Circular material use rate

CALCULATION METHOD

2018 edition

MANUALS
AND GUIDELINES

eurostat

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Contents

Abbreviations

CMU rate	Circular material use rate
COMEXT	Statistical database on trade of goods managed by Eurostat
CPA	Statistical Classification of Products by Activity
DMC	Domestic Material Consumption
DMI	Direct Material Inputs
EU	European Union
EWC-Stat	European Waste Classification for Statistics
EW-MFA	Economy-wide material flow accounts
EXPs	Amount of exported secondary material
EXPw	Amount of exported waste bound for recovery
IMPs	Amount of imported secondary material
IMPw	Amount of imported waste bound for recovery
ITGS	International trade in goods statistics
JRC	Joint Research Centre
M	Overall material use
MFA	Material Flow Accounts
NACE	European Classification of Economic Activities
NSI	National statistical institutes
PRODCOM	European System of production statistics for mining and manufacturing
RCV_B	Recovery other than energy recovery - backfilling
RCV_E	Energy recovery
RCV_R_B	Recovery other than energy recovery
RCV_R	Recovery other than energy recovery - except backfilling
RMC	Raw Material Consumption
SEEA	System of Environmental Economic Accounting 2012
U	Circular use of materials
WStatR	Regulation on waste statistics

1 Introduction

1.1. Background

The transition to a more circular economy, where the value of products, materials and resources is maintained in the economy for as long as possible and the generation of waste minimised, is an essential contribution to the EU's efforts to develop a sustainable, low carbon, resource efficient and competitive economy. The transition towards a circular economy is the opportunity to transform our economy, create jobs and generate new and sustainable competitive advantages for Europe.

It is necessary to monitor if existing actions and policy measures in EU and the Member States are beneficial to meet the objectives of the circular economy, and to assess if the EU is on right track towards a circular economy. In December 2015 the European Commission published an EU Action Plan for the Circular Economy([1]) and thus committed to come forward with a simple and effective monitoring framework. Two years later, on 16 January 2018, the European Commission released a framework to monitor progress towards the circular economy in a Communication([2]) and a Staff Working Document([3]). This monitoring framework consists of 10 indicators, some of them with sub-indicators, addressing a whole range of aspects related to the circular economy.

In the absence of a single summary indicator about the circularity of our economies at macro economical level, Eurostat developed one new indicator for this purpose, after consulting the working group environmental accounts and other stakeholders on methodology. This new indicator is called 'Circular material use rate'. This indicator is used to monitor progress towards a circular economy on the thematic area of 'secondary raw materials'. The circular material use rate measures the contribution of recycled materials to overall materials use.

Eurostat publishes the results of the indicator in two data sets: Circular material use rate env_ac_cur and Circular material use rate by material type env_ac_curm. The former dataset reports annual estimates for all the Member States from 2010 onwards and for the EU aggregate from 2004 onwards. The latter dataset includes a breakdown by relevant material flows for the EU aggregate from 2010 onwards.

This publication presents the reference methodology for the circular material use rate indicator.

([1]) COM(2015) 614 final: http://eurlex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614

([2]) http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2018:29:FIN

([3]) http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2018:17:FIN

1.2. Circular material use rate – the basic concept

The *circular material use (CMU) rate* measures the share of material recovered and fed back into the economy — thus saving extraction of primary raw materials — in overall material use. The indicator includes flows of materials but it does not include flows of water. It includes flows of fossil fuels and energy products.

Alone the amount of material re-fed into the economy measured in absolute terms does not necessarily represent the circularity of an economy. The amount of secondary material re-fed might increase at the same pace as the overall amount of materials. In that case the circularity of the economy does not increase although the amount of re-fed materials does. Thus, some sort of reference value makes sense to which the amount of re-fed material is put into relation.

The CMU rate is defined as the ratio of the *circular use of materials (U)* to an indicator of the *overall material use (M)*:

$$CMU = \frac{U}{M} \qquad \text{(Equation 1)}$$

A higher CMU rate value means that more secondary materials substitute for primary raw materials thus reducing the environmental impacts of extracting primary material.

Numerator and denominator in equation 1 can be measured in different ways depending on considerations of analysis and data sources. Explaining them is the main purpose of this note. In principle this indicator measures both the capacity of a country to produce secondary raw materials and its effort to collect waste for recovery. In a closed economy, with no imports or exports, both are one and the same. However, in reality, countries are open economies with flows of imports and exports of waste collected in one country but treated and recycled in another one. In that case, the production (of secondary raw materials) and collection effort (of waste for recycling) in one country may not be one and the same. Therefore the CMU rate must focus on one or the other. This is a design choice. Depending on the approach sought, the CMU rate indicator may come with a different specification.

In this respect, it was decided that the CMU rate measures a country's effort to collect waste for recovery. This perspective credits the country's effort to gather waste bound for recovery which indirectly contributes to the worldwide supply of secondary materials and hence avoidance of primary material extractions. This is also the perspective taken by the Eurostat waste management indicators. For further information it is possible to visit the Eurostat's dedicated section on waste or consult the statistics explained article Waste management indicators.

The implementation of this choice is explained in section 2.2 below.

1.3. Relation with Sankey diagrams

The CMU rate indicator is closely related to Sankey diagrams of material flows which play an important role in the monitoring framework for the circular economy.

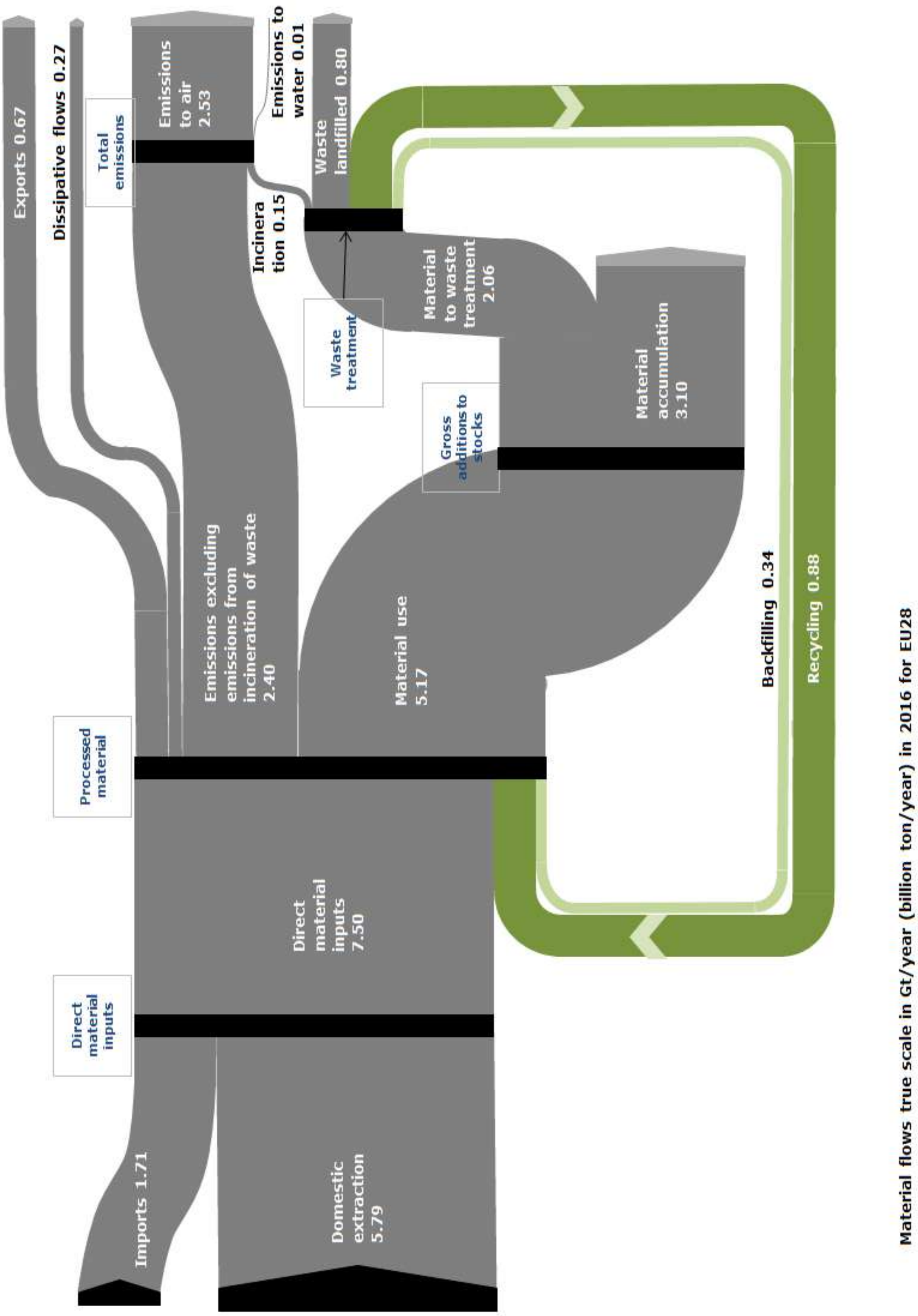
Sankey diagrams of material flows present visually the flows of materials entering in the economy — either domestically extracted or imported, the processing of materials into products, how they accumulate in societal stocks, and how they become waste and are discharged in the environment, or treated and re-fed to the economy. The Sankey diagram represents these flows from left to right. The width of the colour bands is proportional to the weight of materials flowing.

In January 2018 Eurostat published in the monitoring framework for the circular economy a Sankey diagram developed by the Joint Research Centre (JRC). It is based on Eurostat statistics of material flow accounts and waste statistics, supplemented by assumptions and models by JRC([4]).

The CMU rate intuitively represents the size of the closing loop relative to the overall amount of materials entering the economy. Ensuring full consistency between the Sankey and the CMU rate requires special care, as regards definitions, classifications, treatment of imports and exports of waste, etc. Eurostat is working on an enhanced version of the Sankey diagram which will improve this coherence and bring new features such as allowing users to interact, report more years and countries, etc. (see Figure 1–1).

([4]) Andreas Mayer, Willi Haas, Dominik Wiedenhofer, Fridolin Krausmann, Philip Nuss, Gian Andrea Blengini. 2018. Measuring Progress towards a Circular Economy - A Monitoring Framework for Economy-wide Material Loop Closing in the EU28. *Journal of Industrial Ecology*. https://onlinelibrary.wiley.com/doi/full/10.1111/jiec.12809

Figure 1–1: Material flows [Gt] in the EU-28 economy, 2016



Source: Eurostat (forthcoming)

2 Data sources and methodology

This section explains the data sources used for the CMU rate and the methodological choices followed.

2.1. Data sources

The CMU rate indicator is based on official statistics compiled by Member States and reported to Eurostat under legal obligations. They are existing data sources, requiring no additional burden on Member States. Data are available for all Member States and EU aggregates. Data for several years exist, allowing us to produce time series.

2.1.1. Waste statistics

Regulation (EC) No 2150/2002 on waste statistics (WStatR) is a framework for harmonised Community statistics in this domain. Starting with reference year 2004, the WStatR requires EU Member States to provide data on the generation, recovery and disposal of waste every second year. Data on waste treatment are used for the calculation of CMU rate. The available data set is env_wastrt, which is currently available for even reference years since 2004.

References:

- Statistics explained. Waste statistics
- Eurostat's dedicated section. Waste

2.1.2. Economy-wide material flow accounts

Economy-wide material flow accounts (EW-MFA) describes the interaction of the domestic economy with the natural environment and the rest of the world economy in terms of flows of materials (excluding water and air). EW-MFA is a statistical framework conceptually embedded in environmental-economic accounts and fully compatible with concepts, principles, and classifications of national accounts — thus enabling a wide range of integrated analyses of environmental, energy and economic issues e.g. through environmental-economic modelling. The collection of EW-MFA data is based on Regulation (EU) 691/2011.

EW-MFA provide an aggregate overview, in thousand tonnes per year, of the material flows into and out of an economy. EW-MFA cover solid, gaseous, and liquid materials, except for bulk flows of water and air.

Material inputs into national economies include domestic extraction of material originating from the domestic environment and physical imports originating from other economies. Material outputs from national economies include materials released to the domestic environment (e.g. emissions to air, water and soil) and physical exports to other economies. Material flows within the economy are not represented in EW-MFA. The available data set is env_ac_mfa.

References:

- Statistics Explained. Material flow accounts and resource productivity
- Eurostat's dedicated section. Material flows and resource productivity

2.1.3. Trade statistics

International trade in goods statistics (ITGS) published by Eurostat measure the value and quantity of goods traded between the EU Member States (intra-EU trade) and goods traded by the EU Member States with non-EU countries (extra-EU trade). 'Goods' means all movable property including electricity. 'European' means that the statistics are compiled on the basis of the concepts and definitions set out in EU legislation. European ITGS are the official harmonised source of information about exports, imports and the trade balances of the EU, its Member States and the euro area. Data is extracted from COMEXT website.

The main classification for the European ITGS is the Combined Nomenclature (CN). This is the primary nomenclature as it is the one used by the EU Member States to collect detailed data on their trading of goods.

References:

- Eurostat, Dedicated Section. International trade in goods.
- Eurostat, Statistics Explained. International trade in goods statistics - background
- Eurostat, Statistics Explained. International trade in goods

2.2. Methodology

The basic concept of the CMU rate indicator was introduced in section 1.2. It measures the circular use of materials as a share of the overall material use. For memory, equation 1 is repeated here:

$$CMU = \frac{U}{M} \qquad \text{(Equation 1)}$$

2.2.1. Specification of the denominator 'overall material use'

One perspective is that the overall material use M represents the overall amount of primary raw materials used by an economy. For this perspective *raw material consumption* (*RMC*) would be the ideal indicator. RMC represents the world-wide amount of primary raw materials directly and indirectly used by an economy([5]). Unfortunately, estimates of RMC are only available for a few European countries and the aggregated EU economy.

([5]) RMC represents the portion of annual global raw material extraction attributable to the final use of an economy.

Therefore the denominator in the CMU rate, retained for practical reasons, is the *domestic material consumption* (*DMC)* as proxy for RMC (e.g. resource productivity = *GDP*/*DMC*). Data show that the development over time of DMC and RMC is rather similar for the EU economy, thus DMC is a good proxy. The data source is economy-wide material flow accounts (EW-MFA). Data are collected on annual basis, from every Member State.

An alternative denominator considered but not retained for CMU rate was the *domestic material input (DMI)*. This is the sum of domestic extractions plus imports. Because it does not balance out materials extracted in one country and then imported by another one, the use of DMI for CMU rate would lead to double-counting in the EU aggregates, and for this reason it was not retained.

Furthermore, with a view to ensure that CMU rate has a maximum threshold of 1 (or 100 %), the overall material use M will be measured by the aggregate DMC plus the amount of circular use of materials U.

$$M = DMC + U$$

2.2.2. Approximating 'circular use of materials'

The circular use of materials U in Equation 1 can be approximated by the amount of waste recycled in domestic recovery plants and thereby indirectly or directly substituting primary raw materials. But recycled amounts of waste in treatment operations can be also corrected by imports and exports of waste destined for treatment. These two aspects are developed below.

Amount of waste recycled in domestic recovery plants

The first component of U is measured from waste statistics. It may be decomposed into the following components (cases):

a) Residual material legally declared as waste which is recovered and after treatment fed back to the economy (material flowing through the legally demarcated waste management system);

b) Residual material, outside the legal waste coverage (outside the waste management system), generated e.g. as by-product during certain production processes, and fed back into the economy. This category can further be distinguished into

   b.1) residual material subject to economic transactions between establishments([6]),

   b.2) intra-establishment flows([7]).

As regards flows of case a), residual material treated in the waste management system and fed back into the economy can be approximated using European waste statistics. In this case, U represents the flow of materials that had become legally defined waste, which after recovery is fed back into the economy and used for production, thus indirectly or directly avoiding the use of primary raw materials([8]).

As regards flows of case b), i.e. circular material flows outside the legally demarcated waste management system, hardly any official statistics exist. European production statistics (PRODCOM) cover only CPA([9]) divisions 07 to 33; i.e. data on the production of secondary raw materials (CPA

([6]) Example: A manufacturer sells steel scrap to a professional scrap trader who sells it to an electric steel plant.

([7]) A road builder on the site shredders broken-down material into aggregates used to build new roads. Notably, the material recycled on site is excluded from legal waste coverage.

([8]) See Kovanda, J. (2014) Incorporation of recycling flows into economy-wide material flow accounting and analysis: A case study for the Czech Republic. Resources, Conservation and Recycling 92 (2014) pp. 78-84

([9]) Classification of products.

codes 38.32.2 and 38.32.3) are not provided by this source. Intra-establishment circular material flows (case b.2) are not recorded by European statistics.

Using only waste statistics (i.e. approximating case a) has consequences for the interpretation of the CMU rate: it only represents the contribution of the waste management system to the circular economy. Excluded is any circular use of residual material which does not touch the waste management system and which is currently infeasible to quantify based on European statistics. In the future, the non-waste part of circular material flows may increase because of their increasing value. In other words, one may expect that retaining some value of residual materials and their circular flows will increasingly be integrated into the ordinary economy, i.e. become intermediate use. This would not show as circular use but would reduce the need for primary raw materials.

Hence, the numerator U is approximated using European waste statistics collected under Regulation (EC) No 2150/2002. European waste statistics measures the input of waste into recovery operations, not the amount of secondary raw materials that result from these operations. An analysis by Eurostat concluded that the input to recovery plants is an acceptable proxy for the output from recovery plants.

The available Eurostat data set is env_wastrt. On the basis of the treatment operations defined in the Waste Framework Directive 75/442/EEC, a distinction is made in treatment types, namely:

- Recovery - energy recovery (RCV_E). Operation R1 corresponds with the treated amount of waste used principally as fuel or other means to generate energy.
- Recovery – recycling and backfilling (RCV_R_B). RCV_R_B breaks down in RCV_R (Recovery – recycling) and RCV_B (Recovery – backfilling). RCV_R is the waste recycled in domestic recovery plants and it comprises the recovery operations R2 to R11 – as defined in the Waste Framework Directive 75/442/EEC.

For the purpose of the CMU rate indicator it is concluded that the best option is to include recycling (code: RCV_R) i.e., excluding energy recovery and backfilling. Waste statistics are available every second year but Eurostat has developed an interpolation method to have estimates every year. Data on waste treatment are currently available for the even reference years from 2004 onwards([10]).

Adjusting circular use of material for net imports of waste

Recycled amounts of waste in treatment operations can be corrected by imports and exports of waste destined for treatment. Eurostat's international trade in goods statistics (ITGS) are used to approximate the imports and exports of waste destined for recycling.

The focus of U is to represent a country's effort to collect waste for recovery, including waste collected in the country and later exported for treatment abroad. This perspective credits the country's effort to gather waste bound for recovery which indirectly contributes to the worldwide supply of secondary materials and hence avoidance of primary material extractions. This perspective is also taken by Eurostat's waste management indicators.

Consequently, the total amount of recycled waste in treatment operations is adjusted as follows:

$$U = RCV\_R - IMP_w + EXP_w$$

with:
IMP_W: amount of imported waste bound for recovery, and
EXP_W: amount of exported waste bound for recovery

The amount of waste recycled in domestic recovery plants, minus imported waste destined for recovery, plus exported waste destined for recovery abroad.

([10]) Data for the sub-categories RCV_R and RCV_B are available only from the year 2010 onwards.

Then, the CMU rate is formalised as following:

$$CMU = \frac{U}{DMC + U} = \frac{(RCV\_R - IMP_w + EXP_w)}{DMC + (RCV\_R - IMP_w + EXP_w)} \qquad \text{(Equation 2)}$$

In order to calculate the amounts of *imported waste* (IMP_W) and *exported waste* (EXP_W), Eurostat has identified the CN-codes which can be considered trade in waste([11]), see annex 1([12]). These CN-codes are coherent with the codes used for calculating the set of Eurostat waste management indicators which are already publicly available on Eurostat's website.

A perspective different from the one adopted for CMU rate may have been possible too. It would emphasise the use of secondary material recovered from former waste. This can also be regarded as contribution to the saving of primary raw material extraction on a global scale.

A country's use of secondary material recovered from former waste (apparent consumption) is composed as following:

+ secondary material produced in domestic recovery plants (approximated from RCV_R)
+ imports of secondary materials recovered from former waste
– exports of secondary materials recovered from former waste
= domestic use (apparent consumption) of secondary material recovered from former waste

The imports and exports of secondary material recovered from former waste can be aggregated to net-imports of secondary material recovered from former waste.

$$CMU' = \frac{U'}{DMC + U'} = \frac{(RCV\_R + IMP_s - EXP_s)}{DMC + (RCV\_R + IMP_s - EXP_s)} \qquad \text{(Equation 3)}$$

with:
IMP_s : amount of imported secondary material, and
EXP_s : amount of exported secondary material.

When adjusting the amounts of recycled waste in treatment operations RCV_R by imports and exports of secondary material (RCV_R + IMP_s – EXP_s), the country which uses the secondary material (recovered from former waste) get the 'credit' for the contribution to the worldwide saving of primary raw materials. This perspective seems to be closer to the national accounts' logic in which most re-attributions are directed towards final use.

Both the retained perspective for CMU rate and the alternative CMU' rate were considered reasonable and meaningful by the Eurostat working group on Environmental accounts when the issue was discussed at the May 2017 meeting. The first option was finally chosen and, therefore, the rest of this document focuses on the CMU rate as in Equation 2.

([11]) The CN codes identified are residual materials assumed to be destined for treatment in recovery plants (excl. energy and backfilling): i.e. 'material to be recovered'. It is assumed the materials also fall under the legal waste coverage, although this cannot be proved from the trade statistics.

([12]) The updated list of codes is available online: http://ec.europa.eu/eurostat/documents/8105938/8465062/cei_srm030_esmsip_CN-codes.pdf

2.3. Breakdowns by type of material

2.3.1. Consumption by material category

It is possible to consider a breakdown of CMU rate by material categories. An analysis by material category conveys the relative significance of various materials and their potential for reuse, recovery or recycling.

In order to calculate the CMU rate by material flow, data with the same classification breakdown are needed for all the components of equation 2. DMC can be broken down by material category. The challenge is to also break down U by material category.

2.3.2. Approach for the breakdown of the circular use of materials into material categories

The data source for DMC, which is EW-MFA, classifies material flows in different categories. The four main categories are biomass (MF1), metal ores (MF2), non-metallic minerals (MF3) and fossil energy carriers/materials (MF4). The total DMC of the EU economy in 2016 was estimated at 13 tonnes per capita, of which non-metallic minerals make up around 6 tonnes per capita, biomass and fossil energy materials are 3.3 and 3.0 tonnes per capita respectively, and metal ores constitute 0.7 tonnes per capita.

As waste data from the regulation on waste statistics are not reported by material flow, it is necessary to establish a correspondence between EWC-Stat waste categories and the four main material flow categories: biomass (MF1), metal ores (MF2), non-metallic minerals (MF3) and fossil energy carriers/materials (MF4).

This was achieved as follows: waste categories were divided up into different groups. Those which can be generally identified with a certain material flow (e.g. by label) were assigned in full to the respective material flow, e.g. W013 (Used Oils) was assigned to MF4 with 100 % (see table 2-1 below). The remaining waste categories (W02A, W032, W033, W05, W101, W102, W103, W121) required a split assignment to the material flows, and were analysed in more detail i.e. on the level of associated list of waste codes and on the basis of the national waste statistics of Germany. The split was based on waste composition data where such data were available or on estimates.

The determined factors for the correspondence from EWC-Stat categories to the four material flow categories MF1 to MF4 are shown in Table 2–1.

Table 2–1: Correspondence factors from EWC-Stat waste categories to material categories

Code	EWC-Stat label	MF1 biomass	MF2 Metal ores	MF3 Non-metallic minerals	MF4 Fossil energy carriers
Total	Total Waste	0%	0%	0%	0%
W011	Spent solvents	0%	0%	0%	100%
W012	Acid, alkaline or saline wastes	0%	0%	100%	0%
W013	Used oils	0%	0%	0%	100%
W02A	Chemical wastes (W014+W02+W031)	7%	16%	18%	59%
W032	Industrial effluent sludges	42%	8%	43%	6%
W033	Sludges and liquid wastes from waste treatment	21%	16%	47%	16%
W05	Health care and biological wastes	62%	1%	3%	35%
W061	Metal wastes, ferrous	0%	100%	0%	0%
W062	Metal wastes, non-ferrous	0%	100%	0%	0%
W063	Metal wastes, mixed ferrous and non-ferrous	0%	100%	0%	0%
W071	Glass wastes	0%	0%	100%	0%
W072	Paper and cardboard wastes	100%	0%	0%	0%
W073	Rubber wastes	0%	0%	0%	100%
W074	Plastic wastes	0%	0%	0%	100%
W075	Wood wastes	100%	0%	0%	0%
W076	Textile wastes	30%	0%	0%	70%
W077	Waste containing PCB	0%	0%	100%	0%
W08A	Discarded equipment (W08 except W081, W0841)	0%	100%	0%	0%
W081	Discarded vehicles	0%	100%	0%	0%
W0841	Batteries and accumulators wastes	0%	100%	0%	0%
W091	Animal and mixed food waste	100%	0%	0%	0%
W092	Vegetal wastes	100%	0%	0%	0%
W093	Animal faeces, urine and manure	100%	0%	0%	0%
W101	Household and similar wastes	64%	7%	12%	16%
W102	Mixed and undifferentiated materials	31%	11%	9%	48%
W103	Sorting residues	50%	10%	11%	30%
W11	Common sludges	100%	0%	0%	0%
W121	Mineral waste from construction and demolition	1%	0%	96%	3%
W12B	Other mineral wastes (12.2, 12.3, 12.5)	0%	0%	100%	0%
W124	Combustion wastes	0%	0%	100%	0%
W126	Soils	0%	0%	100%	0%
W127	Dredging spoils	0%	0%	100%	0%
W128_13	Mineral wastes from waste treatment and stabilised wastes	0%	0%	100%	0%

This conversion has the following caveats and limitations:

- The water content of the waste was ignored for the conversion. It may result in a bias for waste with a high waters content (e.g. for oil emulsions or for some chemical wastes). The impact is limited because the concerned waste types are less important in terms of quantities. The problem does not exist for the EWC-Stat categories industrial effluent sludges (W032), common sludges (W11) and dredging spoils (W127) because these categories are reported in dry weight.
- In the calculation above, all material components of a waste category are counted as recovered although the recovery process usually aims only at a part of material components. Accordingly, losses and the share of material components not recovered are not considered in the calculation.
- The conversion factors were based on German waste statistics. Considering that the amounts and types of waste that are recovered vary from country to country this may hamper the application of the factors to other countries.
- In waste statistics, the amounts of metal waste refer to the pure metal whereas the MFA data refer to the metal ore. Data are thus not fully aligned.

The correspondence in Table 2–1 is possible only for data for the reference year 2010 and onwards. Before 2010, WStatR recovery data had a different breakdown which does not allow identifying waste amounts entering in recovery operations, excluding backfilling and energy recovery (i.e. RCV_R). Correspondingly a conversion of the old breakdown is not feasible before 2010. Whereas this variable may be estimated with sufficiently good results at EU level([13]), for some Member States it is not and analyses are ongoing.

([13]) At EU level, the ratio of waste recycled over total recovery is fairly stable, so we have used the average of the years 2010 to 2014 to estimate the amount of waste recycled (AM=0.789517; σ=0.01).

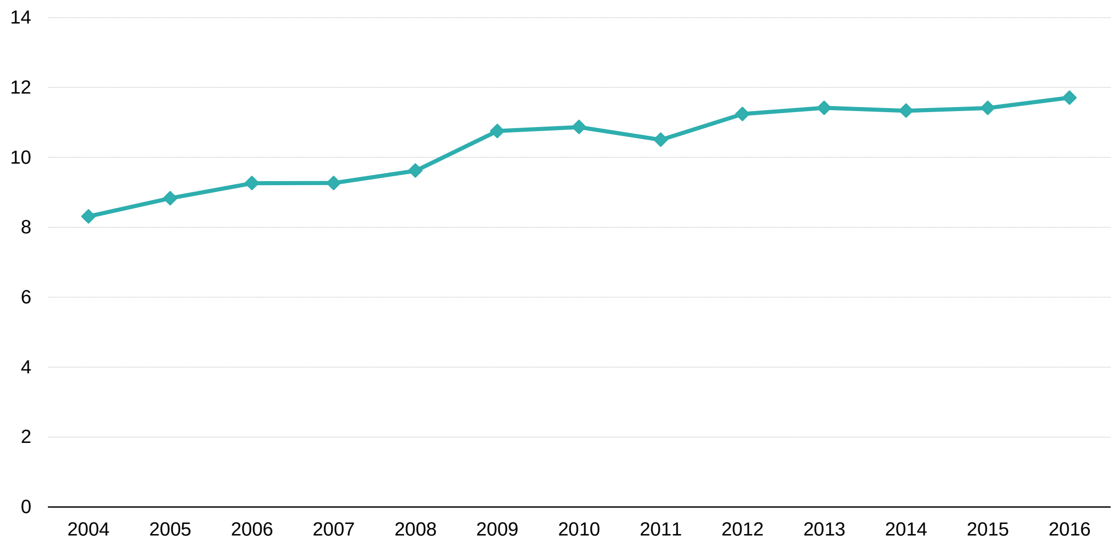
3 Results and interpretation

This section presents some CMU rate results with a view to present his main characteristics. The analysis is based on data for 2016([14]) and previous years, which is the most recent data available at the time of this writing.

Figure 3–1 shows the evolution of the EU-28 CMU rate from 2004 to 2016.

Figure 3–1: **Circular material use rate, in percentage, EU-28**

(%)

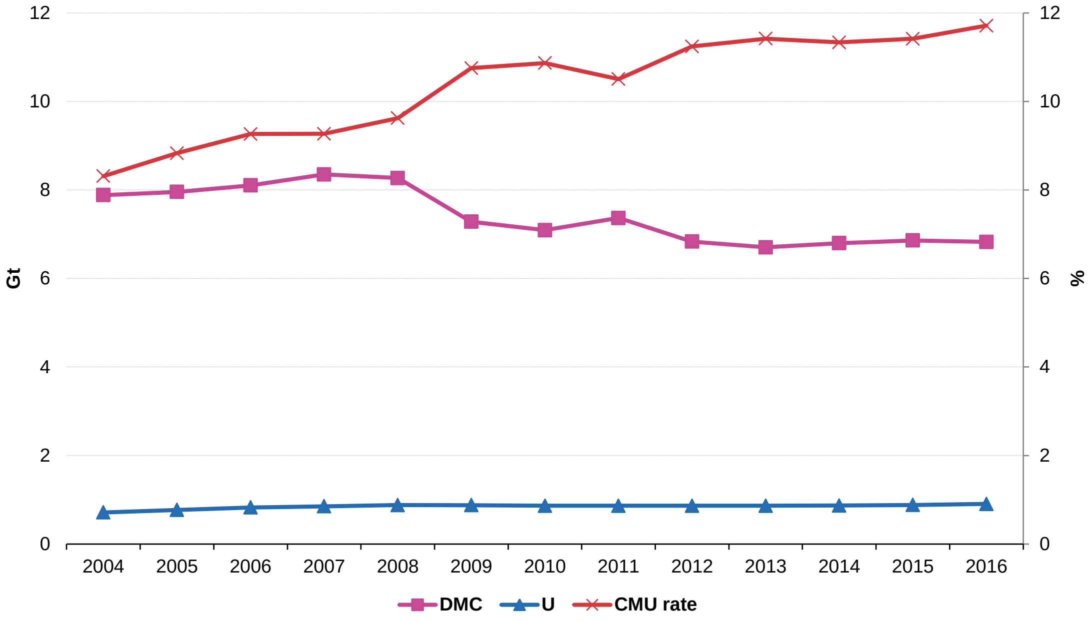


Source: Eurostat (online data code: cei_srm030)

The CMU rate for the EU 28 has a steady upward trend from 8.3 % in 2004 to 11.7 % in 2016, with a small dip in 2011. The improvement of the indicator is primarily due to the decrease of the DMC rather than an improvement of the amount of waste recycled, as we can see in figure 3–2. In the year 2008 more than 880 million tonnes of waste were recycled. From that year on, the amount steadily decreased down to 864 million tonnes in 2013, to raise again in 2016 to 906 million tonnes. On the other hand, DMC has dropped from 8 270 million tonnes in 2008 to 6 827 million tonnes in 2016.

([14]) Recycling data (RCV_R) have not yet been published for Austria, Czechia, Germany, Greece and Luxembourg for 2016.

Figure 3–2: **Circular material use rate, domestic material consumption and circular use of materials, EU-28**



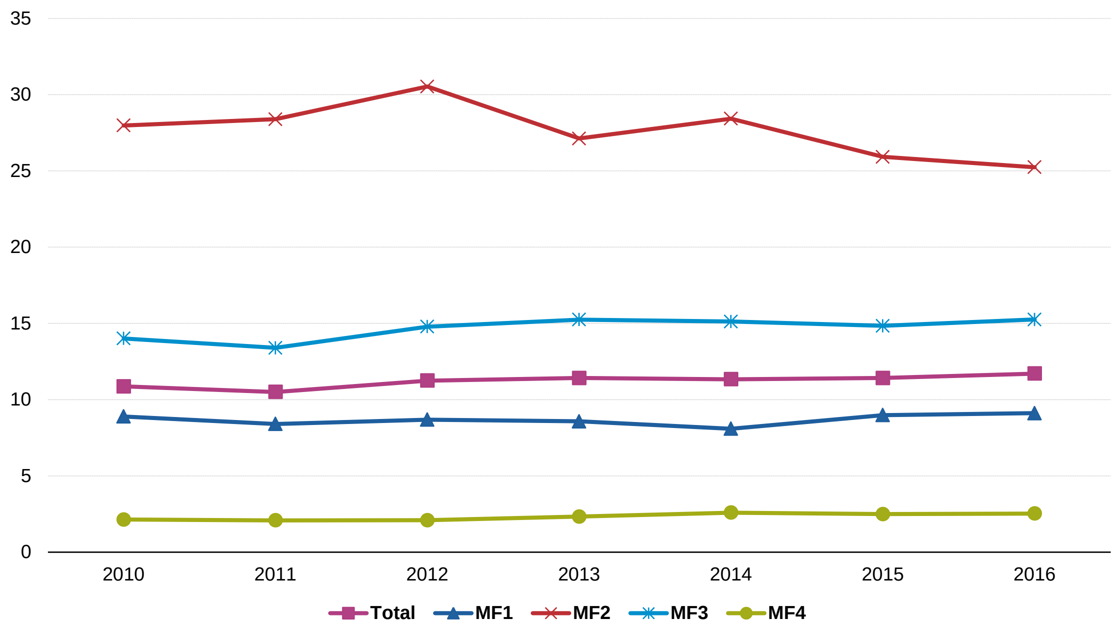
Note: DMC and U: primary axis; Circular material use rate: secondary axis

Source: Eurostat (online data codes: cei_srm030, env_wastrt, env_ac_mfa)

The breakdown of the EU-28 CMU rate by material categories is shown in Figure 3–3.

Figure 3–3: **Circular material use rate by material categories, EU-28**

(%)



Source: Eurostat (online data code: env_ac_curm)

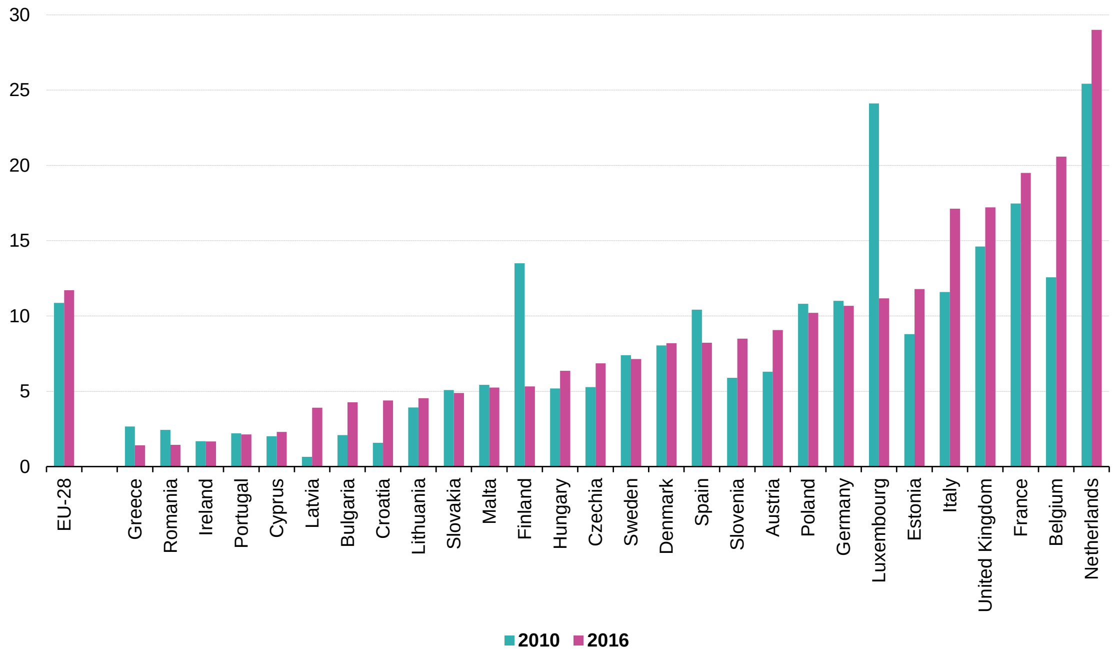
The material with highest CMU rate corresponds to metal ores (MF2), followed by non-metallic minerals (MF3), biomass (MF1) and fossil energy carriers/materials (MF4).

The complete list of values for the different components of the CMU rate, based on the numerator and denominator discussed in the previous section can be found in Annex 2.

Figure 3–4 shows the evolution of the CMU rate in the European Union and Member States between 2010 and 2016.

Figure 3–4: Circular material use rate, by Member States and EU-28, 2010 and 2016 ([1])

(%)



([1]) Data are not available for Austria, Czechia, Germany, Greece and Luxembourg. 2014 data instead of 2016.

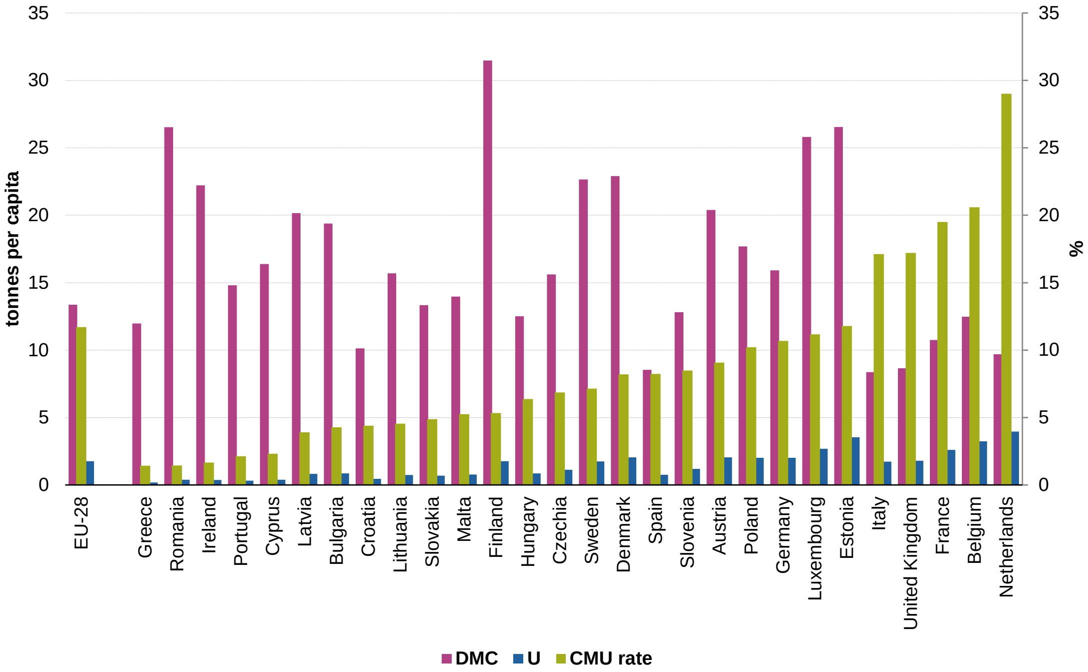
Source: Eurostat (online data code: cei_srm030)

There are big differences of CMU rate across countries: they range between 1.5 % in Romania to 29.0 % in the Netherlands, in 2016.

To better understand these differences, let's look separately at U and DMC. Figure 3–5 shows the values of the CMU rate, the domestic material consumption and circular use of materials per capita for all Member States and EU aggregate. Figure 3–5 shows the strong influence of structural differences of national economies e.g. low DMC (Italy, Spain, United Kingdom) and high recovery capacities e.g. U in The Netherlands, Estonia or Belgium.

The comparison of CMU rates across countries becomes only meaningful when the economic structure is considered. A mere ranking of countries according to the achieved rates is not very telling unless it is recognised that their economies have different structures and starting points.

Figure 3–5: Circular material use rate, domestic material consumption and circular use of materials (1), 2016



(1) Data are not available for Austria, Czechia, Germany, Greece and Luxembourg. 2014 data instead of 2016.

Note: DMC and U: primary axis; Circular material use rate: secondary axis

Source: Eurostat (online data codes: env_ac_cur; env_wastrt, env_ac_mfa, demo_gind)

4 Next steps

Eurostat intends to continue developing the circular material use rate in the next years, as far as resources and existing capacity allow. Eurostat is already thinking of possible improvements. Some areas identified are:

Improved visual tools:

- An improved Sankey diagram of material flows. It would be more interactive and methodologically better aligned to the CMU rate indicator.

Sources and methods:

- Further clarify borderlines between products, materials, residuals;
- More and better data on production and trade of secondary raw materials;
- Publication of results with more detail by material than the four categories presently published;
- Further improve connections between material flow accounts and waste statistics;
- Further improve availability and quality of estimates of material footprints (raw material consumption);
- Clarify terminology e.g. recycling vs recovery; complete cycle vs concrete steps. Promote common and proper use of terminology among producers of statistics (not only in the WG environmental accounts but also in other groups, e.g., waste statistics).

5 Conclusions

This document presents the methodology for the newly developed indicator CMU rate. This indicator represents the amount of material re-fed into the economy measured as a share of the overall material use.

Some design decisions were taken for this indicator:

First, it was decided to exclude energy recovery and backfilling, so that the CMU rate covers exclusively material recovery.

Secondly, it was decided to focus the CMU rate on the perspective of a country's effort to collect waste for recovery which indirectly contributes to the worldwide supply of secondary materials. This is also the perspective taken by Eurostat waste management indicators. This approach requires deducting the amount of imported waste bound for recovery and adding the exports of waste bound for recovery. Imports and exports of waste bound for recovery are identified on the basis of CN-codes. An alternative perspective considered but not retained for the CMU rate was to measure the country's use of secondary material recovered from former waste. This approach would have required adding the imports of secondary materials recovered from former waste less the exports of secondary materials recovered from former waste.

Thirdly, the choice for the denominator was the domestic material consumption (DMC*)* as proxy for material footprints (RMC), as the latter are only available for a few European countries and the aggregated EU-28 economy. Another denominator considered was the domestic material input (DMI) but it was not retained because it would lead to double-counting in the EU aggregates.

The CMU rate is calculated on the basis of existing official statistics compiled by Member States and reported to Eurostat under legal obligations. They require no additional burden on Member States. Data are available for all Member States and EU aggregates. Data for several years exist, allowing producing time series.

The data sources are waste statistics based on Regulation (EC) No 2150/2002, Economy-wide material flow accounts based on Regulation (EU) 691/2011 and International trade in goods statistics from the COMEXT database. The use of those sources has consequences for the interpretation of the CMU rate as regards the material flows that are included and excluded.

A breakdown by type of material flows was developed, based on a correspondence from waste statistics categories to the four material flow categories in EW-MFA. This correspondence is only possible for 2010 data onwards.

Eurostat intends to continue developing the circular material use rate in the next years, as far as resources and existing capacity allow.

It is also important to mention that the Eurostat CMU rate could differ from National statistical institutes (NSI) indicators due to various reasons, like differences in methodology, source data or selection of materials included. That not-identical methodology can contribute to the confusion among users. This is why it is important to emphasize that Eurostat has some constraints, in the way that the CMU rate can only use data available at EU level — i.e., available for all the countries. For some countries, more detailed data may allow improve the indicator.

Annexes

Annex 1. List of CN codes used for indicator calculation — from year 2004 onwards

CN-code	Description of CN-code (label)	Material
5059000	Skins and other parts of birds, with their feathers or down, feathers and parts of feathers, whether or not with trimmed edges, not further worked than cleaned, disinfected or treated for preservation; powder and waste of feathers or parts of feathers (excl. feathers used for stuffing and down)	MF1
5119110	Fish waste	MF1
5119910	Sinews or tendons of animal origin, parings and similar waste of raw hides or skins	MF1
9019010	Coffee husks and skins	MF1
15220091	Oil foots and dregs; soapstocks (excl. those containing oil with characteristics of olive oil)	MF1
15220099	Residues from treatment of fatty substances or animal and vegetable waxes (excl. those containing oil with characteristics of olive oil, oil foots and dregs and soapstocks)	MF1
18020000	Cocoa shells, husks, skins and other cocoa waste	MF1
23033000	Brewing or distilling dregs and waste	MF1
23070011	Wine lees, having a total alcoholic strength of <= 7,9% mas and a dry matter content >= 25% by weight	MF1
23070019	Wine lees (excl. wine lees having a total alcoholic strength of <= 7,9% and a dry matter content of >= 25% by weight)	MF1
24013000	Tobacco refuse	MF1
25253000	Mica waste	MF3
26190020	Waste from the manufacture of iron or steel suitable for the recovery of iron or manganese	MF3
26190040	Slag from the manufacture of iron or steel suitable for the extraction of titanium oxide	MF3
26190080	Slag, dross, scalings and other waste from the manufacture of iron or steel (excl. granulated slag, waste suitable for the recovery of iron or manganese and slag suitable for the extraction of titanium oxide)	MF3
26190090	Slag, dross, scalings and other waste from the manufacture of iron or steel (excl. granulated slag, waste suitable for the recovery of iron or manganese)	MF3
26201100	Hard zinc spelter	MF2
26201900	Slag, ash and residues containing mainly zinc (excl. hard zinc spelter)	MF2

CN-code	Description of CN-code (label)	Material
26202900	Slag, ash and residues containing mainly lead (excl. leaded gasoline sludges and leaded anti-knock compound sludges)	MF2
26203000	Slag, ash and residues containing mainly copper	MF2
26204000	Slag, as and residues containing mainly aluminium	MF2
26206000	Slag, ash and residues, containing arsenic, mercury, thallium or their mixtures, of a kind used for the extraction of arsenic or those metals or for the manufacture of their chemical compounds (excl. those from the manufacture of iron or steel)	MF2
26209100	Slag, ash and residues, containing antimony, beryllium, cadmium, chromium or their mixtures (excl. those from the manufacture of iron or steel)	MF2
26209910	Slag, ash and residues containing mainly nickel	MF2
26209920	Slag, ash and residues containing mainly niobium or tantalum	MF2
26209940	Slag, ash and residues containing mainly tin	MF2
26209960	Slag, ash and residues containing mainly titanium	MF2
26209995	Slag, ash and residues containing metals or metal compounds (excl. those from the manufacture of iron or steel and those containing primarily zinc, lead, copper, aluminium, nickel, niobium, tantalum, tin or titanium, those containing arsenic, mercury, tha	MF2
26219000	Slag and ash, incl. seaweed ash "kelp" (excl. slag, incl. granulated, from the manufacture of iron or steel, ashes and residues containing arsenic, metals or metal compounds and those from the incineration of municipal waste)	MF3
27109900	Waste oils containing mainly petroleum or bituminous minerals (excl. those containing polychlorinated biphenyls [PCBs], polychlorinated terphenyls [PCTs] or polybrominated biphenyls [PBBs])	MF4
27139010	Residues of petroleum oil or of oil obtained from bituminous minerals for the manufacture of carbon of heading 2803	MF4
39151000	Waste, parings and scrap, of polymers of ethylene	MF4
39152000	Waste, parings and scrap, of polymers of styrene	MF4
39153000	Waste, parings and scrap, of polymers of vinyl chloride	MF4
39159011	Waste, parings and scrap, of polymers of propylene	MF4
39159018	Waste, parings and scrap, of addition polymerization products (excl. that of polymers of ethylene, styrene and vinyl chloride and propylene)	MF4
39159080	Waste, parings and scrap, of plastics (excl. that of polymers of ethylene, styrene, vinyl chloride and propylene)	MF4
39159090	Waste, parings and scrap, of plastics (excl. that of addition polymerization products)	MF4
40122000	Used pneumatic tyres of rubber	MF4
40122010	Used pneumatic tyres of rubber, for civil aircraft	MF4
40122090	Used pneumatic tyres of rubber (excl. Those for civil aircraft of subheading 40 4012.20.10)	MF4
41152000	Parings and other waste of leather or of composition leather, not suitable for the manufacture of leather articles; leather dust, powder and flour	MF1
47071000	Recovered "waste and scrap" paper or paperboard of unbleached kraft paper, corrugated paper or corrugated paperboard	MF1
47072000	Recovered "waste and scrap" paper or paperboard made mainly of bleached chemical pulp, not coloured in the mass	MF1
47073010	Old and unsold newspapers and magazines, telephone directories, brochures and printed advertising material	MF1
47073090	Waste and scrap of paper or paperboard made mainly of mechanical pulp (excl. old and unsold newspapers and magazines, telephone directories, brochures and printed advertising material)	MF1

CN-code	Description of CN-code (label)	Material
47079010	Unsorted, recovered "waste and scrap" paper or paperboard (excl. paper wool)	MF1
47079090	Sorted, recovered "waste and scrap" paper or paperboard (excl. waste and scrap of unbleached kraft paper or kraft paperboard, or of corrugated paper or corrugated paperboard, that of paper or paperboard made mainly of bleached chemical pulp not colured in the mass, that of paper or paperboard made mainly of mechanical pulp, and paper wool)	MF1
50030000	Silk waste, incl. cocoons unsuitable for reeling, yarn waste and garnetted stock	MF1
50031000	Silk waste, incl. cocoons unsuitable for reeling, yarn waste and garnetted stock, neither carded nor combed	MF1
50039000	Silk waste, incl. cocoons unsuitable for reeling, yarn waste and garnetted stock, carded or combed	MF1
51032000	Waste of wool or of fine animal hair, incl. yarn waste (excl. noils and garnetted stock)	MF1
51032010	Yarn waste of wool of of fine animal hair	MF1
51032091	Waste of wool or of fine animal hair, non-carbonised (excl. yarn waste, noils and garnetted stock)	MF1
51032099	Waste of wool of fine animal hair, carbonised (excl. yarn waste, noils and garnetted stock)	MF1
51033000	Waste of coarse animal hair, incl. yarn waste (excl. garnetted stock, waste of hair or bristles used in the manufacture of brooms and brushes, and of horsehair from the mane or tail)	MF1
52021000	Cotton yarn waste, incl. thread waste	MF1
52029100	Garnetted stock of cotton	MF1
52029900	Cotton waste (excl. yarn waste, thread waste and garnetted stock)	MF1
53013000	Flax tow and waste, incl. yarn waste and garnetted stock	MF1
53013010	Flax tow	MF1
53013090	Flax waste, incl. yarn waste and garnetted stock	MF1
55051010	Waste of staple fibres of nylon or other polyamides, incl. noils, yarn waste and garnetted stock	MF4
55051030	Waste of staple fibres of polyesters, incl. noils, yarn waste and garnetted stock	MF4
55051050	Waste of acrylic or modacrylic staple fibres, incl. noils, yarn waste and garnetted stock	MF4
55051070	Waste of polypropylene staple fibres, incl. noils, yarn waste and garnetted stock	MF4
55051090	Waste of synthetic staple fibres, incl. noils, yarn waste and garnetted stock (excl. that of polypropylene, acrylic, modacrlyic, polyester, nylon and other polyamide staple fibres)	MF4
55052000	Waste of artificial staple fibres, incl. noils, yarn waste and garnetted stock	MF4
63090000	Worn clothing and clothing accessories, blankets and travelling rugs, household linen and articles for interior furnishing, of all types of textile materials, incl. all types of footwear and headgear, showing signs of appreciable wear and presented in bulk or in bales, sacks or similar packings (excl. carpets, other floor coverings and tapestries)	MF4
63101000	Used or new rags, scrap twine, cordage, rope and cables and worn-out articles thereof, of textile materials, sorted	MF4
63101010	Used or new rags, scrap twine, cordage, rope and cables and worn-out articles thereof, of wool or fine or coarse animal hair, sorted	MF1
63101030	Used or new rags, scrap twine, cordage, rope and cables and worn-out articles thereof, of flax or cotton, sorted	MF1

CN-code	Description of CN-code (label)	Material
63101090	Used or new rags, scrap twine, cordage, rope and cables and worn-out articles thereof, of textile materials, sorted (excl. flax, cotton, wool or fine or coarse animal hair)	MF1
63109000	Used or new rags, scrap twine, cordage, rope and cables and worn-out articles thereof, of textile materials (excl. sorted)	MF1
70010010	Cullet and other waste and scrap of glass (excl. glass in the form of powder, granules or flakes)	MF3
71123000	Ash containing precious metal or precious-metal compounds	MF2
71129100	Waste and scrap of gold, incl. metal clad with gold, and other waste and scrap containing gold or gold compounds, of a kind used principally for the recovery of precious metal (excl. ash containing gold or gold compounds, waste and scrap of gold melted down into unworked blocks, ingots, or similar forms, and sweepings and ash containing precious metals)	MF2
71129200	Waste and scrap of platinum, incl. metal clad with platinum, and other waste and scrap containing platinum or platinum compounds, of a kind used principally for the recovery of precious metal (excl. ash containing platinum or platinum compounds, waste and scrap of platinum melted down into unworked blocks, ingots, or similar forms, and sweepings and ash containing precious metals)	MF2
71129900	Waste and scrap of silver, incl. metal clad with silver, and other waste and scrap containing silver or silver compounds, of a kind used principally for the recovery of precious metal (excl. ash, and waste and scrap of precious metals melted down into unworked blocks, ingots or similar forms)	MF2
72041000	Waste and scrap, of cast iron (excl. radioactive)	MF2
72042110	Waste and scrap of stainless steel, containing by weight >= 8% nickel (excl. radioactive, and waste and scrap from batteries and electric accumulators)	MF2
72042190	Waste and scrap of stainless steel (not containing >= 8% nickel, radioactive, or waste and scrap from batteries and electric accumulators)	MF2
72042900	Waste and scrap of alloy steel (excl. stainless steel, and waste and scrap, radioactive, or waste and scrap from batteries and electric accumulators)	MF2
72043000	Waste and scrap of tinned iron or steel (excl. radioactive, and waste and scrap of batteries and electric accumulators)	MF2
72044110	Turnings, shavings, chips, milling waste, sawdust and filings, of iron or steel, whether or not in bundles (excl. such items of cast iron, alloy steel or tinned iron or steel)	MF2
72044191	Trimmings and stampings, of iron or steel, in bundles (excl. such items of cast iron, alloy steel or tinned iron or steel)	MF2
72044199	Trimmings and stampings, of iron or steel, not in bundles (excl. such items of cast iron, alloy steel or tinned iron or steel)	MF2
72044910	Waste and scrap of iron or steel, fragmentised "shredded" (excl. slag, scale and other waste of the production of iron and steel; radioactive waste and scrap; fragments of pigs, blocks or other primary forms of pig iron or spiegeleisen; waste and scrap of cast iron, alloy steel or tinned iron or steel; turnings, shavings, chips, milling waste, sawdust, filings, trimmings and stampings; waste and scrap of primary cells, primary batteries and electric accumulators)	MF2
72044930	Waste and scrap of iron or steel, not fragmentised "shredded", in bundles (excl. slag, scale and other waste of the production of iron and steel; radioactive waste and scrap; fragments of pigs, blocks or other primary forms of pig iron or spiegeleisen; waste and scrap of cast iron, alloy steel or tinned iron or steel; turnings, shavings, chips, milling waste, sawdust, filings, trimmings and stampings; waste and scrap of primary cells, primary batteries and electric accumulators)	MF2

CN-code	Description of CN-code (label)	Material
72044990	Waste and scrap of iron or steel, not fragmentised "shredded", not in bundles (excl. slag, scale and other waste of the production of iron and steel; radioactive waste and scrap; fragments of pigs, blocks or other primary forms of pig iron or spiegeleisen; waste and scrap of cast iron, alloy steel or tinned iron or steel; turnings, shavings, chips, milling waste, sawdust, filings, trimmings and stampings; waste and scrap of primary cells, primary batteries and electric accumulators)	MF2
74040010	'Waste and scrap, of refined copper (excl. ingots or other similar unwrought shapes, of remelted refined copper waste and scrap, ashes and residues containing refined copper, and waste and scrap of primary cells, primary batteries and electric accumulators)	MF2
74040091	Waste and scrap, of copper-zinc base alloys "brass" (excl. ingots or other similar unwrought shapes, of remelted waste and scrap of copper-zinc alloys, ashes and residues containing copper-zinc alloys and waste and scrap of primary cells, primary batteries and electric accumulators)	MF2
74040099	Waste and scrap, of copper alloys (excl. of copper-zinc alloys, ingots or other similar unwrought shapes, of remelted waste and scrap of copper alloys, ashes and residues containing copper alloys, and waste and scrap of primary cells, primary batteries and electric accumulators)	MF2
75030010	Waste and scrap, of non-alloy nickel (excl. ingots or other similar unwrought shapes, of remelted non-alloy nickel waste and scrap, ashes and residues containing non-alloy nickel, waste and scrap of primary cells, primary batteries and electric accumulators)	MF2
75030090	Waste and scrap, of nickel alloys (excl. ingots or other similar unwrought shapes, of remelted nickel alloys waste and scrap, ashes and residues containing nickel alloys)	MF2
76020011	Turnings, shavings, chips, milling waste, sawdust and filings, of aluminium; waste of coloured, coated or bonded sheets and foil, of a thickness "excl. any backing" of <= 0,2 mm, of aluminium	MF2
76020019	Waste of aluminium, incl. faulty workpieces and workpieces which have become unusable in the course of production or processing (excl. slag, scale and other waste from the production of iron or steel, containing recyclable aluminium in the form of silicates, ingots and other primary forms, of smelted waste or scrap, of aluminium, ash or the residues of the production of aluminium, and waste in heading 7602.00.11)	MF2
76020090	Scrap of aluminium (excl. slags, scale and the like from iron and steel production, containing recoverable aluminium in the form of silicates, ingots or other similar unwrought shapes, of remelted waste and scrap, of aluminium, and ashes and residues from aluminium production)	MF2
78020000	Lead waste and scrap (excl. ashes and residues from lead production "heading No 2620", and ingots or other similar unwrought shapes, of remelted waste and scrap, of lead "heading No 7801" and waste and scrap of primary cells, primary batteries et electric accumulators)	MF2
79020000	Zinc waste and scrap (excl. ash and residues from zinc production "heading 2620", ingots and other similar unwrought shapes, of remelted waste and scrap, of zinc "heading 7901" and waste and scrap of primary cells, primary batteries and electric accumulators)	MF2
79031000	Zinc dust	MF2
79039000	Zinc powders and flakes (excl. grains of zinc, and spangles of heading 8308, and zinc dust)	MF2
80020000	Tin waste and scrap (excl. ash and residues from the manufacture of tin of heading 2620, and ingots and similar unwrought tin produced from melted tin waste and scrap of heading 8001)	MF2

CN-code	Description of CN-code (label)	Material
81019700	Tungsten waste and scrap (excl. ash and residues containing tungsten)	MF2
81029700	Molybdenum waste and scrap (excl. ash and residues containing molybdenum)	MF2
81033000	Tantalum waste and scrap (excl. ash and residues containing tantalum)	MF2
81042000	Magnesium waste and scrap (excl. ash and residues containing magnesium, and raspings, turnings and granules graded according to size)	MF2
81053000	Cobalt waste and scrap (excl. ash and residues containing cobalt)	MF2
81060010	Unwrought bismuth; bismuth powders; bismuth waste and scrap (excl. ash and residues containing bismuth)	MF2
81073000	Cadmium waste and scrap (excl. ashes and residues containing cadmium)	MF2
81083000	Titanium waste and scrap (excl. ash and residues containing titanium)	MF2
81093000	Zirconium waste and scrap (excl. ash and residues containing zirconium)	MF2
81102000	Antimony waste and scrap (excl. ash and residues containing antimony)	MF2
81110019	Manganese waste and scrap (excl. ash and residues containing manganese)	MF2
81121300	Beryllium waste and scrap (excl. ashes and residues containing beryllium)	MF2
81122200	Chromium waste and scrap (excl. ash and residues containing chromium and chromium alloys containing > 10% by weight of nickel)	MF2
81123040	Germanium waste and scrap (excl. ashes and residues containing germanium)	MF2
81124010	Unwrought vanadium; vanadium powders; vanadium waste and scrap (excl. ash and residues containing vanadium)	MF2
81125200	Thallium waste and scrap (excl. ashes and residues containing thallium)	MF2
81129210	Unwrought hafnium "celtium"; hafnium powders; hafnium waste and scrap (excl. ash and residues containing hafnium)	MF2
81129221	Niobium "columbium", rhenium, gallium, indium, vanadium and germanium waste and scrap (excl. ashes and residues containing these metals)	MF2
81129239	Niobium "columbium" and rhenium waste and scrap (excl. ash and residues containing these metals)	MF2
81129250	Gallium and indium waste and scrap (excl. ashes and residues containing these metals)	MF2
81129291	Unwrought vanadium; vanadium powders (excl. ash and residues containing vanadium)	MF2
81130040	Waste and scrap of cermets (excl. ashes and residues containing cermets)	MF2
85481010	Spent primary cells and spent primary batteries, electrical	MF2
85481021	Spent electric lead-acid accumulators	MF2
85481029	Spent electric accumulators (excl. lead-acid accumulators)	MF2
85481091	Waste and scrap of electric primary cells, primary batteries and accumulators, containing lead	MF2
85481099	Waste and scrap of electric primary cells, primary batteries and accumulators (excl. those containing lead)	MF2
89080000	Vessels and other floating structures for breaking up	MF2

Annex 2. Circular material use rate, domestic material consumption, recycling and imports/exports of waste

Note: this annex reports the components of the indicator by country and year, so that readers can replicate the Eurostat estimates.

geo	year	DMC (thousand tonnes)	RCV_R (thousand tonnes)	EXPw (thousand tonnes)	IMPw (thousand tonnes)	CMU rate (%)
EU-28	2010	7 092 109.9	835 460.0	37 845.0	8 546.3	10.9
EU-28	2011	7 366 221.6	834 610.0	39 083.5	9 105.9	10.5
EU-28	2012	6 834 229.8	833 760.0	40 014.8	8 115.8	11.2
EU-28	2013	6 703 167.8	837 460.0	34 974.9	8 407.2	11.4
EU-28	2014	6 797 578.6	841 160.0	36 006.0	8 149.2	11.3
EU-28	2015	6 859 229.9	858 325.0	33 388.3	7 861.2	11.4
EU-28	2016	6 827 163.1	875 490.0	38 387.4	8 324.7	11.7
Austria	2010	170 039.5	12 186.3	2 122.1	2 878.6	6.3
Austria	2011	179 517.6	13 236.4	2 167.8	3 081.2	6.4
Austria	2012	176 476.0	14 286.5	2 199.1	2 943.1	7.1
Austria	2013	174 771.5	16 495.0	2 195.1	2 951.7	8.3
Austria	2014	176 001.7	18 703.6	2 253.2	3 399.1	9.1
Austria	2015	174 095.9	:	2 270.7	3 379.0	:
Austria	2016	178 085.9	:	2 412.9	3 389.5	:
Belgium	2010	164 275.9	24 106.9	8 068.9	8 551.5	12.6
Belgium	2011	174 466.9	27 848.5	8 123.7	8 868.5	13.4
Belgium	2012	156 256.7	31 590.0	7 975.9	8 472.5	16.6
Belgium	2013	151 462.6	32 197.8	7 186.3	8 253.3	17.0
Belgium	2014	147 283.4	32 805.6	8 750.4	9 010.8	18.1
Belgium	2015	145 782.3	35 018.9	7 644.7	8 141.2	19.1
Belgium	2016	141 353.5	37 232.2	7 907.1	8 492.4	20.6
Bulgaria	2010	120 746.2	1 922.4	1 089.4	429.1	2.1
Bulgaria	2011	133 714.0	1 855.4	1 024.9	411.1	1.8
Bulgaria	2012	128 520.6	1 788.5	960.7	314.4	1.9
Bulgaria	2013	124 052.1	2 674.5	813.9	304.3	2.5
Bulgaria	2014	135 626.8	3 560.5	600.9	342.9	2.7
Bulgaria	2015	153 073.0	4 809.3	471.8	355.9	3.1
Bulgaria	2016	138 135.7	6 058.1	512.4	397.0	4.3
Croatia	2010	44 613.0	403.2	501.8	185.0	1.6
Croatia	2011	44 172.8	698.7	663.5	262.6	2.4
Croatia	2012	40 240.3	994.1	678.0	173.0	3.6
Croatia	2013	42 337.7	1 284.7	578.0	217.4	3.7
Croatia	2014	38 581.8	1 575.2	559.6	278.3	4.6
Croatia	2015	40 978.9	1 656.2	482.2	280.2	4.3
Croatia	2016	42 255.3	1 737.2	565.0	362.1	4.4
Cyprus	2010	23 084.6	314.6	161.1	1.1	2.0
Cyprus	2011	22 656.6	361.6	205.7	3.3	2.4

geo	year	DMC (thousand tonnes)	RCV_R (thousand tonnes)	EXPw (thousand tonnes)	IMPw (thousand tonnes)	CMU rate (%)
Cyprus	2012	16 626.9	408.5	204.1	1.2	3.5
Cyprus	2013	12 014.5	326.6	168.3	1.1	3.9
Cyprus	2014	11 927.9	244.8	143.4	0.7	3.1
Cyprus	2015	12 000.3	224.3	129.9	1.0	2.9
Cyprus	2016	13 945.7	203.9	129.2	3.0	2.3
Czechia	2010	167 823.5	7 389.5	2 808.5	836.1	5.3
Czechia	2011	177 149.9	7 904.8	3 165.1	1 008.1	5.4
Czechia	2012	157 548.3	8 420.1	3 255.8	1 066.4	6.3
Czechia	2013	155 107.2	8 986.3	3 234.9	1 122.1	6.7
Czechia	2014	160 383.7	9 552.4	3 464.7	1 212.2	6.9
Czechia	2015	167 182.2	:	3 200.1	1 171.7	:
Czechia	2016	164 884.6	:	3 332.6	1 205.1	:
Denmark	2010	116 497.8	7 778.9	3 172.1	757.4	8.0
Denmark	2011	129 973.8	7 742.3	3 028.1	910.2	7.1
Denmark	2012	130 374.2	7 705.6	2 401.4	1 067.3	6.5
Denmark	2013	123 122.3	8 953.3	2 277.3	948.8	7.7
Denmark	2014	123 754.9	10 201.0	2 757.8	662.3	9.0
Denmark	2015	127 289.2	9 996.1	2 254.8	579.0	8.4
Denmark	2016	131 233.1	9 791.1	2 561.9	638.2	8.2
Estonia	2010	33 328.0	2 569.2	697.2	49.3	8.8
Estonia	2011	35 542.1	5 236.1	745.2	56.8	14.3
Estonia	2012	35 604.6	7 903.0	805.3	270.1	19.2
Estonia	2013	37 959.0	6 026.7	680.2	211.5	14.6
Estonia	2014	37 173.2	4 150.3	583.9	152.2	11.0
Estonia	2015	36 151.7	4 217.8	450.2	105.5	11.2
Estonia	2016	34 922.4	4 285.2	528.6	149.2	11.8
Finland	2010	184 442.5	29 099.9	583.0	882.2	13.5
Finland	2011	186 651.4	30 400.1	727.1	843.6	14.0
Finland	2012	179 170.5	31 700.3	782.6	189.3	15.3
Finland	2013	203 121.2	22 277.2	775.5	183.1	10.1
Finland	2014	169 433.8	12 854.0	746.6	228.7	7.3
Finland	2015	167 278.4	11 063.0	705.6	173.9	6.5
Finland	2016	172 928.1	9 272.0	673.8	210.6	5.3
France	2010	784 290.1	159 002.4	12 549.2	5 467.4	17.5
France	2011	808 202.5	155 363.3	13 717.2	5 738.9	16.8
France	2012	785 109.2	151 724.1	13 294.3	5 888.7	16.9
France	2013	786 701.5	156 107.5	13 246.8	5 320.9	17.3
France	2014	777 286.1	160 490.8	13 549.5	5 763.4	17.8
France	2015	740 095.0	164 139.0	12 083.1	5 811.0	18.7
France	2016	718 922.0	167 787.1	11 713.9	5 386.0	19.5
Germany	2010	1 264 927.6	150 504.0	19 678.3	13 606.0	11.0
Germany	2011	1 366 051.7	151 655.7	20 790.3	14 935.7	10.3
Germany	2012	1 320 995.4	152 807.3	19 543.7	14 134.7	10.7
Germany	2013	1 311 713.1	155 506.3	18 484.6	13 857.9	10.9
Germany	2014	1 362 428.0	158 205.3	18 910.5	14 137.9	10.7

geo	year	DMC (thousand tonnes)	RCV_R (thousand tonnes)	EXPw (thousand tonnes)	IMPw (thousand tonnes)	CMU rate (%)
Germany	2015	1 309 338.0	:	17 615.6	13 316.6	:
Germany	2016	1 310 226.9	:	18 665.4	13 410.4	:
Greece	2010	176 825.5	5 307.6	637.1	1 095.6	2.7
Greece	2011	159 023.9	4 117.7	606.6	1 112.9	2.2
Greece	2012	145 446.2	2 927.9	569.7	629.4	1.9
Greece	2013	134 860.1	2 551.4	491.7	491.0	1.9
Greece	2014	138 771.9	2 174.8	481.3	650.5	1.4
Greece	2015	130 038.7	:	475.1	631.3	:
Greece	2016	129 085.4	:	550.8	1 039.2	:
Hungary	2010	99 534.8	4 706.7	1 454.4	705.5	5.2
Hungary	2011	99 640.5	4 671.6	1 786.2	813.7	5.4
Hungary	2012	86 223.9	4 636.5	1 738.9	808.4	6.1
Hungary	2013	98 847.3	5 552.2	1 697.4	764.0	6.2
Hungary	2014	127 208.7	6 467.8	1 602.9	793.8	5.4
Hungary	2015	124 999.7	7 013.2	1 480.3	783.9	5.8
Hungary	2016	122 840.9	7 558.6	1 663.7	868.0	6.4
Ireland	2010	105 561.3	1 288.7	1 047.5	515.9	1.7
Ireland	2011	99 473.2	1 057.8	1 271.5	401.2	1.9
Ireland	2012	91 352.6	826.8	1 153.5	375.8	1.7
Ireland	2013	100 896.7	1 047.4	1 063.9	494.1	1.6
Ireland	2014	96 843.8	1 268.0	1 147.5	536.7	1.9
Ireland	2015	97 920.6	1 255.4	1 106.5	520.5	1.8
Ireland	2016	105 625.3	1 242.8	1 134.6	582.5	1.7
Italy	2010	681 717.1	92 699.5	3 219.7	6 452.9	11.6
Italy	2011	661 007.1	95 754.0	3 294.4	7 722.8	12.1
Italy	2012	564 732.0	98 808.5	3 791.6	7 049.8	14.5
Italy	2013	497 682.2	99 103.0	3 516.6	6 624.6	16.2
Italy	2014	474 853.3	99 397.5	3 375.4	6 845.3	16.8
Italy	2015	505 491.0	103 372.9	3 758.4	6 411.5	16.6
Italy	2016	507 880.7	107 348.2	3 968.2	6 341.5	17.1
Latvia	2010	36 932.4	312.4	489.0	558.5	0.7
Latvia	2011	40 845.1	560.1	659.5	541.6	1.6
Latvia	2012	39 316.4	807.8	606.5	1 117.4	0.7
Latvia	2013	41 819.1	942.5	573.0	524.6	2.3
Latvia	2014	41 414.7	1 077.3	573.0	314.3	3.1
Latvia	2015	42 444.7	1 196.9	514.5	242.1	3.3
Latvia	2016	39 491.4	1 316.6	463.6	175.0	3.9
Lithuania	2010	38 462.8	1 062.4	745.6	234.3	3.9
Lithuania	2011	41 725.5	1 030.7	839.3	309.0	3.6
Lithuania	2012	38 283.6	999.0	815.3	302.5	3.8
Lithuania	2013	46 343.3	1 085.2	719.0	268.2	3.2
Lithuania	2014	43 503.4	1 171.3	821.6	271.4	3.8
Lithuania	2015	43 495.0	1 389.8	720.3	254.1	4.1
Lithuania	2016	45 034.5	1 608.2	811.1	276.4	4.5
Luxembourg	2010	10 925.5	6 072.4	427.6	3 027.6	24.1

geo	year	DMC (thousand tonnes)	RCV_R (thousand tonnes)	EXPw (thousand tonnes)	IMPw (thousand tonnes)	CMU rate (%)
Luxembourg	2011	10 884.8	5 381.5	438.6	2 980.8	20.7
Luxembourg	2012	10 788.8	4 690.6	448.1	2 686.9	18.5
Luxembourg	2013	11 303.8	4 192.6	355.7	2 502.9	15.3
Luxembourg	2014	11 914.0	3 694.7	349.3	2 545.5	11.2
Luxembourg	2015	13 589.1	:	324.8	2 679.1	:
Luxembourg	2016	15 016.5	:	341.3	3 228.8	:
Malta	2010	2 891.0	119.5	47.7	1.2	5.4
Malta	2011	3 793.5	118.7	68.3	1.1	4.7
Malta	2012	4 346.2	117.8	62.1	0.9	4.0
Malta	2013	3 852.1	318.2	56.6	0.9	8.8
Malta	2014	5 246.1	518.6	78.6	0.9	10.2
Malta	2015	6 251.1	399.9	61.7	3.1	6.8
Malta	2016	6 363.5	281.2	71.6	0.6	5.2
Netherlands	2010	189 358.4	57 962.3	13 795.4	7 213.3	25.4
Netherlands	2011	184 594.8	58 914.0	11 382.7	7 913.6	25.3
Netherlands	2012	177 102.1	59 865.7	11 594.0	7 211.0	26.6
Netherlands	2013	168 880.1	59 745.9	10 073.0	6 559.2	27.3
Netherlands	2014	174 376.9	59 626.0	10 340.6	6 390.1	26.7
Netherlands	2015	186 453.8	61 698.1	10 086.2	6 464.7	25.9
Netherlands	2016	165 084.4	63 770.2	10 267.7	6 585.3	29.0
Poland	2010	644 835.0	76 839.5	2 458.6	1 166.1	10.8
Poland	2011	797 870.8	78 890.2	3 190.0	1 303.9	9.2
Poland	2012	695 354.2	80 941.0	3 239.8	1 367.7	10.6
Poland	2013	657 020.7	86 533.6	3 281.2	1 650.9	11.8
Poland	2014	654 385.4	92 126.2	3 537.6	1 830.6	12.5
Poland	2015	643 165.3	83 677.8	3 052.8	2 101.2	11.6
Poland	2016	671 920.7	75 229.5	3 401.3	2 247.5	10.2
Portugal	2010	196 351.5	4 819.9	1 091.9	1 477.2	2.2
Portugal	2011	182 189.6	4 709.1	1 026.1	2 068.4	2.0
Portugal	2012	167 254.1	4 598.3	975.6	2 036.7	2.1
Portugal	2013	145 900.9	5 033.5	937.6	2 139.4	2.6
Portugal	2014	154 435.1	5 468.8	924.8	2 394.0	2.5
Portugal	2015	155 559.6	4 836.3	870.6	2 250.1	2.2
Portugal	2016	152 883.1	4 203.8	1 240.0	2 105.5	2.1
Romania	2010	399 826.8	7 359.5	2 815.0	169.0	2.4
Romania	2011	449 050.7	7 518.5	2 675.0	217.6	2.2
Romania	2012	437 217.9	7 677.6	2 234.6	269.2	2.2
Romania	2013	440 751.3	7 082.0	2 260.7	259.0	2.0
Romania	2014	450 859.8	6 486.5	1 743.6	252.9	1.7
Romania	2015	539 029.4	6 778.3	1 143.0	308.0	1.4
Romania	2016	522 584.4	7 070.1	1 171.2	543.3	1.5
Slovakia	2010	71 877.0	3 559.2	715.7	426.9	5.1
Slovakia	2011	72 635.5	3 105.0	940.8	420.4	4.8
Slovakia	2012	64 414.2	2 650.8	776.3	657.8	4.1
Slovakia	2013	61 537.6	2 776.3	887.8	699.9	4.6

geo	year	DMC (thousand tonnes)	RCV_R (thousand tonnes)	EXPw (thousand tonnes)	IMPw (thousand tonnes)	CMU rate (%)
Slovakia	2014	68 068.9	2 901.9	1 042.0	501.6	4.8
Slovakia	2015	68 615.0	3 037.3	1 031.2	458.5	5.0
Slovakia	2016	72 447.7	3 172.7	1 079.1	528.2	4.9
Slovenia	2010	32 822.2	2 470.1	714.1	1 125.8	5.9
Slovenia	2011	29 561.2	2 717.6	872.5	1 166.6	7.6
Slovenia	2012	25 613.7	2 965.1	828.9	1 149.6	9.4
Slovenia	2013	25 118.1	2 891.4	791.5	1 138.8	9.2
Slovenia	2014	26 989.2	2 817.8	883.6	1 227.2	8.4
Slovenia	2015	27 399.5	2 857.7	842.9	1 170.2	8.5
Slovenia	2016	26 447.7	2 897.6	829.5	1 272.2	8.5
Spain	2010	588 651.0	74 575.4	1 757.7	7 873.7	10.4
Spain	2011	519 561.4	61 660.4	2 091.9	7 092.4	9.8
Spain	2012	413 412.5	48 745.4	2 554.0	6 621.5	9.8
Spain	2013	388 042.4	43 021.8	2 240.8	7 362.1	8.9
Spain	2014	391 232.1	37 298.1	2 803.5	7 506.9	7.7
Spain	2015	406 562.0	38 439.8	2 704.1	7 844.1	7.6
Spain	2016	396 611.9	39 581.4	2 890.6	6 910.1	8.2
Sweden	2010	200 125.7	15 794.6	2 199.3	2 003.6	7.4
Sweden	2011	210 283.0	17 263.5	2 466.2	1 915.4	7.8
Sweden	2012	210 976.5	18 732.4	2 478.8	1 824.7	8.4
Sweden	2013	217 184.2	16 955.7	2 302.7	1 576.5	7.5
Sweden	2014	221 698.7	15 179.1	2 471.3	1 714.4	6.7
Sweden	2015	221 043.6	15 825.4	2 243.2	1 660.7	6.9
Sweden	2016	224 885.4	16 471.7	2 450.6	1 617.9	7.1
United Kingdom	2010	575 336.4	85 237.8	14 773.2	1 568.8	14.6
United Kingdom	2011	581 120.5	84 838.0	15 159.0	1 763.0	14.5
United Kingdom	2012	562 236.4	84 438.2	14 423.9	1 289.0	14.8
United Kingdom	2013	569 125.8	87 787.7	13 495.7	1 463.8	14.9
United Kingdom	2014	589 557.9	91 137.2	13 893.8	1 376.6	15.0
United Kingdom	2015	583 847.7	97 570.0	14 475.6	1 361.4	15.9
United Kingdom	2016	567 245.8	104 002.7	15 406.1	1 462.3	17.2

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Circular material use rate

CALCULATION METHOD

The purpose of this paper is to present the reference methodology for the calculation of the circular material use rate indicator. The circular economy aims at increasing the amount of material recovered and fed back into the economy, therefore reducing the generation of waste and limiting the extraction of primary raw materials. The circular material use rate measures the share of material recovered and fed back into the economy - thus saving extraction of primary raw materials - in overall material use. The European Commission has released a framework to monitor progress towards the circular economy. This indicator is part of that monitoring framework and is used to monitor the progress towards a circular economy on the thematic area of 'secondary raw materials'.

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