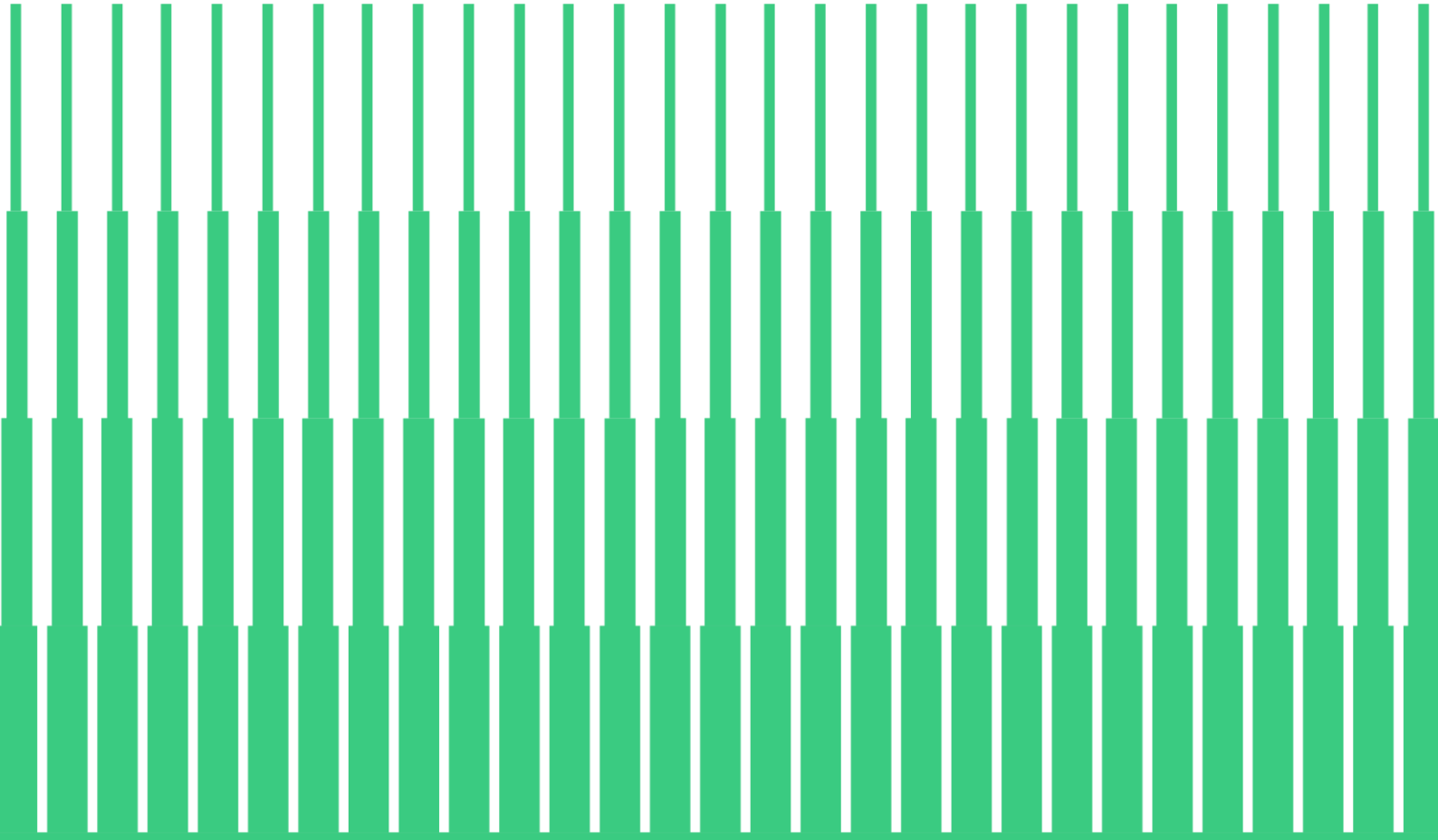
Documentation of Changes Implemented in the ecoinvent Database V3.13 (2026.11.04)

Stoikou N., Fazio S., Ioannou I., Schilling J., Sonderegger T., Superti V., Symeonidis A., Vadenbo C., Treichel A., Bonanno E., Grimaldi I., Kaarlela O., Anagnostou A., Bichot L., Bohara K., Bourmaud C., Cipriani J., Cirone F., Fernandez Roncal I., Giakoumatos A., Hinze Cassar C., Kjærulff Jensen S., Laurent A., Martinez Modamio I., Polimeno A., Savant S., Smith G., Toeperwien F., Valente A., Moreno Ruiz E.



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1 Introduction to the New Version

This report covers the changes to the ecoinvent database between version 3.12, released in 2025, and version 3.13, released in 2026. It describes both changes that affect the whole database, as well as specific changes in different sectors. These changes consist of the addition of new datasets, the deletion of outdated ones, and the updating of others.

All changes described in this report potentially affect or modify impact assessment results, even when they seem as minor as changing an activity link. The description of the changes has been provided to help the users with the interpretation and understanding of the possible changes in results they might encounter when comparing version 3.12 with version 3.13.

For a full comparison at the exchange level between the versions of the database, the Change Report Annex can be downloaded as an Excel file from the “Files” section of ecoQuery, accessible only to license holders. This file lists all datasets available in versions 3.12 and 3.13 with indication of the changes between versions. Changes that may affect the LCIA scores are reported.

The Correspondence File, which is available on the ecoinvent Knowledge Base, provides a mapping of datasets for each system model between versions 3.12 and 3.13, indicating which new datasets are available in cases where datasets in the previous version have been deleted or replaced.

More information about the technical background of the sectors can be found in the dedicated sector pages on the ecoinvent Knowledge Base.

The main updates introduced with v3.13 include the following:

— Pharmaceuticals: Introducing the new sector of pharmaceuticals developed with the Pharma LCA Consortium and Boehringer Ingelheim to support LCA harmonization and align with PAS 2090. It includes 61 regionalized datasets covering Europe, North America, and Asia, including pharmaceutical substances, water, waste treatment, and solvent recycling processes.

— Energy: We updated electricity market mixes for all countries with 2023 data, and China, India, Brazil, Switzerland, Canada, and the U.S. have been updated with 2024 data.

— Fuels: Version v3.13 expands the production of calcined petroleum coke (CPC) with production datasets for six key geographies and improved technological representativeness. It also introduces six regionalized CPC market datasets, providing more accurate supply data for downstream users.

— Metals: We expand the lithium supply chain, with 32 new datasets covering major producing countries, production routes, and lithium products, improving geographical and technological representativeness. The update also enhances aluminium supply-chain modeling through improved CPC inputs, alongside technical corrections to selected aluminium datasets.

— Chemicals and Plastics: We’ve improved the technological and geographical coverage of key products, including formaldehyde, acetaldehyde, and polystyrene grades. The update

also introduces 12 new chemical and plastic products, further expanding the sector's product coverage.

— Batteries & Electronics: We introduce 24 new battery module and pack datasets covering different sizes and chemistries, based consistently on the Argonne National Laboratory's BatPaC model. The update increases the granularity and representativeness of battery data for electric vehicles, supported by improvements to lithium and graphite supply chains in other sectors. Moreover, the battery supply chain is strengthened by expanding lithium extraction in the metals sector and regionalizing CPC production in the fuels sector, two critical inputs for battery manufacturing.

— Waste Management & Recycling: We implemented technical corrections and the introduction of two new waste streams: waste solvent and pharmaceutical wastewater, with corresponding treatment processes useful for the pharmaceuticals sector. The update also resolves EN15804 waste indicator double counting and corrects emission calculations for residues from coal mining, improving the consistency and reliability of waste inventories.

— Pulp & Paper: We updated the sector by adding new datasets for corrugated board, kraft paper, and cartonboard production in Europe. The update also separates cartonboard production from folding carton conversion, improving the granularity and accuracy of the modeling.

— Agriculture, Fishery and Animal Husbandry: ecoinvent v3.13 improves the sector through technical corrections to carbon accounting in Australian cereal and Brazilian perennial crop datasets. The updates address carbon imbalances and double counting, improving the consistency and accuracy of agricultural inventories.

— Textiles: Version 3.13 strengthens textile raw-material coverage with new Tier 4 datasets for cotton and flax, covering major producing regions and improving data quality for the apparel and footwear industry. The update also extends the European flax supply chain with a new rescutching dataset based on primary data, supporting the modeling of flax fibres for subsequent textile applications.

— Building & Construction: We've improved construction-related datasets through technical corrections to cement, infrastructure, and perlite quarrying data. The updates address mass balance, material intensity, and land-use inconsistencies, improving the reliability of LCA results for construction products.

— Life Cycle Impact Assessment Methods: For the new version, we included the addition of the GHG Protocol breakdown to the IPCC 2021 method and an update of IMPACT World+ Footprint from v2.1 to v2.2.1. The release also includes minor methodological improvements and new characterization factors for additional elementary flows.

2 Database-wide Changes

2.1 Renamed Activities

Only one activity was renamed in version 3.13. The change was introduced to improve the consistency and clarity of activity naming and to ensure alignment with the technology used in the dataset. The changes are listed in **Table 1**.

Table 1. Activities Renamed for v3.13. More details of some changes are given in the corresponding chapters.

Activity Name V3.12	Activity Name V3.13
propylene oxide production, from isobutene, PO/TBA process	propylene oxide production, from isobutane, PO/TBA process

2.2 Exchanges

There were no changes to the names of Intermediate or Elementary Exchanges in this version. However, some CAS numbers and formulas associated with Elementary Exchanges have been updated. They are listed in the following **Table 2**.

Table 2. Updates in CAS Numbers of Elementary Exchanges in Version v3.13

	CAS Number		Formula	
Exchange Name	V3.13	V3.12	V3.13	V3.12
Alpha-endosulfan	000959-98-8	000115-29-7	C9H6Cl6O3S	C9H6Cl6O3S
Alpha-lindane	000319-84-6	000058-89-9	C6H6Cl6	C6H6Cl6
Beta-endosulfan	033213-65-9	000115-29-7	C9H6Cl6O3S	C9H6Cl6O3S
Beta-lindane	000319-85-7	000058-89-9	C6H6Cl6	C6H6Cl6
Caesium I	018459-37-5	007440-46-2	Cs+	Cs+
Delta-lindane	000319-86-8	000058-89-9	C6H6Cl6	C6H6Cl6
Dibutyltin	014488-53-0	001002-53-5	C8H18Sn+2	C8H18Sn
Diphenyltin		001011-95-6	C12H10Sn+2	C12H12Sn
Molybdenum VI	016065-87-5	007439-98-7	Mo+6	Mo+6
Nitrogen, organic bound		007727-37-9	R-N	R-N
Phenyltin		002406-68-0	C6H5Sn+3	C6H8Sn
Propyl propionate	000106-36-5	000623-53-0	C6H12O3	C6H12O3
Strontium II	022537-39-9	007440-24-6	Sr+2	Sr+2
Trioctyltin		000869-59-0	C24H51Sn1+	C24H51Sn
Triphenyltin	000668-34-8	000892-20-6	C18H15Sn+	C18H15Sn

2.3 Properties

Properties are an essential part of the ecoinvent database, providing additional information that supports the consistent interpretation, modeling, and use of datasets. In each release, properties may be updated to reflect improved data sources, corrected values, or changes required to maintain consistency with the underlying inventories and database structure. This chapter summarizes the property updates implemented in version 3.13.

2.3.1 New Properties

New properties have been introduced in version 3.13 to provide additional information and improve the completeness and usability of the database. The newly added properties are listed in the following **Table 3**.

Table 3. Exchanges with New Properties. The newly added properties include aluminium content, fossil carbon content, non-fossil carbon content, chromium content, cobalt content, copper content, dry mass, iron content, lithium content, manganese content, nickel content, oxygen content, phosphorus content, silicon content, water content, water in wet mass, and wet mass.

Exchange Name	Property Name	Amount
battery pack, LFP-G, 100 kWh, Energy configuration	aluminium content	0.170757
battery pack, LFP-G, 100 kWh, Energy configuration	carbon content, fossil	0.278233
battery pack, LFP-G, 100 kWh, Energy configuration	carbon content, non-fossil	0.001054
battery pack, LFP-G, 100 kWh, Energy configuration	chromium content	0.006224
battery pack, LFP-G, 100 kWh, Energy configuration	copper content	0.08341
battery pack, LFP-G, 100 kWh, Energy configuration	dry mass	0.980958
battery pack, LFP-G, 100 kWh, Energy configuration	iron content	0.12477
battery pack, LFP-G, 100 kWh, Energy configuration	lithium content	0.012715
battery pack, LFP-G, 100 kWh, Energy configuration	nickel content	0.003046
battery pack, LFP-G, 100 kWh, Energy configuration	oxygen content	0.117326
battery pack, LFP-G, 100 kWh, Energy configuration	phosphorus content	0.05664
battery pack, LFP-G, 100 kWh, Energy configuration	silicon content	0.001614
battery pack, LFP-G, 100 kWh, Energy configuration	water content	0.019411
battery pack, LFP-G, 100 kWh, Energy configuration	water in wet mass	0.019042

battery pack, LFP-G, 100 kWh, Energy configuration	wet mass	1
battery pack, NCA-G, 100 kWh, Energy configuration	lithium content	0.019121
battery pack, NMC111-G, 100 kWh, Energy configuration	lithium content	0.02039
battery pack, NMC532-G, 100 kWh, Energy configuration	lithium content	0.019447
battery pack, NMC622-G, 100 kWh, Energy configuration	lithium content	0.019175
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	aluminium content	0.122561
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	carbon content, fossil	0.272125
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	carbon content, non-fossil	0.001441
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	copper content	0.108042
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	dry mass	1
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	iron content	0.143088
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	lithium content	0.017785
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	oxygen content	0.164107
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	phosphorus content	0.079224
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	silicon content	0.000988
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	water content	0
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	water in wet mass	0
module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	wet mass	1
module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	lithium content	0.028145
module, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	lithium content	0.02944
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	aluminium content	0.120032
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	carbon content, fossil	0.273589

module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	carbon content, non-fossil	0.001638
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	cobalt content	0.048219
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	copper content	0.09754
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	dry mass	1
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	lithium content	0.028395
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	manganese content	0.067425
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	nickel content	0.120056
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	oxygen content	0.130911
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	silicon content	0.001046
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	water content	0
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	water in wet mass	0
module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	wet mass	1
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	aluminium content	0.120273
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	carbon content, fossil	0.267857
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	carbon content, non-fossil	0.001722
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	cobalt content	0.047647
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	copper content	0.097493
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	dry mass	1
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	lithium content	0.028059
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	manganese content	0.044417

module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	nickel content	0.14236
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	oxygen content	0.12936
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	silicon content	0.00105
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	water content	0
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	water in wet mass	0
module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	wet mass	1
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	aluminium content	0.121933
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	carbon content, fossil	0.269636
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	carbon content, non-fossil	0.001691
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	cobalt content	0.02263
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	copper content	0.097547
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	dry mass	1
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	lithium content	0.026654
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	manganese content	0.021096
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	nickel content	0.180307
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	oxygen content	0.122881
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	silicon content	0.00108
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	water content	0
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	water in wet mass	0
module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	wet mass	1

2.3.2 Updated Properties

Existing properties have been updated in version 3.13 to reflect corrected or improved information and ensure consistency across the database. The updated properties are listed in **Table 4**.

Table 4. Exchanges with updated properties. The updated properties include aluminium content, boron content, fossil carbon content, non-fossil carbon content, cobalt content, copper content, dry mass, net heating value, lithium content, manganese content, nickel content, oxygen content, strontium content, water content, water in wet mass, and wet mass.

Exchange Name	Property Name	Previous Amount	New Amount
coconut, dehusked	carbon content, non-fossil	0.708236182	0.3177585
module, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	carbon content, fossil	0.292731383	0.25494532
module, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	carbon content, non-fossil	0.0000111	0.00160053
battery pack, NMC111-G, 100 kWh, Energy configuration	water content	0.00000684	0.020284
battery pack, NMC111-G, 100 kWh, Energy configuration	water in wet mass	0.00000671	0.019881
battery pack, NMC111-G, 100 kWh, Energy configuration	wet mass	0.980125696	1
battery pack, NMC532-G, 100 kWh, Energy configuration	water content	0.00000698	0.020686324
battery pack, NMC532-G, 100 kWh, Energy configuration	water in wet mass	0.00000684	0.020267073
battery pack, NMC532-G, 100 kWh, Energy configuration	wet mass	0.979739765	1
battery pack, NMC622-G, 100 kWh, Energy configuration	water content	0.000007	0.02075854
battery pack, NMC622-G, 100 kWh, Energy configuration	water in wet mass	0.00000686	0.020336386
battery pack, NMC622-G, 100 kWh, Energy configuration	wet mass	0.979670475	1
battery pack, NMC811-G, 100 kWh, Energy configuration	water content	0.00000716	0.021213497
battery pack, NMC811-G, 100 kWh, Energy configuration	water in wet mass	0.00000701	0.020772833

battery pack, NMC811-G, 100 kWh, Energy configuration	wet mass	0.979234175	1
battery pack, NCA-G, 100 kWh, Energy configuration	carbon content, fossil	0.302022743	0.27844674
battery pack, NMC111-G, 100 kWh, Energy configuration	carbon content, fossil	0.286435901	0.26558201
battery pack, NMC532-G, 100 kWh, Energy configuration	carbon content, fossil	0.294501042	0.27872492
battery pack, NMC622-G, 100 kWh, Energy configuration	carbon content, fossil	0.296374385	0.27471016
battery pack, NMC811-G, 100 kWh, Energy configuration	carbon content, fossil	0.306576751	0.27587883
battery pack, NCA-G, 100 kWh, Energy configuration	carbon content, non-fossil	0.0000123	0.0012355
battery pack, NMC111-G, 100 kWh, Energy configuration	carbon content, non-fossil	0.0000114	0.0011348
battery pack, NMC532-G, 100 kWh, Energy configuration	carbon content, non-fossil	0.0000119	0.00114893
battery pack, NMC622-G, 100 kWh, Energy configuration	carbon content, non-fossil	0.000012	0.00120559
battery pack, NMC811-G, 100 kWh, Energy configuration	carbon content, non-fossil	0.0000127	0.00116832
seed-cotton	carbon content, non-fossil	0.475	0.47
seed-cotton, organic	carbon content, non-fossil	0.475	0.47
fibre, cotton	carbon content, non-fossil	0.475	0.47
fibre, cotton	dry mass	0.94	0.923
fibre, cotton	water in wet mass	0.06	0.077
fibre, cotton	water content	0.063829787	0.08342362
fibre, cotton, organic	carbon content, non-fossil	0.475	0.47
fibre, cotton, organic	dry mass	0.98	0.923
fibre, cotton, organic	water in wet mass	0.02	0.077
fibre, cotton, organic	water content	0.020408163	0.08342362
ginning waste	carbon content, non-fossil	0.475	0.47
cottonseed	carbon content, non-fossil	0.475	0.47

cottonseed, organic	carbon content, non-fossil	0.475	0.47
energy feed, gross	carbon content, non-fossil	0	0.46957
peanut seed, at farm	carbon content, non-fossil	0.636	0.42
peanut seed, for sowing	carbon content, non-fossil	0.636	0.42
protein pea, feed	dry mass	0.84	0.87
sunflower seed	carbon content, non-fossil	0.78	0.574
horticultural fleece	carbon content, non-fossil	1	0
polyethylene terephthalate, granulate, amorphous	carbon content, fossil	0.526	0.625
polyethylene terephthalate, granulate, bottle grade	carbon content, fossil	0.526	0.526
packaging, for fertilisers or pesticides	dry mass	0.058350101	1
packaging, for fertilisers or pesticides	wet mass	0.058350101	1
steel, 3.2% silicon alloy, for grain oriented electrical steel	carbon content, fossil	0	0.00005
steel, 3.2% silicon alloy, for grain oriented electrical steel	carbon content, non-fossil	0.0025	0
calcium borates	boron content	0.090863226	0.169674037
strontium sulfate, 90% SrSO4	strontium content	0.477	0.4293
battery pack, NMC111-G, 100 kWh, Energy configuration	cobalt content	0.060819801	0.0577046
battery pack, NMC111-G, 100 kWh, Energy configuration	manganese content	0.056696991	0.05379289
battery pack, NMC111-G, 100 kWh, Energy configuration	nickel content	0.063760763	0.06065803
battery pack, NMC111-G, 100 kWh, Energy configuration	oxygen content	0.099073524	0.09399893
battery pack, NMC622-G, 100 kWh, Energy configuration	cobalt content	0.034310644	0.032562013
battery pack, NMC622-G, 100 kWh, Energy configuration	manganese content	0.031981725	0.030354669
battery pack, NMC622-G, 100 kWh, Energy configuration	nickel content	0.105776139	0.100551403

battery pack, NMC622-G, 100 kWh, Energy configuration	oxygen content	0.093156472	0.088404107
battery pack, NMC811-G, 100 kWh, Energy configuration	cobalt content	0.019694186	0.015252411
battery pack, NMC811-G, 100 kWh, Energy configuration	manganese content	0.018359269	0.014218468
battery pack, NMC811-G, 100 kWh, Energy configuration	nickel content	0.160247464	0.124857624
battery pack, NMC811-G, 100 kWh, Energy configuration	oxygen content	0.053468704	0.08281899
battery pack, NMC811-G, 100 kWh, Energy configuration	water content	7.15663E-06	0.021213497
battery pack, NMC811-G, 100 kWh, Energy configuration	water in wet mass	7.00797E-06	0.020772833
battery pack, NMC811-G, 100 kWh, Energy configuration	wet mass	0.979234175	1
battery pack, NMC532-G, 100 kWh, Energy configuration	cobalt content	0.034804082	0.033023065
battery pack, NCA-G, 100 kWh, Energy configuration	copper content	0.072687112	0.072687112
battery pack, NCA-G, 100 kWh, Energy configuration	nickel content	0.139644557	0.132591729
battery pack, NCA-G, 100 kWh, Energy configuration	oxygen content	0.092992852	0.088029751
battery pack, NCA-G, 100 kWh, Energy configuration	water content	7.05903E-06	0.020924195
battery pack, NCA-G, 100 kWh, Energy configuration	water in wet mass	6.91436E-06	0.020495346
battery pack, NCA-G, 100 kWh, Energy configuration	wet mass	0.979511568	1
battery pack, NCA-G, 100 kWh, Energy configuration	aluminium content	0.175906705	0.175885807
module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	aluminium content	0.120777647	0.120746887
module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	carbon content, fossil	0.316523029	0.273366368
module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	carbon content, non-fossil	1.21842E-05	0.001775344
module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	cobalt content	0.037795824	0.035834901

module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	nickel content	0.200706207	0.190324851
module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	oxygen content	0.136880095	0.129574697
polypropylene, granulate	heating value, net	32.78	43.4
polybutadiene	heating value, net	25.97	42.75
spodumene concentrate	lithium content	0.06	0.02787
lithium brine, concentrated, 1.39%Li	water content	2.237293623	2.23834197
lithium brine, concentrated, 1.39%Li	dry mass	0.3089	0.3088
lithium brine, concentrated, 1.39%Li	water in wet mass	0.6911	0.6912
lithium brine, concentrated, 1.39%Li	lithium content	0.044836517	0.04501295
lithium carbonate, battery grade	carbon content, fossil	0	0.1625
lithium carbonate, battery grade	carbon content, non-fossil	0.1625	0
battery pack, NMC811-G, 100 kWh, Energy configuration	lithium content	0	0.017963957

2.4 Geographies

In this version, the names of two geographies have been changed to align with the recommended nomenclature of the International Aluminium Institute (IAI, 2024). The changes are presented in **Table 5**.

Table 5. Changes in Geographies in Version 3.13

Geography Name V3.12	Geography Name V3.13
IAI Area, EU27 & EFTA	IAI Area, Western and Central Europe
IAI Area, Russia & Europe outside EU27 & EFTA	IAI Area, Russia and Eastern Europe

3 LCIA Methods

For v3.13, we added the GHG breakdown as in the GHG Protocol for the IPCC 2021 method. Then, the *IMPACT World+, footprint version* method was updated from v2.1 to v2.2.1. *Inventory results and indicators* were revisited. The characterization of Spodumene was updated for a few methods, and a few corrections were completed, including updated mappings to methods considering the CAS number and formula updates listed in Chapter 2.2. Finally, there are some new elementary exchanges from the Pharma project that show up in toxicity impacts in several methods. For more details, check the Change Report Annex.

3.1 IPCC 2021 (GHG Protocol mandatory)

The mandatory GHGs following the GHG Protocol are added in a new IPCC 2021 implementation called “IPCC 2021 (GHG Protocol mandatory)”. It contains the impact categories following ecoinvent terminology covering the GHG breakdown as in the protocol (**Table 6**).

Table 6. GHG Breakdown as in the GHG Protocol and Related ecoinvent Impact Categories; LULUCF = Land Use, Land-Use Change and Forestry.

GHG Protocol GHG Breakdown	Impact Category (V3.13)
Total mandatory GHGs excluding biogenic CO2	climate change: total mandatory GHGs (excl. biogenic CO2)
CO2 – fossil	climate change: CO2, fossil
CO2 – LULUCF	climate change: CO2, LULUCF
CH4	climate change: CH4
CH4 – LULUCF	climate change: CH4, LULUCF
N2O	climate change: N2O
HFC	climate change: HFC
PFC	climate change: PFC
NF3	climate change: NF3
SF6	climate change: SF6
CO2 – biogenic	climate change: CO2, non-fossil

3.2 EF V3.1 (also included in EN15804)

The official Assessment Report 6 (AR6) of IPCC had updates for a few characterization factors (CFs) for climate change. We implemented these in v3.12 for IPCC 2021 methods and for EF v3.1 (deviating from the original EF v3.1 source). For v3.13, we reverted to v3.11/ the original EF v3.1, as staying true to the EF source seemed to be valued higher by customers than being in line with the latest CFs (see **Table 7**). This provides better comparability with implementations of EF v3.1 in tools and software. The updated CFs remain in IPCC 2021 implementations.

Table 7. **CFs Updated from V3.12 to V3.13**

		V3.11 / V3.13	V3.12
Elementary Flow	**IPCC Name**	**GWP 100**	**GWP 100**
1,1,1,2-Tetrafluoroethane	HFC-134a	1530	1526

Trichlorofluoromethane	CFC-11	6230	6226
Sulfur hexafluoride		25200	24300
Sulfuryl fluoride			4630

3.3 Inventory Results and Indicators

We changed the indicator name “photochemical oxidants” to “photochemical oxidant formation” as the exchanges (except for ozone itself) are not oxidants but only precursors that cause photochemical oxidant formation.

Several exchanges with the wrong compartment were in emissions to air categories, this was corrected. Some further additions and corrections were made.

3.4 General Updates and Corrections

Spodumene ($LiAl(SiO_3)_2$ has a lithium content of 0.0376. The CF for lithium has been implemented with a conversion factor of 0.0376 for CML, Ecological Scarcity, EPS, and ReCiPe. In the first three methods, Spodumene was not yet characterized; in ReCiPe it was wrongly characterized with the CF for lithium (and a conversion factor of 1).

For ReCiPe, a wrong mapping of cerium (based on the wrong formula for cerium in the ReCiPe method) was corrected, resulting in the removal of the CF, and the mapping of manganese as a resource from water was removed, as only resources from ground are characterized.

The CAS number and formula updates (see Chapter **2.2**) lead to changes in toxicity impacts in several methods (CML, EF including EN15804, EPS, IMPACT World+, ReCiPe, TRACI, USEtox).

New elementary exchanges from the Pharma project also show up in toxicity impacts in several methods (EF including EN15804, ReCiPe, TRACI, USEtox).

4 Pharmaceuticals

Pharmaceuticals is a new sector added to the ecoinvent database in 2026. It aims to address the growing demand in the pharmaceutical and health care industry for science-based, harmonized, and compliant background data in response to evolving standards, sustainability reporting requirements, and regulatory frameworks. The sector was developed in collaboration with 13 companies from the Pharma LCA Consortium (PEG, 2026) and the Boehringer Ingelheim company (Boehringer Ingelheim, 2026).These industry experts have played a collaborative role in the development process, working alongside ecoinvent to identify critical data gaps and prioritize the most essential components and processes. This direct engagement ensures that the resulting datasets are not only technically robust but are also perfectly aligned with the real-world requirements and evolving needs of the sector.

4.1 New Pharmaceutical Datasets

The pharmaceutical project generated a total of 399 datasets. It includes 61 newly modelled products, regionalized across Europe (RER), North America (RNA), and Asia (RAS), resulting in 183 production datasets. These datasets were developed through a rigorous literature review combined with ecoinvent's internal modeling methodology. The project is further complemented by 198 market datasets, which represent the transport and distribution of these products across all included geographies.

The modeled products cover the key materials, chemicals, excipients, and process inputs required for pharmaceutical manufacturing, together with specialized utilities such as purified water and water for injection. It also includes datasets for solvent recovery and recycling, pharmaceutical-specific waste management, and regionalized supply chains enabling more representative and robust life cycle assessments and product carbon footprint studies of pharmaceutical products. Additionally, the new pharma datasets are fully aligned with the first Product Category Rule (PCR) for pharmaceutical products (PAS 2090, 2026).

All the new production datasets together with the corresponding market datasets are presented in **Table 8**.

Table 8. **New Production and Market Datasets Added in the Pharmaceutical Sector.**

Activity Name	Geography	Product Name
2-pyrrolidone production	RAS; RER; RNA	2-pyrrolidone
N-vinylpyrrolidone production	RAS; RER; RNA	N-vinylpyrrolidone
alanine production	RAS; RER; RNA	L-alanine
alanylglutamine production	RAS; RER; RNA	L-alanyl-L-glutamine
alanyltyrosine production	RAS; RER; RNA	L-alanyl-L-tyrosine
butylated hydroxyanisole production	RAS; RER; RNA	butylated hydroxyanisole
carbohydrates production	RAS; RER; RNA	carbohydrates

carbomer production	RAS; RER; RNA	carbomer
copovidone production	RAS; RER; RNA	copovidone
croscarmellose sodium production	RAS; RER; RNA	croscarmellose sodium
cysteine production	RAS; RER; RNA	L-cysteine
cysteine production	RAS; RER; RNA	L-cystine
dextrose production	RAS; RER; RNA	dextrose
ethyl cellulose production	RAS; RER; RNA	ethyl cellulose
ethyl chloride production	RAS; RER; RNA	ethyl chloride
gelatin, bovine production	RAS; RER; RNA	gelatin, bovine
gelatin, porcine production	RAS; RER; RNA	gelatin, porcine
glutamine production	RAS; RER; RNA	L-glutamine
glycylglutamine production	RAS; RER; RNA	L-glycyl-L-glutamine
glycyltyrosine production	RAS; RER; RNA	L-glycyl-L-tyrosine
histidine production	RAS; RER; RNA	L-histidine
hydroxypropylcellulose production	RAS; RER; RNA	hydroxypropylcellulose
hydroxypropylmethylcellulose production	RAS; RER; RNA	hydroxypropylmethylcellulose
inorganic salts production	RAS; RER; RNA	inorganic salts
lactose production, anhydrous	RAS; RER; RNA	lactose, anhydrous
lactose production, monohydrate	RAS; RER; RNA	lactose, monohydrate
leucine production	RAS; RER; RNA	L-leucine
lysine production	RAS; RER; RNA	L-lysine
magnesium stearate production	RAS; RER; RNA	magnesium stearate
mannitol production	RAS; RER; RNA	mannitol
market for 2-methyltetrahydrofuran	RNA	2-methyltetrahydrofuran
market for 2-pyrrolidone	RAS; RER; RNA	2-pyrrolidone
market for L-alanine	RAS; RER; RNA	L-alanine

market for L-alanyl-L-glutamine	RAS; RER; RNA	L-alanyl-L-glutamine
market for L-alanyl-L-tyrosine	RAS; RER; RNA	L-alanyl-L-tyrosine
market for L-cysteine	RAS; RER; RNA	L-cysteine
market for L-cystine	RAS; RER; RNA	L-cystine
market for L-glutamine	RAS; RER; RNA	L-glutamine
market for L-glycyl-L-glutamine	RAS; RER; RNA	L-glycyl-L-glutamine
market for L-glycyl-L-tyrosine	RAS; RER; RNA	L-glycyl-L-tyrosine
market for L-histidine	RAS; RER; RNA	L-histidine
market for L-leucine	RAS; RER; RNA	L-leucine
market for L-lysine	RAS; RER; RNA	L-lysine
market for L-proline	RAS; RER; RNA	L-proline
market for L-tyrosine	RAS; RER; RNA	L-tyrosine
market for N-vinylpyrrolidone	RAS; RER; RNA	N-vinylpyrrolidone
market for butylated hydroxyanisole	RAS; RER; RNA	butylated hydroxyanisole
market for carbohydrates	RAS; RER; RNA	carbohydrates
market for carbomer	RAS; RER; RNA	carbomer
market for copovidone	RAS; RER; RNA	copovidone
market for croscarmellose sodium	RAS; RER; RNA	croscarmellose sodium
market for dextrose	RAS; RER; RNA	dextrose
market for ethyl cellulose	RAS; RER; RNA	ethyl cellulose
market for ethyl chloride	RAS; RER; RNA	ethyl chloride
market for gelatin, bovine	RAS; RER; RNA	gelatin, bovine
market for gelatin, porcine	RAS; RER; RNA	gelatin, porcine
market for hydroxypropylcellulose	RAS; RER; RNA	hydroxypropylcellulose
market for hydroxypropylmethylcellulose	RAS; RER; RNA	hydroxypropylmethylcellulose
market for inorganic salts	RAS; RER; RNA	inorganic salts

market for lactose, anhydrous	RAS; RER; RNA	lactose, anhydrous
market for lactose, monohydrate	RAS; RER; RNA	lactose, monohydrate
market for magnesium stearate	RAS; RER; RNA	magnesium stearate
market for mannitol	RAS; RER; RNA	mannitol
market for microcrystalline cellulose	RAS; RER; RNA	microcrystalline cellulose
market for monostearyl fumarate	RAS; RER; RNA	monostearyl fumarate
market for monostearyl maleate	RAS; RER; RNA	monostearyl maleate
market for niacinamide	RAS; RER; RNA	niacinamide
market for pantothenic acid	RAS; RER; RNA	pantothenic acid
market for poloxamer	RAS; RER; RNA	poloxamer
market for polyethylene glycol	RAS; RER; RNA	polyethylene glycol
market for polypropylene glycol	RAS; RER; RNA	polypropylene glycol
market for polysorbate	RAS; RER; RNA	polysorbate
market for povidone	RAS; RER; RNA	povidone
market for purified water	RAS; RER; RNA	purified water
market for pyridoxine, from oxazole	RNA; RER	pyridoxine, from oxazole
market for pyridoxine, from pyruvate	RAS; RER; RNA	pyridoxine, from pyruvate
market for sodium stearyl fumarate	RAS; RER; RNA	sodium stearyl fumarate
market for sorbitan monooleate	RAS; RER; RNA	sorbitan monooleate
market for sorbitol	RAS; RER; RNA	sorbitol
market for sucrose	RAS; RER; RNA	sucrose
market for thiamine hydrochloride	RAS; RER; RNA	thiamine hydrochloride
market for trometamol	RAS; RER; RNA	trometamol
market for vitaminB12	RAS; RER; RNA	vitaminB12
market for vitamins	RAS; RER; RNA	vitamins
market for water for injection, from distillation	RAS; RER; RNA	water for injection, from distillation

methyltetrahydrofuran production	RNA	2-methyltetrahydrofuran
microcrystalline cellulose production	RAS; RER; RNA	microcrystalline cellulose
monostearyl fumarate production	RAS; RER; RNA	monostearyl fumarate
monostearyl maleate production	RAS; RER; RNA	monostearyl maleate
niacinamide production	RAS; RER; RNA	niacinamide
pantothenic acid production	RAS; RER; RNA	pantothenic acid
poloxamer production	RAS; RER; RNA	poloxamer
polyethylene glycol production	RAS; RER; RNA	polyethylene glycol
polypropylene glycol production	RAS; RER; RNA	polypropylene glycol
polysorbate production	RAS; RER; RNA	polysorbate
povidone production	RAS; RER; RNA	povidone
proline production	RAS; RER; RNA	L-proline
purified water production	RAS; RER; RNA	purified water
pyridoxine production, from oxazole	RNA; RER	pyridoxine, from oxazole
pyridoxine production, from pyruvate	RAS; RER; RNA	pyridoxine, from pyruvate
sodium stearyl fumarate production	RAS; RER; RNA	sodium stearyl fumarate
sorbitan monooleate production	RAS; RER; RNA	sorbitan monooleate
sorbitol production	RAS; RER; RNA	sorbitol
sucrose production	RAS; RER; RNA	sucrose
tert-butanol production, isobutane oxidation	RAS; RER; RNA	tert-butanol
thiamine hydrochloride production	RAS; RER; RNA	thiamine hydrochloride
trometamol production	RAS; RER; RNA	trometamol
tyrosine production	RAS; RER; RNA	L-tyrosine
vitaminB12 production	RAS; RER; RNA	vitaminB12
vitamins production	RAS; RER; RNA	vitamins

water for injection production, from distillation	RAS; RER; RNA	water for injection, from distillation

Table 9 lists all the pharmaceutical activities modeling the recycling of used solvents, along with the respective markets.

Table 9. Activities and Markets Modeling Solvent Recycling in the Pharmaceutical Sector.

Activity Name	Geography	Product Name
acetone recycling process	RAS; RER; RNA	used acetone, for recycling
market for acetone recycled	RAS; RER; RNA	acetone recycled
methyl ethyl ketone recycling process	RAS; RER; RNA	used methyl ethyl ketone, for recycling
market for methyl ethyl ketone recycled	RAS; RER; RNA	methyl ethyl ketone recycled
recycling solvents process	RAS; RER; RNA	used solvent, for recycling
market for recycled solvent	RAS; RER; RNA	recycled solvent
tetrachloroethylene recycling process	RAS; RER; RNA	used tetrachloroethylene, for recycling
market for tetrachloroethylene recycled	RAS; RER; RNA	tetrachloroethylene recycled
tetrahydrofuran recycling process	RAS; RER; RNA	used tetrahydrofuran, for recycling
market for tetrahydrofuran recycled	RAS; RER; RNA	tetrahydrofuran recycled
triethylamine recycling process	RAS; RER; RNA	used triethyl amine, for recycling
market for triethyl amine recycled	RAS; RER; RNA	triethyl amine recycled
market for used acetone, for recycling	RAS; RER; RNA	used acetone, for recycling
market for used methyl ethyl ketone, for recycling	RAS; RER; RNA	used methyl ethyl ketone, for recycling
market for used solvent, for recycling	RAS; RER; RNA	used solvent, for recycling
market for used tetrachloroethylene, for recycling	RAS; RER; RNA	used tetrachloroethylene, for recycling
market for used tetrahydrofuran, for recycling	RAS; RER; RNA	used tetrahydrofuran, for recycling
market for used triethyl amine, for recycling	RAS; RER; RNA	used triethyl amine, for recycling

4.2 Additional Datasets

To accommodate the rules of the consequential system model, 18 renaming activities were created. All the renaming activities generated for the pharma project are listed in **Table 10**.

Table 10. Renaming Activities Created for the Consequential System Model.

Activity Name	Geography	Product Name
acetone recycled to generic market for acetone, liquid	RAS; RER; RNA	acetone, liquid
methyl ethyl ketone recycled to generic market for methyl ethyl ketone	RAS; RER; RNA	methyl ethyl ketone
recycled solvent to generic market for solvent, organic	RAS; RER; RNA	solvent, organic
tetrachloroethylene recycled to generic market for tetrachloroethylene	RAS; RER; RNA	tetrachloroethylene
tetrahydrofuran recycled to generic market for tetrahydrofuran	RAS; RER; RNA	tetrahydrofuran
triethyl amine recycled to generic market for triethyl amine	RAS; RER; RNA	triethyl amine

Finally, new pharmaceutical waste treatment processes were modeled to better support the pharmaceutical datasets. More details can be found in the Waste section, Chapter **11.2.1,** listed in **Table 23**.

5 Fuels

5.1 New Datasets – Calcined Petroleum Coke (CPC)

In this new release of the database, the fuels sector expands and improves the modeling of calcined petroleum coke (CPC) production. More specifically, CPC production is regionalized to six geographies: Brazil, China, Germany, India, Oman, and the United States. These geographies were selected based on their importance in the international CPC market and include the major CPC-exporting countries identified during the project.

CPC is produced by calcining green petroleum coke (GPC), a by-product of petroleum refining, at temperatures above 1,200°C. Calcination removes volatile matter, increases electrical conductivity, and reduces CO_2 reactivity, making CPC suitable for applications such as aluminium anodes, synthetic graphite, and steel production. Approximately 25% of the estimated 115 million dry metric tonnes of GPC produced globally is directed to calcination, corresponding to around 29 million tonnes of CPC production per year.

The update also improves the technological representativeness of CPC production. Previously, CPC production in ecoinvent was represented by a single dataset for China based on rotary-kiln technology. This was inconsistent with industry practice in China, where shaft calciners are the predominant technology. The new modeling therefore distinguishes shaft calcination in China from rotary-kiln calcination in the United States, India, Brazil, Germany and Oman.

This distinction is relevant because the two technologies differ in their operation and environmental performance. Rotary kilns involve direct contact between the flue gas and the coke bed and typically achieve a yield of around 75%, whereas shaft calciners use indirect heating, have substantially longer residence times, and typically achieve yields of around 80–85%. The lower yield of rotary kilns can result in higher greenhouse-gas emissions per unit of CPC and greater particulate emissions.

Overall, the update introduces six geographically differentiated CPC production datasets and six corresponding market datasets. The existing Chinese CPC production dataset is replaced by the new technology-specific representation, while the other five production geographies are newly introduced. The associated market datasets provide geographically differentiated supply of CPC for downstream applications.

The new datasets created and their associated reference product are listed in **Table 11.**

Table 11. New Calcined Petroleum Coke Transforming Activity Datasets for v3.13.

Activity Name	Geography	Time Period	Product Name	Unit
calcined petroleum coke production, rotary kiln	US	2019 - 2025	calcined petroleum coke	kg
calcined petroleum coke production, rotary kiln	IN	2019 - 2025	calcined petroleum coke	kg
calcined petroleum coke production, rotary kiln	OM	2019 - 2025	calcined petroleum coke	kg
calcined petroleum coke production, rotary kiln	DE	2019 - 2025	calcined petroleum coke	kg

calcined petroleum coke production, rotary kiln	BR	2019 - 2025	calcined petroleum coke	kg
calcined petroleum coke production, vertical shaft	CN	2019 - 2025	calcined petroleum coke	kg

5.2 New Markets - Calcined Petroleum Coke (CPC)

In addition, seven new market datasets for CPC are introduced, corresponding to Brazil, China, Germany, India, Oman, and the United States (**Table 12**). These markets complement the regionalized production datasets and provide geographically differentiated CPC supply for downstream users. The existing Chinese market is updated/replaced, while markets for the other six geographies (including a global market) are newly introduced.

Table 12. New Calcined Petroleum Coke Markets for V3.13.

Market Name	Geography	Time Period	Product Name	Unit
market for calcined petroleum coke	US	2019 - 2025	calcined petroleum coke	kg
market for calcined petroleum coke	IN	2019 - 2025	calcined petroleum coke	kg
market for calcined petroleum coke	OM	2019 - 2025	calcined petroleum coke	kg
market for calcined petroleum coke	DE	2019 - 2025	calcined petroleum coke	kg
market for calcined petroleum coke	BR	2019 - 2025	calcined petroleum coke	kg
market for calcined petroleum coke	CN	2019 - 2025	calcined petroleum coke	kg
market for calcined petroleum coke	GLO	2019 - 2025	calcined petroleum coke	kg

5.3 Downstream Value Chain Updates - Calcined Petroleum Coke (CPC)

Calcined Petroleum Coke (CPC) is a key input to anode production for the Hall-Héroult aluminium electrolysis process and is used in the production of both anode paste and prebake anodes.

Previously, the CPC input to all *'anode production, prebake, for aluminium electrolysis'* and *'anode production, paste, for aluminium electrolysis'* datasets was linked to the Chinese CPC market, regardless of the anode dataset's own geography, as this was the only CPC market available and was therefore used as a proxy for regional CPC markets.

With the expansion of CPC production and market datasets in ecoinvent v3.13, each geography's CPC input now links directly to the newly introduced CPC market datasets, split according to each region's supply mix. All the datasets affected by this change are listed in **Table 13**.

Table 13: Updated Anode, Paste and Anode, Prebake Transforming Activity Datasets for V3.13.

Activity Name	Geography	Time Period	Product Name	Unit
anode production, paste, for aluminium electrolysis	GLO	2019 - 2019	anode, paste, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	CA	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	CN	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	GLO	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	IAI Area, Africa	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	IAI Area, Asia without China and GCC	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	IAI Area, Gulf Cooperation Council	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	IAI Area, Russia and Eastern Europe	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	IAI Area, South America	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	IAI Area, Western and Central Europe	2019 - 2019	anode, prebake, for aluminium electrolysis	kg
anode production, prebake, for aluminium electrolysis	UN-OCEANIA	2019 - 2019	anode, prebake, for aluminium electrolysis	kg

6 Building and Construction

In version 3.13, ecoinvent has implemented a series of technical corrections to improve the technological representativeness and internal consistency of several construction-related datasets. These corrections address issues that were identified through user feedback, internal review, and published literature. Most notably, (Tokede & Rouwette, 2024) critically examined the treatment of capital goods in the ecoinvent database and highlighted the presence of some unrealistic assumptions in some datasets. The corrections concern unrealistic machinery parameterization, inconsistent or absent material inputs, and mismatched land transformation flows. Where relevant, revised exchange amounts have been grounded in peer-reviewed literature on material intensities in buildings. Together, these changes reduce the risk of implausible results in downstream LCA applications, particularly for impact categories sensitive to mineral resource use and land transformation.

6.1 Technical Correction – Cement production, Portland [CH] – Mass Balance Correction

The dataset representing Portland cement (CEM I) production in Switzerland contained an inconsistent mass balance in its composition, introduced from version 3.10 onwards. Specifically, the declared inputs of clinker, gypsum, and limestone no longer summed to 1 kg (the reference product amount). Additionally, the inclusion of limestone was inconsistent with the EN 197-1 definition of CEM I, which reserves limestone additions for CEM II/A-L and similar types.

The dataset has been corrected by restoring a mass-balanced composition aligned with EN 197-1: clinker (0.95 kg), gypsum (0.04521 kg), and iron sulfate (0.00479 kg) per kg of cement. Limestone has been removed from the composition. The dataset documentation has also been updated to unambiguously reflect this formulation.

This correction improves the physical consistency of one of the most widely used construction material datasets in ecoinvent, reducing the risk of systematic errors in LCA studies involving cement, concrete, and related building products in the Swiss concrete supply chain.

6.2 Technical Correction – Infrastructure Datasets: Machinery and Copper Inputs

Three datasets of the machinery and infrastructure sector contained unrealistic exchange amounts, as identified in recent literature (Tokede & Rouwette, 2024). They have been corrected as follows:

6.2.1 Packing, Clay Product [CH] and [GLO]:

The annual throughput of the packing machine was unrealistically low (~1,000 t/year), leading to an infrastructure intensity that was orders of magnitude higher than comparable datasets. The exchange amount for "industrial machine, heavy, unspecified" has been corrected from 0.0015 to 2.55E−05 kg per kg packed, harmonizing the throughput assumption (~59,000 t/year) with the source dataset ("packing, lime product").

6.2.2 Building, Steel Hall Construction [CH] and [GLO]

The dataset contained no copper input, despite real industrial buildings always including copper in wiring and building services. The adjusted quantity of 0.1 kg Cu/m² has been added based on literature ranges for copper intensity in buildings: (Wang et al., 2022) report residential building copper intensities of 0.0062–1.281 kg/m², while (Marinova et al., 2019) report mean values ranging from 0.01 to 0.31 kg/m² depending on building type. The selected value is conservative, reflecting the lower building-services density typical of industrial halls compared to residential buildings.

6.2.3 Building, Multi-Storey Construction [RER] and [GLO]

The copper content of 8.48 kg/m³ was far above literature-based estimates and has been revised to 0.0176667 kg/m³. The corrected value is based on the mean copper intensity for apartment-type buildings reported in (Marinova et al., 2019) (0.053 kg Cu/m²), which falls within the broader range documented by (Wang et al., 2022), assuming a typical storey height of 3 m.

6.3 Technical Correction – Perlite Quarry Operation [DE] and [GLO] – Land Transformation Flow

The dataset "perlite quarry operation" contained an inconsistency in its land transformation flows: "Transformation, from unspecified" was reported as 5.00E−04 m², while "Transformation, to mineral extraction site" was correctly reported as 1.00E−05 m². Land transformation flows “from” and “to” should, by definition, be equal, as they represent the same physical area being converted. The larger value appears to have originated from an erroneous multiplication by the mining depth (50 m) rather than representing a surface area.

The value for "Transformation, from unspecified" has been corrected from 5.00E−04 m² to 1.00E−05 m² per kg of perlite produced, consistent with the "Transformation, to mineral extraction site" flow and with the area derived from the dataset's own density and mining depth parameters.

This correction has a significant effect on the Land Use indicator (EF 3.1): the previously reported impact of −0.729 per reference product was dominated by an inflated negative contribution from the "transformation, from unspecified" flow. Following the correction, the Land Use indicator becomes 0.006 per reference product, eliminating an erroneous and large negative result that could have misled users interpreting environmental profiles of perlite-containing products.

7 Chemicals and Plastics

ecoinvent v3.13 further develops the chemicals and plastics sector through updates to production systems and the introduction of new products. Existing data are enhanced through the technological and geographical expansion of formaldehyde production, alongside the recontextualization of up-to-date datasets for acetaldehyde and polystyrenes to additional geographies. In parallel, new products broaden the sector's coverage, while targeted technical corrections address identified limitations in existing inventories. Together, these developments strengthen the representativeness of the sector, extend its product coverage, and improve the quality of the available data.

7.1 Formaldehyde: Technological and Geographical Expansion

Formaldehyde is an important industrial chemical and a key intermediate in the production of resins, with major applications in wood-based and construction materials, coatings, adhesives, and other products. In previous versions of ecoinvent, formaldehyde was represented by the global and European **formaldehyde production**, **methanol oxidation** datasets, which model an average technology combining data for the silver catalyst and the iron–molybdenum mixed oxide-catalyzed route, commonly referred to as the Formox process. This new version replaces this representation by distinguishing the main industrial production technologies at the global level and introducing average production datasets for 23 countries. All datasets/activities encompassed in this update are listed in **Table 14**.

Three global unit process datasets are introduced to represent the principal technological configurations used to produce formaldehyde from methanol. The silver catalyst route is differentiated according to the degree of methanol conversion, through the **formaldehyde production**, **complete methanol conversion**, **silver catalyst process** and **formaldehyde production**, **partial methanol conversion**, **silver catalyst process** datasets. The Formox process is represented separately through **formaldehyde production**, **methanol conversion**, **Formox process**.

Geographical coverage is extended through the introduction of the **formaldehyde production**, **methanol conversion**, and **average process** dataset for 23 countries. This average process is constructed as a weighted combination of the three technologies described above. According to the literature, approximately 55% of global formaldehyde production is attributed to silver-catalyzed processes and 45% to the Formox process (van Valen et al., 2025). In the absence of further information distinguishing the two silver-catalyzed configurations, the silver share is divided equally between complete and partial methanol conversion. The resulting technology shares, 27.5% for each silver process and 45% for the Formox process, are applied consistently across the country-level average datasets:

- **Americas:** Argentina, Brazil, Canada, Chile, Mexico, United States;
- **Asia:** China, India, Indonesia, Japan, Malaysia, South Korea, Taiwan, Thailand;
- **Europe without Russia:** Belgium, Germany, Italy, the Netherlands, Poland, Spain, Sweden, United Kingdom;
- **Russia**.

Production volumes for the country-specific datasets are based on country-level formaldehyde production capacities reported in *Ullmann's Encyclopedia of Industrial Chemistry* (Franz et al., 2016). The global production volume is calculated as the sum of these capacities, ensuring a consistent basis between the global and country-level data. As no more recent source with consistent coverage across all 23 countries was identified, the

reported values are used as representative estimates of installed production capacity. Although capacities at individual production sites may have changed since the reference year, the available data provides a consistent basis for approximating the geographical distribution and overall scale of formaldehyde production in ecoinvent v3.13.

The broader country-level coverage also enables a more geographically differentiated representation of formaldehyde supply. New market activities are introduced for Asia and Northern America, while the existing European market is replaced by a market for Europe without Russia; the Global/Rest-of-World market remains available. These markets are supplied by the country-level average production datasets within their respective geographies, rather than by the individual technology-specific global datasets. The latter are retained to provide transparency on the technological basis underlying the average processes and to allow users to model a specific formaldehyde production technology where this distinction is relevant to their application.

Table 14: Formaldehyde-Related Data in Version 3.13 Compared to 3.12. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. The "Version 3.12" columns show activities that were updated or replaced in that version, while the "Version 3.13" columns list activities that either replace older ones or include new data not previously covered.

Activity Name	Geography	Time Period	Activity Name	Geography	Time Period
Version 3.12			**Version 3.13**		
formaldehyde production, methanol oxidation	RER	1997 – 2020	formaldehyde production, methanol conversion, average process	BE; DE; ES; GB; IT; NL; PL; SE	2015 – 2026
formaldehyde production, methanol oxidation	GLO	1997 – 2020	formaldehyde production, methanol conversion, average process	AR: BR: CL; RU: MX; US; CA; JP; KR; TH; TW; MY; ID; IN; CN	2015 – 2026
"New activity"			formaldehyde production, partial methanol conversion, silver catalyst process	GLO	2015 – 2026
"New activity"			formaldehyde production, complete methanol conversion, silver catalyst process	GLO	2015 – 2026
"New activity"			formaldehyde production, methanol conversion, Formox process	GLO	2015 – 2026
"New activity"			market for formaldehyde	RAS; RNA	2011 – 2011
market for formaldehyde	RER	2018 – 2018	market for formaldehyde	RER w/o RU	2018 – 2018

7.2 Regional Expansion through Recontextualization

Version 3.13 further expands the geographical representation of selected chemical and plastic products through the recontextualization of existing, up-to-date unit process (UPR) representations. The expansion builds on data updated or introduced in recent database versions, extending their geographical coverage while retaining the latest underlying inventories. Recontextualization is applied only where production in the corresponding geography can be justified through documented production facilities or other supporting information, and where the underlying UPR data are considered up to date and representative of the production process being regionalized. All datasets/ activities encompassed in this update are listed in **Table 39** of the Error! Reference source not found..

Acetaldehyde is an important chemical intermediate used in the production of a range of chemicals and chemical derivatives. In ecoinvent, acetaldehyde production was previously represented at the Global and European levels, with the underlying production data updated in ecoinvent v3.10 (FitzGerald et al., 2023). Building on this data, v3.13 expands the geographical representation of acetaldehyde production to the United States, China, Japan, and India. The geographical expansion of acetaldehyde production is complemented by new markets for Europe, Asia, and the United States, supplied by the respective regional production datasets, while the existing global market remains available.

As no single secondary source providing acetaldehyde production volumes across all relevant geographies and a common reference year was identified, data from different sources and reference years are combined to provide a reasonable approximation of regional production scale. Production volumes are primarily based on *Ullmann's Encyclopedia of Industrial Chemistry* (Eckert et al., 2006), complemented by more recent data for India (Statista, 2024). As part of this work, the production volumes of the existing global and European datasets were also updated to ensure consistency with the newly introduced regional datasets.

Polystyrene (PS) is a widely used and versatile thermoplastic represented in ecoinvent through three grades: general-purpose polystyrene (GPPS), high-impact polystyrene (HIPS), and expandable polystyrene (EPS). Disaggregated UPR data for these three grades were introduced in ecoinvent v3.12, replacing the previously available aggregated inventories (Stoikou et al., 2025). Building on this data, v3.13 further expands their geographical representation to South America, Northern America, and Asia. The geographical expansion of the three polystyrene grades is complemented by new markets for South America, Northern America, and Asia, supplied by the respective regional production datasets, while the existing European and global markets remain available.

As no single secondary source providing both global polystyrene production capacity and its regional distribution for a common reference year was identified, data from different reference years are combined to provide a reasonable approximation of regional production scale. The global production capacity reported for 2022 (Statista, 2023) is combined with the regional distribution reported for 2016 (Statista, 2018), assuming that the relative geographical distribution of production capacity did not change significantly over this period. In the absence of information on the relative production shares of GPPS, HIPS, and EPS, the resulting regional production volumes are distributed equally among the three grades. As part of this work, the production volumes of the existing global and European datasets were also updated to ensure consistency with the newly introduced regional datasets.

7.3 New Products: Portfolio Expansion

Overall, the v3.12 database hosts chemicals and plastics data for **six hundred and eighty** unique CAS numbers, including **forty** new CAS numbers added in that release that were not present in ecoinvent v3.11 (Stoikou et al., 2025; FitzGerald et al., 2024). These additions expanded coverage of chemicals and plastics by addressing key datasets previously missing from the database.

The chemicals and plastics sector continues the expansion of product coverage in v3.13, with **twelve** additional products, corresponding to an increase of approximately **2%** relative to v3.12. These additions comprise **one inorganic** and **eleven organic substances**, addressing further gaps in the existing portfolio and extending the range of chemical products available to users. The newly introduced products are listed in **Table 15**, while the corresponding transforming and market activities are provided in **Table 40** and **Table 41**, respectively.

The expansion of CAS-number coverage in v3.13 is not limited to products added in the chemicals and plastics sector but also includes developments in the new pharmaceuticals sector (see Chapter **0**) which introduces a further **forty-six** new CAS number entries, equivalent to an additional **7%** relative to v3.12. Across the chemicals and plastics and pharmaceuticals sectors, **fifty-eight** new CAS number entries are introduced in v3.13, increasing the number of unique CAS numbers represented in the ecoinvent database by ca. **9%**, to **seven hundred and thirty-eight** entries.

The continued expansion of product coverage remains a priority, with further additions planned for future database releases.

Table 15: Products Newly Covered in Version 3.13. The table lists all newly introduced flows, grouped by product type and functional group, together with their corresponding CAS numbers.

Product Type	Functional Group	Product Name	CAS Number
Organic	Halogenated aromatic	monofluorobenzene	462-06-6
Organic	Halogenated ketone	4,4-difluorobenzophenone	345-92-6
Organic	Halogenated ketone	2,4-difluorobenzophenone	342-25-6
Organic	Halogenated alkane	1,6-dichlorohexane	2163-00-0
Organic	Halogenated carbonyl	propionyl chloride	79-03-8
Organic	Diol	1,6-hexanediol	629-11-8
Organic	Dialdehyde	glutaraldehyde	111-30-8
Organic	Aromatic alcohol	phenethyl alcohol	60-12-8
Organic	Nitroaromatic	1,4-dimethyl-2-nitrobenzene	89-58-7

Organic	Carboxylic acid	valeric acid	109-52-4
Organic	Carboxylate salt	sodium acetate	127-09-3
Inorganic	Fluoride salt	potassium fluoride	7789-23-3

7.4 Other Updates: Database Maintenance

This section provides a brief overview of selected stand-alone data corrections and adjustments implemented in v3.13 that may have specific impacts of interest to users. Adjustments related to minor documentation enhancements, production volume updates, and other changes without relevant effects on the underlying inventories are not discussed in detail. All datasets/ activities encompassed in this update are listed in **Table 42** of the **Appendix.**

7.4.1 Ammonia

In earlier database versions, the ammonia production, steam reforming, liquid and ammonia production, partial oxidation, liquid dataset modeling relied on inconsistent feedstock properties. The underlying sources report feedstock requirements on an energy basis (European Commission, 2007; Fertilizers Europe, 2000), which are converted into feedstock quantities using the respective lower heating values. Together with the carbon and dry mass contents of the feedstocks, these properties determine the carbon input and, consequently, the direct carbon dioxide emissions calculated through the carbon balance. The values previously applied for these properties were not mutually consistent, leading to an overestimation of the carbon input and associated carbon dioxide emissions. In v3.13, the relevant feedstock properties are updated to representative values, and the carbon balances of both production routes are recalculated accordingly. The resulting direct carbon dioxide emissions are lower than in previous versions and in closer agreement with the ranges reported by Fertilizers Europe. Consequently, the climate change scores of the affected ammonia datasets decrease by approximately 8–10%, when compared to the previous version, bringing them closer to values reported in the literature (Brentrup et al., 2018), with remaining deviations largely attributable to differences in background data and reference years.

7.4.2 Urea

In earlier database versions, the urea production data assumed an ammonia input corresponding to the stoichiometric requirement for urea formation, representing a theoretically complete conversion of ammonia to urea. Following the correction of the ammonia carbon balance described above, this idealized representation resulted in a shortfall between the captured carbon dioxide available from ammonia production and the amount required for urea production in regions supplied exclusively by the ammonia production, steam reforming, liquid data. In v3.13, the ammonia input is therefore adjusted in the urea production data based on a representative conversion rate, providing a more realistic representation of urea production while ensuring consistency between the ammonia and carbon dioxide requirements and supply. The resulting changes are relatively small, with climate change scores of the affected urea datasets changing by less than 3% when compared to the previous version.

8 Electricity

8.1 General Market Update

The overall methodological approach used to update the electricity market datasets remains consistent with the approach applied in ecoinvent versions 3.6 through 3.12. For this update, the reference year is 2023 except for Brazil (BR), Canada (CA), China (CN), Switzerland (CH), and the United States (US), which are updated to 2024, as well as India (IN), which is updated to the fiscal year 2023-24 (April 2023 – March 2024), using the most recent versions of comprehensive country-specific data sources available, as outlined in Section **8.2.**

Consistent with v3.12, Enerdata (Enerdata, Global Energy & CO2 data, 2026) serves as the primary data source for electricity generation, for all regions except where the national updates follow the approach described in **8.2** and for the European countries covered by EuroSTAT (EU member states, EFTA countries, the Western Balkans, Türkiye, Georgia and Moldova), where the European Commission's EuroSTAT database (European Commission, 2026) is used. As in version 3.12, data reported for the individual geographies were aggregated or disaggregated to align with the IEA resolution and were processed in the same way as in the previous releases. Several data gaps and issues were addressed based on information from the previous ecoinvent releases and national energy balance reports. Additionally, missing classifications between main activity producers and auto-producers in the Enerdata export for v3.13 were added, consistent with prior ecoinvent versions. Disaggregation was carried out using data from the previous year wherever necessary, and often supplemented with facility-level information from Enerdata's Power Plant Tracker database (Enerdata, Power Plant Tracker, 2026), for example, to identify certain auto-producers such as those in the pulp and paper industry, sugar mills, etc. In most cases, disaggregation was required for countries outside the major global economies, while it was not needed for Europe, the USA, Canada, China, India, or Brazil.

Electricity trade datasets were compiled from various sources depending on the region. For European countries, electricity trade data was primarily obtained from European data sources, mainly from the Eurostat database (European Commission, 2026), ENTSO-E (ENTSO-E, 2026) and Bundesnetzagentur (Bundesnetzagentur, 2026). Additional trade statistics were sourced from Enerdata (Enerdata, Global Energy & CO2 data, 2026) and further disaggregated using trade partner shares from (United Nations Comtrade, 2026). For the United States, electricity import data for the year 2024 was obtained directly from the U.S. Energy Information Administration (EIA, 2026). Further details on trade updates are provided in **8.1.2** below.

Electricity transmission and distribution losses were updated for the same reference years as the generation and trade data, using total loss volumes reported by Enerdata (Enerdata, Global Energy & CO2 data, 2026), complemented by national statistics for the countries described in **8.2.**

8.1.1 New Technology Splits

Some electricity generation technologies were missing for certain geographies that were not present in v3.12 and have been added as shown in **Table 16**.

Table 16**. New Technology Splits.**

Geography	Fuel Type and Technology	Technology Splits	Data Year	Data Source
IN-JK, IN-GA, IN-SK, IN-ML, IN-MZ, IN-NL	Solar (photovoltaic)	100% electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted	2025	Parameter for production volume and yield taken from (European Commission Joint Research Centre (EUJRC), 2026) using the state capital as location
IN-AS, IN-HP, IN-KL, IN-JH, IN-ML	Wood (CHP)	100% heat and power co-generation, wood chips, 6667 kW	2014	Recontextualizatio n from other IN states without changes
IN-GA	Hydropower (run-of-river)	100% electricity production, hydro, run-of-river	2023	National source
CN-HE	Wind (offshore)	100% electricity production, wind, 1-3MW turbine, offshore	2023	Parameter for capacity taken from expert estimations
CN-XZ	Wind (onshore)	100% electricity production, wind, 1-3MW turbine, onshore	2023	Parameter for capacity taken from expert estimations
CN-HL, CN-SA, CN-XJ, CN-CQ	Hydropower (pumped)	100% electricity production, hydro, pumped storage	2023	Parameter for capacity taken from expert estimations
BR-South-eastern/Mid-western grid	Wind (onshore)	100% electricity production, wind, 1-3MW turbine, onshore	2024	Parameter for capacity taken from (Ministry of Mines and Energy, BR, 2025)
CU, HN, MU, NI, PY	Wood (CHP)	100% treatment of bagasse, from sugarcane, in heat and power co-generation unit, 6400kW thermal	2023	National source
PA	Wood (CHP)	100% heat and power co-generation, wood chips, 6667 kW	2023	National source
CG	Natural gas (non-CHP)	100% electricity production, natural gas, conventional power plant	2023	Parameter for technology split taken from (Global Energy Monitor, 2026)
QA	Natural gas (non-CHP)	100% electricity production, natural gas,	2023	Parameter for technology split

		combined cycle power plant		taken from (Global Energy Monitor, 2026)
QA	Natural gas (CHP)	32.75% heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical 67.25% heat and power co-generation, natural gas, conventional power plant, 100MW electrical	2023	Parameter for technology split taken from (Global Energy Monitor, 2026)
TZ	Wind (onshore)	100% electricity production, wind, <1MW turbine, onshore	2023	Parameter for technology split taken from (The Wind Power, 2026)
ID	Wind (onshore)	50.74% electricity production, wind, <1MW turbine, onshore 49.26% electricity production, wind, >3MW turbine, onshore	2023	Parameter for technology split taken from (The Wind Power, 2026)
OM	Wind (onshore)	100% electricity production, wind, >3MW turbine, onshore	2023	Parameter for technology split taken from (The Wind Power, 2026)
SY	Wind (onshore)	100% electricity production, wind, <1MW turbine, onshore	2023	Parameter for technology split taken from (The Wind Power, 2026)

8.1.2 Electricity Trade Data and Import Splits

Electricity trade data frequently differs across sources, with discrepancies arising from temporal aggregation and the netting of electricity flows, but also differences in physical flows and commercial trade, which may lead to inconsistencies in the reported data. For the European countries covered by Eurostat, the Eurostat database was used (European Commission, 2026), which reflects physical trade between partner countries. The reported partner flows were validated against the cross-border interconnections listed by ENTSO-E (ENTSO-E, 2026), and flows between countries without a physical interconnection were removed. However, the electricity trade data reported was incomplete for certain countries, with part of the imports attributed to unspecified or aggregated partners. To account for unspecified electricity imports and address gaps in electricity trade statistics, the hierarchy of data sources from version 3.12 was applied, taking available data from the data sources at the top first, and then filling gaps with the data sources further down the list.

1. Eurostat (European Commission, 2026)
2. Bundesnetzagentur (Bundesnetzagentur, 2026)
3. ENTSO-E (ENTSO-E, 2026)
4. United Nations (UN) Comtrade (United Nations Comtrade, 2026)

5. Enerdata total trade data (Enerdata, Global Energy & CO2 data, 2026), considering trade splits from 3.12 and (United Nations Comtrade, 2026)

The established hierarchy of data sources enables filling gaps in electricity trade datasets, as applied in version 3.12 (see Change Report of 3.12 for examples).

8.1.2.1 New Electricity Imports Trade Datasets

Some electricity import origins were added because the respective electricity imports were not present in previous versions of the ecoinvent database. New electricity import datasets were therefore created to represent the electricity trade as reported in the statistics. **Table 17** presents the newly created electricity import trade datasets with their corresponding origin and destination geographies.

Table 17**. New Electricity Imports Trade Datasets Introduced with Version 3.13.**

Activity Name	Geography	Time Period	Product Name
electricity, high voltage, import from BO	AR	2020 - 2020	electricity, high voltage
electricity, high voltage, import from BR-Northern grid	BR-North-eastern grid	2021 - 2021	electricity, high voltage
electricity, high voltage, import from BR-South-eastern/Mid-western grid	BR-North-eastern grid,	2020 - 2020	electricity, high voltage
electricity, high voltage, import from BR-South-eastern/Mid-western grid	BR-Northern grid	2021 - 2021	electricity, high voltage
electricity, high voltage, import from BR-Southern grid	BR-South-eastern/Mid-western grid	2020 - 2020	electricity, high voltage
electricity, high voltage, import from CN-CSG	MM	2022 - 2025	electricity, high voltage
electricity, high voltage, import from GB	DK	2020 - 2020	electricity, high voltage
electricity, high voltage, import from MY	TH	2020 - 2020	electricity, high voltage
electricity, high voltage, import from MZ	ZM	2020 - 2020	electricity, high voltage
electricity, high voltage, import from PE	EC	2020 - 2020	electricity, high voltage
electricity, high voltage, import from RAF	TZ	2020 - 2020	electricity, high voltage

electricity, high voltage, import from RAF	ZA	2024 - 2024	electricity, high voltage
electricity, high voltage, import from RAF	ZM	2020 - 2020	electricity, high voltage
electricity, high voltage, import from RAS	KH	2024 - 2024	electricity, high voltage
electricity, high voltage, import from RAS	TH	2020 - 2020	electricity, high voltage
electricity, high voltage, import from ZA	ZM	2020 - 2020	electricity, high voltage
electricity, high voltage, import from ZM	CD	2020 - 2020	electricity, high voltage
electricity, high voltage, import from ZM	TZ	2020 - 2020	electricity, high voltage

8.2 National Update Based on Country-specific Data Sources

For further details on the different data sources used and detailed explanation of the country-specific electricity mixes for Brazil, Canada, China, India, Switzerland, and the U.S., please refer to the version 3.9 change report (Moreno Ruiz E. et al., 2022).

8.2.1 Brazil

The Brazilian electricity market datasets are updated in line with previous ecoinvent versions, with 2024 taken as the reference year for the current update. Net generation per state and fuel type was taken from the national energy balance (Balanço Energético Nacional) published by EPE on behalf of Brazil's Ministry of Mines and Energy (Ministry of Mines and Energy, BR, 2025). Electricity market share data for 2024 compiled by ACV Brazil (ACV Brazil, 2026) was also incorporated into the update, as in the previous ecoinvent versions. Additionally, national and international electricity trade data compiled from Operador Nacional do Sistema Elétrico (ONS) (Operador Nacional do Sistema Elétrico (ONS), 2026) were used for the exchanges between the four Brazilian grids and with Argentina and Uruguay. As ONS does not report the transfers from the binational Itaipu plant, the imports from Paraguay were derived as the difference between the national import total of the energy balance and the imports measured by ONS, complemented by the information published by the Ministerio de Obras Públicas y Comunicaciones of Paraguay (Ministry of Mines and Energy, PY, 2026) is used.

8.2.2 China

The Chinese electricity market datasets are updated in line with previous ecoinvent versions, using national statistics from 2024 (National Bureau of Statistics of China, 2026).

Power plant capacities have been updated to data from 2024 from Obershelp et al. (Obershelp et al., 2023) and personal expert communications.

8.2.3 India

The Indian electricity markets were updated in line with previous ecoinvent versions and represent the year 2023-2024 for v3.13. All electricity-related statistics used for the v3.13 update are taken from the national statistics for the fiscal year[1] of 2023-2024 (Ministry of Power, 2025).

Power plant capacities for India have been updated to 2024 data from the National Power Portal (Central Electricity Authority, Ministry of Power, Government of India, 2026), except for the coal power plant capacities used to define the hard coal-lignite technology split.

8.2.4 Switzerland

The Swiss electricity markets were updated in line with the ecoinvent version v3.8 (Moreno Ruiz E. et al., 2021) which provides details on national data sources and methodologies. The present update uses 2024 as the reference year and is based on the national energy statistics (Swiss Federal Office of Energy, 2026; Pronovo, 2026).

8.2.5 Canada

The Canadian electricity market has been updated in line with the earlier ecoinvent versions, using the national statistics from 2024 (StatCAN, 2026).

8.2.6 United States

The U.S. electricity market has been updated consistently with previous ecoinvent versions, based on the 2024 eGRID-equivalent data compiled by Cornerstone (Cornerstone, 2026) The database follows the eGRID2023 methodology established by the U.S. Environmental Protection Agency (EPA). As the EPA has discontinued the official release of eGRID data starting with the 2024 reference year, the Cornerstone compilation was used as the most recent available equivalent dataset.

8.3 Residual Mix Update

The European electricity residual mix markets have been updated following the procedure established for version 3.9 of the ecoinvent database (Moreno Ruiz E. et al., 2022) and represent the year 2025 in v3.13. The share of residual mixes implemented in v3.13 was calculated using statistics from AIB (Association of Issuing Bodies (AIB), 2026), applying the methodology developed by Grexel and used in earlier ecoinvent versions. For further details and explanation on the residual mix update, refer to the change report from v3.9 (Moreno Ruiz E. et al., 2022).

Note 1: The reference years of the residual mixes and the general electricity markets differ due to the availability of our data providers. We use the most recent available year for both the general market and residual mix updates, accepting a discrepancy, which we expect to have a negligible effect in practice.

Note 2: In ecoinvent v3.12, the climate change impact of the Italian medium- and low-voltage residual mix datasets dropped substantially compared to v3.11. This issue was caused by a strong increase in the share of "FO unspecified" in the underlying AIB 2024 data (from 3.57% to 68.77%), combined with how this share is modeled under the Grexel methodology and cut-

[1] The fiscal year of India starts on the 1st of April and ends on 31st March of the succeeding year (spanning two calendar years).

off system model. A detailed explanation is available in the "Known issues" section of version 3.12 on the ecoinvent website. In v3.13, the residual mix datasets are based on the AIB 2025 data, in which the share of "FO unspecified" for Italy has decreased again to around 7%. The climate change impact of the Italian medium and low voltage residual mixes is therefore back within the expected range.

8.4 Technical Corrections

Two technical corrections have been applied to fossil-based power generation datasets.

- The first correction concerns the reference product amount of "*electricity production, lignite*" in Bosnia and Herzegovina, Bulgaria, Czechia, Germany, Greece, Hungary, Romania, Serbia, and Slovenia. In previous versions, the electricity output of these activities was parameterized to represent 1 kWh but did not resolve exactly to that value. This issue has now been corrected by setting the electricity output to exactly 1 kWh in each of these datasets.
- The second correction addresses the plant efficiency used in the activity "*treatment of coal gas, in power plant*" in Austria, Brazil, Czechia, Finland, Great Britain, Hungary, Poland, Sweden, and Slovakia. In previous versions, the mathematical relation governing the electricity output exchange referenced the global (GLO) electrical efficiency, whereas a country-specific efficiency parameter was already reported in each dataset. The relation has now been revised to use the country-specific efficiency, so that the electricity output correctly reflects local plant performance.

Additionally, we corrected a misassignment whereby natural gas-based electricity production was incorrectly attributed to autoproducers instead of main activity producers for Congo (CG) and Qatar (QA). This correction resulted in a substantial increase in production volumes and global warming potential for these countries (among other impact categories).

9 Metals

This update significantly expands and improves the data coverage of the metals sector with new and updated datasets across the lithium value chain.

In the lithium value chain, ecoinvent v3.13 introduces an expanded set of datasets covering upstream production steps across five countries: Argentina, Australia, Chile, China, and the United States, based on recent, site-specific literature.

Both brine and spodumene extraction routes are represented, covering the full production chain from raw material extraction through lithium carbonate and lithium hydroxide monohydrate production. This update provides more regionally and technologically differentiated and reliable environmental impact results for lithium-intensive value chains, benefiting users modeling electric mobility, grid storage, and battery supply chains.

Additionally, in v3.13, ecoinvent implemented three technical corrections to improve the accuracy and internal consistency of datasets in the aluminium value chain. The key update concerns the use of Calcined Petroleum Coke (CPC) in anode production datasets. Previously, this exchange was linked entirely to the China (CN) market for CPC, regardless of the anode's own geography. It now links directly to the newly available regional markets (CN, US, BR, DE, OM, IN); see **Fuels** section. Two additional corrections address issues identified through user feedback and internal review, concerning uncertainty parameterization in an aluminium hydroxide dataset and an incomplete consequential market for aluminium cast alloy.

9.1 Lithium

9.1.1 Lithium Upstream Value Chain

Lithium-related datasets have been substantially expanded and updated, based on recent site-specific literature, covering brine-based and spodumene-based routes to lithium carbonate and lithium hydroxide monohydrate across five countries: Argentina, Australia, Chile, China, and the United States. 32 new transforming activities and market datasets have been introduced.

Production sites newly modeled include Salar de Atacama (Chile), Salar de Cauchari-Olaroz (Argentina), Salar de Olaroz (Argentina), and Fenix/Hombre Muerto (Argentina), Silver Peak (United States), Chaerhan (China), Zhangjiagang (China), Shehong (China), and Greenbushes (Australia).

A subset of these datasets has been developed in partnership with Bureau de Recherches Géologiques et Minières (BRGM, n.d.), which contributed to the Chinese spodumene-based datasets, as well as Salar de Atacama and Salar de Cauchari-Olaroz.

This update also introduces an explicit distinction between lithium carbonate battery grade and technical grade, reflecting the different purity requirements and end-use applications of these two product qualities. The new datasets are reported in **Table 18**.

Table 18: New Lithium Transforming Activity and Market Datasets. Activity names are reported in alphabetical order. In column V3.13, “N”: “New Activity”, “U”: “Updated Activity”, and “D”: “Deleted Activity”.

Activity Name	Geography	Time Period	Product Name	Unit	V3.13
lithium brine concentration	CL	2018-2018	lithium brine, concentrated, 6%Li	kg	N
lithium brine concentration	US	2022-2022	lithium brine, concentrated, 0.6%Li	kg	N
lithium brine concentration, Chaerhan	CN	2018-2018	lithium brine, concentrated, 1.39%Li	kg	N
lithium brine concentration, Fenix	AR	2022-2022	lithium brine, concentrated, 0.15%Li	kg	N
lithium brine concentration, Salar de Cauchari	AR	2011-2020	lithium brine, concentrated, 4.3%Li	kg	N
lithium brine concentration, Salar de Olaroz	AR	2019-2019	lithium brine, concentrated, 1.2%Li	kg	N
lithium carbonate production, battery grade, from concentrated brine	CL	2018-2018	lithium carbonate, battery grade	kg	N
lithium carbonate production, battery grade, from concentrated brine	US	2022-2022	lithium carbonate, battery grade	kg	N
lithium carbonate production, battery grade, from concentrated brine, Chaerhan	CN	2018-2018	lithium carbonate, battery grade	kg	N
lithium carbonate production, battery grade, from concentrated brine, Fenix	AR	2022-2022	lithium carbonate, battery grade	kg	N
lithium carbonate production, battery grade, from concentrated brine, Salar de Cauchari	AR	2011-2020	lithium carbonate, battery grade	kg	N
lithium carbonate production, battery grade, from concentrated brine, Salar de Olaroz	AR	2019-2019	lithium carbonate, battery grade	kg	N
lithium carbonate production, battery grade, from spodumene concentrate, Shehong	CN	2017-2017	lithium carbonate, battery grade	kg	N
lithium carbonate production, battery grade, from spodumene concentrate, Zhangjiagang	CN	2014-2014	lithium carbonate, battery grade	kg	N

lithium carbonate production, technical grade, from concentrated brine	AR	2019-2019	lithium carbonate, technical grade	kg	N
lithium carbonate production, technical grade, from concentrated brine	US	2022-2022	lithium carbonate, technical grade	kg	N
lithium hydroxide monohydrate production, from lithium carbonate	CL	2018-2018	lithium hydroxide monohydrate	kg	N
lithium hydroxide monohydrate production, from spodumene concentrate	CN	2017-2017	lithium hydroxide monohydrate	kg	N
spodumene concentrate production	AU	2022-2022	spodumene concentrate	kg	N
market for lithium brine, concentrated, 0.15%Li	AR	2022-2022	lithium brine, concentrated, 0.15%Li	kg	N
market for lithium brine, concentrated, 1.2%Li	AR	2019-2019	lithium brine, concentrated, 1.2%Li	kg	N
market for lithium brine, concentrated, 4.3%Li	AR	2011-2020	lithium brine, concentrated, 4.3%Li	kg	N
market for lithium brine, concentrated, 6%Li	CL	2018-2018	lithium brine, concentrated, 6%Li	kg	N
market for lithium brine, concentrated, 1.39%Li	CN	2018-2018	lithium brine, concentrated, 1.39%Li	kg	N
market for lithium brine, concentrated, 0.6%Li	US	2022-2022	lithium brine, concentrated, 0.6%Li	kg	N
market for lithium carbonate, battery grade	CN	2014-2018	lithium carbonate, battery grade	kg	N
market for lithium carbonate, battery grade	GLO	2011-2022	lithium carbonate, battery grade	kg	N
market for lithium hydroxide monohydrate	CN	2017-2017	lithium hydroxide monohydrate	kg	N
market for lithium hydroxide monohydrate	GLO	2017-2018	lithium hydroxide monohydrate	kg	N
market for lithium hydroxide monohydrate	RER	2017-2018	lithium hydroxide monohydrate	kg	N
market for lithium hydroxide monohydrate	US	2017-2018	lithium hydroxide monohydrate	kg	N
market for lithium carbonate, technical grade	GLO	2011-2022	lithium carbonate, technical grade	kg	N

The datasets in **Table 18** have replaced the datasets in **Table 19**, which have been deleted.

Table 19: Datasets that Have Been Replaced with the Lithium Update, thus not Available Anymore in V3.13. Activity names are reported in alphabetical order. In column V3.13, "N": "New Activity", "U": "Updated Activity", and "D": "Deleted Activity".

Activity Name	Geography	Time Period	Product Name	Unit	V3.13
lithium brine inspissation	CL	2018-2018	lithium brine, 6.7 % Li	kg	D
lithium carbonate production, from concentrated brine	GLO	2009-2010	lithium carbonate	kg	D
lithium carbonate production, from spodumene	CN	2014-2020	lithium carbonate	kg	D
lithium carbonate production, from spodumene	GLO	2014-2020	lithium carbonate	kg	D
market for lithium brine, 6.7 % Li	GLO	2011-2011	lithium brine, 6.7 % Li	kg	D
market for lithium carbonate	GLO	2011-2011	lithium carbonate	kg	D
spodumene production	AU	2000-2012	spodumene	kg	D
spodumene production	GLO	2000-2012	spodumene	kg	D
market for spodumene	GLO	2011-2014	spodumene	kg	D

9.1.2 Lithium Downstream Value Chain

With the introduction of 'lithium carbonate, battery grade', 'lithium carbonate, technical grade', and 'lithium hydroxide monohydrate' as new distinct products, downstream datasets in the chemical and battery sectors that previously relied on the generic product 'lithium carbonate', or on 'lithium hydroxide' anhydrous, have been updated to consume these new, more specific products instead. **Table 20** contains the list of the updated datasets.

Table 20: Datasets that Have Been Updated. Activity names are reported in alphabetical order. In column V3.13, "N": "New Activity", "U": "Updated Activity", and "D": "Deleted Activity".

Activity Name	Geography	Time Period	Product Name	Unit	V3.13
electrolyte production, KOH, LiOH additive	GLO	2002-2006	electrolyte, KOH, LiOH additive	kg	U

lithium chloride production, from lithium carbonate and hydrochloric acid	GLO	2003-2024	lithium chloride	kg	U
lithium fluoride production	CN	2009-2010	lithium fluoride	kg	U
lithium fluoride production	GLO	2009-2010	lithium fluoride	kg	U
lithium hydroxide production	GLO	2000-2020	lithium hydroxide	kg	U
lithium iron phosphate production, hydrothermal process	CN	2014-2025	lithium iron phosphate	kg	U
lithium iron phosphate production, hydrothermal process	GLO	2014-2025	lithium iron phosphate	kg	U
lithium iron phosphate production, solid state process	CN	2014-2025	lithium iron phosphate	kg	U
lithium iron phosphate production, solid state process	GLO	2014-2025	lithium iron phosphate	kg	U
lithium sulfate production	GLO	2020-2020	lithium sulfate	kg	U
lithium manganese oxide production	GLO	2009-2010	lithium manganese oxide	kg	U
lithium nitrate production	GLO	2015-2025	lithium nitrate	kg	U
lithium titanate spinel production	GLO	2014-2024	lithium titanate spinel	kg	U
lithium titanate spinel production	RER	2014-2024	lithium titanate spinel	kg	U
lithium titanate spinel production	UN-EASIA	2014-2024	lithium titanate spinel	kg	U
lithium titanate spinel production	US	2014-2024	lithium titanate spinel	kg	U
manganese carbonate production	GLO	2015-2025	manganese carbonate	kg	U
NCA oxide production, for Li-ion battery	CN	2016-2020	NCA oxide	kg	U
NCA oxide production, for Li-ion battery	GLO	2016-2020	NCA oxide	kg	U
NMC111 oxide production, for Li-ion battery	CN	2018-2020	NMC111 oxide	kg	U
NMC111 oxide production, for Li-ion battery	GLO	2018-2020	NMC111 oxide	kg	U
NMC532 oxide production, for Li-ion battery	CN	2020-2024	NMC532 oxide	kg	U

NMC532 oxide production, for Li-ion battery	GLO	2020-2024	NMC532 oxide	kg	U
NMC622 oxide production, for Li-ion battery	CN	2018-2023	NMC622 oxide	kg	U
NMC622 oxide production, for Li-ion battery	GLO	2018-2023	NMC622 oxide	kg	U
NMC811 oxide production, for Li-ion battery	CN	2018-2020	NMC811 oxide	kg	U
NMC811 oxide production, for Li-ion battery	GLO	2018-2020	NMC811 oxide	kg	U
treatment of used Li-ion battery, hydrometallurgical treatment	GLO	2005-2005	lithium carbonate, battery grade	kg	U

9.2 Aluminium Value Chain

9.2.1 Anode, Paste and Anode, Prebake Production: Updates to Calcined Petroleum Coke (CPC) Input

As described in the Fuels section, the Calcined Petroleum Coke (CPC) supply chain was updated for the ecoinvent v3.13 release. These changes affect downstream datasets in the metals sector, as listed in **Table 13**, in the **Fuels** section.

The changes to the CPC supply chain improve the geographical representativeness of CPC inputs to aluminium anode production. Previously, CPC inputs were linked to the Chinese CPC market as a proxy, regardless of the anode dataset's geography. In ecoinvent v3.13, these inputs are linked to the newly introduced CPC markets, reflecting each region's supply mix. This, in turn, improves the representativeness of downstream aluminium datasets. For a detailed description of the changes to the CPC supply chain and the new datasets introduced, refer to the CPC updates in the **Fuels** section.

9.2.2 Aluminium Hydroxide Production | IAI Area, Asia, without China and GCC: Sulfur Hexafluoride Uncertainty Distribution

The uncertainty distribution of the sulfur hexafluoride (SF6) emission exchange in 'aluminium hydroxide production | IAI Area, Asia, without China and GCC' has been corrected from normal to lognormal. This is consistent with ecoinvent data quality guidelines and all other regional variants of the dataset. Users can now obtain physically plausible Monte Carlo uncertainty results for downstream systems relying on this dataset, including photovoltaic supply chains.

9.2.3 Market for Aluminium, Cast Alloy | GLO: Consequential System Model

The 'market for aluminium, cast alloy |GLO' in the consequential system model has been corrected via a market overwrite to fix an incomplete supply mix present in v3.12. Users can now obtain accurate results for this market in the consequential system model.

10 Batteries and Electronics

10.1 New Datasets

In this new release of the database, the batteries and electronics sector introduces new modules and pack datasets to increase the granularity of the database. More specifically, battery packs of 75 kWh and 100 kWh, along with their supporting modules, are created for six battery chemistries (NMC111, NMC532, NMC622, NMC811, LFP and NCA). These new datasets are built using a structured methodology relying on BatPaC (Knehr et al., 2022) and are linked to pre-existing cell datasets.

These new datasets allow users to model packs closer to the sizes used in most electric vehicles today (roughly 75–100 kWh). The packs and modules were designed using an energy configuration, i.e., one with a low P/E (Power/Energy) ratio, rather than a power configuration, in which the battery sustains higher power peaks, so with a high P/E ratio. Energy configurations are typically used in electric vehicles, whereas power configurations are more common in hybrid or mild-hybrid vehicles. Power configurations are not yet covered in the database.

The names of the pack datasets include the total energy of the pack, to allow users to directly pick a product close to their needs. More information on the specific energy, number of modules, and total weight of the pack is indicated within the metadata of the datasets. For the module datasets, the names include the energy of the module as well as the number of cells and the energy of individual cells. This was chosen as modules are more likely to be reused and adapted for other applications, and the design (in terms of number of cells and the energy of those cells) can influence the choices of the users.

The new datasets created and their associated reference products are listed in **Table 21**.

Table 21**. New Batteries Transforming Activity Datasets for V3.13**

Activity Name	Geography	Time Period	Product Name	Unit
battery pack production, NMC622-G, 100 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC622-G, 100 kWh, Energy configuration	kg
battery pack production, NMC811-G, 100 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC811-G, 100 kWh, Energy configuration	kg
module production, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	kg
module production, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	kg
module production, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
module production, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	kg

module production, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	kg
module production, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
battery pack production, LFP-G, 100 kWh, Energy configuration	CN	2022 - 2026	battery pack, LFP-G, 100 kWh, Energy configuration	kg
battery pack production, NCA-G, 100 kWh, Energy configuration	CN	2022 - 2026	battery pack, NCA-G, 100 kWh, Energy configuration	kg
battery pack production, NMC111-G, 100 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC111-G, 100 kWh, Energy configuration	kg
battery pack production, NMC532-G, 100 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC532-G, 100 kWh, Energy configuration	kg
module production, NCA-G, 3.7 kWh with 15 cells of 249 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NCA-G, 3.7 kWh with 15 cells of 249 Wh, Energy configuration, for Li-ion battery	kg
module production, NMC111-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC111-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
module production, NMC532-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC532-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
module production, NMC622-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC622-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	kg
module production, NMC811-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, NMC811-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
battery pack production, LFP-G, 75 kWh, Energy configuration	CN	2022 - 2026	battery pack, LFP-G, 75 kWh, Energy configuration	kg
battery pack production, NCA-G, 75 kWh, Energy configuration	CN	2022 - 2026	battery pack, NCA-G, 75 kWh, Energy configuration	kg
battery pack production, NMC111-G, 75 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC111-G, 75 kWh, Energy configuration	kg
battery pack production, NMC532-G, 75 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC532-G, 75 kWh, Energy configuration	kg
battery pack production, NMC622-G, 75 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC622-G, 75 kWh, Energy configuration	kg
battery pack production, NMC811-G, 75 kWh, Energy configuration	CN	2022 - 2026	battery pack, NMC811-G, 75 kWh, Energy configuration	kg
module production, LFP-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	CN	2022 - 2026	module, LFP-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	kg

Additionally, market datasets for China and global (GLO) were created. The local production in China feeds both the Chinese market and the global one. The new market datasets are listed in **Table 22**.

Table 22**. New Batteries Market Datasets for V3.13**

Activity Name	Geography	Time Period	Product Name	Unit
market for battery pack, NMC622-G, 100 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC622-G, 100 kWh, Energy configuration	kg
market for battery pack, NMC811-G, 100 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC811-G, 100 kWh, Energy configuration	kg
market for module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	kg
market for module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
market for battery pack, LFP-G, 100 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, LFP-G, 100 kWh, Energy configuration	kg
market for battery pack, NCA-G, 100 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NCA-G, 100 kWh, Energy configuration	kg
market for battery pack, NMC111-G, 100 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC111-G, 100 kWh, Energy configuration	kg
market for battery pack, NMC532-G, 100 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC532-G, 100 kWh, Energy configuration	kg
market for module, NCA-G, 3.7 kWh with 15 cells of 249 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NCA-G, 3.7 kWh with 15 cells of 249 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC111-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC111-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC532-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC532-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC622-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC622-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	kg
market for module, NMC811-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, NMC811-G, 3.7 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery	kg

market for battery pack, LFP-G, 75 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, LFP-G, 75 kWh, Energy configuration	kg
market for battery pack, NCA-G, 75 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NCA-G, 75 kWh, Energy configuration	kg
market for battery pack, NMC111-G, 75 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC111-G, 75 kWh, Energy configuration	kg
market for battery pack, NMC532-G, 75 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC532-G, 75 kWh, Energy configuration	kg
market for battery pack, NMC622-G, 75 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC622-G, 75 kWh, Energy configuration	kg
market for battery pack, NMC811-G, 75 kWh, Energy configuration	CN, GLO	2022 - 2026	battery pack, NMC811-G, 75 kWh, Energy configuration	kg
market for module, LFP-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	CN, GLO	2022 - 2026	module, LFP-G, 3.7 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery	kg

10.2 Technical Corrections

As described in the metals section, the lithium supply chain was completely updated for the v3.13 release. This impacts battery datasets as listed in **Table 13**, in the **Fuels** section.

This change in the metals sector improves the technical and geographical representativeness of the lithium supply chain, hence improving the downstream representativeness of battery datasets. For further description of the changes and the new products created, refer to the **Fuels** section, Chapter **5.3**, and metals section, Chapter **9.1.**

11 Waste Management and Recycling

11.1 Sector Introduction

The waste treatment and recycling sector is responsible for representing the management of solid wastes (treatment, recycling, disposal) and wastewater treatment in the ecoinvent database. There is a large interplay with other sectors, as they generate waste to be disposed of, or those treatments provide valuable products to re-enter the market. Waste specificity and regional differentiation are important characteristics of waste treatment datasets.

11.2 Updates in the Waste Sector for Version 3.13

Version 3.13 includes a minor correction on inventory indicators of waste disposal, for use in the EN15804 system model, as well as corrections on phosphate, nitrate, and/ or sulfate emissions in three coal treatment datasets. It also introduces waste treatment datasets for pharmaceutical waste solvents and wastewater.

11.2.1 Pharmaceutical Waste Treatment Datasets

Pharmaceutical production processes were added to ecoinvent v3.13 as described in Chapter **0**. These processes also include the recycling and recovery of several solvents, which can be found in **Table 9**, Chapter **4.1.** The waste sector contributes end-of-life treatment activities for two newly introduced waste flows: waste solvent, which goes to incineration, and wastewater from pharmaceutical production, which goes to wastewater treatment. Primary treatment datasets were added for four regional geographies: RER, RNA, RAS, and RLA. Secondary treatments (e.g., landfilling of incineration residues, utilization of sewage sludge generated in wastewater treatment) are similarly introduced. **Table 23** shows the 68 new treatment and market activities.

Table 23. Waste Treatment Datasets Added for the Wastes Generated in the New Pharmaceutical Production Processes

Activity Name	Geography
treatment of wastewater from pharmaceutical production, wastewater treatment	RNA; RLA; RER; RAS
treatment of waste solvent, municipal incineration	RNA; RLA; RER; RAS
treatment of sewage sludge, 97% water, WWT, WW from pharmaceutical production, landfarming	RNA; RLA; RER; RAS
treatment of sewage sludge, 75% water, WWT, WW from pharmaceutical production, unsanitary landfill	RLA; RAS
treatment of sewage sludge, 75% water, WWT, WW from pharmaceutical production, sanitary landfill	RNA; RLA; RER; RAS
treatment of sewage sludge, 70% water, WWT, WW from pharmaceutical production, municipal incineration	RNA; RER; RAS

treatment of residues, MSWI-WWT, WW from pharmaceutical production, residual material landfill	RNA; RER; RAS
treatment of residues, MSWI, waste solvent, residual material landfill	RNA; RLA; RER; RAS
treatment of bottom ash, MSWI-WWT, WW from pharmaceutical production, slag compartment	RNA; RER; RAS
treatment of bottom ash, MSWI, waste solvent, slag compartment	RNA; RLA; RER; RAS
market for wastewater from pharmaceutical production	RNA; RLA; RER; RAS
market for waste solvent	RNA; RLA; RER; RAS
market for sewage sludge, 97% water, WWT, WW from pharmaceutical production	RNA; RLA; RER; RAS
market for sewage sludge, 75% water, WWT, WW from pharmaceutical production	RNA; RLA; RER; RAS
market for sewage sludge, 70% water, WWT, WW from pharmaceutical production	RNA; RER; RAS
market for residues, MSWI-WWT, WW from pharmaceutical production	RNA; RER; RAS
market for residues, MSWI, waste solvent	RNA; RLA; RER; RAS
market for bottom ash, MSWI-WWT, WW from pharmaceutical production	RNA; RER; RAS
market for bottom ash, MSWI, waste solvent	RNA; RLA; RER; RAS

11.2.2 Correction on EN15804 Waste Indicators

Waste treatment processes often include the Elementary Exchanges “Hazardous waste disposed (HWD)” and “Non-hazardous waste disposed (NHWD)”, to be used by the EN15804 system model and calculation. After internal harmonization of said indicators in v3.12, a double counting of the indicator was spotted on some treatment activities. When the indicator flow exists both in the treatment activity itself and in the “process-specific burdens” input, the two indicator flows are added, resulting in double counting in the treatment activity. Therefore, the indicator was removed from the “process-specific burdens” datasets, which are listed in **Table 24**.

Table 24. Datasets with EN15804 Indicators Removed. The inventory indicators “Hazardous waste disposed” (HWD) or “Non-hazardous waste disposed” have been removed from these datasets.

Activity Name	Geography	Indicator Removed
process-specific burdens, hazardous waste incineration plant	CH	HWD
process-specific burdens, slag landfill	Europe without Switzerland	NHWD
process-specific burdens, slag landfill	CH	NHWD
process-specific burdens, residual material landfill	Europe without Switzerland	HWD
process-specific burdens, sanitary landfill	CH	NHWD
process-specific burdens, residual material landfill	CH	HWD

11.2.3 Correction on Coal Waste Landfilling Datasets

A few datasets concerning the disposal of residues generated during coal mining have been corrected. A mistake was identified in the conversion of contained phosphorus to phosphate. The three affected datasets are shown below in **Table 25**. For the “*treatment of coal slurry, impoundment”* dataset, the nitrate and sulfate emissions were also erroneously underestimated and have been similarly corrected.

Table 25. Datasets with Updated Nitrate, Phosphate and Sulfate Emissions

Activity Name	Exchange Name	Geography	Time Period
treatment of spoil from hard coal mining, in surface landfill	Phosphate	GLO	1985-2025
treatment of spoil from lignite mining, in surface landfill	Phosphate	GLO	1985-2025
treatment of coal slurry, impoundment	Phosphate; Nitrate; Sulfate	GLO	1985-2025

This modification causes an increase in the eutrophication scores of these datasets, as well as across the database, as coal, coke, and lignite datasets depend on these treatments and appear in many supply chains. The coal slurry dataset had a large relative increase compared to previous values but is not widely propagating to other datasets. In the cut-off system model, eutrophication impact from phosphorus generally increases between 0-34% across the database due to this change. Nitrogen-based eutrophication metrics increase by less than 3% (except for the large relative increase in the coal slurry impoundment dataset).

12 Agriculture, Fishery and Animal Husbandry

12.1 General Overview

Regarding the agriculture, fishery and animal husbandry sector, no new projects have been added to the database for v3.13. Only one important technical correction has been implemented to improve existing datasets and correct existing issues. Hence, this section will provide a clear description of technical corrections in specific datasets.

12.1.1 Technical Corrections for Australian Datasets

In several Australian cereal datasets from different regions, a carbon imbalance was identified due to the incorrect assignment of the amount of embodied biogenic carbon. Specifically, the amount of "Carbon dioxide, non-fossil" from the group To Environment was mistakenly assigned to the flow "Carbon dioxide, land transformation". Hence, for the datasets reported in **Table 26**, the amount of elementary exchange "Carbon dioxide, non-fossil" has been updated to derive the emissions from burning residues. Also, the comments for specific flows have been corrected accordingly, as shown in **Table** 27. This overall issue was already present in v3.11 and v3.12. For this specific reason, it has been reported in the “Known issues” section on ecoinvent web pages for both versions.

Table 26. Updated Amount of “Carbon Dioxide, Non-Fossil” for Australian Cereal Datasets.

Activity Name	Geography	Exchange Name	Compartment	Sub-Compartment	Unit	Updated Exchange Amount
barley grain production	AU-WA	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.598506155
barley grain production	AU-NSW	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.593384789
barley grain production	AU-QLD	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.598506155
barley grain production	AU-SA	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.596585643
barley grain production	AU-TAS	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.593064704
barley grain production	AU-VIC	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.593704875
maize grain production	AU-NSW	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.329548774
maize grain production	AU-QLD	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.160940211
maize grain production	AU-VIC	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.319010739
oat grain production	AU-QLD	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.768142347

oat grain production	AU-NSW	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.762477493
oat grain production	AU-SA	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.766018027
oat grain production	AU-TAS	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.76212344
oat grain production	AU-VIC	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.762831547
oat grain production	AU-WA	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	1.768142347
rape seed production	AU-NSW	Carbon dioxide, non-fossil	air	non-urban air or from high stacks	kg	2.69847424

Table 27. Updated Comments for Specific Exchanges for Australian Cereal Datasets.

Activity Name	Geography	Group	Exchange Name	Compartment	Exchange Comment
barley grain production	AU-WA	To Environment	Carbon dioxide, non-fossil	air	emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x fraction burnt* emission factor from NPI workbook/1000 (Environment Australia, 1999).
oat grain production	AU-QLD	To Environment	Carbon dioxide, non-fossil	air	emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x fraction burnt* emission factor from NPI workbook/1000 (Environment Australia, 1999).
barley grain production	AU-WA	To Environment	2,4-D	air	mass of active ingredient 2,4-D applied x fraction released in air - Primary partitioning from PestLCI (Nemecek et al., 2022)
barley grain production	AU-WA	To Environment	2,4-D	soil	4.09E-04 kg --- mass of active ingredient 2,4-D applied x fraction released off field and redeposited to other agricultural land and fraction reaching soil. +2.99E-05 kg --- mass of active ingredient 2,4-D applied x fraction released off field and redeposited to natural land - Primary partitioning from PestLCI (Nemecek et al., 2022).

barley grain production	AU-WA	To Environment	2,4-D	water	5.55E-07 kg --- mass of active ingredient 2,4-D applied x fraction released off field and redeposited to freshwater.
barley grain production	AU-WA	From Technosphere	ammonium nitrate	-	mass ammonium nitrate
barley grain production	AU-WA	To Environment	Antimony ion	air	emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x fraction burnt* emission factor from NPI workbook/1000 (Environment Australia, 1999).
barley grain production	AU-WA	From Technosphere	application of plant protection product, by field sprayer		number of times ha is processed x surface
barley grain production	AU-WA	To Environment	Arsenic ion	air	emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x fraction burnt* emission factor from NPI workbook/1000 (Environment Australia, 1999).
barley grain production	AU-WA	To Environment	Butadiene	air	emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x fraction burnt* emission factor from NPI workbook/1000 (Environment Australia, 1999).
barley grain production	AU-WA	To Environment	Cadmium II	air	Emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x fraction burnt* emission factor from NPI workbook/1000 (Environment Australia, 1999).
barley grain production	AU-WA	To Environment	Cadmium II	soil	Mass of metal Cadmium contained in fertilizer x fraction released in soil
barley grain production	AU-WA	From Environment	Carbon dioxide, in air	natural resource	atmospheric CO2 absorbed by the plant yield * drymatter content of crop * carbon content of crop + plant residue x dry matter content of residue x carbon content of residue all multiplied by carbon to carbon dioxide conversion factor.

barley grain production	AU-WA	To Environment	Carbon monoxide, non-fossil	air	emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x carbon content x CO emission factor x conversion factor.
barley grain production	AU-WA	To Environment	Chromium VI	air	emissions from burning residues = yield x quantity of plant residue x fraction of residues remaining at time of burning x dry matter content x burning efficiency x fraction burnt* emission factor from NPI workbook/1000 (Environment Australia, 1999)
barley grain production	AU-WA	To Environment	Clopyralid	air	mass of active ingredient clopyralid applied x fraction released in air - Primary partitioning from PESTLCI (Nemecek et al., 2022).

12.1.2 Technical Corrections for Carbon Balance

Further to the carbon balance correction applied in v3.12, a carbon imbalance was identified in the Brazilian land use change, perennial crop datasets. Since v3.11, carbon uptake in land-use-change datasets is meant to be balanced using "Carbon dioxide, to soil or biomass stock" instead of "Carbon dioxide, in air". This is because both flows are characterized with a -1 factor, so keeping both would count the same carbon uptake twice. In the affected Brazilian datasets, the v3.12 correction added "Carbon dioxide, to soil or biomass stock" as intended, but the legacy "Carbon dioxide, in air" flow it was meant to replace was not deleted. This inconsistency remains unresolved and results in a double counting of carbon uptake for these datasets. **Table 28** reports the flows that were deleted in v3.13.

Table 28. Updated Amount of “Carbon Dioxide, Non-Fossil” for Australian Cereal Datasets

Activity Name	Geography	Group	Exchange Name	Updated Exchange Amount
land use change, perennial crop	BR-AC	From Environment	Carbon dioxide, in air	124.09
land use change, perennial crop	BR-AL	From Environment	Carbon dioxide, in air	1410.279
land use change, perennial crop	BR-AM	From Environment	Carbon dioxide, in air	71.52956
land use change, perennial crop	BR-AP	From Environment	Carbon dioxide, in air	0.111453
land use change, perennial crop	BR-BA	From Environment	Carbon dioxide, in air	207.9113

land use change, perennial crop	BR-CE	From Environment	Carbon dioxide, in air	978.2663
land use change, perennial crop	BR-DF	From Environment	Carbon dioxide, in air	148.4828
land use change, perennial crop	BR-ES	From Environment	Carbon dioxide, in air	972.7144
land use change, perennial crop	BR-GO	From Environment	Carbon dioxide, in air	697.2316
land use change, perennial crop	BR-MA	From Environment	Carbon dioxide, in air	415.0949
land use change, perennial crop	BR-MG	From Environment	Carbon dioxide, in air	1237.747
land use change, perennial crop	BR-MS	From Environment	Carbon dioxide, in air	498.5884
land use change, perennial crop	BR-MT	From Environment	Carbon dioxide, in air	122.0998
land use change, perennial crop	BR-PA	From Environment	Carbon dioxide, in air	186.5713
land use change, perennial crop	BR-PB	From Environment	Carbon dioxide, in air	1358.374
land use change, perennial crop	BR-PE	From Environment	Carbon dioxide, in air	940.3454

13 Pulp and Paper

The pulp and paper sector has been enhanced with new and updated data focused on carton and paper production in Europe.

13.1 Updated Data for Corrugated Board Production in Europe

Data on corrugated board production were updated with data from the production year 2024. The data were collected by the European Federation of Corrugated Board Manufacturers (FEFCO) and provided to the ecoinvent database in collaboration with the Research Institutes of Sweden (RISE). The updated data were also used to update the recontextualized global datasets. The updated datasets related to corrugated board box production are listed in **Table 29**.

Table 29. Updated Corrugated Board Datasets

Activity Name	Geography	Time Period	Product Name
containerboard production, fluting medium, recycled	RER; GLO	2024–2026	containerboard, fluting medium
containerboard production, fluting medium, semichemical	RER; GLO	2024–2026	containerboard, fluting medium
containerboard production, linerboard, kraftliner	RER; GLO	2024–2026	containerboard, linerboard
containerboard production, linerboard, testliner	RER; GLO	2024–2026	containerboard, linerboard
corrugated board box production	RER; GLO	2024–2026 (RER); 2014–2024 (GLO)	corrugated board box

13.2 Updated and New Data for Kraft Paper Production in Europe

Datasets on kraft paper and paper sack production were updated using data from the production year 2024. As part of this update, a new dataset, "kraft paper production, for bags and wrapping," was introduced alongside the existing "kraft paper production" dataset.

The two datasets represent different kraft paper types and end uses. The original "kraft paper production" dataset represents kraft paper used in paper sacks for high-strength applications, such as cement or pet food packaging. The new "kraft paper production, for bags and wrapping" dataset represents machine-glazed (MG) and machine-finished (MF) kraft paper, which is typically used in lighter-duty applications such as grocery bags and wrapping.

The data were collected by CEPI Eurokraft and Eurosac and then provided to the ecoinvent database in collaboration with the Research Institutes of Sweden (RISE). The data were also

used to update and create the recontextualized global datasets. The datasets related to kraft paper and paper sack production are listed in **Table 30**.

Table 30. Updated (U) and New (N) Kraft Paper and Paper Sack Datasets.

Activity Name	Geography	Time Period	Product Name	Status
kraft paper production	RER; GLO	2024–2026	kraft paper	U
kraft paper production, for bags and wrapping	RER; GLO	2024–2026	kraft paper, for bags and wrapping	N
paper sack production	RER; GLO	2024–2026	paper sack	U

13.3 New Data for Cartonboard Production and Conversion in Europe

Datasets on cartonboard production and conversion were introduced to the database. Both virgin and recycled cartonboard production are modeled, as well as the conversion of cartonboard to folding cartons. The datasets represent the production year 2024 in Europe. The data were collected by Pro Carton and provided to the ecoinvent database in collaboration with the Research Institutes of Sweden (RISE). The data were also used to create the recontextualized global datasets

The virgin cartonboard activity replaces the activities “solid bleached and unbleached board carton production” (SBB/SUB) in RER and “folding boxboard carton production” (FBB) in RER and GLO. The recycled cartonboard activity replaces the activity “white lined chipboard carton production” (WLC) in RER and GLO. However, please note that the system boundaries of the old and new datasets are somewhat different. For more information, please refer to the information provided below **Table 31**.

Table 31. New Cartonboard Production and Conversion Activities, and the Corresponding Old Activities
*System boundaries are slightly different from those in the removed activity; please read more below the table.

Removed activity	Corresponding Activity in V3.13*	Time Period in V3.13	Product Name in V3.13
folding boxboard carton production [RER; GLO] solid bleached and unbleached board carton production [RER]	cartonboard production, virgin [RER; GLO]	2024–2026	cartonboard, virgin

white lined chipboard carton production [RER; GLO]	cartonboard production, recycled [RER; GLO]	2024–2026	cartonboard, recycled
-	folding carton production [RER; GLO]	2024–2026	folding carton

The new carton datasets are structured differently from the previous ones. The previous SBB/SUB, FBB, and WLC production datasets merged two distinct processes into one: cartonboard production and carton conversion. The new virgin and recycled cartonboard production datasets model only the production of cartonboard, and they feed into the folding carton production activity, which then converts the cartonboard into cartons. Consequently, the scores of the old and new activities are not fully comparable.

If you wanted to model the use of a finished flat carton product for packaging, you should opt for "folding carton" instead of “cartonboard, virgin” or “cartonboard, recycled”. Note that this dataset represents a weighted average of virgin and recycled cartonboard usage, so if you know that the raw material in your product system is either virgin or recycled, please modify the cartonboard input in the folding carton production dataset accordingly.

13.4 System-Model Specific Corrections

13.4.1 Correction to the Activity “Market for Waste Paper, Sorted” in APOS

In the APOS system model, "waste paper, sorted" is classified as a material-for-treatment (mft) product. Several datasets in the pulp and paper sector use "waste paper, sorted" as a technosphere input; because this product is an mft in APOS, these datasets supply the treatment of "waste paper, sorted", and therefore supply the market for "waste paper, sorted" as well.

However, two suppliers, "clay brick production, extruded" [RER] and "containerboard production, unspecified" [US], were missing from this market. As a result, their linking did not function correctly in APOS, and the affected inventories contained no technosphere flows.

This issue was corrected in v3.13: the two activities now correctly supply the market, and linking functions as expected. Because the technosphere flow supply chains are now complete, this correction also increases the impact assessment scores of the two activities in APOS.

13.4.2 Correction to the Activity “Market for Containerboard, Linerboard” in Consequential

As explained in Imbalanced Markets **15.1**, a number of market datasets in v3.12 were found to be imbalanced. In the pulp and paper sector, the activity "market for containerboard, linerboard" [RoW] was imbalanced in the Consequential system model and fixed for v3.13. As a result, the scores of consumers of "waste paperboard, sorted" increased in Consequential due to the effects of this change on supply chain modeling, as illustrated in **Figure 1**. In particular, the carton and paper production activities that use "waste paperboard, sorted" as their main fibre input were affected.

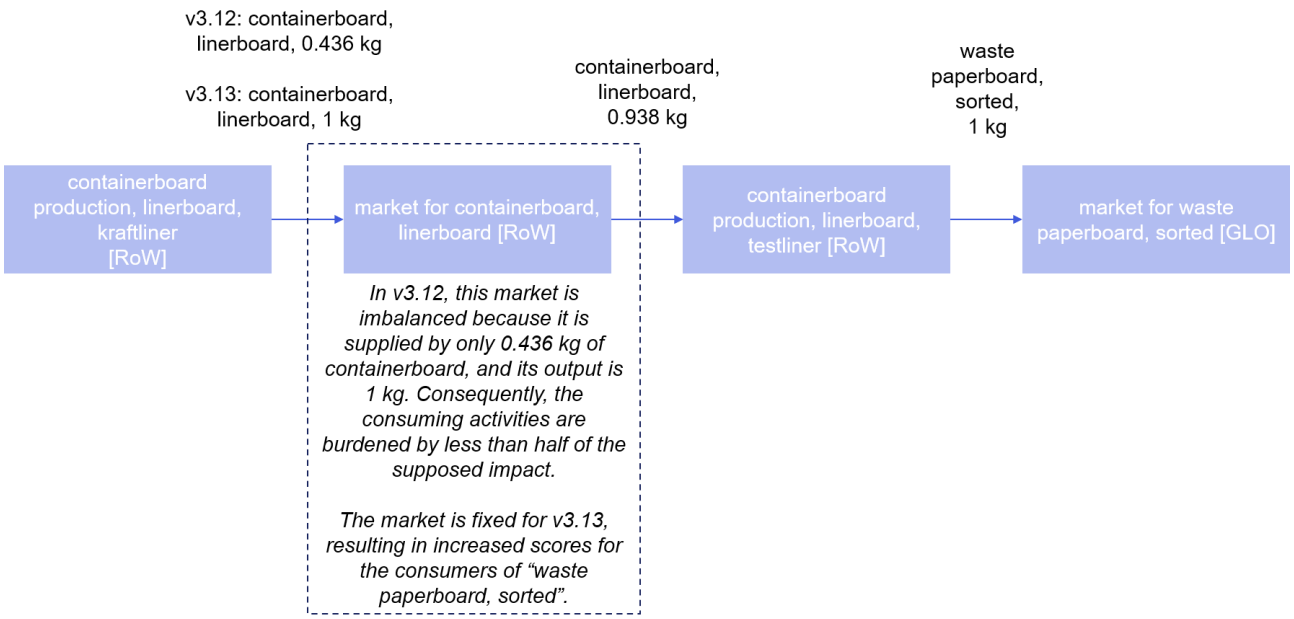


Figure 1. Supply Chain of "Waste Paperboard, Sorted" in the Consequential System Model
The upstream activity "market for containerboard, linerboard" [RoW] was imbalanced in v3.12 (0.436 kg input per 1 kg output) and corrected in v3.13 (1 kg input per 1 kg output).

14 Textiles

The ecoinvent v3.13 release includes a comprehensive update and regionalization of the cotton supply chain (seed-cotton production, ginning and the associated markets, for both conventional and organic cotton) as well as the addition of a flax rescutching dataset for Europe. These additions strengthen the coverage of Tier 4 textile data (raw material production & primary processing) for cotton and flax fibre across their main producing regions. The latest market data show that cotton remains the world's second most consumed fibre after polyester, and the most widely demanded natural fibre overall (Textile Exchange, 2025). Flax-linen accounts for 0.3% of global textile fibre demand, corresponding to approximately 5% of non-cotton plant-based fibres, making it the third-largest non-cotton plant-based textile fibre by market share (Textile Exchange, 2025); (Alliance for European Flax-Linen & Hemp, 2026).

Following the introduction of French hemp fibre data in v3.12, this release therefore continues to expand ecoinvent's coverage of some of the most widely used plant-based textile fibres.

14.1 New Data for Cotton

Cotton is the most widely used natural fibre in the textile industry. Up to v3.12, ecoinvent covered cotton cultivation with three conventional datasets (seed-cotton production, conventional for BD, IN-GJ and GLO) and two organic datasets (seed-cotton production, organic for IN-OR and GLO), followed by ginning in all regions where agricultural production was modeled, and only global (GLO) markets for organic & conventional seed-cotton, cottonseed and fibre, cotton.

In v3.13, this supply chain has been re-modelled with country-specific data for main producing countries (Brazil, China, India, Türkiye, and the USA for conventional cotton production, and Brazil, India, Peru, Türkiye, Tanzania, and the United States for organic cotton production) and new global datasets replacing the former global averages. The country-specific datasets are all derived from the cotton LCA study published by Textile Exchange (Thylmann et al., 2026). This project forms part of an ongoing collaboration with Textile Exchange (Textile Exchange, 2025) who are committed to improving the availability and quality of textile data for the apparel and footwear industry.

The original cotton LCA study from which the ecoinvent datasets are derived follows a non-comparative, attributional LCA approach. For publication in the ecoinvent database, the modeled processes were adapted to work in the four calculated System Models of cut-off, EN15804, consequential, and APOS, which are not all attributional. More details on the modeling choices are described in Section **14.1.3**.

Users are encouraged to consult the metadata of the ecoinvent datasets as well as the published cotton LCA study (Thylmann et al., 2026) to read more details on assumptions taken, modeling choices, data quality differences between regional datasets, and differences in modeling between ecoinvent and the original study.

14.1.1 Conventional Seed-Cotton Production

New conventional production data are represented for Brazil, China, India, Türkiye, and the United States, accounting for almost three-quarters of global production (Textile Exchange, 2025). For seed-cotton cultivation in India and the United States, the data are mainly primary data, whilst secondary data sources were mainly used for Brazil, China, and Türkiye.

The term ‘conventional’ is used in ecoinvent activity naming to maintain consistency with existing datasets for the same process, and to distinguish these from organic production. However, users should be aware that where secondary data sources such as national statistics were used, the underlying data may also include contributions from cotton produced under specific sustainability or government initiative programs. More details regarding this can be found in the full cotton LCA study (Thylmann et al., 2026).

In versions preceding v3.13, a dataset for conventional seed-cotton production existed for the IN-GJ geography, and a conventional cotton ginning dataset existed for the IN geography. These have both been replaced with newly updated datasets representative of the country-level geography for India. These changes are listed in **Table 32** and **Table 34**. Furthermore, new markets for seed-cotton and seed-cotton, organic, have been created for all geographies, including the BD and IN geographies, where previously only the GLO market existed.

14.1.2 Organic Seed-Cotton Production

New organic production data is represented for Brazil, India, Peru, Türkiye, Tanzania, and the United States, covering around three-quarters of global organic production (Textile Exchange, 2025). For organic seed-cotton cultivation, the data are mainly primary data for all modeled geographies.

In ecoinvent versions preceding v3.13, a dataset for organic seed-cotton production existed for the IN-OR geography, and an organic cotton ginning dataset existed for the IN geography. These have both been replaced with newly updated datasets representative of the country-level geography for India. These changes are listed in **Table 32** and **Table 34**.

14.1.3 Ginning Process

Ginning is a critical post-harvest crop activity which transforms harvested seed-cotton into separated raw cotton fibres (lint) and cotton seeds. Despite this step being carried out near the fields, it was modeled separately in ecoinvent to enable increased transparency and improved supply chain analysis. All ginning datasets for both conventional and organic production systems are built using only secondary data sources, apart from the US and TZ datasets that include some primary data sources.

The allocation of burden between cotton fibre and cottonseed is based on economic allocation for system models that follow the attributional approach (cut-off, EN15804 and APOS).

The generation of ginning waste is also considered in the ginning datasets. This material is a heterogeneous mix of broken cottonseeds, fibres, dust, stones and plant residues. Disposal pathways for ginning waste include land application, dumping, incineration, landfilling, or cattle feeding (Ahsanul Haque et al., 2021), depending on the region. In ecoinvent v3.13, ginning waste is modeled as leaving the system burden-free in both cut-off and EN15804. This is also in line with the default allocation approach followed by the Cascale Cotton LCA Methodology (Cascale, 2025).

For consequential and APOS, the ginning waste is treated by a proxy ginning waste treatment process that models landfarming, whereby the material is spread on nearby fields. Since sufficient data on regional variation in utilization and treatment practices were not identified, only the nutrient-recovery pathway through land farming is modelled. Future versions of the ecoinvent database may expand the modelling of ginning waste treatment by including additional treatment pathways.

14.1.4 Updated Data for Global Cotton Datasets

The global datasets for seed-cotton cultivation and ginning (for both conventional and organic production) have been updated as weighted averages based on the new regional datasets. These changes are summarized in **Table 32**.

Since the former global averages are replaced by national datasets, results for seed-cotton and fibre now differ by country of origin.

14.1.5 Effect on Results for Cotton Products

Cultivation datasets were rebuilt with country-specific yields, fertilization, irrigation, crop protection and field operation data. The main modeling changes compared to v3.12 are summarized below. These changes have resulted in different score changes across multiple impact categories.

- **Irrigation:** Irrigation is now modeled per country with the respective national irrigation markets. For conventional cotton in IN-GJ, the amount of irrigation water in versions up to v3.12 contained a decimal error and was listed as 15 m^3/kg. The new irrigation value in the updated Indian dataset has decreased tenfold. This change has led to a significant score decrease in almost all impact categories for conventional Indian seed-cotton. Organic cotton, which was modeled as fully rain-fed in v3.12, is now irrigated in IN, PE, TR, US and GLO, while BR and TZ remain rain-fed.
- **Fertilisation:** Generic inorganic N & P fertiliser inputs were replaced by explicit mineral fertiliser products (urea, diammonium phosphate, NPK 15-15-15, potassium chloride, triple superphosphate) from national or regional markets. Country-specific manure and compost inputs have also been included.
- **Crop protection:** Active ingredients and application rates are found in all relevant seed-cotton production datasets. Substances that are no longer in use, such as trichlorfon, were removed. Organic datasets now include azadirachtin (neem) and copper-based products.
- **Field emissions:** Nitrate leaching, ammonia, N_2O, phosphorus losses, and heavy-metal balances were recalculated with the updated fertilizer and pesticide inputs.
- **Land-use change:** CO_2 emissions associated with LUC (0.27 kg CO_2/kg seed-cotton in the former GLO dataset) as well as the “land use change, annual crop” input in the former IN-GJ and IN-OR datasets are no longer included. Land-use change is not currently included in the new ecoinvent seed-cotton cultivation datasets because it will be incorporated as part of an upcoming sector-wide update of agricultural datasets in future releases. This is a notable modeling difference from the cotton LCA study (Thylmann et al., 2026) which considers emissions from direct land-use change for conventional seed-cotton production in Brazil.
- **Field operations:** All new seed-cotton production datasets (conventional and organic) received field operation exchanges. The organic datasets in releases up to v3.12 contained no field operations, whereas the conventional IN-GJ dataset only contained tillage.

Regional markets for seed-cotton, cottonseed, and cotton fibre (conventional and organic) were created for each new geography, each supplied by the domestic producer. Global markets are now only supplied by global transforming activities. In versions up to v3.12, only a global market for fibre, cotton existed, which was supplied by RoW (74 %), IN (25 %), and BD (<1 %). Downstream cotton yarn production datasets, including regional production in India and Bangladesh, were all supplied by the global market. With the introduction of regional markets, downstream regional activities such as spinning, knitting and weaving are now supplied by upstream regional production. The regionalization of the supply chain has thus caused significant score differences in the downstream cotton activities. All new and updated cotton markets are listed in

Table 33.

Transport distances and modes in individual markets were updated to national averages. The short distances between the field and the ginning facility were obtained directly from the data provider. Other distances and modes for the transportation of ginned lint (cotton fibre) within individual countries were also updated or added.

Table 32. Summary of New and Updated Cotton Datasets. Activity names are reported in alphabetical order. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography column". The time period corresponds to that found in v3.13. In column V3.13, "N": "New Activity" and "U": "Updated Activity".

Activity Name	Geography	Time Period	Product Name	Unit	V3.13
fibre production, cotton, ginning	BR; CN; TR; US	2023 - 2031	fibre, cotton; cottonseed	kg;	N
fibre production, cotton, ginning	IN; GLO	2021 - 2031	fibre, cotton; cottonseed	kg	U
fibre production, cotton, organic, ginning	BR; PE; TR; TZ; US	2023 - 2031	fibre, cotton, organic; cottonseed, organic	kg	N
fibre production, cotton, organic, ginning	IN; GLO	2023 - 2031	fibre, cotton, organic; cottonseed, organic	kg	U
seed-cotton production, conventional	BR; TR; US	2015 - 2025	seed-cotton, conventional	kg	N
seed-cotton production, conventional	CN	2021 - 2021	seed-cotton, conventional	kg	N
seed-cotton production, conventional	IN	2021 - 2023	seed-cotton, conventional	kg	N
seed-cotton production, conventional	GLO	2021 - 2036	seed-cotton, conventional	kg	U
seed-cotton production, organic	BR	2023 - 2023	seed-cotton, organic	kg	N
seed-cotton production, organic	IN; PE; TZ; US	2021 - 2023	seed-cotton, organic	kg	N
seed-cotton production, organic	GLO	2021 - 2036	seed-cotton, conventional	kg	U
seed-cotton production, organic	TR	2021 - 2024	seed-cotton, conventional	kg	N
treatment of ginning waste, nutrient supply recovery	GLO	2026 - 2026	organic potassium fertiliser, as K2O; organic nitrogen fertiliser, as N; organic phosphorus fertiliser, as P2O5	kg	N

Table 33. Summary of New and Updated Markets for Cotton Products. Activity names are reported in alphabetical order. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography column". In column V3.13, "N": "New Activity" and "U": "Updated Activity".

Activity Name	Geography	Time Period	Product Name	Unit	V3.13
cottonseed to generic market for energy feed	BR; CN; TR; US	2020 - 2025	energy feed, gross; protein feed, 100% crude	MJ, kg	N
cottonseed to generic market for energy feed	BD; IN; GLO	2016 - 2017	energy feed, gross; protein feed, 100% crude	MJ, kg	U
cottonseed, organic to generic market for energy feed	BR; PE; TR; TZ; US	2020 - 2025	energy feed, gross; protein feed, 100% crude	MJ, kg	N
cottonseed, organic to generic market for energy feed	IN; GLO	2016 - 2017	energy feed, gross; protein feed, 100% crude	MJ, kg	U
market for cottonseed	BR; CN; TR; US	2020 - 2025	cottonseed	kg	N
market for cottonseed	GLO	2020 - 2025	cottonseed	kg	U
market for cottonseed, organic	BR; PE; TR; TZ; US	2020 - 2025	cottonseed, organic	kg	N
market for cottonseed, organic	GLO	2020 - 2025	cottonseed, organic	kg	U
market for fibre, cotton	BD; BR; CN; IN; TR; US	2020 - 2025	fibre, cotton	kg	N
market for fibre, cotton	GLO	2020 - 2025	fibre, cotton	kg	U
market for fibre, cotton, organic	BR; IN; PE; TR; TZ; US	2020 - 2025	fibre, cotton, organic	kg	N
market for fibre, cotton, organic	GLO	2020 - 2025	fibre, cotton, organic	kg	U
market for ginning waste	GLO	2020 - 2025	ginning waste	kg	N
market for seed-cotton	BD; BR; CN; IN; TR; US	2020 - 2025	seed-cotton, conventional	kg	N
market for seed-cotton	GLO	2020 - 2025	seed-cotton, conventional	kg	U
market for seed-cotton, organic	BR; IN; PE; TR; TZ; US	2020 - 2025	seed-cotton, organic	kg	N
market for seed-cotton, organic	GLO	2020 - 2025	seed-cotton, organic	kg	U

Table 34. Summary of Deleted and Replaced Cotton Datasets. Activity names are reported in alphabetical order. The "V3.12" column indicates activities replaced in the new version, while the "V3.13" column lists activities that replace older ones.

Activity Name	Geography	Time Period	Activity Name	Geography	Time Period
	V3.12			V3.13	
seed-cotton production, conventional	IN-GJ	2015 - 2025	seed-cotton production, conventional	IN	2021 - 2023
seed-cotton production, organic	IN-OR	2015 - 2025	seed-cotton production, organic	IN	2021 - 2023

14.2 New Data for Rescutched Short Flax Fibres in Europe

14.2.1 New Flax Dataset and Products

New data in the European flax supply chain models the rescutching process that is done to short scutched flax fibres. Rescutching is an important step in the flax-linen cottonization pathway since it prepares short flax fibres by improving their uniformity and cleanliness as required for subsequent textile applications. In undefined, the rescutching dataset is modeled as having a Reference Product output of “fibre, flax, short, rescutched”, along with valuable by-products “flax shive” and “duvex fibre, flax”. Economic allocation is applied in system models that follow the attributional approach (cut-off, EN15804 and APOS).

The addition of the new rescutching process, as well as markets and other auxiliary datasets, is detailed in **Table 35**.

Table 35. Summary of New Flax Datasets. Activity names are reported in alphabetical order. If several geographies of the same activity with the same time period exist, all of them are listed in the “Geography column”. The time period corresponds to that found in v3.13. In column V3.13, “N”: “New Activity” and “U”: “Updated Activity”.

Activity Name	Geography	Time Period	Product Name	Unit	V3.13
fibre production, flax, rescutching	RER	2021 - 2030	fibre, flax, short, rescutched; duvex fibre, flax; flax shive	kg	N
duvex fibre, flax to generic market for cellulose fibre	RER	2025 - 2026	cellulose fibre	kg	N
market for fibre, flax, short, rescutched	RER	2025 - 2026	fibre, flax, short, rescutched	kg	N
market for flax residues	GLO	2025 - 2026	flax residues	kg	N
market for duvex fibre, flax	RER	2025 - 2026	duvex fibre, flax	kg	N
treatment of flax residues, nutrient supply recovery	GLO	2026 - 2026	organic potassium fertiliser, as K2O; organic nitrogen fertiliser, as N; organic phosphorus fertiliser, as P2O5	kg	N

14.2.2 Updates to Flax Scutching Dataset in Europe

Technical corrections were carried out to existing European flax data to fix spotted issues. These are summarized in **Table 36**.

Table 36. Summary of Corrections in Flax Datasets

Activity Name	Geography	Time Period	Update
fibre production, flax, scutching	RER	2014 - 2018	The exchange amount of 0.000595 MJ for 'diesel, burned in building machine' was incorrect since this value represented kilos. This has been converted to the correct exchange units in MJ.

	The exchange ‘biowaste’ has been replaced with ‘flax residues’. The activity link for ‘flax straw, dew-retted’ has been deleted. This means that ‘flax straw, dew-retted’ is now supplied by its regional market which considers transportation. The General Comment has been updated.

15 Various Updates

15.1 Imbalanced Markets

A number of market datasets were found to exhibit mass-balance inconsistencies, with the input amount of the transported product being lower than the output amount. These imbalances were observed across all system models and arise from several causes. One reason is the incorrect linking of a market to an activity that does not produce the product transported by that market. Another contributing factor is the exclusion of certain activities in specific system models, in accordance with their respective modeling rules (e.g., APOS, consequential). As a result, the markets that would normally be supplied by these activities remain imbalanced. All market datasets affected by this issue are listed in **Table 37** below.

Table 37. Imbalanced Market Corrected for V3.13

Activity Name	Geography	Product Name
market for protein feed, 100% crude	GLO	protein feed, 100% crude
market for water, decarbonised	RoW	water, decarbonised
market for residual softwood, green, measured as green volume	RER	residual softwood, green, measured as green volume
market for residual softwood, green, measured as green volume	RoW	residual softwood, green, measured as green volume
market for copper, cathode	GLO	copper, cathode
market for nickel, class 1	GLO	nickel, class 1
market for used vegetable cooking oil	GLO	used vegetable cooking oil
market for biowaste, garden waste	GLO	biowaste, garden waste
market for biowaste, kitchen and garden waste	GLO	biowaste, kitchen and garden waste
market for glass cullet, from fluorescent lamps treatment	GLO	glass cullet, from fluorescent lamps treatment
market for acetone, liquid	RER	acetone, liquid
market for naphtha	RER	naphtha
market for sodium methoxide	GLO	sodium methoxide
market for butane	RoW	butane
market for containerboard, linerboard	RoW	containerboard, linerboard
market for waste plastic plaster, for final disposal	CH	waste plastic plaster, for final disposal

market for waste polypropylene, packaging, for recycling, unsorted	RER	waste polypropylene, packaging, for recycling, unsorted
market for used vegetable cooking oil, purified	GLO	used vegetable cooking oil, purified
market for used liquid crystal display	GLO	used liquid crystal display
market for used cathode ray tube display	GLO	used cathode ray tube display
market for spent sawing slurry from Si-wafer cutting	GLO	spent sawing slurry from Si-wafer cutting
market for sodium nitrate, unrefined	CL	sodium nitrate, unrefined
market for raw sewage sludge	RoW	raw sewage sludge
market for residual fuels	GLO	residual fuels
market for heavy fuel oil	Europe without Switzerland	heavy fuel oil
market for coke	RoW	coke
market for diesel	Europe without Switzerland	diesel

15.2 Additional Datasets in the APOS System Model

In the allocation at the point of substitution (APOS) system model, 64 datasets in v3.13 have been added that were not available in the previous releases. These datasets were inadvertently omitted from the APOS system model and have been restored with this release. The remaining system models (undefined, cut-off, consequential, and EN15804) are not affected.

The datasets concern waste treatment activities, or those seen as treatment activities by APOS, whose treated waste is not produced by any other activity in the database. Since such a treatment cannot be supplied with waste, APOS models it by assigning the full burden of the treatment to the valuable by-product it generates. That by-product becomes the reference product of the dataset, while the treatment of the waste itself is not offered as a separate dataset for these activities. In previous releases, the resulting datasets were not retained where the treatment had a single valuable by-product. This has been corrected. The full list of datasets is provided in **Table 38.**

Results for these markets, and for datasets that consume them, may therefore differ from v3.12. When comparing results between versions, differences in these supply chains should be read in light of this change rather than as changes in the underlying data.

Table 38. Additional Datasets in APOS in Version 3.13

Activity Name	Geography	Product Name
bronze scrap, post-consumer to generic market for bronze	GLO	bronze
glass cullet supply, from fluorescent lamps, for Saint-Gobain ISOVER SA	GLO	glass cullet, for Saint-Gobain ISOVER SA
pelletising of PS/ABS	RER	PS/ABS, pellets, recycled
pelletising of acrylonitrile-butadiene-styrene	RER	acrylonitrile-butadiene-styrene, pellets, recycled
pelletising of polyethylene	RER	polyethylene, pellets, recycled
pelletising of polyethylene terephthalate	RER	polyethylene terephthalate, pellets, recycled
pelletising of polyethylene terephthalate, coloured	RER	polyethylene terephthalate, pellets, coloured, recycled
pelletising of polyethylene/polypropylene	RER	polyethylene/polypropylene, pellets, recycled
pelletising of polypropylene	RER	polypropylene, pellets, recycled
pelletising of polystyrene	RER	polystyrene, pellets, recycled
recycled polyethylene terephthalate unsaturated polyester resin production	RER	recycled polyethylene terephthalate unsaturated polyester resin
treatment of leachate, SLF, waste newspaper, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of sewage sludge, 70% water, WWT, rainwater mineral oil storage, municipal incineration FAE	CH	heat, for reuse in municipal waste incineration only
treatment of sewage sludge, 97% water, WWT-SLF, cake from recycling of waste plastic, WEEE, landfarming	RER	organic nitrogen fertiliser, as N
treatment of used cathode ray tube display, mechanical treatment	GLO	iron scrap, sorted, pressed
treatment of used fluorescent lamp	GLO	mercury
treatment of used liquid crystal display, mechanical treatment	GLO	iron scrap, sorted, pressed
treatment of waste mixed polyolefins, unprocessed, sorting	GB	iron scrap, unsorted
treatment of waste plastic, consumer electronics, dismantling, sorting and cleaning, formal sector	IN	waste plastic, consumer electronics, sorted
treatment of waste plastic, consumer electronics, manual dismantling, sorting and cleaning, informal sector	IN	waste plastic, consumer electronics, sorted
treatment of waste plastic, refrigerator, flakes, recycling	RER	iron scrap, unsorted

treatment of waste plastic, small domestic appliances, recycling	RER	iron scrap, unsorted
treatment of waste polyester, industrial, from textile production, hydrothermal treatment	CN-ZJ	polyethylene terephthalate, pellets, recycled fibre based
treatment of waste polyethylene terephthalate, food grade, recycling	RER	polyethylene terephthalate, fines
treatment of waste polyethylene terephthalate, recycling	RER	iron scrap, unsorted
treatment of waste polyethylene, low density, packaging, recycling	RER	polyethylene, low density, pellets, recycled
treatment of waste polypropylene, packaging, pellets, recycling	RER	polypropylene, pellets, recycled
treatment of wastewater from recycling of waste PET, wastewater treatment	RER	iron scrap, sorted, pressed
clay brick production, extruded	RER	clay brick
dewatering of ethanol from biomass, from 95% to 99.7% solution state	CN	ethanol, without water, in 99.7% solution state, from fermentation
heat production, untreated waste wood, at furnace 1000-5000 kW	CH	heat, district or industrial, other than natural gas
heat production, untreated waste wood, at furnace 1000-5000 kW, state-of-the-art 2014	CH	heat, district or industrial, other than natural gas
paper production, newsprint, recycled	Europe without Switzerland	paper, newsprint
treatment of garden biowaste, home composting in heaps	FR	compost
treatment of kitchen and garden biowaste, home composting in heaps and containers	FR	compost
treatment of leachate, SLF, waste aluminium, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste graphical paper, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste paperboard, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste plastic plaster, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste plastic, mixture, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste polyethylene terephthalate, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste polyethylene, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste polypropylene, wastewater treatment	CH	iron scrap, sorted, pressed

treatment of leachate, SLF, waste polystyrene, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste polyurethane, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste polyvinylchloride, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of leachate, SLF, waste wood, untreated, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of rainwater mineral oil storage, wastewater treatment	CH	iron scrap, sorted, pressed
treatment of rainwater mineral oil storage, wastewater treatment	Europe without Switzerland	iron scrap, sorted, pressed
treatment of sewage sludge, 97% water, WWT-SLF, waste aluminium, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste paperboard, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste plastic plaster, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste plastic, mixture, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste polyethylene terephthalate, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste polyethylene, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste polypropylene, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste polystyrene, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste polyurethane, landfarming	CH	organic nitrogen fertiliser, as N
treatment of sewage sludge, 97% water, WWT-SLF, waste polyvinylchloride, landfarming	CH	organic nitrogen fertiliser, as N
treatment of used cathode ray tube display, manual dismantling	CH	iron scrap, unsorted
treatment of used vegetable cooking oil by anaerobic digestion	CH	biogas
treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting	US	waste polyethylene terephthalate, for recycling, sorted
treatment of waste, pneumatic tyres, open burning	GH	iron scrap, sorted, pressed
treatment of wastewater from anaerobic digestion of whey, wastewater treatment, rural	CH	iron scrap, sorted, pressed

16 References

Global Energy Monitor. (2026). *Global Energy Monitor - Trackers*. https://globalenergymonitor.org/

ACV Brazil. (2026). *https://acvbrasil.com.br/*. https://acvbrasil.com.br/

Ahsanul Haque, A. M., Remadevi, R., & Naebe, M. (2021). A review on cotton gin trash: Sustainable commodity for material fabrication. *Journal of Cleaner Production, 281*. https://www.sciencedirect.com/science/article/abs/pii/S0959652620353452?via%3Dihub

Alliance for European Flax-Linen & Hemp. (2026). *Everything you need to know about European flax.* Paris, France: Alliance for European Flax-Linen & Hemp. https://allianceflaxlinenhemp.eu/en/all-about-european-linen

Association of Issuing Bodies (AIB). (2026). *European Residual Mix*. https://www.aib-net.org/facts/european-residual-mix

Boehringer Ingelheim. (2026). Boehringer Ingelheim (Schweiz) GmbH. https://www.boehringer-ingelheim.com/ch

Brentrup, F., Lammel, J., Stephani, T., & Christensen, B. (2018). Updated carbon footprint values for mineral fertilizer from different world regions. *11th International Conference on Life Cycle Assessment of Food 2018 (LCA Food).*

BRGM. (n.d.). *BRGM – Service géologique national*. BRGM (Bureau de recherches géologiques et minières). https://www.brgm.fr/fr

Bundesnetzagentur. (2026). *Market*. https://www.smard.de. https://www.smard.de/home/downloadcenter/download-marktdaten/

Cascale. (2025). *Industry Aligned Life Cycle Assessment Methodology and Requirements for creating Cotton Fiber Datasets for the Higg Product Tools.* Version 1.1.

Central Electricity Authority, Ministry of Power, Government of India. (2026). *National Power Portal - Published Reports*. https://npp.gov.in/publishedReports

Cornerstone. (2026, March). *Making eGRID 2024 data easily accessible*. https://cornerstonedata.org/blog/egrid2024. https://zenodo.org/records/18968658

Eckert, M., Fleischmann, G., Jira, R., Bolt, H. M., & Golka, K. (2006). Acetaldehyde. In *Ullmann's Encyclopedia of Industrial Chemistry.* Wiley-VCH Verlag GmbH & Co. KGaA. https://doi.org/10.1002/14356007.a01_031.pub2

EIA. (2026). *Electric Power Industry - U.S. Electricity Imports from and Electricity Exports to Canada and Mexico (Megawatthours)*. Retrieved July 2024, from https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=table_7_01

Enerdata. (2026). *Global Energy & CO2 data*. https://www.enerdata.net. https://global-energy-data.enerdata.net/database

Enerdata. (2026). *Power Plant Tracker*. https://www.enerdata.net. https://www.enerdata.net/research/power-plant-database.html

ENTSO-E. (2026). *Physical Energy & Power Flows - Power flows from country to country*. Retrieved July 2024, from https://www.entsoe.eu. https://www.entsoe.eu/data/power-stats/

Environment Australia. (1999). *Emission Estimation Technique Manual for Aggregated Emissions from Prescribed Burning and Wildfires.* National Pollutant Inventory. https://www.dcceew.gov.au/sites/default/files/documents/burningff.pdf

European Commission. (2007). *Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers.* European Commission. https://bureau-industrial-transformation.jrc.ec.europa.eu/sites/default/files/2022-03/LVIC-AAF.pdf

European Commission. (2026). *Imports of electricity and derived heat by partner country, DOI:10.2908/nrg_ti_eh*. https://ec.europa.eu. https://ec.europa.eu/eurostat/databrowser/view/nrg_ti_eh/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_t.nrg_ti

European Commission. (2026). *Production of electricity and derived heat by type of fuel, DOI:10.2908/nrg_bal_peh*. https://ec.europa.eu. https://ec.europa.eu/eurostat/databrowser/view/nrg_bal_peh__custom_14425791/default/table?lang=en

European Commission Joint Research Centre (EUJRC). (2026). *Photovoltaic Geographical Information System (PVGIS)*. https://joint-research-centre.ec.europa.eu/photovoltaic-geographical-information-system-pvgis_en

Fertilizers Europe. (2000). *Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry. Booklet No. 1 of 8: Production of Ammonia.* Fertilizers Europe.

FitzGerald, D., Bourgault, G., Vadenbo, C., Sonderegger, T., Symeonidis, A., Fazio, S., Mutel, C., Müller, J., Dellenbach, D., Stoikou, N., Baumann, D., Clementi, M., Ioannou, I., Cirone, F., Superti, V., Beckert, P., Treichel, A., Kaarlela, O., Kunde, S., Valsasina, L., & Moreno Ruiz, E. (2023). *Documentation of changes implemented in the ecoinvent database v3.10.* Zürich: ecoinvent.

FitzGerald, D., Bourgault, G., Vadenbo, C., Sonderegger, T., Symeonidis, A., Fazio, S., Valente, A., Müller, J., Dellenbach, D., Stoikou, N., Bonanno, E., Baumann, D., Clementi, M., Ioannou, I., Cirone, F., Superti, V., Savant, S., Beckert, P., Treichel, A., Kaarlela, O., . . . Moreno Ruiz, E. (2024). *Documentation of changes implemented in the ecoinvent database v3.11.* Zürich: ecoinvent.

Franz, A. W., Kronemayer, H., Pfeiffer, D., Pilz, R. D., Reuss, G., Disteldorf, W., Gamer, A. O., & Hilt, A. (2016). Formaldehyde. In *Ullmann's Encyclopedia of Industrial Chemistry.* Wiley-VCH Verlag GmbH & Co. KGaA. https://doi.org/10.1002/14356007.a11_619.pub2

IAI. (2024). *International Aluminium Institute (IAI)*. Primary Aluminium Production – Definitions and Areas. https://international-aluminium.org/statistics/primary-

aluminium-production/?filter=%7B%22row%22%3A85%2C%22group%22%3Anull%2C%22multiGroup%22%3A%5B%5D%2C%22dateRange%22%3A%22monthly%22%2C%22monthFrom%22%3A2%2C%22monthTo%22%3A2%2C%22quarterFrom%22%3A1%2C%2

Knehr, K., Kubal, J. J., Nelson, P. A., & Ahmed, S. (2022). *A Manual for BatPaC v5.0: Battery Performance and Cost Modeling for Electric Vehicles.* Argonne National Laboratory. https://publications.anl.gov/anlpubs/2022/07/176234.pdf

Marinova, S., Deetman, S., van der Voet, E., & Daioglou, V. (2019). Global construction materials database and stock analysis of residential buildings between 1970-2050. *Journal of Cleaner Production*, 247, 119146. https://doi.org/10.1016/j.jclepro.2019.119146

Ministry of Mines and Energy, BR. (2025). *ANUÁRIO ESTATÍSTICO DE ENERGIA ELÉTRICA 2025*. https://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/anuario-estatistico-de-energia-eletrica

Ministry of Mines and Energy, PY. (2026). https://minasyenergia.mopc.gov.py. https://minasyenergia.mopc.gov.py/index.php?option=com_content&view=article&id=1805&Itemid=589

Ministry of Power. (2025). *All India Electricity Statistics- General Review 2025 (containing data for the year 2023-24).* New Delhi: Govenment of India, Ministry of Power, Central Electricity Authority.

Moreno Ruiz, E., Fitz Gerald, D., Symeonidis, A., Ioannidou, D., Müller, J., Valsasina, L., Vadenbo, C., Minas, N., Sonderegger, T., & Dellenbach, D. (2021). *Documentation of changes implemented in the ecoinvent database v3.8*. Zurich: ecoinvent. https://support.ecoinvent.org/hubfs/Knowledge%20Base/Database/Releases/3.8/Change-Report-v3.8.pdf

Moreno Ruiz, E., Fitz Gerald, D., Symeonidis, A., Ioannidou, D., Müller, J., Valsasina, L., Vadenbo, C., Minas, N., Sonderegger, T., & Dellenbach, D. (2022). *Documentation of changes implemented in the ecoinvent database v3.9.* Zurich: ecoinvent. https://support.ecoinvent.org/hubfs/Change-Report-v3.9.pdf

National Bureau of Statistics of China. (2026). *National data*. https://data.stats.gov.cn/dg/website/page.html#/pc/national/en/yearData

Nemecek, T., Antón, A., Basset-Mens, C., Gentil-Sergent, C., Renaud-Gentié, C., Melero, C., Naviaux, P., Peña, N., Roux, P., & Fantke, P. (2022). Operationalising emission and toxicity modelling of pesticides in LCA: the OLCA-Pest project contribution. *The International Journal of Life Cycle Assessment, 27*, 527-542. https://link.springer.com/article/10.1007/s11367-022-02048-7

Obershelp, C., Pfister, S., & Hellweg, S. (2023). Global site-specific health impacts of fossil energy, steel mills, oil refineries and cement plants. *Scientific Reports, 13*, 13708. https://doi.org/https://doi.org/10.1038/s41598-023-38075-z

Operador Nacional do Sistema Elétrico (ONS). (2026). *Intercâmbio do SIN com Outros Países*. https://dados.ons.org.br/. https://dados.ons.org.br/dataset/intercambio-nacional; https://dados.ons.org.br/dataset/intercambio-internacional

PAS 2090. (2026). *PAS 2090 Pharmaceutical products – Product category rules for environmental lifecycle assessments – Specification, Standards development project*. The British Standards Institution. https://standardsdevelopment.bsigroup.com/projects/9025-12045

PEG. (2026). *Pharma LCA Consortium*. Pharmaceutical Environment Group. https://peghub.org/lca

Pronovo. (2026). *Stromkennzeichnung*. https://www.strom.ch/de/service/stromkennzeichnung

StatCAN. (2026). *Statistics Canada Data*. https://www150.statcan.gc.ca/. https://www150.statcan.gc.ca/n1/en/type/data?subject_levels=25

Statista. (2018). *Global polystyrene production distribution by region*. Retrieved March 9, 2026, from Statista. https://www.statista.com/statistics/856709/ps-global-production-distribution-by-region/

Statista. (2023). *Global polystyrene production capacity*. Retrieved March 9, 2026, from Statista. https://www.statista.com/statistics/1065889/global-polystyrene-production-capacity/

Statista. (2024). *Production volume of acetaldehyde in India*. Retrieved April 21, 2026, from Statista. https://www.statista.com/statistics/727896/india-acetaldehyde-production-volume/

Stoikou, N., FitzGerald, D., Vadenbo, C., Sonderegger, T., Symeonidis, A., Fazio, S., Treichel, A., Ioannou, I., Bonanno, E., Kaarlela, O., Anagnostou, E., Beckert, P., Bichot, L., Bohara, K., Cassar, C., & F. (2025). *Documentation of changes implemented in the ecoinvent database v3.12.* Zürich: ecoinvent. https://support.ecoinvent.org/hubfs/Knowledge%20Base/Database/Releases/3.12/Change%20Report%20v3.12.pdf

Swiss Federal Office of Energy. (2026). *Electricity Statistics*. https://www.bfe.admin.ch/bfe/de. https://www.bfe.admin.ch/bfe/de/home/versorgung/statistik-und-geodaten/energiestatistiken/elektrizitaetsstatistik.html/

Textile Exchange. (2025). *Materials Market Report 2025.* Textile Exchange. https://textileexchange.org/knowledge-center/reports/materials-market-report-2025/

The Wind Power. (2026). *Wind power and wind farms database*. www.thewindpower.net

Thylmann, D., Matzke, I., Howel, C., Johnson, R., & Deimling, S. (2026). *Life Cycle Assessment for Cotton (Country averages, organic, regenerative, recycled).* Textile Exchange. https://textileexchange.org/knowledge-center/reports/cotton-life-cycle-assessment

Tokede, O., & Rouwette, R. (2024). Problematic consequences of the inclusion of capital goods inventory data in Environmental Product Declarations. *nternational Journal of Life Cycle Assessment,*, 29, 1–24. https://doi.org/10.1007/s11367-023-02231-4

United Nations Comtrade. (2026). *Trade Data*. https://comtradeplus.un.org/. https://comtradeplus.un.org/TradeFlow

van Valen, Y., Bergh, T., Skrzydło, T., Emanuelli, M., Gramazio, P., Bjørkedal, O. H., Lagmannsveen, A. K., Lødeng, R., Yang, J., & Venvik, H. J. (2025). Sub-reactions of the Silver Catalysed Conversion of Methanol to Formaldehyde. *Topics in Catalysis*, 2462–2477.

Wang, T., Berrill, P., Zimmerman, J., Rao, N., Min, J., & Hertwich, E. (2022). Improved Copper Circularity as a Result of Increased Material Efficiency in the U.S. Housing Stock. *Environmental Science & Technology*, 56(7), 4565–4577. https://doi.org/10.1021/acs.est.1c06474

17 Appendix

17.1 Products with Updated Prices

2-methyltetrahydrofuran [kg]; 2-pyrrolidone [kg]; acetone recycled [kg]; butylated hydroxyanisole [kg]; carbohydrates [kg]; carbomer [kg]; copovidone [kg]; croscarmellose sodium [kg]; dextrose [kg]; ethyl cellulose [kg]; ethyl chloride [kg]; gelatin, bovine [kg]; gelatin, porcine [kg]; hydroxypropylcellulose [kg]; hydroxypropylmethylcellulose [kg]; inorganic salts [kg]; lactose, anhydrous [kg]; lactose, monohydrate [kg]; L-alanine [kg]; L-alanyl-L-glutamine [kg]; L-alanyl-L-tyrosine [kg]; L-cysteine [kg]; L-cystine [kg]; L-glutamine [kg]; L-glycyl-L-glutamine [kg]; L-glycyl-L-tyrosine [kg]; L-histidine [kg]; L-leucine [kg]; L-lysine [kg]; L-proline [kg]; L-tyrosine [kg]; magnesium stearate [kg]; mannitol [kg]; lithium brine, concentrated, 6%Li [kg]; lithium carbonate, battery grade [kg]; lithium hydroxide monohydrate [kg]; lithium brine, concentrated, 4.3%Li [kg]; spodumene concentrate [kg]; lithium brine, concentrated, 0.15%Li [kg]; lithium brine, concentrated, 0.6%Li [kg]; lithium brine, concentrated, 1.39%Li [kg]; lithium brine, concentrated, 1.2%Li [kg]; battery pack, LFP-G, 100 kWh, Energy configuration [kg]; battery pack, NCA-G, 100 kWh, Energy configuration [kg]; battery pack, NMC111-G, 100 kWh, Energy configuration [kg]; battery pack, NMC532-G, 100 kWh, Energy configuration [kg]; battery pack, NMC622-G, 100 kWh, Energy configuration [kg]; battery pack, NMC811-G, 100 kWh, Energy configuration [kg]; module, LFP-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery [kg]; module, NCA-G, 5 kWh with 20 cells of 249 Wh, Energy configuration, for Li-ion battery [kg]; module, NMC111-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery [kg]; module, NMC532-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery [kg]; module, NMC622-G, 4.96 kWh with 20 cells of 248 Wh, Energy configuration, for Li-ion battery [kg]; module, NMC811-G, 4.95 kWh with 20 cells of 247 Wh, Energy configuration, for Li-ion battery [kg]; 1,6-dichlorohexane [kg]; 1,6-hexanediol [kg]; glutardialdehyde [kg]; phenethyl alcohol [kg]; propionyl chloride [kg]; 1,4-dimethyl-2-nitrobenzene [kg]; sodium acetate [kg]; battery pack, LFP-G, 75 kWh, Energy configuration [kg]; module, LFP-G, 3.71 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery [kg]; battery pack, NCA-G, 75 kWh, Energy configuration [kg]; module, NCA-G, 3.71 kWh with 15 cells of 249 Wh, Energy configuration, for Li-ion battery [kg]; battery pack, NMC111-G, 75 kWh, Energy configuration [kg]; module, NMC111-G, 3.71 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery [kg]; battery pack, NMC532-G, 75 kWh, Energy configuration [kg]; module, NMC532-G, 3.71 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery [kg]; battery pack, NMC622-G, 75 kWh, Energy configuration [kg]; module, NMC622-G, 3.71 kWh with 15 cells of 248 Wh, Energy configuration, for Li-ion battery [kg]; battery pack, NMC811-G, 75 kWh, Energy configuration [kg]; module, NMC811-G, 3.71 kWh with 15 cells of 247 Wh, Energy configuration, for Li-ion battery [kg]; fibre, cotton [kg]; fibre, cotton, organic [kg]; cottonseed [kg]; cottonseed, organic [kg]; cartonboard, virgin [kg]; folding carton [kg]; cartonboard, recycled [kg]; kraft paper, for bags and wrapping [kg]; lithium carbonate, technical grade [kg]; potassium fluoride [kg]; valeric acid [kg]; monofluorobenzene [kg]; 4,4-difluorobenzophenone [kg]; 2,4-difluorobenzophenone [kg]; duvex fibre, flax [kg]; fibre, flax, short, rescutched [kg]; flax shive [kg]; methyl ethyl ketone recycled [kg]; microcrystalline cellulose [kg]; monostearyl fumarate [kg]; monostearyl maleate [kg]; niacinamide [kg]; N-vinylpyrrolidone [kg]; pantothenic acid [kg]; poloxamer [kg]; polyethylene glycol [kg]; polypropylene glycol [kg]; polysorbate [kg]; povidone [kg]; purified water [m3]; pyridoxine, from pyruvate [kg]; recycled solvent [kg]; sodium stearyl fumarate [kg]; sorbitan monooleate [kg]; sorbitol [kg]; sucrose [kg]; tert-butanol [kg]; tetrachloroethylene recycled [kg]; tetrahydrofuran recycled [kg]; thiamine hydrochloride [kg]; triethyl amine recycled [kg]; trometamol [kg]; used acetone, for recycling [kg]; used methyl ethyl ketone, for recycling [kg]; used solvent, for recycling [kg]; used tetrachloroethylene, for recycling [kg]; used tetrahydrofuran, for recycling [kg]; used triethyl amine, for recycling [kg];

vitaminB12 [kg]; vitamins [kg]; water for injection, from distillation [m3]; pyridoxine, from oxazole [kg];

17.2 Additional Information on Chemicals and Plastics

Table 39: Acetaldehyde- and Polystyrene-Related Data in Version 3.13 Compared to 3.12. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. The "Version 3.12" columns show activities that were updated or replaced in that version, while the "Version 3.13" columns list activities that either replace older ones or include new data not previously covered.

Activity Name	Geography	Time Period	Activity Name	Geography	Time Period
	Version 3.12		**Version 3.13**		
	"New activity"		acetaldehyde production, ethylene oxidation	CN; IN; JP; US	1989 – 2022
	"New activity"		market for acetaldehyde	RAS; RER; US	2011 – 2011
	"New activity"		polystyrene production, expandable	RAS; RNA; UN-SAMERICA	2007 – 2024
	"New activity"		polystyrene production, general purpose	RAS; RNA; UN-SAMERICA	2007 – 2024
	"New activity"		polystyrene production, high impact	RAS; RNA; UN-SAMERICA	2007 – 2024
	"New activity"		market for polystyrene, expandable	RAS; RNA	2011 – 2011
	"New activity"		market for polystyrene, general purpose	RAS; RNA	2011– 2011
	"New activity"		market for polystyrene, high impact	RAS; RNA	2011 – 2011

Table 40: Newly Added Transforming Activity Data in Version 3.13 Not Previously Covered. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.

Activity Name	Geography	Time Period
monofluorobenzene production, aniline diazotization	GLO	2015 – 2026
monofluorobenzene production, halex process	GLO	2015 – 2026
4,4-difluorobenzophenone production, formaldehyde condensation, nitric acid oxidation	GLO	2015 – 2026
1,4-dimethyl-2-nitrobenzene production, p-xylene nitration	GLO	2015 – 2026
1,6-dichlorohexane production	GLO; US	2015 – 2026
1,6-hexanediol production, adipic acid hydrogenation	GLO; US	2015 – 2026
glutaraldehyde production, Diels–Alder reaction	GLO	2015 – 2026
phenethyl alcohol production, Friedel–Crafts process	GLO	2015 – 2026
propionyl chloride production, phosgenation process, from propionic acid	GLO	2015 – 2026
valeric acid production, pentanal oxidation	GLO	2015 – 2026
potassium fluoride production, potassium hydroxide neutralization	GLO	2026 – 2026
sodium acetate production	GLO	2026 – 2026

Table 41: Newly Added Market Activity Data in Version 3.13 Not Previously Covered. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.

Activity Name	Geography	Time Period
market for monofluorobenzene	GLO	2026 – 2026
market for 4,4-difluorobenzophenone	GLO	2026 – 2026

market for 2,4-difluorobenzophenone	GLO	2026 – 2026
market for 1,4-dimethyl-2-nitrobenzene	GLO	2026 – 2026
market for 1,6-dichlorohexane	GLO	2026 – 2026
market for 1,6-hexanediol	GLO	2026 – 2026
market for glutaraldehyde	GLO	2026 – 2026
market for phenethyl alcohol	GLO	2026 – 2026
market for propionyl chloride	GLO	2026 – 2026
market for valeric acid	GLO	2026 – 2026
market for potassium fluoride	GLO	2026 – 2026
market for sodium acetate	GLO	2026 – 2026

Table 42: Other Data Related to Database Maintenance for the Chemicals and Plastics Sector Representation. In column Version 3.13, U stands for “Updated Activity”. If several geographies of the same activity with the same time period exist, all of them are listed in the “Geography” column.

Activity Name	Geography	Time Period	Version 3.13
ammonia production, partial oxidation, liquid	GLO; CN	2011 – 2014	U
ammonia production, steam reforming, liquid	GLO; CN; RAF; RER w/o RU; RLA; RNA; RU; SAS; UN-OCEANIA; UN-SEASIA	2011 – 2014	U
urea production	GLO; CN; RER; RNA	2011 – 2014	U
bromine production, bromide oxidation, from Dead Sea brine	IL	2025 – 2025	U