GaBi Databases 2022 Edition
Upgrades & Improvements

Please read this document carefully, as it contains:

- Important information regarding changes in the databases
- Details on changes in process datasets and on cross-cutting changes
- Information on new datasets
- Information on discontinued datasets

February 2022

1 Overview

About this document

This document covers relevant changes in around 15,000 upgraded LCI datasets of the GaBi Databases 2022 Edition. The document addresses both changes in technology and in methodology, when appliable, as well as error corrections, and is structured by type of material/process or topic, e.g., electricity, metals, plastics, renewables. It also covers newly added datasets to the GaBi databases.

In the Annex you will find the list of datasets that are no longer updated, as well as expired EPD datasets.

Sphera uses a professional issue tracking software (JIRA), so the issue numbers in the tables are issue numbers from this software. Please provide us with this number if you have specific questions.

Key changes and affected datasets

In the following paragraphs, you will find a short summary of the most important changes that took place in this year's upgrade.

The reference year of the *GaBi Databases 2022 Edition* is 2018 for all energy carrier supply mixes (e.g., hard coal, crude oil, and natural gas) and energies, as this is the latest available, consistent global data. For the remaining datasets, the reference year is documented in each dataset.

Please note that processes, that will no longer be updated (in the "Version 2021" folder), as well as "flows with limited use" (for further information see Annex I: "Version 2021" discontinued datasets – Explanations and Recommendations) are marked with a differently coloured icon in the database:  .

Selected, important changes made in the 2022 GaBi Databases edition include:

- **Energy update:** all energy-related datasets, such as electricity, thermal energy, fuels, and the like, have been updated in line with the latest consistent international energy trade and technology data. Some key points in the energy upgrade include the following:
    - Ongoing trend in many countries to relevantly increase the share of renewable energies in their electricity generation, which is, for example, the case for, Denmark, Finland, Germany, Ireland, Lithuania, United Kingdom.
    - Fluctuations in renewable electricity generation due to weather conditions, especially regarding water availability for hydro power stations (e.g. Portugal, Spain, or Latvia).
    - Some highlights on the shift of energy carriers/sources:

- The share of renewable energy sources for electricity generation in Germany increased from 34.2 %[1] in 2017 to 36.1 % in 2018.
- The share of electricity generation from renewable energy in the EU-28 increased from 30.7 % to 33.2 %, mainly due to higher water availability for hydro power stations. In addition the share of wind power increased from 11.0 % to 11.6 %.
- In the U.S., electricity output from coal power plants decreased from 1292 TWh in 2017 to 1243 TWh in 2018, the share of electricity from coal in the production mix decreased from 30.8 % to 28.5%. The reduced generation from coal was substituted mainly by generation from natural gas, increasing the share of electricity from natural gas from 31.3 % to 34.1 %. The share of electricity from renewable sources overall remained about stable.

Please see Chapters 3.7 for more information.

- **Electricity from photovoltaics (PV)**: The solar irradiation has been modelled in greater detail and country-specific parameters in the electricity from PV datasets have benn updated. The model now includes the emission flow dichloro-1-fluoroethane (R 141b) and chlorodifluoethane (R 142b), which are precursors of Polyvinylidene fluorine (PVDF) used in the production of PV modules. Due to this most recent information concerning this emission flow, the average impact of ODP increases significantly. Depending on the amount of electricity from PV, the changes in the different countries can vary.
- **Harmonization of energy content in natural gas flows:** The energy net and gross calorific value of the product flows of natural gas for all countries are now harmonized. In case you have build models around the country specific natural gas flows, using their calorific value, we advise you to check your own models to ensure that the harmonised values do not lead to unwanted results in your models. The corresponding values are as follows:
    - Energy (net calorific value): Natural gas, at consumer [Natural gas, at consumer] 47.5MJ/kg
    - Energy (gross calorific value): Natural gas [Natural gas, at production] 52.5MJ/kg
- **Heavy metal balance closed in livestock plans:** Heavy metals that livestock (eg. sheep, lamb,...) consumed via grass (i.e. not other feed materials) are brought back to the field due to the use of manure as fertilizer. Therefore the heavy metal balance is now fully closed to avoid unintended virtual credits due to these heavy metals uptake. Changes are evidently noticeable especially in human toxicity and freshwater metal elements.

[1] 50% of electricity from waste is accounted as renewable energy

- **Improvement of energy and mass balance in lignite dust datasets:** The lignite dust model is now updated with newer information on the production phase of pulverizing lignite from raw lignite. Thermal energy consumption and landfill use is added in the model and the water balance for the transformation of pulverised lignite is increased based on better literature and more recent and complete data. The lignite dust dataset therefore increases significantly in global warming and water use.
- **Natural rubber:** The TH: Natural rubber and TH: Latex concentrate datasets are updated with lower irrigation water input and corrected land use change values. The lower energy usage in the irrigation pump is visible in the reduction of results in many impact categories. The impact category EF3.0 Climate Change, land use and land use change has the largest change of -37%.
- **Harmonization of EN15804 module grouping for the datasets dip-switch and power outlet from category C3 to C4:** The end of life datasets for dip-switch and power outlets are harmonized following the availability of most recent interpretations of the standard. C3 has now correctly the impacts of incineration, while C4 gives the impact of the landfill. The user is advised to check his/her model for consistent naming and plan grouping.
- **Update of precious metals:** Using consistent price information from USGS, the 10-year average mean price used for economic allocations for PGM (Platinum Group Metals) has been updated. Overall changes range between -5 to 5% in the environmental impact categories.
- **Phosphoric acid:** Both phosphoric acid (100%) and (75%) datasets are updated with information from various literature sources (including BREF) and expert knowledge. Overall, EF3.0 impacts are reduced down to -34% for phosphoric acid (100%) and down to -48% for phosphoric acid (75%). Additionally, for phosphoric acid (100%), the product output flow is renamed from phosphorus pentoxide to phosphoric acid (See Annex II).
- **Update of production route in propylene oxide:** According to the Best Available Techniques Reference (BREF) document for the production of large volume organic chemicals, propylene oxide in the European Union, except for one plant, is no longer produced via the chlorohydrine route. In background models, datasets via the chlorohydrine route are now replaced with propylene oxide using the oxirane production route. Impacts are reduced between -8% to -22%, depending on the country.
- **Nitric acid:** All nitric acid models are improved using information on Best Available Techniques (BAT) Large Volume Inorganic Chemicals document. In the report, energy recovery is considered as the BAT. The model includes the updates in net energy production from exothermal reaction, credits for thermal energy from natural gas, consumption of platinum catalyst, and replacement of steam medium pressure (superheated) with steam high pressure (not superheated). Based on new available data from the National Inventory Reports, the N_2O emission from nitric acid production is reduced. For India, the emission standards were changed from

European standards to local standards. As nitric acid is used in ammonium nitrate, these datasets are changed as well. Differences for nitric datasets range between -7% to -28% in CML EP and GWP, depending on the country. For the IN: Nitric acid dataset, EP and GWP are increased by 112% and 93% respectively.

- **Plastic granulates regionalisation:** The input and output water flows in the plastic granulates datasets are now regionalized, EF3.0 Water use values now correct.
- **Municipal waste water treatment plant composition:** Using latest available Eurostat data, the sludge distribution of all municipal waste water treatment plants has been updated. Changes in EF3.0 Acidification (total), and Eutrophication (freshwater) are well below the range of ±10%.
- **Indian landfill from municipal household waste:** To reflect actual practice of waste management in India, the leacheate treatment is removed and the dataset now assumes an unmanaged landfill. The update is based on literature including a study on greenhouse gas (GHG) mitigation potential of municipal solid waste (MSW) management from the Federal Environmental Agency (Germany). The following changes have been made:
    - IN: Landfill (Municipal household waste) {a3ec58f2-68db-4061-83d9-399bfd30a4d9} moved to "Version 2021" folder and will not be updated in upcoming GaBi database versions
    - IN: Landfill (Municipal household waste) (unmanaged) {22014570-01ec-4923-a72c-9da91e72aaac}, the sludge output is removed. Users are advised to check the plans where this dataset is used.
- **Further harmonization of truck transports:** throughout the database, further truck transports with Euro 3 trucks are now updated to a Euro 0-6 mix. As transports usually have a low overall impact on a product, changes are less relevant.

All other changes, as well as further details and the related rationale are provided in the remainder of this document.

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Abbreviations

AP	Acidification Potential
ADP	Abiotic Depletion Potential
BAT	Best Available Technique
B2B	Business-to-Business
B2C	Business-to-Consumer
BREF	Best Available Technique Reference Document
CF	Characterisation factor
CHP	Combined Heat and Power Plant
CML	Centrum voor Milieuwetenschappen (Institute of Environmental Sciences)
EF	Environmental Footprint
EP	Eutrophication Potential
EPS	Environmental Priority Strategies
EPD	Environmental Product Declaration
GWP	Global Warming Potential
ILCD	International Reference Life Cycle Data System
IPCC	Intergovernmental Panel on Climate Change
JIRA	JIRA issue tracking software
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
ODP	Ozone Depletion Potential
PED	Primary Energy Demand
POCP	Photochemical Ozone Creation Potential
PV	Photovoltaic
UBP	Umweltbelastungspunkte (Ecological Scarcity Method)
WIR	World Resources Institute

For chemical elements, the IUPAC nomenclature is applied.

Country codes use the ISO 3166-1 alpha 2 2-letter code, plus a few 3-letter codes for regions, such as RER for Europe, RNA for North America and GLO for global. The different combinations of the European Union, reflecting its growth over time, are identified by the prefix EU and the Number of Member States (potentially plus “EFTA” when including the countries of the European Free Trade Association, i.e., Iceland, Liechtenstein, Norway and Switzerland).

2 Introduction to the upgrade of databases available with GaBi

In total, around 50 Sphera employees were involved in the upgrade of the GaBi databases, with the 10 staff strong Content Team signing responsible. The invested time, knowledge and dedication of our employees resulted in the new GaBi Databases 2022 Edition, with about 15,000 processes and plans of the regular Professional and Extension Databases, plus more than 3,500 processes as Data-on-Demand-only datasets.

The process of continuous upgrades of the GaBi Databases by the Content team is enabled and supported with domain expertise along the team structure within Sphera, which is illustrated in the figure below.

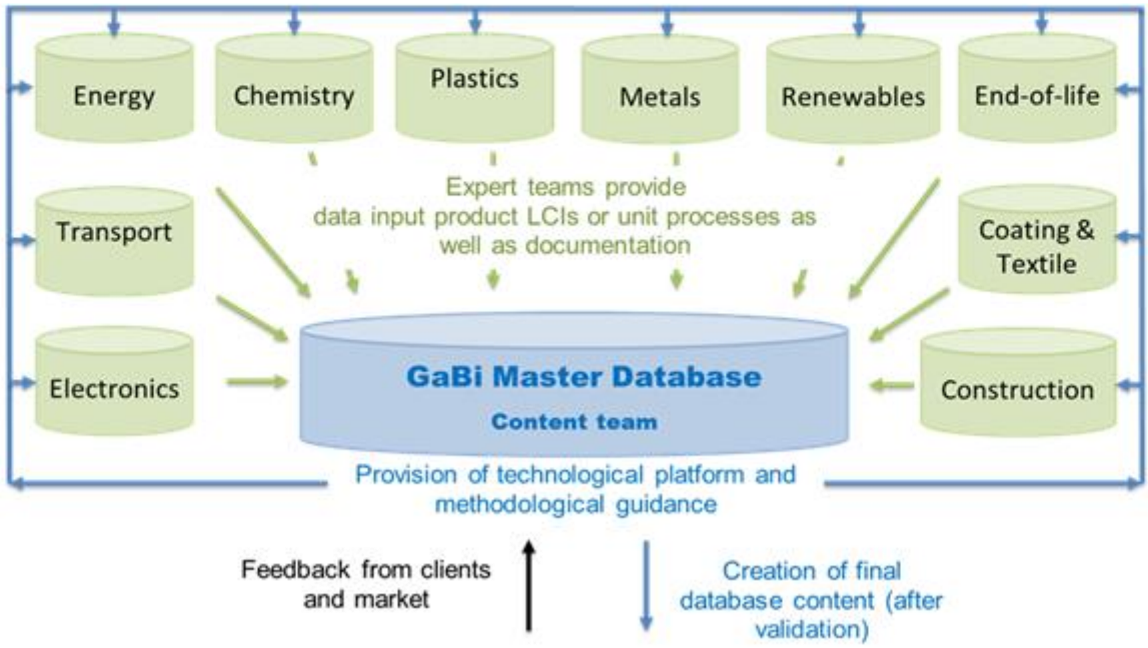


Figure 1: GaBi Master Database maintenance and upgrade process

In the GaBi databases, process documentation is directly integrated in the datasets. Additional information about the modelling principles that are applied to all datasets can be found in the document *GaBi Databases and Modelling Principles.*[2] Furthermore, specific modelling information on specific topics and recommendations for users to get the best value out of the GaBi databases can equally be accessed in complementary documents that can be accessed our website.

This present document covers relevant changes in the upgraded LCI datasets of the GaBi Databases. The document addresses both methodology changes and changes in technology, if any, and is structured by material or topic, e.g., electricity, metals, plastics, renewables. In principle, all Sphera-related datasets

[2] https://gabi.sphera.com/index.php?id=8375

have been upgraded, with some changes occurring exclusively in the background system of datasets, others also in the foreground.

Note: LCI methodology changes do not automatically imply endorsement by Sphera and have been introduced only when necessary: Methodological changes are only useful if these changes or improvements are supported by relevant best practice cases, evolving or edited standards or by relevant stakeholder initiatives with a respective practice approval.

3 GaBi Databases 2022 Edition

"*Facts do not cease to exist because they are ignored.*" – Aldous Huxley

3.1 Principles

Sphera has introduced the annual upgrade of the GaBi Databases now about 10 years ago and for three main reasons:

- To keep your results as up-to-date and close to evolving supply chains as possible, including automated upgrades of your valued work in alignment with the most recent state of the surrounding global economy.
- To avoid disruptive changes caused by multi-year intervals that are often hard to communicate and interpret and that prolong the time that user results are affected by known data errors.
- To keep track of necessary methodological changes and then implement them promptly.

Sphera's databases are based on technical facts and are internationally accepted and broadly applied. We preferably use standardized LCI methods established by industry, science, and regulatory authorities. New methods are applied when they have proven to be based on a relevant standard, on broadly and internationally accepted approaches or when enforced by relevant regulations.

Changes in the environmental profile of the datasets, from the preceding year's GaBi Databases to the most recent GaBi Databases, may be attributed to one or more of the following factors:

- **Upgrade of the background systems.** The changed market situation or newly available technologies or improved operation see also next bullet) result in changed impacts. The environmental profile for the supply of energy carriers or intermediates may be subject to year-to-year changes and affect the environmental profile of virtually all materials and products to a varying extent. For example, a change of the energy carrier mix or of the efficiency for electricity supply changes the environmental profile of all materials or products using that electricity supply.
- **Improvements and changes in the technology of the production process.** Improvements or developments in production processes might achieve, for example, higher energy efficiency or a reduction of material losses and of process emissions. Sometimes, the technology is subjected to higher quality requirements that are defined further downstream at the final product-level (e.g., more end-of-pipe measures to reduce emissions, stricter desulphurization of fuels) and improved use phase performance. In addition, certain production routes might have been phased out, have changed the production mix of a material, substance, or energy. A frequently changing and quite

dynamic example are the electricity grid mix datasets, as some countries reduce or phase-out certain types of energy or fuels in the electricity supply mix, which require the introduction of alternative sources of fuels and energy.

- **Further standardization, LCI method evolvement, and regulatory developments.** Modelling of realistic technology chains has always been the core focus of the GaBi databases. This includes changes due to the regulatory requirements (e.g. shift from Euro 5 to Euro 6 vehicle emission standards, implementation of the Montral protocol, ...). Further harmonization and improvement in the LCI methodology (as mirrored by developments in standardization and in relevant governenmental initiatives) and feedback from clients and consultants at Sphera have moreover enhanced over the years the modelling approach for the GaBi Databases. Detailed information is gprovided in the document *GaBi Databases and Modelling Principles.*[3] Methodological adoptions are however carried out extremely carefully, passing through multiple levels of reviews by Sphera experts responsible for standardization, technology developments and quality assurance. This internal review process was audited within the continuous improvement process by our external verification partner DEKRA. GaBi databases updates and upgrades focus on reliability through consistency to ensure clients' system models and results are not jeopardized due to research-interest driven and/or short-lived methodological changes.

The degree of influence of each of these factors is specific to each process and cannot be generalized for all cases, nor can a single factor be highlighted. However, as technological excellence is a core value of Sphera data, our focus is to update and apply all relevant and important improvements and changes in technology and the supply chain and the necessary and practice-tested improvements and changes in the methodology.

3.2 Reasoning behind this document

GaBi models — leading to a single aggregated dataset in the GaBi databases — consist of many datasets all along the supply chain network towards the product that is represented by the resulting dataset. This means, many smaller or bigger changes within the supply chain contribute to the overall change in impact results. The change analysis from the preceding to the latest databases edition is a time consuming, but important process within Sphera, and the results are documented in this report.

It is important to be aware, that the relevance of changes in the GaBi databases related to the user's own systems is highly dependent on the goal and scope in the specific user model and intended application of the results. This means the same dataset may lead to significant changes for one user and one kind of application (e.g. reporting), whereas in another user's system or another application (e.g. a comparison, with both systems being affected in the same way), the changes might be irrelevant. To shorten the time for users to reflect on the relevancy of the GaBi database changes for their own systems, the analyst function of GaBi Software may support you in an effective way. As a means of guiding users to the relevant changes in their models that are due to changes in external factors and GaBi background data up-

[3] https://gabi.sphera.com/index.php?id=8375

grades, Sphera provides the present document "*GaBi Databases 2022 Edition - Upgrades and Improvements*" in addition to the document "*GaBi Databases and Modelling Principles,*" and supporting satellite documents, complemented by close to 15,000 interlinked electronical documentation files of the processes supplied with the GaBi databases and also accessible online.

The following sections address the most relevant changes in the GaBi Databases for different impact topics.

3.3 Regionalization of water use

Where possible, the regionalization of country-specific production processes was further increased, to better capture water scarcity implications.

Generally, we note that correct modelling of water use – as net abstraction – is inherently challenging and frequently subject to errors in models. For further information regarding water assessment and how to ensure correct and coherent regionalization at the input and output side in your models, please see the satellite documentation in "Introduction to Water Assessment in GaBi"[4].

3.4 Land use Change

Direct land use change (dLUC): Emissions from direct land use change are upated with recent information, namely the IPCC 2019 Refinements to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for above-ground mass carbon stock (if land use change is known), values of soil organic carbon stock and stock change factors. This methodology takes changes in soil organic carbon stock into account.

Please refer to the document "Documentation for Land Use Change Emissions Evaluation in GaBi"[5] for further details.

Indirect land use change (iLUC): iLUC is not considered.

3.5 LCIA Methods – method updates, characterization factor updates, corrections

3.5.1 IPCC AR 5

The IPCC AR5 characterization factors in GaBi now include climate carbon feedbacks from non-CO_2 gases (cc fb). The previous IPCC AR 5 factors without climate carbon feedbacks can now be found in the folder "earlier versions of methods". All IPCC AR 5 quantities were renamed to clearly reflect whether climate carbon feedbacks are included.

3.5.2 IPCC AR 6 (version August 2021)

IPCC AR6 GWP and GTP factors are now available in GaBi. The IPCC AR6 quantities are available in two versions: including and excluding biogenic CO_2. These factors are based on the Working Group 1 report

[4] https://gabi.sphera.com/index.php?id=8375

[5] https://gabi.sphera.com/index.php?id=8375

published in August 2021, which at time of implementation was still subject to copy-editing, corrigenda, and trickle backs. We will review and if necessary update these factors once the final report has been published.

3.5.3 ISO14067 GWP indicators

The ISO14067 GWP values were updated to include climate carbon feedbacks, ensuring consistency with ISO 1467:2018. Furthermore, the quantity "ISO 14067 GWP 100, Biotic" was split into two quantities. Now, biotic uptake and biotic emissions can be calculated separately as required by the standard. Additionally, all quantities were renamed according to ISO14067 (see Error! Reference source not found.).

Table 3-1 Previous and current naming of the ISO14067 quantities – Before and after the change

Name of quantity – Before	Name of quantity - After
ISO14067 GWP100, Aviation	ISO14067 GWP100, Aircraft emissions
ISO14067 GWP100, Biotic	ISO14067 GWP100, Biogenic GHG emissions
	ISO14067 GWP100, Biogenic GHG removal
ISO14067 GWP100, Land Use	ISO14067 GWP100, Emissions from land use change (dLUC)
ISO14067 GWP100, Fossil	ISO14067 GWP100, Fossil GHG emissions

3.5.4 SBK Bepalingsmethode – Jan. 2021 (NMD 3.3)

The SBK Bepalingsmethode (version Jan. 2021 – NMD 3.3) is now available GaBi. It covers a number of environmental impact indicators, resource use indicators and output/waste indicators as well as three sets of weighting factors.

3.5.5 ISO21930 (non-LCIA indicators)

Non-LCIA indicators for EPDs according to ISO21930 are now available in GaBi. They cover resource use, greenhouse gas emissions and removals, freshwater consumption, as well as waste and other output flows

3.5.6 CML August 2016 Normalization Factors

Four sets of normalization factors for CML version Aug. 2016 were added:

- CML2001 - Aug. 2016, EU25+3, year 2000, incl biogenic carbon (region equivalents) {b06aea9a-6f86-46dd-83d1-6d458f98efe7}
- CML2001 - Aug. 2016, EU25+3, year 2000, excl biogenic carbon (region equivalents) {15c1045c-17fe-40c6-b499-fb6ef732fcfa}
- CML2001 - Aug. 2016, World, year 2000 , excl biogenic carbon (global equivalents) {f9982e88-133e-4bde-8d0f-850cc9cec65d}
- CML2001 - Aug. 2016, World, year 2000 , incl biogenic carbon (global equivalents) {a2f193c0-b061-4b9d-b120-0488c536590a}

3.5.7 EF 3.0 Normalization Factors (November 2019)

The EF 3.0 normalization factors were updated according to the official release from November 2019. This affects:

- EF 3.0 (Person equivalents) {81983D3E-8296-42DA-BB58-377A3D127BE1}
- EN15804 based on EF 3.0 (Person equivalents) {58A6B6F3-345A-4616-A979-3C581B39B2B1}

3.5.8 Single elementary flows

The following corrected characterization factors of single elementary flows have been implemented:

- The material declaration quantity Indium (E) *was removed from the flow* Indium [non renewable elements] {4C0D1FDD-21EA-4DA5-9834-9E0215D492BE}

The following flows have been renamed:

- The spelling of the substance *Metam sodium* was harmonized for these flows:
    - {b7cb85ed-d3aa-4660-bf54-455ebf955af1}
    - {8b7b411c-389a-48b5-b959-9a24a25d35d7}
    - {fbce422b-0d94-4a85-8662-6b11c9c65c6d}
- The naming of the flows for the substance *EPTC / Dipropylthiocarbamic acid S-ethyl ester* was harmonized to *Dipropylthiocarbamic acid S-ethyl ester* for these flows:
    - {9f7a1096-f3f6-43cb-b288-9a33bbf1df7a}
    - {0d446c2d-b515-4f70-9061-8e281e340e1b}
    - {d0540136-b853-45eb-8040-e2cc109fef40}
- The naming of the flows for the substance *Clomazone / Dimethazone* was harmonized to *Clomazone* for these flows:
    - {d8b800b4-193c-4eb5-ba45-96c560071d85}
    - {95dea254-8f25-4921-90d2-9fbd65dfb538}
    - {3dade8da-9977-4fc8-8f44-46f715e450b7}
    - {0494e60a-044f-4c2b-a75d-7a26fde7ec44}
    - {dcc4462d-5ca1-4cda-b0cb-5d4c99d3cdb2}

The following flows have been merged:

- *Sulfite [Inorganic emissions to fresh water] {4d9a8790-3ddd-11dd-96ef-0050c2490048}* merged into *Sulphite [Inorganic emissions to fresh water] {ffe5f343-39ce-4696-a95e-27e06badf84d}*

3.6 New datasets

With this year's upgrade, 269 new processes and 2 new plans are additionally made available to users, as part of existing GaBi databases, i.e. without extra charge to all customers with a valid subscription or maintenance license:

Professional DB: **150 new processes** DE: Caprolactam mix,, DE: Green electricity grid mix (production mix)(2020), US: Metal roll forming, US: diverse spray polyurethane foam insulation, EU-28: diverse wood chips, RNA: EPD for renewable primary resources, recovered thermal energy,…
Indian DB: **22 new processes** Association datasets for aluminum from AA, precious metals from IPA, nickel sulphate hexahydrate from Nickel Institute, natural rubber, universal tractor, pesticide,…
Extension DBs:
Ia "organic Intermediates": 6 new processes Diverse organic intermediate products, such as cumene (isopropylbenzene), ethene, methacrylate, and chlorodifluoromethane, …
Ib "inorganic Intermediates": 6 new processes Diverse inorganic intermediate products: phosphoric acid, titanium dioxide pigment, trichlorosilane by-product chlorosilanes, sodium hydroxide from chlorine-alkali-electrolysis, and ammonia without CO_2 recovery.
II "energy": 58 new processes Electricity from biogas for several countries, US: Electricity from nuclear, SG: Electricity grid mix, Electricity grid mixes for several US subregions, IN: Thermal energy from LPG,… **2 new plans** US: Electricity grid mix (production mix) US: Electricity grid mix, Puerto Rico (production mix)
VII "plastics": 4 new processes BR: Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD) JP: Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD) EU-28: Polyvinyl butyral (PVB) by-product ethyl acetate DE: Natural Rubber (NR) (incl. LUC emissions)

IXa "end of life": 1 new process EU-28: Ferro metals in waste incineration plant
XII "renewable materials": 1 new process DE: Cattle hide, fresh (diary cow, from slaughterhouse, PEFCR allocation)
XIV "construction materials": 2 new processes DE: Bathing and shower tub enamel (approximation) DE: Cable 5 wire (EN15804 C4)
XVI "seat covers": 4 new processes Diverse grain leather datasets and cattle hide for DE
XVII "full US": 41 new processes Electricity grid mix for several US subregions, Caprolactam mix, EPD for non-hazardous waste disposed, calcination carbon emissions,... **2 new plans** US: Electricity grid mix (production mix) US: Electricity grid mix, Puerto Rico (production mix)
XXI "India": 2 new processes IN: Cumene (isopropylbenzene) (C9H12) IN: Natural Rubber (NR) (incl. LUC emissions)
XXII "carbon composites": 16 new processes Diverse carbon fiber (CF) and Tailored-Fiber-Placement (TFP) datasets from Fraunhofer

Access to the complete dataset documentation is available for searching and browsing by extension database online under https://gabi.sphera.com/databases/gabi-data-search/

3.7 Inventories for electricity, thermal energy, and steam

Relevant changes in energy carrier mix for electricity generation after the upgrade

In the GaBi Databases 2022, the reference year is 2018 for all electricity grid mixes and energy carrier mixes (hard coal, crude oil, and natural gas), i.e. using the latest available data with global coverage. The electricity grid mixes in the Extension Module XVII: Full US (electricity grid mixes for US sub grids and subregions under eGRID) refer now to 2019 in the GaBi Databases 2022, using the most recent version of eGRID2019 [EPA 2021].

Relevant changes in the life cycle inventory (LCI) of the upgraded national grid mix datasets occur for a couple of countries due to changes in the energy carrier mix that is used for electricity generation, as well as changes in the amount of imported and exported electricity and the country of origin of the imports. The changes in the LCI datasets reveal the following trends:

- An ongoing trend in some countries to increase the share of renewable energies in their electricity generation, which is, for example, the case for, Denmark, Finland, Germany, Ireland, Lithuania, United Kingdom.
- As in the years before, several transition countries have an ongoing increase in electricity consumption. In countries like China, India or Indonesia, the domestic electricity production has increased by 3 % to 8 %.
- Fluctuations in renewable electricity generation due to weather conditions, especially regarding water availability for hydro power stations (e.g. Portugal, Spain, or Latvia)

The following three figures present the development of the energy carrier mix for electricity generation in Germany, the European Union, and the United States between 2000 and 2018.

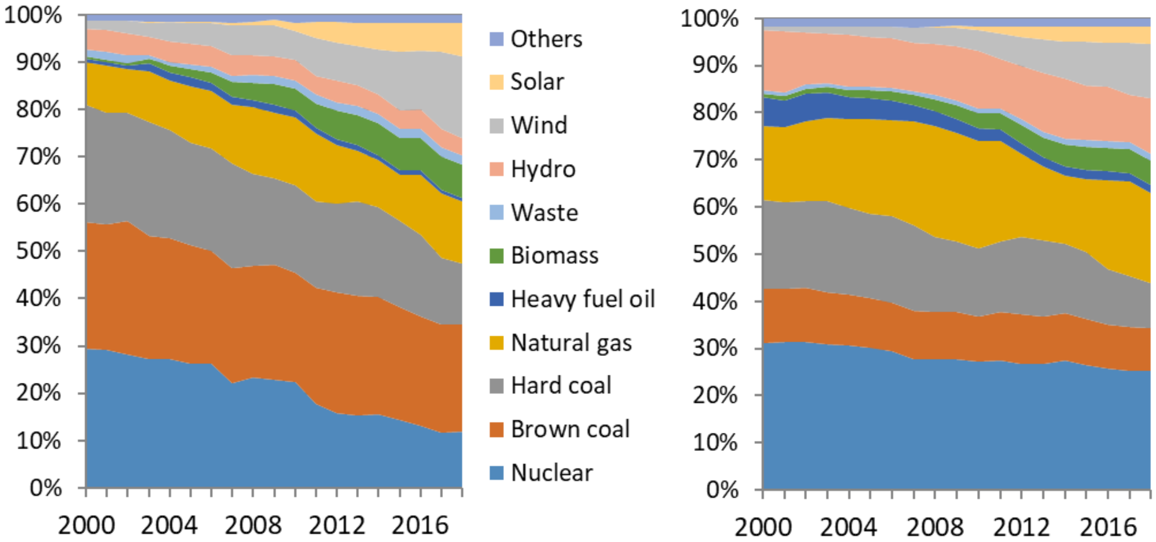


Figure 2: Development grid mix in Germany (left) and EU-28 (right) [Eurostat 2021]

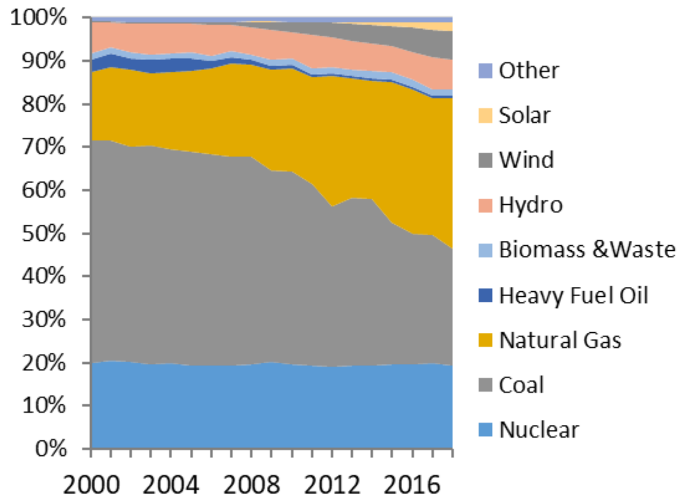


Figure 3: Development grid mix United States [EIA 2020]

In Germany, generation from nuclear remained stable in the reported year, whereas generation from coal power stations dropped further from 37.0 % to 35.6 %. The share of renewable energy sources for electricity generation in Germany increased from 34.2 %[6] in 2017 to 36.1 % in 2018. Absolute electricity generation from renewable sources increased from 230 TWh in 2017 to 236 TWh in 2018, most of the incremental renewable electricity was produced by wind power.

In the EU-28, the share of electricity generation from renewable energy increased from 30.7 % to 33.2 %, mainly due to higher water availability for hydro power stations. In addition, the share of wind power increased from 11.0 % to 11.6 %.

In the U.S., the electricity output from coal power plants decreased from 1292 TWh in 2017 to 1243 TWh in 2018. The share of electricity from coal in the production mix decreased therefore from 30.8 % to 28.5%. The reduced generation from coal was substituted by more generation from natural gas, increasing the share of electricity from natural gas from 31.3 % to 34.1 %. The share of electricity from renewable sources remained about stable.

In the following tables, the energy carrier mixes for 2017 and 2018 are displayed for selected economically relevant countries and for those with important changes.

Table 3-2: Energy carrier mix for electricity generation – selected EU countries [IEA 2020]

[6] 50% of electricity from waste is accounted as renewable energy

[%]	France		Germany		United Kingdom		Italy		Poland		Spain	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Nuclear	71.0	71.0	11.7	11.8	20.8	19.5	0.0	0.0	0.0	0.0	21.1	20.3
Lignite	0.0	0.0	22.8	22.7	0.0	0.0	0.0	0.0	30.6	29.0	0.9	0.6
Hard coal	2.3	1.4	14.2	12.9	6.7	5.0	11.0	9.8	46.4	47.8	15.4	13.0
Coal gases	0.4	0.5	1.8	1.7	0.2	0.2	0.8	0.9	1.3	1.4	0.4	0.5
Natural gas	7.2	5.3	13.4	13.0	40.4	39.4	47.5	44.5	5.9	7.4	23.2	21.1
Heavy fuel oil	1.3	1.0	0.9	0.8	0.5	0.3	3.9	3.8	1.2	1.1	5.7	5.3
Biomass (solid)	0.6	0.6	1.6	1.7	6.1	7.1	1.4	1.4	3.1	3.1	1.6	1.5
Biogas	0.4	0.4	5.3	5.3	2.3	2.5	4.3	4.4	0.6	0.7	0.3	0.3
Waste	0.8	0.8	2.0	2.1	2.2	2.6	1.6	1.7	0.2	0.3	0.6	0.6
Hydro	9.9	12.2	4.0	3.8	2.6	2.4	12.9	17.5	1.8	1.4	7.6	13.4
Wind	4.4	4.9	16.2	17.1	14.8	17.1	6.0	6.1	8.7	7.5	17.8	18.6
Photovoltaic	1.7	1.8	6.0	7.1	3.4	3.9	8.3	7.8	0.1	0.2	3.1	2.9
Solar thermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.8
Geothermal	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.1	0.0	0.0	0.0	0.0
Peat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3-3: Energy carrier mix for electricity generation – selected non-EU countries [IEA 2020]

[%]	Brazil		China		India		Japan		Russia		USA	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Nuclear	2.7	2.6	3.7	4.1	2.5	2.4	3.1	6.3	18.6	18.3	19.6	18.9
Lignite	1.0	1.0	0	0.0	11.7	13.9	0.0	0.0	7.0	6.7	1.8	1.5
Hard coal	1.7	1.3	66.2	65.0	62.2	59.4	30.5	29.8	8.3	8.6	29.0	27.0
Coal gases	1.5	1.5	1.4	1.4	0.1	0.2	3.0	2.9	0.6	0.6	0.1	0.1
Natural gas	11.1	9.1	2.8	3.1	4.6	4.6	38.0	36.4	47.4	47.3	31.2	34.1
Heavy fuel oil	2.7	2.1	0.1	0.1	1.6	0.5	6.7	5.0	0.6	0.7	0.8	1.0
Biomass (solid)	8.7	8.7	1.2	1.3	2.8	2.7	1.9	2.0	0.0	0.0	1.1	1.0
Biogas	0.2	0.2	0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.3	0.3
Waste	0.0	0.0	0.2	0.2	0.1	0.1	2.0	2.2	0.2	0.2	0.4	0.4
Hydro	63.0	64.7	17.9	17.2	9.3	9.5	8.6	8.5	17.1	17.3	7.6	7.1
Wind	7.2	8.1	4.4	5.1	3.3	4.1	0.6	0.7	0.0	0.0	6.0	6.2
Photovoltaic	0.1	0.6	2.0	2.5	1.7	2.5	5.3	6.0	0.1	0.1	1.6	1.8
Solar thermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Geothermal	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.4	0.4
Peat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3-4: Energy carrier mix for electricity generation – countries with significant changes [IEA 2020]

[%]	Argentina		Belgium		Croatia		Latvia		Malta		Portugal	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Nuclear	4.3	4.7	49.1	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hard coal	1.2	1.1	0.1	0.1	11.3	10.6	0.0	0.0	0.0	0.0	24.7	20.1
Coal gases	0.5	0.4	2.7	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural gas	56.7	65.0	26.6	32.1	25.8	16.5	27.5	47.9	78.2	89.0	31.8	26.2
Heavy fuel oil	7.9	4.6	0.2	0.2	1.8	0.5	0.0	0.0	11.7	0.9	2.2	1.9
Biomass (solid)	1.4	0.8	4.4	4.7	1.8	2.3	7.0	8.5	0.0	0.0	4.3	4.3
Biogas	0.0	0.1	1.1	1.4	2.6	2.6	5.4	5.6	0.6	0.5	0.5	0.5
Waste	0.0	0.0	2.8	3.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.0
Hydro	27.6	22.2	1.6	1.8	46.0	57.1	58.2	36.2	0.0	0.0	12.8	22.9
Wind	0.4	1.0	7.6	10.0	10.0	9.8	2.0	1.8	0.0	0.0	20.6	21.2
Photovoltaic	0.0	0.1	3.8	5.2	0.7	0.5	0.0	0.0	9.4	9.7	1.7	1.7
Solar thermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Geothermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4
Peat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

The following list summarizes countries with significant changes in the energy carrier mix for electricity generation (percentual values always refer to the entire production mix in the country):

- Argentina (AR) → The share of hydropower at the production mix decreased from 27.6 % down to 22.2 %. Use of fuel oil for electricity production decreased from 7.9 % at the production mix to 4.6 %. This was both compensated predominantly by higher production from power stations using natural gas (share 56.7 % up to 65.0 %).

- Belgium (BE) → Lower production from nuclear power stations (share 49.1 % down to 38.3 %) has been compensated by use of natural gas for power generation (share 26.6 % up to 32.1 %) and renewable energies (share 19.4 % up to 23.9 %).

- Bulgaria (BG) → Higher generation from renewables (share 18.7 % increased to 26.2 %), especially wind power (share 7.7 % up to 11.6 %) decreased the share of electricity generation from lignite from 45.0 % down to 39.0 %.

- Croatia (HR) → Higher electricity output from hydropower stations (share 46.0 % up to 57.1 %) resulted in reduced electricity generation from natural gas power stations (share 25.8 % down to 16.5 %).

- Greece (GR) → The share of electricity generation by renewables increased from 25.1 % to 30.6 %, reducing the share of power generation from natural gas (share 31.0 % down to 26.4 %) and lignite (share 34.0 % down to 32.3 %).

- Ireland (IE) ➔ A further increase in wind power capacities and an associated increase from 24.1 % to 27.8 % at the production mix resulted in a drop of electricity generation of coal (share 11.8 % down to 6.9 %).
- Italia (IT) ➔ The share of hydro power increased from 12.9 % to 17.5 % (higher water availability) decreasing the share of electricity from natural gas from 47.5 % to 44.5 % and the share of coal from 11.0% down to 9.8%.
- Latvia (LV) ➔ A considerable drop in electricity generation from hydropower stations (lower water availability) decreased the share of hydropower from 58.2 % to 36.2 %. The drop in hydropower was mainly compensated by natural gas (share 27.5 % up to 47.9 %).
- Macedonia (MK) ➔ Due to higher output from hydropower stations (share 19.8 % up to 31.9 %) the share of electricity from lignite has been decreased from 60.5 % down to 50.8 %.
- Malta (MT) ➔ After the start of the new CCGT unit in 2017 in the Delimara power and a retrofitted diesel engine plant which also runs on natural gas since 2017, Malta has switched its electricity generation nearly completely from oil to natural gas. The share of electricity from fuel oil dropped further from 11.7 % to 0.9 %.
- Portugal (PT) ➔ As observed in previous years, for Portugal water availability for electricity generation can lead to relevant annual changes in the grid mix. In 2018, the share of hydro power in the grid increased from 12.8 % in 2017 to 22.9 % in 2018. Consequently, output from natural gas power stations (share 31.8 % down to 26.2 %) and coal power stations (24.7 % down to 20.1 %) decreased.
- Spain (ES) ➔ Similar like in Portugal, higher water availability for hydro power stations increased the share of hydro power in the grid mix from 7.6 % to 13.4 %. As a consequence, generation from fossil combustible fuels dropped from 45.8 % to 40.5 %.

Development GWP and other impact categories for electricity grid mix datasets

The following figure 4 illustrates the absolute primary energy demand (PED), as well as global warming potential (GWP[7]), acidification potential (AP[7]), eutrophication potential (EP[7]) and photochemical ozone creation potential (POCP[7]) per kWh of supplied electricity in Germany, the European Union and the United States.

[7] CML 2001, Updated January 2016

In the 2022 GaBi databases, the emission factors for the combustion of fuels in power plants have been unchanged compared to the 2021 edition, with exception of the eGRID subregions (Extension Module XVII: Full US - electricity grid mixes for US sub grids and subregions under eGRID) which have been updated to eGrid2019 [EPA 2021].

In Germany, GWP of the grid mix decreased by 4 % from 535 g CO_2-eq./kWh in 2017 to 513 g CO_2-eq./kWh in 2018. Generation from coal power stations (down from 241 TWh to 210 TWh) was reduced by higher generation from wind power (from 106 TWh in 2017 to 110 TWh in 2018) and photovoltaics (from 39 TWh in 2017 to 46 TWh in 2018). Changes in PED fossil, AP, EP and POCP are between -8 % and -5 % and are linked to the changes in the energy carrier mix.

For the EU-28, the GWP decreased from 394g CO_2-eq./kWh in 2017 to 372g CO_2-eq./kWh in 2018. Due to the reduction of generation of electricity from coal substituted by generation from natural gas the EP, AP, POCP have been reduced by between -1% and -6 %.

In the U.S., the GWP decreased from 532 g CO_2-eq./kWh in 2017 to 516 g CO_2-eq./kWh in 2018. The main reason for the decrease in GWP was the lower generation from coal, substituted by higher generation from natural gas. Reductions in EP, AP and POCP are around -10 %, mostly due to the realised partly substitution of coal by natural gas for electricity generation.

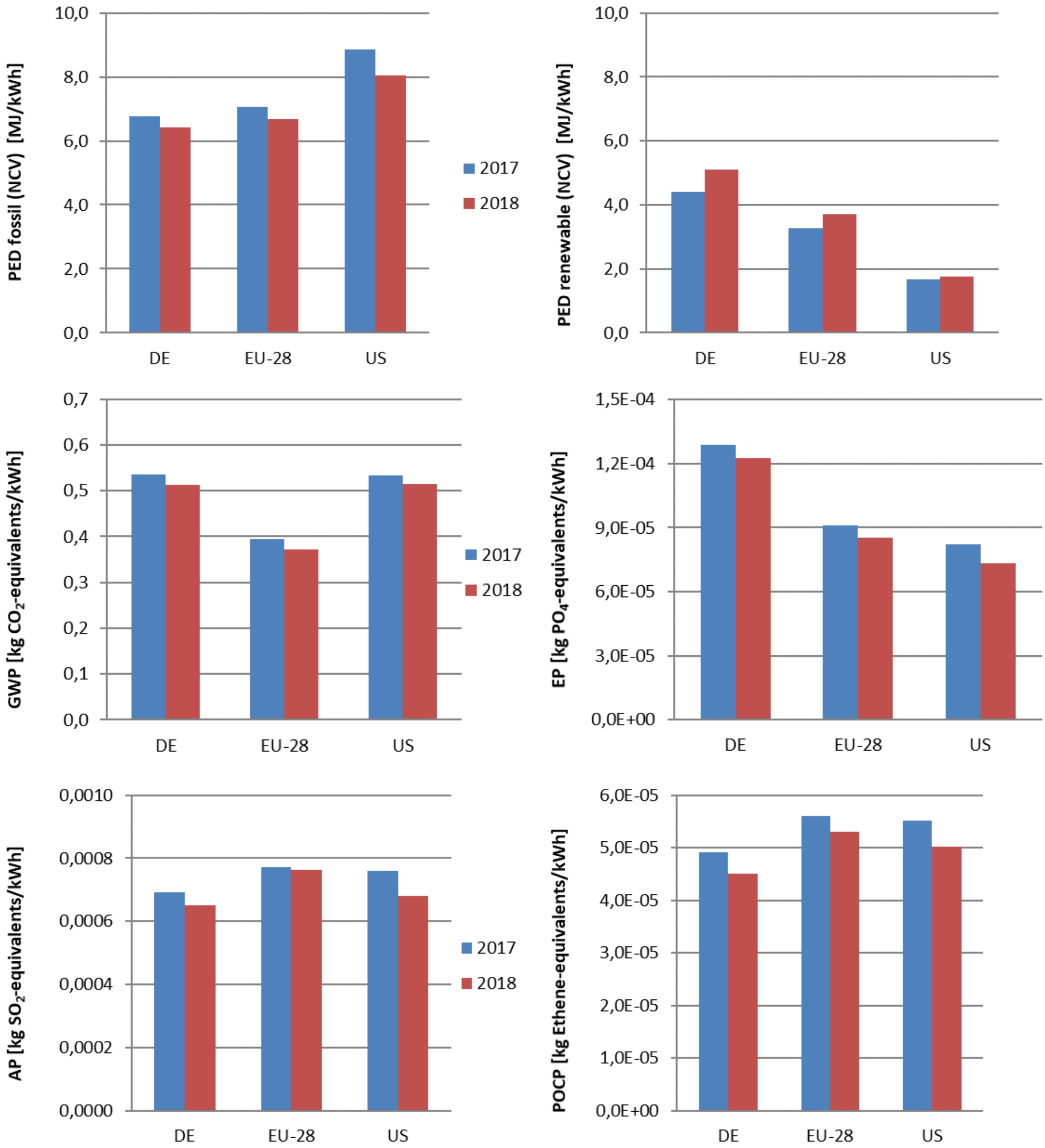


Figure 4: PED, GWP, EP, POCP and AP of electricity grid mixes DE, EU-28 and US

The following figures 5 and 6 present the percentile changes of the greenhouse gases for the upgraded electricity grid mixes in the 2022 *GaBi Professional* database (reference year 2018). and the *Extension Module Energy* compared to the 2021 data (reference year 2017), as well as the absolute greenhouse gas emissions per kWh in the 2021 and 2022 GaBi Databases.

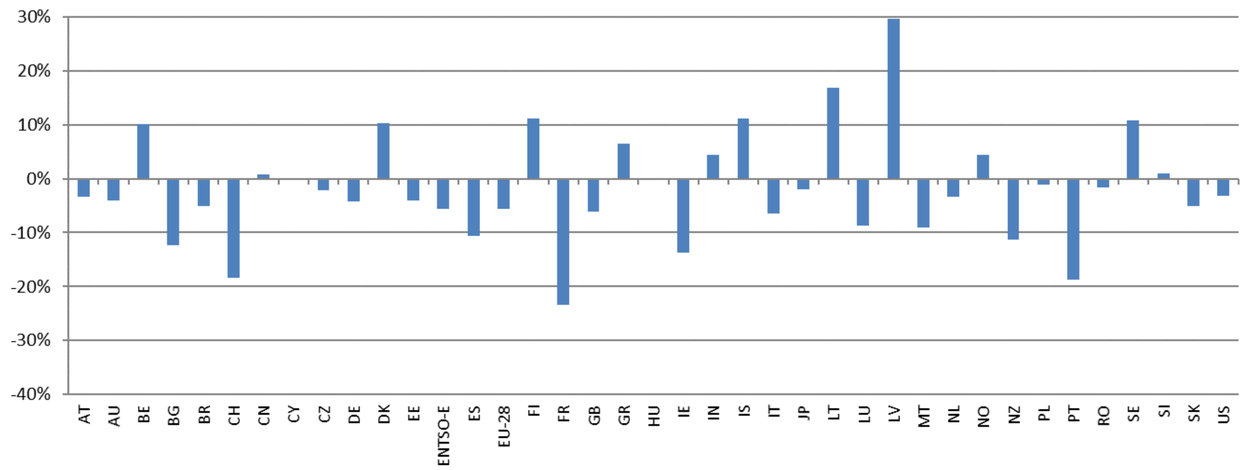


Figure 5: Changes in GWP of electricity grid mix datasets in GaBi Professional 2022 Edition compared to 2021

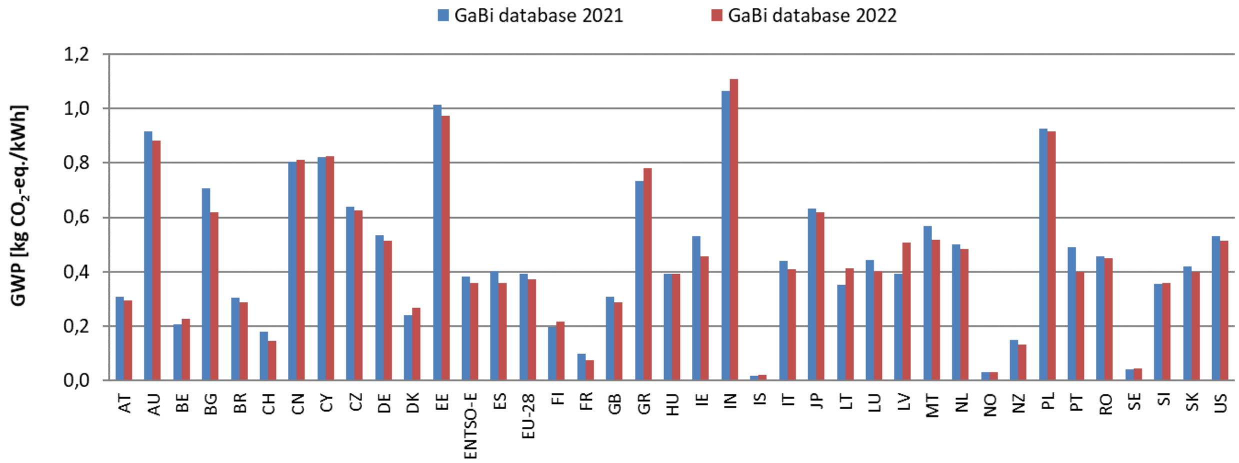


Figure 6: Absolute GWP of electricity grid mix datasets in GaBi Professional 2021 & 2022 Edition

For most cases, the changes in the national electricity grid mix datasets are related to the upgraded energy carrier mix:

- Belgium (BE) ➔ The 10 % increase in GWP for average grid electricity (consumption mix) in Belgium from 206 g CO_2-eq./kWh in 2017 to 227 g CO_2-eq./kWh in 2018 is related to lower production from nuclear power stations (share in grid mix down from 49.1 % to 38.3 %). Although partly compensated by incremental production from renewable energies, more than 50 % is compensated by electricity from natural gas. It should be noted that the carbon intensity of the supplied electricity in Belgium is already low and changes in the grid mix due to fluctuating power output can lead to high relative changes between two years (see Figure 5). This holds true also for Denmark, Finland, France, New Zealand, Switzerland and especially for Iceland, Norway, and Sweden with very low carbon intensities per supplied kWh of electricity.

- Bulgaria (BG) ➔ GWP impacts per kwh of grid electricity in Bulgaria decreased by 12 % from 706 g CO_2-eq./kWh in 2017 to 619 g CO_2-eq./kWh in 2018. Increasing generation from renewables (especially wind power) reduced the share of electricity from lignite by -13 %.
- Denmark (DK) ➔ Lower electricity output from wind installations and biomass power plants has been compensated by electricity generation from coal (share up from 20.0 % to 21.6 %). Consequently, the carbon intensity of the electricity supply in Denmark increased from 242 g CO_2-eq./kWh in 2017 to 267 g CO_2-eq./kWh in 2018.
- Finland (Fi) ➔ Lower output from hydro power stations has been partly compensated by electricity from natural gas, resulting in an increase of the carbon intensity from 196 g CO_2-eq./kWh in 2017 to 218 g CO_2-eq./kWh in 2018.
- France (FR) ➔ Due to higher output from renewable power generation (especially hydro-power) the use of natural gas (share in grid mix 7.2% down to 5.3%) and coal for electricity generation has been reduced. The GWP decreased from 101 to 77 g CO_2-eq./kWh. Due to the low carbon intensity for the supply of electricity in France, the relative decrease was -23 %.
- Iceland (IS) ➔ The relatively high 11% increase in GWP impact is to be judged on the back-ground of the low absolute GWP impacts per supplied kWh in Iceland (20 g CO_2-eq./kWh in 2017 up to 22 g CO_2-eq./kWh in 2018) that render small changes in fossil sources having big impact on the mix.
- Ireland (IE) ➔ The -14% drop in carbon impacts from 532 g CO_2-eq./kWh in 2017 to 458 g CO_2-eq./kWh in 2018 is related to the further increase in wind power capacities and the decrease of electricity generation from coal (share 11. 8% down to 6.9 %).
- Latvia (LV) ➔ The GWP impacts of supplied electricity in Latvia increased by 30% from 391 g CO_2-eq./kWh in 2017 to 507g CO_2-eq./kWh in 2018 because of lower electricity out-put from hydro power stations having been compensated mainly by electricity from natural gas.
- Lithuania (LT) ➔ GWP impacts of supplied electricity increased by 17 % from 353 g CO_2-eq./kWh in 2017 to 412g CO_2-eq./kWh in 2018. The change is related to increased im-pacts of imported electricity. In addition, the share of imports at the total supplied electrici-ty increased from 79 % to 83 %.

- New Zealand (NZ) ➔ Similar to other countries with low carbon intensities per supplied kWh of electricity, the absolute change is low (down from 149 g CO_2-eq./kWh in 2017 to 133 g CO_2-eq./kWh in 2018 due to higher share from hydro power stations.

- Portugal (PT) ➔ Like in previous years, changing water availability for power generation can have a considerably impact on the carbon intensity of the supplied electricity. The higher output of electricity from hydro power stations in 2018 (share up from 12.8% in 2017 to 22.9%) decreased the GWP impacts from 492 g CO_2-eq./kWh in 2017 to 400 g CO_2-eq./kWh in 2018.

- Spain (ES) ➔ Similar to Portugal, higher water availability for hydro power generation resulted in a lower GWP value for grid electricity (decrease from 403g CO_2-eq./kWh in 2017 to 360 g CO_2-eq./kWh in 2018).

- Sweden (SE) ➔ The 11 % increase in GWP impact is again to be seen on the backgroundof the low absolute GWP impacts per supplied kWh in Sweden (42 g CO_2-eq./kWh in 2017 up to 46 g CO_2-eq./kWh in 2018).

- Switzerland (CH) ➔ The GWP impact decreased by -18% from 181 g CO_2-eq./kWh in 2017 to 148 g CO_2-eq./kWh in 2018, due to hgher renewables share resulting from lower imports and lower carbon intensities of the imported electricity.

The following Figure 7 illustrates the GWP of the electricity supply in selected countries over the last ten years. Compared to 2008, the GWP in Germany has been reduced by -18 %, in the EU by -24 %. The share of renewables for power generation in Germany has increased significantly from 16 % in 2008 to 36 % in 2018, substituting mostly nuclear power and electricity from coal. In some of the EU Member States, relevant GWP reductions have been achieved over the last seven years, mainly due to a substitution of fossil fuels by renewable sources. e.g., Denmark -49 %, Finland -30 %, United Kingdom -51 %, Greece -23 %, Hungary -27 %, Malta -59 %, Czech Republic -25 %, Portugal -26 % and Romania -31 %. In the U.S., the substitution of electricity from hard coal by electricity from natural gas, as well as a higher share of electricity from renewables, has decreased the GWP per kWh of supplied electricity between 2008 and 2018 by -23 %. In Japan, a different development can be seen, related largely to the shift toward more fossil fuels after the 2011 Fukushima nuclear reactor catastrophe that has in consequence lead Japan to take some nuclear reactors off the grid.

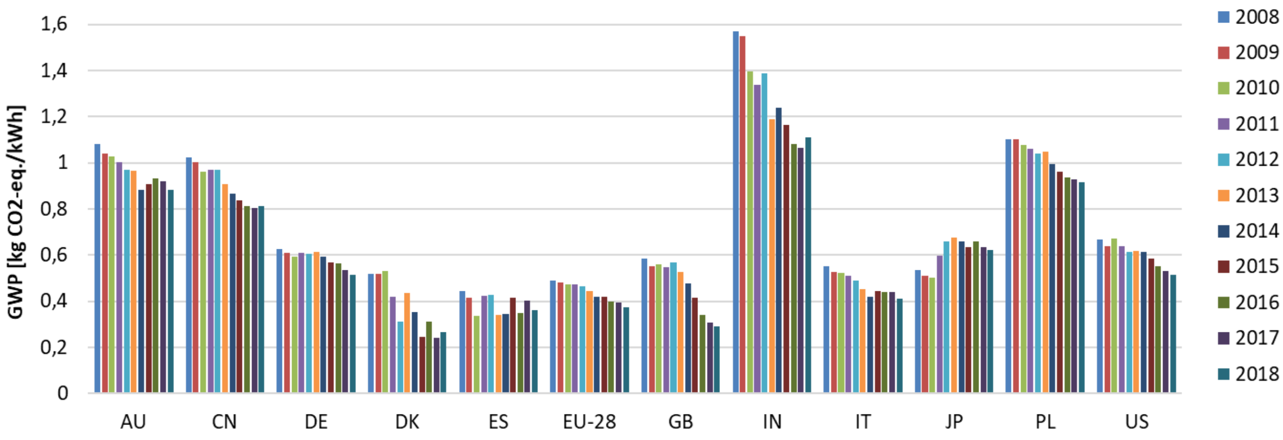


Figure 7: Development GWP for electricity supply in selected countries

The following three figures 8, 9, and 10 illustrate the relative and absolute changes of the GWP for the electricity grid mix datasets in the extension module Energy, as well as the changes over time.

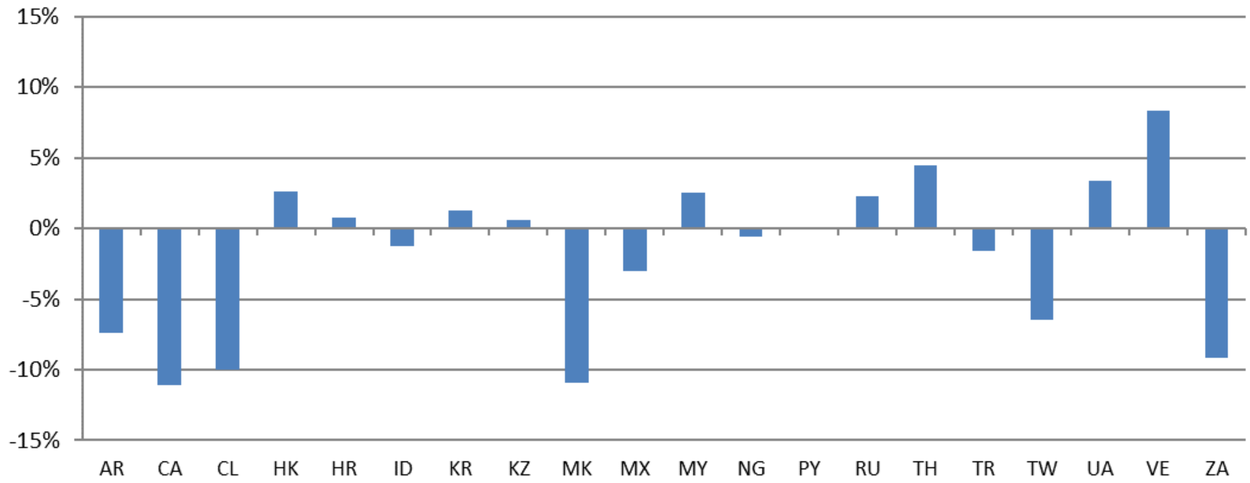


Figure 8: Changes in GWP electricity grid mix datasets in GaBi Extension Module Energy 2022 compared to 2021

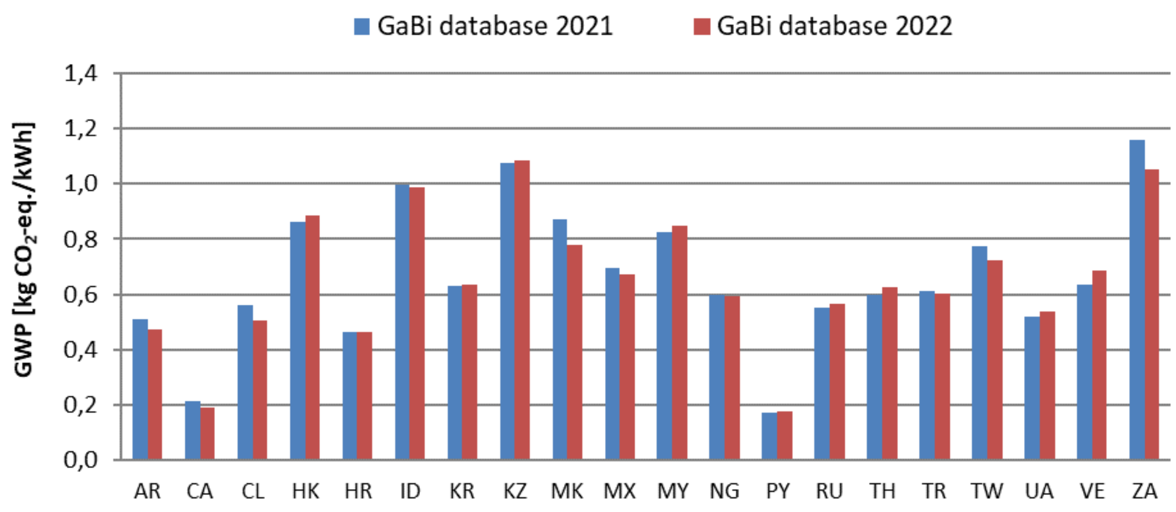


Figure 9: Absolute GWP of electricity grid mix datasets in GaBi Extension module Energy 2021 & 2022

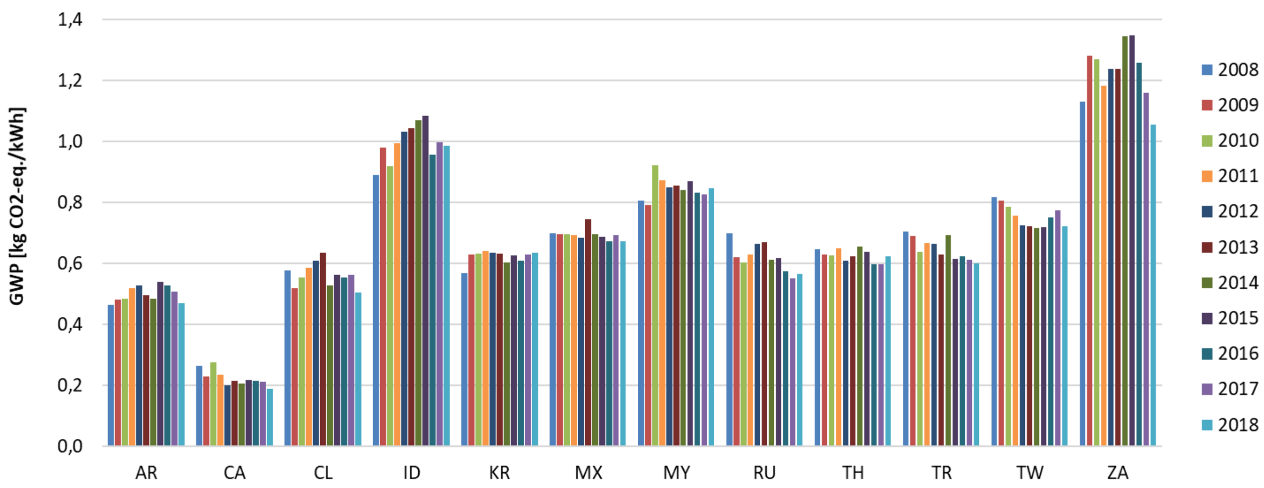


Figure 10: Development GWP for electricity supply in selected countries

Extension module XVII: Full US – electricity grid mixes US subregions

Figure 11 and Figure 12 illustrate the absolute and relative changes in GWP of the eGRID subregions, as well as the five subgrids and the US average comparing data from eGRID2019 used within the GaBi Databases 2022 and data from eGrid2018 used in the GaBi Databases 2020. For the subregions (see Figure 13 to get an overview) and subgrids in GaBi, the reference year has been updated from 2018 in GaBi Databases 2021 to 2019 in GaBi Databases 2022. The changes in GWP are mostly related to the updated energy grid mixes and partly to updates in the supply of energy carriers and infrastructure.

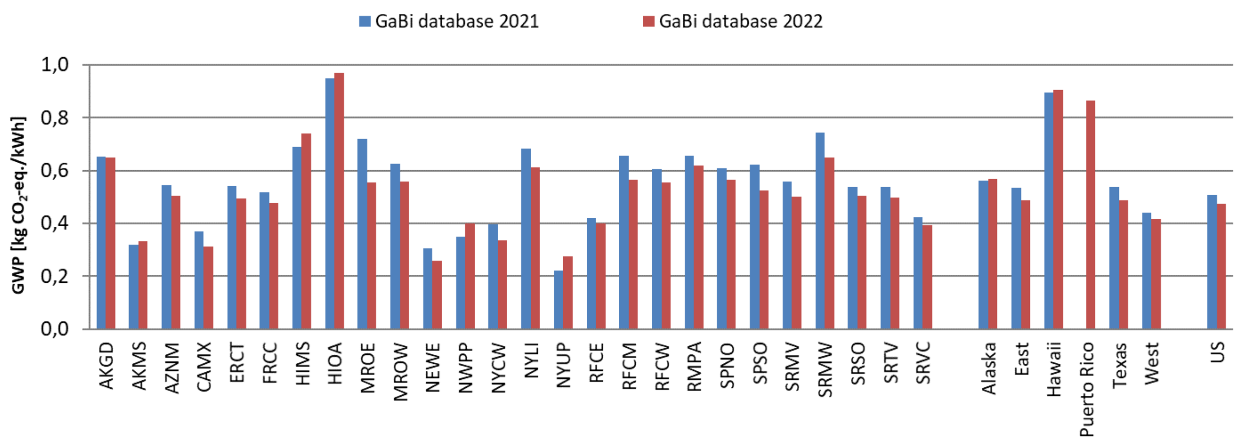


Figure 11: Absolute GWP of electricity grid mix datasets in GaBi Extension module Full US 2021 & 2022

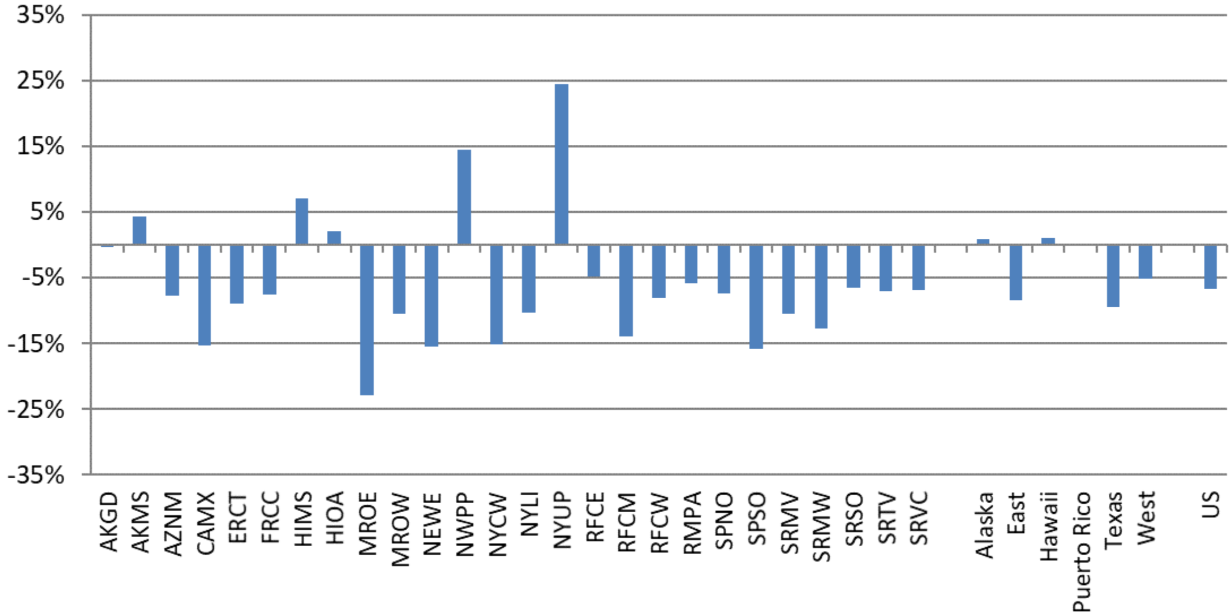


Figure 12: Changes in GWP electricity grid mix datasets in GaBi Extension Module Full US 2022

Other impact categories, such as acidification or eutrophication, are in addition to the updated energy carrier mixes also affected by updated emission factors of combustion power plants.

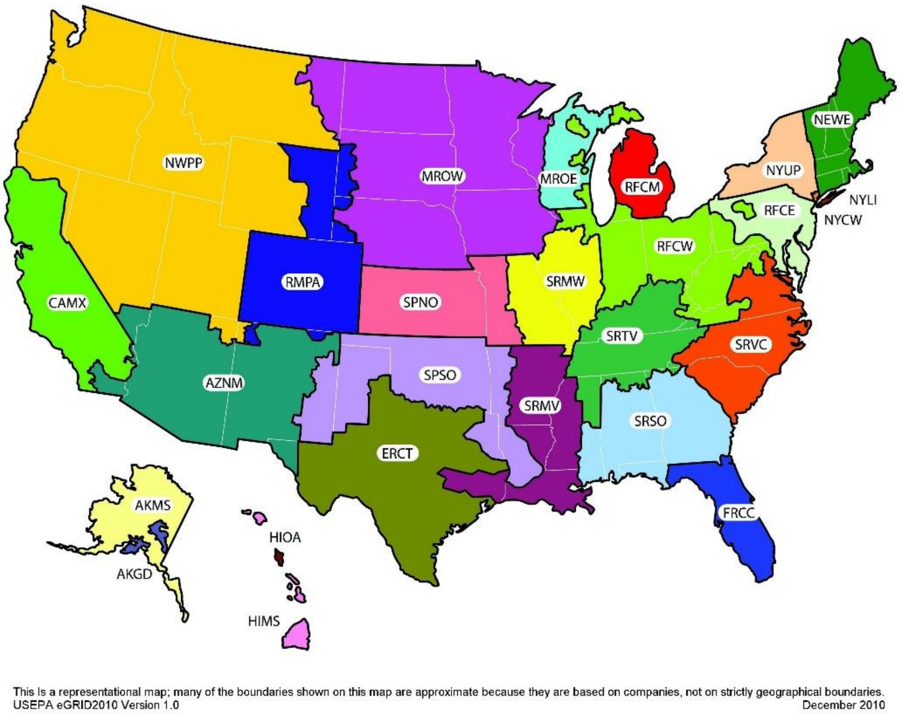


Figure 13: 26 eGRID subregions

Further developments in electricity datasets

Changes in electricity datasets from specific fuels:

Power plant efficiencies, calculated based on energy statistics, can significantly vary between reference years. The following reasons are considerations for variations over time:

- final or periodic shutdown and use as reserve capacity of specific power plants,
- different share between CHP and direct production over time (e.g., different heat demand over time),
- technology measures to increase efficiency (or to reduce emissions and thereby reduce efficiency),
- rounding effects (if a small amount of fuel is used),
- correction of statistical errors,
- a combination of several of the factors listed above.

The used LCA photovoltaic model to calculate the LCI for the supply of **electricity from photovoltaics** of all considered countries in the GaBi databases has been updated to the latest version of the IEA

PVPS Task 12 report on LCI and LCA of photovoltaic systems [IEA PVPS 2020]. Technology improvements during manufacturing with regard to wafer thickness of mono- and multi-crystalline, kerb loss reduction and reduction of energy consumption across the supply chain of the wafer supply as well as the update of irradiation values, efficiencies and technology mix resulted in a considerable reduction of impacts. For Germany, the GWP decreased from 67 g CO_2-eq./kWh average PV electricity to 35 g CO_2-eq./kWh. For Italy the GWP dropped from 52 to 27 g CO_2-eq./kWh and for Spain from 39 to 26 g CO_2-eq./kWh.

Like PV, the LCA model for **electricity from solar thermal (concentrated solar power)** has been updated as well. In the previous years, the used model represented the Compact Linear Fresnel Reflector (CLFR) technology, which has now been replaced by the more relevant and large-scale concentrated solar power (CSP) technologies parabolic through power plant and tower power plant. A share of 50% parabolic through and 50% tower has been applied to all data sets (based on [IEA 2019]). In South Africa (new dataset), most of the generation capacity has been recently commissioned using thermal storage systems. For Spain (EU28) and the United States (new dataset) the plants are older and are not always using thermal storage systems, a share of 50% with thermal storage system has been applied for these datasets. For Spain (EU28), the GWP for the new and more recent technology mix decreased from 89 g CO2-eq./kWh average CSP electricity to 12 g CO2-eq./kWh.Inventories for primary energy carriers

As already stated more above, the reference year of the GaBi Databases 2022 Edition is 2018 for all energy carrier supply mixes (e.g., hard coal, crude oil, and natural gas). The changes in the environmental impacts of the energy carrier datasets after the upgrade are described in the following paragraphs:

- The environmental impacts of the lignite mixes of countries that burn lignite changed due to the update of the country-specific consumption mixes (mix of domestic production and imports) and changes in the background data. The country-specific lignite mixes show smaller changes for GWP of below 5 %.
- Changes in the results of the hard coal mixes are mostly related to an update of the coal production of several important hard coal exporting countries, these include Colombia, Russia, South Africa, and the United States. The data to update the hard coal production models in GaBi for these countries have been taken from a recently published report by the German Federal Environmental Agency [Baumann 2021]. As a multitude of countries, for which hard coal mixes are covered in GaBi, import hard coal from these four countries in relevant shares, the LCI of these hard coal supply mixes as well.

  Due to the update, the GWP changes are four the exporting countries as follows:

  - Colombia (CO) -80 %
  - Russia (RU) -33 %
  - South Africa (ZA) -75 %
  - United States (US) +30 %

Countries with relevant import shares from these four countries are affected by changes as well. Changes in GWP for countries with changes above ± 30 %:

- Denmark -39 % (68 % of supply mix imported from RU, 19 % ZA, 9 % CO)
- Ireland -66 % (93 % of supply mix imported from CO)
- Luxembourg -60% (93 % of supply mix imported from ZA)
- Norway -40% (50 % of supply mix imported from CO, 17% RU)
- Portugal -60% (82 % of supply mix imported from ZA)
- Romania -32 % (93 % of supply mix imported from RU)
- Turkey -48% (48 % of supply mix imported from CO, 31 % RU, 4 % ZA)

- The environmental impacts of the natural gas mixes changed due to the update of the country-specific consumption mixes and changes in the background data. Additionally, the model for the natural gas transmission was updated from a pipeline to network approach. Natural gas mixes with changes in the GWP results of more than ±10 % are listed in the following:
  - Natural gas mix of Croatia (HR) ➔ the GHG emissions were reduced by -14 % due to changes in the supply mix.
  - Natural gas mix of Germany (DE) ➔ the GWP decreased by -25 %. Reasons are the missing imports from the Netherlands (19 %) in the used energy statistics in 201.
  - Natural gas mix of Lithuania (LT) ➔ the GHG emissions were reduced by -17 % due to changes in the supply mix (less LNG, and more LNG with shorter distances.
  - Natural gas mix of Luxembourg (LU) ➔ the GHG emissions increased by 20 % due to higher shares of Russian gas imports.
  - Natural gas mix of the United States (US) ➔ the GWP decreased by -39% due to a change in the approach for the natural gas transmission. Instead of calculating the energy consumption and associated emissions plus methane leakage, the impacts have been calculated based on the overall emissions of the network and the amount of delivered natural gas.
- Changes in the results of the crude oil mixes were related to the update of the country-specific consumption mixes and changes in the background data. Crude oil mixes with changes in the GWP results of more than ±10 % are listed in the following
  - Crude oil mix of Ireland (IE) ➔ the GWP result increased by 29% due to changes in the crude oil consumption mix (less imports from Norway and United Kingdom, compensated by higher imports from Canada and the United States).
- The environmental impacts of the fuel mixes (diesel and gasoline, at refinery and filling station) change because of updated country-specific biofuel and fossil fuel consumption mixes, the update of the country-specific blending quota of biofuels and changes in the biofuel and crude oil supply chains. All country-specific fuel mixes show GWP changes of less than ±10%, except for:
  - Diesel mix of Brazil at filling station (BR) ➔ the GWP (including biogenic carbon dioxide) decreased from 0.26 kg CO_2-eq/kg to 0.18 kg CO_2-eq/kg due to an increased share of biofuels and the associated CO_2 intake.

- Gasoline mix of Brazil (BR) → the GWP (including biogenic carbon dioxide) decreased from -0.17 kg CO_2-eq/kg to -0.58 kg CO_2-eq/kg due to an increased share of biofuels (38 wt.% in 2017 to 56 wt.% in 2018) and the associated CO_2 intake (noting that the fuel incineration will release its biogenic C, resulting over the life cycle in complete GWP values, of course).

Table 3-5 Primary energy carriers

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11174	New	New electricity production mixes	Several new datasets for electricity production mixes are now available. The full list of new electricity production datasets can be found via link in Chapter 3.6.	Does not change the results	Extension database II: energy
GC-11295	Improvement	On/Offshore share and full load hours in wind models update	Electricity from wind power datasets for all countries are updated.	Changes in impacts vary for each country: EU-28 overall environmental impact increases between 7% to 17% in all CML2016 and USEtox categories, except for POCP with an increment of 45%.	Professional database
GC-11680	Bug	Improved MY: Electricity grid mix (production mix)	The photovoltaic parameter in the MY: Electricity mix (energy carriers, generic) dataset is now correctly connected to the flow "Electricity from photovoltaic".	Does not change the results (as dataset is a unit process). Please be aware, that if the process is used and fixed with a connection to electricity from hard coal/photovoltaic, that in this case the results will change.	Extension database II: energy
GC-11897 GC-11901	Improvement	Update of electricity from photovoltaic and solar thermal datasets	The solar irradiation and other country-specific parameters in the electricity from solar thermal and electricity from photovoltaic (PV) datasets are now updated. As an improvement to the PV model, it now includes the emission flow dichloro-1-fluoroethane (R 141b) and chlorodifluoethane (R 142b), which are precursors of Polyvinylidene fluorine (PVDF) used in the production of PV modules.	Changes in impacts vary for each country: EU-28 overall EF 3.0 results decrease between -13% to -95%, with EF3.0 Climate Change (total) decreased by -73% in electricity for solar thermal and -45% in electricity from photovoltaic. For the PV model, the introduction of the emission flows are evident in the impact changes EF3.0 Ozone depletion. On average, the ODP values range from 2,8E-13 kg R11 eq. to 1,5E-10 kg R11 eq..	Professional database
GC-11936	Improvement	Harmonization of energy content in natural gas flows	The energy net and gross calorific value of natural gas is now harmonized to one value. Energy (net calorific value): Natural gas, at consumer [Natural gas, at consumer] → 47.5 MJ/kg	In case you have build models around the country specific natural gas flows, using their calorific value, we advise you to check your own models to ensure that the harmonised values do not lead to unwanted results in your models. Otherwise no change in results.	All

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
			Energy (gross calorific Energy (gross calorific value): Natural gas [Natural gas, at production → 52.5 MJ/kg		
GC-12013	Documentation	Improved documentation of electricity from wind dataset	Documentation of electricity from wind dataset throughout the database now states the correct capacity factor for onshore and offshore wind models.	Does not change the results	Extension database II: energy Extension database XVII: full US
GC-12122	New	New datasets for thermal energy from LPG	New datasets for thermal energy from LPG created for IN, RU, and AU are now available.	New dataset	Professional database
GC-12487	Improvement	Improvement of energy and mass balance in lignite dust datasets	The model now includes relevant process steps to produce pulverized lignite from raw lignite. Thermal energy consumption and landfill use is added and the water balance for the transformation of 1kg of pulverised lignite is now increased based on latest information.	GWP increased by 193%, and water use increased by 55% in US: Lignite dust.	Professional database Extension database XVII: full US

3.8 Inventories for organic and inorganic intermediates

Possible updates and upgrades of technologies may happen on three different levels, while in the upgraded datasets in most cases multiple effects can be observed:

- due to possible breakthrough technologies (improvements in the foreground system of the existing technology),
- due to changed situations in a production or consumption mix of different technologies providing the same product, and lastly,
- due to changes and updates in the background system of resources and energy supply.

In addition, errors in the data can of course affect a single dataset or several when the product is used downstream.

The required information to check and update the technologies and supply chains is based on the knowhow of our engineers as well as on information shared by our clients who are active in the chemical sector, patents, technical literature. The provided documentation of GaBi datasets serves as a viable basis to discuss supply chain aspects and demands.

Our in-house experts use moreover scientific and engineering knowhow (e.g., thermodynamic laws, the mass- and energy conservation, stoichiometric balances, combustion calculation and the like) as a basis to quality-assure, maintain, and update chemical LCA data. Chemical technologies were checked in this sense. In relation to possible breakthrough technologies, no major new technologies or significant process improvements on existing technologies that would affect dataset results relevantly were identified by Sphera experts in this year's upgrade.

Changes in the background system mainly relate to:

- Upgraded distribution on primary, secondary, and tertiary fossil resource extraction, such as for oil and gas
- Upgraded market share of imported fossil resources
- Upgraded distribution of the type of resources used (oil, gas, and coal, etc.)
- Increased amounts of renewable feedstock and energy supplies

Changes in the energy sector and supply chain are, in most cases, a key driver for overall improvement throughout several impact categories. The intermediates are directly influenced by the upgraded performance of the energy supply and the feedstock, i.e. crude oil and natural gas.

The following table documents the changes for datasets from this sector, the principle effect on the results (if any) and the affected extension databases.

Changes with a larger effect on single or multiple datasets are highlighted with a bold JIRA[8] number. Moreover, all changes of a high or very high relevance in one of the more robust impact categories for at least one dataset are highlighted with a **bold JIRA number**; the same is done for all material groups/subchapters below:

Table 3-6 Organic and inorganic intermediates

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11506	Improvement	Update of Chlorine and Sodium hydroxide (caustic soda) mix for DE and FR	The chlorine and sodium hydroxide mix for Germany and France is now revised by using updated technology information. Throughout the database, the use of sodium hydroxide and chlorine from chlorine-alkali electrolysis process is further harmonized.	Changes are visible in AP, EP, and POCP from +16% to +28%.	Professional database Extension database VII: plastics Extension database XIV: construction materials
GC-12237 GC-11823	Improvement	Improvement of nitric acid datasets	All nitric acid models are improved based on BAT Large Volume Inorganic Chemicals. The updates include net energy production from exothermal reaction, credits for thermal energy from natural gas, consumption of platinum catalyst, and replacement of steam medium pressure (superheated) with steam high pressure (not super-	Differences between -7% to -28% in CML EP and GWP, depending on the country. For the IN: Nitric acid dataset, EP and GWP are increased by 112% and 93% respectively.	Professional database Indian database Extension database Ib: inorganic intermediates

[8] JIRA is our issue tracking system. Please provide this number if you have specific questions back to us.

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
			heated). Using new available data from the National Inventory Reports, N_2O emissions in nitric acid production is now updated. As nitric acid is used in ammonium nitrate, these datasets are changed as well. For India, the emission standards were changed from European standards to local standards.		
GC-11569	Improvement	Harmonization of cooling water in Butanediol dataset	The amount of cooling/process water and waste water/water vapour for DE and US butanediol process is now harmonized with other butanediol processes.	Blue water consumption result for DE increased by up to 20,000% and for US up to 5,500%.	Several
GC-11721	Bug	Update of price allocation in Chloroacetic acid	The economic allocation now correctly attributes the environmental impact to the chloroacetic acid.	Overall, almost all changes are below +17%.	Extension database Ia: organic intermediates
GC-11815	Bug	Water to river water regionalization of steam cracker	The output flow water to river water in the steam cracker unit process is now regionalized.	Overall, almost all changes are well below +-10%, if regionalized water quantities are used the values turn from negative to positive impacts.	Several
GC-12180	New	New Caprolactam production datasets for BE, CN, DE, and US	New caprolactam datasets for BE, CN, DE, and US are now available. Full details of the available datasets can be found via link in Chapter 3.6.	New dataset	Professional database Extension database XVII: full US
GC-12208	Documentation	CAS number in documentation	As a continuous improvement, further CAS numbers are now included in the documentation of chemical datasets.	Does not change the results	Several

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-12230	Improve-ment	Update of Phosphoric acid datasets	The phosphoric acid datasets are updated throughout the database. The amount of phosphorus pentoxide input in the phosphoric acid (75%) dataset is improved according to information from various literature sources (such as BREF) and expert knowledge. The valuable substance flow for phosphoric acid (100%) is updated and renamed from phosphorus pentoxide to phorphoric acid (See Annex III).	Overall, EF3.0 impacts are decreased down to -34% for phosphoric acid (100%) and down to -48% for phosphoric acid (75%). Blue water consumption, fossil and mineral resources, AP, and EP are reduced by about -40%, and POCP is reduced by -50%.	Professional database Extension database XVII: full US
GC-12279	Improve-ment	Update of formaldehyde datasets	All the formaldehyde datasets are now updated with a 50:50 ratio of metal oxide and silver catalyst processing.	Differences between -50% to -35% in blue water consumption. For IN, POCP and EP increase by about 30%.	Professional database Extension database Ia: organic intermediates
GC-12280	Improve-ment	Replacement of Propylene Oxide (Chlorohydrin) with Propylene Oxide (Oxirane)	Using new information from the BREF report, propylene oxide datasets using the chlorohydrin route are now replaced using the more common oxirane route in the background systems.	Most impact categories lowered between -8% to -22%, depending on country.	Professional database Extension database Ia: organic intermediates Extension database VII: plastics
GC-12360	Editorial	Renaming of Soaping agent (Phosphonic Acid and foam stabilizer)	The dataset name Soaping agent (Phosphonic Acid and foam stabilizer) is changed to Soaping agent (based on Sodium dithionite).	Does not change the results	Extension database XV: textile finishing
GC-9916	New	New CN: Ethylene glycol (MEG) via coal to ethylene glycol dataset is now available	A new dataset CN: Ethylene glycol (MEG) via coal to ethylene glycol is now available.	New dataset	Professional database

3.9 Inventories for metal processes

Data and models have been checked by Sphera metals experts regarding technological upgrades.

Table 3-7 Metal processes

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11572	Improvement	Update of 10 annual mean quantity	Quantity for 10 annual mean is updated using the latest metal prices from USGS.	Changes are below +-5%.	Professional database Extension database VI: precious metals
GC-11576	Bug	Correction in parameter settings of EU: Aluminum sheet (AlMg4.5)	The magnesium share in the EU: Aluminium sheet (AlMg4.5) is now correctly set to 5%.	GWP increases by about 12%. ADP fossil and EP are increased by 9%.	Extension database IV: aluminium
GC-11603	Bug	Correction of energy input in CN: Magnesium production dataset	The thermal energy process in the CN: Magnesium production dataset is now replaced with a hard coal mix and a unit process which converts the hard coal to coke oven gas. The energy processes are now corrected to match its unit process.	GWP decreases by -15% and ADP elements decreases by -18%.	Professional database Indian database
GC-11993	Bug	Correction in nickel datasets	The crediting of sulphuric acid in the nickel model is removed and an extended allocation is introduced with metal input/output 100% allocated to nickel and 0% to sulfuric acid. Price allocation is additionally introduced with 95% allocated to nickel and 5% to sulfuric acid. Negative values in EF3.0 Resource use, mineral and metals now are more defensible positive values.	EF 3.0 Resource use, mineral and metals decreases by 1476%.	Extension database V: nonferrous metals

3.10 Inventories plastics processes

The environmental profile of polymers is largely influenced by the monomer production impacts. Sphera experts have verified whether the polymerisation technologies are still representative. To our knowledge, no completely new process designs in polymerization are in industrial use compared to the preceding year. The polymerization technologies in the GaBi Databases are considered representative. This is supported by our experience from working for the chemistry and polymer industries.

Table 3-8 Plastics processes

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11739	Bug	Harmonized plastic granulator flow tracking	The plastic waste input for all plastic granulators throughout the database is now harmonized. The inputs are now tracked as product flow.	Does not change the results. Dataset is a unit process and substance flows are scaled automatically.	Professional database Lean database Indian database Extension database IXa: end of life Extension database IXb: end of life parameterised

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
					models
GC-11740	Bug	Plastic Film (PE, PP, PVC): Plastic film waste scaling factor	The scaling factor for the plastics waste output in the dataset GLO: Plastic Film (PE, PP, PVC) is now fixed to 1 instead of 0.965.	Does not change the results. Dataset is a unit process and scaled automatically.	Professional database Indian database
GC-12054	Improvement	Regionalisation of water flows in plastic granulates	Plastic granulates now have regionalized input and output water flows.	Due to the regionalization of input and output water flows, the quality of the results in the impact category of EF3.0 Water use is increased substantially. Negative values now became positive values.	Extension database VII: plastics Extension database XVII: full US
GC-12421	Bug	Improvement of water content in DE: Epoxy resin dataset	The water content for DE: Epoxy resin mix and DE: Epoxy resin datasets are now regionalized and have positive water outputs.	The changes are visible in AWARE 1.2C: - AWARE 1.2C, global average for unspecified water is reduced by -310% and -1,531% in mix dataset - AWARE 1.2C, high characterization factor for unspecified water is reduced by -768% and -278% in mix dataset	Professional database Extension database VII: plastics

3.11 Inventories for End-of-life processes

All data and models have been checked by Sphera metals experts regarding technological upgrades and were identified as representative for their technology descriptions in 2021.

Other more specific aspects are mentioned in the following table.

Table 3-9 End-of-life processes

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11525	Improvement	Update of municipal waste water treatment plant composition	The sludge distribution of all municipal waste water treatment plants in the database are updated based on latest available Eurostat data.	Changes in EF3.0 Acidification, Climate Change - total, and Eutrophication - freshwater are below the range of ±10%.	Extension database IXb: end of life parameterised models
GC-11729	Bug	Improvement of AT: Expanded clay dataset	Carbon correction is now added to the “AT: Expanded clay” datasets; the biogenic carbon content in clay is assumed as 0. The affected datasets now have positive values in the biogenic CO_2 emissions.	EF3.0 Climate Change, land use and land use changes decreases between -37% and -74%, depending on dataset. EF3.0 Climate Change, biogenic decreases between up to -33%, depending on the specific dataset.	Extention database XIV: construction materials Extension database IXa: end of life

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11941	Improve-ment	Update of IN: Landfill (Munic-ipal household waste) dataset	The leachate treatment is removed in the IN: Landfill (Municipal household waste) dataset to reflect actual practice and is re-named to IN: Landfill (Mu-nicipal household waste)(unmanaged). The update is based on recent literature and the report "The Climate Change Mitiga-tion Potential of the Waste Sector".	EP increases by about 53%.	Indian database
GC-12014	Bug	Improvement and update of DE/EU/US: Plastic packag-ing in waste incineration plant	The antimony content in the DE/EU/US: Plastic packag-ing in waste incineration plant datasets is now cor-rected for 1 ton of plastic waste. The heating value in the DE/EU dataset is now updated.	EF3.0 Resources use, fossils decreases between -25% to -29%.	Professional data-base Extension database IXa: end of life Extension database XVII: full US
GC-12191	Bug	Improvement of water vapour flow in waste incineration datasets	A water vapour output flow is now introduced in the unit process (u-so) of the boiler in the waste incinera-tion datasets. The new output flow has the same parameter name as the water input, and therefore closes the water balance of the u-so.	Change in blue water use varies in affected datasets. The IT: Ferro metals in waste incinera-tion plant dataset has the largest reduction of -324%.	Extension database IXa:end of life Extension database XVII: full US

3.12 Inventories for renewable processes

The datasets, including renewable materials (e.g., crop cultivation), are modelled with a comprehensive agricultural model. The model considers local and regional aspects of climate, soil, and farming practices on the technical side. In addition, it considers international guidelines, current scientific literature, and available databases on the methodological side. The Sphera agriculture and farming experts maintain and enlarge the model as needed, that it one of the most advanced LCI models related to this topic.

Emissions from direct land use change are calculated for the approach "weighted average" (as required for compliance with the ENVIFOOD protocol and WRI GHG Protocol) based on the approach from PAS 2050-1:2012 and WRI GHG protocol (see Chapter 2.4).

The biogenic carbon balance was harmonized in all the foreground and background systems when re-newable materials are involved, what is especially resulting in relevant changes in the cases when eco-nomic allocation approach has been used. The primary energy data has been harmonized and corrected in all the datasets on products used as fuel, where an allocation based on a different reference than mass was applied.

Table 3-10 Renewable processes#####

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-12144	New	New DE leather datasets and renaming of existing datasets	New grain leather datasets following PEFCR are now available for Germany (DE). The term "grain" is added in existing German leather datasets.(See Annex IV)	Does not change the results	Extension database XVI: seat covers
GC-12211	Task	Inclusion of heavy metal correction in livestock plans	Livestock datasets (eg. sheep, lamb, ...) now include a heavy metal correction to avoid credits due to heavy metal uptake in Livestocks.	Due to the change in the heavy metal uptake, the human toxicity and freshwater metal elements are increased by a large amount. EF 3.0 Human toxicity increases between 2,900% and 3,900% and EF 3.0 Ecotoxicity of freshwater elements increases by about 240%. Other categories have minor changes ranging from -5% to +6%.	Extension database XX: food and feed
GC-12283	Improvement	Update of direct land use change (LUC) emissions	Emissions from direct land use change calculated with the "direct land use change assessment excel tool" for the approach "weighted average" are updated.	EF3.0 Climate change impact vary between -75% and +546%, depending on datasets.	All
GC-12489 GC-12465	Bug	Improvement of TH: Natural rubber and TH: Latex concentrate dataset	The TH: Natural rubber dataset and TH: Latex concentrate now have lower irrigation input and correct land use change values.	Overall categories have decreasing impacts due to correction in classification of land use change emissions and lower irrigation effort. EF3.0 Climate Change, land use and land use change has the largest change of -37%.	Indian database Extension database XII: renewable materials
GC-12015	Bug	Correction of carbon balance in Testliner 2018 datasets	All "Testliner 2018 - for use in avoided burden EoL scenario cases" datasets renamed to "Testliner 2018; substition EoL" now have a corrected carbon balance based on the uptake of waste paper in the dataset.	ODP increases by 7%.	Professional database Extension database IXb: end of life parameterised models Extension database XXI: India

3.13 Inventories for transport processes

In this year's upgrade, harmonization for transport datasets used throughout the database was improved.

Table 3-11: Transport processes

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11349	Improvement	Euro 3 trucks in background systems	In the background systems, transports using trucks Euro 3 are now exchanged with Euro 0-6 mix trucks.	Minimal changes to results in majority of cases.	Professional database Extension database XIV: construction materials

3.14 Inventories for construction processes

Foreground data and models were checked by Sphera construction experts regarding technological upgrades. Identified technology improvements were updated in the database.

New EPD datasets are available as industry data (ERFMI, ICDLI,…….). For the specific datasets, please check the industry data in GaBi.

Table 3-12 Construction processes

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11580	Documentation	Update of documentation for Cable 5 wire datasets	The documentation for the overall End of Life Cable 5 wire datasets are updated.	Does not change the results	Extension database XIV: construction materials
GC-11580	New	New DE: Cable 5 wire (EN15804 C4) dataset is now available	A new dataset DE: Cable 5 wire (EN15804 C4) is now available.	New dataset	Extension database XIV: construction materials
GC-11824	Improvement	Update of cement datasets with newest release from Global Cement and Concrete Association (GCCA)	Using the latest available publication from GCCA (reference year 2019), the EU, UK, BR, and IN clinker production is now updated. Update to the models include the fuel supply as well as emissions.	Differences between +1% to +4% in GWP, depending on the country. The impact category EF3.0 Resource use - fossils for IN decreases by -35%, and GB increases by 40%.	Professional database Extension database XIV: construction materials
GC-12096	Improvement	Update of cement datasets with newest release from VDZ (2021)	Using the latest available publication from VDZ (reference year 2019), the German clinker production was updated. Fuel supply as well as emissions is updated	Almost no change for GWP (below +1%). For CML2016, POCP decreases by -16%. AP and EP decreased by -10% and -25%.	Extension database XIV: construction materials
GC-12125	Bug	Harmonization of EN15804 module grouping for DE/EU Dip-switch and DE/EU Power outlet from C3 to C4	The end of life datasets for building equipment dipswitch and power outlets are now renamed from C3 to C4. The inventory of the datasets now refer to C4 disposal, giving impact on the landfill. The user is advised to check his/her model. The renamed datasets can be found in Annex III.	The datasets now have the correct impact for its corresponding EN15804 C4 module.	Professional database Extension database XIV: construction materials
GC-12159 GC-10814	Improvement	Update of asphalt binder thermal energy and input flow	The thermal energy in the asphalt binder dataset is improved following new information from the Deutschen Asphaltverbandes e.V. (DAV).	Almost all changes are below -5%. CMP 2016 ADP elements increased by 33% and EP is increased by 3%.	Professional database Extension database XIV: construction materials

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
			The input flow now correctly uses grit instead of fly ash.		
GC-12173	Editorial	Naming consistency for expanded polystyrene (EPS)	The expanded polystyrene (EPS) datasets are renamed and harmonized throughout the database. The renamed datasets now clearly reflect their respective density. (See Annex III)	Does not change the results	Professional database Extension database XIV: construction materials
GC-12642	Bug	Grouping correction of four construction datasets from C4 to C3	The following datasets are now correctly grouped in module C3, which has the impact of the incineration: EU-28: Bath- and shower tub acrylic (1kg) (EN15804 C3) DE: Used carpet, incineration in MWI (EN15804 C3) DE: Polystyrene, incineration in MWI (EN15804 C3) DE: Plastic, incineration in MWI (EN15804 C3)	GWP decreases between -73% and -83%, depending on dataset.	Professional database Extension database XIV: construction materials

3.15 Inventories for US regional processes

The datasets in the US extension database were checked by Sphera experts for their technological validity. 43 datasets were added to the Extension database XVII: full US.

Table 3-13 US regional processes

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11440	Editorial	Renaming of US landfill datasets based on the WARM model	The US landfill datasets based on some WARM data are renamed throughout the database. The datasets have now "partially based on WARM data" written in brackets.	Does not change the results	Extension database XVII: full US
GC-11592	Editorial	Renaming of coke mix datasets	Coke mix datasets are now renamed to metallurgical coke throughout the database. (See Annex IV)	Does not change the results	Professional database Extension database XVII: full US

4 Industry association datasets in GaBi Databases

Even though several associations have updated their data, some associations did not update this year. Since they have their own cycle for upgrading their data, **these processes cannot be updated by Sphera in the annual upgrade without permission.** Sphera must keep the unchanged processes identical to those in the GaBi Databases 2021 Edition until the associations decide to update and make them available. However, several additional associations now use the GaBi Databases to reach global customers.

New industry data added in GaBi Databases 2022 Edition:

From AA (The Aluminum Association)

(https://www.aluminum.org/)

Country	Process name	Process GUID Can be entered in the search tool
RNA	Remelting and DC casting for can sheet rolling ingot	{e4b590cc-a5ca-48c7-ba28-f1f7ea90caba}
RNA	Primary aluminum ingot	{5f36c9ee-edd6-4e02-b792-1d7730681a0c}

From ACC (American Chemistry Council)

(https://www.americanchemistry.com/)

Country	Process name	Process GUID Can be entered in the search tool
US	Methylene Diphenyl Diisocyanate (MDI)	{92d1698c-1ccc-44ff-899d-1c651574c87e}

From AF & PA (American Forest & Paper Association)

(https://www.afandpa.org/)

Country	Process name	Process GUID Can be entered in the search tool
US	Containerboard (gate-to-gate)	{41bc7c8c-6413-4ff3-bbaa-983da91b9e74}
US	Converting plant (gate-to-gate)	{3114b667-036d-43cb-a469-5422ec7385f4}

From AISC (American Institute of Steel Construction)

(https:/www.aisc.org/)

Country	Process name	Process GUID Can be entered in the search tool
RNA	Hot rolled structural steel sections	{0171265f-bc83-427e-a6ea-4199721eb543}

From CDA (Copper Development Association)

(https:/www.copper.org/)

Country	Process name	Process GUID Can be entered in the search tool
RNA	Copper tube	{7426e30c-499a-4663-b2c8-34dce3085ca5}
RNA	Copper sheet	{430f04d0-1419-42fd-9930-fba3b5348829}

From CPA (Corrugated Packaging Alliance)

(https://www.corrugated.org/)

Country	Process name	Process GUID Can be entered in the search tool
US	Average Containerboard (Cradle-to-Gate, 2014)	{f9c4f7d2-1150-422e-879b-62ff2eafb2d9}
US	Average Corrugated Product (Cradle-to-Gate, 2014)	{7a22e712-3696-4d0e-87a4-131f98daca25}

From ERFMI (European Resilient Flooring Manufacturers' Institute)

(https://erfmi.com/)

Country	Process name	Process GUID Can be entered in the search tool
EU-25	Flooring PVC heterogeneous EN 649	{ccaea791-26c3-47db-a416-a10e40421b6d}
EU-25	Flooring PVC printed, laminated EN 649	{c2c315b3-c9ca-4827-a3a5-4fc7577a23ab}
EU-25	Linoleum flooring	{a5a0a734-7632-46aa-87a6-f48b7eb10782}
EU-25	Flooring PVC flex boards (VCT) EN 654	{ab00dde4-0929-40a4-a2a7-d3e66d0e48fa}
EU-25	PVC flooring foamed EN 653	{fb372979-d1d7-4ccc-a477-ba957737e792}
EU-25	Flooring PVC homogeneous EN 649	{40e7a700-e623-4553-8d3d-c3d5178da436}
EU-25	PVC flooring with foam coat EN 651	{c312e15c-6060-4ddf-b44f-8a8ec3273341}
EU-25	PVC flooring slip-Proof (Safety) EN 13845	{a95b9567-bc61-4134-bee3-8ef8d537bed4}
EU-25	Flooring based on synthetic thermoplastics EN 14565	{75ca4788-d3ee-4f3f-8df6-0dc8517fd7ce}
EU-28	Resilient flooring, printed laminated PVC, EN ISO 10582, 1m2	{b2d10734-3d43-4d6a-90f1-7d2a744afc43}
EU-28	Resilient flooring, Cork floor tiles, EN 12104, 1m2	{609e11ca-2e90-4309-af05-ba6338e61942}
EU-28	Resilient flooring, Linoleum, EN ISO 24011, 1m2	{5dab6612-6b15-4d2e-b1e2-dd9a5422e8d0}
EU-28	Resilient flooring, homogeneous and heterogeneous smooth rubber flooring, EN 1817, 1m2	{9d82e3e7-446c-4222-a7d9-4ba02fb91a52}
EU-28	Resilient flooring, heterogeneous PVC, EN ISO 10582, 1m2	{db362934-0713-4580-89db-6df97e84debe}
EU-28	Resilient flooring, cushioned PVC, EN ISO 26986, 1m2	{1b36690f-d969-4dc1-9c92-7b9fcf5bef15}

EU-28	Resilient flooring, PVC with foam layer, EN 651, 1m2	{3ba3280d-f019-444c-ac39-5aefb7663240}
EU-28	Resilient flooring, PVC with enhanced slip resistance, EN 13845, 1m2	{fcd571b0-f596-4421-bc04-b10f3763ac37}
EU-28	Resilient flooring, homogeneous PVC, EN 649/ISO 10581, 1m2	{d503dc0d-4fab-441b-b29d-924097222a47}

From ICDLI (International Committee of the Decorative Laminates Industry)

(https://www.icdli.com/)

Country	Process name	Process GUID Can be entered in the search tool
EU-28	Decorative High Pressure Thin Laminate (HPL) - ICDLI (A1-A3)	{2c4be0b0-e04e-4e88-b0ae-f2d2c0b4b2ef}
EU-28	Decorative High Pressure Compact Laminate (HPL) - ICDLI (A1-A3)	{d1b60a6e-8aca-4433-abde-49ffde753f79}

From MCA (Metal Construction Association)

(https://www.metalconstruction.org/)

Country	Process name	Process GUID Can be entered in the search tool
US	Metal composite material (MCM) panel fabrication	{c54a4edc-501b-4422-bdef-efdf7cd23650}
US	Insulated metal panel (IMP) continuous foaming	{858e73bb-476e-4c6b-9d7b-cdb1d1b26a5f}
US	Insulated metal panel (IMP)	{95ff0421-756a-4de8-9027-9931d2a99a9f}
US	Roll formed metal cladding	{95eb27ae-7e4b-459c-aa23-ff02f0a0e4f4}
US	Metal composite material (MCM) panel	{f9a43c52-50a1-4ce3-b785-7a9d46ed9adc}
US	Coil coating	{1b176a5e-1a7f-4085-b576-3b17c7c341d4}
US	Metal roll forming	{5b90e799-94f7-47d5-bdb6-1dbfb3dc2337}
US	Metal composite material (MCM) sheet fabrication	{666c39a9-bd1f-46bb-8a16-94d422e5f46c}

From NAIMA (North American Insulation Manufacturers Association)

(https://insulationinstitute.org/)

Country	Process name	Process GUID Can be entered in the search tool
US	Rock loose fill insulation	{9210947e-9b16-4672-8551-639ba0ba618c}
US	Rock board insulation (light density)	{49a5ca5c-e332-4fde-b9aa-e235618d934f}
US	Rock board insulation (heavy density)	{bdd8a862-fe3e-4b86-b6c4-eb3a3d9c9c85}

US	Fiberglass Pipe	{e72f8b1d-b050-4bbe-a3da-86942e4a5a85}
US	Fiberglass Batt	{c0e76cf4-3394-4916-9f69-a5bcae916a6d}
US	Fiberglass Duct Wrap	{756946b5-da7c-4d79-a068-847a814eb25e}
US	Fiberglass Loose Fill	{fd8c8ad3-8973-4e0e-8837-40265e25d66c}
US	Fiberglass Kraft Faced	{2f299b72-072c-48b0-a648-8ac6983ef1bd}
US	Fiberglass Duct Board	{9a567cff-d433-411d-b0e6-783e6214297c}

From PIMA (Polyisocyanurate Insulation Manufacturer's Association)

(https://www.polyiso.org/)

Country	Process name	Process GUID Can be entered in the search tool
US	Polyiso Manufacturing (Roof - R35.7)	{996de05d-91d9-4c4d-94c4-598d20bbf2e2}
US	Foil Facer	{49cee121-7da6-42b6-9bcd-60b88690ac9f}
US	Polyiso Manufacturing (Roof - R20.4)	{4572de80-0e82-49b1-89ea-024b06612161}
US	Polyiso Manufacturing (Roof - R25.5)	{b71da76f-5d79-4e55-9064-6954427a5f80}
US	Polyiso Manufacturing (Roof - R30.6)	{ccad2d91-472e-4263-b6a2-908c6a188d56}
US	Polyiso Insulation Manufacturing	{0b2ea6f8-6aa8-4a3c-806d-97f60fe85441}

From the German SLG (Betonverband Straße, Landschaft, Garten e.V.)

(http://www.betonstein.org)

Country	Process name	Process GUID Can be entered in the search tool
DE	Concrete paving stone (with facing concrete, grey)	{7d5fae7b-4ad9-4a35-9f21-08ebcb27da34}

5 Continuous improvements

5.1 Editorial

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11472	Documentation	Updated documentation of hydrogen datasets	The documentation field "flow diagram" in the global hydrogen dataset is updated.	Does not change the results	Extension database II: energy
GC-11600 GC-11944	Editorial	Renaming of capacitor ceramic MLCC datasets	In all MLCC capacitor datasets, the letter "D" is removed. The MLCC 1210 (50mg) dataset speficifically now has the correct dimensions in the process name: Capacitor ceramic MLCC 1210 (50mg) 3.2x2.5x1.6 (Base Metals) instead of Capacitor ceramic MLCC 1210 (50mg) 3.2x1.6x1.6 (Base Metals).	Does not change the results	Extension database XI: electronics
GC-11845	Editorial	Harmonized process name of chemical processes	Several chemical datasets are renamed and harmonized throughout the database. The datasets now clearly reflect their respective production route. All changes are listed in Annex IV.	Does not change the results	Several
GC-12193	Documentation	Updated documentation of IC datasets	The documentation field "further quantitative specification" is updated in several IC processes. The node size in the documentation now matches the process name and the mass in the documentation now correctly reflects the component mass in flow properties.	Does not change the results	Extension database XI: electronics

5.2 Fixing issues and improvements of cross-cutting aspects

In this chapter, JIRA issues for bugs and improvements of process datasets and a few other dataset types are detailed.

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-11881	New	Inclusion of climate carbon feedback in IPCC AR5 characterization factors	All IPCC AR5 quantities now include climate carbon feedback in accordance with the UNEP LCI GLAM initiative.	Depending on the dataset, the impacts can increase by up to 20%.	All
GC-12239 GC-12294	Bug	Climate carbon feedback correction in ISO14067 quantities and specific correction in biogenic GHG removal	All ISO14067 quantities are updated to include climate carbon feedbacks. The associated side of results in the ISO14067 GWP100, biogenic GHG removal quantity is now correctly assigned to output.	GWP values with climate carbon feedback (ccfb) increased by 18% on average in comparison to GWP without ccfb.	All

JIRA Tracking Number	Issue Category	Item	Description	Change in results	Affects Extension module
GC-12305	Improvement	Harmonization of EN15804+A1 documentation	The documentation of EN15804+A1 quantities are now harmonized. The documentation now correctly describes the quantities to be based on CML quantities with additional calculated factors by Sphera.	Does not change the results	All
GC-12306	Bug	Correction in Indium elementary flow	The electronic material declaration quantity Indium (E) is now removed from the indium elementary flow.	Does not change the results	All
GC-12366	New	New elementary flows for pesticides are now available	18 new elementary flows created for pesticides are now available and characterized in a respective quantitiy where applicable.	New flows	All
GC-12461	New	New IPCC AR6 quantities are now available	30 new quantities, 60 new-to-GaBi flows, of which 19 are characterisation factors, are now available. The values are based on the preliminary release of the 6th IPCC assessment report in August..	Does not change the results	All
GC-12647	Bug	Removal of land use flow "to industrial area" in several datasets	The flow land use flow "to industrial area" in several datasets with concentrated solar panel (CSP) in background system is removed.	Impact on land use change vary considerably between datasets	Several

References

Baumann, M.; Schuller O.: Emissionsfaktoren der Stromerzeugung – Betrachtung der Vorkettenemissionen von Erdgas und Steinkohle, Umweltbundesamt (UBA), Dessau (Germany), 2021

EIA, U.S. Energy Information Administration: Electricity Data – Generation and thermal out-put by energy source, total of all production types, release date January 2020, http://www.eia.gov/electricity/data.cfm#generation

EPA, U.S. Environmental Protection Agency, "eGRID2019 - Emissions and Generation Resource integrated database (eGRID)", 2019 data, Washington, 2021, https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Eurostat, Eurostat: Energy Database - Production of electricity and derived heat by type of fuel [nrg_bal_peh], Luxembourg, 2021

IEA, International Energy Agency: Solar Energy – Mapping the road ahead, 2019

IEA, International Energy Agency Data services: World Energy Balances, World Energy Statistics, Electricity Information (2021 edition), Paris, 2021

IEA PVPS, International Energy Agency – Photovoltaic Power Systems Programme: Task 12 PV Sustainability – Life cycle inventories and life cycle assessments of photovoltaic systems, 2020

Sphera, "GaBi Database & Modelling Principles", 2022

Sphera, "Introduction to Water Assessment in GaBi", 2022

Sphera, "The GaBi refinery model", 2022

Sphera, "The Agricultural LCA Model Documentation", 2022

Sphera, "Land Use Change Emissions in GaBi Documentation", 2022

Sphera, "Documentation of land use inventory in GaBi", 2022

Sphera, "Documentation for Passenger Vehicle Processes", 2022

Sphera, "Documentation for Duty Vehicle Processes", 2022

Vogt, R.; Dehoust, G.; & Merz, C.: The Climate Change Mitigation Potential of the Waste Sector, Umweltbundesamt (UBA), Dessau (Germany), 2015

Further, dataset-specific sources are documented in the corresponding datasets.

Annex I: “Version 2021” discontinued datasets – Explanations and Recommendations

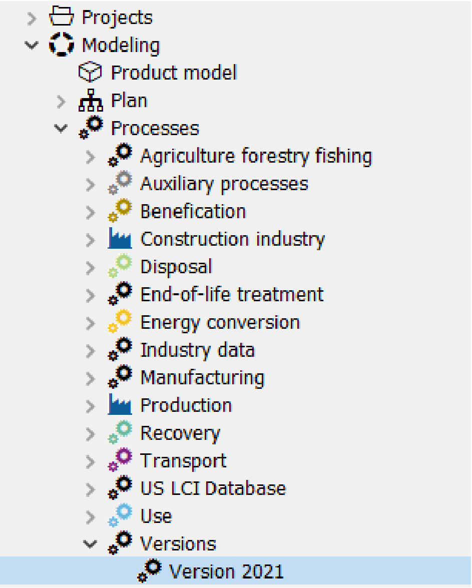
For various reasons, there are a few processes in the Databases 2022 Edition that are no longer appropriate, including that the respective technology is not used anymore. In other cases, updated datasets have been made available by the respective association. These discontinued datasets have been moved into a folder called “Version 2021.” **They are still available for clients who need to work with them but will not be upgraded anymore and are not part of the delivery scope for new GaBi clients.** There are two reasons behind this approach:

i) Sphera is committed not to provide information that is not up-to-date, and, at the same time,

ii) Sphera wants to enable users who have used the dataset to decide if it is still appropriate for their specific goal and scope.

The tables in Annex I and Annex II list all those processes along with the explanations and recommended alternatives where applicable.

Please note, processes that will no longer be updated (in the Version 2021 folder), as well as flows with limited use are now marked with a differently coloured icon in the database: 



Version 2021 processes					Alternative process to be used instead			
Country	Process name	Type	Source	Process GUID (can be entered in the search tool)	Country	Process Name	Source	GUID
RNA	Hot Rolled Aluminum	agg	AA/Sphera	{d9a51b05-ad04-4615-b100-d5f417b8cdd2}	If relevant, please contact the data on demand team from Sphera for alternative processes.			
RER	Continuous filament glass fibre (wet chopped strands)	agg	APFE/ELCD	{d176c895-2f1a-4596-804a-0db4d363f8ab}	If relevant, please contact the data on demand team from Sphera for alternative processes.			
RER	GCC dry	agg	CCA/ELCD	{14db2998-ff19-45e6-9951-f5bd9ae8c149}	If relevant, please contact the data on demand team from Sphera for alternative processes.			
EU-25	Copper sheet; technology mix; market mix, at plant; 0,6 mm thickness	agg	ECI/ELCD	{1323a7e6-7841-47db-8da1-06355432a908}	EU-28	Copper Sheet Mix (Europe 2015)	DKI/ECI	{d4587458-3dd0-4c6e-a1f8-73d440813310}
					EU-28	Copper sheet (A1-A3)	Sphera	{746663a0-3b12-4917-9283-71dd627c84d5}
EU-25	Copper tube; technology mix; market mix, at plant; diameter 15 mm, 1 mm thickness	agg	ECI/ELCD	{5098e9f2-e2f1-44e9-ac4e-62a8864ae2b6}	EU-28	Copper pipe mix (Europe 2015)	DKI/ECI	{8e82d244-1022-4d20-a862-46c3f54f6379}
					EU-28	Copper pipe mix, bare (A1-A3)	Sphera	{09ff4a3d-eeda-465c-9c79-20de72125920}
EU-25	Copper wire; technology mix; market mix, at plant; cross section 1 mm	agg	ECI/ELCD	{819e60d3-2652-47de-9f0b-d3bf8a4e0ea9}	EU-28	Copper Wire Mix (Europe 2015)	DKI/ECI	{35a4b3f7-6e52-4e31-9894-e09d72bc0367}
RER	Articulated lorry (40t) incl. fuel	agg	ELCD	{3f5cb670-57f0-4056-9339-f395ba28d1cb}	EU-28	Articulated lorry transport incl. fuel, Euro 0-6 mix, 40 t total weight, 27 t max payload	Sphera	{b444f4d1-3393-11dd-bd11-0800200c9a66}
RER	Lorry (22t) incl. fuel	agg	ELCD	{62e77e50-d84f-4d04-a4e4-8c0c7f7e4007}	EU-28	Lorry transport incl. fuel, Euro 0-6 mix, 22 t total weight, 17.3t max payload	Sphera	{b444f4d3-3393-11dd-bd11-0800200c9a66}

Version 2021 processes					Alternative process to be used instead			
Country	Process name	Type	Source	Process GUID (can be entered in the search tool)	Country	Process Name	Source	GUID
RER	Small lorry (7.5t) incl. fuel	agg	ELCD	{d08d6079-0e8e-4232-bb72-45abc46c7be4}	EU-28	Small lorry transport incl. fuel, Euro 0-6 mix, 7.5 t total weight, 3.3 t max payload	Sphera	{b4451be0-3393-11dd-bd11-0800200c9a66}
RER	Polyethylene high density granulate (PE-HD)	p-agg	ELCD/ PlasticsEurope	{0704c700-2fb0-43c5-8803-bed8a6f1b968}	DE	Polyethylene High Density Granulate (HDPE/PE-HD)	Sphera	{b5ea9896-dea8-402e-98c3-3b285a9a32d8}
RER	Polyethylene low linear density granulate (PE-LLD)	p-agg	ELCD/ PlasticsEurope	{f35313d3-c5fa-4b97-a212-d11a122070f8}	EU-28	Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD)	Sphera	{27b2f25c-ccec-43cf-97b9-bc97f0f95f49}
EU-25	Graphic Paper	agg	Euro-graph/ELCD	{50e97735-1e19-4788-8525-e39de50cd804}	If relevant, please contact the data on demand team from Sphera for alternative processes.			
RER	Container glass (delivered to the end user of the contained product, reuse rate: 7%)	agg	FEVE/ELCD	{d7bbec20-f8d8-4a8a-9a99-c7cdafaaa77d}	EU-28	Container glass	Sphera	{1251bef4-96ea-4091-ab58-0805050e9102}
DE	Aluminium sheet deep drawing	u-so	Sphera	{ac011c4e-ef9a-49ee-9302-2f8e1ecf4c05}	DE	Aluminium sheet deep drawing (adjustable)	Sphera	{e11a1c21-79ce-4f58-bdc6-379280ee9f7f}
IT	Electricity from lignite	agg	Sphera	{3741aaa8-60e9-4032-9699-1dfc39ec69c7}	If relevant, please contact the data on demand team from Sphera for alternative processes.			
IN	Landfill (Municipal household waste)	p-agg	Sphera	{a3ec58f2-68db-4061-83d9-399bfd30a4d9}	IN	Landfill (Municipal household waste) (unmanaged)	Sphera	{22014570-01ec-4923-a72c-9da91e72aaac}
LU	Residual grid mix	agg	Sphera	{7d6c5b21-8a2c-4731-9288-9bc4b9c19843}	If relevant, please contact the data on demand team from Sphera for alternative processes.			
DE	Steel sheet deep drawing (multi-level)	u-so	Sphera	{1c32edbb-3602-4a7a-81cd-244f82ebb3b6}	DE	Steel sheet deep drawing (adjusta-ble)	Sphera	{b2515169-d0f0-4fca-892e-cc921be615fd}
DE	Zinc mix (92% electroytic and 8% ISP recycled zinc)	agg	Sphera	{19720938-1090-44ee-ad57-6d2be1320d67}	If relevant, please contact the data on demand team from Sphera for alternative processes.			

Annex II: Datasets with changed valuable substance flows

Flow changes are necessary in order to clearly specify outputs, or if the previous output/waste flow was not correct. This list is for information only. When updating a database during GaBi upgrade, the updater automatically replaces all flow connections used by the process in the GaBi datases including in datasets used in user models, no user input is needed.

Region	Process name	Type	Source	Process GUID *(Can be entered in the search tool)*	Previous valuable substance flow name and GUID	New valuable substance flow name and GUID	Flow type
IN	Formaldehyde (HCHO; 37%)	agg	Sphera	{2AD7192F-5813-469B-A807-36C764FCB38C}	Product (unspecified) {E946AAB4-7CA0-4DD7-A1BA-4C90EF6DBC44}	Formaldehyde (37%; methanal) {3874BD5A-B5A9-4653-8004-E8BEC8815C49}	product flow
EU-28	GCC slurry	agg	CCA-Europe	{C220EF06-50B6-4037-B6B2-7562D01EA9E3}	Ground Calcium Carbonate slurry - dry matter (75% solid content) {98D15883-B512-44ED-AC09-7B616FDB9604}	GCC slurry {99EBF9BE-B46D-40EA-A46F-A6A0589596EC}	product flow
EU-28	PCC dry	agg	Sphera	{0D703908-42F0-4669-87B5-69061D426797}	Limestone flour precipitated {65049EBD-1642-43C6-BBEB-C1A4BA427DDC}	PCC dry {A0D612FF-626C-440A-A4CE-C3283571C520}	product flow
EU-28	PCC slurry	agg	Sphera	{DEB8F616-D451-4904-B241-D7295713ACCF}	PCC slurry - dry matter {2777ED60-56C8-47FE-B1D1-EB16FB16DF82}	PCC slurry {02107301-FCAC-4AD3-B80E-D3A51E433103}	product flow
US	Phosphoric acid (100%) (wet process)	agg	Sphera	{4F4E2B0D-55C2-4BC7-90AA-D4E1B2F32EF8}	Phosphorus-pent-oxide {315FDE50-B6D1-4768-B014-D6342497FE06}	Phosphoric acid {89C80ABE-61AB-4083-9A9A-9B2A84BA0100}	product flow
EU-28	Phosphoric acid (100%) (wet process)	agg	Sphera	{52D791C3-ECB7-4DAF-8B55-7DA0224673DC}	Phosphorus-pent-oxide {315FDE50-B6D1-4768-B014-D6342497FE06}	Phosphoric acid {89C80ABE-61AB-4083-9A9A-9B2A84BA0100}	product flow
DE	Phosphoric acid (100%) (wet process)	agg	Sphera	{573E8CE0-499D-4C53-BD2F-AEB02EA534AE}	Phosphorus-pent-oxide {315FDE50-B6D1-4768-B014-D6342497FE06}	Phosphoric acid {89C80ABE-61AB-4083-9A9A-9B2A84BA0100}	product flow
EU-28	Electricity from solar thermal	agg	Sphera	{01F0D98B-3231-4D70-98AC-149681257ECD}	Electricity {890A70B7-B677-4E2A-8A1B-7D017E0A10AE}	Electricity {4F19A2F3-7B3B-11DD-AD8B-0800200C9A66}	product flow
ES	Electricity from solar thermal	agg	Sphera	{9B0151E8-BBBB-4629-8135-169B57888F3C}	Electricity {890A70B7-B677-4E2A-8A1B-7D017E0A10AE}	Electricity {4F19A2F3-7B3B-11DD-AD8B-0800200C9A66}	product flow
ZA	Electricity from solar thermal	agg	Sphera	{E93C8BC4-AF51-4413-8BD8-B8C7643E824E}	Electricity {890A70B7-B677-4E2A-8A1B-7D017E0A10AE}	Electricity {4F19A2F3-7B3B-11DD-AD8B-0800200C9A66}	product flow

Annex III: Renamed datasets

For greater clarity, a number of processes have been renamed, as follows:

Region	GaBi Database 2021 Process name	Type	Source	Process GUID *(Can be entered in the search tool)*	GaBi Database 2022 Process name
IN	Acetic acid from methanol	agg	Sphera	{41ce4aa0-98b2-4361-bdd7-89fe3b06fb51}	Acetic acid from methanol (low pressure carbonylation) (Monsanto process)
BE	Acetone	agg	Sphera	{072f1dce-c6a3-4f87-ba93-b16b8233eb78}	Acetone by-product phenol, methyl styrene (from Cumene)
DE	Acetone	agg	Sphera	{36715767-7ad2-4ae5-833d-8c8a2c822c1a}	Acetone by-product phenol, methyl styrene (from Cumene)
FR	Acetone	agg	Sphera	{8515d38e-0352-4ad3-81f4-9bb66e81c9a7}	Acetone by-product phenol, methyl styrene (from Cumene)
EU-28	Acetone	agg	Sphera	{85b900e2-428e-4b18-8886-393f9956317d}	Acetone by-product phenol, methyl styrene (from Cumene)
IT	Acetone	agg	Sphera	{c9468b10-3c00-44ab-bb25-06ff44ee04e4}	Acetone by-product phenol, methyl styrene (from Cumene)
US	Acetone (from cumene)	agg	Sphera	{4792d8d7-092b-49a8-85ac-e6995b9039cd}	Acetone by-product phenol, methyl styrene (from Cumene)
US	Acrylonitrile (AN) by product ammonium sulfate, hydrogen cyanide	agg	Sphera	{027d973b-d8cb-462a-9409-0dda7e633789}	Acrylonitrile (AN) by-product ammonium sulphate, hydrogen cyanide
GB	Adipic acid	agg	Sphera	{28274c40-d4ac-4350-94bc-800788c29369}	Adipic acid from cyclohexane
FR	Adipic acid	agg	Sphera	{5eaf0ada-f5c1-46cb-bb6f-ac0e195379eb}	Adipic acid from cyclohexane
DE	Adipic acid	agg	Sphera	{f7914637-a1f5-4a84-ba6e-699e96f63e4e}	Adipic acid from cyclohexane
DE	Allyl chloride (C3H5Cl)	agg	Sphera	{0db569df-286c-49ce-83c8-df2fc0baee36}	Allyl chloride (C3H5Cl), by-product hydrochloric acid (100%)
US	Allyl chloride (C3H5Cl)	agg	Sphera	{5d3e2037-d519-49bb-b8af-943601fd68c8}	Allyl chloride (C3H5Cl), by-product hydrochloric acid (100%)
IN	Ammonium sulphate by-product Caprolactam	agg	Sphera	{cd20c214-4cf8-427f-9c9d-436aba1a0139}	Ammonium sulphate by-product Caprolactam from Cyclohexanone from Phenol
NL	Benzene	agg	Sphera	{2948cdea-fdcf-46bc-bc3a-cfcea5a97a3d}	Benzene (from pyrolysis gasoline)
DE	Benzene	agg	Sphera	{2de98231-b88d-4372-b958-35ed729daef3}	Benzene by-product BTX (from reformate)
NL	Benzene	agg	Sphera	{4216dda4-2957-4c3b-80a9-90aed958b9d9}	Benzene by-product BTX (from reformate)

Region	GaBi Database 2021 Process name	Type	Source	Process GUID *(Can be entered in the search tool)*	GaBi Database 2022 Process name
FR	Benzene	agg	Sphera	{4dad7f82-fc83-44e8-90d1-0d4443a855b1}	Benzene (from pyrolysis gasoline)
GB	Benzene	agg	Sphera	{88cabe12-1229-44ce-9795-46c13c438d98}	Benzene (from pyrolysis gasoline)
DE	Benzene	agg	Sphera	{9d3e7b46-6702-46c0-8b68-1ca664d35e0b}	Benzene (from pyrolysis gasoline)
EU-28	Benzene	agg	Sphera	{9ee94c8d-95c6-4651-992f-d79f8298feb1}	Benzene (from pyrolysis gasoline)
IT	Benzene	agg	Sphera	{e2b924da-84db-431f-b77f-c3d5d2842b36}	Benzene (from pyrolysis gasoline)
US	Benzene (by product BTX) (from reformate)	agg	Sphera	{f3125e7a-8e4c-408c-978d-f25480832b33}	Benzene by-product BTX (from reformate)
US	Benzene (from pyrolysis fuel)	agg	Sphera	{f13e8c4d-75b6-4199-9f05-41856b9f9b6c}	Benzene (from pyrolysis gasoline)
FR	Benzene (from reformate)	agg	Sphera	{1c025890-30d6-454a-8eb5-c4482578e965}	Benzene by-product BTX (from reformate)
IT	Benzene (from reformate)	agg	Sphera	{28fc4af2-b2e7-4aff-923f-be83dda4783b}	Benzene by-product BTX (from reformate)
EU-28	Benzene (from reformate)	agg	Sphera	{43cdf9fc-c985-47c9-ada0-bbff1f8137de}	Benzene by-product BTX (from reformate)
GB	Benzene (from reformate)	agg	Sphera	{98365f15-7a86-4101-83fc-13fae539cf56}	Benzene by-product BTX (from reformate)
US	Biodegradable waste on landfill, post-consumer (according to the WARM model)	p-agg	Sphera	{d10d311d-7e1f-42f0-9d51-d3473e60fb4c}	Biodegradable waste on landfill, post-consumer (partially based on WARM data)
US	Butanediol from Acetylene	agg	Sphera	{b3efd80f-acc5-4e01-a29d-b9fd818905fb}	Butanediol from acetylene (H2 via steam re-forming of natural gas)
US	Butanol (n-butanol from propylene)	agg	Sphera	{f6c3b531-e390-4433-987a-6f1b0b99da9e}	Butanol (n-butanol) from propylene with rhodi-um catalyst
GLO	Capacitor ceramic MLCC 01005 (0.054mg) D 0.4x0.2x0.22	agg	Sphera	{9a8a2103-7eb5-4763-a022-dc355868106f}	Capacitor ceramic MLCC 01005 (0.054mg) 0.4x0.2x0.22 (Precious Metals)
GLO	Capacitor ceramic MLCC 01005 (0.054mg) D 0.4x0.2x0.22 (Base Metals)	agg	Sphera	{482afa73-62b6-4a2e-9361-65fcd659fdd9}	Capacitor Ceramic MLCC 01005 (0.054mg) 0.4x0.2x0.22 (Base Metals)
IN	Capacitor ceramic MLCC 0201 (0.17mg) D 0.6x0.3x0.3	agg	Sphera	{b6d315b7-63e4-4c2a-a2e9-d2d8d13c1c2c}	Capacitor ceramic MLCC 0201 (0.17mg) 0.6x0.3x0.3
GLO	Capacitor ceramic MLCC 0201 (0.17mg) D 0.6x0.3x0.3	agg	Sphera	{f8d3cd85-56d5-45c6-9d64-a933d389da5b}	Capacitor ceramic MLCC 0201 (0.17mg) 0.6x0.3x0.3 (Precious Metals)
GLO	Capacitor ceramic MLCC 0201 (0.17mg) D 0.6x0.3x0.3 (Base Metals)	agg	Sphera	{0e89726c-24d4-409e-ae50-d9fcf7fbc9e7}	Capacitor ceramic MLCC 0201 (0.17mg) 0.6x0.3x0.3 (Base Metals)
GLO	Capacitor ceramic MLCC 0603 (6mg) D 1.6x0.8x0.8	agg	Sphera	{3cfe6b9a-e159-4560-b556-592f58cd2b8e}	Capacitor ceramic MLCC 0603 (6mg) 1.6x0.8x0.8 (Precious Metals)
GLO	Capacitor ceramic MLCC 0603 (6mg) D 1.6x0.8x0.8 (Base Metals)	agg	Sphera	{e2e363bf-720f-4267-b2b9-a8f2a2c30587}	Capacitor ceramic MLCC 0603 (6mg) 1.6x0.8x0.8 (Base Metals)
GLO	Capacitor ceramic MLCC 1210 (50mg) D 3.2x1.6x1.6 (Base Metals)	agg	Sphera	{85e51613-a95a-4d6a-a4fe-e8d61eed8340}	Capacitor ceramic MLCC 1210 (50mg) 3.2x1.6x1.6 (Base metals)
GLO	Capacitor ceramic MLCC 1210 (50mg) D	agg	Sphera	{1c8b83cc-b32a-4d2a-87ca-	Capacitor ceramic MLCC 1210 (50mg)

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	3.2x3.2x1.6			7ea4ad2d9ea9}	3.2x3.2x1.6 (Precious Metals)
GLO	Capacitor ceramic MLCC 2220 (450mg) D 5.7x5.0x2.5	agg	Sphera	{f30aa20e-cb4b-4110-bea0-31507157cccd}	Capacitor ceramic MLCC 2220 (450mg) 5.7x5x2.5 (Precious Metals)
GLO	Capacitor ceramic MLCC 2220 (450mg) D 5.7x5.0x2.5 (Base Metals)	agg	Sphera	{4bb0149c-16df-4cc7-80cb-aee572ee7301}	Capacitor ceramic MLCC 2220 (450mg) 5.7x5x2.5 (Base Metals)
IT	Caprolactam	agg	Sphera	{00a588c7-2f5c-49a2-9d06-7b08de5d598a}	Caprolactam from Cyclohexanone from Phenol
NL	Caprolactam	agg	Sphera	{85e4f826-3b69-4901-8c95-93b841441d09}	Caprolactam from Cyclohexanone from Phenol
IN	Caprolactam (from cyclohexane)	agg	Sphera	{54f6e85f-bd2f-4137-bf81-18d1fa6f9afc}	Caprolactam from Cyclohexanone from Cyclo-hexane
US	Caprolactam (from cyclohexane)	agg	Sphera	{98a3ed17-65ea-4bbe-99a5-7fa3e82cc198}	Caprolactam from Cyclohexanone from Cyclo-hexane (by-product ammonium sulphate)
DE	Caprolactam (from cyclohexane)	agg	Sphera	{e7f1fa1a-9461-4ef1-accf-ec596cbde127}	Caprolactam from Cyclohexanone from Cyclo-hexane (by-product ammonium sulphate)
GLO	Car CNG, Euro 2	u-so	Sphera	{373e7e7d-6f4f-4ebe-8241-9afac5596353}	Car, CNG, Euro 2
GLO	Car CNG, Euro 3	u-so	Sphera	{ee3cb0bb-8f5b-43b0-858c-83a398a5055e}	Car, CNG, Euro 3
GLO	Car CNG, Euro 4	u-so	Sphera	{006f40f4-6c00-4aec-83a4-62a861c1e6bf}	Car, CNG, Euro 4
GLO	Car CNG, Euro 5	u-so	Sphera	{a3e2ca18-4b33-478f-876b-d51ee06ddb47}	Car, CNG, Euro 5
GLO	Car CNG, Euro 6	u-so	Sphera	{39b2d609-7652-4ec7-b2f0-9fa5ee465882}	Car, CNG, Euro 6
DE	Car diesel EURO 3 (EN15804 A4)	agg	Sphera	{834bd9ff-507d-4308-a704-9dcd3651a9fb}	Car, diesel EURO 3 (EN15804 A4)
EU-28	Car diesel EURO 4 (EN15804 A4)	agg	Sphera	{1b6bc057-37cf-4fe4-b19a-afc9648fe7b7}	Car, diesel EURO 4 (EN15804 A4)
DE	Car diesel EURO 4 (EN15804 A4)	agg	Sphera	{eec9faa6-7e99-4d6d-96b4-bf719de5d752}	Car, diesel EURO 4 (EN15804 A4)
GLO	Car diesel, 1986-88, engine size 1.4-2l	u-so	Sphera	{453eaf4c-89ba-4747-b4d4-1475a9f57ec1}	Car, diesel, 1986-88, engine size 1.4-2l
GLO	Car diesel, 1986-88, engine size more than 2l	u-so	Sphera	{cd3155d5-a43f-4494-b9cd-34bd9dbebe46}	Car, diesel, 1986-88, engine size more than 2l
GLO	Car diesel, 1986-88, engine size up to 1.4l	u-so	Sphera	{67c9c3bf-ab15-4ce1-8fce-fbe384044522}	Car, diesel, 1986-88, engine size up to 1.4l
GLO	Car diesel, Euro 1, engine size 1.4-2l	u-so	Sphera	{de551616-68e7-4ee1-8b70-91994fc42ea5}	Car, diesel, Euro 1, engine size 1.4-2l
GLO	Car diesel, Euro 1, engine size more than 2l	u-so	Sphera	{dce42801-2284-438c-846b-aa6a4c984a94}	Car, diesel, Euro 1, engine size more than 2l
GLO	Car diesel, Euro 1, engine size up to 1.4l	u-so	Sphera	{332f1874-74fb-4583-bece-d93ede01d153}	Car, diesel, Euro 1, engine size up to 1.4l
GLO	Car diesel, Euro 2, engine size 1.4-2l	u-so	Sphera	{255e2d50-dfa6-4882-9a20-2606339da95b}	Car, diesel, Euro 2, engine size 1.4-2l

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GLO	Car diesel, Euro 2, engine size more than 2l	u-so	Sphera	{99593583-59d9-48e8-87e1-e204a9c02872}	Car, diesel, Euro 2, engine size more than 2l
GLO	Car diesel, Euro 2, engine size up to 1.4l	u-so	Sphera	{a2e608f0-007f-42a0-a3f0-d05c0dc2fa3f}	Car, diesel, Euro 2, engine size up to 1.4l
GLO	Car diesel, Euro 3, engine size 1.4-2l	u-so	Sphera	{43c40cae-f375-43cc-8b97-074c8e626125}	Car, diesel, Euro 3, engine size 1.4-2l
GLO	Car diesel, Euro 3, engine size more than 2l	u-so	Sphera	{d4c4829d-10cc-4f1c-baa7-a8b370ecb6f5}	Car, diesel, Euro 3, engine size more than 2l
GLO	Car diesel, Euro 3, engine size up to 1.4l	u-so	Sphera	{a2bad318-21ca-4c93-83fd-fcbfe7ddc82b}	Car, diesel, Euro 3, engine size up to 1.4l
GLO	Car diesel, Euro 4, engine size 1.4-2l	u-so	Sphera	{1593625f-9883-432d-a9fd-d38bd2266fc5}	Car, diesel, Euro 4, engine size 1.4-2l
GLO	Car diesel, Euro 4, engine size more than 2l	u-so	Sphera	{857afe13-80f3-4539-83f5-d0fb58530011}	Car, diesel, Euro 4, engine size more than 2l
GLO	Car diesel, Euro 4, engine size up to 1.4l	u-so	Sphera	{49b453a0-17ed-4759-bcba-5466ca22eee4}	Car, diesel, Euro 4, engine size up to 1.4l
GLO	Car diesel, Euro 5, engine size 1.4-2l	u-so	Sphera	{c0e011f9-3f4b-4ee9-a57c-5c627826b6ef}	Car, diesel, Euro 5, engine size 1.4-2l
GLO	Car diesel, Euro 5, engine size more than 2l	u-so	Sphera	{945640f2-1a61-4274-bc0d-49568d6a562f}	Car, diesel, Euro 5, engine size more than 2l
GLO	Car diesel, Euro 5, engine size up to 1.4l	u-so	Sphera	{067036ec-dc68-4dd5-a8b3-c5097ac22c74}	Car, diesel, Euro 5, engine size up to 1.4l
GLO	Car diesel, Euro 6 (from Jan 2021), engine size 1,4-2l	u-so	Sphera	{06dbfb0c-6f79-4643-b607-b442d695f279}	Car, diesel, Euro 6 (from Jan 2021), engine size 1,4-2l
GLO	Car diesel, Euro 6 (from Jan 2021), engine size more than 2l	u-so	Sphera	{ef1d765c-7cf1-4e27-8f22-e831f6ee1ea1}	Car, diesel, Euro 6 (from Jan 2021), engine size more than 2l
GLO	Car diesel, Euro 6 (from Jan 2021), engine size up to 1,4l	u-so	Sphera	{04d3c67b-5bae-4243-bdde-317168e12eaa}	Car, diesel, Euro 6 (from Jan 2021), engine size up to 1,4l
GLO	Car diesel, Euro 6 (from Sept 2019), engine size 1,4-2l	u-so	Sphera	{a2a23d22-be40-4b73-aab9-cf92be8415dc}	Car, diesel, Euro 6 (from Sept 2019), engine size 1,4-2l
GLO	Car diesel, Euro 6 (from Sept 2019), engine size more than 2l	u-so	Sphera	{cbea5761-84bc-40b4-92a1-5368ccc398cd}	Car, diesel, Euro 6 (from Sept 2019), engine size more than 2l
GLO	Car diesel, Euro 6 (from Sept 2019), engine size up to 1,4l	u-so	Sphera	{bdd76c4c-a602-4842-a6ad-9018431104c2}	Car, diesel, Euro 6 (from Sept 2019), engine size up to 1,4l
GLO	Car diesel, Euro 6, engine size 1,4-2l	u-so	Sphera	{c439a3a5-d729-4369-a0c7-78df69cddcad}	Car, diesel, Euro 6, engine size 1,4-2l
GLO	Car diesel, Euro 6, engine size more than 2l	u-so	Sphera	{197b352d-c735-4680-b6c8-3e2e2cbc0bee}	Car, diesel, Euro 6, engine size more than 2l
GLO	Car diesel, Euro 6, engine size up to 1,4l	u-so	Sphera	{f64cb71b-9864-4aa5-ac96-0559be61cb34}	Car, diesel, Euro 6, engine size up to 1,4l
GLO	Car LPG, Euro 2	u-so	Sphera	{14fce6ab-9ba2-4743-af11-532457aedbfc}	Car, LPG, Euro 2
GLO	Car LPG, Euro 3	u-so	Sphera	{7cbafc51-de4c-4952-9331-88d3c5605b85}	Car, LPG, Euro 3
GLO	Car LPG, Euro 4	u-so	Sphera	{c90bbbdd-8f36-44ae-a681-86ba0015075a}	Car, LPG, Euro 4

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GLO	Car LPG, Euro 5	u-so	Sphera	{97c2e751-789e-411f-bc9f-96fd6b507ade}	Car, LPG, Euro 5
GLO	Car LPG, Euro 6	u-so	Sphera	{70ab13a5-36bc-48a2-a20f-291c36485de4}	Car, LPG, Euro 6
DE	Car petrol EURO 3 (EN15804 A4)	agg	Sphera	{d695baeb-386f-42de-a00c-75b3de2cb676}	Car, petrol EURO 3 (EN15804 A4)
DE	Car petrol EURO 4 (EN15804 A4)	agg	Sphera	{6fbc8f4d-d1fc-412c-8ede-0edcf91eb704}	Car, petrol EURO 4 (EN15804 A4)
EU-28	Car petrol EURO 4 (EN15804 A4)	agg	Sphera	{799d9e96-714e-408a-bb63-177e456ecf40}	Car, petrol EURO 4 (EN15804 A4)
GLO	Car petrol, controlled catalytic converter < 87, engine size 1.4-2l	u-so	Sphera	{2d189fba-d7b8-492b-b02d-0e417eaf872f}	Car, petrol, controlled catalytic converter < 87, engine size 1.4-2l
GLO	Car petrol, controlled catalytic converter < 87, engine size more than 2l	u-so	Sphera	{65fd951d-4cc5-4110-b189-853c78c84c2f}	Car, petrol, controlled catalytic converter < 87, engine size more than 2l
GLO	Car petrol, controlled catalytic converter < 87, engine size up to 1.4l	u-so	Sphera	{0f98daf5-ab68-4433-9720-09256b9771ac}	Car, petrol, controlled catalytic converter < 87, engine size up to 1.4l
GLO	Car petrol, controlled catalytic converter 87-90, engine size 1.4-2l	u-so	Sphera	{5c92c3a5-4b6c-475e-9ce2-2edf72c226c2}	Car, petrol, controlled catalytic converter 87-90, engine size 1.4-2l
GLO	Car petrol, controlled catalytic converter 87-90, engine size more than 2l	u-so	Sphera	{877b1fd5-abf7-4ac5-a0ab-6195d79d55c9}	Car, petrol, controlled catalytic converter 87-90, engine size more than 2l
GLO	Car petrol, controlled catalytic converter 87-90, engine size up to 1.4l	u-so	Sphera	{6d1833f0-aa63-4f52-b749-14dc872a543d}	Car, petrol, controlled catalytic converter 87-90, engine size up to 1.4l
GLO	Car petrol, conventional, engine size 1.4-2l	u-so	Sphera	{885968e6-cc86-44a5-9452-dfcb87a2f21b}	Car, petrol, conventional, engine size 1.4-2l
GLO	Car petrol, conventional, engine size more than 2l	u-so	Sphera	{598224f8-3005-47bd-a0c1-cb034ae6d045}	Car, petrol, conventional, engine size more than 2l
GLO	Car petrol, conventional, engine size up to 1.4l	u-so	Sphera	{f04b702e-542d-46ba-94ab-aa3d6111cd88}	Car, petrol, conventional, engine size up to 1.4l
GLO	Car petrol, ECE 15'04, engine size 1.4-2l	u-so	Sphera	{6a0a20db-e824-4e9c-943f-f54c6841b36f}	Car, petrol, ECE 15'04, engine size 1.4-2l
GLO	Car petrol, ECE 15'04, engine size more than 2l	u-so	Sphera	{dd8c2a9d-91e5-493a-905d-5998f7a1d294}	Car, petrol, ECE 15'04, engine size more than 2l
GLO	Car petrol, ECE 15'04, engine size up to 1.4l	u-so	Sphera	{ccd2013e-2780-4b11-a032-06d88e62a98e}	Car, petrol, ECE 15'04, engine size up to 1.4l
GLO	Car petrol, Euro 1, engine size 1.4-2l	u-so	Sphera	{d74a046b-2937-4828-b17f-13a6bafd6f82}	Car, petrol, Euro 1, engine size 1.4-2l
GLO	Car petrol, Euro 1, engine size more than 2l	u-so	Sphera	{5f45f84e-86b0-4186-a7a1-c260f523d05d}	Car, petrol, Euro 1, engine size more than 2l
GLO	Car petrol, Euro 1, engine size up to 1.4l	u-so	Sphera	{d8700461-dbb6-4a4f-a83d-b02cf19d5da9}	Car, petrol, Euro 1, engine size up to 1.4l
GLO	Car petrol, Euro 2, engine size 1.4-2l	u-so	Sphera	{d8babc1d-dee3-4688-8c1b-5007a6681725}	Car, petrol, Euro 2, engine size 1.4-2l
GLO	Car petrol, Euro 2, engine size more than 2l	u-so	Sphera	{9115ac36-ef10-49f3-ac1f-bea98439afdd}	Car, petrol, Euro 2, engine size more than 2l
GLO	Car petrol, Euro 2, engine size up to 1.4l	u-so	Sphera	{4bad4c6d-f9f6-4607-a3fc-f730ca37a0df}	Car, petrol, Euro 2, engine size up to 1.4l

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GLO	Car petrol, Euro 3, engine size 1.4-2l	u-so	Sphera	{0330452d-d9d4-4fd6-b9e7-6fe97059022b}	Car, petrol, Euro 3, engine size 1.4-2l
GLO	Car petrol, Euro 3, engine size more than 2l	u-so	Sphera	{35dd191c-710d-4720-aac3-943cccc87ffb}	Car, petrol, Euro 3, engine size more than 2l
GLO	Car petrol, Euro 3, engine size up to 1.4l	u-so	Sphera	{b7cb803f-92f6-4791-b6a3-58392205bd62}	Car, petrol, Euro 3, engine size up to 1.4l
GLO	Car petrol, Euro 4, engine size 1.4-2l	u-so	Sphera	{17327787-58c4-4d86-9884-6d5ccef109b6}	Car, petrol, Euro 4, engine size 1.4-2l
GLO	Car petrol, Euro 4, engine size more than 2l	u-so	Sphera	{28856c97-30f9-4754-a9d1-24f25a249b9e}	Car, petrol, Euro 4, engine size more than 2l
GLO	Car petrol, Euro 4, engine size up to 1.4l	u-so	Sphera	{39b1c428-ebf5-49cf-8c06-5ed6908426d4}	Car, petrol, Euro 4, engine size up to 1.4l
GLO	Car petrol, Euro 5, engine size 1.4-2l	u-so	Sphera	{d47a6c90-e6b0-4977-b694-e05316d5a788}	Car, petrol, Euro 5, engine size 1.4-2l
GLO	Car petrol, Euro 5, engine size more than 2l	u-so	Sphera	{418f045b-995e-44f9-bf29-36df3db9319c}	Car, petrol, Euro 5, engine size more than 2l
GLO	Car petrol, Euro 5, engine size up to 1.4l	u-so	Sphera	{f5af02c8-d37f-4c3e-aaed-0e9673d9e0bf}	Car, petrol, Euro 5, engine size up to 1.4l
GLO	Car petrol, Euro 6, engine size 1,4-2l	u-so	Sphera	{feb99635-f17e-42c7-9c7c-d02a61e699b6}	Car, petrol, Euro 6, engine size 1,4-2l
GLO	Car petrol, Euro 6, engine size more than 2l	u-so	Sphera	{fe8d4983-d37a-4bc6-9671-26276feaf6aa}	Car, petrol, Euro 6, engine size more than 2l
GLO	Car petrol, Euro 6, engine size up to 1,4l	u-so	Sphera	{0fb49443-6798-4f13-af38-33c93063ea3e}	Car, petrol, Euro 6, engine size up to 1,4l
GLO	Car petrol, non-controlled catalytic converter, engine size 1.4-2l	u-so	Sphera	{cc7268ad-a089-4e3d-a065-37011b1302c4}	Car, petrol, non-controlled catalytic converter, engine size 1.4-2l
GLO	Car petrol, non-controlled catalytic converter, engine size more than 2l	u-so	Sphera	{2c2be109-08a9-4416-8c67-569542adf5da}	Car, petrol, non-controlled catalytic converter, engine size more than 2l
GLO	Car petrol, non-controlled catalytic converter, engine size up to 1.4l	u-so	Sphera	{3adb5c13-ab66-4cf4-8bfd-02b7b226f685}	Car, petrol, non-controlled catalytic converter, engine size up to 1.4l
US	Carbon monoxide (via synthesis gas)	agg	Sphera	{f3cbf054-eb44-4d55-a02a-2dbbaa6a468b}	Carbon monoxide via synthesis gas (by-product hydrogen)
FR	Carbon monoxide (via synthetic gas)	agg	Sphera	{08cd948d-f040-4ea1-be59-b92c83ea8f27}	Carbon monoxide via synthesis gas (by-product hydrogen)
DE	Carbon monoxide (via synthetic gas)	agg	Sphera	{831121be-2152-4536-99ec-3c7f5ad706ad}	Carbon monoxide via synthesis gas (by-product hydrogen)
IN	Carbon monoxide via synthesis gas	agg	Sphera	{a9cf249a-c712-451a-aef6-80caf98bf77a}	Carbon monoxide via synthesis gas (by-product hydrogen)
DE	Cattle hide, fresh, from slaughterhouse (economic allocation)	agg	Sphera	{4acae933-dfed-47f5-a46a-157fc0d188cd}	Cattle hide, fresh (beef cattle, from slaughterhouse, PEFCR allocation)
US	Cattle hide, fresh, from slaughterhouse (economic allocation)	agg	Sphera	{b61c1007-d1b2-4d33-999d-8a956a264366}	Cattle hide, fresh (beef cattle, from slaughterhouse, economic allocation)
US	Chlorine (from chlorine alkali electrolysis) (membrane)	agg	Sphera	{ae803f12-390c-4c1e-a423-7a98377ad205}	Chlorine from chlorine-alkali-electrolysis (membrane)
DE	Chlorine from chlorine alkali electrolysis (membrane)	agg	Sphera	{6779bd74-f9ae-4ea4-8bb0-8e79da46dfc5}	Chlorine from chlorine-alkali-electrolysis (membrane)

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US	Chlorine from chlorine-alkali electrolysis (Diaphragm)	agg	Sphera	{16045857-fb39-4346-b70a-d235ee13df5b}	Chlorine from chlorine-alkali-electrolysis (diaphragm)
DE	Coke mix	agg	Sphera	{0af25d7c-55b0-4ee0-b9ea-9b5822a91444}	Metallurgical coke
US	Coke mix	agg	Sphera	{bb03faef-7f5a-40bb-936d-05f29332290f}	Metallurgical coke
EU-28	Corrugated board excl. paper production (2018), open paper input, average composition	p-agg	Sphera/FEFCO	{9ce01d93-ae27-400e-b359-11f5208321e8}	Corrugated board 2018; excl. paper production; input: paper
EU-28	Diethanolamine	agg	Sphera	{768ab9f8-3f42-49f2-8b54-39feeebf0749}	Diethanolamine (DEA) by-prod. ethanolamines
US	Diethanolamine (DEA)	agg	Sphera	{894e2ab9-da97-4357-8dff-1306ad80d3e6}	Diethanolamine (DEA) by-prod. ethanolamines
IN	Dimethylamine	agg	Sphera	{161c8a46-a2c0-4bb6-af89-fc0baf6ab376}	Dimethylamine by-product mono-, trimethyleneamine
DE	Dip-Switch (Light switch) (EN15804 C3)	agg	Sphera	{6542c3d3-c29e-4f3f-b6e4-9faeda5d1f1d}	Dip-Switch (Light switch) (EN15804 C4)
EU-28	Dip-Switch (Light switch) (EN15804 C3)	agg	Sphera	{fbe78fa6-ec95-4a9c-9b84-7176c250d229}	Dip-Switch (Light switch) (EN15804 C4)
US	Dolomite extraction	agg	Sphera	{82ef4b2a-94ae-4b8d-8b59-e08b65950ab4}	Dolomite mining
DE	Epichlorohydrin	agg	Sphera	{839f0f07-d868-4f73-809a-f4eac5a8d206}	Epichlorohydrin (by product calcium chloride, hydrochloric acid)
US	Epoxy-coating of steel reinforcement bar (estimate) - open input steel rebar	p-agg	Sphera	{ff104315-758c-48d8-8235-2c8b332f2b19}	Epoxy-coating of steel reinforcement bar (approximation) - open input steel rebar
DE	Ethanol	agg	Sphera	{07ecf8b3-b571-4a33-82e1-b2d7f37020dc}	Ethanol (96%) (hydrogenation with nitric acid)
GB	Ethanol	agg	Sphera	{2151225d-1eeb-4216-8a89-9be90cd0a3b1}	Ethanol (96%) (hydrogenation with nitric acid)
FR	Ethanol	agg	Sphera	{3891bca6-2bc1-43b9-bd73-3ff297be7ee9}	Ethanol (96%) (hydrogenation with nitric acid)
US	Ethylene dichloride (EDC)	agg	Sphera	{2e82a0a3-8726-49fb-9bda-bbb1c2c44d46}	Ethylene dichloride (EDC) (approximation)
DE	Ethylene glycol	agg	Sphera	{02c5b6a9-eee0-4514-b3c3-09105f9cf678}	Ethylene glycol (from ethene and oxygen via EO)
BE	Ethylene glycol	agg	Sphera	{42eafc6b-fb3e-4504-813c-69f9e20a9885}	Ethylene glycol (from ethene and oxygen via EO)
FR	Ethylene glycol	agg	Sphera	{5e33a758-6699-4942-afad-84f49dc297e2}	Ethylene glycol (from ethene and oxygen via EO)
EU-28	Ethylene glycol	agg	Sphera	{72022e20-d980-47d8-aead-5a5343d69d8d}	Ethylene glycol (from ethene and oxygen via EO)
NL	Ethylene glycol	agg	Sphera	{b09f150e-435a-4747-97b8-22f4e5cb32da}	Ethylene glycol (from ethene and oxygen via EO)
GB	Ethylene glycol	agg	Sphera	{c0f206eb-d939-4f6b-bf80-5cfc4096b941}	Ethylene glycol (from ethene and oxygen via EO)
IN	Ethylene glycol from Ethene and oxygen via EO	agg	Sphera	{7b40485c-94da-4dcd-bcc6-f7ffaeec2fab}	Ethylene glycol (from ethene and oxygen via

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	(approximation)				EO) (approximation)
DE	Ethylene glycol from ethylene oxide	agg	Sphera	{0cfc5ae6-5f9a-4f7d-a385-e00beb1f0ebe}	Ethylene glycol (from ethene and oxygen via EO)
DE	Ethylene oxide (EO) via air	agg	Sphera	{44151e57-4978-4c10-9b4c-705dd899a8d7}	Ethylene oxide (EO) by-product carbon dioxide via air
US	Ethylene oxide (EO) via air	agg	Sphera	{576c25fd-1f33-4eae-93b6-b4a086c88431}	Ethylene oxide (EO) by-product carbon dioxide via air
GB	Ethylene oxide (EO) via air	agg	Sphera	{67d591e9-ab96-4e7c-b116-8faae1ff16b9}	Ethylene oxide (EO) by-product carbon dioxide via air
BE	Ethylene oxide (EO) via air	agg	Sphera	{73e1df8e-0e35-4c37-90c3-48c3c4ff46f1}	Ethylene oxide (EO) by-product carbon dioxide via air
NL	Ethylene oxide (EO) via air	agg	Sphera	{e7210240-83cb-4784-8377-32ac2807a3fe}	Ethylene oxide (EO) by-product carbon dioxide via air
FR	Ethylene oxide (EO) via air	agg	Sphera	{f665a4a6-0430-446f-90d1-387997463597}	Ethylene oxide (EO) by-product carbon dioxide via air
US	Ethyne (acetylene)	agg	Sphera	{01662557-4f51-4a04-90ff-f01b6e71a15e}	Ethyne (acetylene) from natural gas
DE	Ethyne (acetylene)	agg	Sphera	{26ad93f6-d655-4663-8396-9bb2cb908023}	Ethyne (acetylene) from natural gas
GB	Ethyne (acetylene)	agg	Sphera	{3626f227-2afa-416c-a466-313874967d31}	Ethyne (acetylene) from natural gas
EU-28	Ethyne (acetylene)	agg	Sphera	{c7b1d158-ed08-492a-a849-5105afdde032}	Ethyne (acetylene) from natural gas
CN	Expanded Polystyrene (EPS 15)	agg	Sphera	{0b325478-497b-42cf-95bd-7b81e3399c8f}	Expanded Polystyrene (EPS) Foam (15 kg/m3)
UA	Expanded Polystyrene (EPS 15)	agg	Sphera	{6b45d60f-6a91-4a96-abe3-c13296d5e921}	Expanded Polystyrene (EPS) Foam (15 kg/m3)
UA	Expanded Polystyrene (EPS 20)	agg	Sphera	{6e4e5620-d729-46af-b096-ada6cd028422}	Expanded Polystyrene (EPS) Foam (20 kg/m3)
UA	Expanded Polystyrene (EPS 25)	agg	Sphera	{9e38c4b8-6d5c-43e9-8e02-27ba87880d36}	Expanded Polystyrene (EPS) Foam (25 kg/m3)
CN	Expanded Polystyrene (EPS 30)	agg	Sphera	{0be79ea3-fa4b-4758-ad78-4c7f9711859e}	Expanded Polystyrene (EPS) Foam (30 kg/m3)
UA	Expanded Polystyrene (EPS 30)	agg	Sphera	{c2e98095-cfaa-47f4-942a-9ecf709ad229}	Expanded Polystyrene (EPS) Foam (30 kg/m3)
DE	Expanded Polystyrene (PS 15) (EN15804 A1-A3)	agg	Sphera	{db8940f5-bcef-4cd8-af8d-6ec0296f5a76}	Expanded Polystyrene (EPS) Foam (15 kg/m3, EN15804 A1-A3)
DE	Expanded Polystyrene (PS 20) (EN15804 A1-A3)	agg	Sphera	{debc1946-1978-4ae2-97b6-85d53cdc94d1}	Expanded Polystyrene (EPS) Foam (20 kg/m3, EN15804 A1-A3)
DE	Expanded Polystyrene (PS 25) (EN15804 A1-A3)	agg	Sphera	{0541a534-cebf-4862-acc4-04bd8f883db7}	Expanded Polystyrene (EPS) Foam (25 kg/m3, EN15804 A1-A3)
DE	Expanded Polystyrene (PS 30) (EN15804 A1-A3)	agg	Sphera	{51a08546-ad0b-4df9-ae9e-c71795823f87}	Expanded Polystyrene (EPS) Foam (30 kg/m3, EN15804 A1-A3)

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EU-28	Expanded Polystyrene (PS 30) (EN15804 A1-A3)	agg	Sphera	{7f9439b8-1a14-4089-aec9-54f3690bf531}	Expanded Polystyrene (EPS) Foam (30 kg/m3, EN15804 A1-A3)
EU-28	Expanded polystyrene foam (PS 15) (A1-A3)	agg	Sphera	{47246e51-bc19-46ef-ba15-4a4e2a97bea5}	Expanded Polystyrene (EPS) Foam (15 kg/m3, EN15804 A1-A3)
EU-28	Expanded polystyrene foam (PS 20) (A1-A3)	agg	Sphera	{e6d18a05-e8f6-4135-9b80-1516f5c3d5dc}	Expanded Polystyrene (EPS) Foam (20 kg/m3 EN15804 A1-A3)
EU-28	Expanded polystyrene foam (PS 25) (A1-A3)	agg	Sphera	{cbfb303f-11b3-45b3-8404-c7d6d93a1284}	Expanded Polystyrene (EPS) Foam (25 kg/m3, EN15804 A1-A3)
CN	Ferrosilicon (75%) production	u-so	DLR/IMA/Sphera	{49a9b9dd-0db8-4bf9-941e-843a0f397479}	Ferrosilicon (75% Si)
EU-28	Glycerine (refined) by-product rapeseed methyl ester (RME) (price 2014 allocated)	agg	Sphera	{0424e9a6-9212-4bbc-a08f-a5ab465348b1}	Glycerine (refined) by-product rapeseed methyl ester (RME) (price allocated)
DE	Glycerine (refined) by-product rapeseed methyl ester (RME) (price 2014 allocated)	agg	Sphera	{ae64e6da-13be-49f8-9377-9eedf9f0d671}	Glycerine (refined) by-product rapeseed methyl ester (RME) (price allocated)
DE	Glycerine by-product rapeseed methyl ester (RME) (price 2014 allocated)	agg	Sphera	{3f2aca16-dd5d-4ad7-907b-19cda5f13c50}	Glycerine by-product rapeseed methyl ester (RME) (price allocated)
EU-28	Glycerine by-product rapeseed methyl ester (RME) (price 2014 allocated)	agg	Sphera	{df72fc15-6aaa-47e0-ae95-ed27d08c10e8}	Glycerine by-product rapeseed methyl ester (RME) (price allocated)
RER	Ground calcium carbonate slurry	agg	CCA-Europe	{c220ef06-50b6-4037-b6b2-7562d01ea9e3}	GCC slurry
IT	Hydrogen (cracker)	agg	Sphera	{3b2f4c49-b819-4320-b5c2-cfb21ddfe20f}	Hydrogen (steam cracker)
NO	Hydrogen (cracker)	agg	Sphera	{629fbd0d-95f7-4d29-a32b-375b19bdd0b6}	Hydrogen (steam cracker)
US	Hydrogen (cracker)	agg	Sphera	{70bf88f3-76b3-4989-a4bd-5f59196c4ba5}	Hydrogen (steam cracker)
DE	Hydrogen (cracker)	agg	Sphera	{cf1e52a6-4a65-4b46-8926-c25f7b170af7}	Hydrogen (steam cracker)
GB	Hydrogen (cracker)	agg	Sphera	{dd9407f4-eac9-42cb-b13d-b42ce9ebf55b}	Hydrogen (steam cracker)
DE	Hydrogen fluoride	agg	Sphera	{abf90214-13f8-4030-b9b5-2a79f4f266e1}	Hydrogen fluoride by-product gypsum highly pure
NL	Hydrogen peroxide	agg	Sphera	{765b4d8a-61a3-48b0-9e67-5c101ba5a2e8}	Hydrogen peroxide (50%; H2O2)
DE	Hydrogen peroxide	agg	Sphera	{93ca55c4-2d20-4229-892f-792d786aa0b5}	Hydrogen peroxide (50%; H2O2)
FR	Hydrogen peroxide	agg	Sphera	{9d928e39-b892-41df-a568-ccb784ee0afa}	Hydrogen peroxide (50%; H2O2)
BE	Hydrogen peroxide	agg	Sphera	{e6c5e3ae-0bdd-466d-8ba3-5cdcf7ecfeb0}	Hydrogen peroxide (50%; H2O2)
GLO	IC LGA 1366 (~5g) 45x42.5x~2.5 CMOS logic (14 nm node) [based on models 2004-2014]	agg	Sphera	{7f13bfa5-2030-486b-bf75-730a3c54bd13}	IC LGA 1366 (ca. 5g) 45x42.5x ca. 2.5 CMOS logic (14 nm node) [based on models 2004-2014]
GLO	IC LGA 1366 (~5g) 45x42.5x~2.5 CMOS logic (32 nm node) [based on models 2004-2014]	agg	Sphera	{840c6756-335a-4c9e-842c-d896b1416131}	IC LGA 1366 (ca. 5g) 45x42.5x ca. 2.5 CMOS logic (32 nm node) [based on models 2004-

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					2014]
GLO	IC SO 20 (530mg) 12.8x7.5 mm CMOS logic (90nm node)	agg	Sphera	{7f75a43e-8b38-4ac8-95fa-47a374a24f66}	IC SO 20 (530mg) 12.8x7.5 mm CMOS logic (90 nm node)
EU-28	Kraftliner (2018) - for use in avoided burden EoL scenario cases	p-agg	Sphera/FEFCO	{6ac37d3c-caeb-4216-9f1d-c78c1b8c772b}	Kraftliner 2018; by-products: tall oil, turpentine; substitution EoL; [mass allocation]
EU-28	Kraftliner (2018) - for use in cut-off EoL scenario cases	p-agg	Sphera/FEFCO	{db37fa90-370b-4b0a-a49a-5d0d0f0382f7}	Kraftliner 2018; by-products: tall oil, turpentine; cut-off EoL; [mass allocation]
IN	Landfill (Municipal household waste)	p-agg	Sphera	{22014570-01ec-4923-a72c-9da91e72aaac}	Landfill (Municipal household waste) (unmanaged)
AU	Landfill of particleboard, MR, E1, melamine coated, 16 mm (NGA) (EN 15804 D) (Copy)	agg	FWPA	{2dcd6e55-ed49-42f1-a496-b6e6528b638a}	Landfill of particleboard, MR, E1, melamine coated, 16 mm (NGA) (EN 15804 D)
US	Landfill, arid climate (according to the WARM model)	p-agg	Sphera	{143e11bf-00c9-4df0-a9bb-d82789f3a451}	Landfill, arid climate (partially based on WARM data)
US	Landfill, moderate climate (according to the WARM model)	p-agg	Sphera	{7aae8110-cdda-4daf-9bd4-116dad00fe40}	Landfill, moderate climate (partially based on WARM data)
US	Landfill, wet climate (according to the WARM model)	p-agg	Sphera	{9d6d7f84-2760-4ea9-aa82-5af2bb298fbe}	Landfill, wet climate (partially based on WARM data)
DE	Leather (varnished; 1 sqm/0.95 kg)	agg	Sphera	{8a0b9ef1-f01e-48fa-96dc-8472dbf77291}	Grain leather (beef cattle, varnished, 1 sqm/0.95 kg, PEFCR allocation)
DE	Leather (varnished; 1 sqm/0.95 kg) - open input cattle hide	p-agg	Sphera	{4de0774c-2bc6-4892-9d18-28e8f0662419}	Grain leather (varnished, 1 sqm/0.95 kg, PEFCR allocation) - open input cattle hide
DE	Leather seat cover (10 sqm/9.5 kg)	agg	Sphera	{a6a6524d-9ebe-4899-b369-856ff1cbb200}	Grain leather seat cover (10 sqm/9.5 kg)
IL	Magnesium production, electrolysis	u-so	DLR/IMA/Sphera	{250cea57-e3c1-40e2-81c1-839e52181aa8}	Magnesium, electrolysis, by-products Cl2, KCl
CN	Magnesium production, pidgeon process	u-so	DLR/IMA/Sphera	{653fd903-2a29-4750-8ca5-15eed0682172}	Magnesium, pidgeon process
DE	Maleic anhydride	agg	Sphera	{359ac890-dc07-40ed-a0eb-cec934ad1805}	Maleic anhydride (MA) (from n-butane)
GB	Maleic anhydride	agg	Sphera	{7d1decf7-45b1-404e-8c84-e2df2c32b854}	Maleic anhydride (from n- butane)
BE	Maleic anhydride	agg	Sphera	{932ecc0c-c177-428f-912e-44c6680c8d9b}	Maleic anhydride (from n- butane)
IT	Maleic anhydride	agg	Sphera	{9456ad98-6277-4888-b6f2-6aa250f10a03}	Maleic anhydride (from n- butane)
IT	Maleic anhydride	agg	Sphera	{ee45b51e-8e33-4ff5-b4e0-e93667386756}	Maleic anhydride (from benzene)
IN	Melamin (stami carbon process)	agg	Sphera	{962d0200-62e9-4477-97c3-4d101e2242b9}	Melamin (stami carbon process) (by-products ammonia and carbon dioxide)
EU-28	Melamine	agg	Sphera	{a4eb23c4-4f1d-4396-901e-d155be751898}	Melamine (Stami carbon process)
DE	Melamine	agg	Sphera	{b9557ad1-ead8-4886-836c-91850a9780dc}	Melamine (Stami carbon process)

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NL	Methane	agg	Sphera	{30796d54-55b8-4957-8b6e-033aa109b986}	Methane (from natural gas)
BE	Methane	agg	Sphera	{3da80ec8-4867-46c3-a222-5baf9be5d4e6}	Methane (from natural gas)
FR	Methane	agg	Sphera	{4a7775dd-2821-42d8-a2e5-83b65358736f}	Methane (from natural gas)
GB	Methane	agg	Sphera	{5baf31e7-c685-4208-815f-c9b08b51e35e}	Methane (from natural gas)
ES	Methane	agg	Sphera	{7c7bfd7d-80bb-4335-af10-bb75700224b0}	Methane (from natural gas)
DE	Methane	agg	Sphera	{9635537b-740a-4a62-9ff5-203c4576a406}	Methane (from natural gas)
IN	Methane	agg	Sphera	{c13fda5f-ea9d-483b-98ec-ebe8c39e0ccf}	Methane (from natural gas)
IT	Methane	agg	Sphera	{d36d9f47-9dc8-4c18-ae95-ee8559c73b08}	Methane (from natural gas)
US	Methane	agg	Sphera	{d7a37a3f-fdc3-49f5-a94b-923982227f22}	Methane (from natural gas)
EU-28	Methane	agg	Sphera	{e126df3d-6197-44a4-800d-32672d2ac690}	Methane (from natural gas)
CN	Methane	agg	Sphera	{e1ba1f2d-8a28-41f8-afae-93fcd1952dc6}	Methane (from natural gas)
NO	Methane	agg	Sphera	{f2738b1c-29b0-4c54-a8ce-d2c799a5a977}	Methane (from natural gas)
US	Municipal Solid Waste on landfill (according to the WARM model)	p-agg	Sphera	{e164b75a-9c28-412e-98a2-36aeebaa7c95}	Municipal Solid Waste on landfill (partially based on WARM data)
EU-28	N,N-Dimethylaminopropyl Acrylamide (DiMAPA), credit butanol	agg	Sphera	{62624c8d-7a7a-4c11-909f-2befef086072}	N,N-Dimethylaminopropyl Acrylamide (DiMAPA)
IN	Natural Rubber (NR)	agg	Sphera	{df124271-e6c0-45d4-9290-3b3d6f19fc9a}	Natural Rubber (NR) (excl. LUC emissions)
DE	Natural rubber (NR)	agg	Sphera	{ea050d44-4f55-4520-a650-6c4e2f25b3a2}	Natural rubber (NR) (excl. LUC emissions)
US	Paper waste on landfill, post-consumer (according to the WARM model)	p-agg	Sphera	{261951d7-621a-44a3-9974-9e68bbfe4d96}	Paper waste on landfill, post-consumer (partially based on WARM data)
US	Pentafluoroethane, HFC 125, R125 (estimated from HCF 152a)	agg	Sphera	{e1ac065e-fa63-4b29-afa9-45b1f2ad4574}	Pentafluoroethane, HFC 125, R125 (approximation from HCF 152a)
NL	Phenol	agg	Sphera	{09e1dc3d-b344-47da-870c-5327dfa8565f}	Phenol (toluene oxidation)
DE	Phenol	agg	Sphera	{6248ba79-7faf-41bd-bc40-a078b571f471}	Phenol, by-product acetone, methyl styrene (from cumene)
BE	Phenol	agg	Sphera	{6a8710b9-2962-48e5-b802-b0ad67abe917}	Phenol, by-product acetone, methyl styrene (from cumene)
EU-28	Phenol	agg	Sphera	{96e90ba0-518f-4611-b0c2-4494a2d7224f}	Phenol, by-product acetone, methyl styrene (from cumene)
FR	Phenol	agg	Sphera	{dcdf8120-6c21-4ab7-82b3-c49bcabf6a52}	Phenol, by-product acetone, methyl styrene

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					(from cumene)
IT	Phenol	agg	Sphera	{debf3670-a01f-458c-9323-da5ce913f45e}	Phenol, by-product acetone, methyl styrene (from cumene)
US	Phenol (from cumene)	agg	Sphera	{d989b5f7-03af-4621-8bb4-40b4a3a6833b}	Phenol, by-product acetone, methyl styrene (from cumene)
IT	Phthalic anhydride	agg	Sphera	{13547028-8d3b-4413-9210-1b8b0e386990}	Phthalic anhydride (by oxidation of xylene)
DE	Phthalic anhydride	agg	Sphera	{d14d0b72-8411-4e9a-a57c-f005506f2940}	Phthalic anhydride (by oxidation of xylene)
FR	Phthalic anhydride	agg	Sphera	{ddb7410b-64eb-4f6f-a70f-e7861e53b208}	Phthalic anhydride (by oxidation of xylene)
NL	Phthalic anhydride	agg	Sphera	{df2866a3-e0b6-4761-ab98-e1bc7b76ea6c}	Phthalic anhydride (by oxidation of xylene)
GB	Phthalic anhydride	agg	Sphera	{e3b1381b-f653-4524-ae99-75ce6739c865}	Phthalic anhydride (by oxidation of xylene)
US	Phthalic anhydride (PSA) via oxidation	agg	Sphera	{97799c0a-7ee7-417e-8413-09fd6f1bf8ed}	Phthalic anhydride (by oxidation of xylene)
DE	Polypropylene / Ethylene Propylene Diene Elastomer Granulate (PP/EPDM, TPE-O) Mix	agg	Sphera	{adae0063-9fe4-44e8-b5da-9136151e2808}	Polypropylene / Ethylene Propylene Diene Elastomer Granulate (PP/EPDM, TPO, TPE-O) Mix
DE	Power outlet (EN15804 C3)	agg	Sphera	{1435184c-3ca1-47b8-b210-7b63ae7734ba}	Power outlet (EN15804 C4)
EU-28	Power outlet (EN15804 C3)	agg	Sphera	{59fb506b-be6e-4dd5-9ce2-9b2e2dfcc7ed}	Power outlet (EN15804 C4)
RNA	Process steam from biogas	agg	Sphera	{06c3c3ba-85e8-4a45-ab87-06599ead493d}	Process steam from biogas 90%
IT	p-Xylene (from reformate)	agg	Sphera	{0e5c4485-ffb9-45a1-806a-406443913b7b}	p-xylene by-product paraffin (from reformate)
NL	p-Xylene (from reformate)	agg	Sphera	{1c366f73-dccf-4433-a648-01c9ab53a965}	p-xylene by-product paraffin (from reformate)
DE	p-Xylene (from reformate)	agg	Sphera	{29b2ba8c-4200-4d3c-a671-53f264b0bf2b}	p-xylene by-product paraffin (from reformate)
GB	p-Xylene (from reformate)	agg	Sphera	{6873df41-50f3-4364-bfac-f2c632b76943}	p-xylene by-product paraffin (from reformate)
FR	p-Xylene (from reformate)	agg	Sphera	{c5deb348-eb62-4684-b28d-5ca57c19a940}	p-xylene by-product paraffin (from reformate)
GLO	Ring Core Coil 80g (With housing)	agg	Sphera	{8f751297-e20f-4250-bae1-098668c1cb78}	Ring Core Coil 80 g (With housing)
GLO	Ring Core Coil 80g (Without housing)	agg	Sphera	{3d9f10ee-61e5-443a-8d76-54272482133f}	Ring Core Coil 80 g (Without housing)
GLO	Ring Core Coil 8g (With housing)	agg	Sphera	{c69669bf-fe78-4a7e-9e1d-2cf8c055188d}	Ring Core Coil 8 g (With housing)
EU-28	Semichemical Fluting (2018) - for use in avoid-ed burden EoL scenario cases	p-agg	Sphera/FEFCO	{cfa80ad2-98eb-421f-a237-dd41dba6ab70}	Semichemical Fluting 2018; substitution EoL

Region	GaBi Database 2021 Process name	Type	Source	Process GUID *(Can be entered in the search tool)*	GaBi Database 2022 Process name
EU-28	Semichemical Fluting (2018) - for use in cut-off EoL scenario cases	p-agg	Sphera/FEFCO	{eae80cc3-676e-4d27-bc6d-97b57b3e715f}	Semichemical Fluting 2018; cut-off EoL
GLO	Soaping agent (phosphonic acid and foam stabilizers)	agg	Sphera	{a249dc20-6da6-426b-90be-970860698f35}	Soaping agent (based on Sodium dithionite)
US	Soot (c-carrier) by product ethyne (acetylene)	agg	Sphera	{035a1bc0-0b91-44f5-81b0-fd3022a57bfa}	Soot as by-product ethyne (acetylene)
GB	Styrene	agg	Sphera	{05aa69f6-b253-48e8-a014-6c12a519f5ab}	Styrene (ESBM dehydrogenation)
NL	Styrene	agg	Sphera	{141b4bdb-aa31-4374-9af8-59f624a7e86a}	Styrene (ESBM dehydrogenation)
BE	Styrene	agg	Sphera	{15531fe4-0b88-4b2f-8c5b-f72827d27be5}	Styrene (ESBM dehydrogenation)
DE	Styrene	agg	Sphera	{508c9a84-1019-4cc2-a5e8-c96f83c3a52e}	Styrene (ESBM dehydrogenation)
IT	Styrene	agg	Sphera	{54549e5d-e09a-449f-a83a-1ff3bb8e73b1}	Styrene (ESBM dehydrogenation)
US	Styrene	agg	Sphera	{7e44071f-b9d2-4845-b6a0-2010bb10968d}	Styrene (ESBM dehydrogenation)
FR	Styrene	agg	Sphera	{855ebc35-f0bc-45ef-872c-e460cd80a80e}	Styrene (ESBM dehydrogenation)
US	Succinic acid di butyl ester	agg	Sphera	{e8196211-6155-4b27-bf25-ac0340b5d70a}	Succinic acid dibutyl ester
IN	Sulphuric acid aq. (96%)	agg	Sphera	{1563d3b4-fd30-473c-936b-05d2295481a0}	Sulphuric acid (96%)
AU	Sulphuric acid aq. (96%)	agg	Sphera	{19e76ba9-b853-4419-a2fa-6684a8600e5f}	Sulphuric acid (96%)
US	Sulphuric acid aq. (96%)	agg	Sphera	{1eff2da5-68f6-4630-8db0-adc181b70c13}	Sulphuric acid (96%)
US	Sulphuric acid aq. mix (96%)	agg	Sphera	{80d20f69-3842-47c9-8e20-57fa50101b15}	Sulphuric acid mix (96%) (consumption mix)
ES	Sulphuric acid mix (96%)	agg	Sphera	{b4d5a533-095e-4993-800d-050f345f09b3}	Sulphuric acid mix (96%) (consumption mix)
DE	Sulphuric acid mix (96%)	agg	Sphera	{d13d1a8b-b8a6-4277-b208-5395a2946080}	Sulphuric acid mix (96%) (consumption mix)
FR	Sulphuric acid mix (96%)	agg	Sphera	{f4b54a79-3a1b-4644-b203-0aaf0929984e}	Sulphuric acid mix (96%) (consumption mix)
EU-28	Testliner (2018) - for use in avoided burden EoL scenario cases	p-agg	Sphera/FEFCO	{e1f35758-557e-44de-8d73-28be3c87d43f}	Testliner 2018; substitution EoL
EU-28	Testliner (2018) - for use in cut-off EoL scenario cases	p-agg	Sphera/FEFCO	{a0c91472-04d8-4293-acf5-0ec97a514bfd}	Testliner 2018; cut-off EoL
GLO	Thermistor SMD NTC 0402 (ca. 4mg)	agg	Sphera	{294e149e-cb71-4863-b693-2d01c3475b07}	Thermistor SMD NTC 0402 (4mg)
GLO	Thermistor THT PTC Temp Sensor, Leaded Disk (250mg) 4xD42 PE	agg	Sphera	{3df86125-b016-4fd2-84dc-be18f2ab4499}	Thermistor THT PTC Temp Sensor, Leaded Disk (250mg) 4xD42

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GB	Toluene diisocyanate (TDI; Phosgenation)	agg	Sphera	{08af5d6c-edbd-41c2-b935-383aa66d072c}	Toluene diisocyanate (TDI) by-product toluene diamine (TDA), hydrochloric acid (phosgenation)
FR	Toluene diisocyanate (TDI; Phosgenation)	agg	Sphera	{2731716d-fa9d-4248-be22-9fd96309d573}	Toluene diisocyanate (TDI) by-product toluene diamine (TDA), hydrochloric acid (phosgena-tion)
DE	Toluene diisocyanate (TDI; Phosgenation)	agg	Sphera	{ed6e7907-25b8-4251-bed9-7fbe8635691c}	Toluene diisocyanate (TDI) by-product toluene diamine (TDA), hydrochloric acid (phosgena-tion)
US	Untreated wood on landfill, post-consumer (according to the WARM model)	p-agg	Sphera	{02097d5d-450e-4435-aec4-f00fe675085a}	Untreated wood on landfill, post-consumer (partially based on WARM data)
EU-28	Wellenstoff / Fluting (2018) - for use in avoided burden EoL scenario cases	p-agg	Sphera/FEFCO	{e41d0f1c-09ac-451a-8a8d-f928beaff9d7}	Wellenstoff / Fluting 2018; substitution EoL
EU-28	Wellenstoff / Fluting (2018) - for use in cut-off EoL scenario cases	p-agg	Sphera/FEFCO	{24e12050-f4f0-44a7-bbd0-312caedaae02}	Wellenstoff / Fluting 2018; cut-off EoL
US	Wood products (OSB, particle board) on landfill, post-consumer (according to the WARM model)	p-agg	Sphera	{695b038b-1203-4f36-9bee-fd46eacdd120}	Wood products (OSB, particle board) on landfill, post-consumer (partially based on WARM data)
DE	Zinc redistilled mix	agg	Sphera	{19720938-1090-44ee-ad57-6d2be1320d67}	Zinc mix (92% electroytic and 8% ISP recycled zinc)

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