SDG indicator metadata

(Harmonized metadata template - format version 1.1)

0. Indicator information (SDG_INDICATOR_INFO)

0.a. Goal (SDG_GOAL)

Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

0.b. Target (SDG_TARGET)

Target 8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead

0.c. Indicator (SDG_INDICATOR)

Indicator 8.4.1: Material Footprint, material footprint per capita, and material footprint per GDP

0.d. Series (SDG_SERIES_DESCR)

EN_MAT_FTPRPC - Material footprint per capita [8.4.1, 12.2.1]

EN_MAT_FTPRPG - Material footprint per unit of GDP [8.4.1, 12.2.1]

EN_MAT_FTPRTN - Material footprint [8.4.1, 12.2.1]

0.e. Metadata update (META_LAST_UPDATE)

2025-03-28

0.f. Related indicators (SDG_RELATED_INDICATORS)

12.2.1, 8.4.2, 12.2.2

0.g. International organisations(s) responsible for global monitoring (SDG_CUSTODIAN_AGENCIES)

United Nations Environment Programme (UNEP)

1. Data reporter (CONTACT)

1.a. Organisation (CONTACT_ORGANISATION)

United Nations Environment Programme (UNEP)

2. Definition, concepts, and classifications (IND_DEF_CON_CLASS)

2.a. Definition and concepts (STAT_CONC_DEF)

Definitions:

Material Footprint (MF) is the attribution of global material extraction to domestic final demand of a country. The total material footprint is the sum of the material footprint for biomass, fossil fuels, metal ores and non-metallic minerals.

Concepts:

Domestic Material Consumption (DMC) and MF need to be looked at in combination, as they cover the two aspects of the economy, production and consumption. The DMC reports the actual amount of material in an economy, MF the virtual amount required across the whole supply chain to service final demand. A country can, for instance, have a very high DMC because it has a large primary production sector for export or a very low DMC because it has outsourced most of the material intensive industrial process to other countries. The material footprint corrects for both phenomena.

2.b. Unit of measure (UNIT_MEASURE)

Tonnes;
Kilograms per constant United States dollar;
Tonnes per capita.

2.c. Classifications (CLASS_SYSTEM)

- Material categories accordance to the global EW-MFA guide "UNEP (2023). The use of natural resources in the economy: A Global Manual on Economy Wide Material Flow Accounting" (https://wedocs.unep.org/bitstream/handle/20.500.11822/36253/UNRE.pdf?sequence=3&isAllowed=y);
- Standard Country or Area Codes for Statistical Use (UN M49 classification of countries and regions)

3. Data source type and data collection method (SRC_TYPE_COLL_METHOD)

3.a. Data sources (SOURCE_TYPE)

The global estimation for MF is based on data available from different national and international datasets in the domain of material flow accounts, agriculture, forestry, fisheries, mining and energy statistics. International statistical sources for MF include the International Energy Agency, the United Nations Statistical Division, the United States Geological Survey, the Food and Agriculture Organization and COMTRADE databases.

3.b. Data collection method (COLL_METHOD)

For global estimation, the International Resource Panel (IRP) Global Material Flows and Resource Productivity working group compiles the data from national and international databases.
At the same time, country-provided indicators are collected through the QUESTIONNAIRE ON ECONOMY WIDE MATERIAL FLOW ACCOUNTS for the SDG indicators 8.4.1/12.2.1 and 8.4.2/12.2.2.

3.c. Data collection calendar (FREQ_COLL)

 First data collection in 2022 and every 2 to 3 years after.

3.d. Data release calendar (REL_CAL_POLICY)

First data release in 2017, the second in 2021 (fully estimated data). Then, in 2022 and every 2 to 3 years after (both globally estimated and country data).

3.e. Data providers (DATA_SOURCE)

National Statistical Offices

3.f. Data compilers (COMPILING_ORG)

United Nations Environment Programme (UNEP), Organization for Economic Co-operation and Development (OECD) and EUROSTAT

3.g. Institutional mandate (INST_MANDATE)

UNEP was mandated as a Custodian Agency for indicator 8.4.1 / 12.2.1 by the Inter-agency and Expert Group on SDG Indicators. UNEP IRP is the mechanism within UNEP supporting all work aspect in relation to Material Flow Accounting.

4. Other methodological considerations (OTHER_METHOD)

4.a. Rationale (RATIONALE)

Material footprint of consumption reports the amount of primary materials required to serve final demand of a country and can be interpreted as an indicator of the material standard of living/level of capitalization of an economy. Per-capita MF describes the average material use for final demand.

4.b. Comment and limitations (REC_USE_LIM)

A footprint calculation uses the global Multi-Regional Input Output (MRIO) analysis, which compiles information from many countries national statistics to create a global multi-regional input-output table. This process requires a high level of computing capacity by supercomputers. Therefore, a limited number of countries can do the analysis on its own.

4.c. Method of computation (DATA_COMP)

Material footprint by type of raw material (tonnes) is calculated as:

$$MF = DE + RME_{IM} - RME_{EX}$$

Where:
MF – material footprint;
DE – domestic extraction of materials;
RME_{IM} – raw material equivalent of imports;
RME_{EX} – raw material equivalents of exports.

For the attribution of the primary material needs of final demand a global, multi-regional input-output (MRIO) framework is employed. The attribution method based on I-O analytical tools is described in detail in Wiedmann et al. 2015. It is based on the Eora MRIO framework developed by the University of Sydney, Australia (Lenzen et al. 2013) which is an internationally well-established and the most detailed and reliable MRIO framework available to date.

Material footprint per capita, by type of raw material (tonnes), is calculated as:

$$MF\ per\ capita = \frac{MF}{Annual\ average\ population}$$

Material footprint per unit of GDP, by type of raw material (kilograms per constant 2015 United States dollar), is calculated as:

$$MF\ per\ GDP = \frac{MF}{GDP\ in\ constant\ 2015\ United\ States\ Dollars}$$

4.d. Validation (DATA_VALIDATION)

United Nations Environment Programme (UNEP) sends a prefilled questionnaire with estimated data to the National Statistical Office (NSO) Focal Points (FP) with a request to validate globally estimated data for this indicator and replace the data if needed/possible. The FPs coordinate data validation with stakeholders within their countries and report back the data to UNEP. For countries with no national data collected for this indicator, UNEP asks to agree on publishing and releasing the estimated data on UNEP's World Environment Situation Room and UNSD SDG Global database.

4.e. Adjustments (ADJUSTMENT)

UNEP replaces globally estimated data by national data if requested by the country.

4.f. Treatment of missing values (i) at country level and (ii) at regional level (IMPUTATION)

- **At country level:**

A zero is imputed when no positive real value was officially recorded, in the base data sets used, for any of the underlying components which make up this aggregated total. Thus "0.0" can represent either NA, or a genuine 0.0, or (crucially) a combination of both, which is a common situation. This allows for values to be easily aggregated further; however, it should be thus noted that due to imputing missing values as "0.0", the aggregations may represent a lower value than the actual situation.

- **At regional and global levels:**

Similarly, missing values are imputed as zero in the regional and global aggregations. However, in the case where no data is available at all for a particular country, then the per capita and per GDP estimates are weighted averages of the available data.

4.g. Regional aggregations (REG_AGG)

The data are aggregated at the sub-regional, regional and global levels. For the aggregation methods, please see: http://wesr.unep.org/media/docs/graphs/aggregation_methods.pdf

4.h. Methods and guidance available to countries for the compilation of the data at the national level (DOC_METHOD)

- United Nations Environment Programme (UNEP) jointly with the International Resource Panel (IRP), United Nations Statistics Division (UNSD), the Statistical Office of the European Union (Eurostat) and the Organisation for Economic Co-operation and Development (OECD) have

developed a global manual on Economy-Wide Material Flow Accounting (EW-MFA) which brings in the European guidelines but provides a modular approach for countries looking to develop EW-MFA for the first time and it addresses specific issues related to resource extractive based economies. UNEP (2023). The use of natural resources in the economy - A Global Manual on Economy Wide Material Flow Accounting:
https://wedocs.unep.org/bitstream/handle/20.500.11822/36253/UNRE.pdf?sequence=3&isAllowed=y

- EUROSTAT (2018). The EU Economy-wide material flow accounts handbook 2018:
https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-18-006

4.i. Quality management (QUALITY_MGMNT)

Quality management is provided by United Nations Environment Programme (UNEP), jointly with International Resource Panel (IRP), using the Global Manual on Economy-Wide Material Flow Accounting (UNEP, 2023).

4.j Quality assurance (QUALITY_ASSURE)

Quality assurance is provided by United Nations Environment Programme (UNEP), jointly with International Resource Panel (IRP), using the Global Manual on Economy Wide Material Flow Accounting (UNEP, 2023).

4.k Quality assessment (QUALITY_ASSMNT)

Quality assessment is provided by United Nations Environment Programme (UNEP), jointly with International Resource Panel (IRP), in consultation with countries (nominated Focal Points) after receiving their feedback on the globally estimated indicators.

5. Data availability and disaggregation (COVERAGE)

Data availability:
The data covers about 160 countries (either globally estimated or country data).

Time series:
The data set presented in the SDG database covers a time period of 24 years (2000-2023).
The International Resource Panel (IRP) publishes estimated data series for 1970-2024 on its website.

Disaggregation:
The Material Footprint indicator is disaggregated into four main material categories (biomass, fossil fuels, metal ores and non-metallic minerals).

6. Comparability / deviation from international standards (COMPARABILITY)

Material Footprint is calculated coherent with international standards, recommendations, and classifications such as the System of National Accounts 2008, the System of Environmental-Economic Accounting – Central Framework 2012, the Balance of Payments and International Investment Position,

the International Standard Industrial Classification of All Economic Activities (ISIC), the Central Product Classification (CPC) and the Framework for the Development of Environment Statistics.

Sources of discrepancies:
Not applicable

7. References and Documentation (OTHER_DOC)

URL:
UNEP (2023), The use of National Resources in the Economy: a Global Manual on Economy Wide Material Flow Accounting.
https://wedocs.unep.org/bitstream/handle/20.500.11822/36253/UNRE.pdf?sequence=3&isAllowed=y

References:
EUROSTAT (2013). Economy-Wide Material Flow Accounts. Compilation guide 2013:
https://ec.europa.eu/eurostat/documents/1798247/6191533/2013-EW-MFA-Guide-10Sep2013.pdf/54087dfb-1fb0-40f2-b1e4-64ed22ae3f4c

EUROSTAT (2018). The EU Economy-wide material flow accounts handbook 2018:
https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-18-006

Wiedmann, T., H. Schandl, M. Lenzen, D. Moran, S. Suh, J. West, K. Kanemoto, (2013) The Material Footprint of Nations, Proc. Nat. Acad. Sci. Online before print.

Lenzen, M., Moran, D., Kanemoto, K., Geschke, A. (2013) Building Eora: A global Multi-regional Input-Output Database at High Country and Sector Resolution, Economic Systems Research, 25:1, 20-49.