Circular economy – a new road ahead

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Cradle-to-grave vs. Cradle-to-Cradle

- A term used in life-cycle analysis to describe the entire life of a material or product up to the point of disposal [1].
- linear take-make-consume-dispose approach

- A model of industrial systems in which material flows cyclically in appropriate, continuous biological or technical nutrient cycles. All waste materials are productively re-incorporated into new production and use phases.
- "waste equals food." [2]

[1] www.greenprophet.com
[2] Michael Braungart, William McDonough, EPEA

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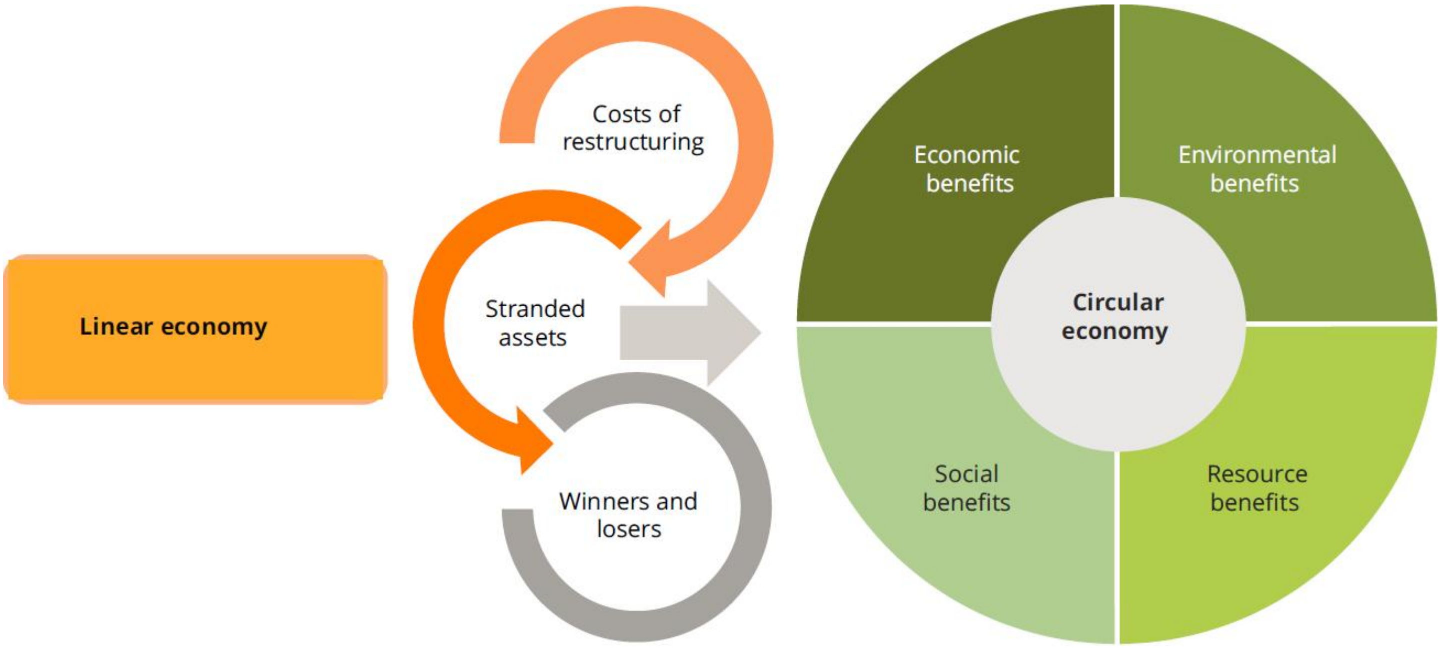
Transition from a linear to a circular economy

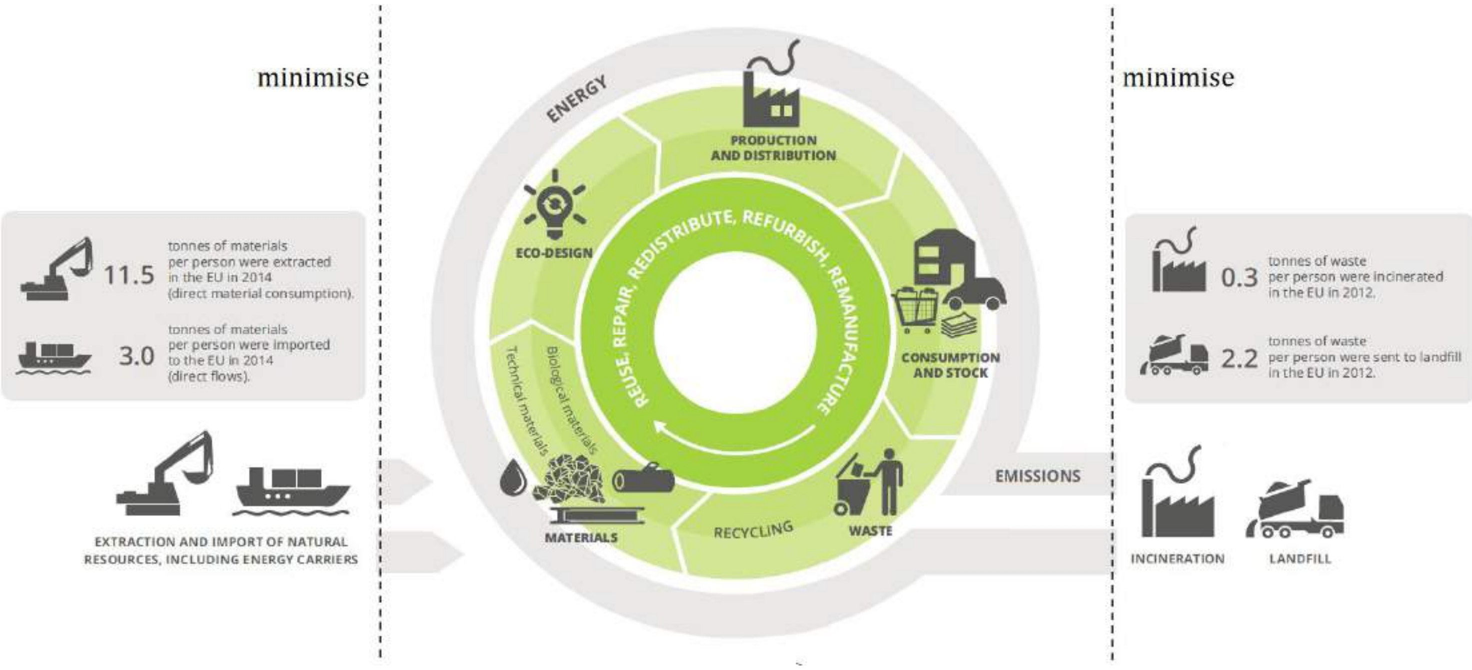


Circular economy IS

- A systematic and coherent framework for re-thinking future business and economic growth considering the availability and access to strategic resources, materials and energy that underpin our economies [1].
- A generic term for an industrial economy that is, by design or intention, restorative and in which materials flows are of two types, biological nutrients, designed to re-enter the biosphere safely, and technical nutrients, which are designed to circulate at high quality without entering the biosphere.
- Whilst elegant and deceptively simple these basic concepts and principles have enormous implications for our current linear economy and business practices, supply chains, business models.
- A positive, solutions-based perspective for achieving economic development within increasing environmental constraints [2].

[1] www.brad.ac.uk
[2] EEA Report – No. 2 2016. Circular economy in Europe Developing the knowledge base

Circular economy MEANS



Key characteristics (1/2)

- *Less input and use of natural resources*
  - minimized and optimized exploitation of raw materials, while delivering more value from fewer materials;
  - reduced import dependence on natural resources;
  - efficient use of all natural resources;
  - minimized overall energy and water use

- *Increased share of renewable and recyclable resources and energy*
  - non-renewable resources replaced with renewable ones within sustainable levels of supply;
  - increased share of recyclable and recycled materials that can replace the use of virgin materials;
  - closure of material loops;
  - sustainably sourced raw materials

Key characteristics (2/2)

- *Reduced emissions*
  - reduced emissions throughout the full material cycle through the use of less raw material and sustainable sourcing;
  - less pollution through clean material cycles

- *Fewer material losses/residuals*
  - build up of waste minimized;
  - incineration and landfill limited to a minimum;
  - dissipative losses of valuable resources minimized

- *Keeping the value of products, components and materials in the economy*
  - extended product lifetime keeping the value of products in use;
  - reuse of components;
  - value of materials preserved in the economy through high-quality recycling

Enabling factors (1/3)

- *Eco-design*
  - products designed for a longer life, enabling upgrading, reuse, refurbishment and remanufacture;
  - product design based on the sustainable and minimal use of resources and enabling high-quality recycling of materials at the end of a product's life;
  - substitution of hazardous substances in products and processes, enabling cleaner material cycles

- *Repair, refurbishment and remanufacture*
  - repair, refurbishment and remanufacture given priority, enabling reuse of products and components

- *Recycling*
  - high-quality recycling of as much waste as possible, avoiding down-cycling (converting waste materials or products into new materials or products of lesser quality);
  - use of recycled materials as secondary raw materials;
  - well-functioning markets for secondary raw materials;
  - avoidance of mixing and contaminating materials;
  - cascading use of materials where high-quality recycling is not possible

Enabling factors (2/3)

- *Economic incentives and finance*
  - shifting taxes from labor to natural resources and pollution;
  - phasing out environmentally harmful subsidies;
  - internalization of environmental costs;
  - deposit systems;
  - extended producer responsibility;
  - finance mechanisms supporting circular economy approaches

- *Business models*
  - focus on offering product–service systems rather than product ownership;
  - collaborative consumption;
  - collaboration and transparency along the value chain;
  - industrial symbiosis (collaboration between companies whereby the wastes or by-products of one become a resource for another)

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Enabling factors (3/3)

- *Eco-innovation*
  - technological innovation;
  - social innovation;
  - organizational innovation

- *Governance, skills and knowledge*
  - awareness raising about changing lifestyles and priorities in consumption patterns;
  - participation, stakeholder interaction and exchange of experience;
  - education;
  - data, monitoring and indicators

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Challenges

- Creating a circular economy requires:
  - fundamental changes throughout the value chain, from product design and technology to new business models;
  - new ways of preserving natural resources (extending product lifetimes) and turning waste into a resource (recycling);
  - new modes of consumer behavior;
  - new norms and practices, and education and finance;
  - integration between policy levels and policy domains, as well as within and across value chains
- Action is needed at all levels, from the European to the local, and by all stakeholders, including governments, businesses, researchers, civil society and citizens!
- It is essential to analyze relevant economic and social factors because of the strong links between the use of natural resources, human health and well-being, and the functioning of ecosystems in Europe and globally through trade in goods and services.

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Resource benefits

- improving resource security (increase the efficiency of primary resource consumption);
- decreasing import dependency (make procurement chains less subject to the price volatility of international commodity markets and supply uncertainty due to scarcity and/or geopolitical factors)
  - 6–12% of all material consumption, including fossil fuels, is currently being avoided as a result of recycling, waste prevention and eco-design policies; the maximum potential using the existing technology is estimated to be 10–17 % (EC, 2011a).
  - Using innovative technologies, resource efficiency improvements along all value chains could reduce material inputs in the EU by up to 24 % by 2030 (Meyer, 2011).

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Environmental benefits

- reduction of greenhouse gas emissions of around 424–617 million tonnes of CO_2eq (<2035) [1]:
  - ambitious targets for recycling of municipal and packaging waste;
  - reducing landfill
- resource efficiency measures in the food and drink, fabricated metals and hospitality and food services sectors, 100–200 million tonnes of CO_2eq emissions can be avoided annually [2];
- the study of the potential in food, mobility and built environment systems estimates:
  - a prospective GHG emissions reduction of 48 % by 2030 and 83 % by 2050 compared with 2012 levels;
  - a reduction in externality costs (2) of up to EUR 500 million by 2030 [3].

[1] EC, 2015b

[2] AMEC Environment & Infrastructure and Bio Intelligence Service, 2014

[3] EMF and McKinsey Center for Business and Environment, 2015

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Economic benefits

- circular economy can offer a platform for innovative approaches to create more economic value from fewer natural resources:
  - innovative technologies;
  - Innovative business models
- circular economy can provide significant cost savings for various industries
  - manufacture of complex durable goods with medium lifespans – EU potential USD 340–630 billion/year in net material (12–23 % of current material input costs) [1];
  - consumer goods – food, beverages, textiles and packaging – global potential of USD 700 billion/year in material savings (20 % of the material input costs) [2]
  - implementing resource-efficiency/ circular economy measures (waste prevention, materials recovery, changing procurement practices and re-design of products) in EU-27 can save EUR 245-604 billion (3–8 % of annual turnover) [3]

[1] EMF, 2012

[2] EMF, 2013

[3] AMEC Environment & Infrastructure and Bio Intelligence Service, 2014

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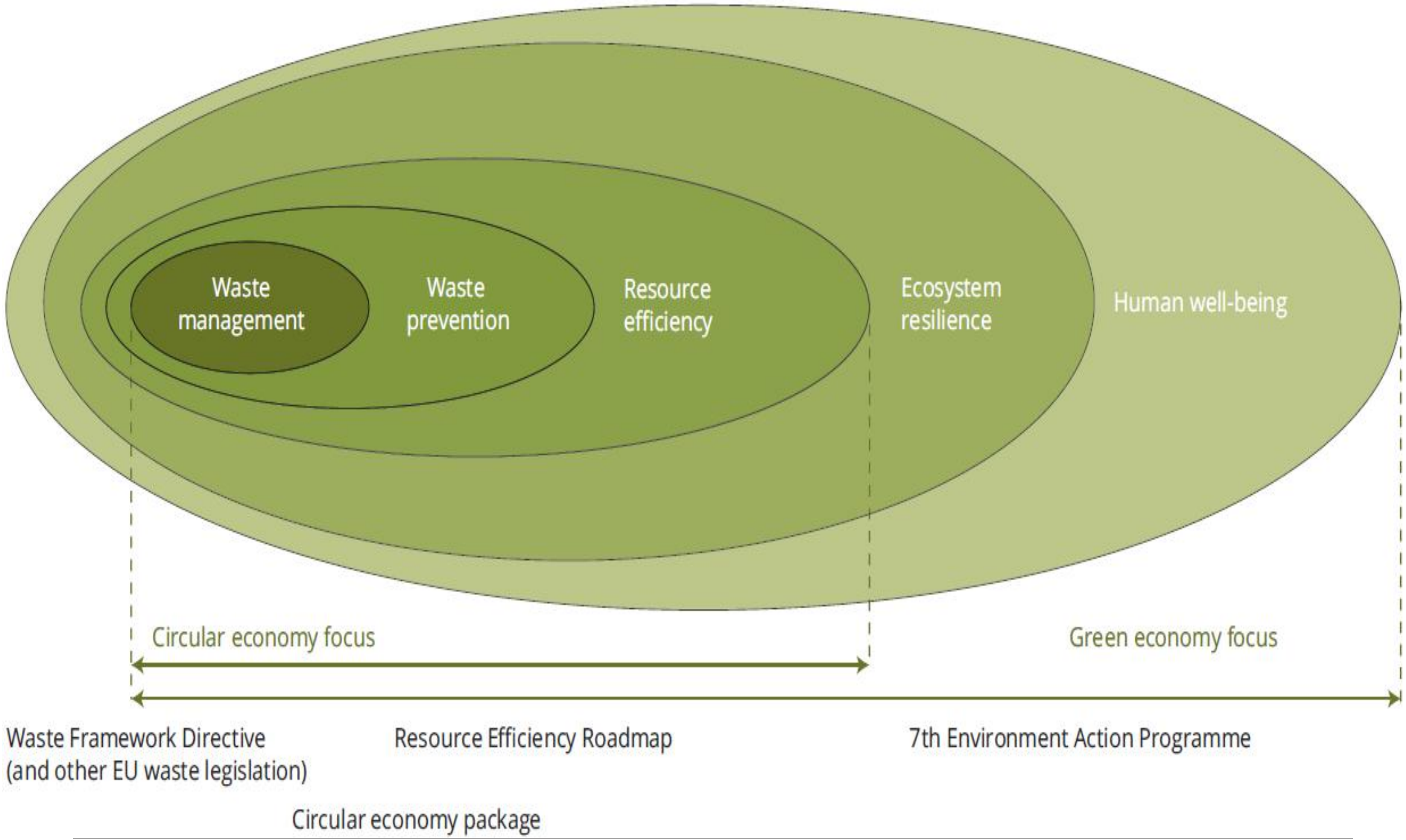
Social benefits

- encourages more sustainable consumer behaviour

- creates job opportunities (up to 178 000 new direct jobs by 2030 [1]:
  - labour-intensive strategies (preparation and sorting of products and materials for reuse or recycling) ->jobs for low-skilled people;
  - closed-loop recycling and remanufacturing -> jobs for medium-skilled people;
  - bio-refining -> jobs for high-skilled people;
  - replacing products with services -> jobs for people with all levels of education

[1] EC, 2015b

Circular economy and green economy



Conclusions

- Current work on indicators that track progress towards a circular economy has been driven, to a large extent, by developments in material resource efficiency and waste management. Such measures of eco-efficiency classify resource flows according to the main categories identified in material flow accounts and waste statistics.

- While these are useful, the statistics fall short of providing a basis for assessing some particularly relevant aspects of a circular economy, such as material losses and the qualitative aspects of recycling.

- In addition, looking at the elements of a circular economy holistically, challenges and large knowledge gaps persist.

- More robust data is needed on new business trends and sustainable consumption relating, for example, to eco-design, the sharing economy, and repair and reuse. Better descriptive social indicators, indicators for industrial symbiosis and waste prevention indicators would also provide greater insights on progress.

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