Water

Content

This document presents figures for data on 1) water quality and 2) water quantity that were considered for its possible use in indicator 22 Water of the 2018 Raw Materials Scoreboard. The final version of the Scoreboard indicator is based on other data, water use from Eurostat.

This documents also summarizes the whole set of data options that were considered and evaluated.

Novelties from the 2016 version of the Scoreboard

- Water data that could be possibly used as a first attempt to monitoring water use by the raw materials sector:
  - Indicator related to water quality considerations: Number of raw materials major facilities by sector and by country that emit pollutants to water, based on E-PRTR data.
  - Indicator related to water quantity considerations: Water withdrawal data covering a water-stressed and a non-water-stressed country, for a selection of raw materials sectors based on data from the MS national statistical offices.
- Text box describing the use of water in a typical raw materials mining and processing facility.

Key points

- Raw materials industries located across the EU pose different environmental pressures on water derived from their emission of pollutants to water.
- Facilities processing metals and producing pulp and paper are the most abundant, being the main contributors to, respectively, the release of heavy metals and chlorinated organic substances.
- Mining operations appear only in some specific countries, being the main contributors to the release of some metals.
- Taking as example a water-stressed and a non-water-stressed EU country, overall decreasing trends in water withdrawal by the raw materials sectors have been observed, except for the increase associated to the development of the construction sector in the 2000s.
- Changes in water withdrawal are related to fluctuations in production volumes, but also to improvements in water efficiency, especially in some raw materials manufacturing sectors.

Facts and figures

- **Figure 1** shows the number of **major raw materials facilities by EU country and sector**[1] that release to water more than 100 kg of any of these pollutant groups: heavy metals, inorganic substances, chlorinated organic substances and other organic substances[2].
- Data comes from the European Pollutant Release and Transfer Register (E-PRTR)[3], which requires facilities producing above specific thresholds to report their pollutants releases, and which accounts for pollutants releases embodied in the treated wastewater.
- Facilities processing metals and producing pulp and paper are the most abundant. While metals processing facilities are more concentrated in central Europe, pulp and paper facilities are more present in northern Europe. Mining operations appear only in some specific countries.
- Metals production facilities are the most abundant contributors to the release of heavy metals to water; while pulp and paper facilities are more relevant for the release of chlorinated organic substances; and mining facilities for the release of some metals[4].
- These data informs about the different environmental pressures on water coming from the diverse raw materials industries, which are very industry-specific. The ultimate impact of these pollutants on the environment will depend on the emissions level and local water framework conditions.

[1] See details of sector coverage in the methodological notes.
[2] See methodological notes for details on the pollutant coverage.
[3] See more details in the methodological notes.
[4] See also ETC – European Topic Centre on Inland, Coastal and Marine Water, European Environment Agency, 2017, van den Roovart, J., van Duijnhoven, N., Fribourg-Blanc, B., Siauve, S., Prchalova, H., 'Emissions of pollutants to Europe's waters – sources, pathway and trends', ETC/ICM Technical Report 3/2017.

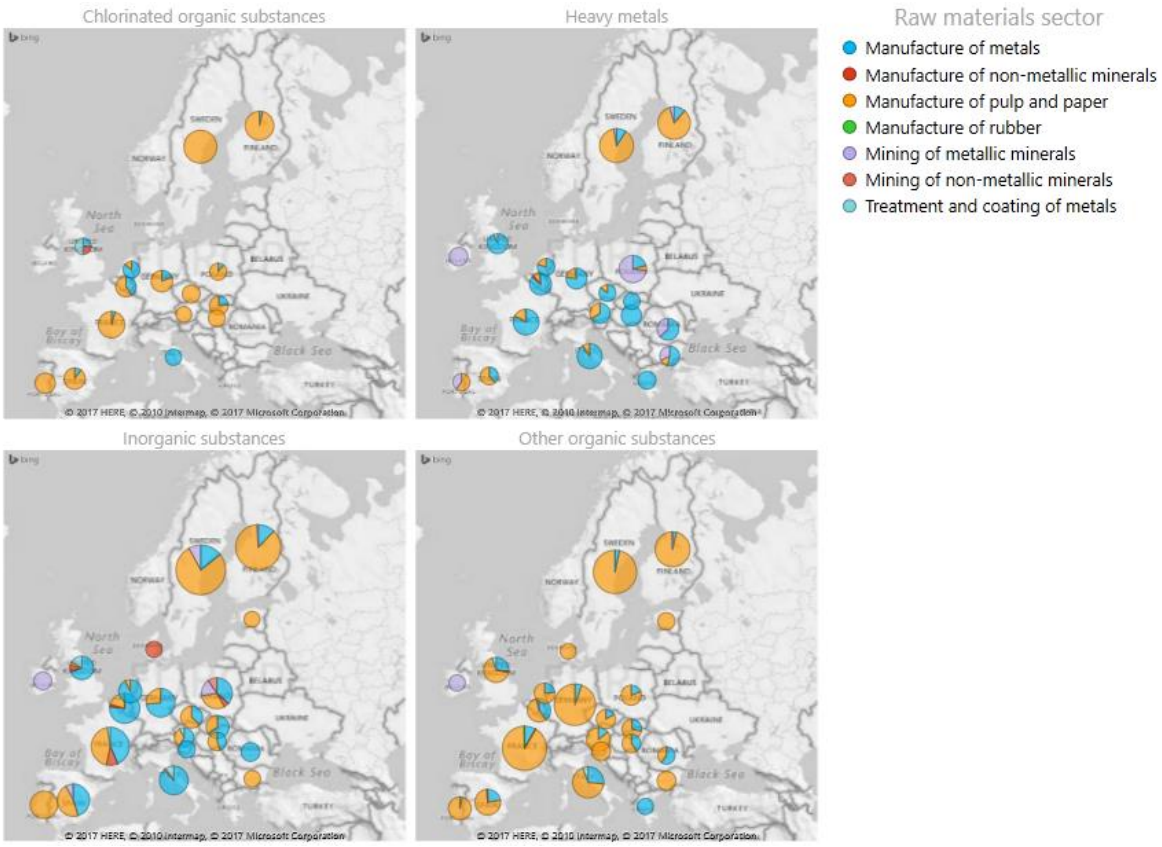

Figure 1: Major raw materials industrial facilities reporting pollutants to water to E-PRTR, per pollutant group (EU-28, year 2014)[5]. The size of the pie charts is proportional to the number of facilities per country. Data might not be fully accurate (see methodological notes).

- Figure 2 presents data on water withdrawal by economic sector based on data compiled by national statistical offices. Water withdrawal is the sum of water extracted from nature through self-supply and water supplied by the public network. The figure shows water withdrawal for a country that on average does not show water-stress conditions (Germany) and for a significantly water-stressed country[6]. The underlying water stress figures refer to the Water Exploitation Index (WEI) provided by the European Environment Agency[7].
- Figure 2 shows overall decreasing trends of water withdrawal except for the increase associated to the development of the construction sector in the 2000s. These changes seem to be very related to production volumes. However, improvements in water efficiency in some raw materials manufacturing sectors have been also observed[8]. The latter applies for instance

[5] Source: JRC elaboration based on E-PRTR data, 2017.
[6] Data for more EU-28 countries are available. See methodological notes.
[7] WEI is part of the dashboard of indicators in the European Commission's Roadmap to a Resource-Efficient Europe. It estimates water abstraction as a percentage of fresh water available and thus informs about stress of freshwater resources in the EU.
[8] JRC analyses of water withdrawal and production level (in monetary values) from the MS national statistical offices show reductions in water intensity in many sectors and countries. Results should be taken with caution since water estimates could not be related to production in physical units, and since the level of data aggregation does not allow

to the basic metals manufacturing in Germany during the period 1990-2000 and to wood products manufacturing in Spain along the 2000s.

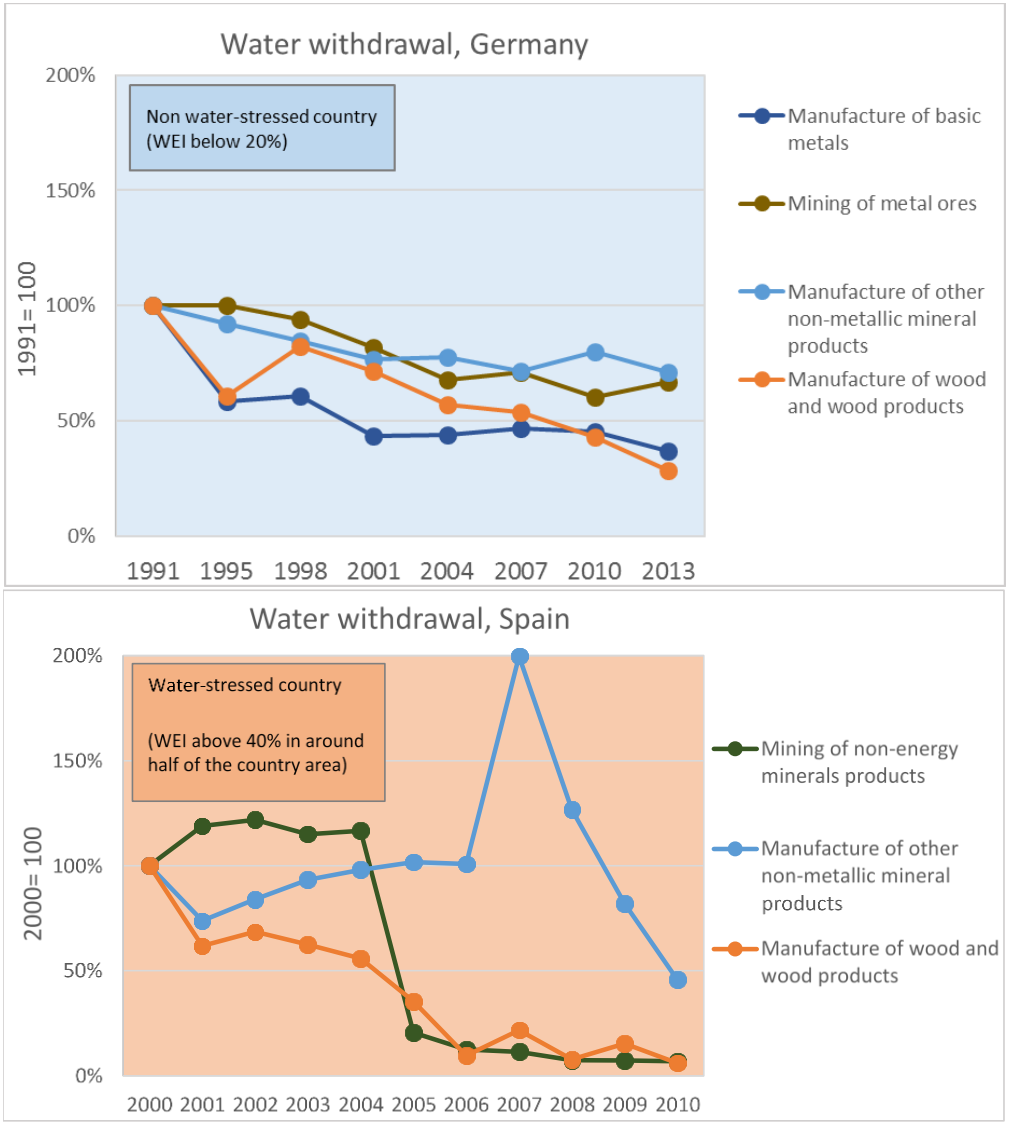

Figure 2: Trends of water withdrawal over time for selected raw materials sectors (Germany and Spain)[9]. Note that time periods and sector coverage differ between the two charts. A Water Exploitation Index (WE) above 20% is considered an indication of water stress, and above 40% an indication of severe water stress. Many water-stressed areas are expected to become more stressed under changing climate conditions.

to identify the specific processes that improved water efficiency. See also Vidal-Legaz, B., Torres de Matos, C., Latunussa, C., Bernhard, J. (2018), 'Non-energy, non-agriculture raw materials' production: data to monitor the sector's water use and emissions to water', JRC Technical report 113206.

[9] Source: JRC elaboration based on Member State national offices and Reynaud, A, 2016, 'Use and value of water by industries in Europe: a cross-country analysis'. The framework colour of the figures refers to the country average WEI values, obtained from EEA, 2012, https://www.eea.europa.eu/data-and-maps/explore-interactive-maps/water-exploitation-index-for-river.

Box 1: The use of water in raw materials mining and processing facilities

Mining and processing facilities often count on self-supplies of water that might come from local water courses, groundwater or from the sea, yet water might be also supplied by the public network. For mining operations, additional water resources are usually available from mine dewatering, which might satisfy the facility requirements and provide additional resources for other users of water. As drawback, dewatering might lead to drawdown of the water table under certain circumstances. Depending on the water quality requirements for the specific mining and industrial processes, water supplies might require a pretreatment.

After multiple uses within the operating facilities, the incurring wastewater is discharged to nature. In some cases, wastewater can be reused and/or recycled and loop back in the facility for processes that are less demanding in terms of water quality. While for processing industries it is easier to control water circulation, mining operations' boundaries with nature are less defined and run-off can lead to e.g. acid mine drainage from sulphide minerals. This applies to active but also to non-operating or even abandoned sites, where water managements systems are usually less advanced.

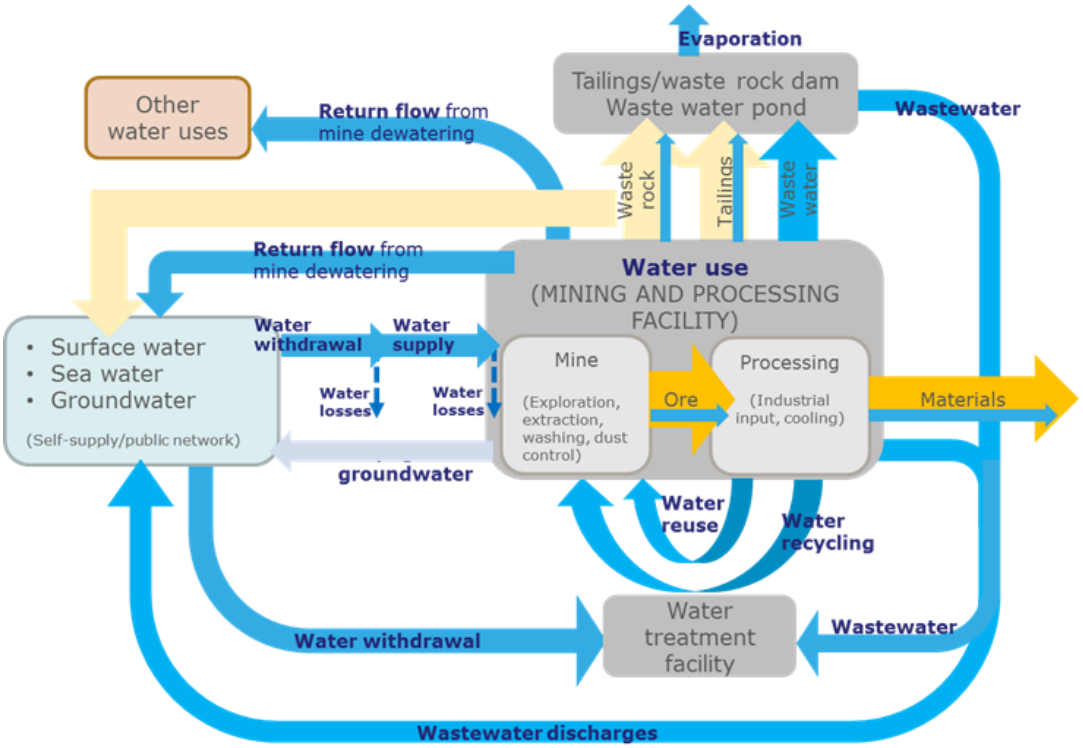

Figure Box 1: Diagram of water use at a typical mining and processing facility[10].

[10] Source: Vidal-Legaz, B., Torres de Matos, C., Latunussa, C., Bernhard, J. (2018), 'Non-energy, non-agriculture raw materials' production: data to monitor the sector's water use and emissions to water', JRC Technical report 113206.

The search for suitable data…

- The level of sector disaggregation of data on water withdrawal obtained from a selection of Member States' statistical offices was considered more adapted to the EIP-RM scope than those available at EU level (from Eurostat). Data are officially endorsed and relevant. However, the usability of these data for a comprehensive monitoring of water use over time is limited: the set of MS for which data are available is limited, and data are not harmonized between countries. The fact that the current proposal does not cover all EU-28 Member States could raise awareness about the importance of improving data collection on water use over time to be able to monitor changes in water performance.
- E-PRTR was considered the most suitable source to provide comprehensive data on the pressures of the raw materials industry on water quality across EU countries and sectors. E-PRTR data is an official data source, based on a transparent reporting framework, which follows a validation process, and covers a complete set of water pollutants. Moreover, facilities are classified following the NACE codes, covering a complete set of raw materials sectors and allowing comparison with other sectors. However, do to the limitation of the E-PRTR pollutant releases data, the present analysis refers to the number of facilities reporting to E-PRTR (and not to the pollutant releases' volume), as first proxy of the pressures of the raw materials sector on the water quality. Some of the limitations of E-PRTR data on pollutant releases are:
    - E-PRTR reports pollutant releases separately by pollutant (e.g. lead). Given the variety of pollutant releases by each industry, aggregated data (e.g. all heavy metals) would be preferred. However, E-PRTR does not provide guidance on a method to aggregate releases of single pollutants (e.g. weighting considering their different toxicity potential).
    - E-PRTR does not provide data on the concentration of pollutants.
    - Reporting to E-PRTR by MS is in some cases not fully homogenous and might introduce errors.
    - The coverage of facilities is limited: not all industrial facilities in the EU are required to report to E-PRTR, but only those facilities with emissions above a certain threshold.
    - Due to the lack of activity data, very poorly reported, efficiency improvements regarding pollutant releases cannot be estimated.

  Research is advancing in the field of providing sound aggregated data on pollutant release based on E-PRTR, yet results are still preliminary and limited in terms of geographic coverage[11].

[11] A first attempt to aggregate pollutant releases based on their different impact potential has been made by Sörme et al., 2016, 'Using E-PRTR data on point source emission to air and water – First steps towards a national chemical footprint'. Their results for Sweden point to the manufacturing of basic metals and paper as main contributors to both human and ecosystem toxicity among all economic sectors.

Summary of other options that were considered

All potential water data sources that were listed in the 2016 Scoreboard as possible data sources for the 2018 version, have been critically revisited. Based on the results of that assessment[12] and on the feedback from the Ad How Working Group of the European Innovation Partnership on Raw Materials (EIP-RM), analyses based on two options (E-PRTR and Member State data) were presented here. These data are presented here as a potential step towards a quantitative indicator on water. The following are the other options considered and evaluated in previous steps:

- **Option 1 – Water abstraction of mining and quarrying from OECD/Eurostat reporting**
  - It would assess trends over time of water use and water intensity in the mining and quarrying sector (including also the extraction of oil and gas), based on **Eurostat data on water abstraction**, related to the production level of the sector (measured as value added of the sector's output.
  - It was disregarded since **data were limited to the mining and quarrying sector** and aggregated together with oil and gas extraction.
- **Option 2 – Water use/consumption by sector based on EE-IO tables**
  - Data from **EXIOBASE** version 3, an environmentally-extended input-output (EE-IO) database, would display water withdrawal and consumption by raw materials sector and country over time (1995-2010).
  - This option has been disregarded since **the underlying methodology yields results that do not match actual water use figures**, not allowing for a robust cross-sector, cross-country comparison.
- **Option 3 – Water use case studies based on industry reporting**
  - This option could assess water use data from a selection of raw materials companies (mining, metals manufacturing and forestry and paper) in EU countries and other world regions, based on the **Global Reporting Initiative (GRI) data**.
  - This option has been disregarded since the way in which water data are reported **would not allow for a robust cross-sector, cross-country comparison**, neither for a significant **coverage** of the raw materials sectors.
- **Option 4 – Water use data from *ad-hoc* LCA case studies (specific materials)**
  - This option, based on Life Cycle Assessment (LCA), would zoom into the water use and water discharges along the extraction and production of a reference amount of specific intermediate raw material commodities (one metal, e.g. aluminium/steel; one industrial mineral, e.g. fluorspar; and one biotic material, e.g. pulpwood).

[12] For more details, see Vidal-Legaz, B., Torres de Matos, C., Latunussa, C., Bernhard, J. (2018), 'Non-energy, non-agriculture raw materials' production: data to monitor the sector's water use and emissions to water', JRC Technical report 113206.

- This option has been disregarded since **it would not allow a time trend analysis** neither it will have a comprehensive sector **coverage**.

Methodological notes

Indicator related to water quality considerations (Figure 1)

- **Name of indicator:** major raw materials industrial facilities reporting pollutants to water to E-PRTR.
- **Organization (data provider):** European Pollutant Release and Transfer Register (E-PRTR), managed by the European Environment Agency (EEA).
- **Website (URL):** https://www.eea.europa.eu/data-and-maps/data/member-states-reporting-art-7-under-the-european-pollutant-release-and-transfer-register-e-prtr-regulation-21(link to downloadable data); http://prtr.eea.europa.eu/ (data viewer).
- **Definition, description of data:** E-PRTR is the Europe-wide register that provides easily accessible key environmental data from industrial facilities in the EU and beyond. Data from this registry are publicly available and validated. The registry covers facilities that produce emissions above certain sector-specific thresholds. Thresholds are based on e.g. the facility production capacity or area under extractive operation for some mining-related activities. The thresholds have been set with the intention of covering for each specific pollutant about 90% of the total mass emissions from industrial facilities. For some specific activities, pollutants have to be reported regardless the facility production capacity (e.g. underground mining, metal ore roasting/sintering, etc.). The register covers a complete set of substances (including heavy metals, inorganic substances, pesticides, organic pollutants), and years from 2007 until 2016. The pollutant groups covered in Figure 22.1 include:
    - Heavy metals: copper, zinc, lead, nickel, chromium, arsenic, cadmium and compounds thereof
    - Inorganic substances: nitrogen, phosphorous, fluorides, cyanides and chlorides
    - Chlorinated organic substances: halogenated organic compounds and trichloroethylene
    - Other organic substances: phenols, polycyclic aromatic hydrocarbons and organic carbon.
- **Update frequency:** annual.
- **Data format:** online, downloadable in .csv, .mdb and .xlsx.
- **Geographic coverage:** EU-28. E-PRTR also covers Iceland, Liechtenstein, Norway, Serbia and Switzerland.

- **JRC processing methodology for the indicator:** the processing consisted in the *ad-hoc* selection of raw materials sectors, and filtering facilities with a minimun amount of pollutant releases to water.
    - Selection of economic sectors. The table below details the raw materials sub-sectors that are included under each of the categories displayed in Figures 20.1, which were reclassified *ad-hoc* for this analysis, based on the E-PRTR sector classification.

Sector	Sub-sector
Manufacture of metals	Aluminium production
	Casting of iron
	Casting of metals
	Casting of other non-ferrous metals
	Casting of steel
	Copper production
	Lead, zinc and tin production
	Manufacture of basic iron and steel and of ferro-alloys
	Manufacture of basic metals
	Manufacture of basic precious and non-ferrous metals
	Other non-ferrous metal production
	Precious metals production
Manufacture of non-metallic minerals	Manufacture and processing of other glass, incl. technical glassware
	Manufacture of bricks, tiles and construction products, in baked clay
	Manufacture of cement, lime and plaster
	Manufacture of other non-metallic mineral products
	Manufacture of other non-metallic mineral products n.e.c.
	Production of salt
	Shaping and processing of flat glass
Manufacture of pulp and paper	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
	Manufacture of paper and paperboard
	Manufacture of pulp, paper and paper products
Manufacture of rubber	Manufacture of rubber products
Manufacture of wood products	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting
	Sawmilling and planing of wood, impregnation of wood
Mining of metallic minerals	Mining of iron ores
	Mining of non-ferrous metal ores, except uranium and thorium ores
	Mining of other non-ferrous metal ores
Mining of non-metallic minerals	Extraction of salt
	Mining of clays and kaolin
	Operation of gravel and sand pits
	Quarrying of limestone, gypsum and chalk
	Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate
	Quarrying of stone
Treatment and coating of metals	Treatment and coating of metals

    - Selection of facilities. The total set of facilities belonging to the sector include in the table above where filtered according to the volume to pollutants releases. Only facilities that release to water more than 100 kg per year of any of the four most relevant pollutant groups were selected. Pollutants groups include heavy metals, inorganic substances, chlorinated organic substances and other organic substances.

Indicator related to water quality considerations (Figure 2)

Member States' national official statistical offices data

- **Name of indicator:** Water withdrawal (Water extraction from nature and receipt of water from water works or other establ.) – Germany; Water withdrawal (Continental water withdrawal) – Spain.
- **Organization (data provider):** Destatis (The Federal Statistical Office of Germany) – Environmental-economic accounting – Germany; Instituto Nacional de Estadística (National Institute of Statistics) – Water environmental accounts – Spain.
- **Website (URL):**

  https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwj5m-iA3vndAhUBsqQKHVy_DrYQFjAAegQICRAC&url=https%3A%2F%2Fwww.destatis.de%2FEN%2FPublications%2FSpecialized%2FEnvironmentalEconomicAccounting%2FCrossSection%2FTablesEEA5850020_Part_4.pdf%3F__blob%3DpublicationFile&usg=AOvVaw2sWihcv84XYYlsunbzz0lv - Germany; http://www.ine.es/jaxi/Tabla.htm?path=/t26/p067/p02/agua00-04/l0/&file=01007.px&L=0 – Spain, 'Captacion total de agua continental, Cuentas satélite del agua en España.
- **Definition, description of data:**

  Germany: water withdrawal is defined as the sum of withdrawal from nature and water received from the supply network.

  Spain: water withdrawal inlcudes water taken from the public supply network and own intakes. This includes the withdrawal of water to be used and water not to be used (e.g. mine water and drainages).
- **Update frequency:** annual.
- **Data format:** online, downloadable in .xls format.
- **Geographic coverage:** Germany and Spain.
- **JRC processing methodology for the indicator:** For Spain, data on mining is the sum of sector CB and CA. For Germany, we summed withdrawal from the public network and from all suplies, which were provided in a disaggregated manner.