Making things last

Consultation on creating a more circular economy in Scotland

August 2015

The Scottish Government
Riaghaltas na h-Alba

FOREWORD

I am delighted to be consulting on proposals for a more circular economy in Scotland.

In a world of finite resources, where global population and consumption growth are driving increased volatility and vulnerability in the supply of raw materials, the circular economy offers a new and exciting perspective.

It is an approach that shifts the focus from being efficient in the use of materials to the bigger gains from reusing those materials across the economy. It supports the aims of Scotland's Economic Strategy, particularly with regard to innovation and more efficient resource use, by offering new ways to create value, decoupled from the consumption of natural resources. Put simply, the circular economy is about keeping materials flowing in the economy at as high a value as possible for as long as possible.

For me, the attraction of a more circular approach to our economy is that it tackles a number of economic, environmental, social and moral imperatives.

And so I believe a more circular economy offers a compelling opportunity for Scotland. The options can seem endless, and the concept can be daunting. But at the end of the day it comes down to making things last. Whether that be designing complex products to enable remanufacture, or quite simply empowering people to repair household items instead of throwing them away, the concept makes sense for business, industry, the public sector and individuals.

This consultation paper is the first step in preparing a circular economy strategy for Scotland. It covers all the elements – or "loops" – of a circular economy, and focuses on the priorities for Scotland in the next decade. In some areas, we are extending our ambition further along an existing path; in others, thinking is at an earlier stage.

Throughout, this document is clear about the actions that we propose to take the opportunities, and the big ideas we want to explore further. It is aimed primarily at those who participate in the activities required for a more circular economy every day: business, local authorities, and the waste management industry. It is however the choices of the public that ultimately determine success.

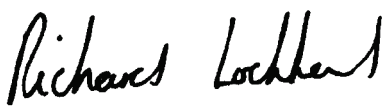
The Scottish Government and its partners are proud to be at the forefront of action in managing our resources more effectively.

- our Zero Waste Plan, published in 2010, recognised waste as a resource and set out some of the most ambitious national recycling targets globally, and was a forerunner in articulating an ambition for a zero waste society;
- our Safeguarding Scotland's Resources programme in 2013 sought to drive new levels of resource efficiency within our economy, and introduced our flagship Resource Efficient Scotland service, helping businesses be more competitive by using energy, water and materials more efficiently;
- and to reflect the integral role that material use plays in our economy, Scotland's Economic Strategy now recognises the potential benefits of a more circular approach to business, individuals and communities.

We have taken that ambition and turned it into real, tangible action. Our Scottish Institute for Remanufacture is the first of its kind in Europe and one of only four in the world. Our Scottish Materials Brokerage Service is an innovative approach to achieve better value for recyclable materials, and reduce risk from price volatility. Zero Waste Scotland was among the first in the world to develop a carbon metric for waste materials and explore the impacts of a more circular economy on carbon emissions, and Scotland's proposed household recycling charter is a unique approach within the UK to working with local government to improve recycling collections.

Our proposals have been informed by a period of debate in Scotland in the first half of 2015. Together with our partner agencies, we have published a number of reports for discussion, organised workshops and events with groups as diverse as biotechnology industry bodies and Young Scot, and most recently our social media campaign #makethingslast. I want our proposals to contribute to the EU's consideration of its own circular economy plans.

I would like your views to help us shape Scotland's steps towards a more circular economy. A circular economy is an economic, environmental and moral necessity. It will help conserve our finite resources, help support jobs in our communities, improve our quality of life, and it just makes good sense.



RICHARD LOCHHEAD

EXECUTIVE SUMMARY

This consultation explores the priorities for building a more circular economy – where products and materials are kept in high value use for as long as possible. It builds on Scotland's progress in the zero waste and resource efficiency agendas, with a new focus on a much broader set of business and industry opportunities through reduced reliance on virgin materials.

This matters because of the significant potential benefits:

- to the economy – improving productivity, opening up new markets and improving resilience;
- to the environment – cutting waste and carbon emissions; and
- to communities – more, lower cost options to access the goods we need.

Realising these benefits will mean rethinking our approach to how goods are supplied, how they are used, and what happens at the end of products' lifetimes. Our consultation sets out our ambition, and seeks views on potential actions in key areas.

Design

Our ambition is for more products to be designed for longer lifetimes, ready to be disassembled, repaired and eventually recycled; with more companies keeping hold of valuable products and components through leasing, servicing, repair and re-sale.

We are seeking views on the scope for a Scottish centre of expertise on circular design, alongside proposed actions on education, packaging design and a support service to help businesses adopt circular economy approaches.

Reuse

Our ambition is for second hand goods to become a good value, mainstream, option - helping reuse-businesses and community organisations to thrive. And we want our major industrial sectors to learn from best practice to optimise the value of used equipment and infrastructure.

We are consulting on proposals to build on the *Revolve* standard for reuse organisations; clarify the regulation of reuse activities; improve the capture of items for reuse; and explore reuse opportunities in key industrial sectors, notably in the oil and gas industry.

Repair

We want to empower Scotland's repair sector to grow, both business and community organisations. For an increasing range of items, we want repair to be the first choice when they develop a fault on the basis of quality, reliability and value.

We are consulting on proposals for a comprehensive repair-finding service or network to make it easy to find where items can be repaired; alongside actions to expand repair skills in communities; increase the availability of technical manuals for products; and to engage more companies in offering repair services for the products they make or sell.

Remanufacture

We want Scotland's strategically important remanufacturing sector to fulfil its potential for growth. We are therefore proposing to enhance support to companies in

relation to remanufacturing; alongside actions around recognition of remanufactured products; improving the return of end of life products to remanufacturers; and the potential for remanufactured products to feature more in public procurement.

Recycling
We want recycling to be routine in every business and household; with more consistent local services; more packaging designed for recyclability, and every household having access to a food waste service. And we want to see higher quality recyclate, to maximise the economic benefits.

We are proposing a number of actions focused on improving recycling rates including collaboration with the waste and packaging industries; reviewing the exemption to the requirement for food waste collections in rural areas; and examining the issues raised in the call for evidence on a deposit return system for Scotland. On the issue of quality, we will examine how best to minimise contamination in recycling collections. On re-processing, we will look at mechanisms to support investment; and will investigate opportunities in the chemicals sector, construction and agricultural plastics.

We also intend to explore the potential for schemes to involve producers in increasing recycling and reuse of tyres, furniture and bed mattresses.

Recovering value from biological resources
We want Scotland to be an international leader in the efficient use of biological resources. We are proposing a number of actions to maximise the value from biological resources which would otherwise end up in lower value uses or as waste.

Communications
We want the behaviours that support a circular economy to be seen as commonplace in Scotland – ending our 'throwaway culture' and allowing people and businesses to see the true value in the products and materials they use. We are proposing actions to broaden understanding and encourage change. We also intend to build on engagement with businesses through a new 'Scottish Circular Economy Network', a network of SMEs and other businesses to help achieve a more circular economy, through collaboration and business-led initiatives.

Skills for a circular economy
We want to embed the development of new skills and thinking in the next generation of designers, business leaders and innovators. We are proposing actions to help make sure Scotland's workforce has the right skills to take advantage of opportunities from a more circular economy.

Measuring progress
We want to improve our range of indicators to better understand how products and materials flow through our economy, both to track progress and to identify opportunities for action. As part of this, we are proposing to make the use of the electronic 'edoc' system mandatory for movements of waste in Scotland.

CONTENTS

CHAPTER 1: INTRODUCTION

1.a - About this Document

1. This consultation is a key milestone in the process of understanding the scale and nature of circular opportunities for Scotland, and re-aligning policy to establish the right conditions to enable businesses and communities to grasp the opportunities.

2. It builds on the progress that has been made on the zero waste and resource efficiency agenda, but scopes out ambition and action into a much broader set of business and industry opportunities.

3. At this stage, the document is not a strategy, but rather a set of proposals for consultation, discussion and debate. The conclusions from this process will be brought together with on-going actions from the Zero Waste Plan and Safeguarding Scotland's Resources to create Scotland's first circular economy strategy.

4. A more circular economy is a long term ambition, given the complexity of existing supply chains, the changes in approach required by a range of players, and the as yet unknown technological and research developments that lie ahead. It is however important to take steps to lead the direction of travel and support the journey.

5. The material in this document has been developed from a programme of evidence programme undertaken by the Scottish Government, Zero Waste Scotland, Scottish Enterprise, SEPA and Highland and Islands Enterprise. It also incorporates issues that have emerged through our on-going relationships with stakeholders and delivery partners.

6. From January to June 2015 we worked to involve more people in discussions about a circular economy. We published reports with evidence relevant to particular industry sectors; we held workshops including with Industry Leadership Groups; we worked with Young Scot to develop a survey and weekend workshop; and we launched the #MakeThingsLast campaign.

7. Further evidence will certainly be required, and any specific proposals would be subject to the usual range of impact assessments associated with policymaking. But for now we are identifying our priority areas for Scotland, articulating our aspirations and proposing a number of actions to take us towards those goals.

8. We have structured Chapter 3 – 'Our areas for action' into the different elements of a more circular economy, for ease of navigation. The nature of the subject matter however, means that there is considerable interplay between each element. Likewise, we have not set out all the relevant background information such as rules, regulations and reports, with which most readers will be familiar.

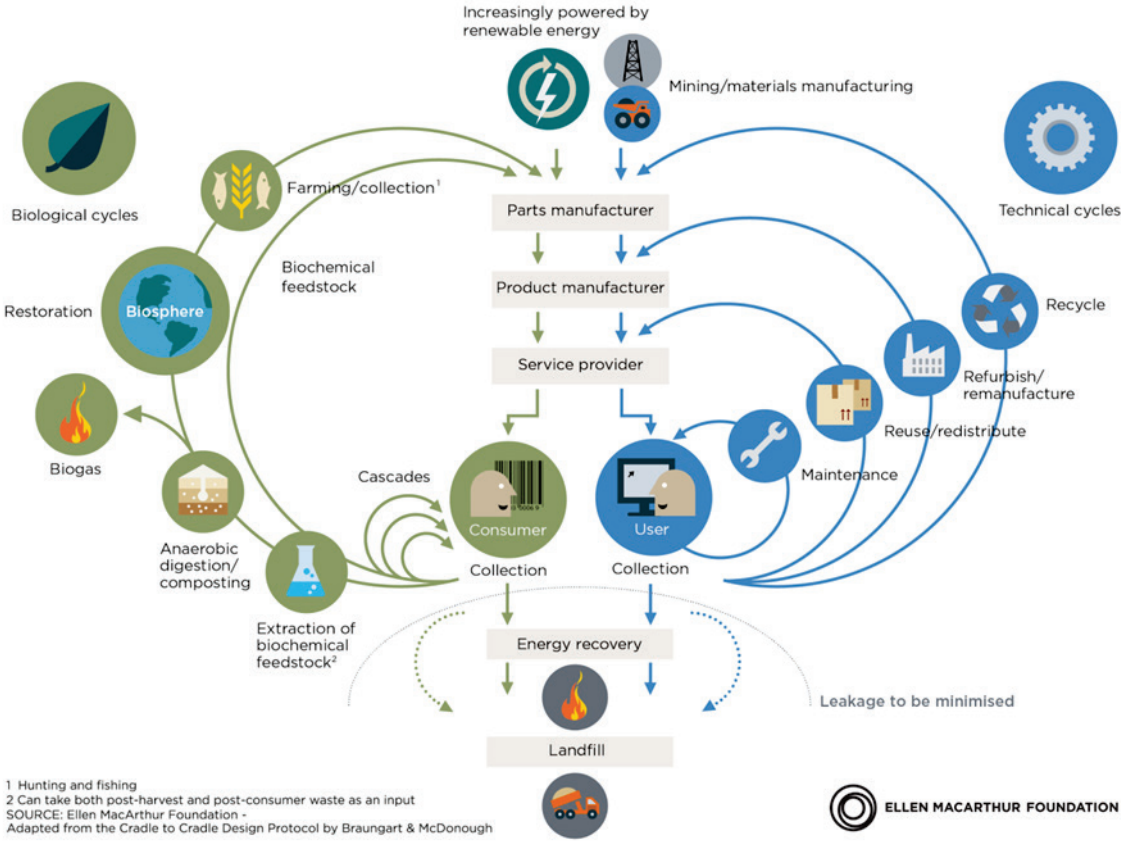
9. Throughout this document, we invite you consider a number of key questions:
   - Do you agree with our aspirations for a more circular economy?
   - What other opportunities are there for transformational change?
   - Do you agree with the proposed actions for further exploration?
   - What other actions would help unlock opportunities?

1.b - The case for a circular economy

10. In our existing economy, we "*take, make and dispose*". We take resources from the ground, air and water; we make them into products and structures; then we dispose of them.

11. In a circular economy, systems are designed to make better use of valuable products and materials - changing the way they are produced and managed to have less impact on finite natural resources, and create greater economic benefit. The following diagram from the Ellen MacArthur Foundation sets out the concept.

Figure 1 – Circular economy – An industrial system that is restorative by design



12. The left hand side of the diagram represents the flow of biological materials in a circular economy. The right hand side represents the flow of materials and products such as metals, plastics etc. Similar principles apply to both sides of the diagram, and there are multiple interactions between them.

13. The most desirable actions are in the smallest, inner loops, such as maintenance and reuse. Value is lost as the loops become larger and when materials "leak" from the system. A more circular economy aims to protect that value by keeping products and materials circulating at the highest value for the longest time; with a systematic approach to designing out negative impacts such as waste.

14. In this context, landfill and energy recovered from waste by thermal treatment are referred to as ways to manage "leakage" of value from the economy. These are options to be minimised (in the case of thermal treatment) and avoided (in the case of landfill). The aim is to retain valuable materials in the "loops" and avoid losing those materials to the less valuable options of thermal treatment or landfill.

15. The circular economy presents an exciting vision for how businesses and nations can operate in the 21st century. It is a vision increasingly supported by leading economies, global businesses and by the EU, World Economic Forum and UN agencies. The Scottish Government and our partners share this vision.

16. There are many reasons why a more circular economy presents a compelling proposition:

- mitigating risk to business;
- retaining value in our economy;
- creating jobs and growth;
- tackling climate change and preserving natural capital; and
- building on Scotland's advantages.

Mitigating risk to business

17. Analysis of global commodity price trends by McKinsey & Co[1] has shown that price reductions achieved for all commodities through the 20th Century due to improved efficiency and productivity were reversed in the first decade of the 21st Century. While commodity prices have fallen significantly in recent months, there is clear potential for much greater uncertainty and volatility of resource prices going forward – a significant issue for businesses, especially those which rely on the most 'at risk' materials.

18. Several studies[2] have highlighted which materials are most critical within different economic contexts. For Scotland, they include phosphorus (important for agriculture) and several metals used in low carbon technologies, such as lithium, used in batteries, and neodymium, used in wind turbines. Having a greater ability to harvest these materials in Scotland, for instance from unwanted electrical goods, will help to mitigate supply risks.

Retaining value

19. A circular economy redesigns systems so that the value of materials can be retained within cycles, maximising the economic benefits. This is illustrated through work carried out by the Green Alliance (see Figure 2), which shows that if items are reused rather than recycled, more of the manufactured value is maintained.

- An average car, when sold for reuse near the end of its life can be worth **£475**. When it is disassembled for spare parts, it is worth **£421**. When it is broken down and recycled for scrap, the value of the parts drops to **£134**.
- A modern smartphone, when reused, is worth **£290**, or **£170** for spare parts, compared to just **72p** if the materials within it were to be recycled.
- A tonne of T-shirts is worth over **£2,500** if sold, and **£410** if used for mixed rags, but the material value for recycling is only **£121**.

[1] Towards the Circular Economy (Vol 1), Ellen Macarthur Foundation, 2012: http://www.ellenmacarthurfoundation.org/business/reports/ce2012

[2] *Raw Materials Critical to the Scottish Economy*, Scottish Environment Protection Agency (SEPA) and SNIFFER 2011; *Priority Resource Streams - Identifying Opportunities to Develop the Recycling Infrastructure in Scotland*, Zero Waste Scotland, June 2012; and *Critical Materials, Examining the Materials that are Critical to our Sectors and Economy*, Scottish Enterprise 2014

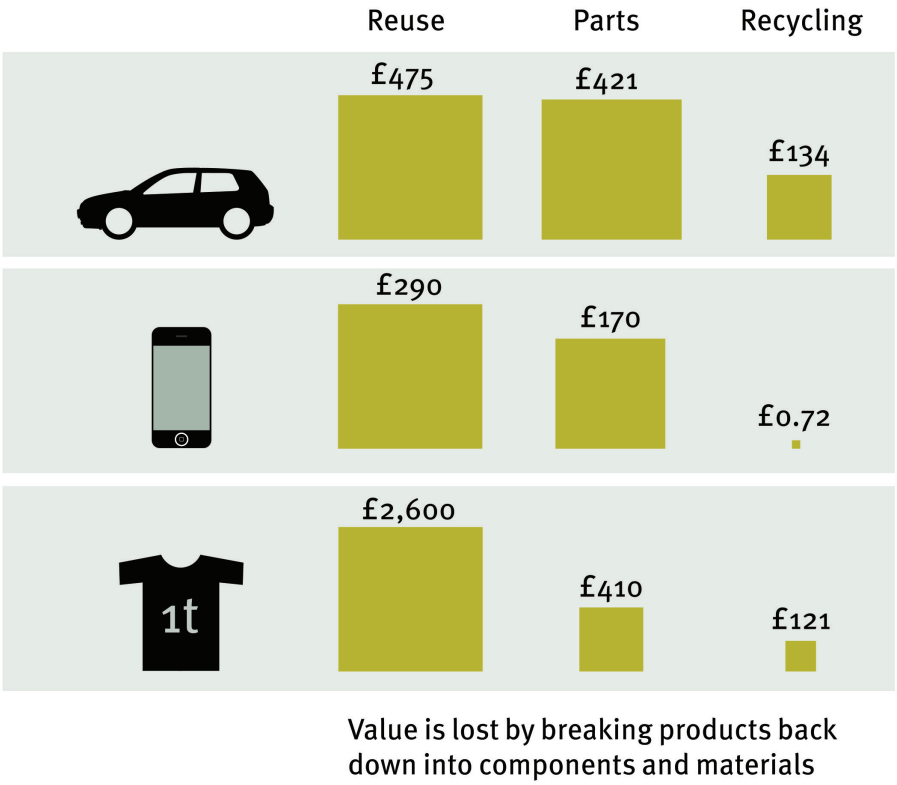


Figure 2 – Value of reuse versus other approaches

Jobs and growth

20. There is a growing body of evidence on the scale of the economic opportunity from a more circular economy. Analysis by the Ellen MacArthur Foundation and McKinsey suggests there could be a trillion dollar opportunity globally, including:

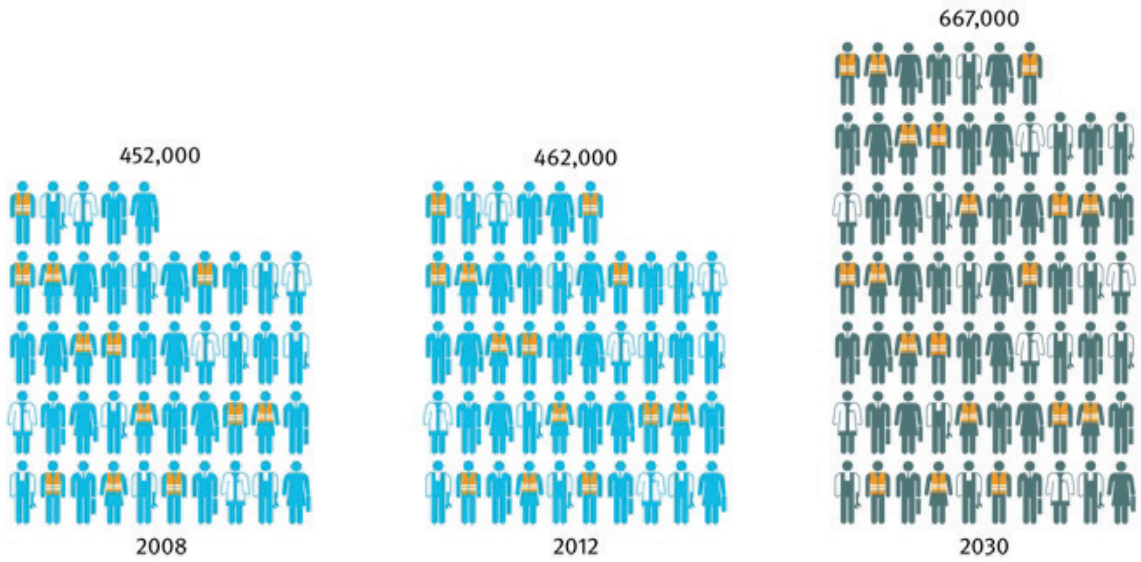
- net savings of between £245-400 billion in the cost of materials (14-23% of total input costs) per year across the EU from a more circular approach to items such as motor vehicles, electrical machinery and furniture; and
- net savings of up to £450 billion in the cost of materials (around 20% of total input costs) per year globally from a more circular approach to items such as clothing, food, beverages and other consumer goods[3].

21. Other nations are investigating the opportunities. Analysis in Wales[4] suggests potential material cost savings of up to £2 billion a year. In the Netherlands[5] an estimated 54,000 jobs could be created from adopting a more circular approach in a range of industry sectors.

22. The nature of employment in a circular economy is also relevant; many key activities such as repair and maintenance are by their nature labour-intensive and closer to the point of consumption. Research carried out by WRAP and the Green Alliance (see Figure 3) suggests significant employment opportunities in the UK from the growth of these activities based on current trends, i.e. without accounting for any potential new policy interventions to stimulate their uptake[6].

[3] Towards the Circular Economy (Vol 1 and 3), Ellen MacArthur Foundation, 2012 and 2014: http://www.ellenmacarthurfoundation.org/business/reports
[4] Wales and the Circular Economy, Favourable system conditions and economic opportunities, Ellen MacArthur Foundation, WRAP, 2014: http://www.wrap.org.uk/sites/files/wrap/Wales_and_the_Circular_Economy_Final_Report.pdf
[5] Opportunities for a circular economy in the Netherlands, Netherlands Organisation for Applied Scientific Research on behalf of the Netherlands Ministry of Infrastructure and the Environment http://www.institut-economie-circulaire.fr/attachment/447647/
[6] Employment and the circular economy, Infographic produced by the Green Alliance for the Waste & Resources Action Programme http://www.green-alliance.org.uk/resources/Employment%20and%20the%20circular%20economy_infographic.pdf

Figure 3 – Actual UK Employment in circular economy activity in 2008 and 2012 and potential employment to 2030, based on current path of development



Tackling climate change and preserving natural capital

23. As well as the economic drivers for a more circular approach, there are also significant environmental benefits, ranging from reducing greenhouse gas (GHG) emissions, relieving pressure on water resources, virgin materials and habitats, and limiting pollution of air, soils and watercourses.

24. Since we import many of our goods and materials, benefits are most evident when we focus on the impact of what we consume, not just what we produce. Zero Waste Scotland has published research which suggests a potential greenhouse gas saving of around 11 million tonnes of Scottish territorial emissions per annum by 2050 from moving to a circular economy, compared to business as usual[7].

Building on Scotland's advantages

25. The evidence we have accumulated on specific opportunities to develop a more circular economy in Scotland identifies suggest we are in a strong position to move quickly. There are advantages in the make-up of our industries, in our scale and in our connectedness.

26. The *Circular Economy Scotland* report, commissioned by Zero Waste Scotland and produced by the Green Alliance in partnership with the Scottish Council for Development and Industry (SCDI) also highlights potential interventions in the oil and gas sector and the food and drink sector[8].

27. This consultation includes proposals to address the opportunities identified in our research in areas such as design and remanufacturing.

[7] The Carbon Impacts of the Circular Economy, Zero Waste Scotland (2015): http://www.zerowastescotland.org.uk/CarbonImpactsOfTheCircularEconomy
[8] Circular Economy Scotland, Green Alliance (2015) http://www.zerowastescotland.org.uk/content/circular-economy-scotland-report-0

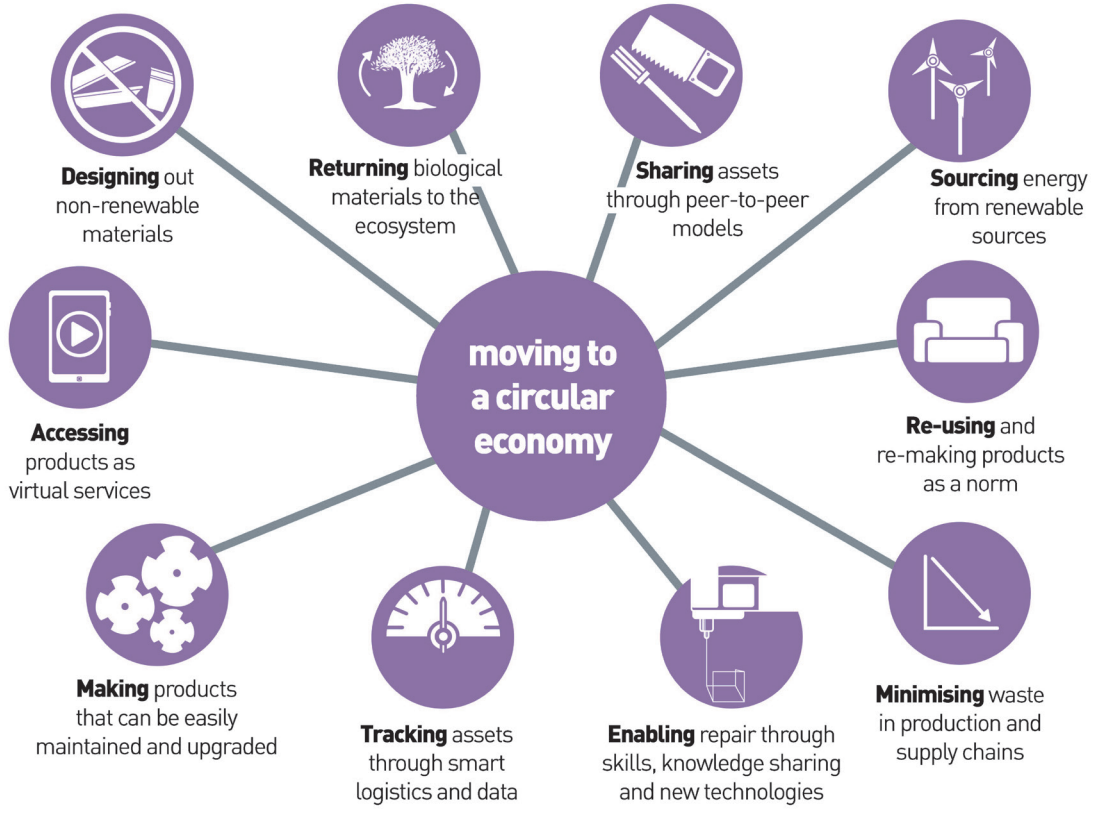
CHAPTER 2: MAKING THE TRANSITION

28. Moving to a circular economy will be a long-term process. This consultation focuses on actions which can help Scotland make tangible progress over the short to medium term. It is however equally important to create conditions for longer-term change.

29. We need to build on our existing zero waste and resource efficiency agendas and use the circular economy to create a framework to help our society and economy to become more innovative, inter-connected and resilient. Recycling and waste prevention are important and need to continue. But the next step is to start to redesign our products, supply chains and business models; and support the right type of innovation. We need to understand much more about the way that materials flow through our economy – going beyond the traditional streams of paper, plastic, metals and glass.

30. To consider what a circular economy would look like, we first need to understand the specific changes required across society. Figure 4 illustrates the different ways in which the use of goods and physical assets can be increased, prolonging their life and shifting resource use from finite to renewable sources.

Figure 4 – Key changes in moving to a circular economy



31. Fully delivering these changes will take time, and the global economy is still at the early stages of this transition. This consultation process and the resulting strategy, along with the forthcoming EU package of action, will set the direction and pace of Scotland's journey on that path.

32. Because realising a circular economy will require societal change, there are key roles for business leaders, for Government, its agencies and the wider public sector, and for people and communities across Scotland.

Making the transition – the role of businesses

33. In making a shift to more circular practices we in Scotland can expect to see benefits for businesses and the economy:

- **Increased productivity and competitiveness**: reducing overheads by eliminating waste and optimising the value of products and materials;
- **Increased market share**: innovation in the supply chain and redesign of products, providing new market opportunities;
- **Stronger customer relationships**: through new opportunities for product maintenance, refurbishment, leasing, collaborative use and re-sale;
- **Greater resilience**: to supply constraints and price spikes in key materials;
- **Job creation**: associated with new market opportunities.

34. For some industries supply chains are truly global while others have more local foundations. In some cases Scottish businesses can benefit from being part of a global supply chain that moves towards a circular approach. Other opportunities will come from innovations enabling more elements of a supply chain to be retained in Scotland with the associated economic benefits.

35. Globally, many leading companies have joined the Ellen MacArthur Foundation's CE100 network to help accelerate the shift to a circular economy. A number of Scottish-based SMEs have also participated in knowledge exchange, and are developing new business opportunities through this network.

36. A significant amount of change will be business-led. In particular, there is a role for business innovation in new technologies, products and business models. We welcome collaborative approaches from businesses to achieve this, so that they develop 'whole system' solutions and share innovation more readily.

37. There is also an important transitional role for businesses currently involved in the 'outer loops' of recycling or the 'leakage' of landfill or thermal treatment. These businesses have capabilities in logistics, materials handling, and customer networks, etc. which could support the 'inner loop' activities.

Making the transition – the role of Government and the public sector

38. Scotland's policy approach is ambitious, and we are recognised as a world leader in our aspirations for a circular economy. With Scotland's scale and connectedness, we have a strong partnership among industry bodies, public sector agencies and local government able to make change happen effectively.

39. The Scottish Government's role is to create an enabling policy framework, underpinned by a clear and consistent direction of travel. The Scottish Government's Purpose is to make Scotland a more successful country, with opportunities for all to flourish, through increasing sustainable economic growth.

40. Scotland's Economic Strategy supports this with two mutually supportive goals of increasing competitiveness and tackling inequality. Our approach to delivering this is underpinned by four priorities for sustainable economic growth:

- **Innovation**: fostering a culture of innovation and research and development;
- **Investment**: investing in our people and our infrastructure in a sustainable way;
- **Inclusive Growth**: promoting inclusive growth and creating opportunity through a fair and inclusive jobs market and regional cohesion; and

- **Internationalisation**: promoting Scotland on the international stage to boost our trade and investment, influence and networks.

41. For the first time, our ambitions to create a more circular economy in Scotland have been explicitly recognised in the Government's overall economic strategy[9]:

> *"A more circular approach to our economy helps take us towards those goals: we are creating conditions for a more circular economy that helps companies embrace new business models and manufacturing processes, and which transforms used products into assets that support industries like remanufacturing, reuse, product disassembly and reprocessing. Remanufacturing is transforming how parts and products are produced. In doing so, it helps industries minimise their use of raw materials, while reducing energy and water use. Sectors as diverse as aerospace, energy, automotive, IT and medical equipment industries are already benefiting from this transformation".*

42. Much of the evidence that has led to this consultation has been developed collaboratively by Scottish Government, Zero Waste Scotland, the Enterprise Agencies, SEPA and others. And many of the existing and proposed actions in this consultation involve these and other public bodies – both as service providers and through the influence of public procurement.

43. The Scottish Government also intends to lead by example and to collaborate with other nations and regions to address what will often be global or international challenges.

Making the transition – the role of Scotland's people and communities

44. As individuals, moving to a circular economy may bring about profound changes in how we access goods and services.

45. In the longer-term this could mean major shifts away from product ownership, to greater leasing or service-based models, for example paying a washing machine or dishwasher provider 'per wash' rather than actually owning the appliances. Service providers would have a clear incentive to maximise the lifetime of their products, making them more reliable, easier to repair and remanufacture.

46. There are also a number things we can all do today. Most of us now recycle at home and work, but we can build on this and do more to re-use items or buy second-hand; to make things last longer by repairing them; or to purchase longer-lasting items in the first place. As 'active consumers', people can influence business by demanding more durable or better designed products.

47. Some of these behaviours can be supported by communities and other networks, for example community-based sharing schemes, like tool or toy libraries, as well as online communities sharing expertise such as repair skills.

48. Finally, the circular economy can also be useful in broadening understanding of the inherent value in the products and materials we use - helping more people to be enthused, empowered and have the knowledge and capabilities to support the transition at their work and at home.

[9] Scotland's Economic Strategy (2015 - page 46): http://www.gov.scot/Publications/2015/03/5984

CHAPTER 3: OUR AREAS FOR ACTION

3.a - Area for action - Design

Our ambition and priorities for Scotland

We want Scotland to be recognised as a centre of excellence in design for a more circular economy. We want to see more Scottish products designed with their full life-cycle in mind: for long lifetimes, ready to be disassembled and repaired, and eventually recycled. And we want an increasing number of companies to find profitable ways to keep hold of valuable products and components: increasing revenue through leasing, servicing, repair and re-sale.

Context

49. Action starts with design: the design of products, the design of business models, the design of services, and the design of systems.

50. The design of products is key in determining how far their value can be retained in a more circular approach. Design for disassembly, using standard components, recyclable materials etc. are fundamental to enabling greater repair, reuse, remanufacturing and recycling. And the design of systems and business models shapes the scope for business to retain the value in the products and materials that flow through their operations.

51. Scotland has a strong history of innovation, and significant activity continues across academia and industry in innovative design.

52. In some sectors, such as aerospace, where high value manufactured components are used, circular economy principles have been applied for decades in product design and system design. In other industries, these models have been established more recently through technological innovation or in response to increasing resource costs. For example, Aggreko provides power and temperature control equipment on a rental basis - users operate the equipment while Aggreko retains ownership together with responsibility for servicing and maintenance.

53. On a smaller scale, “upcycling” provides creative opportunities for designers to create desirable new products (such as clothing and handbags) from materials that have already had one productive life.

54. The growing use of innovative techniques such as 3-D printing can support greater levels of repair or remanufacture of complex products. The technology requires a new way of designing products, involving a limited number of printed materials, making them easier to recycle. Previously obsolete parts can be printed, avoiding a product being discarded unnecessarily.

55. The use of asset tracking technology and the expansion of data management and internet capabilities will allow us to track our assets more closely. Products and materials could be separated more easily for recycling using unique identifiers; and replacing products through “trade in” or “take back” services if they fail could become easier. Service models are easier to apply if the use of the product can be measured.

What we're already doing

56. There is a range of academic art, design and engineering institutions playing a key role in developing the designers of the future. There is a wealth of design support available to industry through public agencies and academia: Interface Innovation Vouchers; Creative Scotland; MAKLab Incubator spaces; Design in Action activities; and Scottish Enterprise support including its new By Design programme.

57. We have undertaken research to identify evidence of where there are existing resource efficient and circular economy **business models** in Scotland; and the opportunities and barriers to the uptake of such business models. Circular economy business models involve hiring and leasing, performance/service systems, incentivised return, asset management, collaborative consumption and long life as set out in the diagram below.

Figure 5 – Circular economy business models

58. The extent to which circular economy business models are currently applied varies by industry, and we are developing a number of case studies to showcase successful examples in Scotland. These include:

- **iSwapsy**: online children's clothing 'swapping' platform;
- **iPower**: lease/service models to access micro combined heat and power unit;
- **Norkram**: pipeline thread protector refurbishment in the oil and gas sector.
- **Save Juice** (formerly Market LED): developing a 'rent a light' model whereby their customers can effectively lease LED lighting
- **Kalopsia** : the development of a 'sharing' model to provide access to textiles manufacturing equipment and the recovery of used equipment

59. We have been working with the Royal Society of the Arts, Manufacture and Commerce (RSA) and Innovate UK to explore the challenges and opportunities of product, business and system design for circularity. A range of disciplines were targeted in order to raise awareness amongst designers, engineers, technicians, and manufacturers. Zero Waste Scotland has also been working with The National Centre for Product Design and Development Research (PDR) and the Design Council to develop an action plan on design for a Circular Economy.

60. We are managing a programme of action which, as well as supporting resource efficiency in Scottish SMEs, will support early adopter companies to pilot and introduce new circular economy technologies, models and services.

What we propose to do next

61. To bring together action on design, and to stimulate and co-ordinate circular design thinking we want to explore the scope for a **Scottish centre of expertise on circular design, and the skills required**, with Zero Waste Scotland and through the Scottish Funding Council, academic partners and design organisations.

62. We will explore scope for local or EU actions to drive the manufacture of goods to **last longer**, including minimum warranty requirements.

63. Zero Waste Scotland and the Enterprise Agencies will build on existing support for business growth and innovation, to help businesses exploit circular economy opportunities. In particular, this will include a new **circular economy business development service** for developing technologies and business models.

64. We intend to undertake further research, in partnership with the packaging industry, to determine where compostable or recyclable **packaging** (i.e. left or right side of Figure 1) could be the best option for Scotland's developing collection and reprocessing infrastructure – and scope to design out packaging creating the greatest leakage of materials.

65. We will work with international networks to seek opportunities for innovations in circular design to be **trialled in Scotland**.

Question A – Design

We are looking for feedback on these ideas for influencing design of products, business models, services, and systems.

- Do you agree with our aspirations on design for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

3.b - Area for action - Reuse

Our ambition and priorities for Scotland

We want the sale and use of second hand goods to be seen as an attractive, mainstream, good value option for an increasing range of products. We want reuse businesses and community organisations to thrive, on the back of a growing reputation for quality and value for money for their goods.

We want our major industrial sectors in Scotland to learn from best practice to optimise the value of used equipment and infrastructure.

Context - public

66. Reuse is a key element of a more circular economy, and is as important for the public as it is for business and industry. The reuse economy in Scotland has a turnover of £244 million, supports over 6,000 jobs and reuses 89,000 tonnes of material annually[10], and provides opportunities for individuals to obtain high quality products at considerably lower cost than new.

67. For the majority of day to day reuse transactions for the public, there are already established markets and practices which facilitate exchanges, such as eBay, Gumtree and car boot sales. Research however shows that while 72% of the population would like to shop second-hand, only 23% actually do so[11].

68. Some activities to prepare discarded goods for reuse are regulated as waste activities. There is a balance to be struck in supporting reuse activities whilst ensuring that the collection, storage, and preparation of discarded goods for reuse do not cause environmental harm. The reuse sector has also expressed concern about the potential for criminal activity.

Context – business and industry

69. A number of businesses are involved in the reuse of items. Space Solutions (Scotland) Ltd, office planning experts and commercial architects, promotes the reuse of unwanted office furniture and equipment from their clients through their Recycling Scotland division. Re–Tek (UK) Ltd reuse information technology equipment. John Lawrie Group reuse equipment from oil and gas platforms as building materials, highlighting the opportunity to increase levels of reuse, remanufacturing and higher value recycling in the oil and gas industry, when decommissioning end of life offshore equipment. The Green Alliance identified a range of interventions that could realise these opportunities[12].

70. There is significant potential to add value to end of life North Sea assets due to be decommissioned over the next decade, depending on the level of higher value

[10] Scottish re-use mapping and sector analysis report, 2013 produced by Zero Waste Scotland: http://www.zerowastescotland.org.uk/sites/files/zws/ZWS%20Re-use%20mapping%20and%20sector%20analysis%20%28MPD001-009%29_0.pdf

[11] Study into consumer second-hand shopping to identify re-use behaviour, WRAP 2013, http://www.wrap.org.uk/content/study-consumer-second-hand-shopping-identify-re-use-behaviour

[12] Circular Economy Scotland, a report by Green Alliance in partnership with the Scottish Council for Development and Industry (SCDI), January 2015: http://www.green-alliance.org.uk/circular-economy-scotland.php

reuse that can be achieved over lower value recycling. Reuse options will have to take into account all the requirements of health and safety etc.

71. Over the period to 2023, it is estimated that almost 500,000 tonnes of end of life assets will be removed from the UK Continental Shelf[13]. Total decommissioning spend is forecast to reach £46 billion in real terms by 2040 and average £1.8 billion per year for the remainder of the decade[14]. Investment costs on topsides and substructure removal has been estimated to account for £280 million per year in the period to 2023. This offers significant potential for Scotland to capture a share of emerging reuse activity and there may be potential for this to contribute to the 40% cost saving target that the industry has set in the North Sea.

72. Reuse of equipment and modules such as vessels, tanks, valves, cranes, helidecks and valuable metals and alloys offer greater potential than reuse of large steel structures. Markets are starting to emerge for these end of life and used assets.

What we're doing already

73. Together with the Community Recycling Network Scotland, Zero Waste Scotland has developed the *Revolve* reuse quality standard, designed specifically to overcome issues of consumer confidence, and to establish a robust and recognisable reuse sector in Scotland. The *Revolve* standard aims to make it easier, more attractive and safer for the public to buy second hand items.

74. Zero Waste Scotland's National Reuse Phoneline is receiving more than 1400 calls each month, making it easier for people to donate items for reuse.

75. During 2015-16, local authority staff will receive training from Zero Waste Scotland on how to encourage reuse when people visit recycling centres.

76. We are also trialling large scale reuse and repair hubs to encourage increased capture rates, to deliver economies of scale for the sector and create recognised reuse superstores for consumers. The first such hub opened recently in Dingwall, in partnership with Blythswood Care.

77. Our forthcoming statutory guidance on the sustainable procurement duty under the Procurement Reform (Scotland) Act 2014 will create opportunities for public sector buyers to allow innovative solutions that increase the reuse of goods or allow options like leasing or buying performance rather than products, through public contracts. In support of the sustainable procurement duty, the Act also makes clear that contract award decisions can include an element of life cycle costs.

78. Traceability systems for certain items in the offshore oil and gas sector (such as those in the aerospace sector) could encourage greater asset management, greater levels of component recovery and refurbishment, and lead to higher levels of confidence in reused items. Decom North Sea and Zero Waste Scotland are currently exploring the potential for this within the sector.

[13] Oil and Gas UK, Decommissioning Insight, 2014
[14] Oil & Gas UK, Activity Survey 2015: http://www.oilandgasuk.co.uk/forecasts.cfm

What we propose to do next

79. We propose to further **expand the availability of the Revolve standard** to include a wider range of reuse organisations, and to develop the standard to provide further confidence for consumers in the products they are purchasing.

80. We will explore scope for **large scale, collaborative approaches to reuse** in specific sectors to maximise the capture of products for reuse. For example:

- work with Decom North Sea, DECC and Oil and Gas UK to help develop and **support protocols and standards for the reuse of key components**.
- raise awareness amongst key stakeholders in the offshore oil and gas sector through **further development of evidence** on potential and implemented savings; including typical business cases for key components and processes that champion the benefits of circular approaches.

81. We will explore with the reuse sector how to improve the quality of **reuse data** to capture relevant impacts and help strengthen business cases for action.

82. Linked to our Better Environmental Regulation programme we will consider what improvements can be made to the **regulatory and licencing framework** to provide greater clarity on where activities are subject to regulation, and to support and promote greater levels of reuse.

83. We will explore the role of reuse as an aspect of relevant **producer responsibility schemes**.

84. We will, building on the work of the Zero Waste Taskforce[15], **support local authorities and local reuse organisations** to improve reuse collection, storage, retail and communications, including at Household Waste Recycling Centres and through bulky waste services.

Question B – Reuse

We are looking for feedback on the ideas in this section on extending the life of goods through reuse.

- Do you agree with our aspirations on reuse for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

[15] See section 3.e Recycling.

3.c - Area for action - Repair

Our ambition and priorities for Scotland

We want to empower Scotland's repair sector to grow, both business and community organisations. For an increasing range of items, we want repair to be the first choice when they develop a fault on the basis of quality, reliability and value – both for business and individuals.

Context

85. Repair is an area that brings together the innovation of a more circular economy with the established repair and maintenance services that have been commonplace in communities across Scotland. In recent years a combination of pace of technological change, cheaper products, and a lack of information and confidence in how to repair complex products has led to a decrease in repair.

86. Zero Waste Scotland and WRAP research[16] estimates that 32% of goods reaching local authority recycling centres and bulky uplift collections were reusable and that, with slight repairs, this could increase to 51%.

87. New services are emerging such as *eSpares* and *iFixit*: online suppliers of spare parts, tools and tutorials for repairing common consumer goods. Community-based repair workshops like *Restart* and *Men's Sheds* provide access to knowledgeable volunteers to help householders to fix specific items. This is in addition to more traditional services provided by companies such as Midland Electrical Winding and Contracting (Scotland) Ltd who undertake rapid onsite repair of industrial equipment and engines.

88. There is already a strong repair, refurbishment and remanufacturing base in sectors such as aerospace, defence, and oil & gas, since these sectors require the regular maintenance of a range of high value equipment.

89. A variety of approaches can stimulate greater levels of repair and associated business opportunities, for example:

- business models based on hiring and leasing products incentivise extending the product life through repair;
- public procurement requirements and extended warranties can encourage repair, rather than replacement; and
- the availability of affordable spare parts and information on how to repair products.

What we're doing already

90. We have a suite of measures already in place to support behaviour change in communities, including Zero Waste Scotland's Volunteer and Community Advocate Programme which aims to recruit a network of 1000 volunteers, and which encourages reuse and repair; grants to support training in repair to support reuse

[16] Study into the re-use potential of household bulky waste, Waste & Resources Action programme (WRAP): http://www.wrap.org.uk/content/study-re-use-potential-household-bulky-waste

organisations build the skills to increase reuse; and a collaborative certified repair training module is being developed to increase the repair skills capacity in Scotland.

What we propose to do next

91. We want to explore the potential for a comprehensive **repair-finding service** or network to make it easy to find where items can be repaired.

92. We will continue to provide opportunities to increase the **repair skills** of the third sector and householders through training and self-repair workshops and infrastructure.

93. We will encourage manufacturers and retailers located in Scotland to trial and increase **repair services to their customers** to increase the lifetime of their products.

94. We will continue to support **repair infrastructure** for domestic and commercial products within the private, third and public sector, reducing the need for new purchases and saving money.

95. We will explore how to best support open access to **technical manuals** to help facilitate greater levels of repair by householders and organisations.

96. We will investigate relevant products commonly purchased by the public sector and identify the opportunities for **public contracts to support greater levels of repair**, e.g. by requiring technical manuals to be provided for some products.

97. We will continue to **work with the procurement professional community** and will draw on circular economy principles in building upon previous and current programmes of capability building, such as The Marrakech Approach to Sustainable Public Procurement.

98. SEPA will produce guidance to clarify the circumstances in which actions to prolong the life of goods, including repair are subject to **waste regulation**.

Question C – Repair

We would like feedback on extending the life of goods through stimulating greater levels of repair by businesses, community organisations and individuals.

- Do you agree with our aspirations on repair for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

3.d - Area for action - Remanufacture

Our ambition and priorities for Scotland

We want Scotland's strategically important remanufacturing sector to fulfil its potential for growth: to raise the profile of remanufacturing, develop new markets and strengthen Scotland's international reputation for quality remanufactured products.

Context

99. Remanufacturing can be defined as returning a used product to at least its original performance with a warranty that is equivalent or better than that of the new product. It involves the process of taking a product completely apart, cleaning, repairing, rebuilding and testing its functionality for reuse.

100. Remanufacturing can reduce material, water and energy costs meaning remanufactured products can cost less than the equivalent new products, and hence significantly boost productivity, competitiveness and profitability. It provides an excellent circular economy business model, especially if the remanufactured products are leased to the customer or have an incentivised return associated with the product.

101. Our remanufacturing study[17] identified that 17,000 people are employed in remanufacturing in Scotland, contributing £1.1 billion to annual economic activity. Across 16 sectors it has the potential to create an additional £620 million turnover and 5,700 new jobs by 2020. The study suggests that energy, automotive, ICT and medical equipment have the highest potential for remanufacturing growth in Scotland, followed by aerospace, rail, white goods, tyres and furniture.

102. Examples of remanufacturers in Scotland include Vector Aerospace who repair, overhaul, and modify aircraft components; and Cummins ReCon who specialise in the remanufacturing of diesel engines.

103. There are various barriers to the development of remanufacturing and progress depends on product type, sectors, perceptions and consumer behaviour. The return of core components and products is a particular challenge.

What we're doing already

104. The Scottish Institute for Remanufacture was launched in January 2015 with £1.3 million from Zero Waste Scotland and the Scottish Funding Council. Companies based in Scotland have already pledged over £800,000 of funding, or in-kind support, for potential collaborative research projects to explore technical solutions for remanufacturing with the Institute.

105. The Institute, based at University of Strathclyde and operated in partnership with Heriot Watt University, exploits the significant expertise in remanufacturing technologies and processes across universities in Scotland. The Institute is an industry demand-led centre of expertise, with industry and academic membership, also providing peer support to increase the knowledge base required for growth.

[17] Circular Economy Evidence Building Programme – Remanufacturing Study, March 2015: http://www.zerowastescotland.org.uk/RemanufacturingReport

106. The Scottish Manufacturing Advisory Service (SMAS) and Zero Waste Scotland are working with the Institute to refer businesses that could benefit from its services. SMAS is also independently advising and supporting businesses that could benefit from adopting remanufacturing practices, working with around 1,000 manufacturing companies.

What we propose to do next

107. The Scottish Manufacturing Advisory Service will enhance its support to companies in relation to remanufacturing as part of the forthcoming **Manufacturing Action Plan**.

108. We will work with relevant bodies such as British Standards Institute (BSI) to ensure that **remanufactured products are properly recognised** and distinguished from second hand or refurbished products.

109. We will work with the EU and other partners to support the **promotion and recognition of remanufactured products** as comparable or equivalent to new products.

110. We will explore evidence to identify areas in which remanufactured products should be an option in relevant markets for **public procurement**.

111. We will work with the Scottish Institute for Remanufacture to develop efficient and cost effective **methods for returning end of life products** to remanufacturers.

112. We will work with the EU to **identify legal issues** that act as a potential barrier to greater levels of remanufacturing and explore options to address these.

113. We will explore the barriers and opportunities to greater use of **remanufactured medical devices** in the NHS.

Question D – Remanufacture
We are looking for feedback on the ideas proposed in this section to promote remanufacturing in Scotland.

- Do you agree with our aspirations on remanufacture for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

3.e - Area for action - Recycling

Our ambition and priorities for Scotland

We want businesses, councils and householders to work together so that recycling becomes routine in every business and household - with more consistent local services and more packaging designed for recyclability - and we want every household in Scotland to have access to a food waste service.

We also want to improve the quality of recyclate to enable more materials to be returned to the same use, and for greater benefit to be retained in Scotland.

Context

114. Our action on recycling is driven by long term Scottish targets to recycle 70% of all waste and to send no more than 5% of all waste to landfill, both by 2025.

115. The challenge is to increase the volume and quality of materials recycled to support a more circular economy; while tackling contamination and working to remove poor quality and illegal activity from the sector.

116. There are clear and significant concerns in local government and in the waste management industry about the quality – and in particular contamination – of recyclate at the point of collection. The issues of greatest concern are food waste and glass. Even low levels of contamination can render materials unsuitable for reprocessing, losing value.

117. The complex nature of many materials and the way in which they move through our economy can be a barrier to recycling of packaging and other consumer goods with a high turnover; for example the wide range of different types of plastic food packaging that are often a mixture of different materials which are good for storing food safely but not easily recycled. The supply chains for these materials can extend well beyond Scotland, and so collaboration is required to resolve these issues.

118. The World Economic Forum and Ellen MacArthur Foundation's "Project Mainstream" aims to join up thinking between plastic packaging manufacturers, brands, retailers, and local plastic packaging collection. New packaging designs, combined with appropriate collection systems could dramatically increase circularity.

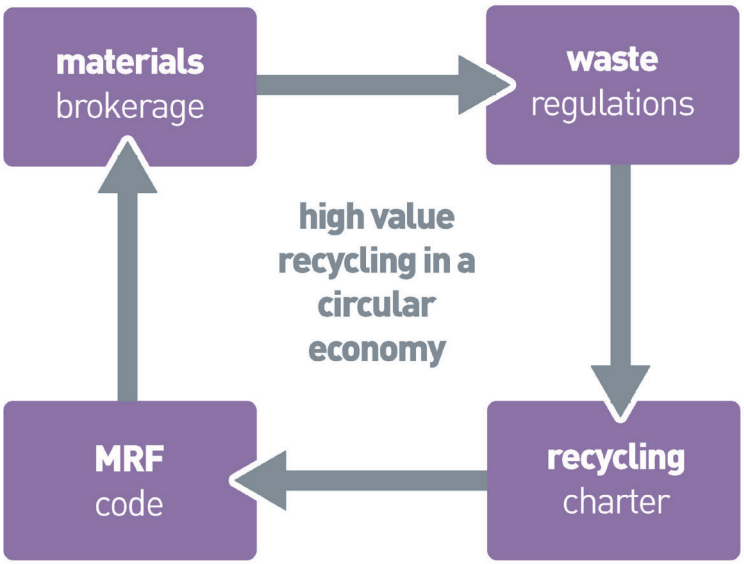
119. A range of recycling businesses already operate in Scotland. For example, Mainetti UK Ltd reuse, refurbish and recycle over 200 million clothes hangers annually; and BPI Recycled Products manufacture furniture, construction membranes and refuse sacks from recycled plastic.

What we're doing already

120. We have put in place a framework with local government and industry to deliver our aim of supporting a more circular economy through our recycling systems. There are four key elements to this framework.

121. First, the Waste (Scotland) Regulations 2012 set out requirements for the separate collection of key materials, including food waste, and prohibit any separately collected material going to incineration or landfill.

Figure 6 – Framework for improving recycling



122. Second, the Zero Waste Taskforce, a joint initiative between the Scottish Government and COSLA to focus on local authority circular economy opportunities, has recommended the development of a charter for more consistent household recycling collection systems, supported by best practice, to:

- increase householder participation in recycling;
- improve the quality of recyclate; and
- provide greater economic benefits and opportunities for savings.

123. Third, the Scottish Materials Brokerage Service will deliver collaborative contracts for waste and recyclable materials from local authorities and other public bodies of sufficient scale to help local authorities and public bodies achieve a better deal, and reduce risk from price volatility. This will support the business conditions for investment in domestic reprocessing in Scotland by providing certainty in the volume and duration of supply of valuable materials.

124. Finally, the statutory Code of Practice for Materials Recovery Facilities will introduce a sampling procedure to improve transparency of waste moving through our economy, and importantly to improve the quality of materials arriving for sorting.

125. We commissioned Zero Waste Scotland to conduct a feasibility study into a Deposit Return System for single use drinks packaging in Scotland, which was published in May 2015 and followed by a call for evidence. That process identified a number of important points for further exploration on deposit return.

What we propose to do next

126. We intend to build on the collaborative approach to recycling service delivery successfully pioneered through the Zero Waste Taskforce. To complement that, we propose to **extend collaboration to the waste and packaging industry**, broadening the focus into markets, communication and packaging design.

127. We intend to **align Scottish Government and Zero Waste Scotland support for recycling activity with the new Household Recycling Charter**, if agreed by COSLA.

128. We would also like to open up a discussion with local government on their view of how their duties are currently defined as **Waste Disposal and Collection Authorities**, rather than resource management or similar authorities.

129. We would like to explore scope for early adopter councils of the proposed recycling charter to participate in pilots for the World Economic Forum and Ellen MacArthur Foundation's **Project Mainstream**.

130. We intend to explore funding mechanisms to **support new re-processors where supply chains are not yet fully developed** to create an effective financing and support network.

131. Because of the impact on quality of recyclate from contamination, we intend to review the specific circumstances in which **contamination arises in collection systems** - in particular mixed collections including glass; food waste collections; and contamination of dry recyclables by food - so that we can take appropriate action.

132. We intend to **review the rural exemption for food waste** in the Waste (Scotland) Regulations 2012 in partnership with local government as part of the process to develop best practice to support the proposed Household Recycling Charter, as well as businesses and the waste management sector.

133. Over the next year, we intend to focus attention and **support on small food businesses** that will come into the scope of our waste regulations in January.

134. In parallel, **SEPA** will engage and support waste producers to ensure compliance with the Waste (Scotland) Regulations 2012 and use appropriate enforcement procedures, including fixed penalty powers, on waste producers that persistently fail to take all reasonable steps to segregate material for recycling.

135. We intend to explore the potential for **regulations on recycled content of materials in public procurement**, initially to build on existing Scottish Government policy on recycled paper[18] – extending the requirement across the public sector.

136. As part of our evidence work on opportunities for a more circular economy, the **chemicals, construction and agricultural** (with regard to plastics) sectors were identified as worthy of further consideration for the opportunities that could arise from recycling materials. We propose to do further work on these sectors during the period of this consultation.

137. We intend to **explore the issues raised in the call for evidence on a deposit return system for Scotland**, in liaison with other parts of the UK.

Question E – Recycling

We are looking for feedback on the proposed approaches to expand recycling among households and businesses and improve the quality of recycled materials.

- Do you agree with our aspirations on recycling for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

[18] Link to the Scottish Government's Scottish Sustainable Procurement Action Plan, Timber and Paper section: http://www.gov.scot/Topics/Government/Procurement/policy/corporate-responsibility/CSR/SSPAP/TimPap

3.f – Area for action – Producer Responsibility for reuse and recycling

Our ambition and priorities for Scotland

We believe that producer responsibility offers an opportunity to drive innovation and greater circularity for certain products – to influence product design as well as increasing recycling and reuse.

Context and what we're doing already

138. There are four UK-wide Producer Responsibility schemes operating in Scotland (End of Life Vehicles, Batteries, Packaging, and Waste Electronic and Electrical Equipment). These schemes give producers and retailers greater responsibility for the collection and treatment of these products when they are discarded (primarily recycling or thermal treatment of the materials for energy recovery). They are operated to ensure compliance with European Directives.

139. There is potential for Scotland to introduce additional schemes for other items, with the potential to deliver a number of outcomes:

- providing a solution for products with no suitable market or waste treatment at the end of their life - examples include tyres, plasterboard, mattresses and light bulbs;
- helping to retain much higher value, for example by encouraging repair or reuse of carpets and furniture; or greater levels recycling of agricultural plastics;
- providing an incentive for innovation in design.

What we propose to do next

140. We intend to explore proposals for **extended producer responsibility schemes for tyres, furniture and bed mattresses**. These are potential candidate for the following reasons:

- **Tyres**: to address the negative environmental, health and safety impacts of inappropriate disposal; incentivise greater recycled content; and retain the value of materials.
- **Furniture, including mattresses**: for the social and economic benefits from greater levels of reuse including local employment opportunities.

141. We also intend to examine the scope for extended producer responsibility schemes for other materials and products.

Question F – Producer Responsibility for reuse and recycling

- Do you agree with our aspirations on harnessing producer responsibility approaches for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

3.g – Area for action – Recovering value from biological resources

Our ambition and priorities for Scotland

We want Scotland to be recognised as an international leader in the efficient use of biological resources. We want production of high value materials and chemicals from biological resources to increase, replacing non-renewable chemical feedstocks. When high value uses have been exhausted, we want to see increased production of renewable fuels, heat, and fertilizer products.

Context

142. Industrial Biotechnology is already viewed at a global and EU level as a key technology with real growth potential. By 2025 estimates of the value of the global market range from £150 billion to £360 billion[19].

143. Scotland's vibrant food & drink sector is currently a major user of biological resources and produces significant quantities of biological waste and by-products which could potentially generate significant value. To support a more circular economy we need to retain the highest value in these biological resources, and reduce reliance on scarce raw materials.

144. To realise the full value from biological resources that would otherwise end up as waste, we need to capture materials from households, businesses and the food and drink industry; develop new technologies; explore new markets and stimulate demand; and collaborate through supply chains and across sectors. Some companies are already leading the way, for example Cellucomp is developing new high value nano-fibre products made from food processing residues.

145. The separate collection of food and organic waste enables extraction and recirculation of nutrients, through anaerobic digestion, composting or biorefining. It also avoids harmful greenhouse gas emissions by diverting the material from landfill and can generate energy in the process. For example, companies such as Keenans Recycling manufacture compost products for the agricultural market.

What we're already doing

146. The Scottish Industrial Biotechnology Development Group works through Chemical Sciences Scotland, across industry and other partners, to deliver a National Plan for Industrial Biotechnology. The Plan aims to increase turnover from £190 million to £900 million by 2025 through Industry Engagement, a Biorefinery Roadmap, the use of the Industrial Biotechnology Innovation Centre (IBioIC), and the development of key skills.

147. Scotland already has a great deal of biorefining expertise including research into brewing and fermentation; the future potential for marine biomass; and excellence in synthetic biology and molecular and micro-biology. The Biorefinery Roadmap aims to develop cost-effective technologies to convert sustainable feedstocks into high value chemicals, biofuels and other renewable products.

[19] IB 2025, Maximising UK Opportunities from Industrial Biotechnology in a Low Carbon Economy, A report to government by the Industrial Biotechnology Innovation and Growth Team, May 2009

148. The Biorefinery Roadmap for Scotland[20] recognises that developing biorefining must not compete with food & feed supply chains, and hence co-products, residues and wastes are priority feedstocks. Actions flowing from this consultation will maintain that principle and seek to complement existing work.

149. Our study of the beer, whisky and fish sectors in Scotland[21] has identified strong growth potential that supports a more circular economy. Waste and by-products from these three sectors currently go to a range of destinations including local cattle feed; processing into fish feed; spreading to land; heat and power production; and discharge to sewer. While routes like cattle feed will continue to be important, in parallel, many of these materials could be used in much higher value applications.

150. For example, Horizon Proteins has developed a process to extract protein from pot ale (a by-product from whisky production) for input to high value aquaculture feeds. Celtic Renewables has a process that converts by-products from distillation into animal feeds, commodity chemicals and industrial gases.

151. The study estimates that if the opportunities identified for these sectors were realised, they could be worth between £500 million and £800 million per year to Scotland's economy.

152. Scotland's collection and reprocessing infrastructure for food waste from households and businesses has developed substantially in recent years. Local authority household collections and commercial investment in in-vessel composting and anaerobic digestion facilities; have both been driven by the Waste (Scotland) Regulations 2012 and supported by Zero Waste Scotland.

153. The Renewable Heat Incentive supports the creation of biogas and its use in the gas grid. Where biogas is used for purposes other than as a transport fuel, our preference is that it be used in heat-only or good quality combined heat and power schemes[22].

154. Linked to the use of fertilizers and growing media, the Scottish Government has committed to supporting the phasing out of peat for horticultural use and the need for market led solutions. Peatlands are important for biodiversity, water quality and reducing carbon emissions – and need to be well managed and protected. The forthcoming National Peatland Plan will set out Scotland's ambitions for protecting, managing and restoring our peatlands. Given that peat used for horticulture is sourced from many countries this commitment recognises Scotland's responsibility to what is a global challenge.

[20] Biorefinery Roadmap for Scotland, Chemical Sciences Scotland: http://www.scottish-enterprise.com/knowledge-hub/articles/comment/biorefinery-roadmap

[21] Sector Study – Beer, Whisky and Fish, Zero Waste Scotland, July 2015: http://www.zerowastescotland.org.uk/BeerWhiskyFish

[22] Chapter 5 of 'Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland' - Scottish Government, 2015: http://www.gov.scot/Publications/2015/06/6679

What we propose to do next

155. Zero Waste Scotland will investigate and pilot ways to help the economics and the environmental footprint of anaerobic digestion:

- **adding more value to digestate** from food waste recycling systems;
- **improving the quality of digestate and compost** in line with PAS standards, making these fertilizer products more acceptable for more markets;
- and to **utilise more of the heat** produced by the facilities.

156. We will explore the scope to **phase out the purchasing of non-renewable biological materials, such as peat**, by the public sector in Scotland through changes to Public Procurement requirements. This will help to stimulate greater domestic demand for renewable based fertilizer products produced from the network of anaerobic digestion and in-vessel composting facilities in Scotland.

157. To support cross-sector awareness of circular economy opportunities, we will work with the IBioIC to help deliver the industry-led National Plan. There are particular opportunities to explore, for example:

- how we can best support investment in research and development and innovation to **develop and commercialise processes** which address technical barriers for the use of biological waste;
- the potential for data collection systems for specific industry sectors to help **understand material flows** and the opportunities they present; and
- the potential for **"regional hubs" for biorefining** processes.

Question G – Recovering value from biological resources

We are looking for feedback on the proposed approaches to harnessing greater value from biological resources that would otherwise end up as waste.

- Do you agree with our aspirations on recovering biological resources for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

3.h – Area for action – Energy recovery

Our ambition and priorities for Scotland

Our ambition is to have an energy from waste infrastructure that effectively manages the "leakage" from a more circular approach to the economy in Scotland without creating demand for materials that could otherwise be kept in higher value use. We want to ensure that energy recovered from waste supports, directly, high quality heat and power schemes.

Context

158. Energy can be recovered from waste products in two key ways: through anaerobic digestion of organic materials which retains nutrients as part of a circular economy; and through the creation of heat and energy through thermal treatment of non-recyclable waste. (Anaerobic digestion, including its energy benefits are addressed in the previous section on biological resources). These approaches can provide valuable heat and energy to communities, business and industry.

159. In a circular economy it is important that thermal treatment (including incineration) of non-recyclable waste is recognised as having a role limited to recovering energy where materials cannot be retained in higher value use. However, materials used in this way have to be replaced. So while thermal treatment plays an important role in diverting non-recyclable materials from landfill, it is important to ensure that, in line with the waste hierarchy[23], we explore all options for retaining the value of those materials before concluding it is the best option.

160. Thermal treatment has a continuing role in addressing demand for energy, during transition to a more circular economy. In the longer term, there will be a more limited role, albeit with an appropriate level of capacity to reflect the success of a more circular economy.

161. We want to avoid the situation arising in some nations where overprovision of energy from waste infrastructure presents a barrier to a more circular economy by creating a demand for material as a feedstock that could otherwise be reused, remanufactured or recycled.

162. Where thermal treatment plants are required, we wish to see only good quality combined heat and power schemes developed. As with other thermal electricity generation plants these should be located where they can make best use of heat to make the most of our resources, while minimising environmental impacts including meeting Scotland's high standards on air quality. This is supported by a regulatory framework through planning, Pollution Prevention and Control regulations on the use of waste heat and by programmes such as district heating support for local authorities.

What we're doing already

163. SEPA produces annual figures of waste infrastructure capacity needs for a variety of technologies including thermal treatment infrastructure. This provides a

[23] Guidance on applying the Waste Hierarchy - Scottish Government, 2013: http://www.gov.scot/Publications/2013/04/7548

guide to the waste management industry, investors and local planning authorities as to the likely level of required infrastructure.

164. The Waste (Scotland) Regulations 2012 also require the removal of non-ferrous metals and dense plastics, where practicable, before the thermal treatment of residual waste, and SEPA's Thermal Treatment of Waste Guidelines[24] provide further detail. The guidelines also drive appropriate levels of efficiency for these facilities to ensure heat benefits are recovered wherever possible.

What we propose to do next

165. We want to ensure that long term decisions on waste infrastructure are as well informed as possible. We will explore, with SEPA and Zero Waste Scotland, how best to improve the way that we provide and present **information on the anticipated capacity requirements for future waste infrastructure**[25], for use by planning authorities and industry - helping ensure the capacity of waste infrastructure developed, such as thermal treatment facilities, is appropriate.

166. Zero Waste Scotland will produce an **Economic Assessment Report**, modelling how the changing composition of residual waste, and other factors, will affect residual waste treatment options in Scotland in an international context, to 2025. This information will also be made available to guide infrastructure investment.

Question H – Energy recovery

- Do you agree with our approach on energy recovery in a more circular economy?
- Do you agree with the proposed actions for further exploration?
- What other actions would support this approach?

[24] Thermal Treatment of Waste Guidelines – SEPA, 2014: http://www.sepa.org.uk/media/28983/thermal-treatment-of-waste-guidelines_2014.pdf

[25] Zero Waste Plan - Waste Management Infrastructure Capacity Requirements http://www.gov.scot/Topics/Environment/waste-and-pollution/Waste-1/wastestrategy/annexb

3.i – Area for action - Landfill

Our ambition and priorities for Scotland

The Scottish Government is the only administration within the UK to introduce a statutory ban on municipal biodegradable waste going to landfill as part of our transition to a more circular economy. As landfilling decreases, we now want to manage the legacy of landfill sites around Scotland, minimising emissions from operational and closed sites.

Context

167. There has been a significant and continuing decrease in the amount of waste being sent to landfill – falling from 7.4 million tonnes in 2007 to 4.5 million tonnes in 2012. However, we are still landfilling materials which would have been worth around £100 million per year had they been recycled[26].

168. In a circular economy, landfill disposal is an option to be avoided. We have therefore already put a strong policy, regulatory and fiscal framework in place to reduce the amount of material sent to landfill. Municipal biodegradable waste will be banned from landfill from 2021, and we have a target to send no more than 5% of all waste to landfill by 2025. Our waste regulations require businesses and local authorities to collect both key recyclable materials and food waste separately, which cannot then be sent to landfill.

169. As waste for landfilling continues to decrease, we would like to see a managed retreat from landfill with the number of active sites reducing and sites closing in accordance with permit requirements, ensuring necessary aftercare so that environmental protection remains a priority. There is also a potential climate change impact from the greenhouse gas emissions if landfill closure is not managed properly.

What we are doing and what we expect to do next

170. The Scottish Landfill Tax provides a strong financial incentive to keep materials out of landfill and in higher value uses. It also provides a new deterrent to illegal dumping by bringing this activity under the scope of the tax.

171. Scottish Landfill Tax rates are in line with UK Landfill Tax rates for 2015-16. We have also committed that Scottish Landfill Tax will be no lower than prevailing UK rates, meaning the standard rate will not fall below £80 a tonne before 2020. In setting these rates, Scottish Government is also acting to avoid any incentive to move waste between Scotland and England.

172. SEPA already requires landfill operators to demonstrate that funds are available to cover environmental obligations including restoration and aftercare requirements when sites are closed. SEPA will shortly be consulting on an improved approach in this area to better ensure that funds are adequate, secure and available when needed.

[26] Zero Waste Scotland estimate 2014: http://infogr8.com/infographics/zws/

173. Former landfill sites are still a significant source of greenhouse gas emissions. Innovative flaring technology which removed the equivalent of more than 20,000 tonnes of carbon dioxide from two sites in the Borders - roughly equal to 14,000 passengers making return flights between Edinburgh and New York – is to be rolled out to two further sites in Glasgow and East Lothian, supported by £500,000 of Scottish Government funding. SEPA is identifying further sites across Scotland where the same technological approach could be applied.

Question I – Landfill

- Do you agree with our approach on landfill as we move towards a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would support this approach?

CHAPTER 4: DELIVERING THE VISION

4.a - Communications

Our ambition and priorities for Scotland

We want the behaviours and practices that will support a circular economy to be increasingly mainstream within Scottish society and our economy – ending our 'throwaway culture' and allowing people and businesses to see the inherent value in the products and materials they use. We want people to be motivated to make changes in their lives and for Scotland to be recognised as a global leader.

Context

174. Making the transition to a circular economy will require some significant changes to how people and organisations operate. Engaging with people and highlighting both the need and opportunity for change will be important in achieving our aspirations.

175. The circular economy can appear complex or abstract and there is a need to bring the concept to life for people so they can appreciate its potential.

176. There is also a compelling argument for seeing this as a generational shift, with younger people being particularly important if circular economy models of production and consumption are to become the norm over time.

177. Successfully moving to a circular economy in Scotland will also create opportunities to promote our achievements internationally and we want Scotland to be a beacon for others around the world on this agenda.

What we're doing already

178. We have existing behaviour change campaigns covering recycling and food waste.

179. Scotland's carrier bag charge sparked high levels of public engagement with ways to reduce waste and reuse items to retain their value. We subsequently sought to capture ideas from people through an online campaign called #MakeThingsLast which put forward five ideas as a starting point for debate:

- Tool sharing libraries – since it is estimated the average drill is only used for about 13 minutes of its life.
- Modular mobile phones – making phones easier to repair and upgrade could significantly extend their average lifespan, currently just two to three years.
- Leasing clothes – around 30 per cent of clothing in the UK (1.7 billion items) has not been worn for at least a year.
- Packaging from plants – a number of companies produce compostable packaging to replace non-degradable alternatives such as polystyrene.
- 3-D printing centres – To make things with less waste and produce spare parts.

180. Zero Waste Scotland funds a number of local community organisations through its Volunteer and Community Advocate Programme, which trains and

supports volunteers to engage people directly and provide practical information or self-help activities to encourage more recycling, reuse and repair.

181. Alongside the action on education mentioned in the Skills section of this document, we have also supported YoungScot (Scotland's national youth information and citizenship charity) to engage young people through its #YSFullCircle initiative.

182. Scotland became the first national government to join the Ellen MacArthur Foundation's CE100 network and we have shared our experiences and ambition on international platforms.

What we propose to do next

183. We want to work with local authorities and others in the recycling supply chain to deliver high profile, **national communications** to drive increased levels of recycling and re-use.

184. We will build on the success of the **#MakeThingsLast** initiative and develop new ways to engage people in the benefits of a circular economy.

185. We will further support **community-based initiatives** which facilitate sharing and the exchange of goods and services, and help to normalise alternative modes of consumption, such as leasing or performance-based models.

186. Reflecting the priority given to addressing circular economy opportunities in Scotland's Economic Strategy we will work with the Enterprise Agencies, Business Gateway, local authorities, Innovation Centres and others to embed it within their mainstream **economic development functions**.

187. By the end of 2015, we intend to launch a '**Scottish Circular Economy Network**', a network of businesses and supporting organisations to help achieve a more circular economy, through collaboration and business-led initiatives.

Question J – Communications

We would welcome views on the approaches to communication outlined in this section.

- Do you agree with our aspirations on communication for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

4.b – Skills for a circular economy

Our ambition and priorities for Scotland

We want to embed the development of new circular economy skills and thinking in the next generation of designers, business leaders and innovators. We want to make sure Scotland's workforce has the right skills to take advantage of opportunities from a more circular economy, to ensure our businesses can innovate and prosper, now and in the future.

Context

188. As we move towards a more circular economy, we need to understand the trends which impact upon the skills required by our workforce to help realise business development opportunities.

189. New, specific skills may be needed to develop different approaches to design, inspection and cleaning in remanufacturing and repair, as well as reskilling to allow people to move from one industry to another as opportunities develop.

190. There is also considerable scope to broaden skills and improve the opportunities in the existing resource management sector. The sector has an ageing workforce profile with few young people and women. Health and Safety related skills and training are a particular priority given the nature of the work undertaken.

191. Industry and employer needs are generally identified in industry Skill Investment Plans. These outline the key skill issues for a relevant industry sector and any skills shortages or reskilling needs.

192. Developing the Young Workforce - Scotland's Youth Employment Strategy[27] focuses on reducing youth unemployment by improving training opportunities for young people and emphasises the importance of connecting education and training with the needs of employers and ensuring employers shape school and college curriculums to better prepare all young people for work.

193. Our commitment to STEM (Science, Technology, Engineering and Mathematics) education, a particular focus of our actions to develop the young workforce, is relevant for a more circular economy. We are committed to on-going support for STEM education in schools, with particular emphasis on the primary sector, to ensure that STEM learning in schools is stimulating and relevant, with close links between industry, academia and schools.

194. In addition, Learning for Sustainability is now integral to teaching standards in Scotland and we are working to support its development across all schools. It is a holistic set of values and approaches to teaching learning and leadership in schools that enables young people to build the values, attitudes, knowledge and skills they will need to engage in sustainable development and social justice locally and globally.

What we're doing already

195. Through Zero Waste Scotland and Skills Development Scotland, we have been engaging with industry partners and academia across a number of sectors (including resource management, resource efficiency, reuse and repair, creative industries and design) to identify skill needs.

[27] Developing the Young Workforce, Scottish Government (2014) http://www.gov.scot/Publications/2014/12/7750

196. Education Scotland and Zero Waste Scotland supported the Ellen McArthur Foundation between 2013 and 2015 in increasing the engagement of Scottish schools in learning relating to the circular economy.

197. There are a number of existing skills development initiatives that can support the transition to a circular economy, such as:

- the Scottish Institute for Remanufacture linking industry and academic groups and a network of hubs across the UK;
- the development of Modern Apprenticeships in Sustainable Resource Management;
- the energy efficiency skills programmes of the Sector Skills Council;
- the Innovation Centres e.g. the Industrial Biotechnology Innovation Centre and their support for PhD studentships;
- Community Resources Network Scotland and its support for repair and refurbishment skills;
- RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce) engaging the design community in new thinking; and
- Decom North Sea – examining skills needed to repurpose offshore equipment

What we propose to do next

198. We will **review existing Skills Investment Plans** (SIPs) to identify how circular economy training and skills development can be incorporated on a cross-sector basis. This information will also be used to build on existing engagement with stakeholders such as Industry Leadership Groups, Skills Groups and Employers.

199. We will **assess the specific skills needs** for the growth opportunities identified by our evidence programme, initially in the Food & Drink sector, Oil & Gas sector, and Re-use organisations.

200. We intend to explore how we can support education on the circular economy through the **embedding of sustainability** in Scottish design undergraduate degrees and the development of learning for sustainability across the school curriculum.

201. We will also explore potential to integrate circular economy awareness and skills into a range of other training and education programmes including Business Studies qualifications.

202. We will explore how to ensure circular economy skills are **mainstreamed** within wider skills development activity.

203. We will consider if there are opportunities to support greater **transfer of skills between industries**, or to align skills with new technologies, to supplement the existing industry-led approaches.

Question K – Skills

- Do you agree with our aspirations on skills for a more circular economy?
- What other opportunities are there for transformational change?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

4.c - Measuring progress

Our ambition and priorities for Scotland

We want to improve our understanding of how products and materials flow through our economy - to track progress, assess the scale of potential opportunities; and help identify future actions.

Context

204. Progress towards a circular economy means a change in the way we do things – a change in process.

205. For waste policy it has been appropriate to measure progress using indicators such as tonnage-based recycling rates, diversion from landfill and reductions in waste produced. All these measures are linked to the existing policy and regulatory framework for waste and so data is readily available. However, a focus on weight does not give us a full understanding of environmental impacts, and further improvement in data reliability and quality are required.

206. The move to electronic waste transfer documentation through the electronic Duty of Care (edoc) system, managed jointly by the four governments in the UK, is assisting with data reliability and quality.

207. As we move towards a more circular approach, we need to better understand the flow of materials through supply chains to consumers and onwards to other uses.

208. We want to strengthen our evidence on the value and business impacts of circular economy opportunities, building on the research undertaken so far to help business and the public sector prioritise. For example, evaluating the extent to which better process and product design can keep material value in the economy. We need to measure processes (such as reuse and repair activity) as well as outputs and outcomes.

209. The EU Circularity Indicators Methodology[28] can be used to measure how effectively a business is making the transition to a more circular approach, by analysing the material flows of its products and processes.

What we're doing already

210. Scotland already has ambitious targets for waste and resource management, going beyond those set by the EU:

Target	Year	Set by
Reduce waste arising by 7% against the 2011 baseline of 13.2 million tonnes.	2017	Scottish Government
Recycling and preparing for re-use of 50% by weight of household waste and similar.	2020	EU
60% recycling/composting and preparing for re-use of waste from households.	2020	Scottish Government
No more than 1.26 million tonnes of biodegradable municipal waste to be sent to landfill.	2020	EU

[28] Ellen MacArthur Foundation, Circularity Indicators: http://www.ellenmacarthurfoundation.org/circular-economy/metrics

70% recycling and reuse of construction & demolition waste.	2020	EU
Reduce waste arising by 15% against the 2011 baseline of 13.2 million tonnes.	2025	Scottish Government
No more than 5% of all waste to go to landfill. (Following ban on municipal biodegradable waste to landfill from 2021)	2025	Scottish Government
70% recycling/composting and preparing for re-use of all waste by 2025.	2025	Scottish Government

211. Scotland's household recycling rate was 42.2% in 2013, improved from approximately 32% for municipal waste in 2007. Total waste arisings have reduced significantly in recent years. We are also tracking key indicators, including:

- the total amount of waste produced by sectors - household; commerce and industry; and construction and demolition.
- the amount of waste produced by sectors per unit of GVA.
- the carbon impact of waste - the whole-life impacts of waste including the benefits of prevention and recycling.

212. Scotland's Carbon Metric[29] assesses and quantifyies the carbon impacts of material consumption and waste; and Zero Waste Scotland updates the Carbon Metric annually.

What we propose to do next

213. We will continue to build our **evidence base** to help identify specific circular economy opportunities.

214. We intend to refresh Scotland's suite of **targets and indicators**, incorporating **process measures** to reflect the development of a more circular economy. This will be developed in parallel with discussions on the EU Circular Economy package.

215. We will continue to promote the **carbon metric** as an alternative to the conventional weight-based waste measurements including in the context of the EU Circular Economy package. Zero Waste Scotland will use the carbon metric to highlight the significant difference in impacts between recycling and reuse.

216. We intend to develop a **long term data strategy** to support a more circular economy.

217. To help understand the flow of materials around our economy, we propose to make the use of the **electronic edoc system mandatory in Scotland**; and will continue working with the UK Government and other devolved governments to develop this system and consider inclusion of transfrontier shipment of waste and hazardous waste.

Question L – Measuring Progress

We are looking for feedback on the proposed approaches outlined in this section.

- Do you agree with our aspirations on measuring progress towards a more circular economy?
- Do you agree with the proposed actions for further exploration?
- What other actions would help unlock opportunities?

[29] Carbon Metric, Zero Waste Scotland: http://www.zerowastescotland.org.uk/category/subject/carbon-metric

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