Environmental, Health, Safety & Sustainability

Sphera® Managed LCA Content (MLC)

Upgrades and Improvements

2026

Public Preview

Supporting Sphera® LCA for Experts (LCA FE)

This is a public sample reading. The full "Managed LCA Content (MLC) Upgrades and Improvements" document is available only to Sphera customers.

To gain full access to the complete document and explore the benefits of Sphera MLC, contact your Sphera representative or become a Sphera MLC customer.

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Abbreviations

AP	Acidification Potential
ADP	Abiotic Depletion Potential
BAT	Best Available Technique
B2B	Business-to-Business
B2C	Business-to-Consumer
BEV	Battery Electric Vehicle
BF	Blast Furnace
BREF	Best Available Technique Reference Document
BWC	Blue Water Consumption
CCS	Carbon Capture and Storage
CCUS	Carbon Capture Usage and Storage
CF	Characterization factor
CHP	Combined Heat and Power Plant
CML	Centrum voor Milieuwetenschappen (Institute of Environmental Sciences)
CNG	Compressed Natural Gas
CUP	Content Update
dLUC	Direct Land Use Change
EAF	Electric Arc Furnace
EF	Environmental Footprint
EFTA	European Free Trade Association
EP	Eutrophication Potential
EPS	Environmental Priority Strategies
EPD	Environmental Product Declaration
EV	Electric Vehicle
GHG	Greenhouse Gas
GWP	Global Warming Potential
IC	Integrated Circuits
ILCD	International Reference Life Cycle Data System
IPCC	Intergovernmental Panel on Climate Change
IUPAC	International Union of Pure and Applied Chemistry
JIRA	JIRA issue tracking software
LCA	Life Cycle Assessment
LCA FE	LCA for Experts
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LNG	Liquefied Natural Gas
LUC	Land Use Change
MLC	Managed LCA Content
ODP	Ozone Depletion Potential

PED	Primary Energy Demand
PEF	Product Environmental Footprint method
PGM	Platinum Group Metals
POCP	Photochemical Ozone Creation Potential
PV	Photovoltaic
PWB	Printed Wiring Board
SCN	Sphera Customer Network
sLUC	Statistical Land Use Change
SOFC	Solid Oxygen Fuel Cells
REE	Rare Earth Element
REM	Rare Earth Metals
REO	Rare Earth Oxide
TfS	Together for Sustainability
UBP	Umweltbelastungspunkte (Ecological Scarcity Method)
VOC	Volatile Organic Compounds
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).

Important Information

Please read this document carefully, as it contains:

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

Overview

About this document

This document covers relevant changes in more than 20,000 updated LCI datasets, including about 600 Sphera plan models including the respective unit process of the Managed LCA Content (MLC) 2026. The document addresses both changes in technology and in methodology, when appliable, as well as error corrections. It is structured by type of material/process or topic, e.g., electricity, metals, plastics, renewables. It also covers newly added datasets to the Managed LCA Content (MLC).

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.

We carried out the check mainly using EF3.1 LCIA methods, the global warming impact (GWP) in all impact results refer to the impact category EF3.1 Climate Change – total. All other impact categories, unless stated, refer to the EF3.1 LCIA methods. To identify changes in water consumption, we used the impact category EF3.1 Water use and Blue water consumption (BWC).

The reference year for the Managed LCA Content (MLC) 2026 is 2022 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 provided by the renowned International Energy Agency. More recent electricity grid mixes are provided as alternative data, and individual grid mixes can be modelled anytime by the user, because the electricity generation processes are provided for each country and each individual technology. For the non-energy datasets, the reference year is documented in each dataset.

Selected, important changes made in the 2026 Managed LCA Content (MLC) include:

Energy update: all energy-related datasets, such as electricity, thermal energy, fuels, and the like, have been updated with the latest consistent international energy trade data and for a substantial share also with the latest technology data. Some key points in the energy upgrade include the following:

- **Energy carrier mix:** Changes in the LCI datasets reveal the following trends such as war in the Ukraine having an effect on energy global markets. Energy carrier imports like natural gas, hard coal, crude oil, refined petroleum products from Russia to many European countries decreased, whereas imports from Russia to other countries, that do not impose sanctions, increased due to an oversupply of those. LNG imports to Europe increased. Furthermore, electricity imports from Russia in Eastern European countries like in the Baltic states decreased.
- **Update of refinery model:** The refinery model has been updated which influences the inventory of petroleum products, that are used in energy and chemical datasets. A deep research about refineries worldwide was conducted on the state-of-the-art technologies applied and which process units are operating in refinery complexes. Inventory data about refinery input and output spectrums was collected.

- **Changes in natural gas modelling approach:** Due the war in Ukraine and the sanctions on Russian energy carriers, there are disruptions in energy statistics. In the statistics for some countries, this led to imports from countries, that do not produce any natural gas. Therefore, the modeling approach was changed in some countries to better reflect the reality.

Please see inventories for energy processes for more information.

Agricultural update: We continued to transfer agricultural datasets to the new Sphera Agricultural Model and the associated data compilation approach which were both also further improved and harmonized, e.g., bamboo, wheat grain, straw, tea, etc. Further improvements to the datasets already using the new model are also applied. This includes switching to DAP fertilizers in the nutrient specification for nitrogen and phosphorous, leading to changes in cultivation systems where this fertilizer is applied. The main reasons for the changes in the agricultural models are using more consistent data sources and hence updated inventory data, especially regarding yields and fertilizer profiles, and methodological improvements. Methodological improvements include, among others, an update of the nitrogen balance calculation to align towards the recommendations of the PEF Technical Advisory Group of companies and organization working in the field of Agriculture. Changes in GWP range from noticeable reductions to noticeable increases for these datasets and are caused, by the dynamics in agriculture practice, increased data availability and by the aforementioned improvements.

For more information on the changes and the harmonized modelling, please see section Development of the Sphera Agriculture Model and update of datasets.

Wood update: All wood processes in the MLC database are updated over the supply chain. This includes as the main part a harmonized sawmill model, which is the basis for all wood products such as sawn lumber, mainly for construction, and woodchips and sawdust for further wood-based materials as well as for the paper industry and as fuel. Consumption values, drying process, allocation, and water balances were key elements that were renewed according to latest information.

For more information on the changes and the harmonized modelling, please see section Development of the Sphera Wood Model and update of datasets.

Electronic update: Several new datasets are created, and semiconductor datasets, as well as incorporation of new electronic datasets into parameterized electronic models are realized. Some key points in the update include the following:

- **New datasets:** A total of 62 new aggregated processes in the MLC Database – Electrics and Electronics
- **Semiconductor datasets:** The power/signal discrete transistors are now updated. The mass balance of the processes for CMOS discrete transistors are now improved and better represents industrial standards. The regional electricity inputs for the semiconductor nodes now reflect the latest global production distribution.
- **Open IC Model:** This parameterized model now offers a broader modelling flexibility. The model now supports the latest semiconductor nodes and discrete transistor options — enabling more varied scenarios. A total of 18 new nodes are added in the open IC parameterized models.
- **Liquid Crystal Display (LCD) parameterized model:** The model now supports broader flexibility across display sizes, improved panel electronics flexibility, enhanced printed wiring board (PWB) scaling, refined panel selection, updated backlight and material data, bare die scaling improvement, and a more simplified parameter structure.

Please see inventories for electronic processes for more information.

Update of land use change: Certain official land use change factors released by the European Commission are hard to comprehend and explain and are partly counter-intuitive and debated in practice and science. The use of some specific land use flows in some specific datasets lead to land use change impact results, which can hardly be explained. We decided to monitor those debatable land use flows further, and interpret carefully, until these are officially reviewed. Several datasets using the land use flow “To scrub land” and “To unspecified, natural” are changed to a more fitting land use flow “To extraction mineral site”. The directly affected/corrected datasets are BF steel, bauxite, bentonite, celestite ore mining, colemanite (extraction and processing), gravel, gypsum stone, limestone, molybdenum, perlites, pumice, sand, tin, and quartz. The quantity for the datasets previously using “To scrub land” and “To unspecified, natural” are increased by 26 and 16 fold respectively. Due to debatable impact factors of these LCI land use flows (see above) the large increase in impact of these datasets up to several 1000% has to be interpreted with caution. To make this clear: The LCI values and flows are certainly much more reliable, than the surprisingly high impact factors of these flows, which should be reviewed and confirmed or corrected by the method developers. The change in impacts also cascades through other datasets using the directly affected datasets in their model.

Update of country shares in lithium production routes: The shares of the different lithium carbonate (Li2CO3) production routes (brine and spudomene) are now updated based on IEA 2023 data on supply chain for lithium. According to the IEA, the vast majority >95% of hard rock spodumene lithium from Australia is in fact refined in China. In other words, a significant CN Lithium carbonate, Li2CO3 (brine) production is now accounted for, whereas the AU LiCO3 (Spudomene) 100% domestic previously overvalued, is now reduced in the GLO: Lithium carbonate mixes (brine and spudomene).

Update of lithium-ion battery cell models with new high purity silicon dataset: A new high purity silicon (>99.9%) dataset is now used in the parameterized plan GLO: Silicon (>99.9%) nanopowder 250nm granule size. The silicon nanopowder is further used in all parameterized lithium ion NCA, NMC, and LFP battery cell models.

New sodium sulphate routes and mixes and replacement of its uses: There are many industrially applied routes for the production of sodium sulphate. Two of which are from by-products of boric acid and by-products of sodium chlorite. Another common route is the direct production of sodium sulphate from natural sources either by mining or collecting Glauberite deposits and dissolving them as brines. The brines are then purified, and sodium sulphate is crystallized from that solution. A similar brine process can stem from natural sodium sulphate. With the multitude of sodium sulphate production routes, new routes and mixes are now introduced and implemented in our database. The summary are as follows:

- **New sodium sulphate (route) datasets:** Datasets for four different sodium sulphate production routes are now available. In other words, the specificity of technology routes is increased.
- **New sodium sulphate (mix) datasets:** From these different routes, new sodium sulphate mixes have been created for regions CN, DE, RER, and US providing more country specific datasets.
- **Changes done to datasets:** Plans using specific sodium sulphate inputs, such as sodium sulphate by-product boric acid, sodium sulphate by-product sodium chloride, etc, now use the sodium sulphate mixes to account for the regional use.
- **Impact changes:** The change in results vary for the affected datasets now using the sodium sulphate mix. Some datasets see an increase in impacts as they were previously using lower impact sodium sulphate routes, and vice versa. The GWP changes vary between [redacted] and [redacted]%.
- **Datasets affected:** Barium sulphate, sodium sulphide, barium chloride, barium hydroxide, sodium ligninsulfonate, boric acid by-product sodium sulphate, and catalyst (Vanadium pentoxide, sodium nitrate)

Update of ethyne (acetylene) datasets and its constituents: The ethyne (acetylene) datasets produced via the oil quench route and its by-products benzene and soot are now updated with new available information based on knowledge transfer with industry.

- **Oil quench process**: The oil quench process is exothermic and requires thermal energy input. To avoid negative thermal energy consumption when looped, this steam energy is no longer recovered as in previous editions. This change mainly affects the ethene by-products benzene and soot.
- **Water quench process**: The properties of the synthesis gas (low H2 ratio) product flow used in the water quench datasets are also updated. The updates are:
  - Net calorific value reduced from 9 to 8MJ/kg
  - Gross calorific value reduced from 10 to 8.5MJ/kg
  - Standard volume increased from 1.24 to 1.33 Nm3
- **Harmonization:** The naming of all ethyne (acetylene) datasets, and benzene and soot by-products are now harmonized to include the respective process routes.
- **New regionalized datasets:** New datasets for benzene and soot for regions CN, DE, GB, IN, JP, TH, RER, and US are now available. The full list of new datasets can be accessed in the spreadsheet Sphera Dataset List MLC Databases 2026.1 Edition located among the Sphera Product Sustainability Files[1].
- **GWP changes:**
  - Ethene (acetylene) datasets: between [redacted] and [redacted]%
  - Benzene datasets: between [redacted] and [redacted]%
  - Soot datasets: between [redacted] and [redacted]%
  - Synthesis gas (CO: H2 = 1: 1) from natural gas by-product Ethin (acetylene): between and [redacted]%

Improvement in US datasets with dimethyl terephthalate (DMT) as material input: The xylene mix used in the DMT production is now exchanged with p-xylene in several US datasets. The additional energy demand from the processing of the xylene mix material input to p-xylene required, affects the impact changes greatly. GWP changes for directly affected datasets are between [redacted] and [redacted]%.

Directly affected datasets with region US include: Aliphatic/aromatic copolyester, dioctyl phthalate/di-(2-ethylhexyl) phthalate (DOP, DEHP) from transesterification of DMT, polybutylene terephthalate granulate (PBT), and polyethylene terephthalate fibers (PET)

Addition of diesel combustion in machinery in RER: Expanded clay plan: Diesel combustion in machinery is now added in the RER: Pit pumice dataset, completing the unit process model. The impacts are generally increased in relation to combustion with GWP increased by [redacted]%. The related downstream lightweight concrete block datasets are only impacted by up to [redacted]%.

Correction of composition in DE: Particle board in municipal incineration plant dataset: The composition in the DE and RER Particle board in municipal incineration plant dataset for the combined share of wood, urea, and formaldehyde in the dataset is now corrected. Fossil carbon previously missing in the urea-formaldehyde (UF) resin typically used in particle boards are now incorporated in the dataset. Amounts of nitrogen and ash are reduced by about [redacted]%. The composition of the particle board of these two datasets are added in the documentation. GWP is increased by up to [redacted]% and eutrophication, freshwater and particulate matter are reduced [redacted] and

[1] https://lcadatabase.sphera.com/dataset-documentation-download/?download=Download+Data

...% respectively due to the reduction of nitrogen and ash. As fossil carbon was previously accounted for as biogenic carbon, the ISO14067 GWP100 Biogenic GHG emissions is subsequently reduced % and the impacts change to the sum of ISO14067 GHG emissions is negligible.

Update of titanium dioxide production via sulphate and chloride route: The raw materials used for the titanium dioxide (TiO2) production via sulphate and chloride route are now supplemented by using a mix of ilmenite/rutile concentrate and titanium slag. The mix is calculated based on Sokol (2023), where the different share of raw materials are given for sulphate and chloride production. The study from Maldybayev, G. et al. (2024) was additionally used as cross-reference on the raw materials used in TiO2 production. GWP is increased by ...%. For datasets via the sulphate route, the impact change is also a result of the update in the sulphate dataset used in the background, where it now uses a sodium sulphate mix instead of specific sodium sulphate. In addition to the update, new TiO2 production for region CN is now available.

Update of global share of producer countries in copper mix: The dataset GLO: Copper mix (99.999% from electrolysis) (consumption mix) is now updated based on latest USGS, 2025 statistical information on copper production. The updated mix includes the division in top producer countries for copper concentrate (mine production) and top producer countries for refined copper. As part of this update, new country data for copper production was added for CN, JP, CO, RU, and US. CN copper production has the highest GWP per kg and is the dominant producer in the new global mix. The impact changes are highly affected by the electricity grid mixes of the newly added countries, i.e. CN and JP. GWP is increased ...% and the share of nuclear power in their electricity grid mix leads to the significant increase of ionizing radiation for the copper dataset ...%.

Update of CN: Rare earth carbonate dataset: The CN: Rare earth carbonate dataset now includes a decomposition step via roasting and solvent extraction. The sub-process includes several material inputs such as sulfuric acid, magnesium oxide, and ammonia water to process the rare earth concentrate to the final rare earth carbonate. Due to the update, acidification impacts are increased by ...%.

Update of copper refining process: The composition of copper anode slime (including gold, silver etc.) is now updated based on the study by Moosavi-Khoonsari E. et al (2024). The study provides an average anode slime composition from more than 100 different smelters. By using the new copper anode slime composition, the 10 annual mean prices for the included metals are used to calculate a new price of copper anode slime. This new price is now applied in the economic allocation of the copper refinery, where the environmental burdens of the copper and the copper anode slime are distributed. The amount of copper anode slime (CAS) produced per tonne Copper (Cu) was updated, from formerly 20 kg CAS/t Cu to 7,5 kg CAS/t Cu. The updated amount is based on literature data and was cross-checked with information from industry data. The update affects the GLO: Silver dataset significantly. GWP is increased by ...% resource use, fossils by ...% eutrophication, freshwater ...% ionizing radiation, human health by ...% and water use ...%.

Update of CN: Electrodeposited (ED) copper foil production: The CN: Electrodeposited (ED) copper foil is now updated based on Volta Energy Solutions (2022). The electricity and thermal energy demand, water, and air emissions are updated. Sulfuric acid and copper demand are also updated based on literature. The feedstock material of the copper foil production is exchanged from primary copper to an open copper scrap flow, as literature states that copper scrap, respectively recycled copper wires are used. Users are advised to validate their model to ensure alignment with their chosen modelling approach - cut-off or avoided burden method. Due to updates in the energy demands, the GWP has increased ...%. As primary copper feedstock is exchanged to open copper scrap flow, the impact resource use, minerals and metals is reduced ...%. Additionally, a new ED copper foil is now available for region RER.

Harmonization of truck transport in database: The update on the truck transport datasets are broken down to the following:

- **Update of biogenic content in truck transport used on plans:** Trucks using diesel mix at filling station are now updated to include the annually updated biogenic content of these mixes. The quantity EN15804+A2 Climate Change, biogenic now correctly shows the impacts of the final product, as the negative values from biodiesel use are now corrected.
- **Update of diesel fuel input in several datasets using truck transport:** Trucks used in several datasets now use the diesel at filling station as its fuel input instead of diesel at refinery. The difference between the two diesel mixes are the inclusion of transport between refinery to filling station, imports from different regions, and addition of biodiesel in the diesel at filling station dataset. This exchange results in datasets having increased impacts. Datasets using specific euro standards (such as Euro 3 truck) are now exchanged with trucks with a euro mix. In these cases, impact results are decreased due to the inclusion of better performance euro standards in the mix

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

Introduction to the upgrade of MLC databases available with LCA for Experts (LCA FE)

In total, around 50 Sphera employees were involved in the upgrade of the Managed LCA Content (MLC), with the 20 core staff of the Content Team signing responsible. The invested time, knowledge and dedication of our employees resulted in the new MLC 2026, with about 20,000 processes and 600 plans of the Professional Core and the bundled Premium databases with all Data-on-Demand only datasets bundled into packages, as well as still maintained Extension Databases. The time investment into the upgrade process covers approximately 10500 working hours of technical update work and documentation per update year.

The process of continuous upgrades of the MLC by the Content team is enabled and supported with domain expertise alongside the team structure within Sphera, which is illustrated in the figure below:

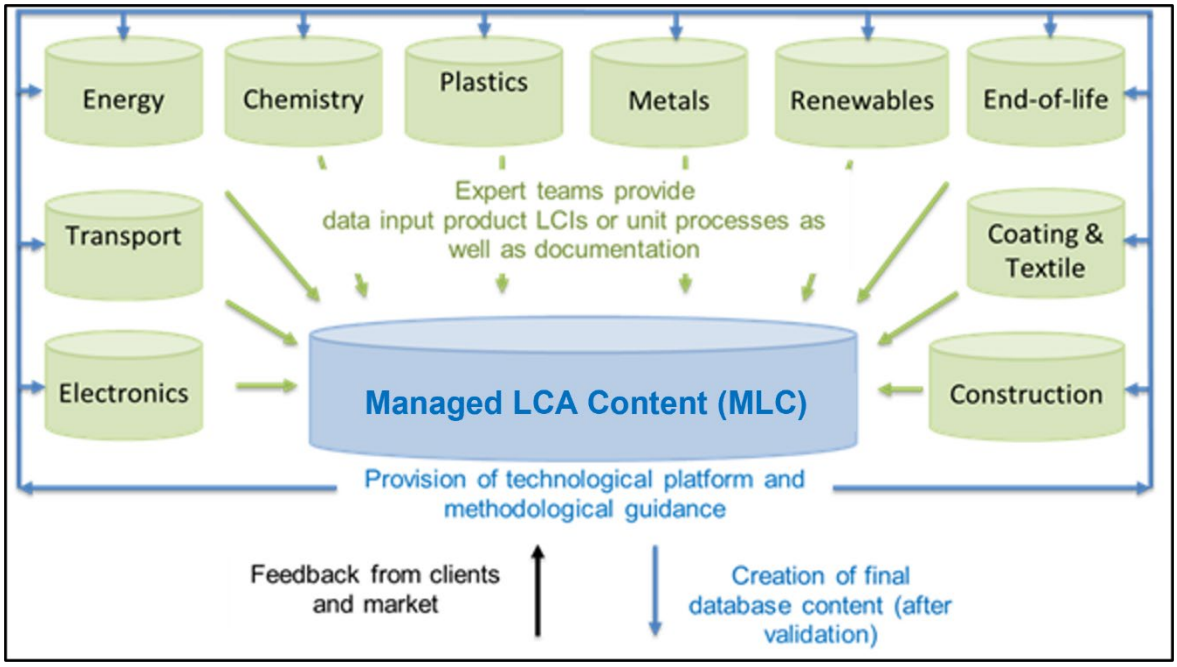

Figure 1 Master Database maintenance and upgrade process

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

This present document covers relevant changes, updates and improvements to the upgraded LCI datasets of the MLC. The document addresses both methodology changes (whereby established

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

international standards and guides are adhered to) and updates in technology of given processes. It is structured by material or topic, e.g., electricity, metals, plastics, renewables. In principle, all Sphera-owned datasets 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 useful or necessary due to enforcement of basic standards: 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 wider industry support and practicality.

Managed LCA Content (MLC) 2026

Principles

Sphera introduced the annual upgrade of the MLC back in 2010 due to demand raised by industry and professional research users for three main reasons:

- To keep the datasets, user models, and results as up-to-date and as close to evolving supply chains as possible, including automated upgrades of your valued work in alignment with the most recent state of the global supply networks
- 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, recognized by our engineers working in the sector or brought to our attention by MLC customers or recently published in engineering encyclopedia.. The databases are internationally accepted and applied in practice. We use standardized LCI methods established by industry, research, science, and regulatory authorities. New methods are applied when they have proven to be based on a relevant standard, on broad and international acceptance in the relevant industries or when enforced by the relevant policy instruments.

Changes in the environmental profile of the datasets, from the preceding year's Managed LCA Content (MLC) to the most recent MLC, may be attributed to one or more of the following factors:

- **Upgrade of the background systems**. The changed geo-political, supply chain and market situation or newly available technologies or improved operations (see also next bullet) result in updated impacts. The environmental profile of the supply of fuels or intermediates may be subject to year-to-year changes and affect the environmental profile of almost materials and products to a varying extent. For example, a change of the fuel mix or of efficiency for electricity supply is changing the environmental profile of all materials or products using that electricity supply directly or indirectly.
- **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 in 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, industrial network efficiency gains) and improved use phase performance. All of the above can also result in lower impacts for some impacts, and possible trade-offs in other impact categories. In addition, certain production routes might have been phased out, and have changed the production mix of a material, substance, or energy. A frequently changing and dynamic example is the electricity grid mix datasets. As some countries reduce or phase out certain types of energy or fuels in the electricity supply mix, alternative sources of fuels and energy are introduced.
- **Further standardization, LCI method evolvement, and regulatory developments.** Modelling of realistic technology chains has always been the core focus of the MLC. This includes changes due to the regulatory requirements (e.g., shift from Euro 5 to Euro 6 vehicle emission standards, implementation of the Montreal Protocol, Basel Convention…). Further harmonization and improvement in the LCI methodology (as mirrored by developments in standardization and in relevant governmental initiatives) and feedback from clients and consultants at Sphera have moreover enhanced over the years the modelling approach for the MLC. Detailed information is

provided in the document Sphera LCA Databases Modelling Principles[3]. Methodological adoptions are, however, conducted 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. MLC 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, nor can single factors be highlighted as sole responsibility. However, technological excellence is a core value of Sphera data. Our focus is, to document in this report as best as possible and apply all relevant and important improvements and changes in technology and in the supply chain. Necessary improvements and changes in the methodology are also applied, if they deem effective, supported by basic standards and represent the common opinion of suitable experts in the sector.

Reasoning behind this document

MLC models — leading to a single aggregated dataset in the databases — consist of many datasets all along the supply chain network towards the product that is represented by the resulting dataset. In other words, Sphera`s MLC data are a digital twin of actual production and supply chain realities. This means, many smaller or bigger changes within the lower tier supply chain datasets contribute to the overall change in impact results of the top level dataset. 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 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's system and one kind of application (e.g. reporting), whereas in another user's system and/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 relevance of the database changes for their own systems, the analyst function of LCA FE 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 background data upgrades, Sphera provides the present document "*Managed LCA Content 2026 - Upgrades and Improvements*" in addition to the document "*Sphera LCA Databases Modelling Principles 2026,"* and supporting satellite documents, complemented by close to 18,000 interlinked electronical documentation files of each of the processes supplied with the MLC that are also accessible online. Beyond this, Sphera Consulting and MLC team can provide further information on the changes made as a service. We encourage customers to reach out in case of uncertainty or open questions via Sphera SCN, Sphera website or via their Sphera representative.

The following sections address the most relevant changes in the MLC for different impact topics:

Regionalization of water use

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

[3] https://scn.spherasolutions.com/client/downloads.aspx?product=lcacontent&productID=58

Generally, we note that correct modelling of water use – as net abstraction and loss from the catchment through evaporation, transpiration and export in or as product – is inherently challenging and frequently subject to inconsistencies 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 "*Sphera Water LCI Modelling & Assessment*[4] [5].

Land use Change

We are adjusting the wording in our documents to more accurately describe the implemented data. Until now, we have used the term direct land use change (dLUC), as only the distinction between direct and indirect land use change (iLUC) was common. Land use change is now being examined more closely, which has led to further differentiation.

[SECTION REDACTED]

This is a public sample reading. The full "Managed LCA Content (MLC) Upgrades and Improvements" document is available only to Sphera customers.

To gain full access to the complete document and explore the benefits of Sphera MLC, contact your Sphera representative or become a Sphera MLC customer.

[5] https://scn.spherasolutions.com/client/downloads.aspx?product=lcacontent&productID=58

LCIA Methods – method updates, characterization factor updates, corrections

New and updated LCIA methods

Impact World 2.1

Impact World 2.1 comes with the following indicators:

- Midpoint
  - Climate change, short term
  - Climate change, short term (incl. bio CO2)
  - Climate change, long term
  - Climate change, long term (incl. bio CO2)
  - Fossil and nuclear energy use
  - Freshwater acidification
  - Freshwater ecotoxicity
  - Freshwater eutrophication
  - Human toxicity cancer
  - Human toxicity non-cancer
  - Ionizing radiations
  - Land occupation, biodiversity
  - Land transformation, biodiversity
  - Marine eutrophication
  - Mineral resources use
  - Ozone layer depletion
  - Particulate matter formation
  - Photochemical ozone formation
  - Terrestrial acidification
  - Water scarcity (excl hydropower), global average for unspecified water
  - Water scarcity (excl hydropower), high characterization factor for unspecified
  - Water scarcity (excl hydropower), low characterization factor for unspecified
  - Water scarcity (excl hydropower), OECD+BRIC average for unspecified water
  - Water scarcity, global average for unspecified water
  - Water scarcity, high characterization factor for unspecified water
  - Water scarcity, low characterization factor for unspecified water
  - Water scarcity, OECD+BRIC average for unspecified water
- Damage
  - Climate change, ecosystem quality, long term
  - Climate change, ecosystem quality, long term (incl. bio CO2)

- Climate change, ecosystem quality, short term
- Climate change, ecosystem quality, short term (incl. bio CO2)
- Climate change, human health, long term
- Climate change, human health, long term (incl. bio CO2)
- Climate change, human health, short term
- Climate change, human health, short term (incl. bio CO2)
- Freshwater acidification
- Freshwater ecotoxicity, long term
- Freshwater ecotoxicity, short term
- Freshwater eutrophication
- Human toxicity cancer, long term
- Human toxicity cancer, short term
- Human toxicity non-cancer, long term
- Human toxicity non-cancer, short term
- Ionizing radiations, ecosystem quality
- Ionizing radiations, human health
- Land occupation, biodiversity
- Land transformation, biodiversity
- Marine acidification, long term
- Marine acidification, short term
- Marine ecotoxicity, long term
- Marine ecotoxicity, short term
- Marine eutrophication
- Ozone layer depletion
- Particulate matter formation
- Photochemical ozone formation, ecosystem quality
- Photochemical ozone formation, human health
- Terrestrial acidification
- Terrestrial ecotoxicity, long term
- Terrestrial ecotoxicity, short term
- Thermally polluted water
- Water availability, freshwater ecosystem
- Water availability, human health

The following indicators were excluded from the implementation owing to the absence of corresponding flow representations:

- Water availability, terrestrial ecosystem
- Plastic physical effect on biota
- Fisheries impact

AWARE 2.0

The latest version of AWARE was published in April 2025, and its implementation comes with the following indicators:

- AWARE 2.0, global average for unspecified water
- AWARE 2.0, high characterization factor for unspecified water
- AWARE 2.0, low characterization factor for unspecified water
- AWARE 2.0, OECD+BRIC average for unspecified water
- AWARE 2.0 (excl hydropower), global average for unspecified water
- AWARE 2.0 (excl hydropower), high characterization factor for unspecified water
- AWARE 2.0 (excl hydropower), low characterization factor for unspecified water
- AWARE 2.0 (excl hydropower), OECD+BRIC average for unspecified water

USEtox 2.14

The latest version of USEtox was released in August 2024 in 2.14 version, and its implementation comes with the following indicators:

- Ecotoxicity (recommended and interim)
- Ecotoxicity (recommended only)
- Human toxicity, cancer (recommended and interim)
- Human toxicity, cancer (recommended only)
- Human toxicity, non-canc. (recommended and interim)
- Human toxicity, non-canc. (recommended only)

SBK Bepalingsmethode

The newly implemented version of the National Milieu Database is EF3.1 (NMD 3.9) published in July 2024. This version is aligned to EN15804+A2 based on EF3.1.
https://milieudatabase.nl/nl/milieuprestatie/bepalingsmethode/

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New datasets

With this year's upgrade, more than 800 new processes are additionally made available to users, as part of the existing bundled database without extra charge to all customers with a valid subscription or maintenance license. In addition, 6 data-on-demand plans are now made available:

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Access to the complete dataset documentation is available for searching and browsing by database online under https://lcadatabase.sphera.com.

Inventories for energy processes

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

In the MLC 2026, the reference year is 2022 for electricity grid mixes and energy carrier mixes (hard coal, crude oil, natural gas, etc.), i.e. using the latest available consistent data with global coverage. The electricity grid mixes in the MLC Database – Full US 2026 (Extension database XVII: Full US, electricity grid mixes for US sub grids and subregions under eGRID) however refer now to 2023 in the MLC 2026, using the most recent version of eGRID2023 (EPA, 2025).

Relevant changes in the life cycle inventories (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:

- War in the Ukraine has effect on energy global markets. Energy carrier imports like natural gas, hard coal, crude oil, refined petroleum products from Russia to many European countries decreased, whereas imports from Russia to other countries, that do not impose sanctions, increased due to an oversupply of those. LNG imports to Europe increased. Furthermore, electricity imports from Russia in Eastern European countries like in the Baltic states decreased.
- An ongoing trend in several countries to increase the share of renewable energies in their electricity generation. For example the following countries increased the shares of renewable energies in their domestic electricity production in 2022 compared to 2021: Brazil from [redacted] to [redacted]%, Chile from [redacted] to [redacted]% and Mexico from [redacted] to [redacted]%.
- Trends in electricity generation in the world's two most populous countries India and China: The electricity generation in China increased from 2021 to 2022 by [redacted]% and in India by [redacted]%. In both countries the absolute amounts of generated electricity from fossil fuels as well as electricity from renewables increased. The increase of renewables was higher than the increase of fossil fuels, so that the shares of renewables in the Chinese grid mix increased from [redacted] to [redacted]% and the shares of renewables in the Indian grid mix increased slightly from [redacted] to [redacted]%.
- Fluctuations in renewable electricity generation due to weather conditions, especially regarding water availability for hydro power stations. There are for example decreases in the shares of hydro power in Spain from [redacted] to [redacted]% and in Portugal from [redacted] to [redacted]%.
- Figure 2 and Figure 3 present the development of the energy carrier mixes for electricity generation in Germany, the European Union, and the United States between 2002 and 2022.

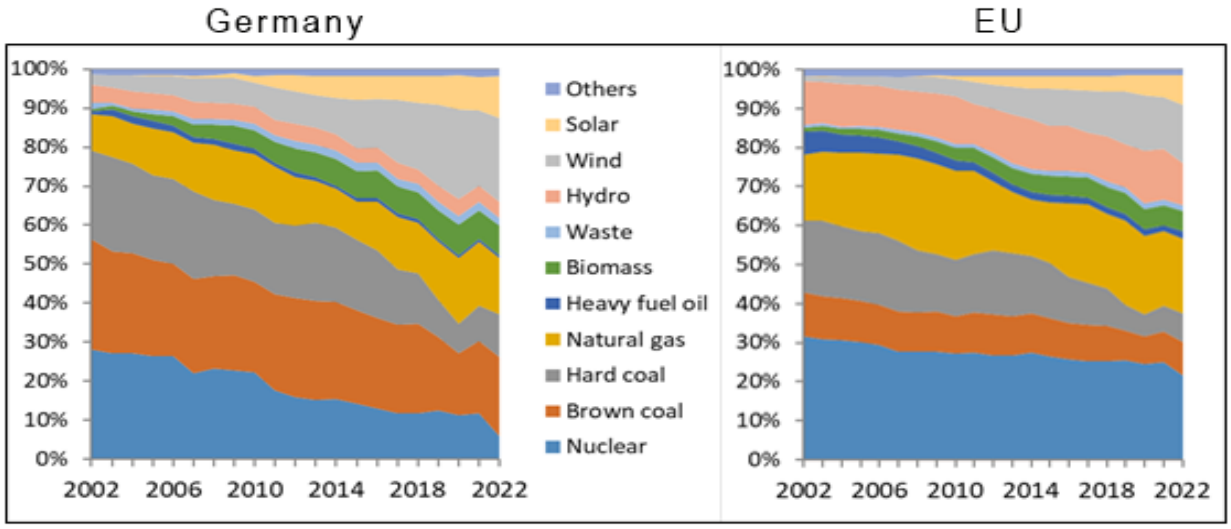

Figure 2 Development of grid mix in Germany (left) and EU (right) [Eurostat, 2025)

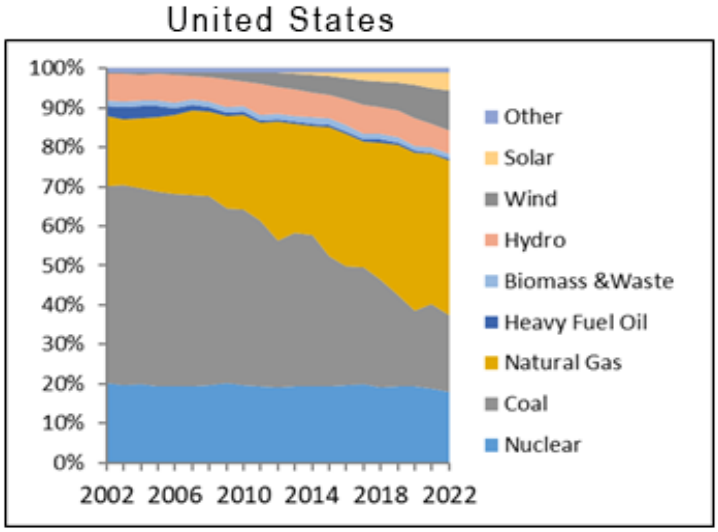

Figure 3 Development of grid mix United States (EIA, 2025)

In Germany, the electricity generation decreased from [redacted] TWh in 2021 to [redacted] TWh in 2022 The electricity from nuclear power decreased by about [redacted]% from [redacted] TWh in 2021 to [redacted] TWh in 2022 because of the shutdown of the last three power plants Grohnde, Gundremmingen C and Brokdorf. From 2021 to 2022, due to the decrease of the non-renewable and non-fossil energy nuclear power, the share of renewables increased from [redacted] to [redacted]% and the share of fossil energies increased from to [redacted]% in the German electricity grid mix.

In the EU-27 from 2021 to 2022, the amount of electricity produced decreased from 2916 TWh to 2823 TWh. Thereof the share of electricity from nuclear power decreased from [redacted] to [redacted]% the share of fossil energy excl. nuclear increased from [redacted] to [redacted]% and the share of renewables decreased from to[redacted]%.

In the USA, the overall electricity production increased from 4164 TWh to 4298 TWh. The share of electricity generation from nuclear in the electricity grid mix decreased from [redacted] in 2021 to [redacted]% in 2022. The shares of electricity from fossil energy carriers excl. nuclear decreased from [redacted] to [redacted]% and the share of renewables increased from [redacted] to [redacted]%.

Update topics with major influence in the supply chain of electricity generation, thermal energy production and fuels

For the CUP 2026.1 Update there are the following topics with relevant influence in the energy sector. Firstly, the refinery model has been updated with newest refining information and product spectrum, which influences the inventory of petroleum products, that are used in energy and chemical datasets. Relevant for the energy sector are gasoline, diesel, kerosene, heavy and light fuel oil. Secondly, due to iterations the 2025 annual update changes of the newly developed agrarian models are fully active in the background of the energy datasets, now. This influences the LCA impact results of energy from solid biomass, biogas, and fuels blended with biocomponents and leads to more accurate results. Thirdly, biomass fuel and biogas substrate mixes have been updated to most recent status. Fourthly, there were disruptions in energy statistics because of the war in Ukraine and the sanctions on Russian energy carriers. In the statistics for some countries this led to imports from countries, that do not produce any natural gas. Therefore, the modeling approach was changed in some countries to better reflect the reality. Fifthly, the modelling approach regarding imports in electricity grid mixes for Scope 2 & 3 has been improved. Sixthly, a new model for Argentinian unconventional oil production has been created. Furthermore, new datasets of European residual grid mixes for Scope 2 & 3 have been created. These six topics are described in detail below:

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Further developments in energy datasets

Changes in electricity datasets from specific fuels:

Power plant efficiencies, calculated based on energy statistics, can substantially vary between reference years. Following technical and operational reasons are triggering variations over time:

- final or periodic shutdown of specific power plants and use as cold reserve capacity
- 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 due to higher own consumption)
- incremental generation capacity with higher efficiency, shutdown of power plants with lower efficiency

Other reasons complementing variations:

- rounding effects (if a small amount of fuel is used)
- correction of statistical errors
- a combination of several of the factors listed above.

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Inventories for energy related processes

The following table lists inventories related to energy datasets concerning specific issue fixes and dataset improvements:

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Inventories for chemical processes

Checks, updates and upgrades of technologies mainly 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, issues or errors in the data can 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 Sphera engineers as well as on information shared by our clients who are active in the chemical sector and often support us to keep our know-how up-to-date with recent industry evolvements. Patents and technical literature is complementing the knowhow. The provided documentation of the MLC datasets serves as the reference and a viable basis to discuss supply chain aspects and demands.

Sphera 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 the 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

The intermediates are directly influenced by the upgraded performance of the energy supply and the feedstock, i.e., crude oil and natural gas (see e.g. chapter above).

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Inventories for metals and mineral processes

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

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Inventories for plastics processes

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

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Inventories for manufacturing and end-of-life processes

All data and models have been checked by Sphera manufacturing and end-of-life experts regarding technological upgrades and were identified as representative for their technology descriptions in 2025.

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Inventories for food and renewable processes

This section summarizes further changes that were made as part of the 2026.1 database update to food and renewable process models.

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

Emissions from statistical 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.

Single issues that were worked on can be found in the sub-section “Corrections and improvements” for food and renewable below.

Development of the Sphera Wood Model and update of datasets

All wood processes in the MLC database have been completely updated. This includes as the main part a new sawmill model, which is the basic for all wood products like sawn lumber, mainly for construction, woodchips and sawdust for further wood-based materials as well as for the paper industry and as fuel. All wood processes in the MLC database have been completely updated. This includes as the main part a new sawmill model, which is the basis for all wood products such as sawn lumber, mainly for construction, and woodchips and sawdust for further wood-based materials as well as for the paper industry and as fuel.

The new sawmill model is based on a German study with a collection of industry data for all wood-based materials by Rüter und Diederichs (2012) as well as US studies with a collection of industry data (CORRIM publications), which are benchmarked and completed by Sphera internal industry data. The update can be broken down to:

- **Consumption values:** Sawmill technologies (e.g. softwood vs. hardwood) and the process steps for storing, sawing, drying and planning are now better distinguished. All former approximations are now replaced by consistent high quality data.
- **Drying process:** The drying process now better reflects the reality within sawmills. The heat generation now is modelled within the sawmill using mainly bark and hog fuel from their own debarking process.
- **Allocation:** Prices for sawn lumber, bark (if not burned on site), wood chips and sawdust are updated and the economic allocation better reflects their individual shares
- **Water balance:** Water is ensured to be correctly taken up in the forest, running through all processing steps down to the correct and real water content of the final product. Users may better distinguish water content directly from the process name and the documentation.
- **Structure:** Within the documentation you will also consistently find all relevant information to the product. E.g.:“10,7% water content, 12% moisture, 430 kg/m3 abs. dry density, 482 kg/m3 gross density”

Development of the Sphera Agricultural Model and update of datasets

The datasets, including renewable materials (e.g., crop cultivation), are modelled with a comprehensive agricultural model. While the previous agricultural model was already advanced and comprehensive, Sphera worked on further improvements and has made efforts to improve the comprehensibility and update ability of its agricultural model. Therefore, Sphera has relevantly developed its generic agricultural model that can be used to consistently assess the environmental impacts of any kind of annual and permanent crop cultivation from cradle to field/plantation or forest border. It considers international guidelines, current scientific literature, and available databases on the methodological side. A more extensive explanation of this development already was included in the 2024 and 2025 Upgrades and Improvements documents.

A detailed description of the Agricultural LCA model and the data used can be found in two parts on the Sphera Customer Network:

Sphera's Agricultural LCA Model Part 1 - Model & Methods

Sphera's Agricultural LCA Model Part 2 - Dataset Generation & Data Sources

The Sphera agriculture and farming experts maintain and enlarge the model as needed, so that it continues to be one of the most advanced LCI models related to this topic. Datasets that are based on this agricultural model received our regular updates. For the MLC release CUP 2026.1 we further improved the model and the associated data compilation approach. Please see Table 19 for the respective changes in emissions for the selected datasets. The main reasons for the relevant changes are summarized as follows.

For Germany, France and Russia the prices were switched for wheat grains and straw leading to incorrect allocation calculations. The nutrient specification for nitrogen and phosphorous were switched for the DAP fertilizer leading to changes in cultivation systems where this fertilizer is applied. The yield for grass was based on a wrong water content. Those issues were corrected for the MLC release CUP 2026.1.

For the MLC release CUP 2024.1, we already used this new model for selected datasets of the MLC database and exchanged the previously used model with the new version. We continued to transfer agricultural datasets to the new Sphera Agricultural Model and the associated data compilation approach. Please see **Table 17** for datasets transferred to the new model and the new data collection approach for the MLC release CUP 2026.1. Please refer to Table 18 for datasets transferred to the new model but using the previous inventory data. Sphera will continue its efforts with the goal to base all cultivation processes provided in LCA FE on the new Sphera Agricultural LCA Model within the coming update cycles.

General remarks to the update of agricultural datasets

Updating our agricultural datasets with this new model led to intended changes in the environmental results. The main reasons for the changes are using more consistent data sources and hence updated inventory data, especially regarding yields and fertilizer profiles, and methodological improvements. Methodological improvements include, among others, an update of the nitrogen balance calculation to better align it with the PEF recommendations.

As those mentioned factors are the drivers for the environmental performance of cultivation processes, changes in these data points might lead to relevant changes in the results of environmental impact assessment.

Many agricultural datasets were previously modelled for specific cultivation systems in the respective countries for specific situations; partly due to specific data availability. Those systems can vary significantly within the country and hence lead to differences in the inventory data. With the new Sphera Agricultural LCA Model we created a generic system which uses a comprehensible and replicable approach with the ability to update the datasets on a regular basis. This leads to the fact that some datasets now represent a different cultivation system than they did before, with the effect that the datasets better represent the country average, while some results substantially change compared to the previous release. The further harmonized modelling approach and the resulting harmonization also of the data collection increases the consistency of the data and improves the data quality. This also allowed us to improve datasets that were previously marked as approximations, which could now be modelled with better matching data points. Hence, the annex “approximation” could be removed from those datasets. The results of a few datasets changed substantially compared to the previous release, due to mistakes that were identified and have been corrected during the upgrade process.

Information on limitations and use advice of the Sphera Agricultural LCA Model can be found in the following documentation on the Sphera Customer Network:

Sphera’s Agricultural LCA Model Part 2 - Dataset Generation & Data Sources.

Due to variable environmental conditions and high site heterogeneity, agricultural systems are very complex production systems to model in life cycle assessments. When changing the approach on data compilation and data sources, changes in the environmental results can be substantial. This emphasizes Sphera’s decision to focus on consistency.

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Inventories for transport processes

Foreground data and models were checked by Sphera transport experts regarding technological upgrades. Identified technology improvements were updated in the database. All changes made to the transport datasets affect the MLC Database Professional Core.

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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.

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Inventories for electronic processes

This section summarizes further changes that were made as part of the 2026.1 database update to electronic models.

New electronic datasets

There are a total of 62 new aggregated processes in the electronic bundle or Extension: Electronics. Among the new datasets are:

- **New EUV lithography datasets:** Introducing detailed process data for extreme ultraviolet lithography (EUV) technology in IC manufacturing — modelled alongside traditional deep ultraviolet (DUV) processes.
- **New CMOS datasets (WLP CSP & BGA packages)**: 54 new datasets covering 5, 7, and 10 nm technology nodes, integrating both EUV and DUV.
- **New discrete bipolar transistors:** 6 additional datasets featuring 3-lead discrete bipolar transistors, broadening modelling options for component-level analysis.

The full list of new datasets can be accessed in the Sphera Customer Network download page.

Changes in semiconductor datasets

Update of Power/Signal discrete Transistors (MLC-18690): The mass balance of the front-end processes for CMOS discrete transistors are recalculated and improved to even better represent industrial standards. Diodes and LED are no longer accounted for in the manufacturing process, and electricity inputs are improved.

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Changes in parameterized electronic models

This section summarizes the update to parameterized electronic models. Please note that the following datasets are data-on-demand datasets, and not part of the electronic bundle or extension: Electronics.

As improvements are done to parameterized model, users are advised to check the results of their model.

Open IC model (MLC-4823): The model offers a broader modelling flexibility. Both the “Open IC model (parametric) {87eb9626-9b31-4190-ad39-c8887bbfdfe7}” and “Open IC model – open electricity input wafer processing (parametric) {1d866473-d0dc-4972-b722-a7edb41a1462}” support the latest semiconductor nodes and discrete transistor options — enabling more varied scenarios. The semiconductor nodes for CMOS logic and WLP CSP CMOS logic of 5, 7, and 10nm variants for DUV, EUV, and a mixture of the two variants are included. A sample of the added datasets are:

- Semiconductor manufacturing CMOS logic 5nm tech node DUV
- Semiconductor manufacturing CMOS logic 5nm tech node EUV
- Semiconductor manufacturing CMOS logic 5nm tech node DUV/EUV
- Semiconductor manufacturing WLP CSP CMOS logic 5nm tech node DUV
- Semiconductor manufacturing WLP CSP CMOS logic 5nm tech node EUV
- Semiconductor manufacturing WLP CSP CMOS logic 5nm tech node DUV/EUV

A total of 18 new nodes are added in the open IC parameterized models.

Liquid Crystal Display (LCD) parameterized model (MLC-18322): The Liquid Crystal Display (LCD), Panel Assembly LED TFT, mixed TN-IPS technology plan model and its sub-plans are updated. The update includes the following:

- **Broader applicability across display sizes:** The previous model is only valid for large monitors (>20”). New model covers small (0–11”), medium (11–24”), and large (>24”) displays
- **Improved panel electronics flexibility:** Addition of switch functions for different use cases:
  - 0 = Mobile devices
  - 1 = Industrial Equipment
  - 2 = Monitors <20"
  - 3 = Monitors >20"
- **Enhanced Printed Wiring Board (PWB) scaling:** Now scaled by weight (not just piece count), improving accuracy across device sizes
- **Refined panel selection:** Panel selection (small/medium/large) affects backlight modeling, but not the panel assembly itself, which improves realism and control
- **Updated backlight and material data:** Distinct material compositions and perimeter data for small, medium, and large panels to better reflect physical characteristics
- **Bare die scaling improvement:** Now scaled by area (cm²) rather than piece count, with a standard of 0.6 cm², improving precision for smaller displays.
- **Simplified parameter structure:** Consolidated key parameters for easier user input and clearer model logic

Inventories for battery processes

Foreground data and models were checked by Sphera battery experts regarding technological upgrades. Identified technology improvements were updated in the database. All mentioned changes affect data-on-demand datasets only.

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Inventories for textile processes

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

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Industry association datasets in the Managed LCA Content (MLC)

Even though several associations update their data periodically, some updates do not always fit the deadlines of the MLC update, and some associations did not yet provide the needed permission to integrate the new data into MLC in time. Since associations have their own cycle for upgrading their data, **some processes cannot yet be updated by Sphera in the annual upgrade**. Sphera must keep the unchanged processes identical to those in the MLC 2025 until the associations decide to update and make them available. However, several additional associations use the MLC Databases to reach global customers; others make available additional datasets.

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Continuous improvements

Editorial, edited documentation

Several changes related to documentation are carried out in this update from the outcome of the DEKRA review in 2024. The updates in the documentation includes:

- Improvements and correction in the technological description
- Improvements in description of technical purpose of dataset
- Improvement and addition of references and sources used in the model development
- Addition of flow diagrams
- Addition of used datasets within the model

There are no changes in results for all editorial issues.

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

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