Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Statistical Office FSO

Embargo: 10.09.2015, 9:15

Actualités OFS
BFS Aktuell
FSO News

02 Territory and Environment

Neuchâtel, September 2015

Material flow accounts

Switzerland's material footprint

The total mass of raw materials extracted in Switzerland or abroad to meet Switzerland's final demand for goods and services amounted to 136 million tonnes per year on average between 2000 and 2012, which equates to around 18 tonnes per capita. These raw materials comprised 15% biomass, 17% metal ores, 24% fossil energy materials and 44% minerals. Just under half of all these materials were extracted in Switzerland. These initial estimates were made by the FSO based on a method developed by Eurostat, the statistical office of the European Union.

In order to meet the demand for goods and services of various economic stakeholders (households, businesses and public administrations), countries extract, import, consume, store, emit and export materials. Material flow accounts keep a record of all the flows this entails in tonnes.

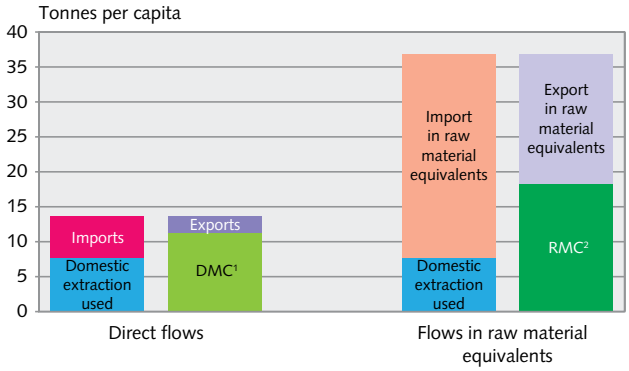
Domestic material consumption (DMC) is the sum of domestic extraction used plus imports of materials and products, minus all physical exports (G 1, left-hand section). The *DMC* therefore corresponds to the actual quantity of materials consumed by a country. This indicator is relevant for measuring potential environmental pressures in a country. The quantity of material, which circulates annually in the national economy, is either released into the environment in the form of waste or emissions, or helps increase the country's physical stock (infrastructure and durable goods).

Different sorts of flows are aggregated to calculate the *DMC*. The domestic extraction used consists of raw materials by definition, while imports and exports are made up of a mix of raw materials, semi-manufactured and finished products. The analyses based on the *DMC* should therefore be considered with caution. For example, shifting resource-heavy production processes overseas results in an apparent fall in a country's material consumption.

Material footprint

This limitation can be addressed by expressing imports and exports in raw material equivalents (G 1, right-hand section), in other words by taking into account the mass of all materials used during the production processes and transport of goods and services until they cross the border.

Comparison between direct material flows and flows in raw material equivalents in 2012 **G 1**



¹ DMC: Domestic material consumption
² RMC: Raw material consumption

Source: FSO – Environmental accounts

This allows us to calculate the *Raw Material Consumption* (*RMC*) or *material footprint*. The *RMC* describes the consumption of raw material brought about by a country's domestic final demand[1].

The flows in raw material equivalents cannot be measured directly and therefore have to be modelled. Several statistical approaches can be used to estimate these flows. Nevertheless, whichever approach is used, they are still models with limits and related uncertainties. The approach used in this study is the one recently developed by Eurostat (→ Methodology, page 4) and used by Switzerland on a pilot basis. The results presented here should therefore be considered estimates.

A footprint of 18 tonnes per capita

In 2012, Switzerland's *DMC* totalled 96 million tonnes, or 12 tonnes per capita (t/cap). *RMC* was estimated at 146 million tonnes (G 2), or 18 t/cap (G 1). The ratio of 1.5 between the *RMC* and *DMC* highlights the importance of taking into account flows of raw material equivalents, particularly for a country like Switzerland, which has significant international trade.

In terms of input, domestic extraction of raw materials amounted to 62 million tonnes in 2012. Imports in raw material equivalents were estimated at 234 million tonnes, which is 3.8 times more than domestic extraction and 4.5 times more than the volume of imports that actually crossed the border.

The total input therefore represented 296 million tonnes, or 37 t/cap. In absolute terms, it had increased by 25% since 2000, with a temporary setback in 2009 following the economic slowdown caused by the global financial crisis.

In terms of output, 149 million tonnes, or 19 t/cap of raw material equivalents were exported in 2012, which is more than eight times the volume of direct exports. This ratio is higher than that of imports because exports consist of a larger portion of finished products. In absolute terms, the total output had increased by 37% since 2000.

A large portion of exported raw material equivalents never actually end up in Switzerland but are linked to the country's imports and are therefore merely transited through the country. For example, the raw material equivalents involved in the extraction of an imported iron bar, which is transformed into a machine tool in Switzerland and then exported, are also exported.

Minerals top the list

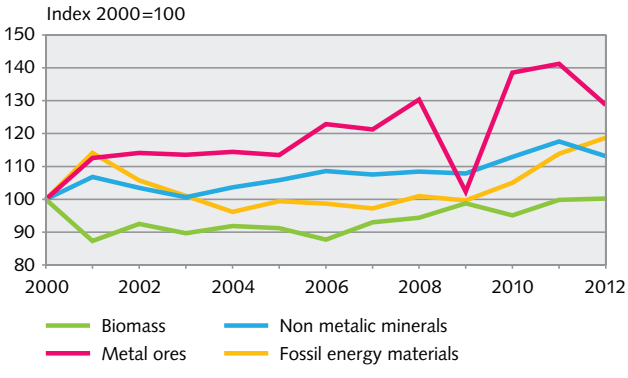
Making up an average of 44% of raw material consumption between 2000 and 2012, non-metallic minerals are the most consumed materials. Consumption of non-metallic minerals rose from 55 to 62 million tonnes during this period (G 3), which is an increase of 13%. Non-metallic minerals are mainly used for construction (sand, gravel etc.). Industry also consumes these resources (e.g. production of mineral fertilisers and salts), but to a lesser extent. Changes in consumption of these minerals are therefore particularly influenced by demand for housing and infrastructure.

Flows in raw material equivalents **G 2**

Source: FSO – Environmental accounts

[1] In national accounts, this corresponds to household and general government final consumption expenditure plus gross fixed capital formation plus changes in inventories

RMC by material categories **G 3**



Source: FSO – Environmental accounts © FSO, Neuchâtel 2015

Fossil energy materials (e.g. oil, natural gas, coal) are the second most consumed materials in Switzerland, representing on average 24% of raw material equivalents consumption. Consumption of this resource is mainly linked to domestic energy demand, as well as overseas energy requirements for the production and transport of imported products. Final demand for petrochemical products such as plastics also influences consumption of this type of material.

Consumption of metal ores, which is primarily associated with construction and industry, amounted to an average of 17%. In Switzerland, the activities of the metalworking, watchmaking and jewellery industries entail high consumption of precious metals (gold, silver and platinum). Although the imported volume of these materials is relatively low, their raw material equivalents are very high. Indeed, large quantities of ores have to be extracted in order to obtain a few grams of precious metals[2]. Consumption of metal ores saw a sharp decline in 2009 following the global financial crisis.

Consumption of biomass is linked to food production, products made of wood and plant fibres and bioenergy. It accounts for an average of 15% of raw material consumption. The decline between 2000 and 2001 can be partly attributed to the extensive timber extraction following windstorm Lothar. Consumption of biomass, which is closely linked to food production, grew slightly faster than the population between 2001 and 2012 (+15% versus +11%).

Services result in material flows

The vast majority of materials consumed are linked to the production of goods. However, although services do not entail an exchange of materials, they still result in materials flows (transport, infrastructure, heating, etc.). On average, between 2000 and 2012, around 4% of imports of raw material equivalents and 7% of exports were linked to services (e.g. commerce, transport and financial services).

45% of raw materials are extracted in Switzerland

As well as consuming a large amount of energy, the extraction, processing and transport of raw materials has an impact on the environment and society. The extent of this impact depends on the type of materials and on where they are extracted. For imported products, these impacts occur outside of Switzerland. The share of domestic extraction used in the *RMC* amounted to 45% on average between 2000 and 2012. Domestic extraction used is processed in Switzerland either to be consumed or to produce exports. Assuming all domestic extraction is consumed in Switzerland, on average 55% of the raw materials necessary to meet Switzerland's domestic final demand would have to be extracted abroad. This material dependency on other countries varies significantly from one type of material to another. Switzerland is fully dependent on other countries for fossil energy materials and metal ores. For biomass, the level of dependency is 26% and for minerals 24%.

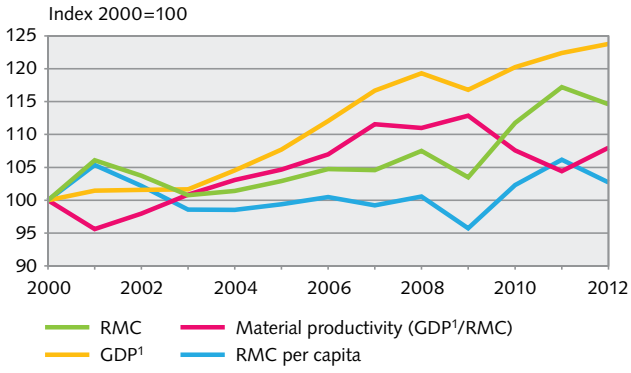
Material productivity is on the increase

The *RMC* fluctuated between 2000 and 2003 and increased overall until 2012, with a dip in 2009 (G 4). Material productivity, measured here in GDP[3]/*RMC*, showed an upward trend between 2001 and 2009, and then declined until 2011, as *RMC* grew faster than real GDP. Considering the whole period between 2000 and 2012, a relative decoupling occurred between real GDP (+24%) and *RMC* (+15%), the latter increasing at a slower pace overall.

Switzerland's material footprint is high by international comparison

Between 2000 and 2012, Switzerland's material footprint per capita fluctuated between 17.0 and 18.8 t/cap. Using the same approach, Eurostat estimates the material footprint of the EU-27 (average between 2000 and 2012) at 16.2 t/cap. With an average of 17.9 t/cap, Switzerland's material footprint is therefore higher.

Material productivity **G 4**



¹ GDP real (at prices for the preceding year, chain linked)

Source: FSO – Environmental accounts © FSO, Neuchâtel 2015

[2] In this study the results for precious metals (gold, silver, platinum) which featured significant annual fluctuations were "smoothed" (moving average). Furthermore, foreign trade of gold bars was excluded from the calculations.

[3] GDP: Gross domestic product

The global material footprint is around 10 t/cap. According to these estimates, Switzerland therefore consumes almost twice as much material as the world average.

Input and consumption indicators in material flow accounts

Material flow accounts allow a set of interlinked macroeconomic indicators to be calculated based on **direct flows**, **flows in raw material equivalents** (RME) and **total flows**. The latter include flows that are not used, in other words materials that are extracted by economic activities but which are not used directly for production or consumption, such as excavated material and straw left on the fields. These three types of flow make it possible in particular to define input and consumption indicators. The input indicators comprise the requirements of domestic and foreign materials for production (including for exports) and consumption (T 1). Depending on the type of flows included (see above), this category is made up of the following three indicators:

- Direct flows: **DMI** (*Direct Material Input*)
- Flows in RME: **RMI** (*Raw Material Input*)
- Total flows: **TMR** (*Total Material Requirement*)

The consumption indicators include all domestic and foreign materials to meet the needs of the country's domestic final demand (T 1). The consumption indicators in raw material equivalents and total raw materials are also known as "footprints". Depending on the type of flows included (see above), this category is made up of the following three indicators:

- Direct flows: **DMC** (*Domestic Material Consumption*)
- Flows in RME: **RMC** (*Raw Material Consumption*)
- Total flows: **TMC** (*Total Material Consumption*)

T 1 Input and consumption indicators

Types of flow	Direct	In RME	Totals
Input indicators	**DMI**	**RMI**	**TMR**
Included flows			
Domestic extraction used	+	+	+
Unused domestic extraction			+
Imports	+		+
Imports in RME		+	
Hidden flows linked to imports[1]			+
Consumption indicators	**DMC**	**RMC**	**TMC**
Flows subtracted from the corresponding input indicator			
Exports	–		–
Exports in RME		–	
Hidden flows linked to exports[1]			–

[1] Including unused extraction
Source: FSO – Environmental Accounts

Switzerland's RMC and TMR

For a number of years now, the FSO has been publishing the *Total Materials Requirement* (*TMR*), which differs conceptually from the *RMC* featured in this study (T 1). From a methodological point of view, the *TMR* is calculated using only coefficients based on lifecycle analyses (LCA). As the method for calculating RME is more sophisticated and comprehensive (see below), the quality of the estimates produced using this new approach can be considered superior. Furthermore, current developments at Eurostat suggest that the RME estimation methods are to be standardised at an international level. The idea of generating RME indicators (*RMC* and *RMI*) annually is to be considered in the coming months and calculation of the *TMR* based on the current approach is likely to be abandoned.

Methodology

Eurostat has developed a method for converting imports and exports from the whole EU into raw material equivalents (RME). A hybrid approach combining input-output tables (IOT) extended to the environment and lifecycle analyses (LCA) is used and the results are published annually. On this basis, Eurostat has subsequently implemented a method for estimating RME flows by country[4]. Using the results for the whole of the EU, annual coefficients are thereby generated. These coefficients represent a quantity of RME per euro or per tonne of imported or exported products. The coefficients that are currently available cover the period 2000–2012. In order to calculate imports in RME at national level, these coefficients are combined with national statistics on foreign trade and energy. To estimate exports in RME, a hybrid approach combining national IOT and coefficients of EU exports is used. The results featured in this publication are based on this method, with three exceptions: 1) coefficients of electricity imports/exports have been adjusted to reflect Swiss particularities; 2) the results for precious metals (gold, silver and platinum) that showed heavy fluctuations were smoothed (moving average); 3) gold bars (customs tariff code 7108.12) were excluded from the analysis. Moreover, the IOT that could be used for this method only exist for the years 2001, 2005 and 2008 in Switzerland: for the other years, they were interpolated. The RME indicators are therefore the result of modelling and involve a higher level of uncertainty than the direct flow indicators. They should therefore be considered as estimates.
The material flow accounts are part of the environmental accounts, which are satellite accounts of the national accounts. The environmental accounts fall within the UN's System of Environmental-Economic Accounting.

Imprint

Publisher: Federal Statistical Office (FSO)

Concept, editor: Florian Kohler

Layout: DIAM, Prepress/Print

Translations: FSO Language Service, **languages:** available as a PDF file (or in a printed version) in French, German, Italian and English

Information: Federal Statistical Office,
Section Environment, sustainable development, territory,
Florian Kohler, Tel. 058 463 6180, umwelt@bfs.admin.ch

Order number: 1251-1200, free of charge

Orders: Tel. 058 463 60 60, fax 058 463 60 61,
order@bfs.admin.ch

[4] Eurostat (2015) Handbook for estimating Raw Material Equivalents of products flows on country-level – based on Eurostat's EU RME model.