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FSO News

02 Territory and environment

Neuchâtel, july 2020

Material flow accounts

Statistics' first contribution to measuring the circular economy

In 2018, around 13% of materials consumed in Switzerland were recovered from waste, with the remainder coming from domestic extraction and imports. Even if all waste could be recovered, it would only cover one-fifth of our current material needs. These findings result from the extension of the FSO's material flow accounts to include waste recycling flows. They make it possible to measure one of the dimensions of the circular economy.

Raw materials extracted from the environment, such as biomass, minerals, metals or fossil energy carriers, are processed and then used by society, sometimes immobilised for years in the form of buildings or infrastructure, sometimes recycled, before they are released into the environment sooner or later as emissions or stored in landfills.

The aim of the circular economy is to keep materials in the economic system for as long as possible before they are released into the environment or stored in landfills. If less material is extracted and less waste produced, our environment is better preserved. This includes extending the lifespan of products (reuse, repair, reconditioning or renovation), sharing the use of products (e.g. car-sharing) and, failing this, recovering waste in the form of secondary raw materials, which can replace primary raw materials extracted from the environment.

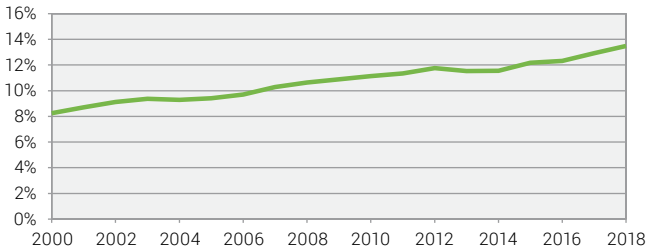
There is great demand for quantified information on the circular economy, such as in the context of measuring sustainable development or progress made towards a green economy. Measuring the evolution of our societies towards a more circular economy is, however, a challenge. Eurostat, the European Statistical Office, has developed, in cooperation with the national statistical institutes, a method for a circular material use rate to approximate the importance of recovery flows in relation to the total material consumption. This rate is calculated from existing data. This publication presents the results of this approach for Switzerland.

The circular material use rate corresponds to the share of the quantities of materials recovered in the total of materials consumed (G1, see details in the methodological box). For Switzerland, this rate was estimated to be around 13% in 2018 and has been rising steadily since 2000.

At EU level[1], Eurostat estimates the material circularity rate for 2017 to be around 11%, which is slightly lower than the estimated value for Switzerland. International comparisons still need to be made with caution, particularly in light of whether or not material flows from excavation or dredging works are taken into account for some countries. The consideration of these flows can have a very significant impact on results. In this study, they are excluded.

Circular material use rate[1]

Share of waste recovery streams in total material consumption — **G1**



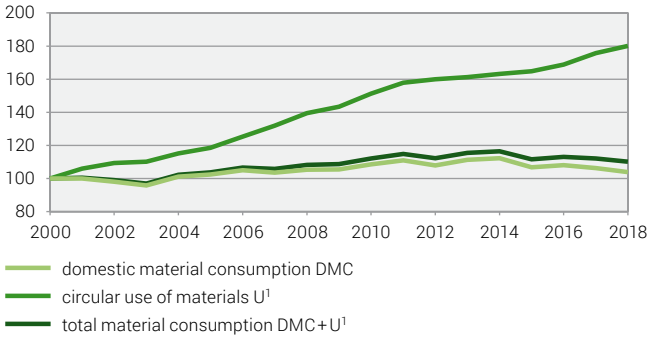
[1] estimates

Source: FSO – Environmental accounts

[1] Composition of the EU on 1 February 2020 without the United Kingdom.

Material consumption

Index 2000 = 100 **G 2**

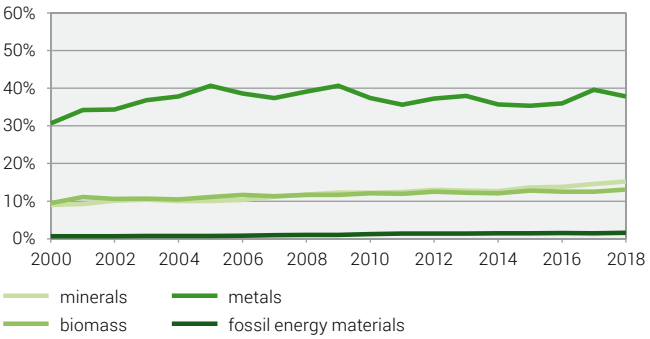


1 estimates

Source: FSO – Environmental accounts © FSO 2020

Circular material use rate[1]

By material categories **G 3**



1 estimates

Source: FSO – Environmental accounts © FSO 2020

Circular flows are increasing faster than the consumption of raw materials

Total material consumption in 2018 was estimated at 109 million tonnes, of which 15 million tonnes came from recovery and 94 million tonnes from domestic extraction or imports.

Domestic material consumption DMC (see definition) increased up to 2014 (G 2) and has seen a downward trend since. During the period 2000–2018, the DMC increased overall by 4% while the total consumption grew by 10%. Over the same period, circular use of materials increased by 80%. Thus, due to the growth in circular material use, decoupling has occurred between the total material consumption and the DMC.

Higher circularity for metals

In 2018, the circular material use rate was 38% for metals, 15% for minerals, 13% for biomass and 2% for fossil energy materials (G 3). Metals have been recovered and recycled for a long time. Most of them can re-enter the economic cycle again and again with little loss of material. In addition, the recycling of metals generally saves resources and energy compared with the extraction of metal ores.

In contrast, fossil energy materials are unsuitable for recycling since, with the exception of the production of plastics and various chemicals, they are mainly used as an energy carrier and are transformed by combustion into air emissions. The use of biomass as food or an energy carrier (firewood) is also poorly suited to recycling. Biomass recovery mainly involves the recovery of paper, natural textiles and biogenic waste (compost, sewage sludge). Finally, as far as minerals are concerned, these are mainly materials resulting from the recovery of construction waste which make it possible, in particular, to replace part of the sand required to produce concrete.

Mineral-dominated flows

In 2018, minerals accounted for 70% of circular material use (G4). Biomass made up 18% of this use. With regards to compost, it does not replace materials in the production process but helps to prevent the use of mineral fertilisers or peat. Metals and fossil energy materials accounted for 10% and 2% of circular material use. These proportions diverge from the share of material categories in domestic material consumption, which were 61% for minerals, 19% for biomass, 15% for fossil energy materials and 3% for metals.

A diagram for an overview of flows

In addition to the circular material use rate, the data collected make it possible to produce a diagram showing the flows in proportion to their size (G 5). This diagram illustrates the main material flows through the Swiss economy and society, as well as trade with the rest of the world and the environment.

The diagram shows that in 2018, 48% of the materials processed by the economy came from domestic extraction, 42% from imports and 10% from recovery. 64% of these materials are used to manufacture products or infrastructure, the rest is exported (14%) or released into the environment (22%[2]) mainly as emissions into the air.

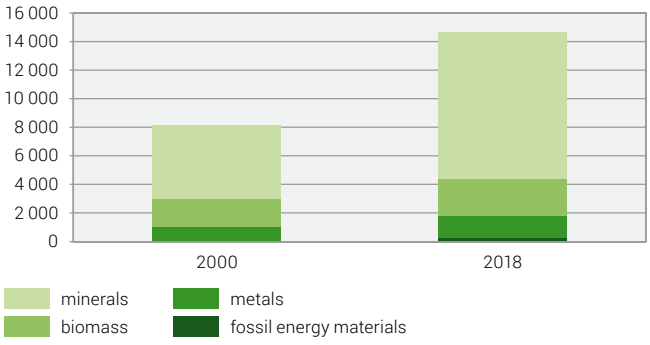
The total waste treated (excluding exports) was about 2.7 tonnes per person in 2018. 55% of this waste was recovered as materials and could thus be re-injected into the economic system (circular loop). 25% was landfilled and the remaining 20% recovered as energy and thus returned to the environment as emissions into the air.

Finally, 6.7 tonnes per person are added annually to the society's material stock, which consists mainly of buildings and infrastructure.

2 This share is deducted from the mass remaining after deduction of the materials used and exports from the total quantities of the processed materials. This mass does not correspond to the actual mass of emissions in nature. The quantity of emissions in nature cannot be compared to that of other flows. Due to the exchanges with the air during the combustion process, the mass of the fuel, for example, is lighter than the mass of its emissions. In material flow accounts, balancing items make it possible to comply with the principle of mass conservation.

Circular material use[1]

By material categories, in thousand tonnes — G 4



[1] estimates

Source: FSO – Environmental accounts

Circular flows cannot cover all current needs

The diagram (G 5) shows that the flow of recovered materials is small in relation to the total material flows, although some recovery rates are high in Switzerland (such as, according to the Federal Office for the Environment (FOEN), over 80% for paper and almost 94% for glass). Even if all waste streams could be recovered, they would only cover one fifth of the Swiss economy's material requirements. In other words, secondary material flows (from recycling) can only partially replace raw material flows.

Domestic material consumption (DMC)

Measures the total amount of materials directly used by an economy and is defined as the annual quantity of raw materials extracted from the domestic territory plus imports (raw materials, semi-manufactured and finished products) minus exports.

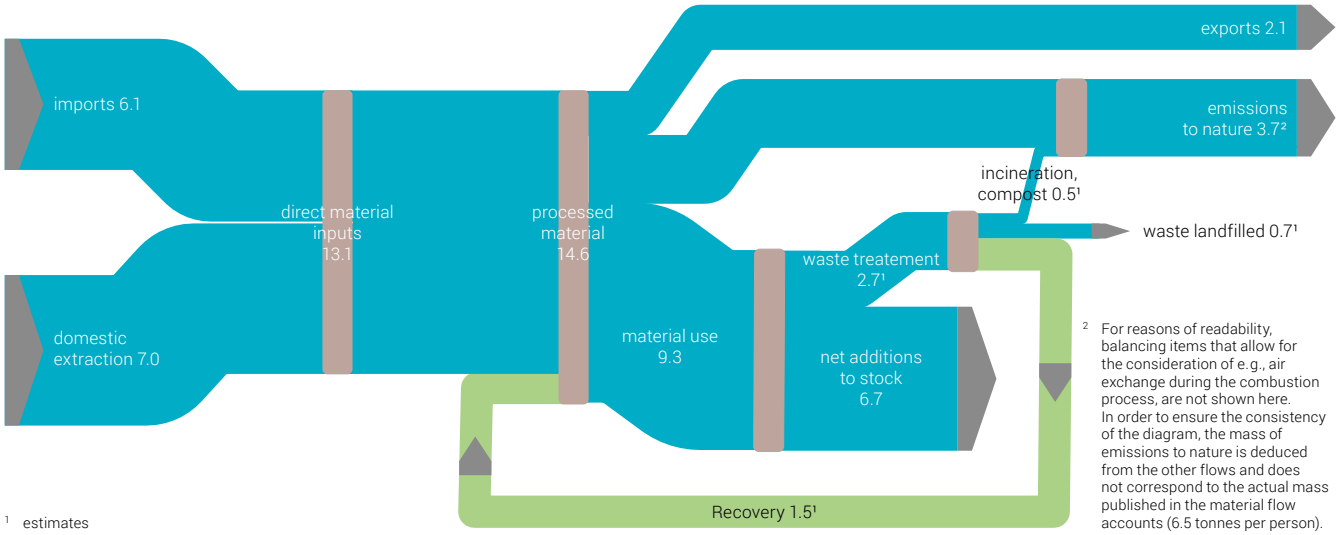
Thus, as long as the demand for materials to produce goods, buildings and infrastructure exceeds the amount of materials that can be supplied by recycling processes, it will be necessary to extract natural resources.

An increase in the circularity rate can, however, be achieved in other ways than by increasing recovery rates. The absolute consumption of materials can potentially also be reduced, for example, by replacing fossil fuels with renewable energies (sun, water, wind) or by extending the lifespan of products.

Towards a broader monitoring of the circular economy

The results presented in this publication are a first step towards the measurement of the circular economy by official statistics. This pragmatic approach, based on information that already exists, allows a first approximation of one of its dimensions. Consolidation and improvement work will be carried out over the next few years. In addition, the measurement of other dimensions of the circular economy (jobs, sharing economy, product repair…) will also be explored.

Material flows in tonnes per person, 2018 — G 5



[1] estimates

[2] For reasons of readability, balancing items that allow for the consideration of e. g., air exchange during the combustion process, are not shown here. In order to ensure the consistency of the diagram, the mass of emissions to nature is deduced from the other flows and does not correspond to the actual mass published in the material flow accounts (6.5 tonnes per person).

Source: FSO – Environmental accounts

Methodology

The method used in this publication is directly inspired by the approach developed by Eurostat (Circular material use rate–Calculation method, 2018 edition).

The circular material use rate (CMU) is based on two quantities: firstly, domestic material consumption (DMC), which measures the total material flows entering the economy directly (domestic extraction used and imports) minus exports; secondly, circular use of materials (U), which measures the material flows recovered and reused by the economy. The sum of these two quantities (DMC + U) corresponds to the total primary and secondary materials consumed annually. The circular material use rate is equal to the share of quantities recovered in Switzerland in this total (CMU = U/(DMC+U)).

The DMC is a value which is taken directly from the FSO's material flow accounts. It can be broken down into four material categories: biomass, minerals, metals, fossil energy materials.[3]

The value U does not exist directly in the statistical system. It can be approximated by the amount of material that is recovered. By convention and following Eurostat's recommendations, it was decided to include only material recovery in U and to exclude energy recovery and backfilling. In order to ensure consistency with DMC, flows of excavated material are also excluded (they account for between 50 and 60 million tonnes annually). In the material flow accounts, excavated material is considered as unused extraction and does not appear in the DMC. By convention, U corresponds to the sum of the quantities of domestic waste recovered as material in Switzerland plus the quantities of domestic waste exported for material recovery abroad. This perspective demonstrates the country's effort to collect waste for recovery, which indirectly contributes to the global supply of secondary materials by avoiding the extraction of primary materials. Recovery that takes place within companies (on site) is not taken into account.

The following statistics were mainly used to estimate U:

- the statistics of the Federal Office for the Environment (FOEN) on urban waste
- the FOEN's statistics on hazardous waste
- statistics on other waste subject to notification by the FOEN
- the statistics of the Federal Customs Administration (FCA) on foreign trade
- the KAR model for Switzerland (TINU SCHNEIDER Datenanalyse, commissioned by the FOEN).

Where information was not available, estimates were made on the basis of the results of studies mostly commissioned by the federal administration or data from industry associations.

Material circularity is measured at the macroeconomic level and for a country as a whole. The approach chosen does not allow a detailed analysis by product (e.g. for plastic bags). However, a breakdown by material category is possible. This is done on the basis of detailed data. In most cases it is obvious (compost → biomass). For waste categories that consist of a mixture of materials, FOEN waste composition surveys or coefficients defined by Eurostat are used.

Limitations:

The quality of materials from recycling streams cannot be demonstrated with the available data. However, it is important for the analysis of the results to take into account the fact that in some cases the waste is transformed into lower quality new materials (downcycling) and thus cannot replace all the materials resulting from extraction. Furthermore, in several cases, the figures used to estimate U correspond to the quantities of materials recovered and not to the quantities actually recycled, which are generally lower (processing losses). Finally, imports also contain materials from recycling. These are not separated here, mainly because they are not easily identifiable in foreign trade statistics.

Difference between U and flow diagram G5:

The value U is closely related to the recovery streams shown in the diagram in figure G5. However, the constitution of this type of diagram implies complete consistency between the different incoming and outgoing flows. This implies that, unlike the approach used to calculate U, the recovery stream in the diagram excludes waste exports (which are included in exports) but includes waste that is imported and recycled in Switzerland. In addition, the compost streams pass directly into nature's emissions without re-entering the recovery loop.

[3] www.statistics.admin.ch → Look for statistics → Territory and environment → Environmental accounting → Material flows

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