Bringing the Action Plan to Life: Towards a Fact Based Circular Economy
20th September 2018, ERSTE Campus / Grand Hall
A-1100 Vienna, Am Belvedere 1

Priorities in science and research:
A Fact Book for the Circular Economy

Helmut RECHBERGER

TU Wien: Institute for Water Quality and Resource Management
Circular Economy Coalition for Europe

The Circular Economy Coalition for Europe

CEC4Europe (Circular Economy Coalition for Europe) is an **initiative of scientists and researchers** with long-term experience in the field of waste and resources management.

Founded in 2015, CEC4Europe aims at **supporting European Institutions, national decision makers** and other stakeholders in developing an effective and efficient circular economy by using an integrated and **fact-based** approach.

www.cec4europe.eu

The Circular Economy Fact Book

CEC4Europe invited leading scientists to provide **core analysis results and recommendations** for a Circular Economy – A Fact Book on the Circular Economy.

The Fact Book is a **living and growing document**: currently

22 contributions over 50 authors

Allesch   Bartl   Baum   Baumgartner   Brunner   Buchner

Berting   Cao   Cullen   Drummond   Ekins   Fellner

Franke   Guyonnet   Haupt   Heldal   Hellweg   Hiebel

Nühlen   Huber-Humer   Kleemann   Kral   Kroop   Laner

Lederer   Lefebvre   Liu   Lundhaug   Menad   Morf   Müller

Obersteiner   Pasquier   Pehnelt   Petavratzi   Plaum   Pomberger   Reh

Rechberger   Reike   Sarc   Scharff   Scherhaufer   Simoni   Somborn-Schulz

Unger   Van Eygen   Vermeulen   Vyzinkarova   Witjes   Zessner   Zoboli

The Circular Economy Fact Book: Content

1. **Why a circular economy?**
   Circular Economy Package, Raw Materials Initiative, …

2. **Circular Economy: Selected issues**
   Optimum recycling targets, economics of recycling, critical factor time, current limits of CE, energy, indicators, clean cycles, uncertainty, …

3. **Selected material stocks and flows**
   Metals, rare earth, carbon-based, nutrients, textiles, food waste, …

4. **Strategies and Instruments**
   Data base, resource efficiency, product design, EPR, …

5. **Window of opportunity**
   What can we offer, who we are, …

6. **Contributors**

7. **Contact**

Conclusions & Recommendations: >70

- Resource management instead of focusing on municipal waste
- Get to know our starting point: harmonization of definitions, statistics, and calculation methods
- Harmonising recycling rates between Member States instead of isolated increase in quotas
- Optimum instead of maximum recycling targets, based on cost-benefit analysis
- Binding minimum requirements for EPR schemes
- Modelling of the future raw material demand in terms of quantity and quality
- Systematic exploration of anthropogenic resource stocks in goods, buildings and infrastructure
- Prioritization of material used (primary and secondary) sources
- Appropriate policies and instruments to support holistic resource efficiency
- Evidence-based approach instead of guesswork, based on insufficient data
- The optimal recycling rate is a temporally moving target and requires careful determination.
- Determination of an ecologically and economically reasonable legal recycling rate requires the knowledge of the optimal recycling rate.
- Commencing studies and research to create and extend the methodological and informational knowledge to determine optimal recycling rates for relevant waste streams and secondary resources.
- The (potential) marginal ecological utility of extended recycling activities must outweigh the marginal (economic and ecological) costs.
- Significant negative external (ecological) effects of the exploitation and processing of raw materials may justify a subsidization of recycling activities in terms of (temporary) co-payments.
- The market prices of recycling must compete with those of primary raw materials.
- The use of secondary raw materials must not adversely affect the production process or increase the risk exposure for consumers and the environment.
- In addition, increased attention should be paid to the quality of the specific input streams.
- The additional quantities of secondary materials induced by implementing the Circular Economy Package CEP for MSW and packaging waste cover only a small amount of demand.
- The current rate of circularity for Iron & Steel and Paper & Board is already high, thus limiting the potential reductions of primary raw material demand induced by the CEP.
- Material stocks for Iron & Steel, Aluminum and Plastics are still growing at a significant rate, meaning that even a 100% recycling rate may only partly cover the material demand.
- At present there is a significant net export of scrap and recyclables for all four commodities, which might be explained by quality constraints of European manufactures.
- Increasing exports of recyclables might be expected if quantities of recyclables increase due to the CEP.
- There is a risk of down-cycling if only recycling quotas are targeted.
- Additional policy measures, such as quotas for the share of secondary raw materials utilized in products in order to prevent/reduce exports of recyclables.
- Expansion of recycling quotas by qualitative aspects.
- In order to increase the material efficiency of resource systems, reliable material flow-based measures are crucial to evaluate current use patterns and monitor progress towards improved resource efficiency.
- Transparent and consistent uncertainty treatment in MFA includes i) data assessment and uncertainty characterization, ii) data reconciliation and uncertainty propagation, iii) consequent interpretation and uncertainty communication.
- The case study results highlight that limitations of material flow data have a direct effect on evaluating the material efficiency of national resource budgets, which can cause significant uncertainty concerning the actual performance of material management.
- Transparent and consistent characterization, handling and communication of uncertainty should become standard practice in MFA.
- The methodological state-of-the art should be translated into easy-to-use tools. Furthermore, a link between the quality of material flow data and the confidence in the material flow results should be established and suitable methods for visualization should be further explored.
- Metal stocks (even in affluent countries) are still growing at a significant rate, meaning that even a 100% recycling of scrap may only partly cover metal demand
- Primary metal input is not only required due to quantitative disparities between Al demand and scrap supply, but also results from qualitative constraints (alloy demand vs. alloy supply via scrap)
- Qualitative constraints of metal recycling are currently avoided through the global trade of scrap (the EU represents a net exporter of metal scrap)
- Alloy specific sorting of scrap may reduce qualitative recycling constraints and may lead to a higher domestic added value of metal scrap
- There are significant losses of aluminium (>40%) in some consumption sectors
- Implementation/advancement of alloy specific sorting of scrap
- Advancement of product design and declaration of product recyclability as a means to enhancing the circular economy of metals
- In the foreseeable future the consumption of rare earths will be driven by demand for rare earth permanent magnets. These magnets are essential in the context of the energy transition.
- In terms of supply risks the issue is "access to rare earths" rather than "geological scarcity". Access is influenced by a variety of factors that are primarily geopolitical, economic and social (the extractive industry's social license to operate).
- While it is essential to reduce in the context of the circular economy, it should be more widely recognized that if demand is increasing, as is the case for rare earths but also for a wide variety of other specialty and base metals, recycling can only partly make available (whether from domestic extraction or from imports).
- Europe should take more responsibility for its own requirements in terms of mineral resources. Progress is required with respect to the sustainable supply of mineral raw materials. The particular issue of mining waste management remains extremely sensitive.
- Developing environmentally optimal recycling schemes for carbon-based materials builds on a thorough understanding of available (currently and in the future) end-of-life material flow quantities, the qualities, and the corresponding utilization pathways.
- Facilitate data availability on the mass flows, technical material quality (e.g. polymers for plastics or solid vs. fiber-based for wood), and substance contents (e.g. additives) of carbon-based end-of-life materials
- Promote research towards improving collection and sorting if future recycling targets are to be reached.
- Annually, about 90 Million t of fibers, which are predominantly used for textiles, are produced. This amount represents a considerable fraction of total waste.
- The textile processing chain is globally dislocated and concentrated in countries with low social and environmental standards. Europe is mainly a consumer of textiles only.
- Commonly, pre-consumer textile waste is generated outside Europe and not affected by EU legislation.
- Most textile products have a fairly short lifespan and the portion of fibers within the product cycle is correspondingly low.
- Quickly changing fashion and low quality products are the major drivers for textile overconsumption.
- In several industrialized countries a separate collection for end-of-life textiles has been established. The highest collection rate of 75 % is reported in Germany, whereas most other countries lag behind.
- Most collection schemes for end-of-life textiles are funded by selling second-hand clothes.
- Recycling schemes for non-reusable items are not cost effective.
- As non-reusable items are not cost beneficial, apparel collectors demand fully functional textiles only.
- Owing to the large quantities, textiles must become a topic of concern within the EU Commission.
- Waste prevention must be promoted by a significant increase in the lifespan of textiles.
- A consistent implementation of "design for recycling" in the field of apparel and textiles is essential to facilitate recycling.
- Expanded producer responsibility systems could increase the collection rate. First, latecomers must catch up with best practice countries. Second, a cost-effective collection scheme for damaged and worn textiles will further increase the collection rate and thus reduce the fraction of textiles in MSW.
- The development of new and economically feasible recycling processes must be encouraged. They can generate a pull factor for end-of-life textiles.
- In order to promote the circular economy in the field of textiles, the retrieval of the textile processing chain to Europe must be supported.
- Materials accounting is feasible and delivers better understanding of the system and data situation.
- The time-series created are instrumental for decision making. They directly point to fields of action (problem spots) and therefore support and guide decision making.
- Routine materials accounting should be introduced at a national and EU level. This should be performed by statistical offices or other administrative bodies such as EPAs. There should be national and EU level experts for each set of commodities exchanging data and knowledge about their respective systems.
- Global pressures to ensure food security and reduce the environmental impact make it imperative to address wastage of resources in the form of food waste.
- Per person 173 kg of food waste are generated in the EU, adding up to 88 mio t.
- More than half (53 % or 46.5 t) of all food waste occurs at household level.
- International targets to halve food waste at retail and consumer level mean that about 31 mio t of food waste need to be avoided by 2030. This can only be achieved if food waste at consumer level is drastically reduced.
- Actions at all stages of the food supply chain by all stakeholders are needed and efforts to re-engage consumers with food are required.
- Unavoidable food waste and other side flows from the food supply chain should be utilised and aligned to the principles of a food waste hierarchy, be demand led and evaluated for their social, environmental and economic impacts to minimise trade-off and rebound effects.
- Transparent mapping and aligning of supply and possible demand for food waste across industries and regions is required to plan utilisation (e.g., surpluses arising from planned overproduction as a consequence of guaranteeing food security), rather than simply reacting to unforeseen quantities of food waste.
- There is a 'web of constraints' to resource efficiency - the direct and indirect relationships and dynamic interaction between institutions, organisations, societies and individuals, and the policies, norms and behaviours they set and exhibit.
- To enable and deliver the transformation to a circular economy, a policy mix is required, with instruments spanning three 'pillars of policy', addressing processes that occur across three 'domains of change', reflecting distinct spheres of economic decision-making.
- The existing and proposed policy landscape in Europe is likely to be insufficient for achieving a circular economy, for three reasons: (1) a focus on the lower tiers of the Waste Hierarchy, (2) varied ambition at the member state level, (3) sometimes conflicting policy objectives, instruments and mechanisms, laterally and over time.
- To be effective, cost-efficient and feasible, a policy mix and its component objectives, mechanisms and processes, must be consistent, coherent and credible. Three priorities for action are to: (a) amend existing (or introduce new) instruments that reduce conflict and increase synergies across the policy mix, (b) ensure policy processes between actors within and between different levels of governance, at a minimum, not in contradiction, and (c) develop a long-term (post-2020), clear and credible strategy, with holistic, clear and measureable targets, for the development of a circular economy in Europe.

7 key messages
(„Rechberger's choice")

Recycling and the CE are **no goals** per se, **rather means/instruments** to achieve sustainable materials management.
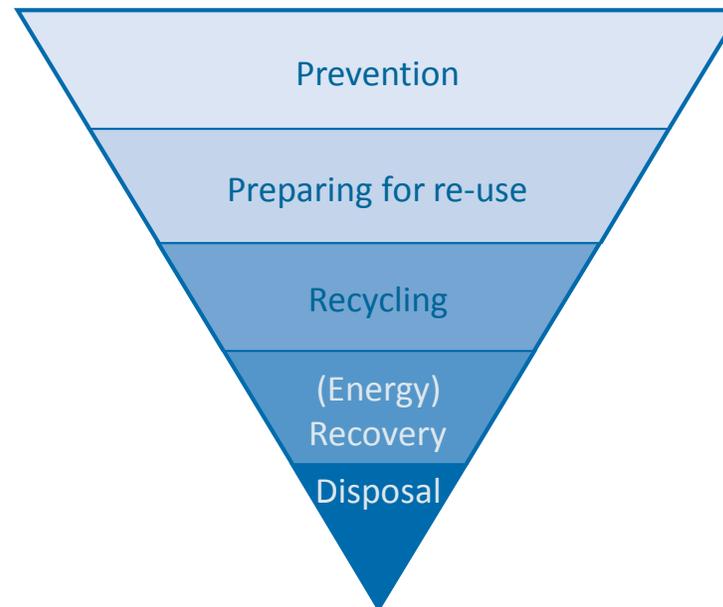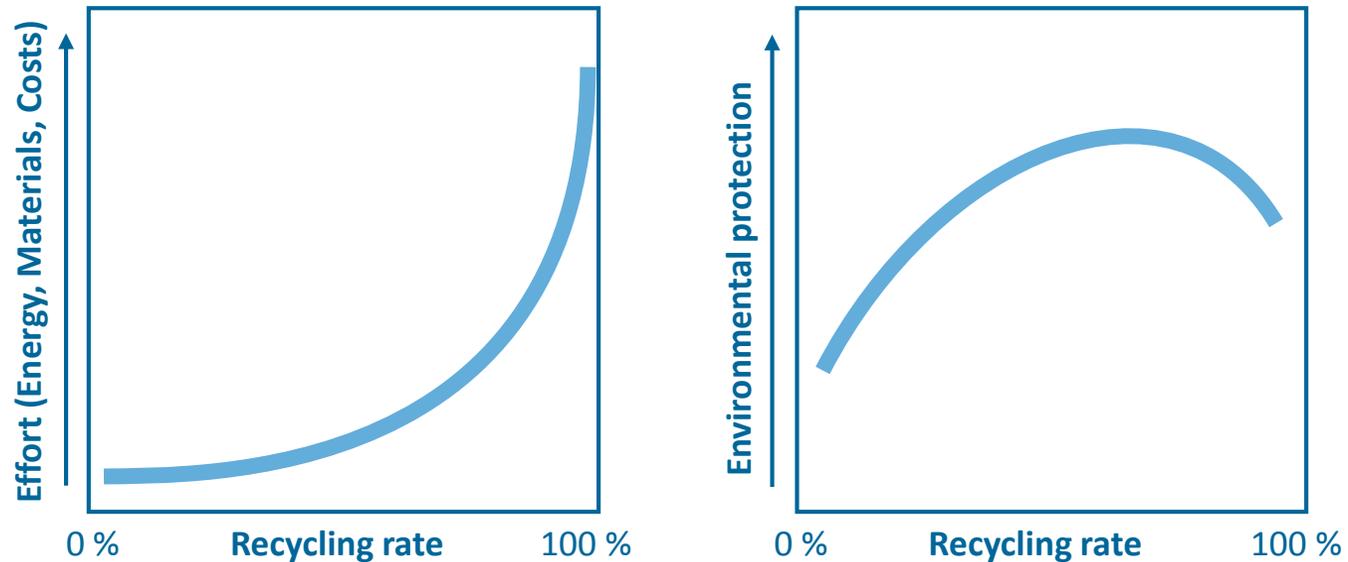

Source: *getyourguide.de*

Source: *n-tv.de*, dpa

Recycling and the CE are **no goals** per se, **rather means/instruments** to achieve sustainable materials management.
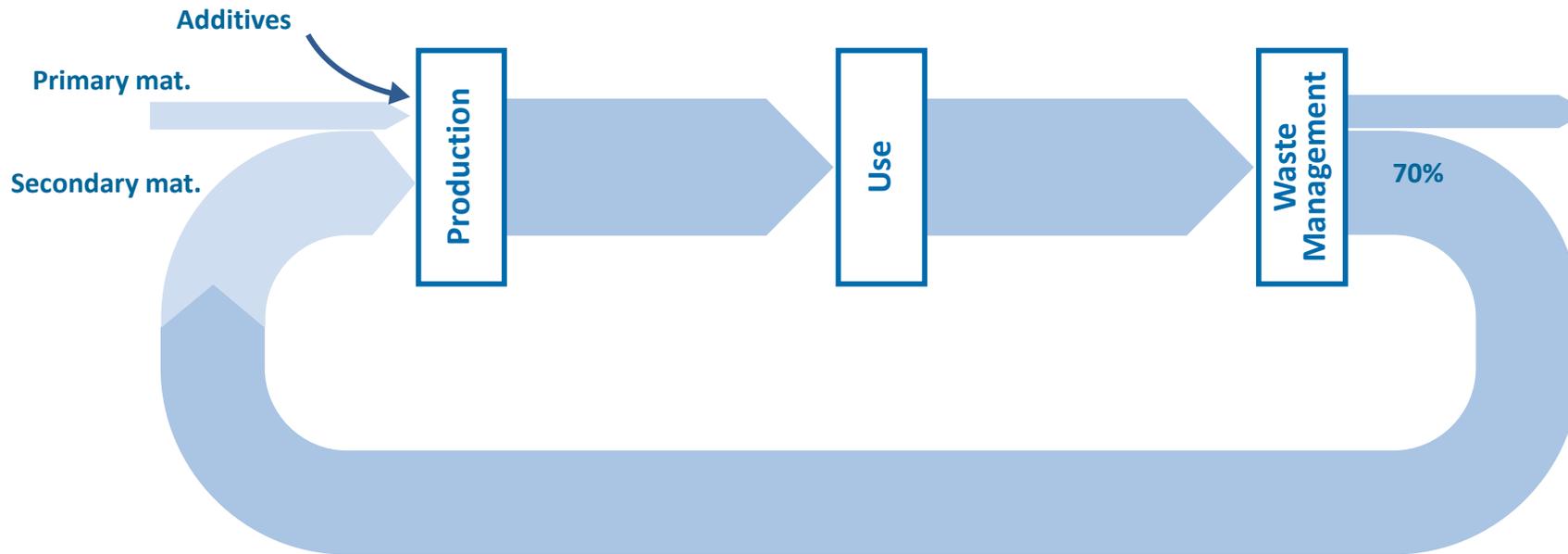

The hierarchy consists of **means to achieve goals** like **protection of human health and the environment** and **resource conservation**.

We do not need the highest but the **optimal recycling** rates (ecologically and economically).

Careful (fact-based) determination of recycling rates is important.
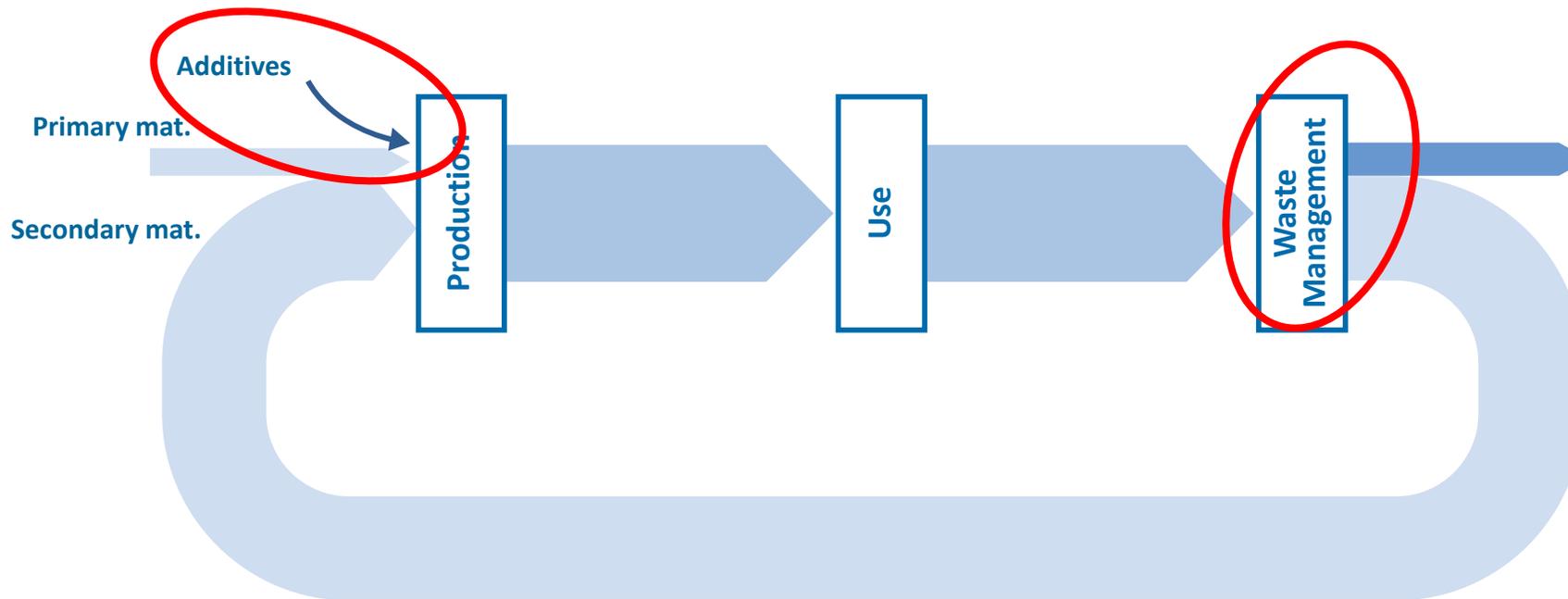
A strong need for also **qualitative targets** to maintain **clean cycles**.

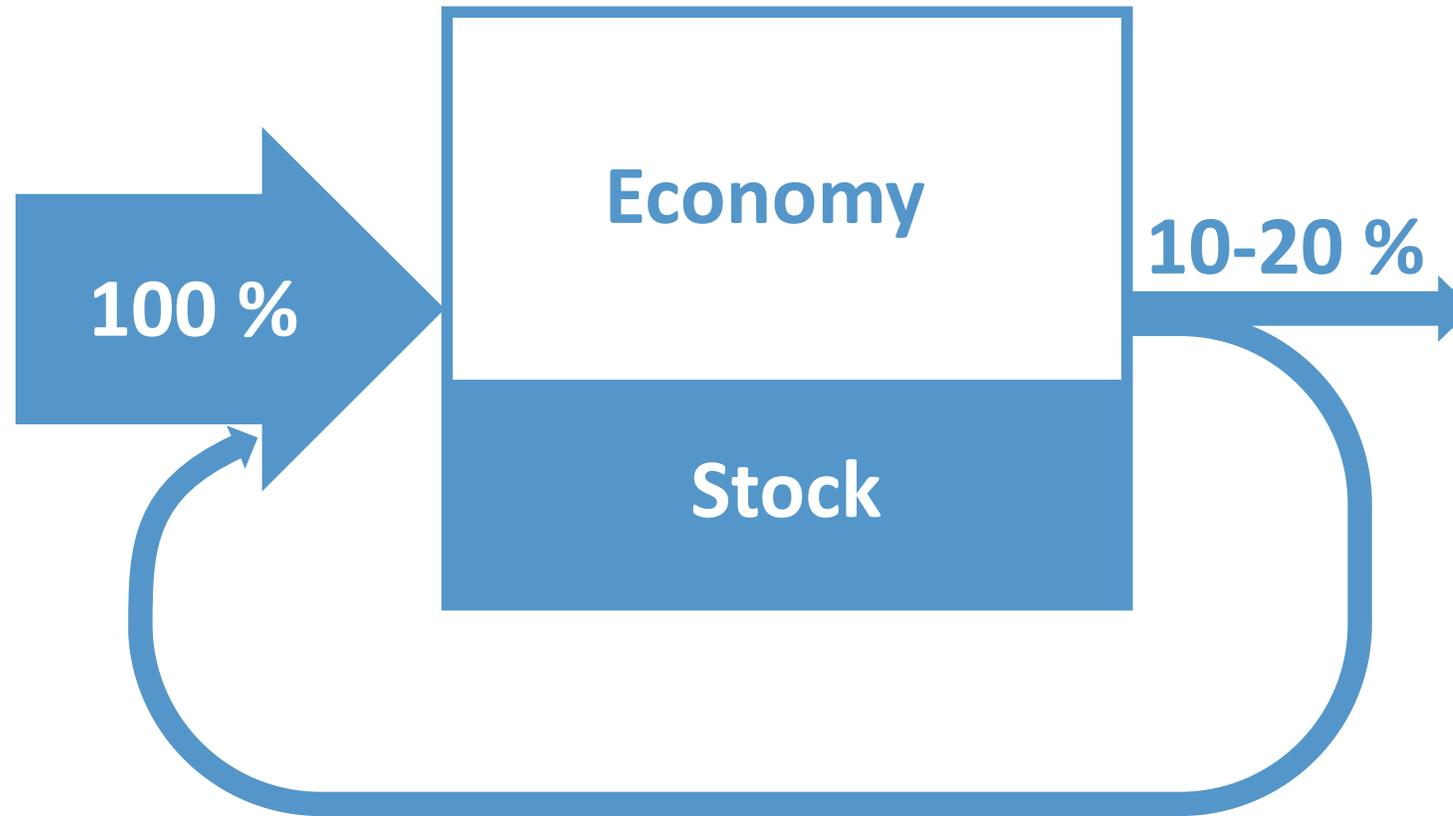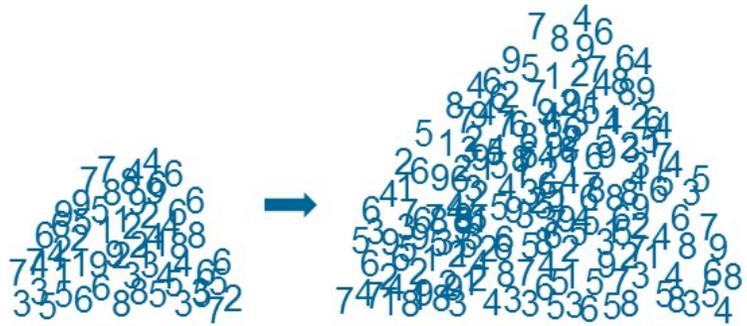A strong need for also **qualitative targets** to maintain **clean cycles**.

A strong need for also **qualitative targets** to maintain **clean cycles**.

A strong need for also **qualitative targets** to maintain **clean cycles**.

So far, the focus is mainly on quantity.
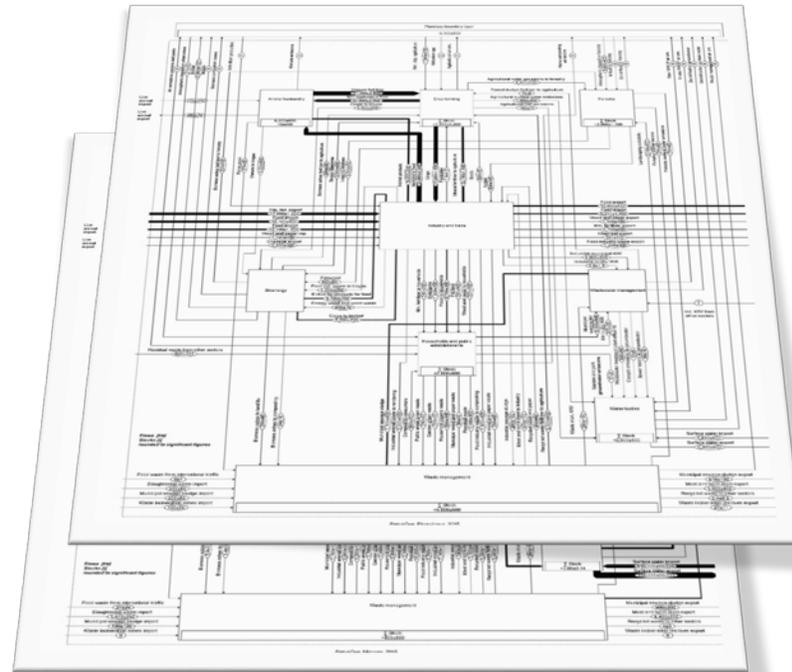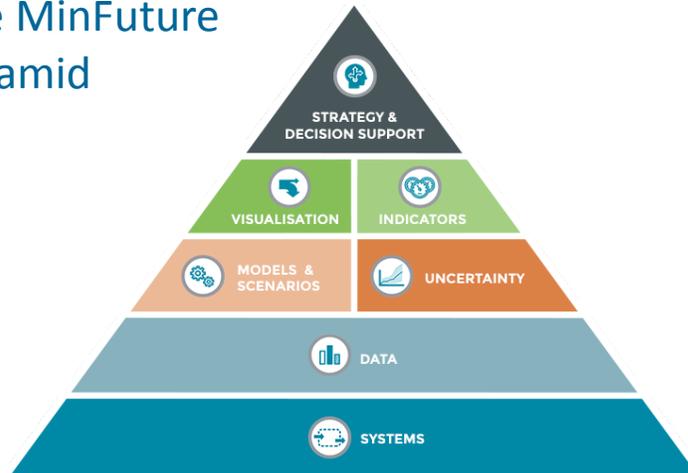
Growing stocks and **limitation of recycling.**

Effective CE requires a more balanced system.

More and better data and system understanding.

The MinFuture Pyramid

Better product design and **extension of EPR schemes.**

- Substitution/reduction of harmful substances
- Recyclability of components and materials
- Long-living and repairable products
- …
- Producers should take responsibility for their products over the entire life-cycle

The need for a **new policy mix** that is consistent, coherent and credible.

Elimination of contradictions or conflicts within or **between policy instruments** (e.g. removal of environmentally harmful subsidies, application of effective environmental taxation instruments).

A consistent policy mix has to be **applicable at all levels of governance** (i.e. EU, national, local/city).

A successful policy mix has to **convey credibility** in order to **provide confidence of market actors to invest** into circular economy technologies and practices.

Main Conclusion from the Fact Book

Realisation of CE requires a better understanding of the industrial metabolism.

This requires i.a.:

➢ **Enhanced data collection and accessibility**

➢ **Development of supporting tools (e.g. software)**

➢ **Interaction of research, administration (e.g. EPAs), statistical offices, industry associations**

➢ **Education and training of CE experts**