MISTRA Dialogue

Investor Brief:

Recycled Materials for Sustainable Investments

by

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Mistra Investor Briefs

The idea of 'Investor briefs' arose from a meeting between two of Mistra's external asset managers and researchers in a Mistra-funded research programme. The aim of is to provide a comprehensive but easily accessible report on trends and key aspects as well as a toolkit that is useful for supporting sustainable investments and engagement. This investor brief, which is focused on increased use of recycled material, is the third in a series in which the Mistra Dialogue initiative helps to connect investors and researchers, and to catalyse the implementation of knowledge produced in the research programme Mistra Closing the Loop.

Mistra, the Swedish Foundation for Strategic Environmental Research, funds academic and multi-stakeholder research with the aim of resolving important environmental problems and contributing to sustainable development. The determination to drive positive change is also key to Mistra in our role as an asset owner. Assets are entirely invested according to sustainability criteria and with a long-term perspective.

These dual roles as research funder and asset owner give Mistra a unique opportunity to provide a bridge between the finance sector and researchers that can provide for increased knowledge of asset management for sustainable development. The Mistra Dialogue initiative emphasises the ambition to refine and adapt the ideas, knowledge and results derived from Mistra-funded programmes to reach different target groups, with asset managers and investors as a key actor.

Mistra Investor Brief no. 1 (2019) *Plastics and Sustainable Investments – an information brief for investors*. Authors Tobias B Nielsen and Fredric Bauer. Based on results from STEPS – Sustainable Plastics and Transition Pathways.

Mistra Investor Brief no. 2 (2020) *Investor Brief: Sustainability in Textiles and Fashion*. Authors Åsa Östlund, Sandra Roos, Susanne Sweet, Emma Sjöström. Based on research results from Mistra Future Fashion.

Mistra Investor Brief no. 3 (2020) *Investor Brief: Recycled Materials for Sustainable Investments*. Authors: Evalena Blomqvist, Nina Waltré and Emma Sjöström. Based on research results from Mistra Closing the Loop.

Title: Investor Brief: Recycled Materials for Sustainable Investments

The contents of this investor brief are the responsibility of the authors.

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Executive summary

This Investor Brief provides the financial sector with a research-based, comprehensive and easily accessible report on the potential for the use of recycled materials. It highlights key features, challenges and opportunities, and provides a toolkit to consider when conducting financial and/or Environment, Social and Governance (ESG) analysis, considering corporate engagement or making investment decisions.

The content is based on the work of the Mistra Closing the Loop research programme, which involved seven years (2012–2019) of interdisciplinary research on developing, analysing and demonstrating ways to use recycled materials.

Recycled materials: a key for circular economy and sustainable development

About half of European Union (EU) total greenhouse gas emissions and more than 90% of its biodiversity loss and water stress are caused by the extraction and processing of virgin materials.[1] To achieve the targets set out in the Paris Agreement, the consumption of virgin resources needs to be at least halved on a global scale by 2050.[2] However, global consumption of materials is predicted to increase by two- to fourfold by 2050.[3] At the same time, we are still only recycling 5% of the 100 billion tonnes of materials that we consume every year, mainly through inefficient processes that generate low quality materials of little value.

The resource-efficient use of materials will require our current linear economy to be transformed into a circular system in which materials are valued more for longer. This transition will require that recycled materials are valued equally or more highly than virgin materials.[4] One prerequisite will be the introduction of a 'materials broker', an actor that facilitates circular material flows and provides the market with knowledge and matchmaking between recycled materials and industrial needs.[5]

A number of societal trends point to an increased use of recycled materials and a transition by companies to enhanced sustainability as a requirement for future profitability. Among these trends are new policy instruments, such as Agenda 2030, the EU Circular Economy Action Plan and the EU Green Deal, new regulations, new data requirements on sustainability performance (e.g., the revision of the European non-financial reporting disclosure, NFRD) and increased interest from the civil society in environmental issues. Furthermore, the EU's ambitious targets on climate change mitigation and resource efficiency are estimated to require a global cut in virgin materials extraction of 20% by 2030 and 50% by 2050.[6]

1 Ellen MacArthur Foundation (2019)

2 M. Fischer-Kowalski, et al., International Resource Panel (2011)

3 Ellen MacArthur Foundation (2019)

4 L. Smuk and E. Blomqvist (2020)

5 L. Smuk and E. Blomqvist (2020)

6 M. Fischer-Kowalski et al., International Resource Panel (2011)

Important materials to consider

It is especially important that certain materials are recycled due to properties such as a scarcity, highly negative climate impact, large material flows, or large-scale losses of value. Such materials include polymers and plastics, concrete, aluminium, steel, textiles, composites and all the critical metals and minerals important in renewable energy systems.

The role of the financial sector in increasing the use of recycled materials

The financial sector has a key role to play in accelerating the transition to a resource-efficient use of materials and a sustainable circular economy.

- Financial actors can push for **equal market conditions** for recycled materials by addressing important barriers and requirements, for example, through clearer regulations on waste, simplified use of recycled materials in production, and political instruments and risk assessment methods that are designed for efficient materials circulation.
- Financial actors can stimulate pull factors for recycled materials by either investing in a business with a **demand for recycled materials** or investing in innovative areas that drive such change:

Innovations that enable more of the **unique properties** of recycled materials to be reused.

Innovative **logistical solutions** based on the needs of recycled materials.

Innovations that empower the **recycling of components.**

Innovations that transform bulk materials recycling into processes, resulting in more functional **recycling of materials**.

Innovative **chemical**, **biological** or **thermal processes** that convert materials into valuable raw materials through molecular recycling.

Innovations that transform **waste incineration processes** to optimise them for materials that cannot be used elsewhere in society.

✳ Investor toolkit

The investor toolkit presents the key issues for investors and analysts to consider, and critical questions for them to ask regarding resource-efficient solutions to increase the use of recycled materials. The toolkit can be used to investigate companies' environmental claims and to analyse potential investments. It can also serve as input into owner dialogues on existing investments or decision support on new investments, and as a checklist for identifying potential greenwashing. Extended supportive information is provided in sections 1 and 2, and in the suggested list of further reading (section 3). The overarching goals referred to in this toolkit reflect the possibilities that recycled materials and circular material flows present for achieving the UN Sustainable Development Goals (SDGs), the EU's sustainability targets and the targets set out in the Paris Agreement.

Terms that could signal greenwashing or that would require further explanation

Imprecise definitions and the lack of applicability of a number of terms commonly used in sustainability communication make it difficult for investors to evaluate corporate claims and can even be a sign of greenwashing.

Reuse	It is possible to reuse most products and materials in theory. To be reused in practice requires infrastructure (collecting and sorting) and market demand for the reused materials or products.
Recyclable	Recycling is the reprocessing of an item into a new raw material for use in a new product. Most materials are recyclable in theory. To be recyclable in practice requires infrastructure (collecting and sorting), recycling technology and market demand for the recycled materials.
Sustainable	Since there is no exact definition of sustainable, claims such as "100% sustainable materials" are very vague.
Circular	Since there is no exact definition of circular, claims such as "100% circular" or "fully circular" are very vague. A circular business model is not the same as a sustainable business model.
Compostable/ Biodegradable	Most biodegradable materials are intended for industrial composting processes. Materials are biodegradable to different extents: from small pieces to molecular structures. To be biodegradable/compostable in practice requires infrastructure. This claim therefore suffers from a lack of applicability in many value chains. Moreover, decomposition of a material after the first cycle does not result in a high-value material in the long term. The biodegradable properties of a material are only a sustainable solution in highly specific and selective circumstances.

Critical questions for investors

The following set of questions aims to help investors assess a current or potential investment and its contribution to achieving a sustainable market in recycled materials and a reduction in the consumption of virgin materials. The questions are categorised for which type of company and which investment process that are most relevant. This categorisation is an indication and should be seen as an additional support function.

1. How does the company contribute to resource-efficient use of materials?

Reduced demand

To what extent does the company contribute to a reduced demand for virgin materials, in the short and the long term?

Strategy

What are the company's plans and strategy for contributing to resource-efficient use of materials?

- Does the company have targets and Key Performance Indicators (KPIs) for this?
- What are the major challenges to achieving the targets?

Life-cycle

What does the life cycle of the materials being used look like?

- How does the company contribute to maintaining the value of the material over an extended period?
- What is the "next" coming use of the materials in the product? Is it possible to reuse or recycle the products and materials once the product reaches its end of life?
- Does the company have a strategy and process plan for producing products and materials that are attractive to recycle and reuse in their next and future applications? In other words, is production dependent on the use of additives and heterogenous materials that are complicated to recycle in the next cycle?
- Does the company have a strategy for sharing materials and process data to enhance market interest in using the material in the next cycle?

Raw material

Which *raw materials* (virgin or recycled) is the company dependent on?

- Does the company know about its current materials consumption and needs? Does it have a materials plan to complement its waste plan?
- What are the main economic and sustainability risks in its raw material flows?
- To what extent is the company in control of their use of materials? Are its value chains local or global?
- Which materials are central for the company? What are the effects in terms of greenhouse gas emissions and the impact on biodiversity of using these materials?
- Has the company considered alternative materials that may be better from a resource-efficiency perspective?

Recycled material

What proportion of the materials used in the company originate from *recycled materials*?

- What is the share of recycled materials in the products/product offering?
- What is the share of recycled materials in other parts of the production process?
- Has the company evaluated the possibilities of increasing the volume of functional materials recycling,[7] i.e. where any unique properties of a material and its full potential are reused in the product.
- Has the company set targets for increasing the proportion of recycled materials in its products/product offering?

2. What is the company's net contribution to resource-efficient materials use and a sustainability transition?

Solution

Does the product replace an existing solution; if so, does this contribute to a reduced demand for virgin materials?

Lifetime

For producing companies: What is the expected lifetime and use of the product?

- Is the product designed for reuse in the next cycle?
- Can the product be repaired?
- Has the product been designed using adaptive design to simplify upgrades and facilitate a longer life?

GHG

What level of greenhouse gas *emissions* will the company generate when materials are recycled to next use (materials recycling, molecular recycling or energy recovery)?

3. What is the company's position or role in the wider business system?

Value chain

How does the business ecosystem and its value chain look like in relation to materials? What can the company control?

Dependence

Does the company depend on a certain technology, infrastructure or logistics solution in relation to materials? Which parts of current processes need to change if the company is to increase the use of recycled materials?

Transformation

How is the company working to change and transform its sector or value chain to achieve a more sustainable use of materials in the short term and the long term?

7 See the examples of functional materials recycling in section 1.2.

Key concepts and definitions

TABLE 1: Key concepts and definitions related to recycled materials

Concept	Definition	Comment
Recycled material/ resource	A material/resource that has already been used in manufacturing and is to be used again.	The synonym secondary material/ resource is frequently used, especially in EU documents.
Virgin material/ resource	A previously unused material/resource extracted and used for the first time.	The synonym primary material/ resource is frequently used, especially in EU documents.
Biodegradable material	A material that can be decomposed by bacteria or other natural organisms in a composting or digestion facility.	Material degradation controlled by either a biological or a thermal process is a method that aims to decompose the original quality of the material. Such processes are controversial from a sustainability point of view as the material is not reused or recycled.
Raw material	An unprocessed material that is used to produce goods, products, energy or intermediate materials that are feedstock for future finished products.	Raw material can be both virgin and recycled material
Functional material recycling	When the full function of a material is retained and reused.	Functional recycling is desirable from a sustainability point of view since it often offers a higher material value and less material destruction than current recycling processes, which are designed for bulk recycling.
Bulk Recycling	A recycling process designed to operate large heterogenous material flows.	The focus in on scale and speed, which can result in losses of scarce resources.
Resource efficiency	Resource efficiency refers to a maximising of the supply of money, materials, staff and other assets that can be drawn on by a person or organisation in order to function effectively with minimum wasted (natural) resource expense. It means using the Earth's limited resources in a sustainable manner while minimising environmental impact.	To be sustainable it is very important that resource efficiency results in the extraction of smaller amounts of virgin resources.

Concept	Definition	Comment
Circular economy	An economic system that seeks the continual use of resources in a closed-loop system, thereby minimising the use of resource inputs and the creation of waste, pollution and CO_2 emissions. All "waste" should become raw materials for other processes, as either a by-product or recovered resource for another industrial process, or regenerative resources for nature (compost). This regenerative approach contrasts with the traditional linear economy, which has a "take, make, dispose" model of production.	Over 100 different definitions have been published in various journals. A concept with multiple definitions can make the purpose unclear. The overall objective of a circular economy is to meet more societal needs using smaller amounts of natural resources.
Planetary boundaries	A scientific framework of nine processes, or "boundaries", that regulate the stability and resilience of the Earth. Crossing these boundaries increases the risk of generating large-scale, abrupt and irreversible environmental changes. Only by staying within the boundaries will there be a safe operating space for humanity.	Research shows that four of the nine processes are currently beyond their limits.
Overshoot day	The date on which humanity exhausts nature's budget for the year. For the rest of the year, we are maintaining our ecological deficit by drawing down local resource stocks and accumulating carbon dioxide in the atmosphere.	In 2020, Earth Overshoot Day fell on 22 August globally. In Sweden it fell on 2 April, placing it 16th in the world rankings.
Greenhouse gas emissions	The emission into the Earth's atmosphere of any of the various gases that contribute to the greenhouse effect.	Carbon dioxide, methane and water vapour are the most important greenhouse gases.
Resilience	The capacity to deal with change and continue to develop.	**Ecosystem resilience** is a measure of how much disturbance (such as storms, fires or pollution) an ecosystem can handle without shifting into a qualitatively different state. It is the capacity of a system to both withstand shocks and surprises, and rebuild itself if damaged. **Social resilience** is the ability of human communities to withstand and recover from stresses, such as environmental change or social, economic or political upheaval. Resilience in societies and their life-supporting ecosystems is crucial to maintaining options for future human development.
Climate change mitigation	Interventions to reduce emission sources or enhance the sinks of greenhouse gases.	
Science-based targets	Science-based targets provide companies with a pathway for by how much and how quickly they need to reduce their GHG emissions to meet the goals of the Paris Agreement and limit global warming to well below 2°C above pre-industrial levels and pursue efforts to limit warming to 1.5°C.	The Science Based Targets initiative is a partnership between the CDP, UN Global Compact, the WRI and WWF.
ESG	Environmental, Social and Governance (ESG) is a term used for environmentally and socially sustainable and responsible investments that aim to contribute to sustainable development.	Many mutual funds, brokerage firms, and robo-advisors now offer products that employ ESG criteria.

1 Why recycled materials are an investor issue

Our world economy is only 8.6% circular.[8] Despite the ever-increasing amount of information on the tremendous risks associated with an unsustainable appetite for resources, we are still heading in the wrong direction. The global annual use of materials has almost tripled since 1970, materials throughput reached 100 billion tonnes for the first time ever in 2019 and the recycling rate of resources has gone into reverse. An urgent transition is now required to a new economic system where products and services are based on resource-efficient solutions that use significantly lower amounts of virgin materials.

About half of the EU's total greenhouse gas (GHG) emissions and the over 90% of biodiversity loss come from the extraction and processing of virgin materials.[9] The use of recycled materials is therefore both a promising solution and an interesting market opportunity.

This is an investor issue as the use of materials is directly related to company profits and losses in both the short and the long term, and hence to the creation and destruction of financial value. That said, the investor who takes a bet on the economy moving in a more sustainable direction over time will need to understand the risks and opportunities associated with current and future materials-related processes.

The scale of the problem: fast facts

- 100 billion tonnes of materials throughput globally in 2019, a threefold increase since 1970.
- 60% of materials lost after first use.
- 5% of the material throughput in the world is recycled.
- 70% of GHG emissions are caused by inefficient use of materials .
- 90% of biodiversity loss and water stress related to extraction of materials.
- >200 % increase in resource demand for industry by 2050 if business as usual continues .
- US$700 billion would be saved annually if efficient use of materials was applied globally.
- 50% reduction in GHG needed by 2030 at the latest, a further 50% by 2040, and a further 50% by 2050 to achieve the Paris Agreement goals.

8 Circular Economy (2020)

9 Ellen MacArthur Foundation (2019)

1.1 Shortages of virgin materials make recycled materials a cost-effective solution

Our excessive global resource consumption is steadily increasing every year and poses a serious threat to the ecosystem and the intention to create a sustainable society. In Sweden alone, resource consumption has tripled in the past 50 years. A shift to reduced resource consumption trends will not happen solely by introducing circular business models. We need a paradigm shift in how we take, make and dispose of virgin materials. We also need to learn how to meet more societal needs with fewer virgin resources.

An additional complexity is the increasing population, which is expected to reach 10 billion people by 2050, as well as the increasing social needs of the existing population. Global materials consumption since 1900 and estimates of future materials consumption are presented in Figure 1. The global use of materials increased by a factor 3.5 between 1970 and 2020.[10] Since the 1970s, the global population had doubled and global GDP has grown fourfold.[11] In recent decades, humanity has been in ecological overshoot as annual demand for resources has exceeded what the Earth can regenerate each year. Globally, humanity currently uses the equivalent of 1.6 Earths to provide the resources that society demands. The Swedish lifestyle requires resources equal to four Earths.[12]

The materials gap

In order to stay within the nine planetary boundaries we need a resource decoupling. This will mean reducing the rate of consumption of virgin resources per unit of economic activity. Global materials consumption and our materials footprint are increasing at a faster rate than either the population or economic output. In other words, at a global level, there has been no decoupling of materials footprint growth from either population growth or gross domestic product (GDP) growth. It is now urgent to reverse this trend.[13] Resource decoupling would lead to increased resource efficiency, meaning less use of virgin materials, energy, water and land resources to fulfil societal needs and achieve the same economic output.

To bring the economy and society within planetary boundaries, global materials consumption will need to be reduced to half the amount consumed in 2019, equivalent to a reduction of 50–60 billion tonnes.[14] However, if we continue with business as usual, global demand for resources is predicted to increase by two- to fourfold by 2050 (see Figure 1).[15] ***The gap between societal "needs" under business as usual and the resources available provides a market for recycled materials.***

Another important aspect of virgin materials shortages is the material intensity of low-carbon technologies: any potential shortages of mineral supplies could affect the speed and scale at which certain technologies can be deployed globally. Access to critical metals and minerals is crucial to the success of many of the international sustainability strategies, such as the EU Green Deal.[16]

It has been calculated that 70% of the GHG emissions in the EU are linked to the inefficient use of materials.[17] ***At the same***

10 Circular Economy (2020)

11 B. Oberle et.al., UNEP International Resource Panel (2019)

12 Global Footprint Network. Advancing the Science of Sustainability

13 M. Fischer-Kowalski et al., International Resource Panel (2011); B. Oberle et al., UNEP International Resource Panel (2019)

14 100 billion tonnes is equal to the capacity of 1.6 Earths, thus 1 Earth equals about 60 billion tonnes. M. Fischer-Kowalski et al., International Resource Panel (2011)

15 Ellen MacArthur Foundation (2019)

16 K. Hund, World Bank (2020)

17 Ellen MacArthur Foundation (2019)

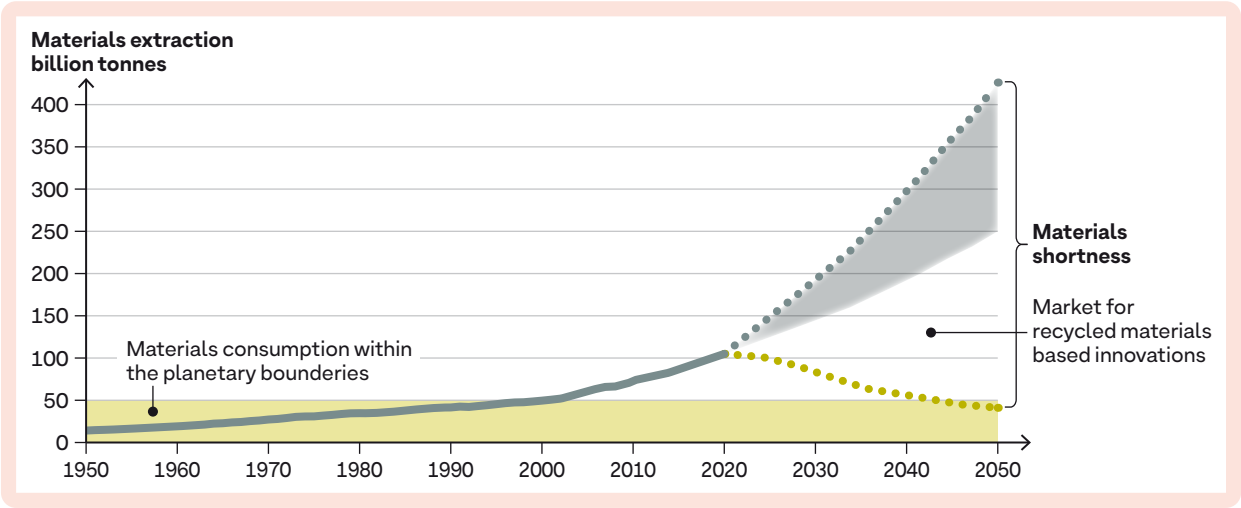


FIGURE 1: Global materials consumption since 1950 and estimated future consumption. The green area shows the consumption limit for virgin materials in order to stay within the planetary boundaries. The grey area shows estimated materials consumption based on different scenarios in the academic literature. If we continue with business as usual there will be a major shortage of virgin materials in the future. One important solution would be to use recycled materials to meet societal needs.

time, almost half of all GHG emissions in the EU and more than 90% of its biodiversity loss and water stress are linked to the extraction and processing of materials.[18]

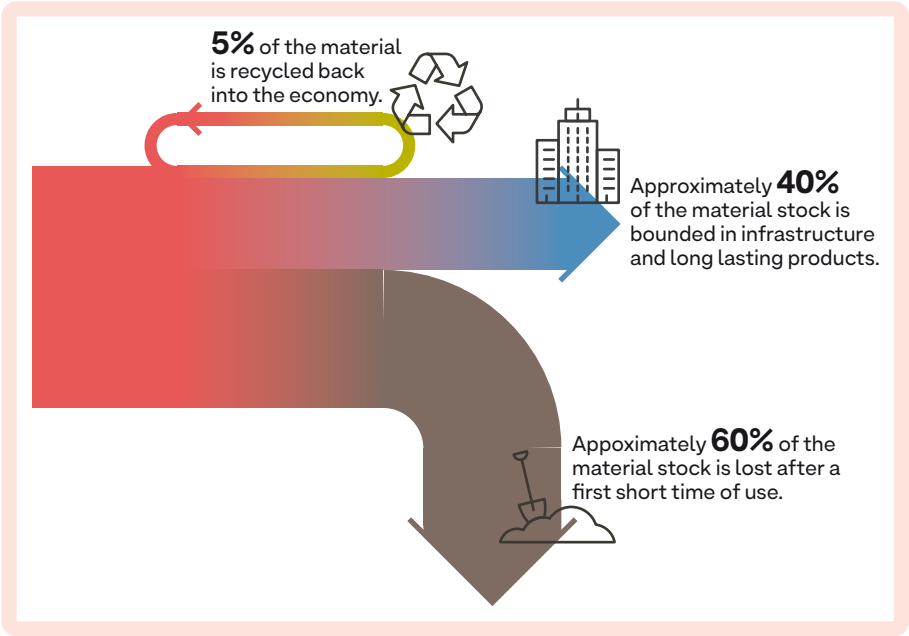
The inefficient and short-term use of materials also leads to huge economic losses. Annual losses due to the inefficient use of steel, plastics and aluminium in Sweden alone are estimated at more than USD 3 billion.[19] Globally, annual savings of at least USD 700 billion could be made by using materials for a longer period of time.[20] Additional research shows that the creation of a circular economy represents a USD 4.5 trillion economic opportunity by avoiding waste while also creating business growth and employment opportunities.[21] ***To achieve the goals set out in the Paris Agreement, GHG emissions will need to be reduced by 50% by 2030, a further 50% by 2040 and a further 50% by 2050.***[22] It is self-evident that the efficient reuse of materials and efficient recycling technologies are prerequisites for a sustainable circular economy.

Untapped market possibilities with recycled materials

Globally, only around 5% of the 100 billion tonnes of materials currently consumed annually is recycled. This recycling is mainly carried out using inefficient processes that generate low quality materials of little value.[23] ***Around 60% of the materials consumed are short-lived products that are consumed and lost in the first life cycle – dispersed in the form either of emissions or of non-recyclable waste*** (see Figure 2). ***The polar opposite of a sustainable circular economy.***

18 Ellen MacArthur Foundation (2019)
19 Material Economics (2018)
20 Ellen MacArthur Foundation (2019)
21 D. McGinty (2020) World Resources Institute (2020)
22 J. Falk et al., Exponential roadmap (2020)
23 Circular Economy (2020)

FIGURE 2: The majority of the global throughput of materials is lost after a short first use, while only 5% of materials are recycled back into the system, mainly as low quality items.[24]



The main reason why materials are dispersed, landfilled or incinerated prematurely in their life cycle is the lack of efficient logistical solutions and processes that would enable an extended life cycle for the materials.

The material-wheel model (see Figure 3) demonstrates the different possible stages in a material's life cycle in a circular economy. The material-wheel connects the design, use, reuse and recycling of a product by focusing on how materials are used. It rewards high material value by keeping materials in use and retaining the energy and value of the material over time. There is no given hierarchy between the solutions: sustainability, both in the first use and for subsequent uses in the life cycle, is defined by how long the material is in use. By using the material-wheel, the possibilities for increasing the resource efficiency of a process and system can be evaluated and the need for innovations to enhance material value become clear.

The lack of efficient processes for component, molecular and functional material recycling (sections 3–5 in Figure 3) is the main reason why 60% of all materials are lost after their first use (Figure 2).[25] To support the transition to resource-efficient circular material use, an energy recovery process is needed to keep the circular material flow clean from materials that are not sustainable to reuse or recycle.

To achieve an economy that remains within the planetary boundaries, all extracted materials will need to be used over a long period. All decomposition processes, even composting, cause a loss of resources and are therefore questionable from a resource-efficiency point of view. If half of all annual material losses (30 billion tonnes) were to be recycled, the extraction of virgin materials could be cut by 25%. Thus it would have a significant impact.

Material efficiency has been shown to be the most significant, fastest and least costly single measure to enable industry to reduce its GHG emissions.[26] Increased material efficiency and the use of recycled materials in production processes have the potential to achieve a reduction of GHG emissions equivalent to the entire emissions of the global transportation sector.[27]

24 Circular Economy (2020)

25 Circular Economy (2020)

26 J. Falk et al., Exponential roadmap (2020)

27 Material Economics (2019)

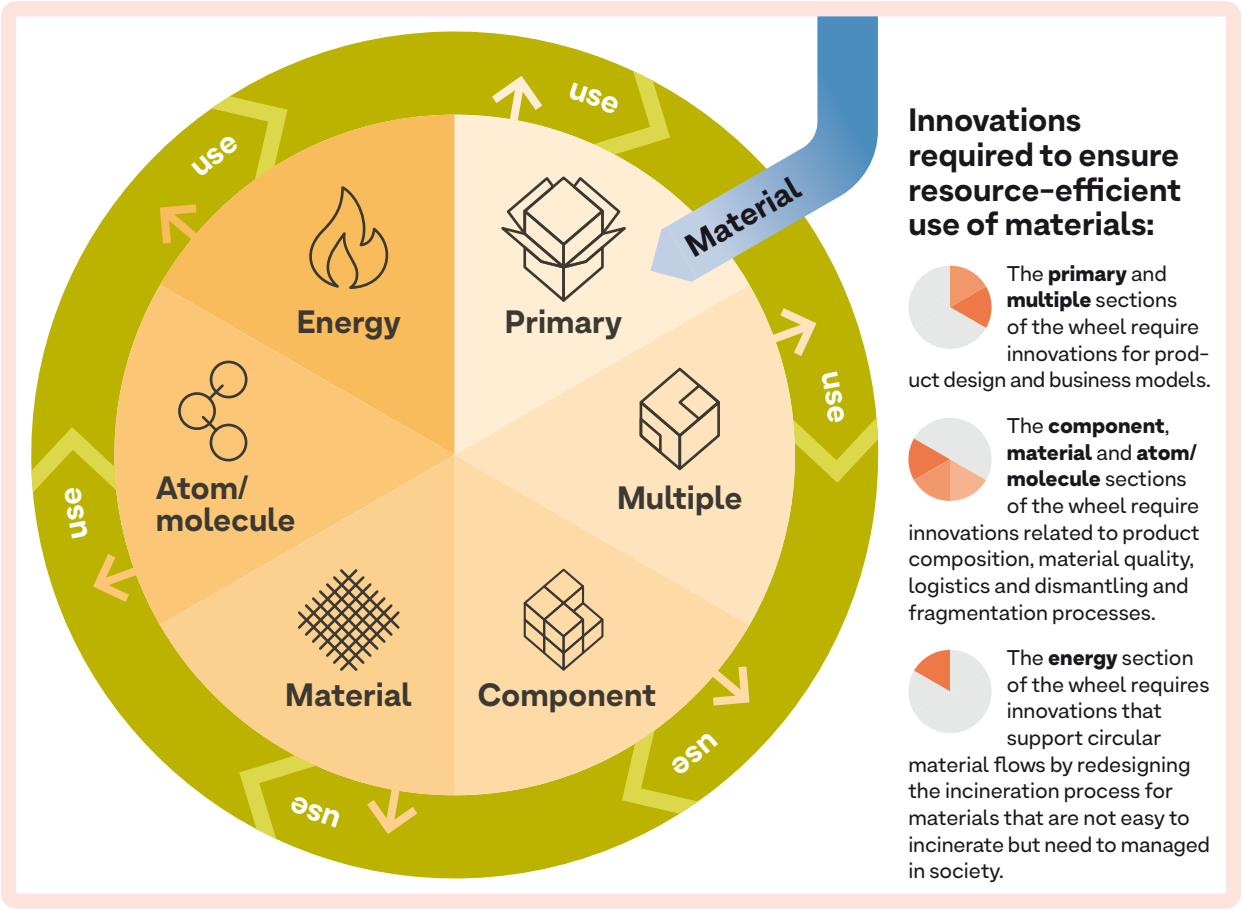


FIGURE 3: The material-wheel model combines product design, use, reuse and recycling. It focuses on the use of materials and rewards high material value by keeping materials in use and retaining the energy and value in the material for an extended period. An animation on the material wheel can be found *here*.

Call for a paradigm shift

- Disruptive changes with exponential effects are needed to transform society to bring it back within the planetary boundaries.
- It is clear that the pathway to a low-carbon future is via slow and prudent use of materials.
- The consumption of virgin materials must be halved, back to the levels of materials consumption in the 1980s.
- A sustainable economy will need to meet social needs by using less virgin materials. Doing "more with less" requires innovation and financial support.
- Increasing the remarkably low use of recycled materials is a cost-effective way to significantly reduce negative climate effects and losses of biodiversity.

1.2 Risk assessment for a resource-efficient use of materials

The increased circulation of materials can replace much of the environmentally stressful extraction of virgin materials but potentially involves other risks.

Risks associated with circular material flows

Recycled materials contain unpredictable levels of contaminants compared to a virgin material. In Sweden, for example, there is a lack of policy instruments aiming

for circularity and recycled materials generally undergo a much more thorough risk assessment than virgin materials.[28] This runs counter to the efficient use of recycled materials and complicates circular risk assessment.

The risks of depending solely on virgin materials are related to resource scarcity, mining, processing, and the destruction of the pre-used material instead of reuse or recycling. ***It is highly important that any potential risks of using recycled materials are evaluated in relation to the application to which the material will be applied.***[29] In assessing company risks, it is important that the investor understands the business and processes, and does not just depend on company data and indicators.[30]

It is also important to understand the potential financial risks of resource-inefficiency and of adapting too slowly to circular materials flows, especially in a society that is aiming for a circular, resource-efficient, economy.

Risks associated with materials-intensive sectors

Businesses that depend on large amounts of virgin materials carry a higher economic risk in the long run. Every year we see the intensifying effects of climate change, such as more intense and more frequent fires, floods, hurricanes and landslides, as well as increased problems related to pollination. These are just some of the reasons why virgin materials will become more scarce and harder to harvest. Both material-intensive sectors and sectors dependent on scarce materials are critical to the transition to a greater use of recycled materials.

Construction and agriculture are the most material-intensive sectors, and together responsible for over 60% of our materials consumption. The largest emissions in the value chain come from cement and steel production, as well as the work of the machines and vehicles needed in the construction sector.[31] Other material-intensive production groups are fast-moving consumer goods and electronics, due to the products' short life cycles and the high content of critical material. This is a diverse and complex group of products, from refrigerators to clothing, cleaning agents, personal care products, non-durable household goods, mobile phones, batteries, games consoles, earphones and digital disposable cameras.

Circularity needs to be achieved in the entire value chain of the products we use. Some materials, however, are especially important to consider due to their properties such as a scarcity, highly negative climate and biodiversity impact, large materials flows or large value losses. Chief among such materials are polymers and plastics, concrete, aluminium, steel, textiles, composites, and all the critical metals and minerals important for renewable energy systems.

1.3 Transformation from value chain to value circle

Three economic models – *linear*, *reuse* or *circular* economy – are often used to describe a society's production and consumption processes (Figure 4). The world economy has long been run in a *linear* form, based on take-make-dispose management. This system of linear production and linear waste handling creates a sub-optimised value chain in which actors rarely have responsibilities or strategies for activities that take place before or after their participation in the process. A lean and efficient linear process does not equal a sustainable resource-efficient process. Although the linear system may be efficient in the short term, it requires infinite access to all incoming resources in the long term.

28 N. Johansson and H. Corvellec (2018); N. Johansson and C. Forsgren (2020)

29 Gehandler J (2020)

30 D. Pamlin (2019); ING Economics Department (2015)

31 Fossilfritt Sverige (2018)

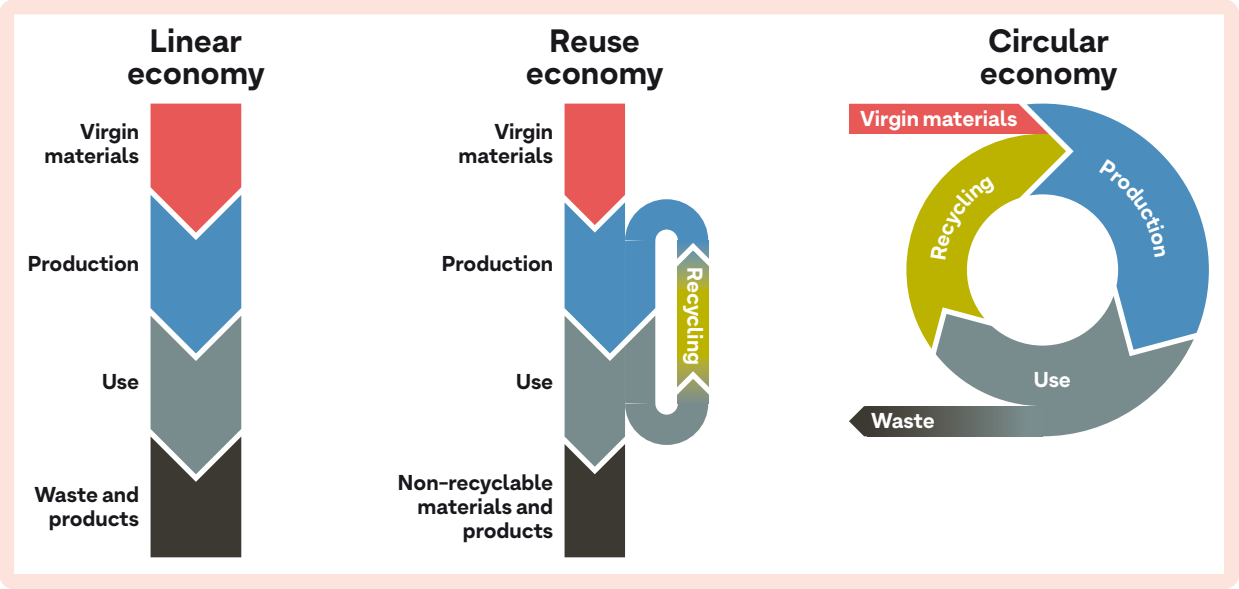


FIGURE 4: Similarities and differences between the linear value chain, the reuse value chain and a value circle that supports a circular economy.

Various recycling measures have been put in place in most developed economies, such as separate waste collection and recycling targets. This gives the impression that the economy is built on *reuse economy* principles and that we have left the unsustainable *linear* economy behind. Unfortunately, this is not the case. ***The suboptimal linear value chain system is one of the reasons why the use of recycled materials is still so low.***[32]

The transition from a value chain to a value circle designed for circular materials flows will require a system change and an open mind as the roles and responsibilities of actors will need to change.

Prerequisites for a transition to a circular economy

While there are many reasons for the dysfunctional use of materials, they are all based on one major reason – the remarkably low economic value of materials in our economy.

As the use of materials has steadily increased, the price of most resources have continuously declined. These declining prices do not reflect an increased supply, but are the result of a market price that bears no relation to the price of sustainable extraction.

Research by Mistra Closing the Loop has concluded that many important barriers to increasing the use of recycled materials exist at the overarching system level, and that material-specific barriers are generally of less importance to the transition.[33]

Recycled materials currently need to adapt to a system defined by the properties of virgin materials. Recycled materials are therefore often classified as "second best", which partly explains the current low level of use of recycled materials. One important step would therefore be to facilitate equivalent market conditions for circular approaches and the current linear system.

Mistra Closing the Loop concluded that an important actor in facilitating circular material flows is a so-called **materials broker,** who provides the market with knowledge and acts as matchmaker between recycled materials and indus-

32 Circular Economy (2020)

33 F. Norefjäll, E. Talalasova and H. Tekie (2020)

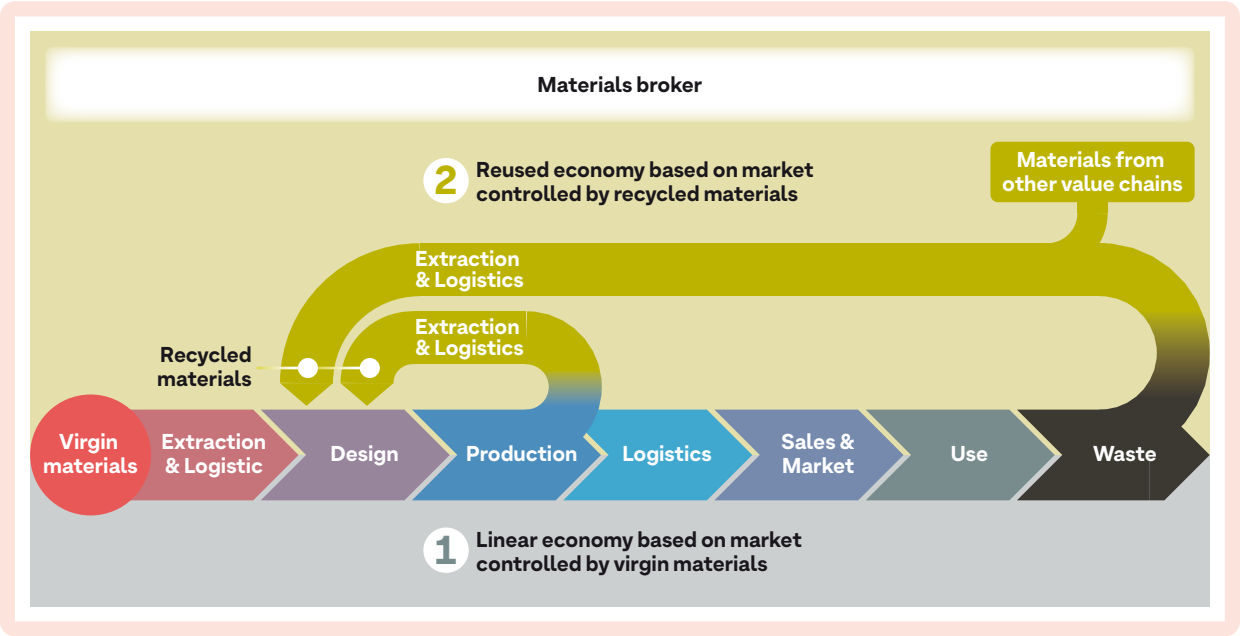


FIGURE 5: The current linear value chain (**1**) needs to be updated with extraction processes, logistics and supply chains tailored to the needs of recycled materials (**2**), according to the reused economy. The materials broker is a key actor in facilitating the market for recycled materials.

try needs.[34] Materials brokers already exist but are still rare. To develop a circular economy adapted for reuse and recycling, the materials broker role will need to be a natural part of the system and to increase in both number and quality. This market gap can be filled by new services from the recycling industry and/or by new actors. Figure 5 illustrates the value chain in a market controlled by virgin materials as well as the additional functions, extraction processes, logistics and supply chain that would need to be added to the value chain in order to establish an attractive market for recycled material. Materials brokers are likely to have a key role in facilitating a market controlled by recycled materials.

In addition to the materials broker, the following are prerequisites for establishing equivalent market conditions for recycled materials:

- Clarify regulations regarding waste to increase companies' willingness to invest in processes for recycling materials and thus increase the availability of recycled materials on the market.
- The application of new design and business models in which the unique properties of recycled materials have a positive value.
- Enable and simplify the use of recycled materials by redesigning production process criteria to align them with the unique properties of recycled materials.
- Facilitate and encourage collaboration and the exchange of information throughout the value chain.
- Design political instruments and risk assessments for efficient materials circulation as a complement to the waste and emissions control policies already in place.[35,36]

34 L. Smuk and E. Blomqvist (2020)

35 N. Johansson and H. Corvellec (2018)

36 N. Johansson and C. Forsgren (2020)

It is important to note, however, that the transformation to a circular flow of materials flow will need to be driven by the manufacturing industries and municipalities, not exclusively by the recycling industry and materials brokers.

The challenge of the different market availability of recycled materials compared to virgin materials could also be used as a market advantage. Stock of materials derived from recycled materials would often be local and thus controlled by the country or local community, possibly even allowing self-sufficiency in some resources where this was not previously possible.

To achieve resource-efficient use of materials we need to rethink and revalue

The current unsustainable use of materials has one major cause: the remarkably **low value placed on materials** in our economy.

To transform to resource-efficient production, **recycled materials need to be the first choice** and option for the industry; anything else cannot be counted as resource-efficient or in line with international agreements.

Recycled materials need to be classified as a **unique resource with highly valued properties**.

The **property of a material needs to be reused** as much as possible. Attempts to make recycled materials "equal" to virgin materials are often associated with large energy and economic losses.

Benefits linked to business resilience can be derived from the fact that **stocks of recycled materials will be local** and thus controlled by the country/ community.

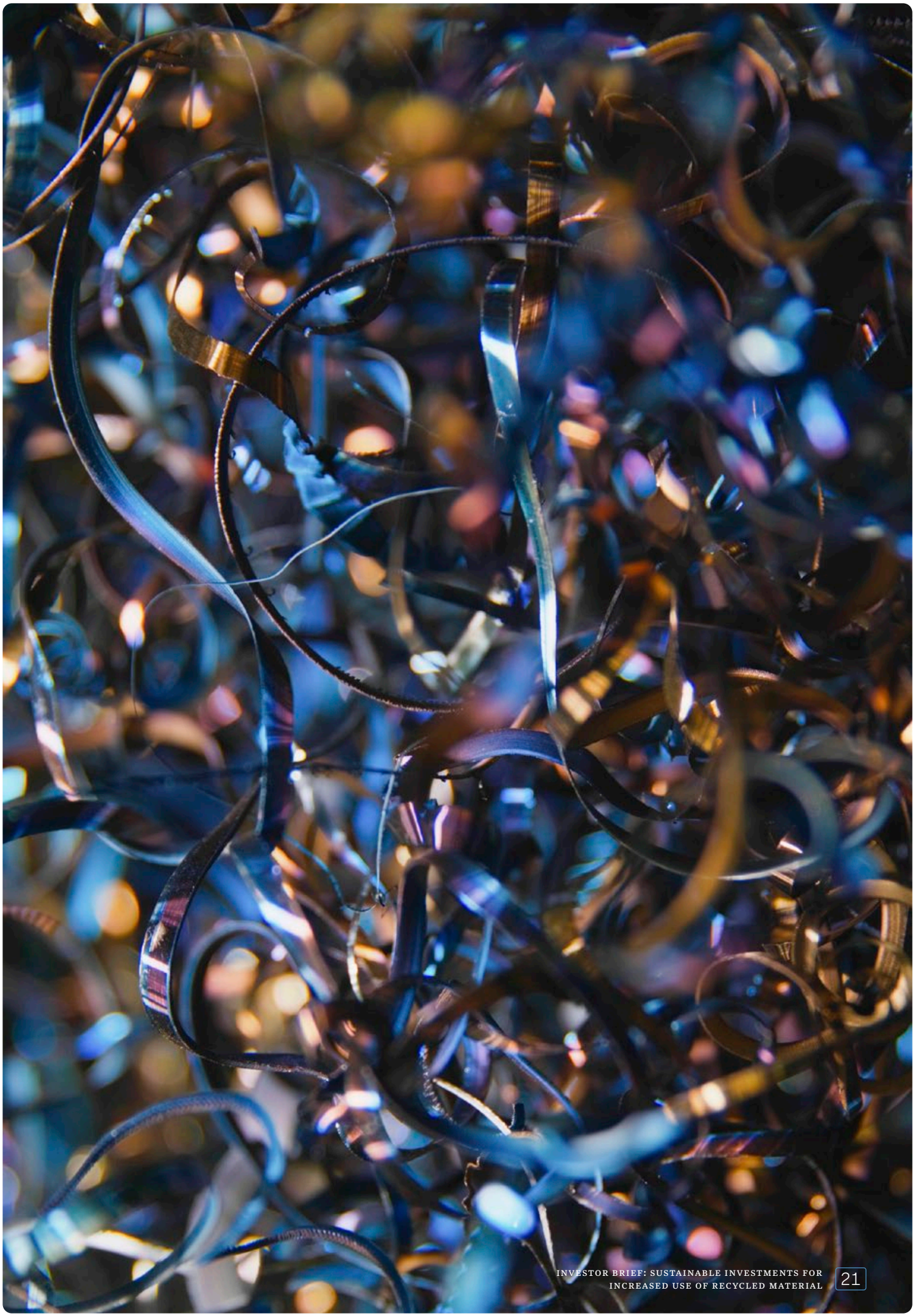
Examples of recycled materials as a key resource

Some industries are ahead of others when it comes to using recycled materials in production processes. These can be used as role models and for knowledge transfer regarding the changes in responsibilities and roles in a reuse or circular economy. Natural market interest means that the value chain for materials with a high value on the market is generally better prepared for a reuse or circular economy. One example is steel production, where the use of recycled materials is well established and constitutes one-third of total production. The market for scrap steel is international and well developed, and there are a number of well-defined standards and products. The use of recycled scrap is growing as the global steel production increases. In addition to natural market pull factors, *Skrotboken*[37] is an important tool for enabling increased use of scrap in Swedish smelters. It helps to classify different scrap, to clarify delivery provisions and to secure the use of recycled scrap material in steel, stainless steel and cast-iron smelters.

Research by Mistra Closing the Loop has shown that there are opportunities for wider use of recycled materials in many industries, such as battery recycling and in the automotive and construction industries. This research has also identified opportunities for greater use of by-products from paper mills, mining, and steel and aluminium smelters.[38]

37 Skrotboken contains the Swedish steel and scrap industries' product specifications for non-alloy scrap steel and, since 2020, product specifications for stainless steel scrap. *More information*

38 L. Smuk and E. Blomqvist (2020)



Selected examples from Mistra Closing the Loop where recycled materials have been used in different processes and applications

- A process concept for the co-recovery of zinc and manganese from alkaline batteries (Project *EBaR*)
- A waste stream, Green Liquor Dregs from the Swedish pulp and paper industry, can replace virgin material as a stabilizer for mining waste on landfills (Project *GLAD*)
- A process for the separate collection of bumper skins from repair workshops and dismantlers (Project *EXPLORE*)
- Plastics and concrete in construction and demolition waste can be recycled and used in the production of new building components (Project *Constructivate*)
- Salt slag from the aluminum recycling industry can be recycled and used as slag by the steel industry (Project *QuickFlux*)
- By-products from the steel industry can partly replace the limestone, marlstone and sand used in traditional cement production (Project *Slag 2 Cement*)

Key conclusions of Mistra Closing the Loop on increasing the use of recycled materials in manufacturing

- **Recycled materials are a unique resource.**
  A recycled material will never be the equivalent of a virgin material. The unique properties of recycled materials must be identified, valued and turned to their advantage.
- **Reduce business appetite for virgin materials.**
  Follow-up on KPIs to cut material consumption significantly. Materials, by-products and even emissions are possible products and profit makers. Demand material plans instead of waste plans.
- **Take responsibility for clean and homogenous materials flows.**
  A clean and homogenous flow is easier to profit from. Producers must address the issue of low- or non-recyclable material flows.
- **Share data to achieve reliable material recycling loops.**
  Increased information sharing (on materials and process data) is crucial to creating sensible recycling solutions and an increased use of recycled materials. The opportunities offered by digitalisation and artificial intelligence should be exploited for transparent and reliable data.

The number of products based on recycled materials is increasing every year but this remains a niche segment. We need to shift from niche products to established, scaled-up, mainstream practice. Examples of commercial products that are made from more than 50% recycled materials are given below.[39]

Products based on polymer structures:

- **Tarkett** has invented a production process that can use both production rejects and used plastic flooring in the production of new flooring materials. The new technology means that used plastic floors can be cleaned of glue and putty residue and restored to raw materials of the same quality as plastics made directly from virgin material.

39 These should be seen as inspiring products or what is already being done today, not as any form of endorsement of the brands themselves.

- **Electrolux** uses recycled plastic and recycled steel in several product lines and is continuously working to increase the quantities of recycled materials; 75% of the materials. in one of its products, a vacuum cleaner, are recycled materials.
- **POLYPLANK**® is a composite of recycled thermoplastics (e.g. packaging plastic) and organic fibres (e.g. cutting chips from the local wood industry). The materials in the product can be recycled several times.
- **Svenska Retursystem** and **Sveriges Bryggerier** are launching a pallet made 100% of recycled plastic in 2020. The pallet will last for at least 15 years and the material can then be recycled in additional loops.
- **Cable drums** are made of 100% recycled cable plastic and polyethylene plastic (PEX).
- **ECOPLY** is a board made of 100% recycled polyethylene and polypropylene. The material is lightweight and has very high impact resistance, which makes it an excellent alternative to MDF and plywood.
- **GOP WOODLON** is a composite board made up 95% of materials recycled from wood fibre and polyethylene.
- The **Orthex group** produces a bucket, a pot and a storage box made 100% of recycled polymers.
- Some **Lenovo** *ThinkVision* products contain more than 50% post-consumer recycling plastics and more than 20 of its products contain some degree of recycled material.
- **Audi** has car upholstery and car mats where up to 89% of the material consists of recycled PolyEthylene Terephthalate (PET) bottles. In total, a little over 100 1.5-litre PET bottles are needed for one seat and one rug. The next step will be to replace the remaining 11% with recycled polyester so that the entire product is a homogeneous material able to be recycled in additional loops.
- The **IKEA** chair *ODGER* and kitchen door *KUNGSBACKA* are made of recycled wood and PET bottles and more than 90% of the curtain *HILJA* is made of recycled polyester.
- **Stadium's** collection *ReRun* is made up 95% of recycled polyester from PET bottles.
- The **Fjällräven** backpack *Re-Kånken* is made from 11 recycled plastic bottles.

Products based on textiles using recycled fibres:

- The first **Houdini** product made from recycled and recyclable fibres went on the market in 2007. Today, a majority of its products are designed to be circular and recycling processes and techniques for new materials are constantly in development.
- **HNST jeans** and **Fabric2fashion** are two examples of businesses using recycled jeans fabric. HNST jeans collects worn-out jeans and processes the material into recycled yarn that is used to weave new jeans fabric. The new pair of jeans consists of 50% recycled material, which is the highest current possible percentage from a technical point of view due to the low quantities of recycled yarn. HNST has set a new standard in the textile industry for maximising the use of existing jeans material.
- Denim is also recycled by **Fabric2fashion** into insulation materials for use in homes, offices and hotels. These insulation materials are made 85% of factory scraps of cotton fibres and natural denim. The insulation material is designed to enable a second recycling loop. It provides outstanding insulating properties and 30% better sound absorption compared to similar sound-proofing materials.

- **Lindex** collection *Re:Design* is made from 100% recycled denim clothing from previous collections. A great example of functional material recycling; a new collection is entirely based on recycled material.
  Other materials:
- **StolAB** is a further example of functional materials recycling in which the unique properties of a discarded material are used to advantage. The product *Lilla Snåland* is made of leftover pieces from the production of another wooden chair. *Lilla Snåland* is an upcycling pallet design based on the idea of using material that would otherwise be incinerated.
- **Fiskeby** is one of Europe's leading manufacturers of packaging boards and depends entirely on recycled cardboard for its production. Their multi-board is a packaging board made of 100% recycled fibre. **STOROpack** is another example of a packaging company using recycled materials.
- **Västerbottensåpa** is made using 100% recycled cooking grease collected from restaurants.

1.4 Opportunities for investors

The financial sector has a great opportunity to accelerate the transition to a resource-efficient use of materials by stimulating the market for recycled materials. This can be done by pushing for **equal market conditions** for recycled materials, addressing important barriers and requirements, and stimulating **market demand for recycled materials.** Both incremental and disruptive change will be needed to stimulate market pull factors. Numerous innovations and new businesses will be needed to create more resource-efficient solutions that extend the life cycles of materials. The transition can be accelerated by investing in businesses with a demand for recycled resources and investing in any of the missing processes highlighted by the material-wheel analysis presented in section 1.1. Examples of interesting innovations are listed below.

Innovation that enable the **unique properties** of recycled materials to become normative. Products and production processes need to be redesigned to fit the specific properties of the recycled material, such as the quality of the material. This type of innovation is defined as disruptive and has the potential to have a large impact on the use of recycled material.

Innovations that optimise a **logistics system** for different market availability, such as when, how and where a recycled material is accessible.

Innovations that enable the **recycling of components.** Current production methods make it difficult for reused components or parts to be an option in many production processes.

Innovations that enable a transition from bulk materials recycling, which generates materials of low quality, to **functional materials recycling**, which preserves the original properties to the greatest possible extent and reuses the material function. Recycling processes need to be designed for specific properties, such as critical substances and materials. Tailored processes for select materials, as opposed to the fragmented methods designed for bulk flow, have a huge potential to produce high quality materials using less energy and with fewer material losses.

Innovations that enable resource-efficient **chemical**, **biological** or **thermal processes** to convert complex or contaminated materials and product flows into valuable materials through molecular recycling.

Innovations that transform the **waste incineration process** into a resource-efficient solution that supports circular material flows and only processes materials that cannot be used elsewhere in society. In other words, an incineration process designed for materials that are not easy to incinerate but need to be managed.

2 The main drivers of increased use of recycled materials

On the 28 November 2019, in an important statement and a signal of increased knowledge and awareness, the European Parliament declared a climate emergency. Since then, discussions within the EU have focused on actions and activities to minimise the negative effects of climate change. On 28 September 2020, political leaders representing 64 states from all regions and the European Union launched a planetary emergency for biodiversity.[40]

Sustainable materials consumption is key to meeting these planetary emergencies.

Planetary emergency is declared by European Parliament and political leaders for climate in 2019 and for biodiversity 2020. This calls for global action.

"We are in a state of planetary emergency: the interdependent crises of biodiversity loss and ecosystem degradation and climate change – driven in large part by unsustainable production and consumption – require urgent and immediate global action". Pledge by Political leaders participating in the United Nations Summit on Biodiversity, September 2020.

2.1 Trends likely to increase the use of recycled materials

A number of initiatives aiming for a sustainable society have been launched in recent years, often driven by influential individuals, environmental organisations, social media or economic imperatives. The upcoming policies, business initiatives, megatrends and other movements that are likely to act as important drivers of the transition to sustainable materials handling in the coming years are described below.

Upcoming policy frameworks

Policy instruments on the use of recycled materials have so far primarily been designed to regulate waste and emission flows. ***Complementary political tools that seek to increase circulation of materials will be required in order to put in place a sustainable value chain and increase the use of recycled materials.***

The importance of materials efficiency received attention in Agenda 2030 and in the EU's Circular Economy Action Plan. The updated EU Circular Economy Action Plan envisages implementation of new policy frameworks and instruments. New instruments to enable a shift to sustainable materials consumption and produc-

40 *https://www.oneplanetnetwork.org/world-leaders-highlight-sustainable-consumption-and-production-pledge-nature*

tion patterns are being intensively discussed, such as quality standards for recycled materials (a recycling plastic standard is expected in 2021–22). Several EU strategies and policies, such as on chemicals, single use plastics, textiles and "Farm to Fork", will soon be finalised. From 1 January 2021, EU member states must pay €800 per tonne on plastic packaging that is not recycled. The new fee will be charged as part of the membership fee from 2021. In Sweden, a mortgage system for mobile phones and other electronic equipment is being investigated and will be launched in April 2021. A schedule on the revision and implementation of a large number of EU instruments is included as Appendix C.

Ongoing implementation of the EU Taxonomy, especially those parts on climate change mitigation and the circular economy, also has great potential to increase the use of recycled materials and to close the materials loop (see section 2.4).

Sustainable business moves

Several societal trends point to a requirement for companies to transition towards sustainability in order to maintain future profitability. The reasons for this include new data requirements, the EU Green Deal strategy and new sustainability initiatives by business communities that are likely to become the new baseline.

- **New data requirements**
  Discussions on materials footprints are an important aspect of the messages in the 17 UN SDGs. To have a credible climate strategy, companies will need to demonstrate an understanding of the importance of doing business within the planetary boundaries. Thus, reliable data and keeping track of consumption footprints are likely to be important in supporting and demonstrating a company's transition to sustainability.

- **The EU Green Deal**
  Europe's new growth strategy, the Green Deal, was launched early in 2020. It contains an action plan on how to transform the EU into a resource-efficient circular economy with zero GHG emissions by 2050 and economic growth decoupled from resource use.

- **Resilient businesses**
  Models, such as integrated capitalism, which takes account not only of shareholders but also of wider society and the environment, have been discussed in the light of the economic stresses caused by the COVID-19 pandemic. Another lesson learned from the pandemic is the importance of a resilient society and industry. The global use of resources has put society in a stressful new situation. Increased services using fewer virgin materials will be key. Industrial symbioses and the use of recycled materials are two examples being discussed.

- **Business community initiatives**
  Initiatives such as the Circular Plastics Alliance, the European Plastics Pact and Circular Sweden are working to accelerate the transition to circular materials and increased recycling rates. Other initiatives comprise common tools and agreements, such as tools for circular housing construction and frameworks for analysing the sustainability risks. The World Economic Forum has concluded that companies will need to find ways in the coming decade to identify and mitigate the material impacts of sustainability risks before they happen. More than 20 industrial sectors have presented roadmaps for transforming Sweden to a fossil-free state by 2045. Increased materials efficiency and use of recycled materials are important activities in many of these roadmaps. One example is the roadmap on the construction and civil engineering sector, which has agreed that rules on waste classification need to be changed to achieve circular business models and increased reuse and recycling of excavated masses, and construction and demolition materials.

Moreover, requirements need to be set for the reuse of materials when it is beneficial from a life cycle perspective, such as in renovation and mass handling.

- **Revision of the EU's non-financial reporting disclosure**
  Disclosure and communication of a company's sustainability-related performance is becoming the new norm. In the EU, the non-financial reporting disclosure (NFRD) is currently being revised to set a new standard for sustainability reporting by European companies and increase the focus on transparency and comparability.

- **Increased market interest in recycled materials**
  Several commercial companies are setting higher targets for recycled materials in their products. IKEA has announced that by 2030, everything it sells will be made of either recycled or renewable materials; Electrolux has increased the amount of recycled plastics in its production to 20,000 tonnes annually and Volvo Car's ambition is that at least 25% of all plastics in its cars will be made from recycled materials by 2025. Goals like this have a positive effect on the market for recycled materials. As a result, the price for recycled plastic was higher than for virgin plastic for the first time in 2019. Important factors are believed to be the large interest from companies in using recycled plastic in their products and public opinion regarding the global issues of plastic littering. These changes have opened up space for the development of new recycling processes, such as chemical and thermochemical processes. However, the historically low price of oil linked to the COVID-19 pandemic has dramatically changed the situation.

Upcoming consumer tools

Another trend in society is to address not just what we consume, but also the way and how much we consume. Consumer information tools, such as ecolabelling and voluntary green public procurement criteria, are examples of current instruments. The updated Circular Economy Monitoring Framework prioritises the development of further indicators on resource use, including consumption, and the EU Ecolabel criteria will include measures on minimum recycled material content. From 2021, suppliers of goods must specify whether a product contains particularly dangerous substances. The European Chemicals Agency (ECHA) has been commissioned to develop the so-called SCIP database, where information on particularly dangerous substances is to be reported.

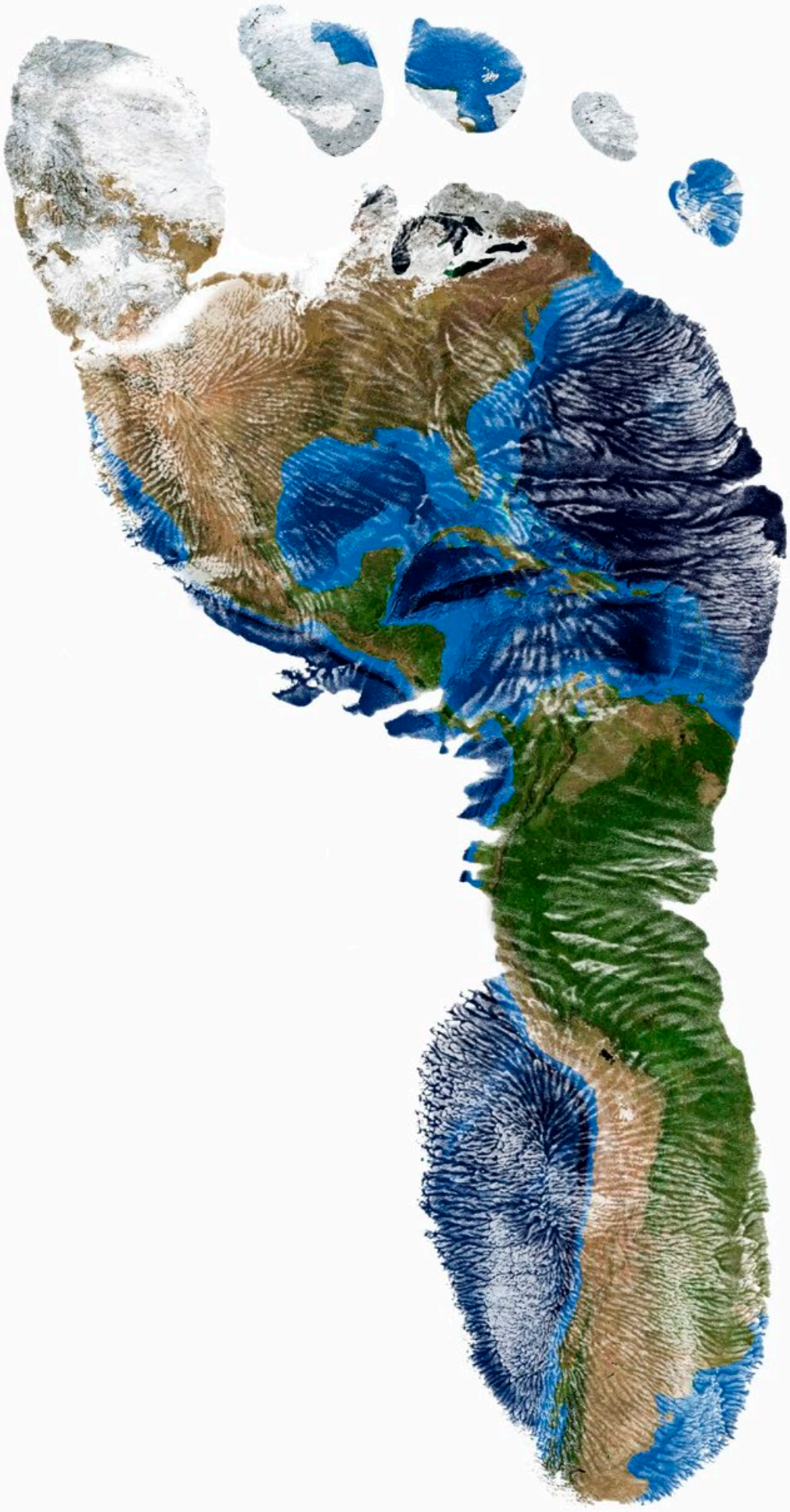
Civil disapproval of environmental problems

Increasing civil disapproval of alarmingly unbalanced ecosystems, littering and pandemics is affecting the use of recycled materials as people become increasingly aware of the effect of consumption on the environment.

- **Civil society initiatives**
  95% of Europeans believe that it is of great importance to protect the environment and to create a socially sustainable society. Civil society will no longer accept unethical resource appetites or unsustainable production and consumption. Organisations such as "Friday for Future" are growing fast and people are changing their consumption patterns. A survey initiated by the Circular Initiative and conducted by Sifo[41] in March 2020 showed that over 90% of Swedes expect manufacturers to use recycled materials in their products, and also expect to pay more for a product made from recycled materials.[42] Furthermore,

41 Sifo is the Swedish actor performing surveys. Sifo is owned by Kantar a data, insights and consulting company.

42 The majority of Swedes want recycled materials in products, see *https://circularinitiative.stenarecycling.com/the-majority-of-swedes-want-recycled-material-in-products/*



the same consumer survey states that consumers expect that industry should lead the transition to a greater use of recycled materials.

- **Unbalanced ecosystems**
  The environment and the condition of the planet are changing and a huge number of natural ecosystems are unbalanced. Climate changes and biodiversity losses are approaching a state where environmental changes become irreversible.

- **Global littering**
  Plastics in the oceans and in other vulnerable environments have reached a level where the negative effects on the environment, natural habitats and human society are obvious.

- **Pandemics**
  The rapid global consumption of resources enhances the effects of a pandemic outbreak on society for two reasons. The global almost instant availability of goods facilitates the spread of epidemics. Pandemics, as is the case with COVID-19, also demonstrate the vulnerability of a globalised society. When borders suddenly close, the availability of globally traded goods ceases and countries without their own reliable supply of food, products, materials, medicine, and so on, suffer. Locally traded and recycled materials strengthen resilience in such cases.

Megatrends

The EU has defined 14 unwanted megatrends as long-term drivers that are observable now and likely to have significant influence in the future unless we manage to change our way of living in time.[43] ***By increasing the use of recycled materials, at least three of these megatrends are likely to have a less damaging impact.***

- **Growing consumption**
  By 2030, the size of the global middle class is expected to reach 5.3 billion people. This will mean an additional 2 billion people at least with increased purchasing power. Most of this growth will be in Asia. By 2030, China and India together will represent 66% of the global middle class population and 59% of middle class consumption. While the expanding middle class could be a driver of economic development, changes in consumer behaviour and consumption patterns are expected to increase demand for food, water and energy by approximately 35%, 40% and 50%, respectively, by 2030.

- **Aggravated resource scarcity**
  Global demand for materials increased ten-fold during the 20th century and is set to double again by 2030 compared to 2010. Demand for water, food, energy, land and minerals will continue to rise substantially, given the increasing purchasing power of a growing population. Bottlenecks in supply could be further aggravated by climate change, making natural resources increasingly scarce and more expensive to source.

- **Climate change and environmental degradation**
  Even if all emissions linked to human activities were suddenly to cease, the climate would continue to change. However, continued unabated, anthropogenic pollution and GHG emissions will further increase global warming, ocean acidification, desertification and changed climate patterns. Aggravated by pollution, overexploitation of natural resources and environmental degradation, this will lead to severe, pervasive and irreversible changes for people, assets, economies and ecosystems around the world.

43 European commission Competence Centre on Foresight
https://ec.europa.eu/knowledge4policy/foresight_en#what

2.2 Current EU and Swedish goals and strategies for a resource-efficient society

There is a scientific consensus that global CO_2 emissions must fall by 50% over the next three decades if the world is to have any chance of keeping global warming below 1.5 degrees. A resource-effective economy is essential to reducing GHG emissions and the EU has agreed on ambitious targets on climate change mitigation, materials use and biodiversity. ***One important transition required to achieve these targets will be to limit the extraction of virgin materials.***

EU level goals by 2030 and 2050

Within 10 years, around 9 billion people will be living on the planet. The following targets are applicable at the EU level for 2030.

- **Climate:** Cut emissions in the EU to at least 40% below 1990 levels.
- **Materials usage:** Sustainable management and efficient use of natural resources. Recycling target for municipal waste of 60%.[44] Significant reduction in the amount of waste through measures to prevent, reduce, reuse and recycle waste material.
- **Biodiversity:** Halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2030.

An extrapolation of the international roadmaps and agreements discussed in section 1.1 results in the conclusion that a ***cut of at least 20% in virgin material extraction globally is required*** to reach the targets set for 2030. A 20% reduction on the current levels is equal to the level of materials extraction at the beginning of the 21st century.

By 2050, it is estimated that about 10 billion people will be living on the planet. The long-term vision for EU states that:

In 2050, we live well, within the planet's ecological limits. Our prosperity and healthy environment stem from an innovative, circular economy where nothing is wasted and where natural resources are managed sustainably, and biodiversity is protected, valued and restored in ways that enhance our society's resilience. Our low-carbon growth has long been decoupled from resource use, setting the pace for a safe and sustainable global society.

This vision identifies three key objectives:

- To protect, conserve and enhance the EU's natural capital.
- To turn the EU into a resource-efficient, green and competitive low-carbon economy.
- To safeguard the EU's citizens from environment-related pressures and risks to health and well-being.

An extrapolation of the international roadmaps and agreements discussed in section 1.1 results in the conclusion that a ***reduction of at least 50% in virgin material extraction globally is necessary*** to reach these targets.[45] A 50% reduction on current levels would be equal to the global materials extraction levels of the 1980s. In countries such as Sweden, with a much larger resource appetite than the average, the reduction will need to be much greater than 50%.

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44 Recycling targets for specific packaging materials are presented in Appendix A. All packaging in the EU market is to be reusable or recyclable in an economically viable manner by 2030. The EU will develop a regulatory framework for biodegradable and bio-based plastics and implement measures on single use plastics.

45 M. Fischer-Kowalski et al., International Resource Panel (2011); B. Oberle et al., UNEP International Resource Panel (2019)

2.3 Circular economy strategies in the EU and Sweden

The idea of a circular economy is to decouple economic growth and prosperity from the consumption of virgin resources, and to build up economic, natural and social capital. The circular economy is based on three principles: (1) design out waste and pollution; (2) keep products and materials in use; and (3) regenerate natural systems.

The EU Circular Economy Action Plan

The European Commission has adopted circularity as the economic paradigm for Europe, starting with the launch of its first EU Circular Economy Action Plan in 2015. The revised plan will ensure that the regulatory framework is streamlined and made fit for a sustainable future, maximising new opportunities from the transition while minimising the burden on people and businesses. ***The revised plan is focused on the sectors that use most resources and where the potential for circularity is high, such as electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients.***

Three of the suggested activities in the action plan in particular have the potential to have a large effect on the use of recycled materials:

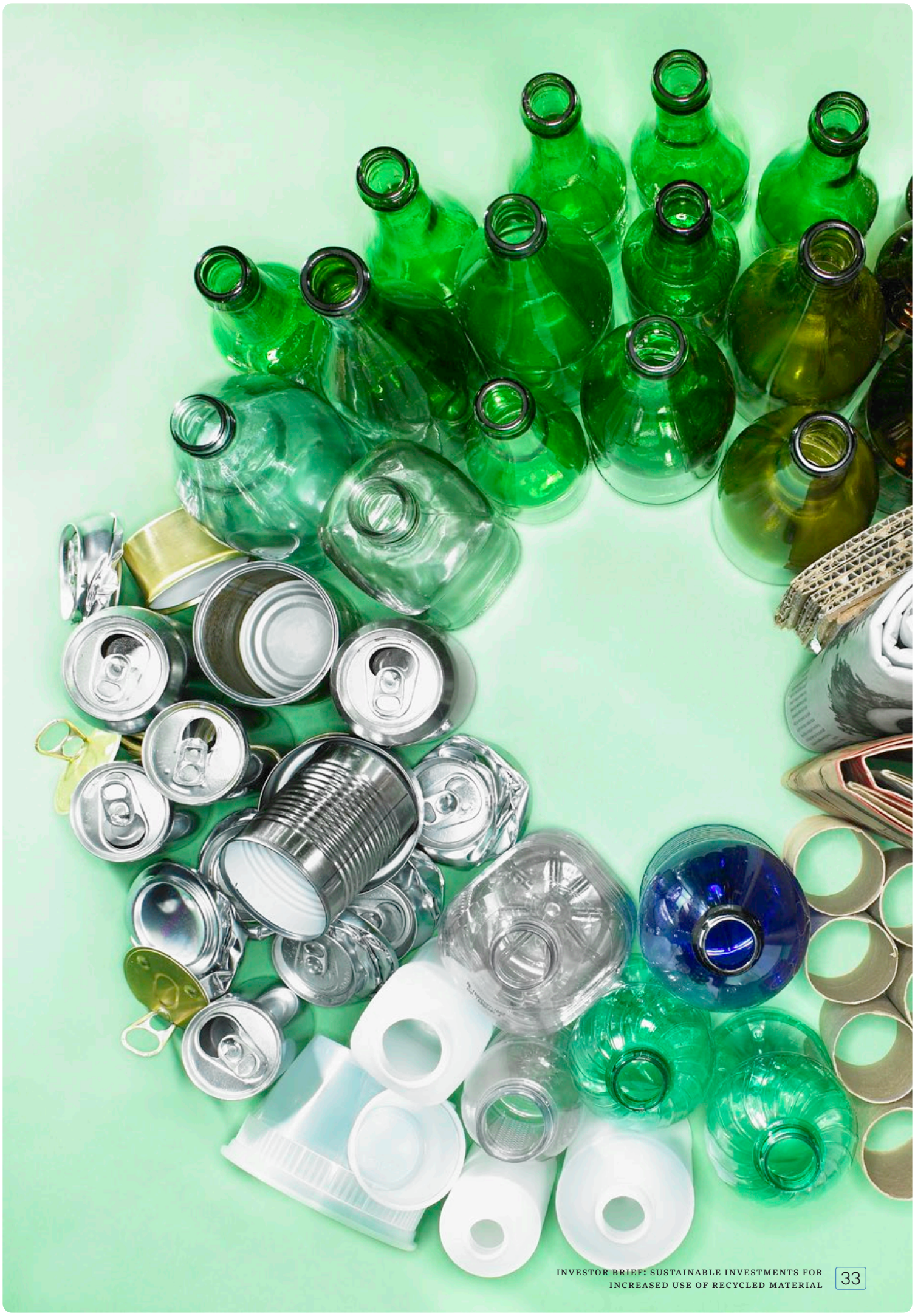
- **Ensure a well-functioning EU market for high-quality recycled materials** by introducing requirements for recycled content in products, further development of end-of-waste criteria for certain waste streams, enhancing the role of standardisation, and establishing a market observatory for key secondary material and restrictions on the use of substances of very high concern in products.
- **Broaden the eco-design framework** with deliverables on circularity applicable to a larger number of products. The European Commission will consider establishing sustainability principles such as targets for higher levels of recycled material to be used in products.
- **Enhancing circularity in a toxic-free environment.** To increase confidence in the use of recycled raw materials, the European Commission will support the development of solutions for high-quality sorting and removal of contaminants from waste, develop methodologies to minimise the presence of substances that pose problems and develop harmonised systems to track and manage information on substances.[46]

The Swedish national strategy for a circular economy

In Sweden, the government adopted a national strategy on a circular economy in July 2020. The strategy sets out the direction of and ambition for a long-term and sustainable transition by Swedish society and aims to accelerate the transition to a circular economy. The overall objective of the national strategy is to create a society in which materials are used more efficiently and have an increased lifespan and value. In the end, this will result in reductions in both the extraction of virgin materials and the disposal of waste on landfill.

The core of the strategy is a vision: "A society in which resources are used efficiently in toxin-free circular flows, replacing new materials". The national work on a circular economy will focus on: sustainable production and product design; sustainable ways of consuming and using materials, products and services; toxin-free and circular eco-cycles; and the circular economy as a driving force for the business sector and other actors through measures to promote innovation and circular business models.

46 EU Circular Economy Action Plan, *https://ec.europa.eu/environment/circular-economy/index_en.htm*



2.4 The EU Taxonomy and its links to recycled materials

The EU Taxonomy is being developed to help determine sustainable decisions that will transform the EU into a low-carbon, resilient and resource-efficient economy. The EU Taxonomy sets performance thresholds, or 'technical screening criteria', for economic activities in six categories. To be environmentally sustainable, economic activities must substantially contribute to at least one of the environmental objectives while not causing significant harm to the other five. The first set of technical screening criteria covers activities that substantially contribute to climate change mitigation or adaptation. These will be adopted by the end of 2020 and enter into force by the end of 2021. The second set of technical screening criteria, which covers economic activities that substantially contribute to the other four environmental objectives, will be adopted by the end of 2021 and enter into force by the end of 2022.

For recycled materials the category "transition to a circular economy" is especially important. In March 2020 the European Commission issued a report on preliminary elements of the eligibility criteria for activities contributing to a circular economy. The report organises the circular economy criteria in four categories: (1) circular design and production models; (2) circular use models; (3) circular value recovery models; and (4) circular support. The proposed criteria, especially in categories 1 and 3, have great potential from a recycled materials point of view, as they focus on resource efficiency, the use of recyclable materials, the development of processes that enable circular strategies, the development of reusable and recyclable materials, the substitution and reduction of critical substances, the substitution of virgin materials, the development of collection and logistics systems, and the development of processes for the recovery of materials.

The EU Taxonomy

The Taxonomy sets performance thresholds, or 'technical screening criteria', for economic activities in six categories:

- Climate change mitigation
- Climate change adaptation
- Sustainable protection of water and marine resources
- The transition to a circular economy
- Pollution prevention and control
- Protection and restoration of biodiversity and ecosystems

The Taxonomy for **Transition to a circular economy** is especially important for recycled materials, particularly the criteria presented on **Circular Design and Production Models** and **Circular Value Recovery Models**.

2.5 Agenda 2030 and its links to recycled materials

Agenda 2030 is an important tool for the holistic approach to sustainable development. The sustainable management of natural resources is crucial to achieving the SDGs.[47] Agenda 2030 specifies 17 SDGs but from a recycled materials point of view, SDG 12 is the most relevant (see Table 2). ***The overall aim of SDG 12 is to reduce the global materials footprint, that is, the total amount of virgin materials extracted to meet global final consumption demand.*** Figure 1 shows that the global material footprint has been accelerating

47 B. Oberle et al., UNEP International Resource Panel (2019)

at a highly unsustainable rate, especially in recent decades. The global materials footprint is increasing at a faster rate than both population and economic output.

TABLE 2: Some of the most relevant targets for SDG 12 stimulating the use of recycled materials

SDG Target	How this will affect the use of recycled materials
12.2: By 2030, achieve the sustainable management and efficient use of natural resources.	The sustainable management of resources requires an efficient system for the use of recycled materials.
12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.	This will require the development of sustainable recycling processes and supporting logistics systems.
12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.	This will require the development of sustainable recycling processes and supporting logistics systems.
12.6: Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle.	This has the potential to enhance information sharing on the content and composition of products and of recycled materials. Any information that can improve the quality of recycled materials is positive.
12.7: Promote public procurement practices that are sustainable, in accordance with national policies and priorities.	This enhances the market for recycled materials.

The challenges of sustainable development are often global but the solutions are usually local and regional. Municipalities and county councils are therefore important actors in transforming global commitments into practical action. These agreements are not mandatory, however, which will make commitment, comparability, follow-up and transparency difficult.

2.6 EU regulations affecting the recycled materials and waste sector

A summary of the prevailing EU policy instruments relevant to the use of recycled materials is presented in Appendix A.

The Waste Framework Directive (2008/98/EC) sets out the basic concepts and definitions related to waste management, such as definitions of waste, recycling and recovery. It lays down some basic waste management principles: it requires that waste is managed without endangering human health or the environment and that it is managed according to the waste management hierarchy. Most importantly, the directive explains when waste ceases to be waste and becomes a recycled material and how to distinguish between waste and by-products (so called end-of-waste criteria). Different rules apply to a material classified as waste or non-waste when it comes to transportation, export and responsibilities.

In addition to the classification between waste and a by-product, one important property of the recycled material is the content of hazardous substances. The **REACH Regulation (EC/1907/2006)** restricts manufacturers' use of 70 chemical substances listed on the restrictions list.

Some laws on waste and materials management also have implications for the closure of material loops. One is the **Directive on Landfills (1999/31/EC),** which restricts landfill of certain material streams; another is the **Directive on Management of Waste from Extractive Industries (2006/21/EC**), which focuses on safe management of waste from mineral resources. The **Waste Shipment Regulation (EC) No 1013/2006** governs the process for waste shipments and is also relevant as it affects the administrative burden on industry when shipping recyclable materials.

Extended Producer Responsibility (EPR) on specific products and waste streams, such as packaging, cars and electrical components, seeks to address the closure of material loops from both the end-of-life phase and the design and production phases by connecting the upstream and downstream value chains of products. Separate collection is already available in Sweden for paper and cardboard, glass, metals and plastic packaging, and will soon extend to new value streams. By 2022, hazardous waste from households will also be collected separately, bio-waste by 2023, and a mandatory EPR scheme for all packaging materials and textiles will be implemented by 2025. Producers are given an important role in the EPR schemes, meaning that a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. Through the new EPR requirements, the EU is hoping for better performance and governance of EPR schemes. In addition, discussions around the effects of implementing an additional Individual Producer Responsibility (IPR) are also continuing. The IPR has the potential to increase a producer's responsibility and control over its products, thereby controlling the quality of the recyclable materials, but it also poses the risk of creating an inefficient individual materials logistics system.

The **"Eco-Design Directive"** has been developed to provide consistent EU-wide rules on improving the environmental performance of products. Although expectations for the directive were high, the criteria mainly focus on energy efficiency and reviews have shown only limited effects on material efficiency. There are new hopes of the new Circular Economy Action Plan, which has a broader directive and contains deliverables on circularity.

The EU has recently been discussing regulatory developments related to specific material flows, such as textiles and plastics. In 2018, the UK announced a tax on plastic packaging with less than 30% recycled plastic content. The aim of the tax was to provide a clear economic incentive for businesses to use recycled materials in the production of plastic packaging, which would create greater demand for this material and in turn stimulate increased levels of the collection and recycling of plastic waste, thereby diverting it away from landfill or incineration. An important recent EU activity is its implementation of the plastics strategy. The goal is to protect the environment while at the same time laying a foundation for a new plastics economy in which design and production fully respect reuse, repair and recycling, and where more sustainable materials are developed. The first implementing step in the strategy was to introduce the **"Single-use plastics ban" (Directive (EU) 2019/904)**. Despite the introduction of the plastics strategy, however, the effect on the use of recycled plastic has been negative. The main reason for this negative effect is that the strategy does not make a clear distinction between the sustainability of different plastics and recycled plastic. One example is the ban on plastic bags. A bag made of 100% recycled and recyclable plastic is still classified as a plastic bag. In addition, as noted above, the historically low oil price as a result of the COVID-19 pandemic has made it difficult to compete with virgin resources. This demonstrates how vulnerable and unpredictable the materials supply chain can be and how difficult it is to design policy instruments that support the creation of a society with circular and sustainable materials flows.

3 Recommended reading

3.1 Reference list

B. Oberle, S. Bringezu, S. Hatfield-Dodds, S. Hellweg, H. Schandl, J. Clement, L. Cabernard, N. Che, D. Chen, H. Droz-Georget, P. Ekins, M. Fischer-Kowalski, M. Flörke, S. Frank, A. Froemelt, A. Geschke, M. Haupt, P. Havlik, R. Hüfner, M. Lenzen, M. Lieber, B. Liu, Y. Lu, S. Lutter, J. Mehr, A. Miatto, D. Newth, C. Oberschelp, M. Obersteiner, S. Pfister, E. Piccoli, R. Schaldach, J. Schüngel, Z. Sonderegger, A. Sudheshwar, H. Tanikawa, E. van der Voet, C. Walker, J. West, Z. Wang and B. Zhu (2019). *Global resources outlook 2019: Natural resources for the future we want*. Report of the International Resource Panel. United Nations Environment Programme. Nairobi, Kenya, *https://wedocs.unep.org/handle/20.500.11822/27517*

Circular Economy (2020). *When circularity goes from bad to worse: The power of countries to change the game. https://www.circularity-gap.world/*

D., McGinty (2020). *How to build a circular economy,* World Resources Institute, *https://www.wri.org/blog/2020/08/how-to-circular-economy*

D., Pamlin (2019). *Companies current focus on circular economy as a sustainability problem and how to turn it into an opportunity*, Naturvårdsverket ISBN 978-91-620-6906-3, *https://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6906-3.pdf?pid=25870*

Ellen MacArthur Foundation (2019). *Completing the Picture: How the Circular Economy Tackles Climate Change, www.ellenmacarthurfoundation.org/publications*

ING Economics Department. (2015). *Rethinking finance in a circular economy. https://www.ingwb.com/media/1383724/rethinking-finance-in-a-circular-economy-report.pdf*

J. Falk, O. Gaffney, A. K. Bhowmik, P. Bergmark, V. Galaz, N. Gaskell, S. Henningsson, M. Höjer, L. Jacobson, K. Jónás, T. Kåberger, D. Klingenfeld, J. Lenhart, B. Loken, D. Lundén, J. Malmodin, T. Malmqvist, V. Olausson, I. Otto, A. Pearce, E. Pihl and T. Shalit (2019) *Exponential Roadmap 1.5. Future Earth. https://exponentialroadmap.org/wp-content/uploads/2019/09/Exponential-Roadmap-1.5-September-19-2019.pdf*

J., Gehandler (2020). *Återvinning av avfall: Beslut och riskbedömning,* RE:Source *https://resource-sip.se/projektdatabas/*

K., Hund, D., La Porta, T., P. Fabregas, T., Laing, J., Drexhage (2020). *Minerals for climate action: the mineral intensity of the clean energy transition,* World Bank, *http://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf*

M. Fischer-Kowalski, M. Swilling, E.U. von Weizsäcker, Y. Ren, Y. Moriguchi, W. Crane, F. Krausmann, N. Eisenmenger, S. Giljum, P. Hennicke, P. Romero Lankao, A. Siriban Manalang and S. Sewerin (2011) A Report of the Working Group on Decoupling to the International Resource Panel. UNEP *Decoupling natural resource use and environmental impacts from economic growth*, *https://www.resourcepanel.org/reports/decoupling-natural-resource-use-and-environmental-impacts-economic-growth*

Material Economics (2018). *Retaining value in the Swedish materials system*, *https://materialeconomics.com/new-publications/ett-vardebestandigt-svenskt-materialsystem*

Material Economics (2019). *Industrial transformation 2050 - pathways to net-zero emissions from eu heavy industry*, *https://materialeconomics.com/publications/industrial-transformation-2050*

N., Johansson and H., Corvellec (2018). *Waste policies gone soft: An analysis of European and Swedish waste prevention plans*. Waste Management, 77, 322–332, *https://www.researchgate.net/publication/324848427_Waste_policies_gone_soft_An_analysis_of_European_and_Swedish_waste_prevention_plans*

N,. Johansson and C., Forsgren (2020). *Is this the end of end-of-waste? Uncovering the space between waste and products,* Resources, Conservation & Recycling 155, 104656, *https://www.researchgate.net/publication/340354598_Is_this_the_end_of_end-of-waste_Uncovering_the_space_between_waste_and_products*

Fossilfritt Sverige (2018). *Bygg och anläggningssektorn färdplan för fossilfri konkurrenskraft*, *http://fossilfritt-sverige.se/fardplaner-for-fossilfri-konkurrenskraft/fardplaner-for-fossilfri-konkurrenskraft-byggbranschen/*

F., Norefjäll, E., Talalasova and H., Tekie (2020). *Barriers for industrial waste recycling in the context of circular transition*: lessons from Mistra Closing the Loop *https://closingtheloop.se/slutrapporter/*

L., Smuk, and E. Blomqvist (2020). *From Waste to Value* Synthesis report of Mistra Closing the Loop research program carried out and completed 2016–2019, *https://closingtheloop.se/slutrapporter/*

3.2 Relevant national and EU strategies

Cirkulär ekonomi - strategi för omställningen i Sverige (2020)

Att göra mer med mindre: Nationell avfallsplan och avfallsförebyggande program (2018–2023)

EU Circular Economy Action Plan (2020)

3.3 Relevant news streams, programmes and webpages

The Circularity Gap Reporting Initiative: a global score for circularity *https://www.circularity-gap.world*

Ellen Macarthur Foundation https://www.ellenmacarthurfoundation.org/

Exponential Roadmap. Brings together technology innovators, scientists, companies and NGOs *https://exponentialroadmap.org/*

Institute European Environmental Policy, a sustainable think tank. *https://ieep.eu/work-areas/green-economy*

Global Footprint Network, Advancing the Science of Sustainability *https://www.footprintnetwork.org/*

Aktuell Hållbarhet Nyheter inom hållbarhetsområdet, både nationellt och global (in Swedish) . *https://www.aktuellhallbarhet.se/*

World Resource Forum https://www.wrforum.org/

Miljö & Utveckling - Hållbarhet i praktiken (In Swedish) *https://miljo-utveckling.se/*

Mistra programs

Mistra Closing the Loop https://www.mistra.org/forskningsprogram/mistra-closing-the-loop/

Mistra Future fashion https://www.mistra.org/forskningsprogram/mistra-future-fashion/

Mistra Sustainable Plastics and Transition Pathways (STEPS) *https://www.mistra.org/forskningsprogram/steps/*

Mistra Resource-Efficient and Effective Solutions (REES) *https://www.mistra.org/forskningsprogram/mistra-rees/*

Mistra Sustainable Consumption https://www.mistra.org/forskningsprogram/mistra-sustainable-consumption/

Innovationsprogram

RE:Source https://resource-sip.se/

Viable Cities https://www.viablecities.se/

Appendix A: Existing policy measures and instruments related to recycled materials in the EU

Policy measure	Policy instrument
Collection/sorting requirements	■ Waste Framework Directive (2008/98/EC) ■ Battery Directive (2006/66/EC) ■ End-of life vehicles Directive (2000/53/EC) ■ WEEE Directive (2012/19/EU) ■ Packaging and Packaging Waste Directive (94/62/EC)
Collection targets	■ Battery Directive (2006/66/EC) ■ WEEE Directive (2012/19/EU)
Recycling targets	■ Waste Framework Directive (2008/98/EC) ■ Battery Directive (2006/66/EC) ■ End-of life vehicles Directive (2000/53/EC) ■ WEEE Directive (2012/19/EU) ■ Packaging and Packaging Waste Directive (94/62/EC)
Separation of components containing hazardous substances	■ Battery Directive (2006/66/EC) ■ End-of life vehicles Directive (2000/53/EC) ■ WEEE Directive (2012/19/EU) ■ Plastics Directive (2019/904)
Landfill bans	■ Landfill of waste Directive (1999/31/EC)
End-of-waste and by-products criteria	■ Waste Framework Directive (2008/98/EC)
Substance restrictions	■ Battery Directive (2006/66/EC) ■ End-of life vehicles Directive (2000/53/EC) ■ Packaging and Packaging Waste Directive (94/62/EC) ■ Hazardous substances in electrical and electronic equipment Directive (2011/65/EU) ■ WEEE Directive (2012/19/EU) ■ REACH Regulation (EC/1907/2006)
Product design requirements related to closure of material loops	■ Battery Directive (2006/66/EC) ■ End-of life vehicles Directive (2000/53/EC) ■ Packaging and Packaging Waste Directive (94/62/EC) ■ Ecodesign requirements for energy-related products Directive (2009/125/EC) ■ Plastics Directive (2019/904)

Policy measure	Policy instrument
Extended producer responsibility (EPR) programme	■ Battery Directive (2006/66/EC) ■ End-of life vehicles Directive (2000/53/EC) ■ Packaging and Packaging Waste Directive (94/62/EC) ■ WEEE Directive (2012/19/EU) ■ Plastics Directive (2019/904) ■ EPR scheme for hazardous household waste, bio-waste, all packages and textiles (in processes)

Appendix B: EU targets on recycling and waste management

The updated circular economy package presents new legally binding targets and fixed deadlines for waste recycling and the reduction of landfill.

The package includes a common EU target for recycling at least 55% of municipal waste by 2025 and a successful increase by 5% each decade to reach at least 65% recycling rates by 2035. By 2035, no more than 10% of municipal waste will be deposited in landfill.

An additional EU target for recycling packaging waste is set at 65% by 2025 and 70% by 2030 with separate targets for the following specific packaging materials:

Recycling targets for specific packages	**By 2025**	**By 2030**
Plastic	50	55
Wood	25	30
Ferrous metals	70	80
Aluminium	50	60
Glass	70	75
Paper and cardboard	75	85

All packaging in the EU market is to be reusable or recyclable in an economically viable manner by 2030.

A regulatory framework on biodegradable and bio-based plastics will implement measures on single use plastics by 2030.

Appendix C: Implementation tracking: table of activities listed in the EU Circular Economy Action Plan

Activity	Year
A sustainable product policy framework	
Legislative proposal empowering consumers in the green transition	2020
Legislative proposal on substantiating green claims	2020
Legislative proposal for a sustainable product policy initiative	2021
Legislative and non-legislative measures establishing a new "right to repair"	2021
Mandatory Green Public Procurement (GPP) criteria and targets in sectoral legislation; phasing-in of mandatory reporting on GPP	2021
Review of the Industrial Emissions Directive, including the integration of circular economy practices in upcoming Best Available Techniques reference documents	2021
Launch of an industry-led industrial symbiosis reporting and certification system	2022
Key product value chains	
Proposal for a new regulatory framework for batteries	2020
Circular Electronics Initiative, common charger solution and rewards systems for return of old devices	2020/2021
Review of the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment and guidance to clarify its links with REACH and Ecodesign requirements	2021
Review of the rules on end-of-life of vehicles	2021
Review of the rules on proper treatment of waste oils	2022
Review to reinforce the essential requirements of packaging and reduce (over)packaging and packaging waste	2021
Restriction of intentionally added microplastics and measures on unintentional release of microplastics	2021
Mandatory requirements on recycled plastic content and plastic waste reduction measures for key products such as packaging, construction materials and vehicles	2021/2022
Policy framework for bio-based plastics and biodegradable or compostable plastics	2021
EU Strategy for Textiles	2021
Strategy for a Sustainable Built Environment	2021

Activity	Year
Initiative to substitute single-use packaging, tableware and cutlery with reusable products in food services	2021
Less waste, more value	
Methodologies to track and minimise the presence of substances of concern in recycled materials and articles made	2021
Harmonised information systems for the presence of substances of concern	2021
Scoping the development of further EU-wide end-of-waste and by-product criteria	2021
Revision of the rules on waste shipments	2021
Waste reduction targets for specific streams and other measures on waste prevention	2022
EU-wide harmonised model for separate collection of waste and labelling to facilitate separate collection	2022
Making the circular economy work for people, regions and cities	
Supporting the circular economy transition through the Skills Agenda, the forthcoming Action Plan for Social Economy, the Pact for Skills and the European Social Fund Plus	2020
Supporting the circular economy transition through Cohesion policy funds, the Just Transition Mechanism and urban initiatives	2020
Crosscutting actions	
Improving measurement, modelling and policy tools to capture synergies between the circular economy and climate change mitigation and adaptation at the EU and national levels	2020
Mainstreaming circular economy objectives in the context of the rules on non-financial reporting, and initiatives on sustainable corporate governance and environmental accounting	2020/2021
Reflecting circular economy objectives in the revision of the guidelines on state aid in the field of the environment and energy	2021
Regulatory framework for the certification of carbon removals	2023
Leading efforts at global level	
Leading efforts to reach a global agreement on plastics	2020
Mainstreaming circular economy objectives in free trade agreements, in bilateral, regional and multilateral processes and agreements, and in EU external policy funding instruments	2020
Proposing a Global Circular Economy Alliance, and initiating discussions on an international agreement on the management of natural resources	2021
Monitoring the progress	
Updating the Circular Economy Monitoring Framework to reflect new policy priorities and develop further indicators on resource use, including consumption and material footprints	2021

This Investor Brief provides the financial sector with a research-based, comprehensive and easily accessible report on the potential for the use of recycled materials. It highlights key features, challenges and opportunities, and provides a toolkit to consider when conducting financial and/or Environment, Social and Governance (ESG) analysis, considering corporate engagement or making investment decisions. The content is based on the work of the Mistra Closing the Loop research programme, which involved seven years (2012–2019) of interdisciplinary research on developing, analysing and demonstrating ways to use recycled materials.

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