refugee-women-iran-afghanistan-glasgow-learn-cycle/

14.3 Translating theory into practice

Many circular businesses credited the funding and support from Zero Waste Scotland in allowing them to develop pilots to show proof of concept. This helped them move beyond their innovative ideas to deliver real-world applications and tangible results to customers.

Translating theory into practice and proving that circular business models are viable was pivotal for many businesses as it enabled them to steadily scale-up, win over initially reluctant clients, and attract further investment. In the absence of this initial funding or support, many businesses felt their products and services were seen as too risky for private sector investment and speculated whether their businesses would have ever been able to take off.

MiAlgae explained how instrumental the initial investment from Zero Waste Scotland was in allowing it to launch its commercial demonstrator.

This was a fundamental step in convincing distilleries that MiAlgae's process was commercially viable and technologically sound, helping to de-risk the project for private investors.

Similarly, Circular Communities Scotland discussed how running pilot projects with local authorities has been incredibly important in overcoming hesitancy regarding reuse products. Delivering first-hand evidence to local authorities on the benefits of employing a reuse strategy allowed the group to win over clients. In a similar light, many businesses highlighted how the business support and funding enabled them to develop unique ideas. This often meant there were no direct competitors offering the same product/service within their respective markets, providing significant commercial advantages.

"Having the commercial demonstrator allows us to get buy-in from both ends of the value chain."

Johann Partridge, MiAlgae

14.4 Working together

Collaboration is critical to driving circular transformation. Many businesses pointed out that for circular initiatives to succeed, there is a need for systemic changes to existing design, manufacturing, and procurement practices, which necessitates sharing knowledge and working with other businesses across the value chain.

MiAlgae has fostered strong partnerships with whisky manufacturers across Scotland. To efficiently harvest by-products from distilleries and feed them directly into MiAlgae's processes, there are plans to construct bioeconomy plants directly on-site at whisky distilleries to create the industrial collaboration needed for its technology to scale up.

In March 2023, Renewable Parts launched an initiative in collaboration with the University of Strathclyde and SSE Renewables, aiming to propel the development of a circular economy within the wind sector. The initiative has garnered significant interest, with nearly 40 businesses already signing up or expressing interest. This growing momentum is attracting the attention of the wind industry, encouraging major OEMs (Original Equipment Manufacturers) to consider integrating circularity principles into their supply chains[47].

Similarly, Circular Communities Scotland noted how the scale of national procurement frameworks means that collaboration is necessary and that it was only by coming together as a consortium that they were able to break into this market.

Given the infancy of the circular economy in many sectors, the companies we interviewed re-affirmed the need to learn from one another and find opportunities to collaborate, instead of acting as rivals. Through collaboration, all parties can benefit and advance more widespread adoption of circularity within their sectors.

For Tennent's, the collaboration with Zero Waste Scotland and education on circularity that came from it helped to unite distinct domains of the business around the project. This fostered a breakdown of siloed thinking which is often commonplace in organisations of this size. Many of the businesses we spoke with were grateful for the networking opportunities that Zero Waste Scotland provides, making connections between organisations across Scotland and internationally which can aid each other on their circular journey. Several businesses suggested that formalising this network and creating a forum space to discuss challenges and new project ideas in a circular hub would unleash further benefits and opportunities for collaboration.

[47] Renewable Parts, Interview by Calum Marshall & Hedda Roberts, 27/07/23

"There is a growing recognition that the only way any of us can improve is through collaboration."

George Kyle, Tennent's

14.5 Flexibility and adaptability

External shocks like the Covid-19 pandemic and Russia's invasion of Ukraine have undoubtedly presented major challenges to many circular businesses. Due to the total standstill in many sectors of the economy during lockdowns, a lot of circular businesses suffered deeply. However, some of the businesses interviewed in this report highlighted their ability to adapt and take advantage of the disruption to conventional systems.

For example, the supply chain issues that were unleashed by these events have pushed larger companies to explore concepts like localisation and onshoring[48]. As a result, products which are produced through local supply chains, using circular strategies such as re-use, re-manufacturing or by utilising by-products, are becoming increasingly attractive. An interesting example comes from Tennent's, where the investment in carbon capture capability meant that it had a resilient supply at a time when there were shortages of CO2 across Europe and prices were rapidly rising.

The Covid-19 pandemic also proved to be a catalyst for businesses to rethink their business models, including their initial product offering and supply chains.

Move On Wood Recycling previously sourced waste wood and pallets from the events and hospitality sector. However, during the pandemic this supply chain almost entirely dried up, encouraging them to look for alternative sources of waste wood. Other companies discussed how the initial investment from Zero Waste Scotland was particularly beneficial in preventing them from taking on debts to launch their projects, allowing them to get through the difficult Covid-19 period.

[48] Tennent's, interview by Calum Marshall & Carly McKinley, 31/07/23

15 Challenges

While the businesses we interviewed are helping to address environmental challenges, and delivering economic and social value for Scotland, it is important to highlight that implementing circular initiatives in an environment which is dominated by linear thinking also presents many challenges.

15.1 Polycrisis

Polycrisis is a term recently coined by the World Economic Forum to describe the cascading and connected crises that have befallen the global economy in recent years, with the overall impacts exceeding the sum of each part.[49] From the Covid-19 pandemic which sent shockwaves through global supply chains, to the war in Ukraine which caused energy and food prices to skyrocket, and political and economic disruption within the UK.

Rising costs across the economy present a significant challenge for many circular businesses, particularly SMEs or those in early stages of product development without the capital needed to withstand shocks. Energy price increases are particularly challenging, leading into significant increases in operational costs. A core element of recycling businesses like Keenan Recycling involves driving trucks to collect and transport food waste to processing plants. Fuel price rises have presented serious challenges for the business.

Such cost increases make it even more difficult for circular products to remain price competitive against linear alternatives. Circular Communities Scotland explained how the local authorities which the Reuse Consortium supplies with re-used furniture are incredibly price-sensitive and the Consortium is therefore unable to increase prices in-line with cost rises.

Businesses like Keenan Recycling which are locked into long-term contracts with local authorities, are equally unable to pass price rises along to the customer and must absorb the costs to the detriment of their bottom line.

The fallout from Brexit is also presenting challenges, particularly in the form of staff shortages. Businesses that were interviewed for this report said that for many key roles such as drivers or machine operators, the only way to attract talent is to increase wages but in a competitive environment, retaining staff is difficult and costs are spiralling. For other companies, Brexit has caused supply chain disruptions. Circular Communities Scotland's Reuse Consortium social enterprises previously sourced second-hand stock for furniture items from European markets but it is no longer economically viable due to new trading restrictions.

Whilst these macro-economic pressures are placing challenges on circular businesses' day-to-day operations, they also help to reaffirm the need for a transition to a circular economy. Embracing circularity can help businesses safeguard against these external shocks through localised supply chains and cost-savings through resource efficiency.

[49] World Economic Forum (2023), Global Risk Report 2023 https://www.weforum.org/reports/global-risks-report-2023/digest

15.2 Resource Constraints

In an environment of notable inflation and economic slowdown, SMEs and social enterprises are finding it difficult to find the time and financial resources to implement their circular projects. For many of these organisations, headcount is tight and so even when circular solutions are available, getting started can be resource intensive and time consuming. For this reason, the support and technical advice that Zero Waste Scotland offers has been invaluable in enabling smaller businesses to develop expertise or take on the extra staff needed to initiate projects.

KR Cladding discussed the transformative power of having a single member of staff devoted to the cladding re-purposing project. Similarly, Circular Communities Scotland discussed the challenges it had in signing up for Scotland Excel's National Performance Framework, largely due to the labour hours that need to be devoted to the engagement and management of the contract. It was only because of funding from the CEIF and the innovative consortium model that small social enterprises were able to supply products through the Framework.

15.3 Shifting mindsets

A common challenge faced by enterprises was the stigma often felt against circular products. In many contexts, re-used or refurbished products are presumed to be inferior or low-quality. Overcoming these prejudices and demonstrating their benefits to customers has been a particular challenge for circular businesses.

Circular Communities Scotland spoke of the challenges it faced when trying to encourage local authorities to procure re-used furniture, while KR Cladding spoke of contractors' reluctance to purchase re-used insulation board due to misguided concerns around product assurance and quality. Similar difficulties were faced by Renewable Parts in the wind sector, where companies have shown misplaced reliability concerns about refurbished products. As a result, gaining trust in circular products by offering warranties or quality guarantees is particularly important.

Many businesses have also struggled with making their product price competitive. There are often significant costs, particularly centred around labour, involved in preparing items for re-use and remanufacture.

Move On Wood Recycling spoke of its difficulties in pricing hand-made upcycled wooden furniture products in an environment where low quality alternatives can be purchased at such low prices. Again, communicating the wider benefits associated with the product was pivotal in differentiating its offering from competitors.

For KR Cladding, the lack of standardisation in repurposed products and difficulties guaranteeing supply availability has been a challenge. Unlike manufactured products, there are many variables and variations in supply for repurposed products which makes stock pricing difficult. KR Cladding learned early on that to meet customer expectations and compete against new products, standardisation of inventory was important.

Zero Waste Scotland provided support to Scottish Water to develop a virtual training module on circular economy principles and Scottish Water's circular economy strategy. The training helps to make sure colleagues are upskilled and equipped with a consistent understanding of what the circular economy means to Scottish Water.

Overall, lack of awareness of the circular economy can make it difficult for companies to promote their products to mainstream customers.

A cultural shift away from linear thinking and towards a widespread understanding of the benefits of re-used, repaired, or refurbished products is urgently needed.

"The transformation behind the circular economy requires different thinking and a different mindset."

Grant Hemple, Scottish Water

16 Key Recommendations

16.1 Investment for scaling:

Given the challenges highlighted previously, businesses are operating in volatile and uncertain environments [50]. Circular businesses also face unique risks and uncertainties as they are trying to commercialise and scale-up innovative circular initiatives.

State funding, in the form of CEIF has been essential for the businesses in this report due to the perceived higher risk of circular innovations, which can make it difficult to leverage private funding early on. Initial funding from governments helps de-risk innovative projects, opening the doors to private investment [51]. The initial funding to advance beyond proof of concept and create confidence in a new product is pivotal for attracting private investment and the commercialisation of many circular businesses.

Further investment is needed to accelerate growth of Scottish circular businesses, allowing them to scale and compete with traditional linear businesses.

As an example, there is a significant opportunity for companies like Renewable Parts to create a new remanufacturing industry in Scotland and the Scottish Government has already demonstrated its commitment to realising a circular economy in the wind sector in recent policy statements [51].

However, such policy ambitions need to be met with continued investment and support to establish circular businesses as viable and competitive players in the global marketplace.

There are also opportunities for private sector finance to contribute to Scotland's circular ecosystem. The businesses supported through the CEIF were able to leverage a further £35m from private sources, however, awareness of the circular economy remains low across the investment community. As the finance sector regulatory environment becomes more aligned with countries net zero ambitions, for example through the EU Taxonomy, Scotland's circular businesses offer promising opportunities for private investors.

"Investment is missing, there is a gap. Under CEIF (the Circular Economy Investment Fund) it was there, it served a purpose, in our case it was highly successful, and we would like to see it return."

James Barry, Renewable Parts

[50] Mazzucato & Perez (2022) Redirecting Growth: Inclusive, sustainable and innovation-led https://www.ucl.ac.uk/bartlett/public-purpose/sites/bartlett_public_purpose/files/mazzucato_perez_2022_redirecting_growth-inclusive_sustainable_and_innovation-led.pdf

[51] Scottish Government (2022) Onshore Wind Policy Statement 2022 https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2022/12/onshore-wind-policy-statement-2022/documents/onshore-wind-policy-statement-2022/onshore-wind-policy-statement-2022/govscot%3Adocument/onshore-wind-policy-statement-2022.pdf

16.2 Addressing the Skills Gap

If Scotland wants to be a global leader in the circular economy, we need to prioritise investments in skills and education. Building a circular economy will have an impact on current roles, while other existing roles will be transformed. It will also create demand for new roles and ways of working as highlighted in the case studies explored in this report. To develop the required skillset for new and future roles the circular economy must be embedded into all national skills planning, education, and lifelong learning systems. As businesses transition and industry shifts the workforce needs to be adaptable and transferable skills need to be recognised and applied in new work contexts, for example moving from applying skills in energy construction to decommissioning. Meanwhile it is important to recognise the importance of existing legacy skills which should be harnessed. There needs to be greater recognition and awareness of the significant job opportunities created in turning waste streams into value and make this emerging sector a mainstream career choice. Fundamentally the circle economy challenges the status quo and skills in leadership, innovation, collaboration, and system thinking will be key to this transition.

The importance of the circular economy is being recognised across current skills planning. For example the Climate Emergency Skills Action Plan (CESAP) is fundamental to ensuring positive collaboration across government, industry, and education in delivering a workforce fit for the future. The Scottish Government is currently updating CESAP, this could be an opportunity to bring greater recognition to the circular economy and the knowledge and skills needed to deliver it.

In turn, embedding circular thinking across educational institutions will help to bring about the much-needed mindset-shift away from linear thinking, and will play a vital role in raising wider awareness among citizens about the benefits of a circular economy and encourage more sustainable consumer behaviours.[53]

[53] Nayar A. (2013) Importance of Education for Sustainable Development. WWF https://wwf.panda.org/wwf_news/?210950/Importance-of-Education-for-Sustainable-Development

16.3 Market Making

Companies also expressed the need for government to take a more active role in shaping markets so that a circular economy can flourish.

Alongside the investment stimulus and upskilling efforts, there is a role for government to incentivise businesses and consumers via policy, legislation and public procurement strategies. Public sector spending in Scotland amounts to about £11billion (10% of the Scottish GDP) annually [54]. Harnessing the purchasing power of the public sector and integrating circular principles into procurement frameworks supports innovation and has the potential to change market demand for circular products and services. Meanwhile, as expressed in the current programme for government [55], mission orientated policy making can also serve as an effective way to provide policy direction, foster collaboration and induce investment [56].

Keenan Recycling demonstrated how the Scottish Government's decision to make it mandatory for all businesses and local authorities to recycle food waste created a new market for food recycling and the right conditions for the business offering to flourish. Other circular businesses are looking to governments to send similar market signals across their sectors, using policy to cultivate the circular economy.

MiAlgae highlighted how tighter regulation and enforcement on what companies can do with their waste products would open significant opportunities for the bioeconomy sector to create valuable products while preventing waste. Many companies stressed that circular businesses cannot thrive without policy intervention and Net Zero targets will not be met otherwise.

[54] Zero Waste Scotland (2023) Circular Procurement. https://www.zerowastescotland.org.uk/resources/circular-procurement

[55] Scottish Government (2023) Programme for Government 2023 to 2024 https://www.gov.scot/programme-for-government/

[56] Mazzucato & Perez (2022) Redirecting Growth: Inclusive, sustainable and innovation-led https://www.ucl.ac.uk/bartlett/public-purpose/sites/bartlett_public_purpose/files/mazzucato_perez_2022_redirecting_growth-inclusive_sustainable_and_innovation-led.pdf

Given the challenging macro-economic climate highlighted previously, the interviewees of this report also emphasised the need for governments to create certainty and trust in new markets by enforcing existing policies. It is particularly important after a policy has been announced that U-turns and delays are avoided whenever possible, as they can be disastrous for investment and create widespread uncertainty. Hamilton Waste outlined that regulating to further restrict the residual waste that can be sent to landfill, building on the biodegradable ban to landfill from 2025, along with ensuring landfill tax keeps up with inflation, would continue the reduction of material being sent to landfill.

17 Conclusion

Zero Waste Scotland has played a pivotal role in the early stages of development and transformation of businesses driving Scotland's circular economy.

Zero Waste Scotland has played a pivotal role in the early stages of development and transformation of businesses driving Scotland's circular economy.

The investment fund and tailored business support offered to a wide variety of projects has proven vital to fostering circular innovations at small and large scales, and in all sectors of the economy. This report demonstrates the impact of Zero Waste Scotland's contributions to circular businesses across the Bioeconomy, Built Environment, Energy, Manufacturing, Retail, and Recycling sectors. The study captured a vast array of projects with meaningful environmental, social, and economic impacts that showcase the very best of what a circular economy has to offer Scotland and the world.

The diversity in business models and product offerings also highlights the ability of Zero Waste Scotland to customise its services and funding to the needs of the full spectrum of sustainable business requirements. By offering this service, Zero Waste Scotland encourages increasing numbers of innovators and entrepreneurs to use their skills in service of socio-ecological good.

Nonetheless, it is clear from this report that businesses still face significant challenges and cannot drive the transition to a circular economy alone. A flourishing business ecosystem is needed in which suppliers, distributors, customers, investors and government agencies collaborate and support each other to pioneer circular products and services.

Over the last decade, through our business support, Zero Waste Scotland has laid strong foundations for the development of this circular ecosystem in Scotland. To build on those foundations, collaboration with the Scottish Government and local authorities is essential to create the conditions for circular business to flourish.

Zero Waste Scotland will continue the vital work of supporting businesses through the sustainability challenges they face. We will do that by offering support and expert advice while building the networks and collaborative spaces needed for the circular ecosystem to thrive.

Through meaningful collaboration, we can deliver on our shared mission of supporting businesses to eliminate waste, create value and drive our transition to a circular economy in Scotland.

18 Appendix A

Overview of business case studies included in the report (companies that were interviewed are highlighted in blue).

Business Name	Business Type	Sector	Type of support received from Zero Waste Scotland
Hamilton Waste	SME	Recycling/Repurposing	CEBS, CEIF
Circular Communities Scotland	Social Enterprise	Circular Retail	CEIF
MiAlgae	SME	Bioeconomy	CEBS, CEIF
Renewable Parts	SME	Energy	CEBS, CEIF
Move On	Social Enterprise	Built Environment	CEIF
Keenan Recycling	SME	Recycling/Repurposing	CEIF
Bike for Good	Social Enterprise	Circular Retail	CEBS, CEDG
KR Cladding	SME	Built Environment	CEBS, CEIF, CEDG
EGG Lighting	SME	Manufactured Goods	CEBS, CEDG
Tennent's	Large Business	Bioeconomy	CEBS
Scottish Water	Large Business	Energy	CEBS
Balfour Beatty	Large Business	Built Environment	CEBS
IndiNature	SME	Manufactured Goods	CEBS, CEIF, CEDG
ReBlade	SME	Energy	CEBS, CEDG
Norkram	SME	Energy	CEIF
ILM Highland	SME	Manufactured Goods	CEIF
Beauty Kitchen	SME	Circular Retail	CEBS, CEDG
Origin	SME	Recycling/Repurposing	CEBS

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