



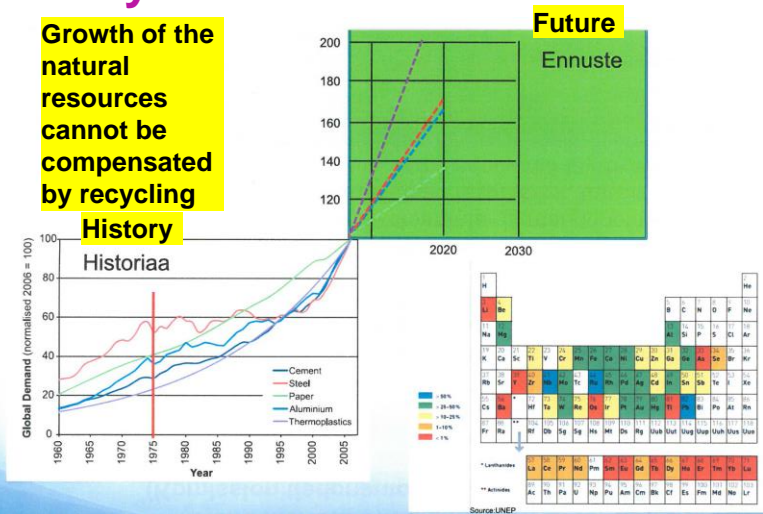
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Waste Management and Recycling

Circular economy in waste management

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Natural resources do not last forever or do they?



What is circular economy?

The circular economy is a novel economic **model** in which the focus is on reusing materials and value, and on creating added value in products through services and smart solutions.

The definition of circular economy was launched by Ellen MacArthur Foundation in report Towards the circular economy (January 2012)

Circular economy versus linear economy

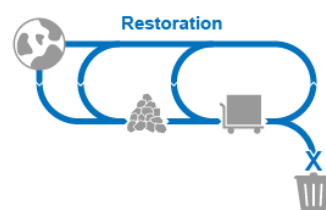
The circular economy is the **opposite** to the 'take, make and waste' linear model of modern times. The latter puts great pressure on virgin resources and leads to waste, toxicity, over use of **fossil fuels**, and so on.

In contrast the circular economy is: "an industrial system that is **restorative** or **regenerative** by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of **renewable energy**, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the **superior design of materials**, products, systems, and, within this, business models.

The linear economy



The circular economy

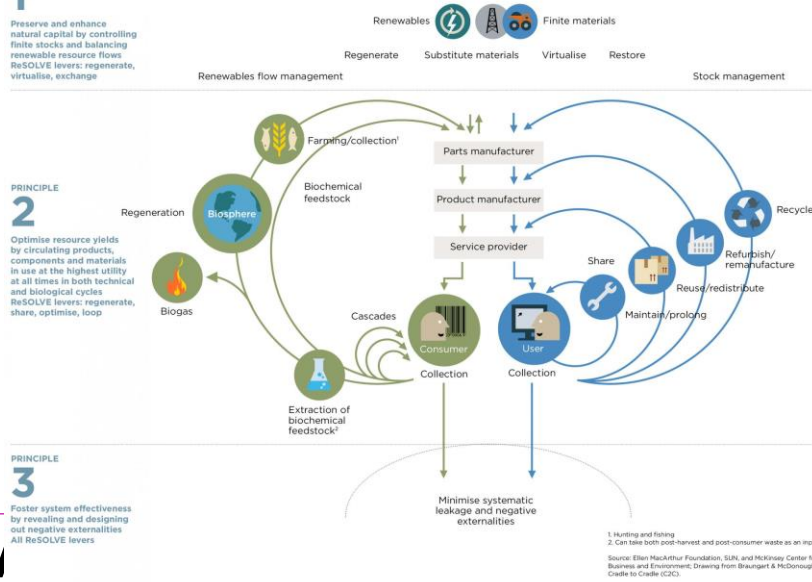


OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE

1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
ReSOLVE levers: regenerate, virtualise, exchange



PRINCIPLE

2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
ReSOLVE levers: regenerate, share, optimise, loop

PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities
All ReSOLVE levers

1. Hunting and fishing
2. Can take both post-harvest and post-consumer waste as an input
Source: Ellen MacArthur Foundation, SRI, and McKinsey Center for Business and Environment, Drawing from Braungart & McDonough, Cradle to Cradle (C2C)

Circular economy insight

The transition towards a circular economy responds to some of the main challenges of our time

- Preserve of resources
- Lowers the environmental pressure
- Boost of economy and competitiveness
- Brings new business opportunities and gives innovative and efficient way of producing and **consuming**
- New local low and high skilled jobs
- Has a link to
 - Sustainability
 - Jobs and growth
 - Climate and energy
 - Social agenda
 - Industrial policy

Objective

The objective of circular economy is:

preserve and maintain the value of products and materials in the economy for as long as possible, while reducing the excessive consumption of primary resources as well as minimizing the generation of non-recyclable waste

Circular economy is not just recycling but much more!! 1/4

Production

- **Product design**
 - Influence to product lifetime, durability and reparability
 - Disassembling possibility
 - Valuable materials recycling ability
 - Electrical and electronic products design in particular focus
 - Eco-design
 - Extended Producer Responsibility
- **Production process**
 - Bad production process may lead to significant waste generation and inefficient use of resources
 - Minimization of the use of primary materials
 - Industrial symbiosis allows waste or by-product of an industry to become raw materials for another one
 - Waste minig

Circular economy is not just recycling but much more!! 2/4

Consumption

- **Millions of consumers around the world can support or hamper the circular economy with their choices**
- **Consumption is also crucial to reduce the waste amount generated by households**
 - Majority of customers prefers environmentally friendly products
 - Often difficult to compare different products environmental values of products (Ecolabeling)
 - Product price versus environmental values
 - Product guarantees
 - Product sharing
 - Reuse centres for discarded products

NOTE: Public procurement represents a large share of European consumption, with nearly 20 % of EU GDP (Gross Domestic Production) -> large impact to circular economy

Circular economy is not just recycling but much more!! 3/4

Waste management

- **Has a central part in circular economy**
 - Waste management leads either to high rates of recycling or most of the waste ending up to landfills
 - Household, business, industry, mining and construction waste must take in to the consideration
 - *The level of recycling of household waste varies between 5 – 70 % between member states*
 - *Packaging waste in big role (EPR schemes) as well as bio waste*
 - **Barriers of recycling:**
 - *Country specific legislation*
 - *Insufficient investments to waste management facilities*
 - *Illegal transport of waste to third countries and environmentally unsound treatment*
 - *The market value of recyclables*
 - The value of collection and transportation of waste as business is in many cases better than the value of waste collected
 - Absence of quality standards for secondary raw materials

Circular economy is not just recycling but much more!! 4/4

From waste to resources, market for secondary raw materials

Circular economy does not work properly without markets for secondary raw materials !!

- *If waste management sector cannot ensure the quality of secondary raw materials industry prefers virgin materials to avoid quality problems in their own products (quality standards needed)*
- *Nutrients important category of secondary raw materials (phosphate, nitrogen)*
- *Hazardous chemicals enrichment into secondary raw materials*
 - *Recycled products must not present a higher risk to health and environment than virgin materials including people working in recycling facilities*

Mechanical treatment processes

- **Size reduction**
- **Density separation**
- **Electric and magnetic separation**
- **Optical sorting**
- **Compacting**

Mechanical treatment processes

Examples of size-reducing equipment

The most common types of are:

- Hammer mills.
- Impact crushers.
- Cutters/shredders.
- Cascade mills.
- Jaw crushers.

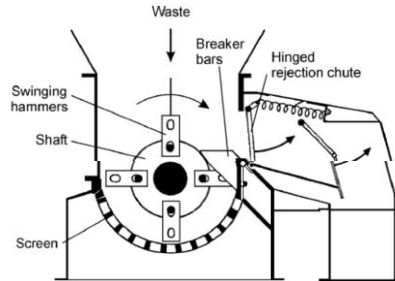


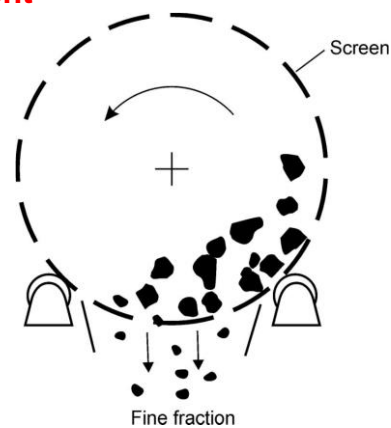
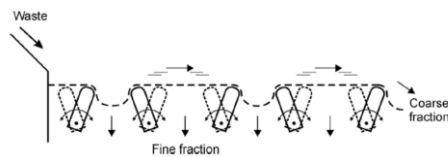
Figure 7.1.1 Hammer mill.

Mechanical treatment processes

Examples of separating equipment

Screens

- Drumscreen
- Oscillating screen



Mechanical treatment processes

Air classifiers

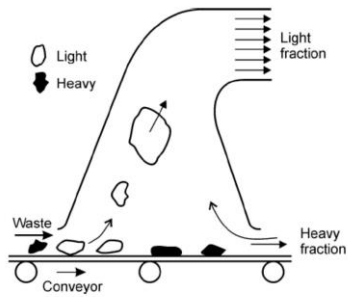


Figure 7.1.13 Overhead suction hood.

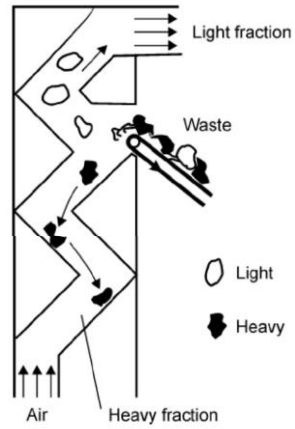
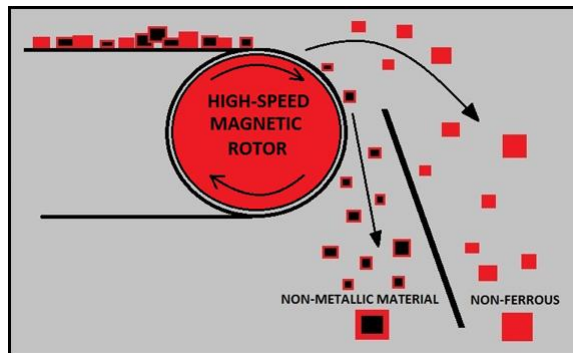


Figure 7.1.11 Zigzag air classifier.

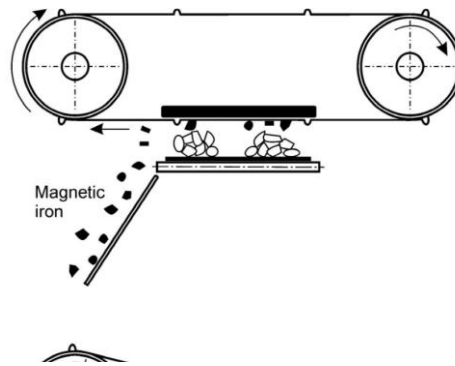
Mechanical treatment processes

Eddy current separation of metals



Mechanical treatment processes

Magnetic separation of metals



Mechanical treatment site

