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Resource Use in Austria 2020

Volume 3
Key Messages

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Content

Key Messages – Resource Use in Austria 2020

The report series “Resource Use in Austria” is published by the Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) and the Federal Ministry of Agriculture, Regions and Tourism (BMLRT). The series presents and discusses current research into Austrian resource use, and draws upon data provided by material flow analysis (MFA).

The thematic focus of the first report (BMLFUW and BMWFJ 2011) in the series concerns construction raw materials, which comprise more than half of all resource use; the second report (BMLFUW and BMWFW 2015) focuses on biomass materials as the backbone of a bioeconomy.

The current report, the third in the series “Resource Use in Austria 2020” focuses on sustainable resource use as a cross-cutting issue linking resource efficiency, climate protection and raw materials for future technologies. The Key Messages of this report are presented in summary form in the following pages. The source references of the Key Messages Report can be found in the full report, available online in German and English:

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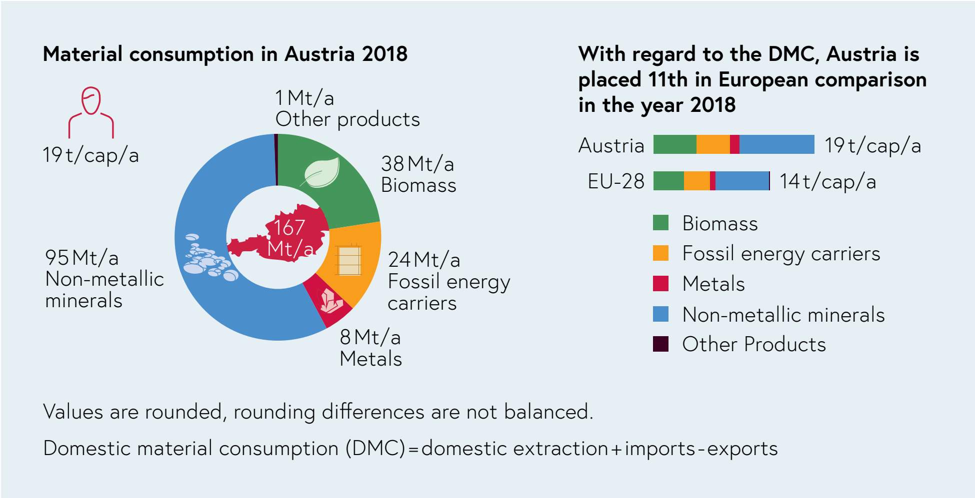
Resource use in Austria has currently stabilised at 19 tonnes per capita and thus exceeds planetary boundaries

The continual growth of resource use through the second half of the 20th century enabled some countries to achieve a high level of material prosperity. Since the 1970s, Austria – in common with most industrialised countries – has shown saturation in terms of resource use at a high level.

In 2018, Austrian material consumption was 167 million tonnes (Mt) per year or 19 tonnes per capita and year (see figure 1, page 6). More than half of all material use comprised non-metallic minerals, primarily construction materials (95 Mt/a or 57 % of domestic material consumption), followed by biomass (23 %). Fossil energy carriers (24 Mt/a or 15 % of DMC) and ores (8 Mt/a or 5 %) were comparatively small categories, although they are highly significant in economic policy terms. Austria’s resource use was 5 t/cap/a above the EU-28 average of 14 t/cap/a. 135 Mt/a of material were extracted from nature in Austria in 2018, while the remainder was imported from abroad (99 Mt in 2018). 67 Mt/a of material was exported to other countries in the form of processed goods.

Figure 1: Material con–sumption in Austria 2018
Sources: Statistik Austria 2019; Eurostat MFA database, Eurostat 2017

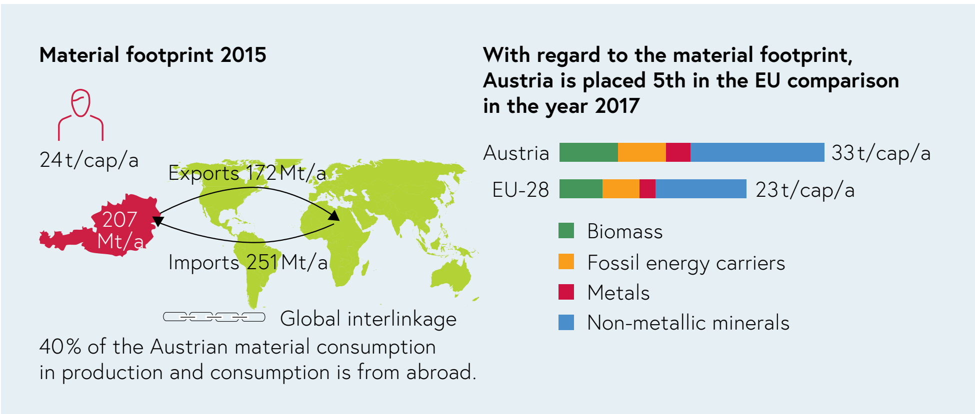


The strongest dynamic in Austrian material consumption over the last 18 years was caused by the global economic crisis of 2008/2009 and the recession or stagnation between 2011 and 2014. During those years in which economic growth was 3 % or above, material consumption also increased significantly. Material consumption only decreased during the years in which economic growth lay below 1.5 %.

Austria's consumption is jointly responsible for resource use in other parts of the world

The involvement of Austria in global trade via imports and exports has created a situation in which raw material extraction and the production of many goods takes place in places other than the location of final consumption. Austrian consumption patterns have therefore an impact beyond the country's borders and have implications for resource use in other world regions.

Figure 2: Material footprint of Austria, 2015 and 2017
Source: UN IRP 2019b



Austria has imported more than it has exported. In 2018, over 40 % of the total materials used in production or consumption were imported from other countries (see figure 2).

In so doing, Austria has, in common with many other industrialised countries, outsourced a share of the resource requirements for goods production – and the environmental impacts related to this – to the producer countries.

The material footprint (MF) takes account of the upstream material use related to imports and exports and attributes the material use of the entire production and supply chains to the countries of final use. Taking a consumption-based approach such as this, Austria's MF in 2015 was 24 t/cap/a and thus 40 % higher than domestic material consumption (DMC).

Our material-intensive economy carries primary responsibility for our excessive resource use

Domestic resource consumption stabilised in Austria from the 1970s onwards, while the economy grew. Resource productivity (GDP/DMC) increased between 2000 and 2018 by 28 % from 1,731 Euro/t to 2,211 Euro/t. If resource productivity is calculated using the material footprint (GDP/MF), then this grew more slowly in the case of Austria, from 1,338 Euro/t in 2000 to 1,665 Euro/t in 2015 (+20 %) (see figure 3). Despite this increase, however, no absolute reduction in material consumption was achieved. In other countries too, there are almost no examples of absolute decoupling to be found.

Domestic resource productivity 2018

€ 2,211 €/t

↑ +28 % from 2000 to 2018

Consumption-based resource productivity 2015

€ 1,665 €/t

↑ +20% from 2000 to 2015

Figure 3: Domestic resource productivity 2018 and consumption-based resource productivity 2015
Source: Statistik Austria 2019

Decoupling together with decreasing material consumption appears hard to put into practice in the future too, since growing economic output was and is one of the most important factors driving increases in resource use. Individual economic activities are become more efficient, yet this reductive effect is cancelled out by ever greater economic production.

A rethinking of our society's conception of prosperity and wellbeing is therefore required. Economic growth is only one possible pathway to achieving this goal, for which reason we must seek alternatives. Even if resource use and economic growth are closely coupled we find that using other measures (e. g. the United Nations' Human Development Index, HDI), an increase in prosperity is also possible without an increase in resource use.

Future challenges

Austria is moving in the right direction, but greater and faster progress is needed

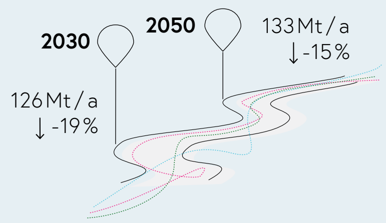
In the period Jahren 2004–2016, Austria managed to increase resource productivity from the perspective of both domestic and consumption-based approaches. In comparison with other EU countries, resource efficiency in Austria increased more slowly, however, and even fell once again in recent years. Furthermore, where an absolute reduction of material consumption is concerned, Austria has shown no significant successes.

The amount of wastes generated did decrease somewhat in the same period, and CO_2 emissions also fell within a shorter time frame (2005–2014). However, these reductions were too small to adequately support the achievement of global climate goals. Recycling rates were also positive: reuse rates for reusable materials grew, reaching the European average by 2016 and now lies somewhat above this rate.

Where energy use is concerned, consumption has increased in Austria and is also above the EU average. However, the share of renewable energy sources in Austria (33 %) is significantly higher than the EU average (17 %). Despite all the measures implemented to date, these have not led to a significant reduction in the resource use of society as a whole (see figure 4).

Figure 4: Development of Austrian material consumption with decrease to the European average
Source: Authors' own diagram, based on Resource Use Report 2020, BMK and BMLRT

Development of Austrian material consumption with decrease to the European average



European average: 14 t / cap/a

Societal stocks are the key driver of resource use and emissions

More than half of all resource consumption comprises non-metallic minerals, i. e. construction materials and industrial minerals, e. g. sand, salts and phosphates, etc. These minerals are used for the expansion and maintenance of our societal stocks.

The largest societal outputs, i.e. air emissions are also closely linked to our societal stocks, through the energy consumption in our buildings or the fuel in our vehicles. Reducing these stocks would not only have an impact in terms of changing consumption patterns for construction materials but also an indirect multiplier effect, primarily through reduced energy use both in the production and the operation of stocks (see figure 5).

Growth in societal stocks

Figure 5: Growth in societal stocks
Source: Authors' own diagram, based on Resource Use Report 2020, BMK and BMLRT

A change relating to resource use and also in the quantity of emissions must inevitably include a restructuring of our societal stocks towards non-increasing, low-maintenance and long-lived infrastructures. This means the optimisation of material composition, a reduction of stocks that provide no or barely any services to society, and the optimisation of regional planning, based on e.g. reduced stocks (e.g. increased density in built environments and short travel distances).

Achieving sustainable reductions in resource use requires an integrated approach to different environmental concerns

Societies worldwide require natural resources to facilitate their production processes and patterns of consumption. Each type of resource use causes environmental impacts, from the extraction of natural resources through production and trade to consumption and, at the end of the utilization chain through waste processing and depositing, finally to outputs to nature. Our current way of living leads to a situation in which our material footprint exceeds the planetary boundaries by a factor of three and CO_2 emissions by a factor of eight (see figure 6).

Austria and the planetary boundaries of CO_2 emissions and material footprint

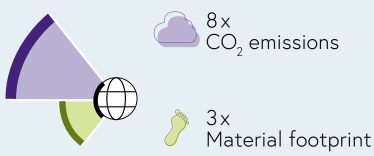


Figure 6: Austria and the planetary boundaries of CO_2 emissions and material footprint
Source: Authors' own diagram, data from O'Neill et al. 2018

The Agenda 2030 published by the UN with its 17 global goals serves as a global model for an integrated view. Sustainable use of resources is anchored above all in SGD 12 "Sustainable production and consumption" (see figure 7). The aim is to gradually improve the global use of resources in consumption and production by 2030 and to achieve a decoupling of economic growth and environmental degradation.

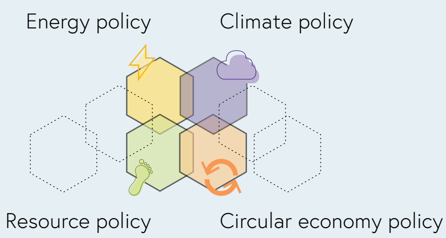
Figure 7: SDG 12 in Austria in the year 2019
Source: Authors' own diagram, based on auf Eurostat 2019a

SDG 12 in Austria in the year 2019

To achieve a more sustainable use of resources, we need a macroeconomic approach to social metabolism, which enables the linking of different environmental policy challenges: Resource efficiency and supply security can, for example, be connected with CO_2 emissions and climate protection, or waste generation and recycling can be linked to our built infrastructure. The diverse areas of policy and their specific perspectives do not act in isolation from each other, but are connected with one another via the production and consumption patterns of society. Successful strategies in individual sectors must therefore be examined to identify both their positive and negative interconnections and their impacts on the system as a whole (see figure 8).

Figure 8: Integrated consideration of the links between different policy areas
Source: Authors' own diagram, based on Resource Use Report 2020, BMK and BMLRT

Integrated consideration of the links between different policy areas



In the case of conflicting aims and objectives, an overarching goal must be identified towards which all individual sectors should direct their energies. In the case of sustainable resource use, the overarching goal is to achieve an absolute reduction in societal resource use. This means that we must extract less resources from nature and produce smaller outputs of wastes and emissions into natural ecosystems. Only by so doing can a change of course, reducing environmental damage, be achieved.

Building blocks of sustainable resource use: Climate protection, circular economy, critical raw materials

The report “Resource Use in Austria 2020” focuses on sustainable resource use and the interplay between a detailed view and simultaneous consideration of the wider context.

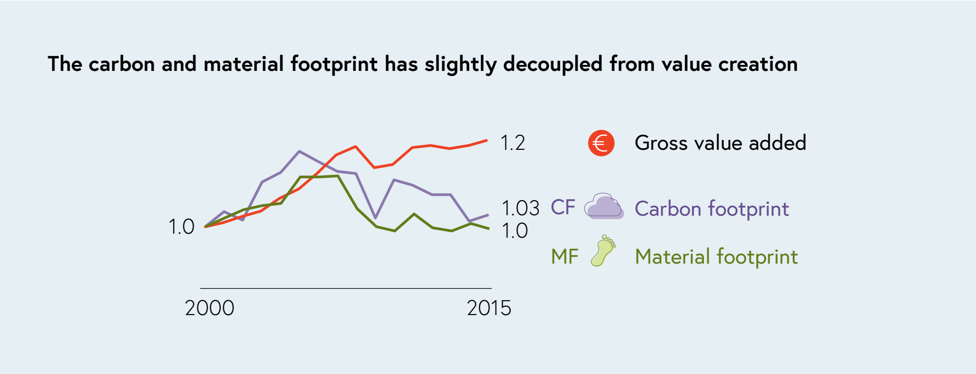
Individual environmental strategies have very different focal points and specific perspectives. Nonetheless, a close relationship between different policy areas is forged by the material cycle of society as a whole: material consumption and climate protection have numerous synergies, according to which measures aimed at increasing resource efficiency have positive effects on CO_2 emissions. Hotspots among economic activities in respect of this are evident in the construction industry, food production and healthcare. A circular economy prioritizes the conservation of natural resources through increasing the period of time in which materials, products and product components remain in use by society. Although the focus here is upon the material use of mineral raw materials, this must be seen in the context of the energetic costs of production and operation. The energy transition and replacement of fossil energy carriers by renewable energies are closely coupled with the use of critical raw materials. These raw materials may only be used in small quantities, yet even these small volumes are affected by high volatility in market prices and supply risks.

Resource conservation and climate protection

Using synergies: Resource use and greenhouse gas emissions are closely coupled

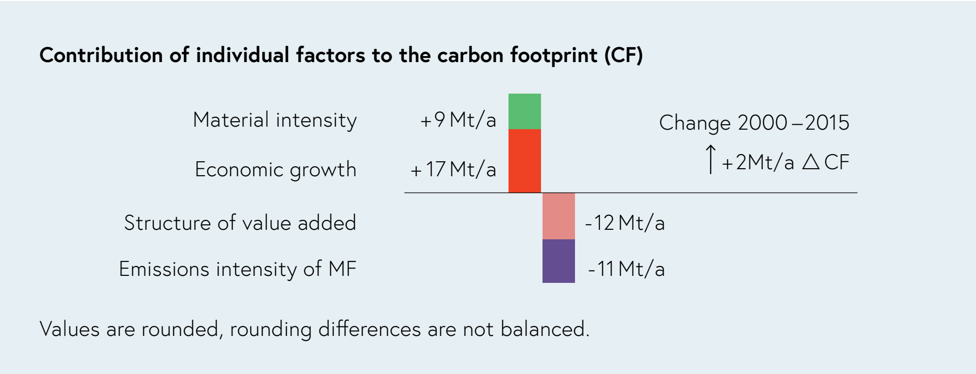
Considering resource use is essential if we are to achieve a comprehensive transformation creating a carbon neutral economy and society. All the resources we extract from nature will, following single or multiple use and consumption and when there is no further use for them by society, become wastes and emissions. After any processing takes place, these will be returned to nature once again. Thus all material inputs into our society will become outputs into nature, if they are not integrated within our societal stocks for a longer period of time. Greenhouse gas emissions are created at every stage throughout the production process and thus throughout the entire material life cycle: from raw material extraction and processing, through the production of goods and services, to final consumption and waste disposal. Resource inputs and emissions are thus in metaphorical terms two sides of the same metabolic "coin" (see figure 9). If one wishes to decrease the output to nature, the material inputs into our social metabolism must be reduced.

Figure 9: The carbon and material footprint has slightly decoupled from value creation
Source: Gross value added: Statistik Austria 2019; CF, MF: EE-MRIO modell exiobase v.3.6, Stadler et al. 2018



Thus to reduce the CO_2 emissions, we must reduce the input of fossil energy carriers first and foremost, e.g. to heat and light our buildings or as fuel for our vehicles. For this reason, input-oriented policy measures, such as e.g. increasing resource efficiency, can make an important contribution to reducing our outputs (emissions) – and thus to mitigating climate change (see figure 10).

Figure 10: Contribution of individual factors to the carbon footprint (CF)
Source: Plank et al. 2020



Integrated policy measures, aiming to impact both resource use and climate protection, are therefore increasingly in the political spotlight. These can achieve a greater reduction in resource use and greenhouse gas emissions than can packets of measures implemented in isolation.

Focus 1: Built infrastructure – Buildings and transport networks

Extraction and processing of materials create 23 % of global greenhouse gas emissions, particularly as a result of housing construction and vehicle production. The processing and treatment of just a few materials play an important role in this context: iron and steel, cement, gypsum and lime, rubber and plastics, paper and other non-metallic minerals.

Changing how and for what purpose we use these materials in housing and vehicles can reduce the associated greenhouse gas emissions by 30–70 %. The measures required affect on one hand the production process, such as a reduction through changes in product design, substitution of materials, efficiency, recycling, reuse and remanufacturing, and increasing product lifetimes, and on the other hand, there are key factors on the demand side, particularly through changes to intensity or type of use.

Because of its lengthy period of use and maintenance, the existing infrastructure, such as buildings, roads or lighting, is also a significant determinant of future material and energy use and the greenhouse gas emissions associated with these. The choice of materials and energy carriers along with reductions in energy use throughout the entire period of use are thus important factors for the development of a resource-conserving economy.

Figure 11: Sectoral focal points
Source: Authors' own diagram, based on Resource Use Report 2020, BMK and BMLRT

Further issues: Food production and health sector

Among the top 5 of the 59 classified sectors of the Austrian economy (ÖNACE sectors), three sectors appear that are characterised by both high material use and CO_2 emissions: construction sector, food and animal feed production, and health and social care sector (see figure 11). The mining and agriculture and forestry sectors are as central to the material footprint and as supplier sectors amplify the effect of both food production and construction activities.

The major part of resource use (75%) and of CO_2 emissions (65%) occur in these sectors within Austria itself, as is the case for most sectors. This proportion is only reversed in the case of manufacturing industry: 63% of material footprint and 68% of the carbon footprint concerned environmental impacts that are created abroad. A combined perspective of emissions and resource impacts and appropriate development of integrated measures in these sectors are therefore particularly important.

The circular economy from a macroeconomic perspective

The circular economy aims to reduce resource use and the environmental impact caused by wastes and emissions

Alongside resource efficiency, the concept of the circular economy is an important building block for sustainable resource use. The circular economy aims to prolong society's use of materials, products and components, in order to reduce society's outputs to and resource inputs from nature. This should alter a society's total material throughput so that it can operate within planetary boundaries and ecological cycles are only used within the limits of their reproductive capacities. The circular economy is based on e.g. sustainable product design, product service models and the reprocessing of secondary raw materials for production and consumption.

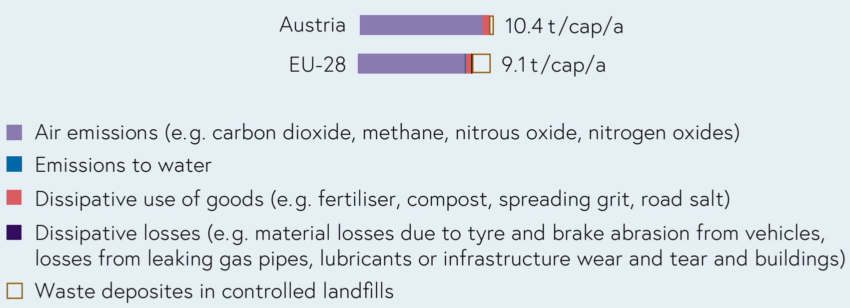
Expanding MFA from its previous input-oriented approach to include output flows means, for example, that the circularity of an economy can be subjected to detailed analysis to identify which share of resources are currently in circulation and to what extent these secondary flows are replacing primary resource inputs and outputs.

Air emissions and fertiliser form the major share of outputs from production and consumption

In Austria in 2017, domestic processed output (DPO), the term used to define all societal wastes and emissions in MFA, amounted to 94 million tonnes of gaseous, liquid or solid materials. In European comparison, Austria thus occupied 12th place. Air emissions represented the vast majority of domestic processed output at 89 million tonnes per year (95 % of DPO). Carbon dioxide (CO_2) constituted 99 % of this total. Between 2005 and 2014 CO_2 emissions exhibited a downward trend, although they increased again in 2015. The share of CO_2 emissions from the combustion of biomass rose continually (from 17 % to 28 %), as a result of increasing use of biomass to generate energy. The amount of wastes deposited in landfill in 2017 was only 3 million tonnes (see figure 12). The second largest share of DPO (5 %) comprised targeted outputs. These include, for example, fertilisers, compost, pesticides or spreading grit. In Austria, the total volume of these products used fell slightly between 2000 and 2017, from 5 million to 4.5 million tonnes per year. More than half of this amount comprised organic fertilisers, followed by compost (18 %) and the use of mineral fertilisers (12 %).

Figure 12: With regard to the DPO, Austria is placed 12th in the EU comparison in the year 2016
Source: Eurostat 2019b

With regard to the DPO, Austria is placed 12th in the EU comparison in the year 2016



Almost half of resource inputs are accumulated in stocks

If one contrasts the societal outputs with inputs, the difference provides an indication of changes to overall societal stocks. If the inputs are greater than the outputs, this suggests that societal stocks are increasing. In Austria, as in most other industrialised countries, the inputs into a society significantly exceed the outputs.

Societal stocks comprise all humans and livestock together with infrastructure, buildings and vehicles, machinery and durable consumer goods. All materials from these stocks eventually flow back into the natural environment as wastes or emissions. The average retention time within the social system varies according to the material category and is dependent both on the lifetime of respective products and also on recycling and reprocessing rates.

Increasing stocks therefore also represent future resource requirements on one hand through the materials and energy needed for their creation and expansion, and on the other hand because of the requirements for maintaining and renovating existing stocks. The quality and quantity of societal stocks have a significant influence on our resource inputs and outputs.

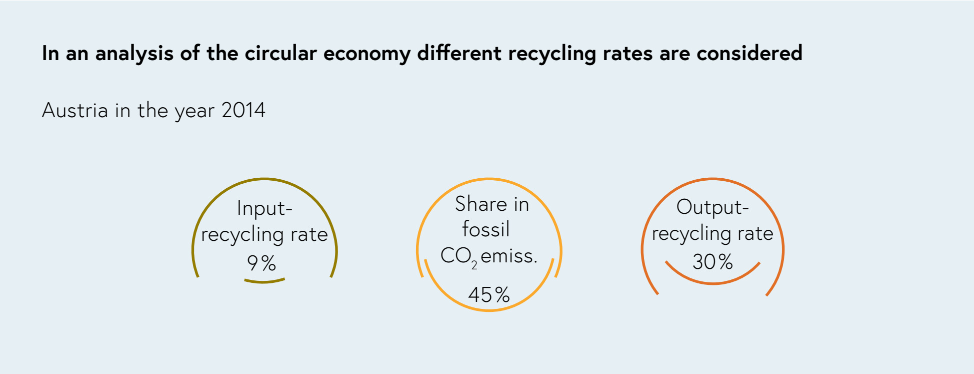
The overall recycling rate of the Austrian economy was 9 % in the year 2014

From a macroeconomic perspective, a circular economy exists where, on one hand, all material wastes from mineral or fossil raw materials are reintroduced into a society's system of production through recycling or reuse. On the other hand, societal use of biomass must not exceed the bioproductivity of land areas, nor may outputs overburden ecosystem cycles.

Expanding MFA to include the output side can, for example, allow for detailed analysis and identification of the circularity capacity of an economy, showing what proportion of resources are currently included in circular flows, and the degree to which these secondary flows can reduce both primary inputs of resources and outputs. According to a research study by the Institute of Social Ecology (Jacobi et al. 2018), the Austrian circular economy in 2014 can be defined at a macroeconomic level using three indicators (see figure 13, page 16):

- Output recycling rates: in Austria in 2014, only 30 % of wastes sent for reprocessing at the end of their life-cycle were actually recycled.
- Input recycling rates: In 2014, recycled materials made up only 9 % of total resource input.
- In Austria, the share of CO_2 emissions coming from fossil energy sources was 45 % in the year 2014. These CO_2 emissions from the burning of fossil fuels cannot be reintroduced into a circular economy and must be reduced to zero.

Figure 13: In an analysis of the circular economy different recycling rates are considered
Source: Authors' own diagram, based on Resource Use Report 2020, BMK and BMLRT



Based on this, the Circularity Gap Report Austria has produced four recommended courses of action concluding that these measures could increase the circularity of Austria's economy to 37.4 % in 2014:

- Fulfilling energy demands using renewable resources.
- Increasing recycling of potentially recyclable wastes.
- Stabilising material stocks (built infrastructure); ensuring that the renovation or replacement of existing infrastructure is only undertaken using continuously generated demolition material.
- Increasing the share of secondary raw materials in imported goods.

This makes clear that in addition to measures aimed at creating a circular economy, an absolute reduction of our resource consumption through sustainable resource use is unavoidable.

Critical raw materials

The smallest group in social metabolism has great strategic importance

The multitude of different metals represent a central resource for our pattern of industrialised production and consumption. In absolute quantities, however, the group of metals forms the smallest of the four material categories (only 5 % of Austrian domestic material consumption – DMC). Alongside the metals used in large quantities, i. e. iron, copper and aluminium, increasing numbers of other metals are used in very small quantities. Yet despite the small volumes concerned, these so-called "spice metals" are vitally important for strategically significant technologies, in particular future technologies. Among them are lithium and cobalt, used in batteries; indium and germanium in photovoltaic systems; tantalum, palladium and platinum in electronic equipment, catalytic converters and the chemicals industry; or metals from the rare earths group in catalytic converters and wind turbines (see figure 14, page 17).

Critical raw materials are indispensable in future technologies

Examples of applications for critical raw materials:

Batteries, photovoltaic systems, electronic equipment, catalytic converters, wind turbines

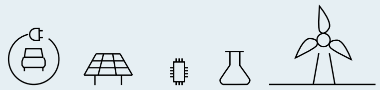


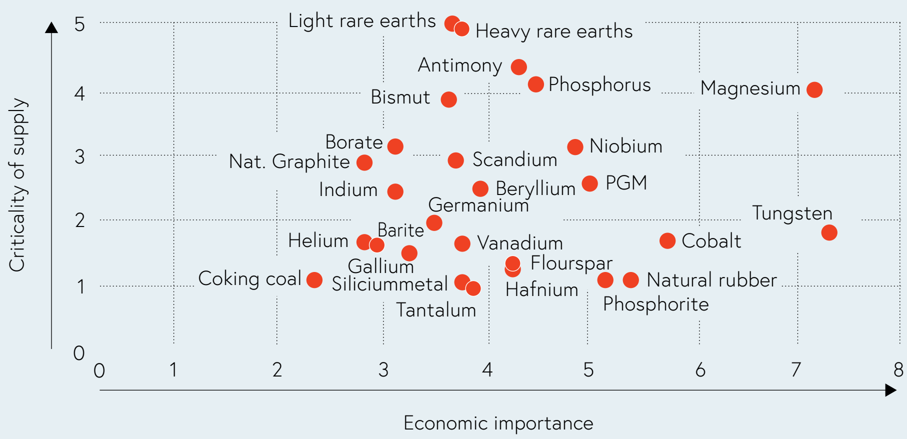
Figure 14: Critical raw materials are indispensable in future technologies
Source: Authors' own diagram, based on Resource Use Report 2020, BMK and BMLRT

Over the last few decades, the metal concentrations at mining sites has continually decreased, i. e. there is less metal within the extracted ores. While the commercial viability of mining is changing, there are growing anthropogenic stocks (in particular, urban mines), which are becoming increasingly important as reserves for the future. Recycling and reuse are therefore central strategies for supplying the growing demand for metals.

Critical raw materials are caught between supply shortages and growing demand linked to future technologies

In recent years, supply shortages of critical raw materials have become evident, particularly as this has led to high price increases. Raw materials that are indispensable for hi-tech goods and innovations (for example, solar panels, wind turbines, electric vehicles, etc.) are particularly badly affected by supply shortages. The EU has therefore decided to monitor and analyse critical raw materials (CRM) more closely and to put measures in place that can mitigate any shortages in supply. The current EU list of critical raw materials contains 27 raw materials (see figure 15).

The 27 critical raw materials



PGM Platinum Group Metals

Figure 15: The 27 critcial raw materials, 2017
Source: Authors' own diagram, based on auf European Commission, DG JRC 2019

The definition of which raw materials should be categorised as critical rests on two factors: a high level of economic importance and a high risk to sustainable supply. The list is intended to trigger measures to protect supply of these raw materials. Such measures include, for example, the efficient use of raw materials and increases in recycling rates, exploration, expansion and/or (re-) development of mining activities, diversification of supply channels and the promotion of research and development.

Cobalt, a critical raw material with a key role in the application of future technologies

Critical raw materials are key components in future technologies and are intended to facilitate "sustainability" and an "electronic revolution", both of which make important contributions to the decarbonisation and energy transition that is needed. Where electromobility is concerned, lithium, cobalt, manganese and graphite are strategically important because of their use in batteries.

In the case of cobalt, 42% is used for battery production, and global demand has risen from 3% in 1995 to 23% in 2006. UNEP estimates regarding future demand suggest a growth in demand of +2.8% per year. At the same time, cobalt is classified as a critical metal, since the world's largest producer of cobalt is the Democratic Republic of Congo (approx. 60% of global production), which is categorised as an unstable democracy with a high potential for conflict. This raw material is exported for further processing to China, where 40% of refined cobalt is produced (see figure 16).

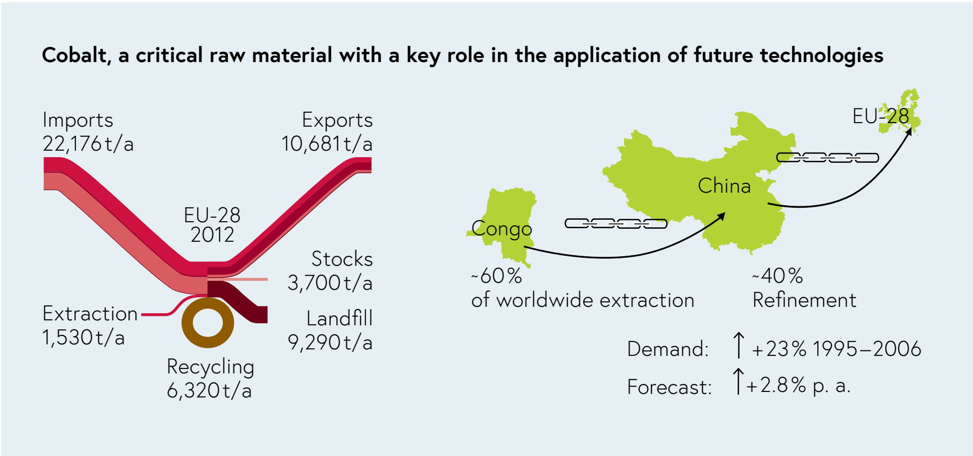


Figure 16: Cobalt, a critical raw material with a key role in the application of future technologies
Source: Authors' own diagram, based on European Commission 2018b; European Commission, DG JRC 2019, and Resource Use Report 2020, BMK and BMLRT

In the EU, 21% of the cobalt used is recycled, and exploiting further recycling potential is an important step forward. Alongside conservation of primary resources, increasing the use of secondary cobalt resources would also have positive impacts on energy and water consumption. The EU is planning the development of a value chain for batteries. The core of this initiative involves developing and expanding currently underdeveloped economic activities relating to the production, collection and re-valorisation of batteries, to gain access to other economies (above all China), and to position itself in future markets through sustainable production of batteries. The aim of the initiative is to increase sourcing within the EU, and thus to achieve resilience in respect of supply shortages.