Waste prevention and the circular economy

Due diligence research report

About BSI

BSI is the UK National Standards Body (NSB). It brings together business, industry, government, consumers, innovators and others to develop British, European and International Standards. The knowledge embodied in the standards, has been carefully assembled in a dependable format and refined through an open consultation process.

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[Note: Annex A and B are provided as separate documents.]

1 Introduction

1.1 Background

Linear “take, make, dispose” industrial processes and the lifestyles that feed on them deplete finite reserves to create products that end up in landfills or incinerators. This realization has triggered the thought process around the re-design of products, components and systems to retain material within the economy over several cycles of use – “closing the loop’” The related concept of the ‘circular economy’ is grounded in the study of non-linear systems and encompasses more than the production and consumption of goods and services, including a shift from fossil fuels to the use of renewable energy, and the role of diversity as a characteristic of resilient and productive systems. It also includes discussion of the role of money and finance as part of the wider debate.

‘Closing the loop’ and the move to a ‘circular economy’ has been identified as a significant opportunity for UK business to contribute towards a resource efficient and low-carbon economy, to reduce costs and supply risks, and to generate value. To this effect, the Government Waste Policy Review for England 2011 recommends that the government "work with standard setting organizations to encourage inclusion of more waste prevention requirements in ... product standards".

The BSI *Waste prevention and the circular economy* project aims to map the existing standards landscape and identify gaps and priority areas. The project also seeks to address the identified gaps either by adding to existing standards or developing new standards in collaboration with interested stakeholders, and where there is a proven need/benefit. This could include looking at standards for circularity (including all types of closed loop systems – from leasing and reuse through to recycling), or mechanisms to help organizations develop or enhance their ‘circular economy’ thinking, and start to embed it (for example though their management systems or re-thinking their business models altogether).

The project comprises two consecutive stages:

1. Due diligence research (i.e. this report) into standards that (could) support and encourage waste prevention and closed loop approaches to production and consumption, including assessing the opportunity to reflect recent thinking around the circular economy model; and
2. Stakeholder forum (event) to validate and prioritise results from the research and register interest in taking forward the key (most impactful) opportunities.

The overall project objectives are as follows:

- Encourage inclusion of more waste prevention requirements in product standards across sectors.
- Explore opportunities for standards and other tools for “circularity” to help organizations develop/enhance their circular economy thinking and start to embed it.
- Explore the opportunity to standardize the emerging circular economy model in order to establish an agreed and consistent approach among those thought leaders seeking to embrace and promote a circular economy.
- Promote closed-loop thinking and practice across industries and stakeholder groups to help address the ever growing concern of resource scarcity and supply chain instability, deliver better environmental performance, and encourage more socially responsible business models.

1.2 Purpose

The purpose of this research report is two-fold:

- to gather information about waste prevention and the circular economy concept, and
- explore the role of standards in encouraging waste prevention and a move to circular economy thinking.

The key findings, observations and recommendations from this report feed into a stakeholder forum, which forms the second stage of the project.

2 Research methodology

2.1 Overview

In order to ascertain the relevant waste prevention and circular economy standards and initiatives, an extensive desk-based review was undertaken between October 2013 and January 2014. A draft version of this report was then circulated to a select number of stakeholders[1] and feedback invited in preparation for the second stage of the project – stakeholder forum (event) which took place on 8 April 2014. Comments received as part of the peer review have been considered and reflected in this final version of the report.

2.2 Standards

2.2.1 Formal standards

The BSI standards reference database, Perinorm (which indexes worldwide standards) was used to identify formal international (ISO) and European (CEN and standards from other EU countries) and BSI publications relating to waste prevention and the circular economy concept.

Several searches on Perinorm were conducted under the two International Classification for Standards (ICS) codes: 13.020 Environmental protection, and 13.030 Wastes. These were followed by general keyword searches around the following categories and terms:

- **Waste**
  - Waste prevention
  - Waste reduction
  - Waste minimization
  - Designing out waste
  - Waste review / waste policy review
- **Recycling**
  - Reuse
  - Product reuse
  - Recycling
  - Upcycling
  - Downcycling
  - Regenerative design
  - Sharing economy
  - Closed loop
  - Closing the loop
- **Manufacturing**
  - Lean manufacturing
  - Advanced manufacturing
- **Resourcing**
  - Resource management
  - Resource scarcity
  - Resource efficiency
- **Circularity**
  - Circularity
  - Circular ecology
  - Virtuous cycle
  - Virtuous circle
- **Materials**
  - Material re-use/reuse, material recovery
  - Sustainable materials
  - sustainable use of materials

[1] Comments on the draft report were invited from the Department for Environment, Food and Rural Affairs (DEFRA), the Ellen McCarthur Foundation (EMF), BioRegional, the Knowledge Transfer Network (KTN), Green Alliance, Kingfisher Group, Waste & Resource Action Programme (WRAP) and the Great Recovery Programme.

2.2.2 Private standards

Web searches were conducted to identify standards developed by organizations other than National Standards Bodies, CEN (European Committee for Standardization) and ISO (International Organization for Standardization). The same key word searches (see above) were conducted.

2.3 Key players and initiatives

Similarly, key word searches were undertaken to identify:

- they key players/organizations leading the circular economy debate; and
- other documents, policies and initiatives relevant to the scope of the project.

2.4 Legislation

Further web-based searches were conducted to identify relevant legislation.

2.5 Limitations

As the concept of the circular economy gathers momentum, so does the number of initiatives in this area. Whilst every effort has been made to identify the key formal standards and other initiatives, the results are limited to the information identified between October 2013 and January 2014 using the key search terms. The research is also limited by the reach of the number of countries covered by the Perinorm database, for example Australian, Chinese, Brazilian standards are not covered by the database.

3 Main findings - standards

3.1 Overview

This section is the first of three that detail the main findings of the research undertaken.

In order to maintain the context of the original source, the information regarding private standards is largely presented verbatim.

3.2 Formal standards

The key word searches identified over 200 published standards that are relevant to the waste prevention and circular economy topics. The key areas that were supported by standards were recycling, materials and waste (in that order). The majority of the standards that included a reference to sustainable material use/reuse/recovery related to plastics and were mainly Italian standards. Those that referenced resource management/scarcity/efficiency were mainly Russian standards.

The standards that cover any of the key search terms in detail, and/or are deemed to be of significance to this research, are discussed below. The full list of standards identified through database searches can be found in Annex A. Note that due to the nature of the performed searches (by key word or classification code) and the limitation of the formal standards databases (e.g. focus on published standards in contrast to standards in development, as well as geographic limitations) some of the standards that appear below do not feature in the list of standards provided in Annex A. These additional standards have been identified using other desk-based approaches and through direct input from standards experts.

3.2.1 BS 8903 - Principles and framework for procuring sustainably – guide

Published in 2010, this standard gives recommendations and guidance on how to adopt and embed sustainable procurement principles and practices across an organization and its respective supply chains.

The standard suggests that only goods that are really needed should be purchased. It also suggests that when buying items or services, environmental, social and economic consequences of design; non-renewable material use; manufacture and production methods; logistics; service delivery; use; operation; maintenance; reuse; recycling options; disposal; suppliers' capabilities to address these consequences throughout the supply chain, should be taken into account

This standard is one of the documents that is being used to inform the development of a new international standard on sustainable procurement.

3.2.2 BS 8895-1 - Designing for material efficiency in building projects - code of practice for strategic definition and preparation and brief

BS 8895-1 was published in 2013 as the first in a projected suite of codes of practice that address specific and interrelated issues and processes of material efficiency in building projects in line with the RIBA Plan of Work[2].

[2] The RIBA Plan of Work is the definitive UK model for the building design and construction process. See http://www.ribaplanofwork.com/.

This part of BS 8895 gives recommendations for the process by which design and project teams seek to maximize material efficiency through design. It outlines what material efficiency in design involves and how the process of designing for material efficiency is implemented through the strategic definition and preparation and brief stages of a project.

The standard applies to all types and sizes of building projects and includes both new build and refurbishment projects but excludes civil engineering projects, facilities management and RMI (repair, maintenance and improvement) activities.

BS 8895, Designing for material efficiency in building projects, will eventually comprise the following parts.

- Part 1: Code of practice for Strategic Definition and Preparation and Brief.
- Part 2: Code of practice for Concept and Developed Design.
- Part 3: Code of practice for Technical Design.
- Part 4: Code of practice for operation, refurbishment and end of life.

3.2.3 BS 8887 Design for manufacture, assembly, disassembly and end-of-life processing (MADE)

The purpose of BS 8887 is to provide context for the preparation of technical product specifications in accordance with Geometrical Product Specifications (GPS) principles. It is intended that subsequent parts of this British Standard will address specific requirements for various types of engineering manufacture, for example mechanical; hydraulic; electronic; chemical. It is currently made up of five parts as detailed below:

1. **BS 8887 - 1 Design for manufacture, assembly, disassembly and end-of-life processing (MADE). General concepts, process and Requirements** was published in 2006. This part of BS 8887 specifies requirements for the preparation, content and structure of design output and the preparation of related technical product documentation for the manufacture, assembly, disassembly and end-of-life processing (MADE) of products. It identifies and describes methodologies and conventions appropriate to the preparation of documentation, in whatever form, intended to transfer a design concept to manufacture, including the determination of required accuracy and tolerances for verification purposes. It also provides guidance on the application of principles and techniques to assist the designer in the preparation of unambiguous instructions, commensurate with the perceived complexity, role and life of the intended product. In addressing end-of-life requirements, this British Standard extends beyond specification for the manufacture and assembly of products to incorporate recommendations on how best to incorporate into the documentation, guidance on the ultimate reuse, recovery, recycling and disposal of the components and materials used.

   This standard is currently is being used as the base document for ISO 8887: Design and documentation for manufacture, assembly, disassembly and end-of-life processing (MADE). It is expected that ISO 8887 will publish in 2016.

2. **BS 8887 - 2 Design for manufacture, assembly, disassembly and end-of-life processing (MADE). Terms and definitions.** This part of BS 8887 was published in 2009 and defines terms for design for manufacture, assembly, disassembly and end-of-life processing (MADE).

3. **BS 8887-220 Design for manufacture, assembly, disassembly and end-of-life processing (MADE). The process of remanufacture. Specification** was published in 2010. This part of BS 8887 specifies requirements for the process of remanufacture and the steps required to change a used product into an as-new product, with at least equivalent performance and warranty of a comparable new replacement product. The remanufacturing process can include parts or components to be used in subsequent assembly. This part of BS 8887 is applicable to manufactured products. It is not applicable to certain transient products or consumables (e.g. food, fuel); digital media; or commodity materials (e.g. base chemical substances, sand or minerals).

4. **BS 8887 - 240 Design for manufacture, assembly, disassembly and end-of-life processing (MADE). Reconditioning** was published in 2011. This part of BS 8887 specifies requirements for the process of reconditioning, i.e. returning a used product to a satisfactory working condition by rebuilding or repairing major components that are close to failure, even where there are no reported or apparent faults in those components. The reconditioning process can include parts or components to be used in subsequent assembly. As with BS 8887, part 220, it is applicable to manufactured products and not applicable to certain transient products or consumables (e.g. food, fuel); digital media; commodity materials (e.g. base chemical substances, sand or minerals).

5. **BS 8887 – 211 Design for manufacture, assembly, disassembly and end-of-life processing (MADE). Specification for reworking and remarketing of computing hardware** was published in 2012. The aim of this part of BS 8887 is to give IT sector remarketers the vocabulary and procedures needed to accurately define their products. This is needed because the industry sells a variety of used products under a number of different grades.

   This enables the user to understand the processes undertaken by the reseller and the level of the final product's quality. The term "remarketed product" is used in the computer hardware industry and refers to a product that cannot be sold as new, even when sold through the Original Equipment Manufacturer's (OEM) primary or standard channels to market. It is relevant to the following categories of organizations:

   a) OEMs.
   b) OEM-contracted and authorized service providers.
   c) Independent remarketing companies and service providers.

   It is intended to be used in conjunction with BS 8887-1, BS 8887-2, BS 8887-220, BS 8887-240 and PAS 141 (see below).

   It is also worth noting that an international (ISO) standard on remanufacturing has recently been proposed by the Chinese Standardization Administration, and is likely to be created in the next two to three years. BS 8887-220 is likely to be used as one of the base documents to inform the development of the future International Standard.

6. **BS 8887-210 Design for manufacture, assembly, disassembly and end-of-life processing (MADE): Specification for reworking and remarketing** is also in development. The work on this standard has just begun and it is likely to publish towards the end of 2014. The aim of this part of BS 8887 is to give remarketers the vocabulary and procedures needed to accurately define their products.

3.2.4 PAS 141 is a process management specification for the re-use of used and waste electrical and electronic equipment (UEEE and WEEE).

PAS 141 Reuse of used and waste electrical and electronic equipment (UEEE and WEEE). Process management. Specification was developed by industry experts working with the Department for Business, Innovation and Skills (BIS) and published in 2011. The standard is intended to:

• improve the standards for the re-use and refurbishment of electrical and electronic equipment that has reached the end of its first useful life in the UK; and
• address the demand from consumers for assurance that the used electrical products they buy are electrically safe to use and functionally fit for purpose.

PAS 141 sets out the requirements to successfully manage the process of preparing used and waste electrical and electronic equipment (WEEE) for reuse. It helps organizations to put the right quality assurance systems in place, while complying with environmental health, and health and safety regulations. Giving practical advice, it helps to reduce costs and ensure that these recycled parts and products are of the highest quality. The standard also covers the preparation process for the reuse of electronic equipment and components. It applies to all organizations that deal with the preparation of equipment for reuse.

3.2.5 ISO 18600 series - environment and packaging standards

ISO 18601:2013 specifies requirements and procedures for the other International Standards in this series on packaging and the environment: ISO 18602, ISO 18603, ISO 18604, ISO 18605, and ISO 18606. It is applicable to a supplier responsible for placing packaging or packaged goods on the market. They key standards of relevance to this report are:

- ISO 18603:2013 specifies the requirements for a packaging to be classified as reusable and sets out procedures for assessment of meeting the requirements, including the associated systems.
- ISO 18604:2013 specifies the requirements for packaging to be classified as recoverable in the form of material recycling while accommodating the continuing development of both packaging and recovery technologies and sets out procedures for assessment of meeting its requirements.
- ISO 18605:2013 specifies the requirements for packaging to be classified as recoverable in the form of energy recovery and sets out assessment procedures for fulfilling the requirements.

ISO 18606:2013 specifies procedures and requirements for packaging that are suitable for organic recycling. Packaging is considered as recoverable by organic recycling only if all the individual components meet the requirements.

There are also a couple standards in development that are looking at returnable transport systems for reusable rigid plastic distribution boxes (ISO 18616-1 and ISO 18616-2) and another couple that are looking at material labelling (PD ISO/TS 18614-1 and PD ISO/TS 18614-2).

European standards that are also of relevance to this research that deal with material recovery, recycling and re-use and were published between 2004 and 2007. These standards are listed in Annex A.

3.2.6 EN 15343 – EN 15348 European plastic recycling standards

A number of European standards (EN 15343 – EN 15348), published in 2007, that have been developed to support the plastic recycling industry that cover the characterization of various types of plastics including polystyrene, polyethylene, polyvinyl chloride (PVC), polyethylene terephthalate (PET), polypropylene (PP) and plastic wastes. EN 15343, also published in 2007, specifies the procedures needed for the traceability of recycled plastics and gives the basis for the calculation procedure for the recycled content of a product.

3.2.7 PAS 105 Recovered paper sourcing and quality for UK end markets

PAS 105 makes recommendations for, and gives guidance on, good practice for the collection, handling and processing of recovered paper intended for recycling within UK end markets. The main aim of this standard is to explain the key factors that influence the efficient recycling of recovered paper in order to promote best practice throughout the whole process chain. It was prepared by BSI in consultation with the Confederation of Paper Industries (CPI), Environmental Services Association (ESA), Local Authority Recycling Advisory Committee (LARAC) and WRAP (Waste & Resources Action Programme) and a wider review panel. PAS 151 is applicable to paper collected by local authorities, local authority contractors, community groups and charities from households and other sources that generate similar material to households. This PAS is due for review and update.

3.2.8 PAS 109:2013 Specification for the production of reprocessed gypsum from waste plasterboard

Sponsored by WRAP with its development facilitated by BSI, the overall aim of this PAS is to provide a specification that can be adopted by reprocessors for producing defined grades of reprocessed gypsum from waste plasterboard, such that potential customers will be assured that they are procuring a material of consistent and verifiable quality.

3.2.9 PAS 402:2013 Waste resource management - Specification for performance reporting

Sponsored by Constructing Excellence in Wales (CEW), funded by the Welsh Government, the aim of PAS 402 is to provide waste management organizations with a specification for performance reporting. The specification provides the framework for the demonstration of performance against key areas of delivery, including landfill diversion and materials recovery, assuring potential and existing customers of the service they are procuring. It can provide clients such as government and local authorities with a framework for good practice which they can specify.

It requires a waste resource management organization to report:

a) how it conducts specific waste resource management activities; and
b) the landfill diversion and material recovery rates it achieves.

Developed in consultation with a wide range of stakeholders, PAS 402's purpose is to increase reuse and recycling of waste by providing a framework within which good practice in waste management can be demonstrated by waste management organizations and specified by clients (e.g. government and local authorities).

3.2.10 BS 8601:2013 Specification for subsoil and requirements for use specifies criteria for the classification, composition and use of subsoils that are moved or traded for creating soil profiles intended to support plant growth

Soil is a dynamic and fragile material, which when managed appropriately fulfils its function, but is easily damaged by mishandling. BS 8601:2013 specifies requirements for the classification, composition and use of subsoils that are moved or traded for creating soil profiles intended to support plant growth.

The standard is not applicable to topsoil, or to subsoil that is to remain in situ. It is not intended to preclude the use of subsoil that is already on site and suitable for its intended purpose. This standard also specifies requirements for multipurpose subsoil, which is fit for the majority of needs, as well as for specific purpose subsoils that are acidic or calcareous, for specialist use where acidic or calcareous soil profiles are required.

3.2.11 BS 8905:2011 Framework for the assessment of the sustainable use of materials. Guidance

BS 8905 was published in 2011 to provide a framework for the concepts, techniques, tools and methodologies that can be used to support decisions surrounding the sustainable use of materials. The framework can be applied to all parts of the supply chain and is intended to support decision making about the sustainable use of any type of material. This standard covers consideration of:

a) the social, economic and environmental aspects throughout the material lifecycle, covering:

- sourcing of materials;
- conversion of materials into products;
- performance of a product over its functional lifetime;
- end of life of the product and either the reuse, remanufacture, recycling or disposal of the product; and
- end of life of a material and either the reuse, remanufacture, recycling or disposal of the material, with particular emphasis on social performance in the use phase of a product life and environmental performance over the full life cycle, and taking into consideration the longer term and local economic issues.

b) how to balance these aspects against stakeholder priorities in terms of sustainable development;

c) guidance on the use of decision support tools to assess the relative sustainability of material choice;

d) the importance of data quality when carrying out a sustainability assessment.

3.2.12 BS EN 62430:2009 Environmentally conscious design for electrical and electronic products

The goal of environmentally conscious design (ECD) is the reduction of adverse environmental impacts of a product throughout its entire life cycle. Environmentally conscious design is not a separate design activity; rather, it is an integral part of the existing design process. BS EN 62430 specifies requirements and procedures to integrate environmental aspects into the design and development processes of electrical and electronic products.

It is intended for use by all those who design or develop electrical and electronic products. This includes all parties in the supply chain, regardless of organization type, size, location and complexity. BS EN 62430 is applicable to all types of electrotechnical products, new as well as modified. This includes combinations of products, and the materials and components of which they are composed.

3.2.13 BS EN ISO 14040 and 14044 - Life cycle assessment - principles and framework and requirements and guidelines (respectively)

These international standards were published in 2006. BS EN ISO 14040, specifies the principles and framework for a life cycle assessment (LCA), whereas BS EN ISO 14044 details the requirements and guidelines for conducting an LCA.

The introduction to the standards states that the following:

LCA addresses the environmental aspects and potential environmental impacts (e.g. use of resources and the environmental consequences of releases) throughout a product's life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal (i.e. cradle-to-grave). It covers both manufactured and consumed products.

LCA can assist in:

- identifying opportunities to improve the environmental performance of products at various points in their life cycle;
- informing decision-makers in industry, government or non-government organizations (e.g. for the purpose of strategic planning, priority setting, product or process design or redesign);
- the selection of relevant indicators of environmental performance, including measurement techniques; and
- marketing (e.g. implementing an eco-labelling scheme, making an environmental claim, or producing an environmental product declaration).

3.2.14 Draft standard for cross-border trade of second-hand goods

New work on an International Standard for cross-border trade of second-hand goods has started within ISO (the International Organization for Standardization). The work recognizes the fact that cross-border movement of second-hand goods (SHG) has been in practice for many years and trade activity has increased exponentially. Most second-hand goods are sold or donated by developed countries to developing ones and the value of this market is estimated at billions of dollars. Consumers welcome having the choice of purchasing low cost, durable, and safe SHG as an alternative to higher priced new goods, and the demand for these products is robust. In addition, the re-use of consumer goods is viewed as a factor in good environmental stewardship because it is more resource efficient than manufacturing new items and diverts goods that might otherwise go to landfills and other disposal facilities.

The standard will:

- establish minimum screening criteria for SHG that are traded, sold, offered for sale, donated, or exchanged between countries.
- Contribute to the protection of consumers' health, safety and the environment in which they interact, when using second-hand goods.
- Be applicable to second-hand goods that are shipped across at least one international border, and where the intended end user is a consumer.

The standard will not apply to goods that are remanufactured, rebuilt or refurbished.

3.3 Private standards

3.3.1 WRI global food loss and waste protocol

The World Resources Institute (WRI) announced on in Copenhagen on the 5th of November 2013 that it has started to design a global standard, called the "Global Food Loss and Waste Protocol", aiming to enable countries and companies to measure and monitor food loss and waste.

The Food Loss & Waste Protocol (FLW Protocol) is a multi-stakeholder effort to develop the global standard for measuring food loss and waste. It will enable countries, companies and other organizations to estimate in a credible, practical and consistent manner how much food is lost and wasted and identify where the loss and waste occur. With this information, users will be better equipped to address food loss and waste.

Development of the FLW Protocol is being coordinated by the World Resources Institute (WRI) in conjunction with the Consumer Goods Forum (CGF), FAO, FUSIONS, UNEP, World Business Council for Sustainable Development (WBCSD), and WRAP.

3.3.2 Carbon Trust waste standard

The UK-based carbon reduction consultancy the Carbon Trust launched the world's first international certification scheme to recognize firms that are effectively reducing their waste year on year. The Carbon Trust Waste Standard is aimed at large organizations and requires them to measure, manage and reduce their solid and hazardous waste. The standard also includes a qualitative assessment to show that waste is being managed responsibly both upstream and downstream.

Five UK organizations have been awarded the Carbon Trust Waste Standard after being part of a pilot programme. The companies include The Football Association, which owns Wembley Stadium; The hospitality group Whitbread, which owns brands such as Costa Coffee and Premier Inn; Chemicals giant AkzoNobel's Decorative Paints UK division; Accountancy firm PwC; and Manufacturing and healthcare company Renishaw.

3.3.3 WRAP re-use standard

WRAP has launched a consultation process for a proposed Re-use Standard in 2013. The aim of the generic, sector-wide standard is to enable organizations in the UK to offer products for re-use that have been subjected to a quality assured process, thereby building customer confidence in purchasing from the re-use sector and aiding its development.

The responses to the public consultation in 2013 on the Re-use Standard provided a range of views. Therefore WRAP is conducting further research to better understand the most effective way that a standard could increase confidence among potential purchasers of re-use products. Once they have the results, WRAP will evaluate the best way forward.

3.3.4 The Cradle to Cradle Products Innovation Institute's Cradle to Cradle Certified™ Products Standard

The standard is a multi-attribute, continuous improvement methodology that evaluates products across five categories of human and environmental health. It is administered by the Cradle to Cradle Products Innovation Institute℠. Product certification is awarded at five levels (Basic, Bronze, Silver, Gold, Platinum), with the expectation that an applicant will optimize each aspect of their product over time. The ultimate goal is to encourage innovation and the design of products that effectively and positively impact people and the environment.

4 Main findings – key players and initiatives

4.1 Overview

There are increasingly more and more organizations from the private and public sector that are developing new initiatives and producing publications around the waste prevention and circular economy concept. This section details the key organizations and initiatives that were identified via the online key word search. In order to maintain the context of the original source, the information in this section is largely presented verbatim. The results are presented in chronological order.

4.2 Aldersgate Group

4.2.1 About

The Aldersgate Group (AG) is an alliance of leaders from business, politics and society that drives action for a sustainable economy. Their mission is to trigger the change in policy required to address environmental challenges effectively and secure the maximum economic benefit in sustainable growth, jobs and competitiveness. The organization's approach is to:

- Develop the network. A powerful coalition of leaders from business, politics and society.
- Build support. Policy objectives that address effectively environmental challenges and maximize the economic opportunities.
- Drive change. Action to accelerate the transition to a low carbon, resource efficient and competitive economy.

Their membership includes:

4.2.2 Key publications

The Aldersgate Group in conjunction with the Ellen MacArthur Report launched two reports on the subject in 2012:

- **Resilience in the Round -** Seizing the growth opportunities of a circular economy, which sets out the opportunities for growth and competitive advantage in a resource constrained world.
- **Skills for a New Economy -** Discusses a paradigm shift in education and learning to ensure future economic a success. This report urges Government to ensure that education and training is better designed for future needs and not merely to remedy current shortages. The economy must be ahead of the game in addressing inevitable worldwide trends, such as increased globalisation and resource scarcity, and not get left behind in the international race to develop high growth sectors in cutting edge technologies.

4.3 BioRegional

4.3.1 About

BioRegional is an entrepreneurial charity which establishes sustainable businesses and works with partners around the world to demonstrate that a sustainable future can be easy, attractive and affordable. Their approach is known as One Planet Living.

4.3.2 Key publications

A number of One Planet Living publications can be accessed via the BioRegional website.

4.3.3 Key initiatives

One Planet Living is a positive vision of a world in which we are living happy, healthy lives, within the natural limits of the planet - wherever we live in the world - and we have left sufficient space for wildlife and wilderness. Real life examples show that this is possible.

The One Planet Living approach is a simple way to plan, deliver, communicate and mainstream sustainable development and the green economy.

There are a number of one planet companies including Cundall (consultancy); B&Q One Planet Home; Kingfisher eco-products; Fabrick Housing Association; Symphony (the UK's largest privately owned manufacturer of fitted kitchen, bedroom and bathroom furniture).

4.4 Business in the Community (BITC)

4.4.1 About

Building on 30 years of action, Business in the Community is 'working to shape a new contract between business and society, in order to secure a fairer society and a more sustainable future'. BITC is a business-led charity with a unique ability to convene the most senior business leaders from UK and global companies.

4.4.2 Key initiatives

4.4.2.1 Sustainable Business Toolkit

'Closing the loop' on the supply chain through improved product design, extending asset life, reuse and recycling can deliver tangible commercial and sustainability gains across a wider range of goods and materials.

Closed-loop systems reduce the need for extraction and processing of new resources, and lessen the associated impacts on the natural environment. They can improve quality and value by extending the useful life of goods, enabling their re-use and re-sale, saving money for businesses and cutting costs for consumers.

Value can be realized by:

- circling goods within the system for longer by enhancing their durability and reusability
- cascading the use of materials more effectively through different sectors and products (for example, using fibres in textiles, upholstery, and finally insulation materials)
- ensuring that material streams remain uncontaminated and of high quality, enabling their longevity
- tightening the circle by minimising initial material use.

Source: Accenture, 2013

4.5 The Cradle to Cradle Products Innovation Institute

4.5.1 About

The Cradle to Cradle Products Innovation Institute, a non-profit organization, administers the Cradle to Cradle Certified™ Product Standard. According to its official website, it was created to bring about a new industrial revolution that turns the making of things into a positive force for society, economy, and the planet. The Institute is headquartered in San Francisco, California.

4.5.2 Key intiatives

The Institute administers the publicly available Cradle to Cradle Certified Product Standard – "a systemic approach to product innovation that spurs the creation of truly beautiful, high-quality products, and transforms the production of consumer products into a positive force for society and the environment".

The Institute is developing an open database of "preferred" alternative chemicals, materials and processes. These are intended to help companies reformulate or retool to create new products. Companies can share their lists of preferred materials, understanding that buyers respond most to full transparency. For further information, refer to the Institute's Innovation Hub.

4.6 Department of Communities and Local Government (DCLG)

4.6.1 About

DCLG work to move decision-making power from central government to local councils. This helps put communities in charge of planning, increases accountability and helps citizens to see how their money is being spent.

4.6.2 Key initiatives

4.6.2.1 Encouraging Cradle to Cradle processing

DCLG has announced a new opportunity for initiatives in the East of England to support, advise and guide small businesses and other organizations in understanding the Cradle to Cradle principle and how it can assist them over the long term to be more sustainable and competitive.

4.6.2.2 Cradle to Cradle: an alternative to linear systems

The Cradle to Cradle framework represents a fundamental alternative to current linear (i.e. cradle to grave) production systems in which resources are shaped into products, sold, then eventually disposed of as waste.

The Cradle to Cradle approach is also known as the circular economy.

4.6.2.3 Developing the Cradle to Cradle approach

£1 million of European Regional Development Funding, which is managed by the Department for Communities and Local Government, will be made available for projects in the East of England under the European Regional Development Fund Competitiveness Programme (2007-13).

Successful initiatives will demonstrate that they can progress and stimulate market developments in new, developing and innovative products, process and services within multiple small businesses, with the main aim of improving and stimulating the East of England's economy.

4.6.2.4 The European Regional Development Fund in the East of England

The European Regional Development Fund (ERDF) is investing €110.9 million in the East of England between 2007 and 2013, enhancing the competitiveness of the region's economy by supporting growth in enterprise and employment. The East of England programme has a theme of low carbon economic growth.

4.7 Department for Environment, Food and Rural Affairs (DEFRA)

4.7.1 About

DEFRA is the government department responsible for policy and regulations on environmental, food and rural issues. Their priorities are to grow the rural economy, improve the environment and safeguard animal and plant health. DEFRA is a ministerial department, supported by 38 agencies and public bodies.

Concordats set out agreed frameworks for co-operation between it and the Scottish Government, Welsh Government and Northern Ireland Executive, which have devolved responsibilities for these matters in their respective nations.

DEFRA leads for Britain at the EU on agricultural, fisheries and environment matters and in other international negotiations on sustainable development and climate change, although a new Department of Energy and Climate Change was created on 3 October 2008 to take over the last responsibility.

4.7.2 Key publications and news releases

4.7.2.1 Government will not fund UK's journey to circular economy

13 May 2013, source edie newsroom

DEFRA's Director of Resource, Atmosphere and Sustainability Dr Colin Church said in the Resource Revolution panel debate from the 13th May 2013 that while the Government is not in a position to provide financial stimulus to help the UK move towards a circular economy, DEFRA are looking at working closely with stakeholders to support and encourage business-led solutions and initiatives. His words were:

"We have to be very careful because we are in a time of paucity of public funds, so if you ask me what the Government are going to do, one of my answers is not going to be - get some money out. …This is a time when we are looking for business-led solutions and not a time of saying 'we have got a problem here, so let the Government solve it for me,' that is not the space we are in here and now."

4.7.2.2 Delivering waste prevention though product standards

DEFRA's internal paper *'Delivering waste prevention through product standards'* provided for the purposes of this research project, introduces the subject of product standards and how they might be used to deliver more waste prevention, and highlights policy and evidence questions we need to answer to make this happen and fulfil the Waste Review commitments.

Below are the salient points from DEFRA's paper.

Objectives:

- Environmental product standards are the tool we use to describe the changes we want to see in products, in order to deliver environmental outcomes;
- Government's top priority in relation to waste is to prevent it arising in the first place, and product standards are one tool we can use to help deliver this;
- Waste prevention criteria (e.g. requirements not to use certain hazardous materials, or for spare parts to be available to enable repairs) are already included in some product standards. DEFRA's policy objective is to bring waste prevention criteria into the mainstream, so they are routinely included in the range of minimum and best practice product standards.

Aim:

The waste review includes commitments to:

- Explore how waste prevention requirements might be incorporated into minimum mandatory standards for the design of energy using products;
- Work with standard setting organizations to encourage inclusion of more waste prevention requirements in voluntary and best practice product standards;

- Develop the business case for including further waste prevention requirements in Government Buying Standards (both minimum mandatory and best practice) and amend the standards to reflect this.

4.7.2.3 The Waste Prevention Programme for England

DEFRA published the Waste Prevention Programme for England on 11th December 2013. The Programme is a requirement of the revised Waste Framework Directive (2008/98/EC) and sets out Government's view of the key roles and actions which should be taken to move towards a more resource efficient economy. As well as describing the actions the government is taking to support this move, it also highlights actions businesses, the wider public sector, civil society and consumers can take to benefit from preventing waste. The programme aims to improve the environment and protect human health by supporting a resource efficient economy, reducing the quantity and impact of waste produced whilst promoting sustainable economic growth.

The programme sets out how we can collectively:

- encourage businesses to contribute to a more sustainable economy by building waste reduction into design, offering alternative business models and delivering new and improved products and services;
- encourage a culture of valuing resources by making it easier for people and businesses to find out how to reduce their waste, use products for longer, repair broken items, and enable reuse of items by others;
- help businesses recognize and act upon potential savings through better resource efficiency and preventing waste, to realize opportunities for growth ;
- support action by central and local government, businesses and civil society to capitalize on these opportunities.

4.7.2.4 Waste Management Plan for England (WMPE)

The WMPE was published on 12th December 2013 and provides an analysis of the current waste management situation in England. . Its core aim is to bring current waste management policies under the umbrella of one national plan.

Developed in response to Article 28 of the EU's revised Waste Framework Directive (WFD), the plan sets out 'an analysis of the current waste management situation in the geographical entity concerned, as well as the measures to be taken to improve environmentally sound preparing for reuse, recycling, recovery and disposal of waste and an evaluation of how the plan will support the implementation of the objectives and provisions of this Directive'.

4.7.2.5 Resource Security Action Plan: Making the most of valuable materials

This document, published by DEFRA and BIS has been developed in response to private sector concerns about the availability of some raw materials. It highlights the opportunity for a more circular economy to address such resource concerns.

4.7.2.6 Realising nature's value: The Final Report of the Ecosystem Markets Task Force

The independent Ecosystem Markets Task Force published its final report in March 2013. The Task force's members include:

- Kingfisher plc
- Unilever
- Jaguar Land Rover
- Environment Bank

- Aldersgate Group.

The Ecosystem Markets Task Force argues that a new approach to business and nature is needed, integrating the real value of nature into business thinking to maximise opportunities and manage future risks.

The report highlights five priority recommendations relating to opportunities that deliver substantial benefits for both nature and business:

- Biodiversity Offsetting: securing net gain for nature from planning and development
- Closing the loop: anaerobic digestion and bioenergy on farms
- Local woodfuel supply chains: active sustainable management supporting local economies
- Nature-based certification and labelling: connecting consumers with nature
- Water cycle catchment management: integrating nature into water, waste water and flood management

The government has published its response to the independent business-led Ecosystem Markets Task Force Final Report. It responds to all 22 recommendations made by the Task Force, including their top 5 priorities: biodiversity offsetting; bio-energy and anaerobic digestion; sustainable local wood fuel; nature based certification and labelling; and water cycle catchment management.

4.8 The Ellen MacArthur Foundation

4.8.1 About

The Ellen MacArthur Foundation is a registered charity with the aim of inspiring a generation to re-think, re-design & build a positive future through the vision of a circular economy.

The Ellen MacArthur Foundation was established in September 2010 with the aim of accelerating the transition to a regenerative, circular economy.

The Foundation focuses its activities in three areas:

- Insight – Providing analysis and leading ideas
- Education - Inspiring a generation to re-think the future
- Business - Catalysing businesses innovation

Defining the circular economy

The linear ‘take, make, dispose’ model relies on large quantities of easily accessible resources and energy, and as such is increasingly unfit for the reality in which it operates. Working towards efficiency—a reduction of resources and fossil energy consumed per unit of manufacturing output—will not alter the finite nature of their stocks but can only delay the inevitable. A change of the entire operating system seems necessary.

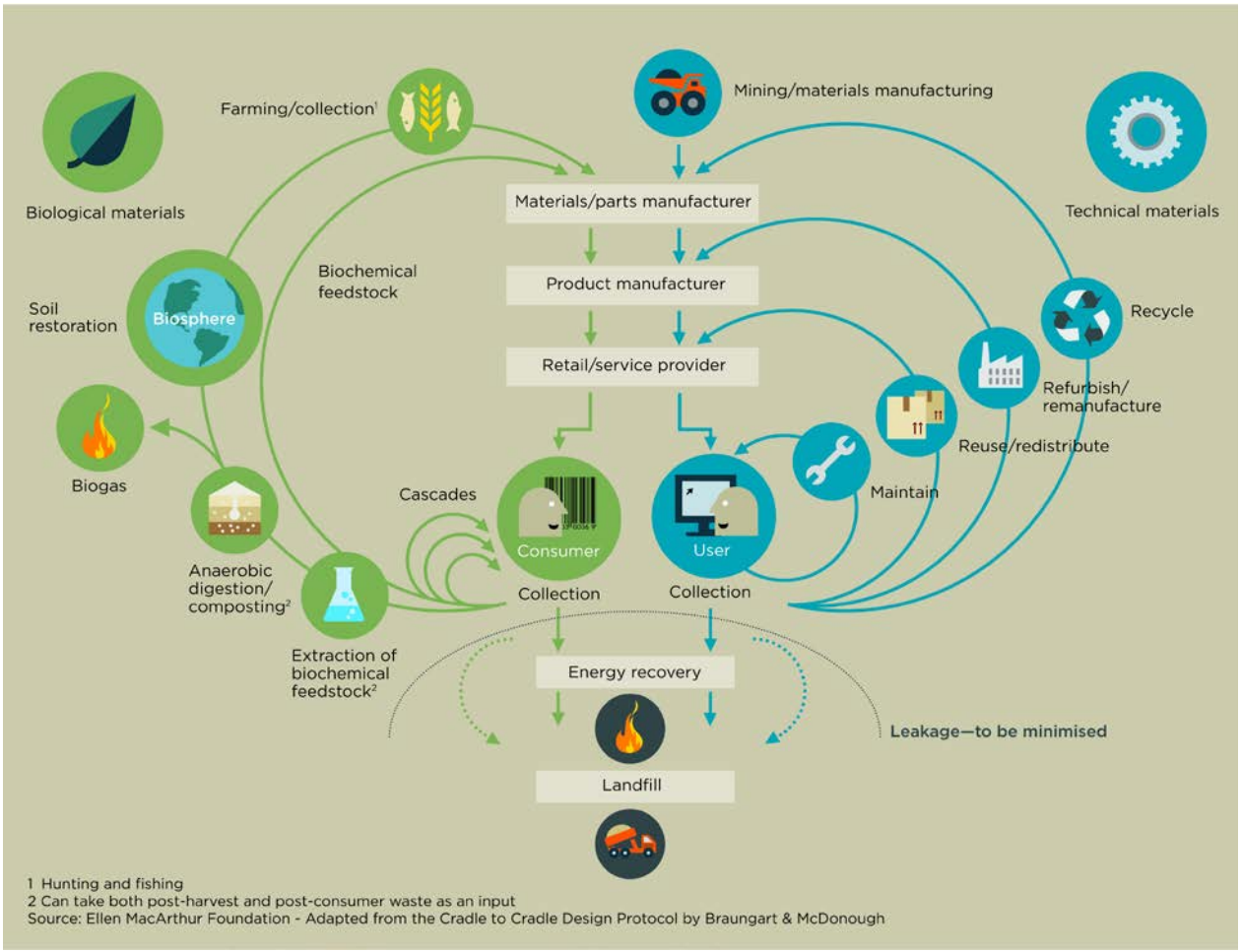
The circular economy refers to an industrial economy that is restorative by intention; aims to rely on renewable energy; minimises, tracks, and hopefully eliminates the use of toxic chemicals; and eradicates waste through careful design. The term goes beyond the mechanics of production and consumption of

goods and services, in the areas that it seeks to redefine (examples include rebuilding capital including social and natural, and the shift from consumer to user). The concept of the circular economy is grounded in the study of non-linear, particularly living systems.

The circular economy is based on a few simple principles:

- Design out waste
- Build resilience through diversity
- Think in 'systems'
- Think in cascades

A circular economy seeks to rebuild capital, whether this is financial, manufactured, human, social or natural. This ensures enhanced flows of goods and services. The following system diagram illustrates the continuous flow of technical and biological materials through the 'value circle'.



4.8.2 Key publications

4.8.2.1 'Towards the Circular Economy' reports

The purpose of 'Towards the Circular Economy' reports is to make the case for a faster adoption, quantify the economic benefits of circular business models, and lay out pathways for action.

In January 2012, the first report was published entitled *"Towards the Circular Economy: Economic and business rationale for an accelerated transition".* The report, commissioned by the Ellen MacArthur Foundation and developed by McKinsey & Company, was the first of its kind to consider the economic and business opportunity for the transition to a restorative, circular model. Using product case studies and economy-wide analysis, the report details the potential for significant benefits across the EU. It argues that a subset of the EU manufacturing sector could realise net materials cost savings worth up to $ 630 billion p.a. towards 2025 - stimulating economic activity in the areas of product development, remanufacturing and refurbishment. Subsequent volumes of this report have since been published: *Ellen MacArthur Foundation Towards the Circular Economy vol.2 - Opportunities for the consumer goods sector*; and *Ellen MacArthur Foundation Towards the Circular Economy vol.3 - Accelerating the scale up across global supply chains*.

4.8.3 Key initiatives

4.8.3.1 Project re-design

Project Re-Design was a series of educational workshops, competitions and internships held up and down the country, to promote the circular economy, for 16-18 year-olds and they were hands-on, free workshops that were to promote how we think about our future and how we use materials, how things should be 'made to be made again'.

4.8.3.2 Project MainStream

Project Mainstream is a World Economic Forum initiative in partnership with the Ellen MacArthur Foundation and supported by McKinsey & Co, which aims to work with companies to tackle ways to enable the circular economy through materials management, information technologies and business model innovation. The programme specifically focuses on areas of stalemate in the economy, where public-private or pre-competitive collaboration across an entire value chain or industry is required to unlock latent economic opportunity.

4.8.3.3 Circular Economy 100

The Circular Economy 100 is a global platform bringing together leading companies, emerging innovators and regions to accelerate the transition to a circular economy. The programme is based on the principle that more value can be gained from collective problem solving than can be achieved by working alone. The number of companies that are already members of the programme is growing, and the list includes, but is not limited to, the following organizations:

There are five global partners of the foundation: Cisco, Kingfisher, Philips, Renault and Unilever. The business areas and projects that the foundation is working on with its global partners can be viewed at http://www.ellenmacarthurfoundation.org/about/partners.

4.8.3.4 Pioneer Universities

Pioneer universities enter into individual formal agreements with the Foundation for up to three years, agreeing a substantial programme of co-operation and development involving research and/or teaching.

The emphasis is on at least one of the Foundation's target disciplines of business, education, and design & engineering, and involves a challenging circular economy programme which will be informed by gap analysis carried out by the Foundation.

The first Pioneer Universities are the University of Bradford (UK) and Euromed Management/KEDGE Business School (France).

Bradford University School of Management has launched the world's first circular economy MBA, developed in partnership with the Ellen MacArthur Foundation and leading businesses including B&Q, BT, Cisco, Renault and National Grid.

4.8.3.5 Schmidt-MacArthur Fellowship

The Schmidt-MacArthur Fellowship is an international fellowship programme for postgraduate students and their university tutors on creative and innovative thinking around the circular economy. The programme takes a multi-disciplinary approach with input across design, engineering and business. It is developed and run in partnership with a Core Team of three leading UK academic institutions – Cranfield University, Imperial College London and London Business School. The programme is open to students from a global network of Partner Universities and is the only fellowship in the world to engage both the

students and their academic mentor, as a partnership, in a full programme of learning and knowledge sharing.

4.8.3.6 The Ellen MacArthur Foundation and the European Commission's LIFE+ programme

The Ellen MacArthur Foundation and the European Commission's LIFE+ programme aims to deliver the **first metric tool for measuring circularity**.

There is already significant evidence that business leaders are seeking to move towards the circular economy as a way to decouple their revenues from material inputs and increase their resilience. However, at present, there is no recognized way of measuring how effective a product or company is in making the transition to a circular mode of operation, nor are there any tools for supporting such a process.

The Ellen MacArthur Foundation has recently been granted funding to create a web-based measurement system that will provide businesses with the tools required to track their progress in delivering a circular economy based business model.

A circularity metric will support businesses in creating accurate, measurable and consistent parameters for tracking their circularity progress and measuring impact. This tool will help businesses to engage with the opportunity of the circular economy and offer an industry standard by which to test and develop its effectiveness within their business.

This project brings together an expert team that includes dedicated project managers, innovators, leading academics and experts from ***Granta Design***, the world leader in materials information technology. It also includes the participation of European businesses who will work with the project team to develop, test and refine the measurement system to ensure its robustness and relevance economy-wide.

Some of the expected results include:

- A tested generic methodology for measuring how well a product performs within the context of the circular economy;
- A tested generic methodology for measuring how well a company performs within the context of the circular economy;
-
- A tried and tested online tool for calculating the product-level circulatory metric;
- A quantitative assessment of the environmental and economic benefits that could accrue from a large-scale adoption of the metrics.

This two year project aims to deliver the completed metric by 2015.

4.8.3.7 ResCom project

ResCoM is an European Commission co-funded project working on the development of closed-loop product systems. The project will focus on some of the key ways to do this including remanufacturing, reuse and multiple lifecycles.

Expected project outputs include:

- ResCoM software platform: collaborative decision-making platform based on product lifecycle management and material information management software modules implementing the ResCoM framework;

- ResCoM industrial pilots: four pilots using the ResCoM framework and the ResCom tools to implement closed-loop systems in various industries.

4.9 The Environmental Services Association (ESA)

4.9.1 About

ESA is the voice of the waste and resource management industry. The ESA and its members are already taking a number of actions that contribute towards preventing waste and improving resource efficiency.

4.9.2 Key publications

The ESA have developed a number of pertinent policy recommendations around the following issues: landfill and disposal; planning; finance; energy from waste; people, health and safety, regulation and carbon management, etc. Many of these recommendations are reflected in the following ESA reports:

- **Going For Growth - A practical route to a Circular Economy (June 2013)**

  In their report they estimate that a circular economy could generate 50,000 new jobs with £10 billion of investment boosting gross domestic product by £3 billion.

  http://www.esauk.org/esa_reports/Circular_Economy_Report_FINAL_High_Res_For_Release.pdf

- **Waste to Resources: The Pathway to Zero Waste (February 2013)**

  http://www.esauk.org/esa_reports/130219_SESA_Pathway_to_Zero_Waste.pdf

- **Beyond Landfill: using green taxes to incentivise the waste hierarchy (December 2012)**

  http://www.esauk.org/reports_press_releases/esa_reports/BeyondLandfill_web.pdf

4.9.3 Key initiatives and activities

4.9.3.1 Responsibility deal

The ESA have agreed a Responsibility Deal with the Government which includes a commitment by their members to promoting the waste hierarchy and the need to place greater emphasis on waste prevention and resource efficiency in their dealings with their waste producer customers.

4.9.3.2 National waste prevention programme

The ESA played an active part in the development by Government of the national Waste Prevention Programme required by the EU. These discussions looked at issues such as how to decide which products and materials to target as waste prevention priorities, how to extend re-use, repair, and leasing business models, and how to make the idea of "waste prevention" more meaningful to people and businesses. Priorities products and materials for waste prevention could include electrical and electronic equipment, clothing and textiles, construction materials, food waste, and packaging.

4.9.3.3 Recycling

The ESA has made the following policy recommendations to government:

1. Government must make the policing of environmental crime a priority and ensure that, in the face of budgetary pressure, there are sufficient resources and intent to conduct these activities effectively.

Resources can be freed-up by leveraging industry self-regulation, and by recognising in regulation, quality assurance schemes like that run by Recycling Registration Service Limited.

2. Domestic end-markets for recycled materials should be encouraged through green procurement and product standards.
3. End of Waste Protocols should be accelerated in order for the market to have confidence in the characteristics of secondary materials.
4. Any additional landfill bans must be supported by a strong evidence base and if applied, must be signalled well in advance and have sufficient lead-in time to allow for the provision of alternative treatment routes for banned materials.
5. Government should work with Local Authorities to promote public awareness and to implement positive reinforcement policies in order to maximise recycling yields and minimise non-target materials in recycling streams.

4.9.3.4 Roadmap to a resource efficient Europe

At EU level, ESA are supporting the European Commission's "Roadmap to a Resource Efficient Europe"[3], which sets out a series of policies to improve the resource efficiency of products and materials across their whole life cycle. Specifically, ESA is calling on the Commission, the European Parliament, and the Council of Ministers to improve product design, and to give the waste and resource management industry an increased role in discussions on that issue so that in future, products are designed with waste considerations in mind. ESA is also ready to work with other interested parties at European level to define indicators and targets for guiding action and monitoring progress on resource efficiency.

4.9.3.5 EQual (Ensuring Quality of waste-derived products to achieve resource efficiency)

The ESA is working in partnership with the Environment Agency on the EU Life+ funded programme that aims to encourage quality products made from waste. The EQual programme builds on and expands the Environment Agency's Quality Protocols initiative and provides a framework to help waste producers and processors to meet the end of waste criteria under the EU Waste Framework Directive.

4.10 Green Alliance

4.10.1 About

Green Alliance is an influential environmental think tank working to ensure UK political leaders deliver ambitious solutions to global environmental issues. While not a formal alliance they work closely with partners in the third sector, business and other spheres to advocate proposals influential on all sides of the political spectrum. Green Alliance's activities include research, advocacy and convening high-profile events with senior politicians and key influencers.

4.10.2 Key publications

4.10.2.1 Resource resilient UK

This is the first year report of the Circular Economy Task Force, a government supported, business led group convened by Green Alliance. It is a forum for policy innovation which aims to disseminate information and recommendations on the best responses to (sustainable) resource security.

[3] For more information on this European initiative, visit http://ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en.htm. Also see http://ec.europa.eu/environment/resource_efficiency/re_platform/index_en.htm for information on the related European Resource Efficiency Platform.

The report shows that resource security concerns have increased significantly over the past five years, reflecting risks affecting the availability and the price of materials essential to industry. The root causes of resource insecurity lie substantially in environmental problems. Water scarcity, rising extraction costs for fossil fuels and limitations on land availability increasingly constrain supply at a time when demand is growing. Greater visibility of globalised supply chains, alongside rising public concern about environmental damage, is compounding these pressures. To address resource constraints on business, the Circular Economy Task Force has identified how reuse, remanufacturing and secondary material supplies can address the root causes of resource insecurity.

Key interventions recommended include:

- disclosure by companies of high impact risks on water, land, and materials use in company reports to investors
- a government-led study into the UK's exposure to material insecurity, starting with sectors identified by the industrial strategy as those most able to contribute to growth
- using the industrial strategy to broker collaboration within business sectors
  clarifying competition law to reinforce exemptions for environmentally beneficial co-ordination between businesses, much greater commitment from businesses to use long term contracts and joint ventures to speed up recovery of materials and products; and
- intervening in product design directly through existing legislation to make products easier to reuse, remanufacture and recycle

Chapter 5 of the *Resource resilient UK* report sets out specific proposals for standards on secondary material quality; reuse and remanufacturing; as well as collection and disassembly requirements (which could be achieved through standards).

The report concludes: "UK businesses have been at the forefront of circular economy thinking, but progress on the ground has yet to catch up with the rhetoric. The actions proposed by Task Force are intended to give companies the confidence to pursue circular approaches, and to help to create the tipping points that enable a resource resilient UK.".

4.10.2.2 Reinventing the wheel: a circular economy for resource security

This report promotes the concept of the circular economy as a new approach to the use of resources. Examples based on current resource issues by examining three crucial inputs to our economy: metals, phosphorus and water have been used. The way they have been used demonstrates the overwhelmingly 'linear' nature of our current economy, with its problems and future risks.
Green Alliance makes the case for a more circular economy, as a way of avoiding at least some of the impacts of ever more extraction of natural resources, and to avoid the worst impacts of generating waste. This concept has influenced economic policy in both China and Japan and is gaining traction in many other countries.

They concentrate on the role of economic instruments. Although adjusting prices and adding economic incentives is just part of the package of measures, both regulatory and voluntary, that we need to achieve better resource stewardship. They highlight that a large part of the shift to a more circular economy may need to come from our values and behaviour, which might be independent from, or else reinforced by, an economic motive.

4.10.3 Key initiatives

4.10.3.1 Designing Out Waste business consortium

Green Alliance held a final meeting of their 'Designing Out Waste business consortium' in May 2012 and where it was stated by one of the companies that they led the debate from designing out waste to the concept of the circular economy. Now it is necessary to take the circular economy concept, where resources are properly valued and retained usefully in the economy for as long as possible, from an idea to reality.

As per their presentation (From Designing Out Waste to the Circular Economy) at the meeting showed, there is already some leadership towards this goal, from UK's devolved governments, the EU and businesses, but progress is still partial and fragmented.

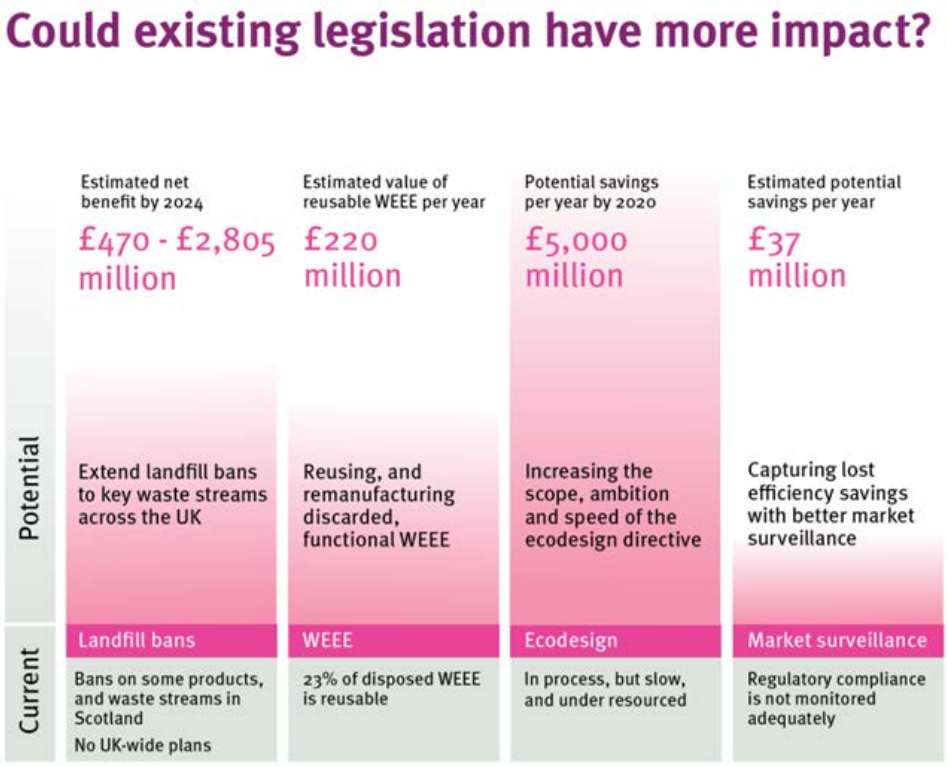
4.10.3.2 Circular Economy Task Force

A key initiative Green Alliance has led is the formation of the Circular Economy Task Force which followed the 'Designing out waste' consortium. The Circular Economy Task Force was set up in response to discussions with Government and given a mandate to advise government in the implementation of its Resource security action plan.

Information about the Circular Economy Task Force's first year report – *Resource resilient UK* – can be found in section 4.10.2.1 above.

4.10.3.3 Supporting policy instruments

Green Alliance believe that existing policy instruments have a vital role to play. The most promising of these is the EU's Ecodesign directive, which already saves consumers and businesses money and carbon with every product it improves. As a forthcoming report from the Dutch consultancy Ecofys shows, the current directive could create EU-wide net savings of €90 billion per year, and potentially much more if the directive expands to include efficiency savings on non-energy impacts.



It would also help companies if it gave a clear steer on the design criteria for a sustainable product. For the circular economy to become a reality, we need to consider circularity from the very beginning of the product journey. At the other end of the chain we would reap huge benefits by restricting the loss to landfill of valuable materials, thereby stimulating innovation and investment in more effective means of recovery.

As the groups shape the Circular Economy Task Force, in partnership with its member businesses, they will keep the pros and cons of the various available policy instruments in mind. However, it is clear that it is leadership that matters. Businesses have voiced their desire to be part of a more circular economy and shown their ability to deliver part of it. They now need a policy process to help them get there.

4.10.3.4 Closing the Loop - transforming UK resource use and delivering a sustainable resource economy

The aim of this project was to drive forward policies and action that would transform UK resource use and reduce the environmental impact of producing and consuming products and services. It attempted to build a broad consensus on shared objectives for waste and resources; develop existing and new polices to address these challenges; and build coalitions of support for these policies.

These aims were progressed through a three year programme (2005 - 2008) of research, events, publication of reports and briefings, coalition building and advocacy.

The project has now ended. Many of the ideas and recommendations developed in the course of this work are being taken forward as part of Green Alliance's new waste and resources theme, Designing Out Waste.

4.11 International Institute for Environment and Development (IIED)

4.11.1 About

The IIED is an independent, non-profit organization promoting sustainable patterns of world development through collaborative research, policy studies, networking and knowledge dissemination. They work to address global issues such as mining, the paper industry and food systems.

IIED strengthens local organizations and institutions by identifying policies, institutions and technologies that enable locally driven design of resilient agri-food systems. Such systems are generally based on circular economy models that involve recycling, reuse and combining resources to reduce dependency on external inputs, in particular fossil fuels. They also apply principles of 'ecoliteracy' in which actors understand and carefully consider the interactions between the different components of agro-ecosystems.

They aim to support local food systems by enhancing local access and control over productive resources — including land and territories, water, seeds and livestock breeds, biodiversity-rich landscapes and ecosystem services. They do this by strengthening local organizations and advocating for fairer policies and their implementation.

4.11.2 Key publications

4.11.2.1 Virtuous circles for sustainable food, energy and water

In Virtuous Circles: Values, Systems and Sustainability, a new book from the IIED, authors Andy Jones, Michel Pimbert and Janice Jiggins call for a circular economy approach to the production and supply of food, energy and water.

Arguing that the linear systems of global food production are inherently unsustainable – assuming and requiring a limitless supply of resources and capacity to absorb waste – the authors of Virtuous Circles: Values, Systems and Sustainability, propose the adoption of circular systems that mimic sustainable natural cycles.

The book is an output of Designing Resilience, part of a collaborative research and communication programme co-ordinated by IIED. Through a process of co-inquiry, the programme aimes to strengthen the capacity, knowledge and innovations of local organizations of farmers, indigenous peoples, pastoralists, food workers and other citizens to bring about positive change in meeting human needs.

4.11.3 Key initiatives

4.11.3.1 Designing resilient food systems with, for, and by people

This project was a collaborative research and communications programme coordinated by IIED in Africa, China, the Andean region of Latin America and the Caribbean, and parts of Europe.

It demonstrated the potential benefits of transforming our industrialised linear systems into locally-controlled circular systems, which mimic the closed-loops of natural cycles. These systems apply to the production of food, energy, materials and clean water, and are integrated with systems of waste management.

Key findings from this research can be found in this news story on 'virtuous circles' or download the book Virtuous Circles: Values, Systems and Sustainability.

4.11.3.2 Sustaining local food systems, agricultural biodiversity and livelihoods

This project analysed how and under what conditions decentralised governance, capacity building and participation by farmers can promote the adaptive management of agricultural biodiversity in the context of local food systems and livelihoods. It was set up in 2001 and collaborated directly with local farming and indigenous communities in regenerating biodiversity-rich farming and locally controlled food systems in India, Indonesia, Iran, Mali and Peru.

Some of the innovations to come out of the research included the following:

- In southern India, collectives of marginalised women working with the programme created a community grain fund to distribute locally-grown, drought-tolerant grains to poor villagers.
- In Indonesia, farmers learned sustainable farming methods through field experiments in Farmer Field Schools — and built the skills and confidence for collective action.
- In Iran, nomadic tribal organizations advocated to co-manage rangelands with the government, using indigenous knowledge and new insights from the science of non-equilibrium ecology to adapt to the impacts of climate change in fragile agro-ecosystems.
- In Peru, work was carried out to link community conserved areas, including the Potato Park, into 'food sovereignty corridors' stretching across the landscape.

Key findings from this research can be found in a Reflect & Act paper or on the Diverse food systems website.

4.11.3.3 Towards food sovereignty

This project looked at the ecological basis of food and agriculture, the social and environmental costs of modern food systems, and the policy reversals needed to democratize food systems.

Key findings from the project can be found in the multimedia book Towards food sovereignty: reclaiming autonomous food systems. This is an on-going project, with some chapters yet to be completed.

4.11.3.4 Farm seed opportunities project

In recent years, the demand for speciality and conservation seeds in Europe has risen. Yet, at the same time, the survival of local varieties and biodiversity have been threatened by strict European Union rules on the marketing of seeds, the small market niches for such varieties and the marketing priorities of commercial companies.

The Farm Seed Opportunities project (FSO) was a partnership that included public-sector research institutes, peasant networks and organic farmers' associations from six European countries. The FSO aimed to develop innovative participatory approaches for managing agricultural biodiversity in Europe, and to identify appropriate regulatory frameworks for the on-farm conservation and sustainable use of seed diversity. It highlighted the need for a fundamental re-orientation of plant breeding so that it could build on both local and scientific knowledge in creating and maintaining a diversity of seeds.

The FSO aimed to:

- develop methods with all relevant stakeholders for participatory breeding strategies
- facilitate the marketing of landrace (local varieties of domesticated animals or plant species, which have developed by natural processes), and the conservation and special amateur seed varieties
- provide information on scientific results and research to address the demand for locally-produced food and the conservation of endangered agro-biodiversity

- stimulate public engagement and citizen involvement in decision making.

Key findings from the project can be found in the report Innovative approaches in participatory research, on-farm conservation and the management of agricultural biodiversity in Europe.

4.12 Knowledge Transfer Network (KTN)

4.12.1 About

Knowledge Transfer Network Limited (KTN Ltd) is a not-for-profit company set up by the Technology Strategy Board to build on and improve the successful work of sector-specific knowledge transfer communities.

For some years, Knowledge Transfer Networks (KTNs) have been one of the Technology Strategy Board's key tools for stimulating innovation through knowledge transfer - which is critical in enabling UK companies to compete successfully at the forefront of global technology and innovation. The new KTN Ltd is intended to build on this success by creating one flexible and dynamic network.

KTN Ltd's key roles are:

- to encourage and support cross-sector innovation, by co-ordinating and improving collaboration between business and the research base
- to encourage and support business-to-business collaboration, particularly between companies who might be from quite disparate sectors and may not ordinarily meet.

The overall remit of the KTNs could be summarised as follows:

- stimulating innovation in the UK economy through knowledge exchange (making introductions, setting up collaborations, etc.)
- providing access to finance
- informing policy

4.12.2 Key initiatives

The following information has been provided by the KTN for the purposes of this report.

"Full realisation of the circular economy vision will demand joined-up system-level thinking and above all collaboration. These being central to the Knowledge Transfer Network, we have been able to take an active and prominent role in shaping the discourse on circular economy and promoting action.
Over the past couple of years, the KTNs have been informing and supporting a string of Technology Strategy Board competitions, representing an investment of over £10m, aiming to facilitate the circular economy. Each of the various competitions, which have all stressed the value of collaboration, has focused on a particular enabler:

- *Design (exploring the notion that waste is a design flaw)*
- *New business models (such as leasing and remanufacturing)*
- *Materials innovation*
- *Supply chain innovation*

The KTNs have been engaged in:

- *Helping inform the competitions, and promoting them to a diverse range of stakeholders across all sectors and disciplines, building the community in the process*

- *Setting up and administering a dedicated group on our web portal _connect ("Collaborations for a Circular Economy" This group now has over 300 members) - https://connect.innovateuk.org/web/collaborations-circular-economy*
- *Running well-received events across the country, featuring inspirational presentations and panel discussions from exemplars such as Kingfisher Group (B&Q), Caterpillar, Kyocera, Crown Packaging, Seymourpowell, Axion, Recycling Lives, CIWM, and the Ellen MacArthur Foundation. These events introduce the competitions and give delegates an opportunity to meet potential collaborators.*
- *Presenting at a range of other events and conferences with partners including RSA, BCSD, Product Design & Innovation 2013, 2Degrees, the Associate Parliamentary Sustainable Resources Group, and the Centre for Sustainable Design*
- *Extensive one-to-one discourse with applicants to help them find partners, understand the context, and to apply for funding*
- *Providing direct support to applicants in refining their applications before submission*
- *Developing and promoting case studies*

The competitions have engaged the likes of Kingfisher Group (B&Q), Kyocera, Sir Robert McAlpine, Morphy Richards, Dyson, Toyota, and we have had a central role in connecting these larger organisations with SMEs and consultancies. Projects we have helped set up have applied circular economy thinking to a huge variety of products including DIY tools, shoe hangers, printers, office chairs, construction components, and "green walls"."

4.13 The Product-life Institute

4.13.1 About

The Product-Life Institute is a not-for-profit, independent and virtual organization domiciled in Geneva, Switzerland. It is the oldest consulting organization on sustainable strategies and policies in Europe. Their main objective is to open new frontiers of economic development towards a Performance Economy (or Functional Service Economy), which focuses on selling performance (services) instead of goods in a circular economy, internalizing all costs (closed loops, cradle to cradle).

Walter R. Stahel is a Swiss architect who co-founded the Institute and has been influential in developing this field of sustainability, by advocating 'service-life extension of goods - reuse, repair, remanufacture, upgrade technologically' philosophies as they apply to industrialised economies. His ideas and those of similar theorists led to what is now known as the circular economy in which industry adopts the reuse and service-life extension of goods as a strategy of waste prevention, regional job creation and resource efficiency in order to decouple wealth from resource consumption, that is to dematerialize the industrial economy.

In the 1990s, Stahel extended this vision to selling goods as services as the most efficient strategy of the circular economy. He described this approach in his 2006 book The Performance Economy, with a second enlarged edition in 2010 which contains 300 examples and case studies.

He currently works closely with the Ellen MacArthur Foundation on further promoting his ideas with economic actors.

4.13.2 Key initiatives

The Institute's vision is a **sustainable economy** and **society** resting on the following five pillars, which are integrated into a holistic view:

- The first pillar – 'nature conservation' – recognizes the need to conserve nature and the natural environment as a base for life on earth. Men's life is based on the resources supplied by the global eco-support system for life on the planet (e.g. biodiversity, the atmosphere and the oceans), and the regional carrying capacity of nature with regard to populations and their lifestyle (e.g. the water cycle, land-use patterns, waste assimilation).

- The second pillar – 'limited toxicity' – recognizes the need to conserve the individual health and safety of people and animals, which is jeopardized by man's economic activities. This is a qualitative issue, measuring the presence of toxic agents (heavy metals such as mercury, nickel, DDT or thalidomide) in tiny quantities (nanograms) as well as nature's capacity of absorption.

- The third pillar – 'resource productivity' – is based on the need of industrialized countries to dematerialize their life-style, in order to allow the material development of industrially less developed countries. This is a domain of innovation and creativity, dominated by business strategies that lead to a higher resource productivity over long periods of time. A reduction of resource consumption by a factor ten is needed to prevent the threat of a radical change for the planet towards a re-acidification and/or climate change which could question man's life on Earth. In addition, this is a factor of disequilibrium between over-industrialized countries and less industrialized ones.

- The fourth pillar – 'social ecology' – encompasses the fabric of societal structures, including peace and human rights, dignity and democracy, employment and social integration, security and safety, the constructive integration of female and male attitudes. Key words here are: the commons, 'prisoners' dilemma', sharing and caring, barter economy.

- The fifth pillar – 'cultural ecology' – encompasses education and knowledge, ethics and culture, attitudes towards risk taking, values of 'national heritage' and other assets, at the level of the individual, the corporation and the State.

The institute is pursuing these objectives through applied scientific research, as consultants to industrial companies, government authorities and universities, to promote and coach the realization of the envisioned sustainable solutions and innovations.

4.14 Resource Revolution

4.14.1 About

Brought out by edie and Local Authority Waste & Recycling (LAWR) and sponsored for a second year by FCC Environment, the Resource Revolution is redefining the concept of waste and revolutionising the way society thinks and deals with it.

Energy security and raw material scarcity are driving radical new business models around recovery and reuse. The transition from waste to resource not only requires more strategic thinking, but smarter ways of working. Resource management is shifting from a linear to circular economy, causing the emergence of closed loop models that power innovation.

As the circular economy of the future began to emerge, the first phase of the Resource Revolution campaign examined how far business and the waste supply chain were along the path towards smarter resource management.

The next phase of the Resource Revolution will examine how the circular economy agenda can be made relevant to business, regardless of size or sector, and explore the practicalities of making it work.

Resource Revolution are creating a guiding blueprint for meeting the challenges faced by organizations in working towards a circular economy, and set out key priorities for action.

The blueprint will be drawn from research undertaken in collaboration with businesses and a specially convened panel of sustainability and circular economy experts across a multi-disciplinary stakeholder spectrum – including policy advisors, think tanks, business leaders, academics, consultants and designers.

The principles will then be tested by applying them to key sectors and key topics, enabling us to drill down on the detail and present tailored solutions for specific issues.

4.14.2 Key publications

4.14.3 Closing the Loop: Risk or Reward

The Resource Revolution started with the production of ground-breaking opinion research looking at attitudes to resource efficiency and the circular economy.

Published in March, the white paper 'Closing the Loop: Risk or Reward?' examines the attitudes to and opportunities for developing a circular economy from a range of commercial organizations around the UK.

This report maps progress along the journey so far. It confirms the demands upon the recycling and waste sector, thereby reducing perceived risks and showing that for those companies willing to adapt, the long-term opportunities are huge.

4.15 Royal Society for the encouragement of Arts, Manufacturers and Commerce (RSA)

4.15.1 About

The RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce): an enlightenment organization committed to finding innovative practical solutions to today's social challenges. Through its ideas, research and 27,000-strong Fellowship it seeks to understand and enhance human capability so we can close the gap between today's reality and people's hopes for a better world.

4.15.2 Key initiatives

4.15.2.1 Great Recovery Programme

The Great Recovery is supported by RSA and the TSB. It aims to build new networks to explore the issues, investigate innovation gaps and incubate new partnerships.

The Technology Strategy Board (TSB) in conjunction with the RSA's Great Recovery Programme launched in September 2012 a competition: **'New Designs for a Circular Economy'.**

The Government is to invest up to £1.25 million to stimulate innovation that will help improve the resource efficiency of UK companies and help contribute towards a resource-efficient, low-carbon economy.

The Technology Strategy Board ran a funding competition and offered grant funding for feasibility studies into the re-design of products, components and systems to retain material within the economy over several cycles of use.

This competition aims to stimulate innovation in design to address two high-level challenges:

1. reducing the global environmental impact of materials that we use;
2. reducing dependence on key raw materials, the supply of which is potentially at risk.

The feasibility projects must be business-led and may be collaborative or led by a single company. All involved a distinctive design contribution. Grants did not exceed £25,000.

The competition was open to all UK companies and had two rounds.

The Great Recovery project aims to build a cross disciplinary design community that is equipped to support the development of an economy based on resource-efficient principles.

4.15.3 Key publication

4.15.3.1 Investigating the role of design in the circular economy

This Investigating the role of design in the circular economy - Report covers the first 6 months of the Great Recovery project, including the circular network, workshops, and teardown observations. Through this the RSA has gained a better understanding of what action and research is required to transform the way society manages resources, and this report outlines a series of key recommendations based on the findings of the first phase of The Great Recovery programme.

It concludes that redesign certainly makes circular systems cheaper and more effective. In the case of end-of-life vehicles, design for recycling will help to turn previously unrecycled plastic, glass, and electronics from old cars into nearly £40 million of recovered resources in the UK by 2015. As a result, we need to learn how to encourage better design. The RSA's debate started from two, relatively straightforward, premises:

- resource constraints will shape the future of business, both because primary extraction is getting more expensive and environmentally damaging, and because consumption is growing;
- most of a product's resource use and environmental impact is locked in at the design stage.

"Both these assertions are well grounded. On the face of it, they put designers at the forefront of making our economy more circular and businesses more resilient to resource risks. This leads to the conclusion that designers are the hotspot in a circular economy. If we can just get them to design better products, then the circular economy is sorted."

4.16 The Technology Strategy Board (TSB)

4.16.1 About

The aim of the TSB is to accelerate economic growth by stimulating and supporting business-led innovation. The Technology Strategy Board's vision is for the UK to be a global leader in innovation and

a magnet for innovative businesses which can apply technology rapidly, effectively and sustainably to create wealth and enhance quality of life. TSB recognize that effective use of resources, energy and social capital is a prerequisite for long-term economic success. In promoting innovation TSB takes account of the 'triple bottom line' of environmental, social and financial sustainability.

4.16.2 Key initiatives

4.16.2.1 New designs for a circular economy competition

The Technology Strategy Board (TSB) recently announced the successful applicants in the second phase of the New Designs for a Circular Economy competition.

The competition invested £1.25 million in feasibility studies that focused on the re-design of products, components and systems to retain material within the economy over several cycles of use.

Successful applicants include Kingfisher, Dyson and Toyota. By means of an example, Kingfisher, parent company of the Foundation's partner B&Q, received funding for three feasibility studies:

- **Return to Sender**: Kingfisher plan to design a returnable packaging system for paint brushes, in which consumers can put used bristle heads into the original packaging and post it back to the retailer, who will identify and manage a circular end-of-life route – be that reuse, or as technical or biological cycles.
- **Circular Design for an Economy Power Tool:** The project will deliver a series of implementable design changes which will make power tool products more suitable for repair and reuse, without introducing additional net costs. These design changes will be disseminated to the group of Kingfisher companies (B&Q, Castorama, Brico Depot, Screwfix, Koctas) and more widely disseminated to the home improvement retail sector.
- **ProjectBox**: Kingfisher's new 'ProjectBox' solution will enable customers to hire, rather than buy, all the tools, consumables and support materials that they require to complete common household DIY tasks, such as shelving, flooring, plastering and tiling. ProjectBox will enable Kingfisher to provide people with access to much higher quality tools and equipment whilst also reducing total material consumption.

4.16.2.2 A new competition – Supply Chain Innovation towards a Circular Economy

The Technology Strategy Board is to invest up to £5m in collaborative research and development that aims to preserve the value of products and/or materials at end-of-life and keeps them in productive use for longer. They are seeking proposals that reduce environmental impact of material lifecycles and dependence on materials with a supply risk, in other words proposals that make supply chains more circular. Proposals should aim to cut general waste stream losses in half – or more.

The new competition started on 04 Nov 2013 and ended on 18 Dec 2013.

4.17 Waste & Resource Action Programme (WRAP)

4.17.1 About

WRAP's vision is a world where resources are used sustainably. Their work helps people recycle more and waste less, both at home and at work, and offers economic as well as environmental benefits.

WRAP have clear guiding principles:

- A focus on preventing waste
- Getting good value for money for the tax-payer and proving it
- Working in partnership and supporting the work of others
- Being flexible and business like

WRAP are funded by all four governments across the UK and the EU and run programmes in England, Scotland, Wales and Northern Ireland.

WRAP's vision for the UK circular economy to 2020

The adoption of a circular economy offers considerable economic benefits; DEFRA calculates that UK businesses could benefit by up to £23 billion per year through low cost or no cost improvements in the efficient use of resources, whilst McKinsey estimates that the global value of resource efficiency could eventually reach $3.7 trillion per year.

WRAP's vision for UK's economy by 2020 assumes (compared to a 2010 baseline):

- 30Mt fewer material inputs into the economy
- 20% less waste produced (50Mt less waste)
- 20Mt more materials recycled back into the economy
- Based on 2011/12 actuals, the Office for Budget Responsibility's forecast for 2013-17, and assumptions of 2% per annum GDP growth for 2018-20, current economic data suggests that GDP will grow between 15 -20% in the 2010-20 decade.
- The Office for National Statistics predicts that UK population will grow by 8% in the decade.
- The headline 30Mt less materials going into the economy is close to WRAP's 2010 research Securing the Future: The Role of Resource Efficiency. This identified potential savings of 38Mt for selected materials by 2020 based on quick win resource efficiency actions. This included several materials considered as being of strategic importance, such as rare earths.

Four key ways of realizing these savings are:

1. lean production (i.e. making goods with a lower material requirement);
2. reducing waste in manufacture and commerce;
3. reducing the amount of working products thrown away, and;
4. goods to services (i.e. increasing the proportion of some products which are leased).

The increase in waste recycled (20Mt) is less than for the 2000 to 2010 decade (70Mt). WRAP suggests that the easy wins in recycling have been achieved, especially with the landfill tax escalation during the decade and greater business awareness of the economic benefits of diverting waste from landfill.

20% less waste produced is about 50Mt less waste. This will require ambitious waste prevention plans from all nations to set the framework for business and public sector to take action.

4.17.2 Key publications

4.17.2.1 Evaluating the financial viability and resource implications for new business models in the clothing sector (February 2013)

This report looks at the commercial viability of a number of alternatives to traditional make-buy-use-dispose business models. It takes into account realistic estimates of the required investment, operating costs and sales value. One option was found to offer great commercial benefits including payback in just over two years.

4.17.2.2 Securing the future – The role of resource efficiency (November, 2010)

This report quantifies how resource efficiency actions, as well as reducing greenhouse gas emissions, can reduce abstracted water, ecological footprint and the use of specific resources.

4.17.2.3 Topic specific presentations:

A number of PowerPoint presentations discuss the role of specific topics and the circular economy which include: food and drink; the built environment; electrical and electronic equipment; and textiles.

4.18 The World Wide Fund for Nature (WWF)

4.18.1 About

The WWF is an international non-governmental organization working on issues regarding the conservation, research and restoration of the environment. The group says its mission is “to stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature”.

4.18.2 Key publications

WWF has published a few reports which touch on waste prevention and the move towards a circular economy:

4.18.2.1 Green game-changers: 50 innovations to inspire business transformation

This publication highlights revolutionary innovations in business models, partnerships, policies, process and products that can help accelerate green growth.

4.18.2.2 New Green game-changers: insights for mainstreaming business innovation

A new edition of WWF’s Green game-changers highlights examples of innovation for sustainability in big business. This latest report investigates how ‘large corporates’ (those with revenues of over US $1 billion per year) are responding to the challenge of those new green businesses innovators.

4.18.2.3 Selling Sustainability? In search of the retail business case for sustainable diets

This report presents the results of a research exercise commissioned by WWF and conducted by

Brook Lyndhurst during the latter part of 2011 and early part of 2012. The research was designed to investigate the business case for retailers to further support and promote sustainable diets.

4.18.3 Key initiatives

Launched in 2009, the aim of this project is to help companies and government cut their costs as well as their emissions from business travel. From 2014, the challenge is being run by Global Action Plan.

The following members of the Challenge have achieved the One in Five Challenge Award: BSkyB, BT, Capgemini, Lloyds TSB, SEPA, Vodafone UK and WWF-UK.

5 Main findings - legislation and regulations

5.1 Overview

This section of the report describes the main areas of legislation impacting on waste management and the circular economy. Further detail on UK, European and international legislation is provided in Annex B – Waste legislation and regulation.

5.2 Waste prevention

The current national controls on waste originate from the Control of Pollution Act 1974 and were greatly tightened with the introduction of the Environmental Protection Act 1990. Legislation originally focused on the disposal of waste, but since the introduction of the EC Framework Directive on waste (see below) control has extended to include the storage, treatment, recycling and transport of waste.

Most UK legislation impacting on waste management is now implemented as a result of European Directives. The European Union's waste legislation comprises three main elements:

a) **Horizontal legislation**, establishing the overall framework for the management of wastes, including definitions and principles

Directives:

Directive 2008/98/EC (Waste Framework Directive) of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. This Directive repealed Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste (the codified version of Directive 75/442/EEC as amended), hazardous waste Directive 91/689/EEC, and the Waste Oils Directive 75/439/EEC. It provides for a general framework of waste management requirements and sets the basic waste management definitions for the EU.

Related legislation:

- Environmental Protection Act 1990, Part II
- Waste Management Licensing Regulations 1994 (SI 1994/1056)
- Hazardous Waste (England and Wales) Regulations 2005 (SI 2005/894)
- List of Wastes (England) Regulations 2005 (SI 2005/895)
- Environmental Permitting (England and Wales) Regulations 2007 (SI 2007/3538)

b) **Legislation on treatment operations**, such as landfill or incineration, which may set technical standards for the operation of waste facilities

Directives:

- EC Directive 1999/31/EC on the landfill of waste
- EC Directive 96/61/EC on Integrated Pollution Prevention and Control
- EC Directive 2000/76EC on the Incineration of Waste

c) **Legislation on specific waste streams**, such as waste oil or batteries, which may include for example measures to increase recycling or to reduce hazardousness

Directives:

- EC Directive 94/62/EC on Packaging and Packaging Waste

- EC Directive 2000/53/EC on End of Life Vehicles (ELV)
- EC Directive 2002/96/EC on Waste Electrical & Electronic Equipment (WEEE)

5.3 Circular economy

A key piece of legislation identified as relevant to the circular economy supports the re-use of industrial waste in China – the ”Circular Economy Promotion Law”. The law aims to facilitate a circular economy by raising resource utilization rate, protecting and improving the environment and realizing sustained development. The circular economy is defined as the activities of decrement, recycling and resource recovery in production, circulation and consumption.

Japan's “Basic Act for Establishing a Sound Material-Cycle Society” is also highly relevant and has a long track record. Article 2 of the Act states: “For the purpose of this Act, a "Sound Material-Cycle Society" means a society in which the consumption of natural resources will be conserved and the environmental load will be reduced to the greatest extent possible, by preventing or reducing the generation of wastes, etc. from products, etc., by promoting proper cyclical use of products, etc. when these products, etc. have become circular resources, and by ensuring proper disposal of ... resources not put into cyclical use...”.[4]

[4] English translation of the Basic Act for Establishing a Sound Material-Cycle Society (Effective June 2, 2000). Full translation available at http://www.env.go.jp/en/laws/recycle/12.pdf.

6 Observations and recommendations

6.1 Overview

The purpose of this research is to gather information about activities and initiatives of relevance to waste prevention and the circular economy concept, and to explore the role standards play in encouraging waste prevention and the move to circular economy thinking. This section of the report brings together observations from across searches into existing standards, initiatives and key players, legislation and policy developments, and provides initial recommendations on the role standards could play to support both topics. The results of this research were discussed at a subsequent stakeholder event in order to validate and prioritize them, as well as to register interest in taking forward the most significant opportunities. The outcomes from the event and the agreed immediate next steps are captured in a separate document, available alongside this report.

6.2 Key trends and standardization gaps

6.2.1 Existing standards

The research findings suggest that the majority of standards work, to date, has focussed on various aspects of waste management and prevention, rather than the circular economy per se. There are a large number of standards that refer to waste prevention, with over 200 standards identified by the 'key word search' of the standards database Perinorm. The majority of the standards of relevance to waste prevention and, indirectly, the circular economy approach, explore issues of material recycling, recoverability, re-use and re-manufacturing, usually in the context of a specific industry and/or product group (such as plastics, paper, metals, etc.).

Although there are no formal standards which focus on the concept of the circular economy in its entirety, examples that encourage circular thinking, especially at the design stage, are already present. These include:

- Design for material efficiency (BS 8895 series, first publication in 2013)
- Design for manufacture, assembly, disassembly and end of life processing (BS 8887 series, first publication in 2006)
- Re-use of electrical and electronic equipment (PAS 141)
- WRAP Re-use standard 2013

A detailed overview of the standards that are most relevant to waste prevention and the circular economy is provided in section 3 of this report.

Work to define and measure 'circularity' at the organizational and product level has started, for example, the European Commission's LIFE+ programme to deliver the first metric tool for measuring circularity, as well as some privately driven initiatives. However this effort is yet to be brought into the standardization arena, which would give it full stakeholder exposure, scaling it up and encouraging wider understanding and uptake.

6.2.2 Legislation

There is extensive legislation (see section 5 and Annex B) covering waste prevention and it is likely that this has been one of the key drivers for the emergence of waste prevention standards across the globe,

particularly on the use of electrical and electronic equipment and recycling. However, there is no UK or EU legislation that focuses purely on the circular economy concept, although the EU is funding work in this area, for example the European Commission's LIFE+ programme.

Our review has revealed that two countries, China and Japan, have begun to legislate for this (China's "Circular Economy Promotion Law" of 2009 and Japan's "Basic Act for Establishing a Sound Material-Cycle Society" of 2000). UK Government has clearly indicated that it is looking for business-led solutions at this point in time (Dr Colin Church, DEFRA Director, Resource, Atmosphere and Sustainability) and has also recommended that standard setting organizations encourage inclusion of more waste prevention requirements in product standards (Government Waste Policy Review for England 2011).

The debate in the UK around the need for legislation to encourage circular economy approaches is ongoing with clearer focus of regulatory effort on waste prevention and minimization (e.g. Zero Waste programmes in Scotland and Wales) and current lack of targets around 'circularity'.

6.2.3 Key players and initiatives

There are increasingly more and more organizations that are developing or sponsoring new initiatives and producing publications around the waste prevention and circular economy concept. These organizations include the Aldersgate Group; BioRegional; Business in the Community (BITC); DCLG; DEFRA; The Ellen MacArthur Foundation, together with its global partners; Environmental Services Alliance (ESA); Green Alliance; Institut de L'Economie Circulaire, IIED; Product Life Institute; Resource Revolution; RSA; The Technology Strategy Board; WRAP; and WWF.

A number of these organizations are moving towards a common (standardized) approach to support the move to a more circular economy, for example:

- The Ellen McCarthur Foundation has set out principles that should be followed to lay out pathway to a circular economy as part of its circular economy reports.
- The Ellen MacArthur Foundation and the European Commission's LIFE+ programme aims to deliver the first metric tool for measuring circularity. Of relevance is also the foundation's work on the circularity indicators project, as well as its participation on the European Resource Efficiency Platform[5].
- WRAP has developed a vision for a circular economy by 2020 and is developing a re-use standard with the aim of increasing consumer trust in quality reusable items.
- The ESA has recommended to government that domestic end-markets for recycled materials should be encouraged through green procurement and product standards.
- The RSA have suggested that there is a need for laws and accreditation fit for circularity with a review of regulations that hinder re-use or repair. They also suggest that there needs to be trusted certification of more recycled materials to boost the market.
- The Great Recovery Programme, designers have been identified as the hotspot in a circular economy - "If we can just get them to design better products, then the circular economy is sorted."
- Green Alliance has suggested that as businesses have voiced their desire to be part of a more circular economy and shown their ability to deliver part of it and that there now need to be some

[5] For more information, visit http://ec.europa.eu/environment/resource_efficiency/re_platform/index_en.htm.

processes to help them get there. They have also suggested that a large part of the shift to a more circular economy may need to come from our values and behaviour, which might be independent from, or else reinforced by, an economic motive. Chapter 5 of the *Resource resilient UK* report produced by the Circular Economy Task Force, convened by Green Alliance, sets out specific proposals for standards on secondary material quality; reuse and remanufacturing; and collection and disassembly requirements (which could be achieved through standards).

6.3 Recommendations

This research report has helped identify numerous standards that address waste prevention and a lot of activity in helping to define and implement the circular economy concept. There appears to be a desire to develop a common approach to the circular economy, and a number of key organizations identified are already collaborating to define such an approach. However, there is an argument that more concerted effort is needed to define, agree, scale up, and promote the uptake of the circular economy model. Taking into account the role of standards in bringing various stakeholder groups together to agree a consistent approach to a given subject (including relatively 'novel' and controversial issues), it is recommended that BSI work in collaboration with government and industry, to build consensus as to what good circular economy practice looks like, and further this work.

The standardization process should be inclusive both in terms of building on existing standardization work and progressive new initiatives outside the formal standards arena, as well as utilizing the skills and the knowledge of the individuals, organizations and networks that have established themselves as thought leaders in the circular economy debate. BSI could support such a collaborative effort through the following proposed actions:

- **Homogenize product and waste prevention standards focussing on specific industries and product groups**.
    - BSI could further review the potential for ensuring consistency in standardization. This could be achieved by revising and/or aligning standards, where possible, to reflect recent approaches to waste prevention and move toward 'circularity'.
    - BSI could research the possibility of building a product standards review programme, to include the mapping out of national, European and International standards; prioritizing these, and developing a revision schedule against each priority group[6]. A potential review should consider the reach and influence of existing standards and determine if the focus should be on the most effective standards to date or on trying to push those standards that could be useful but currently have less traction/visibility. The level of effectiveness and usage, as well as the applicability of standards (e.g. across industry or to individual sectors) could be used as prioritization criteria in implementing any such standards review programme. It has also been suggested that case studies could be developed around existing standards to demonstrate to their current and potential users how these can be used to look at issues of circularity (e.g. BS 8905 for sustainable materials).
- **Ensure all new and updated standards of relevance consider waste prevention and / or the circular economy.** This could be achieved by developing a guide for standards makers that would be used in the development of British standards. BSI could also investigate the possibility of developing guides for national, European and International Standards makers. Similar approaches

[6] It has been noted that the main products that are being recycled now tend to be low value, short life, common items, such as packaging, or very high value products, such as precious metals. Products that fall in between these areas tend to be much harder to deal with. It has been suggested that this may be something to consider when prioritizing the key areas that BSI wishes to focus on.

are present in the wider environmental/sustainability arena and include CEN Guide 4 (2004) for the inclusion of environmental aspects in product standards in European standards and ISO Guide 82 (2014) Guidelines for addressing sustainability for the development of international standards.

- **Develop overarching circular economy standard(s).** This could take the form of a framework or guidance to define the concept, the principles and benefits of circular economy thinking. This could also include standards that detail key requirements for embedding circularity within an organization, industry, community or a supply chain. A vocabulary of common terms and definitions would also contribute to the better understanding and promotion of the circular economy. Similar approaches are already present and have proven successful in BSI's work around sustainability management (e.g. BS 8900 on defining sustainable development and embedding it in every-day operations, BS 8903 on sustainable procurement), environmental and energy management, greenhouse gas management, biodiversity, and other areas of relevance. When/if developing framework approaches to circularity, it is important to consider the appropriate level of applicability, i.e. are such standards likely to deliver best results if developed at the global, national or regional level.
- **Develop standardized mechanisms of measuring circularity.** Standards could be developed for measuring circularity at the national, organizational and/or product/supply chain level. This could be achieved by supporting and building upon existing initiatives such as the Life+ programme of work and other privately driven effort.

  Initial feedback collected during the peer group review of the draft report has suggested that the development of a standardized mechanism for measuring circularity would be very useful while also stating that there might not be sufficient agreement on a technical level at present. A preference has been expressed by some of the commentators for integrating life cycle assessment/footprint-type analysis (carbon, water, land, etc.) to inform an analysis of the value of making any product or material circular. BSI has long experience in the development of environmental assessment standards and has led international standardization effort in the area of product carbon footprinting in particular, and therefore will be well placed to contribute to the development of an assessment methodology for circularity that embodies stakeholder consensus and latest technical knowledge and understanding of the issue.
- **Develop further sector specific re-use and recycling standards; develop standards around other models, which encourage circular thinking.**

  In line with the national Waste Prevention Programmes required by the EU, further standardization could extend to:

  - specific products and materials to target as waste prevention priorities; and
  - how to extend re-use, repair, and leasing business models.

  Priority products and materials for waste prevention could include electrical and electronic equipment (as with PAS 141), clothing and textiles, construction materials, food waste, and packaging.

It has also been pointed out that any new standards developed (or standards revised) to consider waste prevention and circularity, should be designed so that standards work did not inadvertently stifle innovation and creativity in this area, where redesign of systems, supply chains and services is key.

Any new or revised standards that consider circularity, should outline the business case for moving toward a circular economy, thereby highlighting the drivers for the use of circular economy standards.

New/revised standards that encourage waste prevention and circular approaches should also take into account the need to change the mind-set of the public in terms of encouraging re-use or acceptance of used products. The importance of the consumer viewpoint should be therefore considered in related standards work, alongside the use of other means of changing public perception, such as training, and awareness raising campaigns.

6.4 Next steps and related material

The main findings and the initial recommendations contained in this report were presented at a stakeholder forum event on 8 April 2014. The event forms the second part of the project where stakeholder views were sought. The outcomes of the event inform how BSI will support government and industry in enhancing current waste prevention effort, and making a shift towards a circular economy, by prioritizing and validating the recommendations and actions highlighted above. The outcomes from the event and the agreed immediate next steps are captured in a separate document, available alongside this report.