



**ETH**



# **Documentation of changes implemented in ecoinvent database 3.0**

**(2013.09.04)**

Moreno Ruiz E, Weidema B P, Bauer C, Nemecek  
T, Vadenbo C O, Treyer K, Wernet G

ecoinvent report No. 5 (v4)

St. Gallen, 2013-09-04

---

**Citation:**

Moreno Ruiz E, Weidema B P, Bauer C, Nemecek T, Vadenbo C O, Treyer K, Wernet G. (2013). Documentation of changes implemented in ecoinvent Data 3.0. Ecoinvent Report 5 (v4). St. Gallen: The ecoinvent Centre

© Swiss Centre for Life Cycle Inventories / 2013

## Table of Contents

<b>TABLE OF CONTENTS</b> .....	<b>III</b>
<b>1 INTRODUCTION</b> .....	<b>5</b>
<b>2 NAMES AND IDS OF DATASETS AND EXCHANGES</b> .....	<b>7</b>
2.1 Activity names and product names .....	7
2.2 Names of elementary exchanges (from and to nature) .....	9
2.3 Consumption mixes (markets) .....	9
<b>3 REFERENCE PRODUCTS</b> .....	<b>10</b>
3.1 Reference products in treatment activities .....	10
3.1.1 Existing inputs turned into reference products .....	11
3.1.2 Reference product added .....	12
3.1.3 Specialty productions .....	12
3.2 Reference products not available as goods or services .....	13
3.3 Datasets with more than one reference product .....	14
3.4 Change in the reference product of normal transforming activities .....	15
<b>4 UNITS</b> .....	<b>16</b>
4.1 Unit changes .....	16
4.2 One unit per exchange .....	16
4.3 Unit conversion .....	17
<b>5 CLASSIFICATIONS AND TAGS</b> .....	<b>18</b>
<b>6 LINKING OF DATASETS</b> .....	<b>19</b>
6.1 Direct links .....	19
6.2 Generation of new market datasets (consumption mixes) .....	19
6.3 New transforming activities .....	20
6.4 Merging of duplicate intermediate exchanges .....	20
6.5 Re-linking inputs from production and supply mixes .....	20
6.6 Global datasets generated by extrapolation .....	23
6.7 Classification of the technology level used for linking datasets .....	24
6.8 Rest-Of-World datasets generated by calculation .....	25
<b>7 GEOGRAPHICAL INFORMATION</b> .....	<b>27</b>
7.1 Geography IDs, names and coordinates .....	27
7.2 Non-overlapping geographical areas .....	28
7.3 Market activity datasets deleted .....	30
7.4 Placing transforming activities in the markets they supply .....	31
<b>8 EXCHANGES FROM AND TO THE ENVIRONMENT</b> .....	<b>36</b>
8.1 Environmental categories / compartments .....	36
8.2 Land use impacts .....	36
8.3 Sum parameters for carbon compounds (BOD5, COD, DOC, TOC) .....	39

---

8.4	Outlook: Metal resources.....	39
8.5	Renewable energy.....	39
<b>9</b>	<b>PRODUCTION VOLUMES ADDED .....</b>	<b>40</b>
<b>10</b>	<b>UNCERTAINTY INFORMATION.....</b>	<b>41</b>
10.1	Uncertainty format changes .....	41
10.2	Basic uncertainty recalculated .....	41
<b>11</b>	<b>ALLOCATION .....</b>	<b>42</b>
11.1	Deleted joint production datasets with specific allocations.....	42
11.2	Property for “true value” allocation (ecoinvent default) .....	42
11.3	Allocation corrections.....	42
<b>12</b>	<b>REVIEW OF CENTRALLY IMPLEMENTED CHANGES .....</b>	<b>43</b>
<b>13</b>	<b>ACCESS TO DATASETS .....</b>	<b>44</b>
13.1	Public access and terms of use.....	44
13.2	Sponsored datasets.....	44
13.3	Single-enterprise data .....	44
<b>14</b>	<b>NEW OR UPDATED DATASETS .....</b>	<b>45</b>
<b>15</b>	<b>DOCUMENTATION FROM THE ECOINVENT VERSION 2 REPORTS.....</b>	<b>48</b>
<b>16</b>	<b>PROPERTIES ADDED.....</b>	<b>49</b>
16.1	Mass, water and carbon content added as properties.....	49
16.2	Mass, water and carbon balances.....	49
16.3	Price as a property .....	49
<b>17</b>	<b>CHANGES IN VERSION 3.01.....</b>	<b>50</b>
17.1	Modified supply chains.....	50
17.2	Deleted activities .....	50
17.3	Dataset and property corrections .....	50
<b>ANNEX 1</b>	<b>.....</b>	<b>51</b>
<b>ANNEX 2</b>	<b>.....</b>	<b>53</b>
<b>REFERENCES.....</b>	<b>.....</b>	<b>56</b>

# 1 Introduction

This report summarises the central changes implemented in the datasets of the ecoinvent database version 3 as compared to version 2.2. The central changes are changes that are performed for all or several datasets as a centralised procedure by the database administration. **[The report also contains an outlook on future work currently planned for implementation, but which was not implemented before the release of version 3.0, or 3.01. This outlook is either placed in separate sections marked “outlook” or placed in the running text in bold font.]**

Accompanying the report at hand are two Excel files (available on the ecoinvent web-site in the same location as the report at hand). One is listing all datasets converted from ecoinvent version 2.2, indicating which of the changes reported here are applicable to each individual dataset (“Correspondence File for Activities and Products”), as well as giving equivalences between version 2 and version 3 naming. The other lists all elementary flows and compartments, correlating version 2.2 and version 3 names (“Correspondence File for Elementary Exchanges”).

Universally Unique Identifiers (UUIDs) are now applied for all datasets and exchanges (see Chapter 2) in place of the version 2.2 ID numbers. UUIDs are now also applied to all other master data (units, geographies, properties, sources, persons, etc.). For the user, these UUIDs are not visible, but “behind the scene” the use of UUIDs allows the database management to e.g. change names database-wide without having to make this change in each individual dataset. The UUIDs are publicly and freely available, for e.g. software developers who implement converters to other database formats.

Since the changes described in the report at hand have been implemented centrally, the responsibility for these changes and any errors related to these obviously falls on the ecoinvent database management and the group of experts, and not on the individual authors of the datasets. We have nevertheless in most cases retained the original authors of the version 2.2 datasets as authors of the converted datasets in order to give due credit to their work. From the descriptions in this report, it should be clear what parts of the datasets have been changed centrally by the ecoinvent management.

A general disclaimer has been added to the General Comment field of all datasets converted from version 2.2 to the effect that:

“This is a dataset that was already contained in ecoinvent database version 2 that was not extensively or individually updated during the transfer to ecoinvent version 3. It was generated following the ecoinvent quality guidelines for version 2 and it may not in all aspects meet the additional requirements of the ecoinvent data quality guidelines for version 3. It was updated in a series of central changes described in the ecoinvent version 3 change report (<http://www.ecoinvent.org/database/ecoinvent-version-3/reports-of-changes/>) that were aiming to fulfill most new requirements, and the results of the central updates were reviewed extensively. The documentation of this dataset refers to the ecoinvent reports of version 2, which are still available via the ecoinvent website, and the change report linked above covers all central changes that were made during the conversion process.”

This disclaimer will only be removed for a specific dataset if an author updates the dataset and finds that the disclaimer is no longer relevant. This does not automatically mean that the dataset is flawed in any way, just that it may not fulfil some of the non-critical new quality guidelines.

In addition to the central changes described in the report at hand, there are changes performed for specific datasets by individual dataset authors. This may be error corrections, improvements in existing datasets or updates to newer data. These changes are documented directly in the datasets and can be identified by comparing the new dataset to the original version 2.2. dataset.

For cases where new datasets disaggregate an existing dataset into two or more new datasets, the correspondence between the old and new activity names and/or geographies is listed in Chapter 14.

In addition to the changes to individual datasets, the format and structure for the datasets and the database has also been revised. These structural changes are described in the ecoSpold 2 documentation

([www.spold.org](http://www.spold.org)) and in the Data Quality Guidelines (Weidema et al. 2013), respectively. A general overview of the new terminology and basic questions about the version 3 can be found in our web-page.

## 2 Names and IDs of datasets and exchanges

Universally Unique Identifiers (UUIDs) are applied for all datasets in the ecoinvent database version 3, in place of the version 2.2 ID numbers. The UUIDs for the converted datasets are listed in the “Correspondence File for Activities and Products”. The Excel file also contains the UUIDs of the activity names (because there can be more datasets for the same activity, individual datasets and activity names have separate UUIDs).

Similarly, Universally Unique Identifiers (UUIDs) are applied for all intermediate exchanges in the ecoinvent database version 3. The UUIDs for the product outputs of the converted datasets are listed in the same Excel document.

And finally, Universally Unique Identifiers (UUIDs) are applied for all elementary exchanges (exchanges from and to nature) in the ecoinvent database version 3. The UUIDs for the elementary exchanges are listed in the “Correspondence File for Elementary Exchanges”.

### 2.1 Activity names and product names

In ecoinvent version 1&2, separate names for *activities* (in ecoinvent version 1&2 called *processes*) and *products* were only implemented for datasets with multiple product outputs.

In ecoinvent version 3, separate names for activities and intermediate outputs have been implemented throughout the database.

At the same time, all names have been reviewed to ensure consistency with the ecoinvent naming conventions, which were at the same time made more stringent in some aspects (see the Data Quality Guidelines).

In version 2.2, some activity datasets were available in duplicates, typically as identical datasets with only different names for both the generic name of the product group and the name of specific products within the product group. The datasets with the more specific product names have been deleted and datasets that used the specific products have been relinked to the generic product name, thus reflecting the actual level of unit process modelling. For used IT accessory, this also involved a change in the unit of the exchange. See Table 2.1 for a list of all specific products deleted.

Finally, a few obsolete datasets for activities that no longer exist have been deleted. These are listed in Table 2.2.

**Table 2. 1. Name of detailed products for which the duplicate datasets have been deleted and the - typically more generic - product that is now used instead. The factor column lists the conversion factors applied for the unit changes involved.**

Name of detailed products deleted	Instead modelled as generic product:	Factor
2,4-D	phenoxy-compound	
alachlor	acetamide-anilide-compound	
carbofuran	[thio]carbamate-compound	
cyanazine	triazine-compound	
dicamba	benzoic-compound	
diuron	[sulfonyl]urea-compound	
linuron	[sulfonyl]urea-compound	
maneb	dithiocarbamate-compound	
MCPA	phenoxy-compound	
operation, printer, laser, black/white, printing per hour	printed paper	0.52kg/hour
operation, printer, laser, colour, printing per hour	printed paper	0.16kg/hour
parathion	organophosphorus-compound	
propachlor	acetamide-anilide-compound	
resin size	rosin size	
used keyboard	used IT accessory	1.25 kg/unit
used pointing device, optical mouse, with cable	used IT accessory	0.12 kg/unit
used power adapter, for laptop	used IT accessory	0.53 kg/unit
used printer, laser, colour	used printer, laser	5.87 kg/unit

**Table 2. 2. Obsolete datasets deleted.**

Obsolete datasets deleted	Comment
electricity production, hydro, pumped storage (some geographies only)	For the geographies BA, MK, SI, HU, DK, FI, and NL, no such activity exists anymore.*
electricity production, lignite (some geographies only)	For the geographies AT, ES and FR, the classifications of electricity from hard coal and lignite were changed.
Treatment of biogas from biowaste in gas engine (some geographies only)	For the geographies FI, GR, IE, no such activity exists anymore.*
electricity production, natural gas	For the geography BA, no such activity exists anymore.*
treatment of coal gas, in power plant	For the geography NO, no such activity exists anymore.*
electricity production, nuclear, pressure water reactor, centrifugal enrichment (CH)	Does not correspond to the current market.
portland cement, strength class Z 52.5, at plant portland cement, strength class Z 42.5, at plant portland slag sand cement, at plant portland calcareous cement, at plant	Products fall outside new cement classifications
treatment of aluminium scrap, new, by melting, alloying and casting treatment of aluminium scrap, post-consumer, prepared for melting, by melting, alloying and casting aluminium production, primary, liquid	Activities do not fit the new structure of the sector (added during v3.01 update).
aluminium hydroxide production aluminium oxide production	New datasets were created with GLO localisation. RER data became outdated and was deleted (added during v3.01 update).

\* according to latest statistics used.

## 2.2 Names of elementary exchanges (from and to nature)

A few name changes and deletions have been made for elementary exchanges, see Table 2.3. In addition to what is listed here, land use exchanges starting with “occupation” and “transformation” are affected by the name changes to the land use classes, see Chapter 8.2.

**Table 2.3. Name changes and deletions for elementary exchanges**

Exchange name in version 2.2	Exchange name in version 3
Bromine, 0.0023% in water	Bromine, 0.23% in water <sup>1</sup>
Carbon, in organic matter, in soil	Carbon, organic, in soil or biomass stock
Carbon dioxide, land transformation	Carbon dioxide, from soil or biomass stock
Carbon dioxide, biogenic	Carbon dioxide, non-fossil
Carbon monoxide, biogenic	Carbon monoxide, non-fossil
Energy, geothermal, converted	Deleted
Energy, kinetic (in wind), converted	Deleted
Energy, potential (in hydropower reservoir), converted	Deleted
Energy, solar, converted	Deleted
Methane, biogenic	Methane, non-fossil
Oils, biogenic	Oils, non-fossil
Sodium tetrahydroborate	Sodium tetrahydridoborate

<sup>1</sup> This is an error correction; concentration was wrong in v2.2

Note that there are also some name changes to the environmental compartments; see Chapter 8.1.

## 2.3 Consumption mixes (markets)

Market activities provide a production volume-weighted average supply of an intermediate exchange from different transforming activities for a given region. Market activities therefore provide consumption mixes of the intermediate outputs.

In the ecoinvent database version 1&2, consumption mixes existed for some products, but were not consistently named as such and were not identified as a special activity type. In the ecoinvent database version 3, market datasets are identified as a special activity type that results in a specific handling during the linking of the datasets in the database and are the more often named “market for [name of product]”; see Chapter 6.2. The name “market” was chosen since the market activities provide more than just the consumption mix, e.g. transport and product losses during transport.

In the ecoinvent database version 3, the inputs of the intermediate exchange to market datasets are filled in automatically by the database service layer during linking, based on the output from the activities that produce the product within the geographical area of the market, weighted in proportion to their production volumes. Therefore, the inputs of the marketed products are not manually entered into these datasets, and in market datasets converted from the ecoinvent database version 2.2, such inputs have been deleted.

Market datasets that have been converted from the ecoinvent database version 2.2 in some cases contained information that rather belongs in transforming activity datasets. The converted market datasets have therefore been manually reviewed before the release of the ecoinvent database version 3, to retrieve such information and place it in the relevant transforming datasets.

Being included in the market activities, all transport information (falling outside of the boundaries of the activity) has been deleted from the transforming activities. Similarly, many datasets that contained basically transport information about the product have been merged into the market activities, and the dataset have been deleted. Typically, most of the “collection” datasets; and “lime production, from sugar beet carbonation”.

### 3 Reference products

In the ecoinvent database version 3, a distinction is introduced between reference products and by-products/wastes. The reference products are those products for which a change in demand will affect the production volume of the activity.

All multi-output activities converted from ecoinvent version 2 have been reviewed and the reference products identified. The identified reference products are indicated in the “Correspondence File for Activities and Products”. All products that are not the reference product are considered by-products. They always need either a treatment activity, another production route where the product is the reference product, or a constrained market to be present in the database.

For a number of products in the ecoinvent database version 2 that have been identified as by-products (e.g. straw, sodium hydroxide), the activities that have the by-product as its reference product or as an input for treatment were missing. These missing activities have now been added or the by-product has been set as an input to a constrained market (see chapter 11.4 of the Data Quality Guidelines for information on constrained markets). Table 3.1 lists all by-products from version 2.2 for which a constrained market has been generated in version 3.01.

**Table 3. 1. By-products from v2.2 that have a constrained market in v3.01.**

acetonitrile
argon, crude, liquid
calcium chloride
cerium concentrate, 60% cerium oxide
fluosilicic acid, without water, in 22% solution state
glass cullet, sorted (added in v 3.01)
hard coal
heptane
iron scrap, sorted, pressed
krypton, gaseous
lanthanum oxide
methyl acetate
neodymium oxide
nitrogen, liquid
palm kernel oil, crude
petroleum coke
platinum
praseodymium oxide
residual softwood, wet
samarium europium gadolinium concentrate, 94% rare earth oxide
sodium hydroxide, without water, in 50% solution state
soybean oil, crude

#### 3.1 Reference products in treatment activities

In ecoinvent version 2, waste treatment was expressed as service outputs of the treatment activities and service inputs to the activities supplying the waste. All such waste treatment services have been reviewed for naming consistency and their reference products are now expressed as negative outputs of wastes, reflecting that the service activity physically removes the waste. For example, the version 2.2 dataset “municipal solid waste, to municipal incineration”, which for consistency reasons is now called “treatment of municipal solid waste, incineration”, has as its reference product “-1 kg municipal solid waste”.

Some treatment activities in version 2 did not have a service output, but were instead expressed relative to the output of by-products produced from the treated waste. The input of waste was either given

as an input or not included in the datasets at all. For these activities, the missing outputs have now been added, either by moving the input of waste to be a negative output or by adding the missing waste, as will be detailed in the following chapters.

### 3.1.1 Existing inputs turned into reference products

In some treatment activities in ecoinvent version 2.2, the product output was not the material received for treatment, but rather the by-products produced from the treated waste. Thus, these datasets missed their reference products (the treated waste). In some cases, the treated waste was given in the dataset as an input, and has therefore now simply been changed to become a negative output. For example, in the activity “chipboard production, white lined”, the original input “0.866 kg waste paper, sorted” has now been turned into the reference product “-0.866 kg waste paper, sorted”. See Table 3.2 for a complete list of all such instances.

In most cases, the name and amount of the new reference product corresponds to the name and amount of the original waste input. In some cases, two waste inputs had to be merged to make up the new reference product. In other cases (“treatment of copper scrap by electrolytic refining” and “treatment of scrap lead acid battery, remelting”), the new reference products (“copper scrap, sorted, pressed” and “scrap lead acid battery”, respectively) replace an existing input that was given as “iron scrap, sorted, pressed”, which therefore has been deleted in these two datasets (see Table 3.3).

**Table 3. 2. Activity datasets with new reference products that were previously inputs**

Activity name	New reference product (previously input)	Amount	Unit
chipboard production, white lined	waste paper, sorted	-0.866	kg
heat and power co-generation, biogas, gas engine	biogas	-1	m3
heat production, mixed logs, at furnace 30kW	log, energy wood, split, measured as solid wood under bark	-1.06E-4	m3
heat production, mixed logs, at furnace 100kW	log, energy wood, split, measured as solid wood under bark	-1.06E-4	m3
heat production, mixed logs, at wood heater 6kW	log, energy wood, split, measured as solid wood under bark	-1.06E-4	m3
log production, energy wood, split, at forest	log, hardwood, piled in forest, air-dried, measured as solid wood under bark	-0.61171	m3
	log, softwood, piled in forest, air-dried, measured as solid wood under bark	-0.28634	m3
paper production, newsprint, recycled	waste newspaper	a	kg
primary lead production from concentrate	lead, concentrate	-1.855	kg
refinery gas, burned in furnace	refinery gas	-0.0199	kg
tissue paper production	waste paper, sorted	-1.174	kg
treatment of biogas, burned in micro gas turbine 100kWe	methane, 96% by volume, from biogas, low pressure, at user	-1	MJ
treatment of biogas, burned in polymer electrolyte membrane fuel cell 2kWe, future	methane, 96% by volume, from biogas, low pressure, at user	-1	MJ
treatment of biogas, burned in solid oxide fuel cell 125kWe, future	methane, 96% by volume, from biogas, low pressure, at user	-1	MJ
treatment of biogas, burned in solid oxide fuel cell, with micro gas turbine, 180kWe, future	methane, 96% by volume, from biogas, low pressure, at user	-1	MJ
treatment of biogas, purification to methane 96 vol-%	biogas	-1.5	m3
treatment of cadmium sludge from zinc electrolysis	cadmium sludge from zinc electrolysis	-2.22	kg
treatment of coal gas, in power plant	coal gas	-1	MJ
treatment of crust from Parkes process for lead production	crust from Parkes process for lead production	-5.7743	kg
treatment of metal part of electronics scrap, in blister-copper, by electrolytic refining	metal part of electronics scrap, in blister-copper	-60.362	kg
treatment of precious metal from electronics scrap, in anode slime, precious metal extraction	precious metal from electronics scrap, in anode slime	-35.765	kg
treatment of residual hardwood, wet, air drying	residual hardwood, wet	-1.14	m3
treatment of tallow to esterquat	tallow, unrefined	-0.6	kg
treatment of waste cooking oil, purified, esterification	used vegetable cooking oil, purified	-1	kg
treatment of waste glass from unsorted public collection, sorting	waste packaging glass, unsorted	-1.08	kg
treatment of waste paper, unsorted, sorting	waste paper, unsorted	-1.025	kg
treatment of whey by fermentation	whey	-1	kg
treatment of whey, anaerobic digestion	whey	-23	kg
treatment of wood fuel, hardwood, wet, air drying	wood fuel, hardwood, wet, measured as solid wood under bark	-1.14	m3
treatment of wood fuel, softwood, wet, air drying	wood fuel, softwood, wet, measured as solid wood under bark	-1.1	m3

a)The amounts are different depending on the geographical localisation of the activity.

### 3.1.2 Reference product added

In some treatment activities in ecoinvent version 2.2, only the by-products produced from the treated waste were given in the dataset, not the treated waste itself. The treated waste therefore had to be added as a new reference product. For example, the activity “treatment of biowaste, composting” has the by-product “compost”, while the treated “biowaste” was not available in the version 2.2 dataset, and has now been added as the reference product. See Table 3.3 for a complete list of all reference products added. The calculation of the amount of the new reference product is given in the dataset. When a new calculation had to be made, the documentation for this calculation is added to the comment field of the new reference product exchange.

In one case, not only the treated waste (the reference product) was missing but the entire dataset was missing and only available as two allocated datasets (the version 2.2. datasets “silicon carbide, recycling, at plant” and “triethylene glycol, recycling, at plant”). These two datasets were therefore merged into one: “treatment of spent sawing slurry from Si-wafer cutting” and the missing reference product (-1.5873 kg “spent sawing slurry from Si-wafer cutting”) added. The output of the new merged activity is 1 kg of “silicon carbide” and 1 kg “triethylene glycol”, besides the new reference product.

**Table 3. 3. Activity datasets with new reference products added.**

Activity name	New reference product	Amount	Unit	Comment
treatment of aluminium scrap, post-consumer, by collecting, sorting, cleaning, pressing	aluminium scrap, post-consumer	-1.13	kg	Calculated from the transport distances provided in the original dataset.
treatment of biowaste, composting	biowaste	-1.8519	kg	Equals 1000kg/540kg compost. Dry mass of the compost is 50% of the wet mass, while the biowaste dry mass is 40% of the biowaste wet mass.
treatment of blast furnace gas, in power plant	blast furnace gas	-1	MJ	
treatment of copper scrap by electrolytic refining	copper scrap, sorted, pressed	-1.31	kg	Replaces the v2.2 input 'iron scrap, sorted, pressed'
treatment of electronics scrap, metals recovery in copper smelter	electronics scrap	-2.7244	kg	Equals 5882/2159kg (ecoinvent v2.0 report 10, part V, Fig. 5.9, page 84 and Fig.5.13, page 93)
treatment of poultry manure, drying, pelleting	poultry manure, fresh	-2.2666	kg	Calculated from the transport distances provided in the original dataset.
treatment of scrap lead acid battery, remelting	scrap lead acid battery	-1.5446	kg	Replaces the v2.2 input 'iron scrap, sorted, pressed'
treatment of sewage sludge by anaerobic digestion	sewage sludge	-0.060274	m3	Concentrated, 5.6% dry matter content. Values from the original dataset.
treatment of slaughterhouse waste, rendering	slaughterhouse waste	-5.98	kg	Assuming 40% dry matter of slaughterhouse waste, 40% extractable fat in dry matter (97.5% dry matter) and 60% bone, blood and meat (96% dry matter)
treatment of automobile catalyst	spent automobile catalyst	-400	kg	Assumed average recoverable PGM content 0.25% (ecoinvent v2.0 report 10, part V, Fig. 5.16)
treatment of spent sawing slurry from Si-wafer cutting	spent sawing slurry from Si-wafer cutting	-1.5873	l	Source: ecoinvent v2 report 6_XII, page 24, table 4.8.
treatment of used toner module, laser printer, black/white, recycling	used toner module, laser printer, black/white	-0.88	kg	Relates to 1 kg toner actually printed on paper, when each cartridge of 0.26 kg toner is reused once
treatment of used toner module, laser printer, colour, recycling	used toner module, laser printer, colour	-0.88	kg	ditto
treatment of used vegetable cooking oil, purification	used vegetable cooking oil	-1.0082	kg	Calculated from the transport distances provided in the original dataset.
treatment of waste wood, post-consumer, sorting and shredding	waste wood, post-consumer	-188.6	kg	Value from the comment field of the original dataset

### 3.1.3 Specialty productions

In some cases, the materials for treatment are handled in specialty production activities (see the Data Quality Guidelines chapter 11.6 for more information on this type of activity). In those cases, the material for treatment is an input to a normal transforming activity. This activity will be handled as a

treatment activity for the material for treatment during the linking. All activities from version 2.2 that are specialty productions in version 3.0 and 3.01 (no changes happened) are listed in Table 3.4.

All other activities, not listed in Table 3.4 that contained inputs of materials for treatment, have not been considered specialty productions, and the input of material for treatment has been corrected in different ways (substituted by other exchange, merged into another exchange, etc.) in order to be eliminated.

**Table 3. 4. Specialty productions in v3.01, concerning products converted from v2.2.**

Specialty production	Material for Treatment as input	Reference product of the activity
cellulose fibre production, inclusive blowing in	waste paper, unsorted	cellulose fibre, inclusive blowing in
charcoal production	log, energy wood, split, measured as solid wood under bark	charcoal
core board production	waste paper, sorted	core board
cotton seed production, for sowing	cotton seed	cotton seed, for sowing
dewatering of ethanol from biomass, from 95% to 99.7% solution state	bagasse, from sweet sorghum	ethanol, without water, in 99.7% solution state, from fermentation
ethanol production from sugar beet molasses	molasses, from sugar beet	ethanol, without water, in 95% solution state, from fermentation
fibre cement roof slate production	waste paper, unsorted	fibre cement roof slate
glass production, for liquid crystal display	waste packaging glass, unsorted	glass, for liquid crystal display
graphic paper production, 100% recycled	waste paper, unsorted	graphic paper, 100% recycled
gypsum fibreboard production	waste paper, sorted	gypsum fibreboard
indium production	indium rich leaching residues, from zinc production	indium
light clay brick production	straw	light clay brick

## 3.2 Reference products not available as goods or services

Since reference products in the ecoinvent database version 3 are defined as those products for which a change in demand will affect the production volume of the activity, reference products must be specified as either a good or a service. Furthermore, it is sought to avoid the separate reporting of unit processes when this does not add any useful information in an LCA context. This is the case when one unit processes always supplies all of its products directly to another specific unit process at the same location, so that the product of the first unit process never appears as a separate product, and cannot be supplied by an external supplier. In such cases, the use of parameterisation is preferred to further subdivision of unit processes.

A number of activities in the ecoinvent database version 2.2 did not produce separable products. For version 3, these activities have either been deleted, merged with the dataset they supply, or the reference product has been redefined. Table 3.5 lists the activities affected, including:

1. Datasets which in version 2.2 had reference products referring to a fuel input, all with the term “burned in” in their name, e.g. “hard coal, burned in power plant”, being the only supplier to an activity producing heat and/or electricity, are – with a few exceptions; see Table 3.3 – merged with the corresponding heat/electricity producing datasets.
2. The datasets producing electricity as “..., average mix with average share of label-certified electricity” were deleted because such a product (where the label-certified electricity is included in the exact proportion by which it is produced) is not available to the consumers as such, but represents a specific mix of different products.
3. Datasets for “energy use and combustion emissions, ...” for different vehicles (in version 2.2. named “operation, ...”) have been merged with the corresponding datasets for “transport, ...”

for the same vehicles type. At the same time a number of errors have been corrected where other datasets use the output from the “energy use and combustion emissions, ...” datasets instead of the output from the transport datasets.

- The two version 2 datasets “mining, gold-silver-zinc-lead-copper deposit“ and “refining, copper-zinc-lead-gold-silver, in smelter” have been merged (into a new dataset named “gold-silver-zinc-lead-copper mine operation and refining”), because the outputs of the first dataset were intended exclusively for treatment in the second dataset.

**Table 3. 5. Changes made to activity datasets with non-marketable reference products**

Activity name	Change made
[fuel], burned in [boiler, coal mine power plant, combined cycle plant, furnace, gas turbine, industrial furnace, power plant, stove, wood heater] (when supplying a dataset that has no other inputs and produce heat or electricity as reference product)	Merged with supplied heat or electricity producing dataset <sup>1)</sup>
diesel, burned in chopper	Deleted
electricity, high voltage, average mix with average share of label-certified electricity	Deleted
energy use and combustion emissions, [...]	Merged with transport
irrigating	Deleted. Merged with “irrigation” in m <sup>3</sup>
market for electricity, high voltage, average mix with average share of label-certified electricity	Deleted
market for electricity, low voltage, average mix with average share of label-certified electricity	Deleted
market for electricity, medium voltage, average mix with average share of label-certified electricity	Deleted
mining, gold-silver-zinc-lead-copper deposit	Merged with “refining, copper-zinc-lead-gold-silver, in smelter”
natural gas, burned in cogen, [...]	Merged with supplied heat or electricity producing dataset
natural gas, burned in mini CHP plant	Merged with supplied heat or electricity producing dataset

<sup>1)</sup> Except the activity ‘natural gas, burned in power plant’ for the geographies NORDEL and CENTREL, which is anyway deleted (see Table 7.5). “Heavy fuel oil, burned in refinery furnace”, “sour gas, burned in gas turbine” and “sweet gas, burned in gas turbine” are exclusively used internally in another activity.

### 3.3 Datasets with more than one reference product

For some of the datasets from the ecoinvent database version 2.2, more than one of the intermediate outputs was identified as a possible reference product. Some datasets were cases of combined production; while one was identified as a case of joint production (see Chapter 5.3 in the Data Quality Guidelines for a description of the distinction). Table 3.6 lists the datasets concerned.

For the cases of combined production, the dataset is described by parameters and sub-divided as described in Chapter 5.3 of the Data Quality Guidelines.

For the case of joint production, direct activityLinkIds are added for the reference products and the conditional exchanges, as described in Chapter 14.4.2 of the Data Quality Guidelines.

In one case, sheep production, the dataset was subdivided into two, one for each reference product (one for wool and one for meat), with the other product as by-product.

**Table 3. 6. Datasets from version 2.2 for which more than one reference product was identified, divided in cases of combined and joint production**

Activity name	Combined or joint production
benzene chlorination	Combined (with hydrochloric acid as by-product)
ethanolamine production	Combined
ethylene glycol production	Combined
gravel and sand quarry operation	Combined
gypsum quarry operation	Combined
hydroformylation of butene	Combined
hydroformylation of propylene	Combined
log production, energy wood, split, at forest	Combined (with "log, energy wood, split, measured as solid wood under bark" as a by-product)
petroleum refinery operation	Combined (with "electricity, high voltage", "petroleum coke", "refinery sulfur", and "refinery gas" as by-products)
rare earth oxides production from bastnäs site concentrate	Joint

### 3.4 Change in the reference product of normal transforming activities

A special situation applies for the way fertilisers were modelled in version 2. Here, what are in fact single products (ammonium nitrate phosphate, diammonium phosphate, monoammonium phosphate, potassium nitrate) have artificially been modelled as multiple products ("nitrogen fertiliser, as N", "phosphate fertiliser, as P2O5", "potassium fertiliser, as K2O"). For the ecoinvent database version 3, separate market datasets are being added for the single-element and/or composite fertilisers, from which the agricultural activities can demand their specific requirements. This implies that the chemical names of all upstream fertiliser products can be maintained while introducing separate activities that mix these chemicals and supply the said markets.

For version 3.0 (and 3.01), only the following fertilisers have been adapted to this modelisation: "calcium nitrate", "ammonium chloride", "potassium nitrate". For those, the reference product of the production activity is the chemical ("calcium nitrate", "ammonium chloride" and "potassium nitrate", respectively); while the activity "field application of [...]" has the chemical as an input and provides the corresponding amounts of fertilising substance ("nitrogen fertiliser, as N", "phosphate fertiliser, as P2O5", "potassium fertiliser, as K2O").

## 4 Units

### 4.1 Unit changes

Some units applied in the ecoinvent database version 2 have changed their symbol in the version 3 implementation. This does not affect the amounts. The changes are listed in Table 4.1.

**Table 4. 1. Unit changes from version 2.2 to version 3.**

Unit in version 2.2	Unit in version 3	Comment
a m <sup>2</sup> *a	year m <sup>2</sup> *year	
tkm pkm vkm	metric ton*km person*km km	Used for transport services. The term vkm (vehicle-km) is synonymous to km and no longer applied
LU pig place	unit unit	The explanation of the unit (e.g. LU = animal unit) is now provided in the name of the exchange and if necessary further explained in the comment fields.
kg SWU	unit	Expressed as unit of work.
Nm <sup>3</sup>	m <sup>3</sup>	Normal cubic metre. For natural gas, biogas, compogas, town gas: Normal cubic metre = cubic metre of gas at 15 °C and 101.325 kPa (ISO 13443). If other standard conditions are used (for other gases), this is to be given either in the product name or in the comment field of the exchange.

### 4.2 One unit per exchange

The unit is no longer an identifying field, i.e. the same dataset cannot exist with different units for the reference product. Instead, alternative units can be applied as properties of the reference product. That means that the datasets which were found in the database version 2.2 in duplicate units have been merged to one dataset. Table 4.2 lists the exchanges for which the unit has been changed and the factor used for converting from the old to the new unit.

In several cases the products in version 2.2 were expressed in MJ and in m<sup>3</sup> in different datasets. In some cases, e.g. “waste natural gas, sour”, and “sweet gas, burned in gas turbine”, only one of these datasets contained the emissions and other exchanges, while the other dataset was used simply to convert from the other unit. In such cases, the unit of the former dataset is retained. In other cases, e.g. “refinery gas, burned in furnace”, and “heavy fuel oil, burned in refinery furnace”, both datasets contained the full set of exchanges, and the most useful unit could therefore be chosen.

Some electronics waste products in version 2.2, e.g. “used desktop computer”, were expressed in units of “units” in the collection (market) datasets, while the further disassembly and treatment was reported in kg. For version 3.0, these exchanges were all changed to kg.

**Table 4. 2. Harmonisation of units of intermediate exchanges.**

Product	Unit in v.2.2	Unit in v. 3.0	Factor
bark chips, wet	m <sup>3</sup>	kg (dry matter)	450
drying (agricultural products)	kg	l (litre)	1
heavy fuel oil, burned in refinery furnace	kg	MJ	41.2
natural gas, high pressure	MJ	m <sup>3</sup>	1/39
natural gas, low pressure	MJ	m <sup>3</sup>	1/39
refinery gas, burned in furnace	kg	MJ	50.3
sour gas, burned in gas turbine	m <sup>3</sup>	MJ	37
sweet gas, burned in gas turbine	m <sup>3</sup>	MJ	36
used cathode ray tube display	unit	kg	19.9
used desktop computer	unit	kg	11.3
used laptop computer	unit	kg	3.12
used liquid crystal display	unit	kg	5.04
used printer, laser	unit	kg	5.87
waste natural gas, sour	m <sup>3</sup>	MJ	37
waste natural gas, sweet	m <sup>3</sup>	MJ	36
wood chips, dry/wet	m <sup>3</sup>	kg (dry matter)	239 for hardwood / 169 for softwood
wood chips, from post-consumer wood	m <sup>3</sup>	kg (dry matter)	188.6
wood pellet	m <sup>3</sup>	kg (dry matter)	650

### 4.3 Unit conversion

The ecoSpold 2 data format applied for the ecoinvent database version 3 allows the expression of amounts via mathematical relations (formula). Data can therefore be entered in the original units and converted to the standard unit by the use of a conversion factor. A specific unit conversion feature is included in the ecoSpold 2 format, which means that it is only necessary to enter the data, the unit and the target unit, without the need to look up and enter the conversion factors. The unit conversion feature is available in the mathematical relations dialogue of the ecoEditor software (second button from the left).

The unit conversions also include conversions between currencies since year 2000, using EUR2005 as baseline currency.

## 5 Classifications and tags

In the ecoinvent database version 3, a new classification systems for activities is applied based on the ISIC classification (Rev. 4), <<http://unstats.un.org/unsd/cr/registry/>>, with some additional subdivisions necessary for the ecoinvent database.

For datasets transferred from the ecoinvent database version 2.2, the activity classification of version 2 is applied as an additional classification. However, this classification system is no longer maintained by the ecoinvent Centre. The ISIC class of each of the converted datasets is listed in the “Correspondence File for Activities and Products” (in the same location as this report).

In addition to the compulsory classification systems for activities, CPC <<http://unstats.un.org/unsd/cr/registry/>> is recommended as a voluntary classification system for products.

Moreover, the ecoSpold 2 format and the ecoinvent database version 3 support the addition of tags to both activities and exchanges. Tags can be seen as an optional, user-defined classification system, to group specific activities or exchanges together. A number of tags have been predefined and are described in Chapter 9.8 of the Data Quality Guidelines. To allow auto-generation of the production mixes for electricity by source type, all datasets producing electricity for the large-scale electricity market as reference product or by-product are tagged with one of the following tags: fossil fuels, coal power, hard coal power, lignite power, peat power, industrial gas power, natural gas power, oil power, nuclear power, hydro power, photovoltaic power, wind power, geothermal power, biogas power, wood power, waste power.

## 6 Linking of datasets

### 6.1 Direct links

In the ecoinvent database version 1&2, datasets were linked via the names of the activities, which were at the same time names of the intermediate products. This automatic correspondence between activities and products is not maintained in version 3, where the activities and intermediate outputs have separate names (see Chapter 2). In version 3, the linking is done primarily via the product name. Market datasets exist for all products, and all product inputs can therefore be linked to a market, which is linked to the transforming activities that produce this product. This is done automatically by the database service layer according to different linking algorithms for each system model. When justified, the data provider can always manually specify the UUID of the supplying activity as an ActivityLinkId, which will then be used to provide a direct link from the input to the corresponding output of the supplying activity.

During the conversion of the datasets from version 2.2 to version 3, only some of the direct links have been kept, corresponding to those that have a justification within the version 3 (the origin or the fate of the exchange is known, and needs to be marked).

### 6.2 Generation of new market datasets (consumption mixes)

In the ecoinvent database version 1&2, market datasets (consumption mixes) were only available for some intermediate outputs (see also Chapter 2.3). Global market datasets were added during the conversion to version 3 for any intermediate output for which such a global market dataset did not already exist. Even when only one transforming activity is supplying a specific intermediate output, a market dataset was created.

The market datasets by default contain the output of the reference product. During the linking of the system models, the corresponding inputs are added, based on the production volume-weighted output of the transforming activities available within the geographical area of the market.

Market datasets have additionally been supplemented by inputs of transport, which replace the version 1&2 default transport inputs to the transforming activities. The new default transport amounts are based on a study by Borken & Weidema (2013) and calculated as default factors for each ISIC class, per kg wet mass of the product. Default values, as well as exceptions to the default values are detailed in the Excel file “Default transport assumptions”, that can be found on the ecoinvent web-page. **[The datasets for waste building products (in version 2.2 named 'disposal, building,...'), and for wastewater, which is transported in sewers, have not been updated for version 3.0 and will be handled later by the ecoinvent editor for waste treatment.]**

For most products, only a generic global market exists in the current database version, even for such products that do not store or transport easily, such as waste treatment. For such products, it is planned that further detailed information and better spacial resolution will be implemented in later versions of the database, trying to find a compromise between local relevance and general applicability in cooperation with the responsible editors.

Local markets for heat and board, which were missed in version 3.0, have been added for the release of version 3.01. A complete list of the local markets available in version 3.01 is accessible in Annex 2 of this report. Some of those markets were converted and maintained from version 2.2, while others have been specifically generated for version 3.0 or 3.01.

### 6.3 New transforming activities

In the ecoinvent database version 3, market activity datasets have the same product as input and output. Thus, no transformation of the products can occur in a market activity.

In the ecoinvent database version 2.2, some consumption mixes (market datasets) include transformation, e.g. from high voltage to low voltage electricity, and therefore had outputs that differ from the inputs. New datasets have therefore been added to separately represent this transformation, so that the inputs to the market datasets are now the same as the marketed outputs. For example, “transformation from high voltage to medium voltage” activities have been created for each geographical region supporting a medium voltage market. Those activities have “electricity, high voltage” as an input and “electricity, medium voltage” as an output, thus providing the necessary input for the activity “market for electricity, medium voltage”. Table 6.1 lists the new transformation datasets that have been added to enable market datasets to have the same product as input and output.

**Table 6. 1. New transformation datasets providing the missing products required for version 2.2 market datasets.**

Activity name	Locations
electricity voltage transformation from high to medium voltage	AT, BA, BE, BG, BR, CH, CN, CZ, DE, DK, ES, FI, FR, GB, GLO, GR, HR, HU, IE, IT, JP, LU, MK, NL, NO, PL, PT, RO, RS, SE, SI, SK
electricity voltage transformation from high to medium voltage, aluminium industry	GLO
electricity voltage transformation from high to medium voltage, label-certified	CH
electricity voltage transformation from medium to low voltage	AT, BA, BE, BG, BR, CH, CN, CZ, DE, DK, ES, FI, FR, GB, GLO, GR, HR, HU, IE, IT, JP, LU, MK, NL, NO, PL, PT, RO, RS, SE, SI, SK
electricity voltage transformation from medium to low voltage, label-certified	CH
natural gas pressure reduction from high to low pressure	CH

The transformation datasets include the input of capital goods necessary for the transformation and the transformation losses. The transmission losses have now been added as separate losses (outputs) and compensating inputs in the corresponding market datasets.

### 6.4 Merging of duplicate intermediate exchanges

Some datasets in version 2.2 had multiple inputs that, after renaming, referred to the same version 3 product. In cases where this could be replaced by the use of the market input, these multiple inputs were merged, since multiple inputs from the market of an identical product are not permitted in version 3. Nevertheless, it is still possible to have multiple inputs of the same product if direct activity links to different producers are provided.

### 6.5 Re-linking inputs from production and supply mixes

In the ecoinvent database version 1&2, production mixes and supply mixes (a supply mix is a production mix plus any imports) could be created but were only normal datasets with a certain name. In the ecoinvent database version 3, production and supply mixes can be auto-generated by the database service layer for any desired geographical area, and are not used as inputs to any other activities, as all intermediate inputs to other activities are coming either directly from transforming activities (via direct links) or via market activities. Therefore, all production or supply mixes from version 2.2 have been deleted, and the ones now present in the version 3 database are newly generated mixes and do not completely correspond to version 2 production and supply mixes (e.g. in case of electricity, production mixes do not contain any more transmission infrastructure and associated emissions).

Some datasets called production and supply mixes in version 2.2 contained more than just a sum of the production outputs (and imports for supply mixes) for the geographical area. Any such non-market information has been moved to the relevant transforming activity or market datasets.

As in the ecoinvent database version 3 production and supply mixes are no longer applied in the further modelling, those activities that used the production and supply mixes of version 2.2 as inputs have been adjusted so that the input instead comes from the corresponding market datasets (consumption mixes). Table 6.2 shows a list of inputs which were modified in this way.

**Table 6. 2. Inputs of production and supply mixes, replaced by inputs of the corresponding products.**

<b>Input of</b>	<b>replaced by input of</b>
aluminium, cast alloy, production mix	aluminium, cast alloy
aluminium, wrought alloy, production mix	aluminium, wrought alloy
biogas, production mix	biogas
biogas, agricultural co-digestion, with methane recovery, production mix	biogas
chlorine, liquid, production mix	chlorine, gaseous
copper, supply mix	copper
electricity, high voltage, at grid, SBB, supply mix	electricity, high voltage, for Swiss Federal Railways
electricity, high voltage, at market, production mix	electricity, high voltage
electricity, high voltage, label-certified, production mix	electricity, high voltage, label-certified
electricity, high voltage, supply mix	electricity, high voltage
electricity, low voltage, production mix	electricity, low voltage
electricity, medium voltage, production mix	electricity, medium voltage
electricity, natural gas, production mix	electricity, high voltage
electricity, wind, production mix	electricity, high voltage, label-certified
fluosilicic acid, without water, in 22% solution state, supply mix	fluosilicic acid, without water, in 22% solution state
methane production, 96% by volume, from biogas, at service station, production mix	methane production, 96% by volume, from biogas, high pressure, at user
natural gas, high pressure, supply mix	natural gas, high pressure
naphtha, APME mix	naphtha
gold, production mix	gold
hard coal, supply mix	hard coal
hard coal power plant, production mix	hard coal power plant
hydrogen liquid, production mix	hydrogen, liquid
pesticide, unspecified, supply mix	pesticide, unspecified
[pesticide]-compound, supply mix	[pesticide]-compound
petroleum, long distance transport from [XX], production mix	petroleum
polystyrene, extruded, production mix	polystyrene, extruded
sodium hydroxide, without water, in 50% solution state, production mix	sodium hydroxide, without water, in 50% solution state
straw, production mix	straw
sulfate pulp, production mix	sulfate pulp
synthetic gas, production mix	synthetic gas
transport, freight, aircraft, production mix	transport, freight, aircraft
transport, passenger, aircraft, production mix	transport, passenger, aircraft
uranium ore, as U, production mix	uranium ore, as U
uranium, enriched [YY]%, [...], supply mix	uranium, enriched [YY]%, per separative work unit

Table 6.3 list additional inputs where the modification was more extensive because the inputs to the production or supply mixes were not uniform, i.e. the mixes where in fact mixes of different products. For example, “gravel, production mix” is a mix of – and therefore replaced by – “gravel, crushed” and “gravel, round” in a 21:79 ratio, while “log, at forest, production mix” is replaced by “log, hardwood, at forest” and “log, softwood, at forest” in a 28:72 ratio. Table 6.3 lists the names of the replaced inputs.

**Table 6. 3. Production and supply mixes, which are no longer used as inputs; the inputs being replaced by the previous inputs to these production and supply mixes, thus circumventing the mixes.**

Intermediate exchange name
aluminium, production mix <sup>1</sup>
biocide, for paper production, production mix
diode, production mix
electricity, industrial gas, production mix
electronic component, production mix
gravel, production mix
inductor, production mix
log, at forest, production mix
pigment, for paper production, production mix
polyvinylchloride, production mix
printed wiring board, for power supply unit, desktop computer, production mix
printed wiring board, mounted mainboard, desktop computer, production mix
printed wiring board, mounted mainboard, laptop computer, production mix
printed wiring board, production mix
resistor, production mix
silicon production, photovoltaics, production mix
transistor, production mix
used battery, production mix
wood chips and particles at forest, 120% water on dry mass basis, production mix
wood chips and particles from industry, 40% water on dry mass basis, production mix
wood chips and particles, hardwood, 40% water on dry mass basis, production mix
wood chips and particles, softwood, 40% water on dry mass basis, production mix

<sup>1)</sup> The 140 activities that used “aluminium, production mix” were analysed, and in some cases it was possible to specify the input as either “aluminium, wrought alloy” or “aluminium, cast alloy”.

The datasets concerning the natural gas supply chain have been re-structured to allow maintaining the modelling results from version 2.2, while adhering to the version 3 data structure. In that sense, the natural gas supply chain has been modelled using import activities that are localised in the same geography as the corresponding markets, instead of supply mixes. Each import bears an input of “natural gas, high pressure” that is directly linked to the producing activity. As an example, the “natural gas, high pressure, import from RU” localised in Austria (AT), ensures the input of natural gas from Russia (via a direct link to the Russian producing activity) into the Austrian market (where it will be linked to because of common geographical boundaries). All details of this modification are listed in Table 6.4.

**Table 6. 4. Natural gas supply chains have been remodelled using import activities.**

Dataset	Geography	Was replaced by	Geographies
natural gas, DE, supply mix	RER	natural gas, high pressure, import from DE	AT, BE, CH, HU, IT
natural gas, DZ, supply mix	RER	natural gas, high pressure, import from DZ	CH, ES, FR, HU, IT
natural gas, GB, supply mix	RER	natural gas, high pressure, import from GB	CH
natural gas, NL, supply mix	RER	natural gas, high pressure, import from NL	BE, CH, DE, FR, HU, IT
natural gas, NO, supply mix	RER	natural gas, high pressure, import from NO	AT, BE, CH, CZ, DE, DK, ES, FR, GB, HU, IE, NL, SE
natural gas, RU, supply mix	RER	natural gas, high pressure, import from RU	AT, CH, CZ, DE, FI, FR, GR, HU, IT, SK

In addition to the replacements listed in Tables 6.2, 6.3, and 6.4, “1 kg methane, 96% by volume, from biogas, at service station, production mix” and the consumption mix “1 kg natural gas, at service station” have been replaced by “45.83 MJ methane, 96% by volume, from biogas, high pressure, at user” and “1.2282 m<sup>3</sup> natural gas, high pressure”, respectively, as inputs to the consuming activities, reflecting that these inputs are also used in industrial activities and that the activities of the service station will be separately included as an input to the transport activities.

Furthermore, a few production mixes that were not used by any other dataset have been deleted: “fungicide, production mix”, “herbicide, production mix”, “insecticide, production mix”, “plant growth regulator, production mix”.

Some production mixes from version 2.2 were not explicit production mixes (meaning a dataset that had inputs from different activities producing the same product) but represented averages of other already existing datasets. This was the case for example for several transport datasets (passenger car and lorry fleet averages and freight by rail for Europe with specified shares of particle filters and different energy carriers). The lorry fleet average has been replaced by a “market for transport, freight, lorry, unspecified”, supplied by a transforming dataset “size-specific lorry transport to generic market for lorry transport“. **[The similar adaptation has not yet been made for the passenger car fleet average, “chemical, organic”, “chemical, inorganic”, and “solvents, organic”].** The “transport, freight train” datasets have now been specified by fuel and filter technology when this information was available, and as “unspecified” when this information was not available, but all with the same reference product “transport, freight train”, so that the consumption mix includes all such transport.

Some of those production mixes, that averaged in fact different products, could be seen as adequately representative of generic markets for unspecified products and have been changed accordingly, e.g. “cement, production mix” has been changed to “cement, unspecified”.

In the version 3, there’s a special type of activity, with the name “Import”. Those activities contribute to the supply mixes, but to avoid double-counting they are not used as input to markets that already have the imported amounts as part of their inputs. These activities are to be distinguished from imports that are reported as ordinary transforming activities, which do contribute to the markets (consumption mixes) that geographically contain them. The former is used in national balancing of the supply and use of a product, while the latter is used to model the import from or to partly isolated markets; see also Chapter 7.4 in the report at hand and Chapter 11.5 in the Data Quality Guidelines. The import datasets from the ecoinvent database version 2.2., listed in Table 6.5, have all been classified as import datasets of the special activity type “Import”.

**Table 6. 5. Import datasets converted from version 2.2 (here listed with their version 3 activity names)**

Dataset name
import of roundwood, azobe from sustainable forest management, CM, debarked
import of roundwood, meranti from sustainable forest management, MY, debarked
import of sawnwood, paraná pine from sustainable forest management, kiln dried
import of sulfate pulp, unbleached, from eucalyptus ssp. from sustainable forest management, TH

## 6.6 Global datasets generated by extrapolation

The ecoinvent database version 3 requires a global reference activity dataset to exist for any activity in the database, to avoid artificial introduction of differences between datasets for the same technology, and so that all specific products in the database are available as inputs to all other datasets in any geographical location.

For each activity, the global reference activity dataset is intended to represent the global average. Ideally, new data should be collected when global data are not available. However, as a temporary solution, while efforts to collect new data are on-going, most global datasets for the converted version 2.2

datasets have currently been generated as production volume-weighted averages of the existing, non-global version 2.2 datasets, taking the meta-data from the local dataset with the largest production volume, increasing the uncertainty by changing the geographical representativeness score in the pedigree matrix of each exchange, and adding a comment on the averaging in the field ‘Extrapolations’.

For a few activities, there is currently no global reference activity yet; they are listed in Table 6.6.

**Table 6. 6. Activities that do not have a global reference activity.**

Activity Name
ammonium nitrate phosphate production
collection of polystyrene scrap, post-consumer
cooling energy, from natural gas, at cogen unit with absorption chiller 100kW
copper production, from imported concentrates
diammonium phosphate production
energy use and operation emissions, electric bicycle
energy use and operation emissions, electric bicycle, label-certified electricity
heat production, at hot water tank, solar+electric, flat plate, multiple dwelling
heat production, at hot water tank, solar+gas, flat plate, multiple dwelling
heat production, at hot water tank, solar+gas, flat plate, one-family house
heat production, at solar+gas heating, flat plate, one-family house, combined system
heat production, at solar+gas heating, tube collector, one-family house, combined system
heat production, at solar+wood heating, flat plate, one-family house, combined system
mine construction, gold and silver
monoammonium phosphate production
natural gas pressure reduction from high to low pressure
natural gas, burned in gas turbine, for compressor station
operation, computer, laptop, 68% active work with internet access 0.2 Mbit/s, label-certified electricity
operation, computer, laptop, 68% active work, label-certified electricity
operation, computer, laptop, video mode, label-certified electricity
operation, computer, laptop, videoconference, label-certified electricity
operation, internet access equipment
operation, internet access equipment, label-certified electricity
tissue paper production
transport, passenger, electric bicycle, label-certified electricity

## 6.7 Classification of the technology level used for linking datasets

In the system model “Substitution, consequential, long-term” recommended for consequential LCA modelling, the inputs to the market datasets are limited to outputs from unconstrained activities. As part of the algorithm to determine if a dataset is unconstrained (see Chapter 14.6.1 of the Data Quality Guidelines), the database service layer queries the field “technology level” of the supplying datasets. This is a new field in the ecoSpold 2 format. For ecoinvent version 3, the field is applied with a 5-level classification system: “outdated”, “old”, “current”, “modern” and “new” (see Chapter 5.5 of the Data Quality Guidelines for the definitions of these classes). The class “current” is applied as default, also for all transforming datasets converted from version 2.2.

For some datasets converted from version 2.2, the technology level was changed from the default ‘current’, either to ‘modern’, to indicate that they can and will be able to increase their output with an increase in demand, or ‘old’ if their supply is being phased out, or ‘new’ if the technology is not yet the typically installed. This is mainly relevant when activity datasets are available for different technologies providing the same reference product. Converted datasets where the technology level has been changed from the default “current” are listed in Table 6.7. The justification for the technology level is provided in the individual datasets.

**Table 6. 7. Converted datasets from v2.2, for which the technology level has been changed away from the default ‘current’.**

Dataset name	New setting of ‘technology level’	Datasets with same reference product, which keep their technology level as ‘current’
chlor-alkali electrolysis, membrane cell	‘modern’	chlor-alkali electrolysis, diaphragm cell
chlor-alkali electrolysis, mercury cell	‘old’	chlor-alkali electrolysis, diaphragm cell
compressed air production, ... , best generation	‘new’	compressed air production, ... , average generation
compressed air production, ... , optimised generation	‘modern’	compressed air production, ... , average generation
electricity production, hard coal/hydro/lignite/natural gas/wind	‘modern’	all other producers of “electricity, high voltage” except nuclear and oil (see next two lines)
electricity production, nuclear (except for CH, DE, JP)	‘modern’	all other producers of “electricity, high voltage” except oil (see next line)
electricity production, oil (BR, CN, IR, RU, SA)	‘modern’	all other producers of “electricity, high voltage” except nuclear (see previous line)
electricity production, photovoltaic	‘modern’	All other producers of “electricity, low voltage”
ethoxylated alcohol (AE7) production, petrochemical	‘modern’	ethoxylated alcohol (AE7) production, coconut oil; ethoxylated alcohol (AE7) production, palm kernel oil
fatty alcohol [...] production, from palm oil	‘modern’	fatty alcohol [...] production, from coconut oil; fatty alcohol [...] production, from palm kernel oil
fatty alcohol [...] production, petrochemical	‘modern’	fatty alcohol [...] production, from coconut oil; fatty alcohol [...] production, from palm kernel oil
heat and power co-generation, biogas, gas engine, ...	‘modern’	treatment of biogas, purification to methane
heat and power co-generation, wood chips, ...	‘modern’	“heat and power co-generation, wood chips, organic Rankine cycle, 1400kW thermal [...]”, and all other producers of “heat, district or industrial, other than natural gas”
maleic anhydride production by catalytic oxidation of benzene	‘old’	maleic anhydride production by direct oxidation of n-butane
operation, computer, desktop, with cathode ray tube display, [...]	‘old’	operation, computer, desktop, with liquid crystal display, [...]
steel production, converter, [...]	‘modern’	steel production, electric. [...]
transport, freight, lorry [...], EURO3	‘old’	transport, freight, lorry [...], EURO4
transport, freight, lorry [...], EURO5	‘modern’	transport, freight, lorry [...], EURO4

## 6.8 Rest-Of-World datasets generated by calculation

When one or more non-global datasets are available for the same activity, a dataset with the geographical location Rest-Of-World (ROW) is calculated as the residual difference between the global dataset and the production volume-weighted average of the non-global datasets. This calculation is performed automatically each time a new non-global dataset is accepted for inclusion in the ecoinvent database.

When new local data have been added after the initial generation of a global dataset, the global dataset should ideally be updated in order to remain representing the global average. However, some inconsistencies between different regional datasets remain for now. In a few cases this leads to negative amounts for some exchanges in the subsequently generated ROW datasets. Since such negative amounts are calculation artefacts, they are automatically eliminated by setting the amounts to zero instead. In some cases, significant differences between different regional datasets exist for a given transforming activity. In these cases, a procedural exception has been applied in which the ROW dataset is created as a direct copy of the GLO dataset, i.e. without the above-described averaging procedure.

This option is only used sparingly as a solution supervised by the ecoinvent LCI Expert Group in coordination with the data providers, since it creates an inconsistency between the production-volume-weighted sum of all datasets and that provided by original the global dataset. Annex 1 lists all datasets generated with this exception, including datasets converted from version 2.2, and new datasets generated for version 3.

## 7 Geographical information

In the ecoinvent database version 3, information on the geographical location of the datasets is applied in the linking of datasets. An input is automatically linked to the outputs from the local market dataset that supplies the input, i.e. the market that geographically covers the location of the activity that demands the input. And the inputs to the market for this product are automatically linked to the outputs of this product from the transforming activities located within the area of the market.

### 7.1 Geography IDs, names and coordinates

For the ecoinvent database version 3, all geographical locations are expressed as specified by the eco-Spold format 2, with a UUID, a short name, a long name and in terms of geographical information system coordinates (longitude, latitude) in the Keyhole Markup Language (KML). This allows the database service layer to automatically identify activities located within a given area. An advantage of the use of the geographical information system coordinates is that the location of the activities can be used for automated linking to the spatially differentiated characterisation factors of site-dependent impact assessment methods.

All geographies used in ecoinvent version 2 have been defined in KML in the new geographies master file, which is available from the ecoinvent web-site. The previously used short names (e.g. CH for Switzerland, RER for Europe) have been maintained, with a few exceptions listed in Table 7.1, and new longer, more descriptive names (e.g. Switzerland for Switzerland) have been added for ease of use.

Table 7. 1. Changes in short names for geographies used in version 2.2

Version 2 short name	Version 2 description	ecoinvent version 3	Related dataset changes
AFR	Sub-Saharan Africa	Deleted	
CPA	Centrally Planned Asia and China	Deleted	Used for "hard coal mine operation" and "market for hard coal". These datasets are moved to ID (Indonesia), since separate datasets for China exist and separate data for India have been collected (but not yet passed review)
CS	Serbia and Montenegro	RS	Serbia (old datasets indeed covered only Serbia)
EEU	Central and Eastern Europe	Deleted	Used for "hard coal mine operation" and "market for hard coal". These datasets are moved to PL (Poland) where the majority of the production takes place.
ERCOT	Electric Reliability Council of Texas	TRE	To be consistent with the region definition in NERC. All datasets have been relocated from ERCOT to TRE (Texas Regional Entity).
MEA	Middle East and North Africa	Deleted	
OCE	Oceanic	Deleted	Datasets relocated to GLO (Global)
PAO	Pacific OECD	Deleted	
PAS	Other Pacific Asia	Deleted	
RAS	Asia and the Pacific	Redefined as Asia	Used for "copper mine operation" and "copper production, primary", where it is wrongly described as "Europe and Russia".
RNE	Near East	Deleted	

New geographies have been added, e.g. the 30 UN regions and sub-regions, and further geographies can be added by the data providers; see Chapter 9.9 of the Data Quality Guidelines.

## 7.2 Non-overlapping geographical areas

In the ecoinvent database version 3, overlapping geographical areas for datasets for the same activity (i.e. identical activity names) are not allowed, except that a global dataset is allowed to co-exist with datasets for smaller areas and that production and supply mixes (see Chapter 6.5) can be established for any area of interest.

In the ecoinvent database version 1&2, transforming and market datasets could exist for areas contained within the area of another dataset for the same activity. This was especially the case of extensive regions like Europe and the electricity generation networks, like UCTE, CENTREL and NORDEL.

To avoid the overlap of areas for different datasets for the same activity, the geography of the containing datasets have been modified to exclude the contained areas. For example, the dataset “esterification of rape oil” existed in version 2.2 for the two geographies Europe (RER) and Switzerland (CH). For version 3, the geography of the European dataset has been changed to “Europe without Switzerland”. The same procedure of excluding the smaller areas from the more extensive geography has been applied in cases where more than one datasets was contained within the containing area. Table 7.2 lists the affected datasets.

In some cases, when the sum of the contained datasets represents all or nearly all of the dataset for the containing area, the latter was simply deleted. Any smaller areas thereby not covered will then be included in the Rest-Of-World dataset; see Chapter 6.8. This solution was applied to the datasets listed in Table 7.3.

A special case is the activity “dewatering of ethanol from biomass, from 95% to 99.7% solution state” where the converted dataset for Sweden (SE) was in fact identical to the existing dataset for Europe (RER) and was therefore deleted.

Another special case is that of the activities “copper mine operation” and “copper production, primary”, which existed for both Asia (RAS) and Indonesia (ID). On inspection, it appeared that the dataset for Indonesia was in fact intended to cover Indonesia and Australia, and the production volume for Australia is dominating the output of these two countries. Therefore, two non-overlapping datasets were achieved by relocating the Indonesian dataset to the more representative location of Australia (AU).

The dataset “rape seed production (obsolete)” (DE) was deleted due to the overlap with the more recent dataset “rape seed production” (DE).

**Table 7. 2. Changes in the geographical location of datasets. See also Table 7.1. (\*: This change occurred for v3.01.)**

Dataset name	Version 2.2 location	Version 3.01 location
dewatering of ethanol from biomass, from 95% to 99.7% solution state	RER	Europe without Switzerland
diesel production, low-sulfur	RER	Europe without Switzerland
electricity production, hard coal	MRO	MRO, US only
electricity production, hard coal	NPCC	NPCC, US only
electricity production, hard coal	WECC	WECC, US only
electricity production, natural gas, at conventional power plant	MRO	MRO, US only
electricity production, natural gas, at conventional power plant	NPCC	NPCC, US only
electricity production, natural gas, at conventional power plant	WECC	WECC, US only
esterification of rape oil	RER	Europe without Switzerland
floor heating from air-water heat pump	RER	Europe without Switzerland
floor heating from borehole heat pump	RER	Europe without Switzerland
hardwood forestry, CO2-removal and land use	RER	Europe without NORDEL (NCPA)
heat and power co-generation, natural gas, 1MW electrical, lean burn	RER	Europe without Switzerland
heat production, air-water heat pump 10kW	RER	Europe without Switzerland
heat production, anthracite, at stove 5-15kW*	RER	Europe without Switzerland
heat production, at hard coal industrial furnace 1-10MW*	RER	Europe without Switzerland
heat production, borehole heat exchanger, brine-water heat pump 10kW	RER	Europe without Switzerland
heat production, hard coal briquette, stove 5-15kW*	RER	Europe without Switzerland
heat production, hard coal coke, stove 5-15kW*	RER	Europe without Switzerland
heat production, heavy fuel oil, at industrial furnace 1MW	RER	Europe without Switzerland
heat production, light fuel oil, at industrial furnace 1MW	RER	Europe without Switzerland
heat production, lignite briquette, at stove 5-15kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler atm. low-NOx condensing non-modulating <100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler atmospheric low-NOx non-modulating <100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler atmospheric non-modulating <100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler condensing modulating <100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler condensing modulating >100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler fan burner low-NOx non-modulating <100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler fan burner non-modulating <100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler modulating <100kW*	RER	Europe without Switzerland
heat production, natural gas, at boiler modulating >100kW*	RER	Europe without Switzerland
heat production, natural gas, at industrial furnace >100kW*	RER	Europe without Switzerland
heat production, natural gas, at industrial furnace low-NOx >100kW*	RER	Europe without Switzerland
heavy fuel oil, burned in refinery furnace	RER	Europe without Switzerland
hydropower plant construction, run-of-river	RER	Europe without Switzerland
market for diesel	RER	Europe without Switzerland
market for diesel, low-sulfur	RER	Europe without Switzerland
market for heavy fuel oil	RER	Europe without Switzerland
market for kerosene	RER	Europe without Switzerland
market for light fuel oil	RER	Europe without Switzerland
market for petrol, low-sulfur	RER	Europe without Switzerland
market for waste paper, unsorted	RER	Europe without Switzerland
nuclear fuel element production, for boiling water reactor, UO2 4.0% & MOX	UCTE	UCTE without Germany
operation, computer, desktop, [...]	RER	Europe without Switzerland
operation, computer, laptop, [...]	RER	Europe without Switzerland
operation, printer, laser, [...]	RER	Europe without Switzerland
packaging glass production, [...]	RER	RER w/o CH+DE
paper production, newsprint, recycled	RER	Europe without Switzerland
petrol blending for two-stroke engines	RER	Europe without Switzerland
petrol production, low-sulfur	RER	Europe without Switzerland
petroleum refinery operation	RER	Europe without Switzerland
pipeline construction, natural gas, high pressure distribution network	RER	Europe without Switzerland
rape oil mill operation	RER	Europe without Switzerland
refinery gas, burned in furnace	RER	Europe without Switzerland
softwood forestry, CO2-removal and land use	RER	Europe without NORDEL (NCPA)
tap water production and supply	RER	Europe without Switzerland
transport, freight train, diesel	RER	Europe without Switzerland
transport, freight, light commercial vehicle	RER	Europe without Switzerland
transport, pipeline, long distance, natural gas	RER	RER w/o DE+NL+NO
treatment of waste paper, unsorted, sorting	RER	Europe without Switzerland
uranium fuel element production, enriched 4%, for light water reactor	UCTE	UCTE without Germany

**Table 7. 3. Datasets deleted due to the existence of datasets for more specific locations covering all or nearly all of the area of the deleted dataset.**

Dataset name	location
electricity, high voltage, hydro, reservoir, alpine region	RER
electricity, high voltage, hydro, reservoir, non-alpine region	RER
electricity, high voltage, hydro, run-of-river	RER
electricity production, at wind power plant 800kW	RER
electricity production, hard coal	NORDEL
electricity production, natural gas	CENTREL
electricity production, natural gas	NORDEL
electricity production, natural gas, at combined cycle plant, best technology	RER
electricity production, peat	NORDEL
electricity production, hydro, pumped storage	US
electricity production, nuclear, boiling water reactor	US
electricity production, nuclear, pressure water reactor	US
market for electricity, high voltage	US
market for electricity, low voltage	US
market for electricity, medium voltage	US
market for natural gas, high pressure	RER
natural gas, burned in gas turbine, for compressor station	UCTE
natural gas, burned in power plant	NORDEL
natural gas, burned in power plant	CENTREL
natural gas, burned in power plant	UCTE
natural gas, high pressure, supply mix	RER
nuclear power plant construction, boiling water reactor 1000MW	UCTE
nuclear power plant construction, pressure water reactor 1000MW	UCTE

### 7.3 Market activity datasets deleted

Non-global market activities (consumption mixes) now require a justification for their existence. All non-global market datasets converted from version 2.2 have been reviewed by the ecoinvent LCI expert group, and datasets for markets without restrictions on imports and exports, and for which no other justification for a market boundary could be found, have been deleted. **[Justifications still have to be added to retained non-global market datasets]** Table 7.4 lists the market (and import) datasets deleted on these grounds. The Annex 2 lists all non-global market activities, including those that have been retained from version 2.2.

The deletions mainly affect chemicals, metals, and paper, where a separate Swiss or European market could not be justified. All petrol in Switzerland is sold as “petrol, low-sulfur” and “petrol, unleaded” does therefore not have a separate Swiss market. Likewise, the different datasets for “..., methyl ester, ...” from different specified origins have been deleted, since the market does not currently distinguish between different origins. The specific transforming datasets can still be accessed individually for specific study purposes.

The Austrian and Swiss markets for foam glass have been deleted, because these datasets in version 2.2 represented different amounts of renewable energy certificates applied by the Belgian producer for the products sold in these two countries. This is now modelled by a separate production dataset with label-certified electricity, which can be assessed by consumers in all countries, not only AT and CH.

Two Swiss waste markets (for “waste sealing sheet, polyethylene” and “waste wood, untreated”) were deleted because their supplying activities had the geography RER (see Chapter 7.4 for further explanation of the more typical way of dealing with the new requirement that contributing activities must be located within the same geographical area as the market they contribute to).

**Table 7. 4. Non-global market datasets deleted due to missing justification for the existence of a market boundary**

import of natural gas, liquefied	JP
market for ammonia, liquid	CH
market for calcium chloride	CH
market for ferrochromium, high-carbon, 68% Cr	RER
market for foam glass	AT, CH
market for gallium, semiconductor-grade	RER
market for gold	RER
market for hard coal	US
market for krypton, gaseous	CH
market for lead	RER
market for methanol	CH
market for methylchloride	CH
market for naphtha	CH
market for packaging glass, [...]	CH
market for palladium	RER
market for palm methyl ester, at service station	CH
market for paper, newsprint	CH
market for paper, woodcontaining, lightweight coated	CH
market for paper, wood-containing, supercalendred	CH
market for paper, wood-containing, supercalendred	RER
market for paper, woodfree, coated	CH
market for paper, woodfree, uncoated	CH
market for petrol, 15% ETBE additive by volume, with ethanol from biomass	CH
market for petrol, 4% ETBE additive by volume, with ethanol from biomass	CH
market for petrol, unleaded	CH
market for photovoltaic laminate, CdTe	RER
market for platinum	RER
market for rape methyl ester, production RER, at service station	CH
market for rhodium	RER
market for silver	RER
market for soybean methyl ester, BR, at service station	CH
market for soybean methyl ester, US, at service station	CH
market for tetrachloroethylene	CH
market for vegetable oil methyl ester, FR, at service station	CH
market for waste sealing sheet, polyethylene	CH
market for waste wood, untreated	CH
market for xenon, gaseous	CH

## 7.4 Placing transforming activities in the markets they supply

In the ecoinvent database version 3, inputs of the marketed product to market datasets are automatically created during linking by the database service layer, based on the output from the transforming activities that produce the product within the geographical area of the market, weighted in proportion to their production volumes. Thus, all relevant contributing activities must be located within the same geographical area as the market they contribute to.

This requirement is new relative to the ecoinvent database version 1&2, where all datasets were manually linked and links across market boundaries were unproblematic.

For example, the activity “electricity production, hard coal” localised in Poland (PL) has been used as a proxy to represent the local electricity production from hard coal in other national electricity markets with a similar production technology, e.g. the United Kingdom (GB). To ensure the correct market mix of electricity in GB, a copy of the dataset for Polish electricity production from hard coal was added with GB as geographical location, with the appropriate production volume, and so on for other geographies and technologies. Table 7.5 lists all datasets added to ensure presence of the relevant production activities in all markets.

Likewise, imports must be located within the same geographical area as the market they contribute to.

For example, the import of electricity to Switzerland (CH) from different foreign markets is now modelled by adding separate transforming activities “electricity, high voltage, import from [X]” with the geographical specification CH and with the exchange “electricity, high voltage” linking directly with ActivityLinkId to the exporting market (X) (= export mix). Table 7.6 lists all datasets added to ensure presence of the relevant imports to all markets.

The new activity datasets are *not* modelled as special import activities, because by definition, special import activities do *not* contribute to the auto-generated consumption mix, but are solely used for national balancing.

**Table 7. 5. New activities placed within the markets they supply, thereby replacing proxy supplies from other locations (continues in next page).**

New activity		Replaced activity (now only used within original location or deleted)	
Name	Locations	Name	Location
electricity production, hard coal	BG, HU, RO	electricity, hard coal, at power plant	CENTREL
electricity production, hard coal	BR, GB, IE	electricity, hard coal, at power plant	UCTE
electricity production, hard coal	DK, FI, NO, SE	electricity, hard coal, at power plant	NORDEL
electricity production, hard coal	JP	electricity, hard coal, at power plant	BE
electricity production, hard coal	SI	electricity, hard coal, at power plant	HR
electricity production, hard coal, aluminium industry	GLO	electricity, hard coal, at power plant	UCTE
electricity production, hydro, aluminium industry	GLO	electricity, hydropower, at power plant	FR
electricity production, hydro, reservoir, alpine region, label-certified	CH	electricity, hydropower, at power plant	CH
electricity production, hydro, reservoir, non-alpine region	CN	electricity, hydropower, at reservoir power plant, non alpine region	RER
electricity production, hydro, run-of-river	BG, RO	electricity, hydropower, at power plant	SK
electricity production, hydro, run-of-river	CZ	electricity, hydropower, at power plant electricity, hydropower, at pumped storage power plant	PL
electricity production, lignite	BG, RO	electricity, lignite, at power plant	CENTREL
electricity production, lignite, aluminium industry	GLO	electricity, lignite, at power plant	UCTE
electricity production, natural gas, aluminium industry	GLO	electricity, natural gas, at power plant	UCTE
electricity production, natural gas, at conventional power plant	BA, BR, GR, HR, IE, PT, SI	electricity, natural gas, at power plant	UCTE
electricity production, natural gas, at conventional power plant	BG, CN, CZ, HU, PL, RO, RS, SK	electricity, natural gas, at power plant	CENTREL
electricity production, natural gas, at conventional power plant	DK, FI, NO, SE	electricity, natural gas, at power plant	NORDEL
electricity production, natural gas, at conventional power plant	LU	electricity, natural gas, at power plant	FR
electricity production, nuclear, aluminium industry	GLO	electricity, nuclear, at power plant	UCTE
electricity production, nuclear, pressure water reactor and/or electricity production, nuclear, boiling water reactor	BE, BG, CZ, ES, FI, GB, HR, HU, NL, RO, SE, SI, SK	electricity, nuclear, at power plant	UCTE
electricity production, nuclear, pressure water reactor	BR, JP	electricity, nuclear, at power plant	CH
electricity production, oil	BG, RO	electricity, oil, at power plant	SK
electricity production, oil	BR	electricity, oil, at power plant	IT
electricity production, oil	CN, PL	electricity, oil, at power plant	CZ
electricity production, oil	JP	electricity, oil, at power plant	FR
electricity production, oil	MK	electricity, oil, at power plant	HR
electricity production, oil	NO	electricity, oil, at power plant	FI
electricity production, oil, aluminium industry	GLO	electricity, oil, at power plant	IT
electricity production, peat	FI, IE, SE	electricity, peat, at power plant	NORDEL
electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted, label-certified electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted, label-certified	CH	electricity, production mix photovoltaic, at plant	CH
electricity production, wind, <1MW turbine, onshore electricity production, wind, 1-3MW turbine, onshore electricity production, wind, >3MW turbine, onshore electricity production, wind, 1-3MW turbine, offshore	CN	electricity, at wind power plant 600kW	CH
electricity production, wind, <1MW turbine, onshore electricity production, wind, 1-3MW turbine, onshore electricity production, wind, >3MW turbine, onshore	AT	electricity, at wind power plant	CH
electricity production, wind, <1MW turbine, onshore electricity production, wind, 1-3MW turbine, onshore electricity production, wind, >3MW turbine, onshore electricity production, wind, 1-3MW turbine, offshore	BE, BR, DE, DK, ES, FI, FR, GB, GR, IE, IT, JP, LU, NL, NO, PL, PT, SE	electricity, at wind power plant	RER
electricity production, wind, <1MW turbine, onshore, label-certified electricity production, wind, 1-3MW turbine, onshore, label-certified	CH	electricity, at wind power plant	CH, RER
electricity, hydro, reservoir, alpine region, label-certified	CH	electricity, hydropower, at power plant	CH

New activity		Replaced activity (now only used within original location or deleted)	
Name	Locations	Name	Location
heat and power co-generation, biogas, gas engine	AT, BE, CZ, DE, DK, ES, FI, FR, GR, HU, IE, IT, LU, NL, PL, PT, SE, SI, SK	electricity, at cogen with biogas engine, allocation exergy	CH
heat and power co-generation, biogas, gas engine, label-certified	CH	electricity, at cogen with biogas engine, allocation exergy	CH
heat and power co-generation, diesel, 200kWe SCR-NOx reduction	BR	electricity, at cogen 200kWe diesel SCR, allocation exergy	CH
heat and power co-generation, wood chips, 6400kWth, with extensive emission control	AT, BE, CN, CZ, DE, DK, ES, FI, FR, GB, HU, IE, IT, NL, NO, PL, PT, SE, SI, SK	electricity, at cogen ORC 1400kWth, wood, allocation exergy	CH
heat and power co-generation, wood chips, 6400kWth, with extensive emission control, label-certified	CH	electricity, at cogen ORC 1400kWth, wood, allocation exergy	CH
lime production, algae	FR	lime production, algae	CH*
treatment of coal gas, in power plant treatment of blast furnace gas, in power plant	AT, BG, BR, GB, NO, SE,	electricity, industrial gas, at power plant	UCTE
treatment of coal gas, in power plant treatment of blast furnace gas, in power plant	CZ, HU, PL, RO, SK	electricity, industrial gas, at power plant	CENTREL
treatment of coal gas, in power plant treatment of blast furnace gas, in power plant	FI, NO, SE	electricity, industrial gas, at power plant	NORDEL

\* This dataset was erroneously geographically located in CH

**Table 7.6. New import activities placed within the markets they supply, thereby replacing direct supplies from other locations in version 2.2.**

activityName	location	Product (input and output)	input directly linking to activity in location "X"	location "X"
electricity, high voltage, import from ["X"]	AT	electricity, high voltage	market for electricity, high voltage	CH, CZ, DE, HU, SI, IT
electricity, high voltage, import from ["X"]	BA	electricity, high voltage	market for electricity, high voltage	RS, HR
electricity, high voltage, import from ["X"]	BE	electricity, high voltage	market for electricity, high voltage	FR, LU, NL
electricity, high voltage, import from ["X"]	BG	electricity, high voltage	market for electricity, high voltage	RO
electricity, high voltage, import from ["X"]	CH	electricity, high voltage	market for electricity, high voltage	AT, DE, FR, IT
electricity, high voltage, import from ["X"]	CZ	electricity, high voltage	market for electricity, high voltage	PL, unspecified
electricity, high voltage, import from ["X"]	DE	electricity, high voltage	market for electricity, high voltage	AT, CZ, DK, FR, NL, PL
electricity, high voltage, import from ["X"]	DK	electricity, high voltage	market for electricity, high voltage	DE, NO, SE
electricity, high voltage, import from ["X"]	ES	electricity, high voltage	market for electricity, high voltage	FR, PT
electricity, high voltage, import from ["X"]	FI	electricity, high voltage	market for electricity, high voltage	EE, NO, RU, SE
electricity, high voltage, import from ["X"]	FR	electricity, high voltage	market for electricity, high voltage	BE, CH, DE, ES, GB, IT
electricity, high voltage, import from ["X"]	GB	electricity, high voltage	market for electricity, high voltage	FR, IE
electricity, high voltage, import from ["X"]	GR	electricity, high voltage	market for electricity, high voltage	BG, IT, MK
electricity, high voltage, import from ["X"]	HR	electricity, high voltage	market for electricity, high voltage	RS, HU, SI
electricity, high voltage, import from ["X"]	HU	electricity, high voltage	market for electricity, high voltage	AT, HR, RO, UA
electricity, high voltage, import from ["X"]	IT	electricity, high voltage	market for electricity, high voltage	AT, CH, FR, GR, SI
electricity, high voltage, import from ["X"]	LU	electricity, high voltage	market for electricity, high voltage	BE, DE
electricity, high voltage, import from ["X"]	MK	electricity, high voltage	market for electricity, high voltage	RS, GR
electricity, high voltage, import from ["X"]	NL	electricity, high voltage	market for electricity, high voltage	BE, DE, NO
electricity, high voltage, import from ["X"]	NO	electricity, high voltage	market for electricity, high voltage	DK, FI, NL, SE, RU
electricity, high voltage, import from ["X"]	PL	electricity, high voltage	market for electricity, high voltage	CZ, DE, SE, SK, UA
electricity, high voltage, import from ["X"]	PT	electricity, high voltage	market for electricity, high voltage	ES
electricity, high voltage, import from ["X"]	RO	electricity, high voltage	market for electricity, high voltage	BG, UA
electricity, high voltage, import from ["X"]	RS	electricity, high voltage	market for electricity, high voltage	BA, BG, CZ, HR, HU, PL, RO, SK
electricity, high voltage, import from ["X"]	SE	electricity, high voltage	market for electricity, high voltage	DE, DK, FI, NO, PL
electricity, high voltage, import from ["X"]	SI	electricity, high voltage	market for electricity, high voltage	AT, HR, IT
electricity, high voltage, import from ["X"]	SK	electricity, high voltage	market for electricity, high voltage	CZ, PL, UA
electricity, high voltage, hydro, run-of-river, import from France	CH	electricity, high voltage	electricity production, hydro, run-of-river	FR
electricity, high voltage, hydro, reservoir, import from France	CH	electricity, high voltage	electricity production, hydro, reservoir, non-alpine	FR
electricity, high voltage, natural gas, import from Germany	CH	electricity, high voltage	electricity production, natural gas	DE
electricity, high voltage, nuclear, import from France	CH	electricity, high voltage	electricity production, nuclear, pressure water reactor	FR
electricity, high voltage, wind, import from Germany	CH	electricity, high voltage	electricity production, wind, 1-3MW turbine, onshore	DE
kerosene, import from Europe	CH	kerosene	market for kerosene	Europe without Switzerland
light fuel oil, import from Europe	CH	light fuel oil	market for light fuel oil	Europe without Switzerland
liquefied petroleum gas, import	CH	liquefied petroleum gas	petroleum refinery operation	Europe without Switzerland
petrol, low-sulfur, import from Europe	CH	petrol, low-sulfur	market for petrol, low-sulfur	Europe without Switzerland

## 8 Exchanges from and to the environment

### 8.1 Environmental categories / compartments

The term ‘environmental category’ from version 1&2 has been changed to ‘environmental compartment’ in version 3. The compartment ‘Resource’ has been changed to ‘Natural resource’. The sub-compartments ‘Lake’ and ‘River’ have been merged to ‘Surface water’. New compartments have been added for indoor air, direct human uptake, economic and social exchanges.

Duplicate elementary exchanges in the same dataset, as a result of the merger of the sub-compartments ‘Lake’ and ‘River’, have been merged.

### 8.2 Land use impacts

The land use classes used for reporting land occupation and land transformation have been revised based on a draft version of the Handbook on LCIA of Global Land Use within the framework of the UNEP/SETAC Life Cycle Initiative. At the same time, all descriptions/definitions of the classes have been reviewed and made more precise. New land use classes are mainly for natural areas (non-use), to allow reporting of transformation from more specific nature types. Some additional land use types for agriculture and seabed use have also been added. Some names have been changed for increased precision, consistency and generality. Some land use classes in version 2.2 have been merged into four more aggregated classes (‘forest, extensive’, ‘forest, intensive’, ‘industrial area’ and ‘traffic area, rail/road embankment’), since the previous distinctions were not easily applicable in practice. Table 8.1 provides an overview of the changes. Note that the correspondence to version 2.2 exclusively reflects how these land classes were applied in the ecoinvent database version 2.2, and is not reflecting a general correspondence (for example between vine and non-irrigation, and fruit and irrigation). For the revised definitions of the land use classes, please see the Data Quality Guidelines (Table 6.1).

Duplicate elementary exchanges in the same dataset, as a result of the merger of land use classes, have been merged.

In the ecoinvent database version 2, tropical wood from clear-cutting was modelled as a co-product of land transformation from forest to agricultural land. This has been revised so that each cause of land transformation is modelled separately, i.e. ‘harvest, roundwood, primary forest’ and ‘clear-cutting, secondary forest to arable land’ are modelled as separate activities, each with their own land use impacts.

In the ecoinvent database version 2, land occupation and land transformation was modelled as specific inputs to transforming datasets that require land or directly cause land transformation. For the ecoinvent database version 3, the general global land occupation and land transformation is included in separate datasets delivering ‘land tenure’ expressed in g NPP-C, which is then available as an input – via a market for land tenure - for the specific transforming datasets that require land tenure; see Chapter 6.7 in the Data Quality Guidelines.

There is an on-going scientific debate on whether land transformation from nature to arable land is caused by specific crops at the frontier between agriculture and nature, or is rather caused by arable land use in general. The ecoinvent LCI Expert group continues to follow this debate. For now, it has been decided to follow the first modelling approach, i.e. to assign all land transformation from nature to the “frontier crops” (jatropha seed, palm fruit, and soybean) by adding direct links from the frontier crops to the land transformation activities. Due to lack of statistics, some of these frontier crops are unknown and datasets for “unknown land use” have therefore been added to absorb the remaining land transformation from nature. As long as these direct links are maintained, there will be no input of these land-transforming activities to the ‘market for land tenure, arable land’.

In some transport datasets from ecoinvent version 2.2, the land occupation and transformation (and the infrastructure maintenance) were erroneously placed as inputs to the transport rather than to the infrastructure (airports, canals, ports, railways, roads). This error has been corrected.

Table 8 1. Correspondence between land use classes in the ecoinvent database version 2.2 and version 3

Land use class (ecoinvent 2)	Land use class (ecoinvent 3)	
unknown	unspecified	Name change
	unspecified, natural (non-use)	New
forest	forest, unspecified	Name change
	forest, primary (non-use)	New
	forest, secondary (non-use)	New
forest, extensive	forest, extensive	
tropical rain forest	forest, extensive	Merged with the above
forest, intensive	forest, intensive	
forest, intensive, normal	forest, intensive	Merged with the above
forest, intensive, clear-cutting	forest, intensive	Merged with the above
forest, intensive, short-cycle	forest, intensive	Merged with the above
	wetland, coastal (non-use)	New
	wetland, inland (non-use)	New
shrub land, sclerophyllous	shrub land, sclerophyllous	
	grassland, natural (non-use)	New
	grassland, natural, for livestock grazing	New
	arable land, unspecified use	New
pasture and meadow	pasture, man made	Name change
pasture and meadow, extensive	pasture, man made, extensive	Name change
pasture and meadow, intensive	pasture, man made, intensive	Name change
arable	annual crop	Name change
arable, non-irrigated, fallow	cropland fallow (non-use)	Name change
arable, non-irrigated	annual crop, non-irrigated	Name change
arable, non-irrigated, diverse-intensive	annual crop, non-irrigated, extensive	Name change
arable, non-irrigated, monotone-intensive	annual crop, non-irrigated, intensive	Name change
	annual crop, irrigated	New
	annual crop, irrigated, extensive	New
	annual crop, irrigated, intensive	New
	annual crop, flooded crop	New
	annual crop, greenhouse	New
	field margin/hedgerow	New
permanent crop	permanent crop	
permanent crop, vine	permanent crop, non-irrigated	Name change
permanent crop, vine, extensive	permanent crop, non-irrigated, extensive	Name change
permanent crop, vine, intensive	permanent crop, non-irrigated, intensive	Name change
permanent crop, fruit	permanent crop, irrigated	Name change
permanent crop, fruit, extensive	permanent crop, irrigated, extensive	Name change
permanent crop, fruit, intensive	permanent crop, irrigated, intensive	Name change
heterogeneous, agricultural	heterogeneous, agricultural	
	urban/industrial fallow (non-use)	New
urban, continuously built	urban, continuously built	
urban, discontinuously built	urban, discontinuously built	
	urban, green area	New
industrial area	industrial area	
industrial area, built up	industrial area	Merged with the above
industrial area, vegetation	industrial area	Merged with the above
mineral extraction site	mineral extraction site	
dump site	dump site	
construction site	construction site	
traffic area, road network	traffic area, road network	
traffic area, rail network	traffic area, rail network	
traffic area, road embankment	traffic area, rail/road embankment	Merged with the below
traffic area, rail embankment	traffic area, rail/road embankment	Merged with the above
	bare area (non-use)	New
	snow and ice (non-use)	New
	inland waterbody, unspecified	New
	river, natural (non-use)	New
	lake, natural (non-use)	New
water courses, artificial	river, artificial	Name change
water bodies, artificial	lake, artificial	Name change
sea and ocean	seabed, unspecified	Name change
	Seabed, natural (non-use)	New
	Seabed, natural (non-use)	New
	Seabed, natural (non-use)	New
industrial area, benthos	Seabed, infrastructure	Name change
dump site, benthos	Seabed, drilling and mining	Name change
	Seabed, sediment displacement	New
	Seabed, bottom fishing	New

### 8.3 Sum parameters for carbon compounds (BOD<sub>5</sub>, COD, DOC, TOC)

In the ecoinvent datasets, all four sum parameters, BOD<sub>5</sub>, COD, DOC and TOC, for carbon content in wastewaters are recorded in parallel. Missing data are added using best estimates.

Although required also in the ecoinvent version 2 datasets, the parallel reporting was not consistently implemented. For version 3, all situations where entries were missing have been filled by default:

5. If only BOD<sub>5</sub> exist, COD is set to 2\*BOD<sub>5</sub> (rule of thumb applicable to untreated water; the worst-case assumption BOD<sub>5</sub> = COD applied for ecoinvent version 1&2, has been removed as recommendation),
6. Missing entries for TOC (gC) are set to COD/2.7 (COD measured in g O<sub>2</sub>)
7. Missing entries for DOC are set as equal to TOC (i.e. assuming all carbon to be dissolved)
8. If TOC exist and DOC is missing, TOC is set as equal to DOC
9. If both BOD<sub>5</sub> and COD are missing the reverse of the above is applied.

See also Chapter 5.9.7 in the Data Quality Guidelines.

### 8.4 Outlook: Metal resources

For the ecoinvent database version 3, resource inputs of metal shall be reported separately from the residual ore; see Chapter 5.9.3 in the Data Quality Guidelines. The current exchanges for metal resources will therefore be adjusted to this new format, but this has not yet been implemented.

### 8.5 Renewable energy

Since it is theoretically impossible to define a consistent boundary between the natural system supplying renewable energy and the human activities that convert this energy, and thereby to calculate consistent energy efficiencies for renewable energy inputs, the resource inputs of renewable energy will no longer be recorded. Instead, the energy content will be provided for the reference products from the resource extracting activities. Since system-wide energy balances are not required, the inclusion of waste heat emissions has also been abandoned. **[The impact assessment methods for Cumulative Energy Demand will be adjusted accordingly].**

## 9 Production volumes added

For ecoinvent version 3, all intermediate outputs of transforming activities have information on their annual production volume in the geographical area of the dataset and the unit of the product. For the datasets converted from version 2.2 and generated during conversion, the production volumes were collected and added centrally, preferably using year 2005 data.

The sources and calculations for the production volumes are documented for each intermediate output in each dataset.

The production volumes are applied by the linking routines of the database to calculate the proportions of the inputs to the market datasets. The production volumes are therefore especially important when there is more than one activity that produces the same intermediate output in the same geography. **[Therefore, priority has been given to provide production volumes for products that are currently outputs from more than one activity dataset. For some waste treatment datasets, we have temporarily applied proportions only. For some products that are currently the output of one type of activity only, a placeholder value of 4 for global dataset was used, while the local ones were calculated using the relative nominal GDP (from 2005, UN data). These dummy values will be replaced at the latest when a second dataset with the same output is added to the database, so when the production volume values would start to become relevant for the results.]**

For some products from ecoinvent version 2.2, the production volume in year 2005 is zero. If such an input is requested by a converted dataset, this leads to a missing input. In such cases, the missing input has been replaced by the most appropriate alternative input. **[One input with zero production volume due to phase-out still exists in the database: “monochloropentafluoroethane”. The missing substitute is decafluoropentane.]**

## 10 Uncertainty information

### 10.1 Uncertainty format changes

The ecoinvent database version 3 uses a new format (ecoSpold 2) for reporting uncertainty. It is possible to report the basic uncertainty separately from the total uncertainty, directly in the data format (= the basic uncertainty + the additional uncertainty from data quality indicator scores in the pedigree matrix). Each data quality score now has a separate numerical field, which allows automatic calculation of the additional uncertainty. In the new data format, more distributions are now supported (beta, gamma, binomial).

### 10.2 Basic uncertainty recalculated

In the format ecoSpold 1 used for the ecoinvent database version 1&2, there was only one numerical field for reporting the uncertainty, and this was therefore used for the total uncertainty for use in further calculations. The data quality indicator scores were reported in the comment field.

For ecoinvent version 3, the data quality indicator scores were extracted from the comment fields of version 2.2 and placed in the new numerical fields. As it is now possible to distinguish the basic uncertainty from the total uncertainty, the basic uncertainty of each exchange amount was back-calculated using the original formula applied to calculate total uncertainty from basic uncertainty and the additional uncertainty from the data quality indicator scores. In some cases this resulted in a negative value for the basic uncertainty, indicating an error in the original (manual) calculation. In these cases, the basic uncertainty field has been left blank.

## 11 Allocation

### 11.1 Deleted joint production datasets with specific allocations

In the ecoinvent database version 3, allocation for joint production is performed automatically by the database service layer for those system models that apply allocation. Allocated datasets are not manually entered in the database. The allocation factors from version 2.2 have been retained in the converted datasets, but cannot be manually changed, since there are currently no system models that apply manual allocation factors, although the option for this is still available. Pre-allocated datasets with specific allocations (e.g. “heat, at heat pump 30kW, allocation electricity”) have been deleted.

### 11.2 Property for “true value” allocation (ecoinvent default)

Allocation factors for true value allocation are set by the database service layer based on the property “true value relation”. Unless this property is specifically provided in the original, manually edited dataset, the database service layer sets its value equal to the price of the intermediate exchange.

The “true value relation” is manually added in the following situations:

1. When there is a very high annual variation in the relative average prices of the joint products, the “true value relation” property may be set to the same ratio as the ratio of the average prices for the last three years.
2. When the joint products have a shared functional property that should determine their relative value if not affected by market imperfections or distorting regulation, the “true value relation” property may be set to the same ratio as the amounts of this property.

For the converted datasets from version 2.2, the true value allocation has been added for one specific situation after a review of allocation procedures by the LCI Expert Group, namely the joint production of heat and electricity, where the ratio of exergy of the products, i.e. the ability of the products to perform work, is used as “true value relation”. Thus, when both electricity and useful heat are products of the same activity, the “true value relation” results in the same allocation factors for the two products as if the property “exergy” had been used, while the sum of the “true value” of the two products equal the sum of the revenue from these two products, so that allocation based on the price can still be made for any other joint product.

For simple identification of activities for which “true value relation” properties are provided in the original dataset, the ecoinvent database automatically adds a tag “with true value” to these activities.

### 11.3 Allocation corrections

In the ecoinvent database version 2, allocation corrections for carbon were added manually as separate datasets and allocation corrections for metal resources (called “resource corrections”) were added manually as separate exchanges.

In the ecoinvent database version 3, allocation corrections for carbon can automatically be calculated by the database service layer and therefore the manually entered datasets of version 2.2 have been deleted. **[This feature is not implemented in v3.0, nor v3.01.]**

In the ecoinvent database version 3, manual allocation corrections for metal resources will not be retained, and the manually entered correction exchanges from version 2.2 have been deleted. Currently there are no allocation methods in ecoinvent that require allocation corrections for metal resources.

## **12 Review of centrally implemented changes**

The ecoinvent LCI Expert Group and/or staff have reviewed all centrally implemented changes reported in the previous chapters.

## 13 Access to datasets

### 13.1 Public access and terms of use

With the ecoinvent database version 3, access to all unit process datasets becomes publicly visible, however still under usage restrictions:

“I agree that my access to the ecoinvent database is subject to the general End User Licence Agreement <[www.ecoinvent.org/database/terms-of-use/](http://www.ecoinvent.org/database/terms-of-use/)> for the ecoinvent datasets, which particularly implies that the datasets are not to be collected, copied or used in any combination of data into aggregated, calculated results, unless I specifically obtain a separate license for such use.”

This means, among other things, that guest users are not permitted to use the data in studies themselves or to base further work or data on ecoinvent data without acquiring a license. The access to the latest published version of the database is via the ecoinvent web-site.

The database that can be accessed via the ecoEditor software is the working version of the database, i.e. including all datasets that have been accepted after review since the last published version. Thus, the content can be different from the content of the previous or coming public release versions accessible via the ecoinvent web-page. This ensures that data providers always work on the latest versions of all dataset files, while the users are able to refer to a fixed published version corresponding to each release.

### 13.2 Sponsored datasets

In addition to the access to the unit process data, access to the accumulated system datasets (LCI results) is free for a limited number of sponsored datasets. The sponsored datasets are free of copyright, but are subject to the normal rules for citation (see Chapter 15.5 of the Data Quality Guidelines).

The sponsored datasets in the ecoinvent database version 3 are labelled with the following sentence in the general comment field: “The kind contribution of [sponsor name] has made it possible to make this dataset freely available to the public. The sponsors have no influence on the content and/or validation procedure for the sponsored datasets.”

### 13.3 Single-enterprise data

Single-enterprise datasets from version 2.2 will be tagged and possibly given a more specific geographical location. Company or brand names will be removed, unless the company is willing to provide the dataset as a branded dataset (see Chapter 11.3 of Weidema et al. 2013).

## 14 New or updated datasets

On each editor's page [a feature soon to be implemented on the ecoinvent web-site], a list is provided of datasets solicited within that editorial area or for which data collection is in progress. The lists include identified errors that are in process for correction. Data providers are urged to announce on these pages if they are intending to submit datasets, to enable coordination with other data providers within the same area.

For cases where new datasets disaggregate an existing dataset into two or more new datasets, the correspondence between the old and new activity names and/or geographies are listed in Table 14.1. Table 14.1 also includes the correspondence when more than one existing dataset was aggregated into new datasets (e.g. by using parameterisation) or when new datasets aggregate data differently than in version 2.2, which was accepted when the new data at the same time implied a substantial improvement in data quality compared to the previous version.

**Table 14. 1. Datasets in version 2.2 that are have been deleted by disaggregating or aggregating them in new dataset. Those new datasets have been provided by individual dataset authors, i.e. those changes are probably not recorded elsewhere in this report. (continues in next page).**

Version 2 names	Version 3 names
"biogas, burned in cogen with gas engine", "biogas, burned in cogen with ignition gas engine", "biogas, agriculture covered, in cogen with ignition biogas engine", "biogas, agriculture, in cogen with biogas engine"	"heat and power co-generation, biogas, gas engine"
"biowaste, to anaerobic digestion", "biowaste, to agricultural co-fermentation, covered", "fat and oil, to agricultural co-fermentation, covered", "biogas, from agricultural co-digestion, not covered, at storage", "biogas, from agricultural digestion, not covered, at storage", "biogas, from slurry, at agricultural co-fermentation, covered"	"treatment of manure and biowaste by anaerobic co-digestion"
"corrugated board production, fresh fibre, single wall", "corrugated board production, mixed fibre, single wall", corrugated board production, recycled fibre, double wall", "corrugated board production, recycled fibre, single wall", "corrugated board box production" (v3 names)	"corrugated board box production" (change completed for v 3.01)
"electricity, hydropower, at power plant"	"electricity, high voltage, hydro, reservoir, alpine region", "electricity, high voltage, hydro, reservoir, non-alpine region", "electricity, high voltage, hydro, run-of-river"
"electricity, hydropower, at reservoir power plant"	"electricity, high voltage, hydro, reservoir, alpine region", "electricity, high voltage, hydro, reservoir, non-alpine region"
"disposal, passenger car", "maintenance, passenger car", "passenger car", "transport, passenger car, ethanol 5%", "transport, passenger car, methanol", "transport, passenger car, methane, 96 vol-%, from biogas", "transport, passenger car, natural gas", "transport, passenger car, rape seed methyl ester 5%", "transport, passenger car, diesel, EURO3/4/5", "transport, passenger car, petrol, 4/15% vol. ETBE with ethanol from biomass, EURO4", "transport, passenger car, petrol, EURO3/4/5" (RER, transports for CH only)	"charger production, for electric passenger car", "converter production, for electric passenger car", "glider production, passenger car", "internal combustion engine production, for passenger car", "inverter production, for electric passenger car", "maintenance, passenger car", "maintenance, passenger car, electric, without battery", "manual dismantling of used electric passenger car", "manual dismantling of used passenger car with internal combustion engine", "passenger car production, diesel", "passenger car production, electric, without battery", "passenger car production, petrol/natural gas", "power distribution unit production, for electric passenger car", "powertrain production, for electric passenger car", "transport, passenger car", "transport, passenger car", "transport, passenger car, electric", "transport, passenger car, EURO 3/4/5", "transport, passenger car with internal combustion engine", "transport, passenger car, large/medium/small size, diesel/natural gas/petrol, EURO 3/4/5", "treatment of brake/road/tyre wear emissions, passenger car", "treatment of used electric passenger car, manual dismantling", "treatment of used glider, passenger car, shredding", "treatment of used passenger car with internal combustion engine, manual dismantling", "treatment of used powertrain for electric passenger car, manual dismantling" (GLO, RER for some datasets)
"disposal, packaging cardboard, 19.6% water, to sanitary landfill", "disposal, packaging paper, 13.7% water, to sanitary landfill"	"treatment of waste paperboard, sanitary landfill"
"electricity, at wind power plant 2MW, offshore" "electricity, at wind power plant 800kW" "electricity, at wind power plant 600kW" "electricity, at wind power plant Grenchenberg 150kW", "electricity, at wind power plant Simplon 30kW"	"electricity production, wind, <1MW turbine, onshore" "electricity production, wind, <1MW turbine, onshore, label-certified" "electricity production, wind, >3MW turbine, onshore" "electricity production, wind, 1-3MW turbine, offshore" "electricity production, wind, 1-3MW turbine, onshore" "electricity production, wind, 1-3MW turbine, onshore, label-certified"
"wind power plant, 30/150/600kW, ..." "wind power plant, 800kW, ...", CH, RER	"wind power plant construction, 800kW...", GLO

Version 2 names	Version 3 names
"wood chips, hardwood, from industry, u=40%, at plant" "wood chips, softwood, from industry, u=40%, at plant"	"wood chips production, from industry"
"electricity, production mix photovoltaic, at plant"	"electricity production, photovoltaic, at 3kWp facade installation, multi-Si, panel, mounted", "electricity production, photovoltaic, at 3kWp facade installation, single-Si, panel, mounted", "electricity production, photovoltaic, 3kWp facade installation, multi-Si, laminated, integrated", "electricity production, photovoltaic, 3kWp facade installation, single-Si, laminated, integrated", "electricity production, photovoltaic, at 3kWp flat roof installation, multi-Si", "electricity production, photovoltaic, at 3kWp flat roof installation, single-Si", "electricity production, photovoltaic, 3kWp slanted-roof installation, a-Si, laminated, integrated", "electricity production, photovoltaic, 3kWp slanted-roof installation, a-Si, panel, mounted", "electricity production, photovoltaic, 3kWp slanted-roof installation, CdTe, laminated, integrated", "electricity production, photovoltaic, 3kWp slanted-roof installation, CIS, panel, mounted", "electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, laminated, integrated", "electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted", "electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted, label-certified", "electricity production, photovoltaic, 3kWp slanted-roof installation, ribbon-Si, laminated, integrated", "electricity production, photovoltaic, 3kWp slanted-roof installation, ribbon-Si, panel, mounted", "electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, laminated, integrated", "electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted", "electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted, label-certified", "electricity production, photovoltaic, at 570kWp open ground installation, multi-Si"
"yarn, cotton, at plant" "yarn production, cotton fibres" "weaving, cotton" "textile refinement, cotton"	"textile production, knit cotton, batch dyed" "textile production, knit cotton, yarn dyed" "textile production, woven cotton"
"electricity production, hydro, pumped storage", US	"electricity production, hydro, pumped storage", ASCC, FRCC, HICC, MRO (US only), NPCC (US only), RFC, SERC, SPP, TRE, WECC (US only)
"electricity production, nuclear, boiling/pressure water reactor", US	"electricity production, nuclear, boiling/pressure water reactor", FRCC, MRO (US only), NPCC (US only), RFC, SERC, SPP, TRE, WECC (US only)
"uranium production, centrifuge, enriched ...", RER	"uranium production, centrifuge, enriched ...", DE, GB, NL
"aircraft, medium haul" "aircraft, long haul" "aircraft, freight" "aircraft, passenger"	"aircraft production, medium haul" "aircraft production, long haul"
"use, computer, desktop, mix, office use", CH "use, computer, desktop with CRT monitor, office use", CH "use, computer, desktop, with LCD monitor, office use", CH "use, computer, desktop, mix, office use", RER "use, computer, desktop, with CRT monitor, office use", RER "use, computer, desktop, with LCD monitor, office use", RER "use, computer, desktop, mix, home use", CH "use, computer, desktop with CRT monitor, active mode", CH "use, computer, desktop with CRT monitor, standby/sleep mode", CH "use, computer, desktop with CRT monitor, off mode", CH "use, computer, desktop with CRT monitor, home use", CH "use, computer, desktop with LCD monitor, active mode", CH "use, computer, desktop with LCD monitor, sleep/standby mode", CH "use, computer, desktop with LCD monitor, off mode", CH "use, computer, desktop with LCD monitor, home use", CH "use, computer, desktop, mix, home use", RER "use, computer, desktop with CRT monitor, active mode", RER "use, computer, desktop with CRT monitor, standby/sleep mode", RER "use, computer, desktop with CRT monitor, off mode", RER "use, computer, desktop with CRT monitor, home use", RER "use, computer, desktop with LCD monitor, active mode", RER "use, computer, desktop with LCD monitor, sleep/standby mode", RER "use, computer, desktop with LCD monitor, off mode", RER "use, computer, desktop with LCD monitor, home use", RER	"market for operation, computer, desktop, office use", GLO "operation, computer, desktop, with cathode ray tube display, office use", CH "operation, computer, desktop, with liquid crystal display, office use", CH "market for operation, computer, desktop, office use", GLO "operation, computer, desktop, with cathode ray tube display, office use", RER "operation, computer, desktop, with liquid crystal display, office use", RER "market for operation, computer, desktop, home use", GLO "operation, computer, desktop, with cathode ray tube display, active mode", CH "operation, computer, desktop, with cathode ray tube display, standby mode", CH "operation, computer, desktop, with cathode ray tube display, off mode", CH "operation, computer, desktop, with cathode ray tube display, home use", CH "operation, computer, desktop, with liquid crystal display, active mode", CH "operation, computer, desktop, with liquid crystal display, standby mode", CH "operation, computer, desktop, with liquid crystal display, off mode", CH "operation, computer, desktop, with liquid crystal display, home use", CH "market for operation, computer, desktop, home use", GLO "operation, computer, desktop, with cathode ray tube display, active mode", RER "operation, computer, desktop, with cathode ray tube display, standby mode", RER "operation, computer, desktop, with cathode ray tube display, off mode", RER "operation, computer, desktop, with cathode ray tube display, home use", RER "operation, computer, desktop, with liquid crystal display, active mode", RER "operation, computer, desktop, with liquid crystal display, standby mode", RER "operation, computer, desktop, with liquid crystal display, off mode", RER "operation, computer, desktop, with liquid crystal display, home use", RER

The new data on passenger cars were submitted shortly before the release of version 3.0 which did not leave much time for correcting consistency issues related to some of the new requirements of the version 3 data quality guideline, notably that products must be goods and services (which is not the case for “treatment of brake/road/tyre wear emissions, passenger car”), that unspecified products (“transport, passenger car”, “transport, passenger car, EURO 3/4/5”, “transport, passenger car with internal combustion engine”) must be constructed as generic markets to avoid double-counting. Since these inconsistencies do not immediately affect the validity of the calculated results, they have been temporarily accepted. They will be corrected as soon as possible.

For the new global reference datasets created by extrapolation (see Chapter 6.6), we urge data providers to consider submitting datasets that better reflect the global average technology for the activity. When working on other updating tasks, we urge data providers to always consider performing the updating in the global reference dataset.

Provided that the global dataset is of adequate quality, we urge data providers to consider if any geographically located datasets could better be expressed as child datasets relative to the global reference dataset (see Chapter 4.2 of the Data Quality Guidelines).

We urge data providers to express amounts of exchanges by variables when this adds convenience and clarity to the datasets, using the new option for mathematical relations between amounts of exchanges, exchange properties and/or dataset-internal parameters. This can lead to a reduction in the number of datasets submitted, because one dataset with variables may replace several other datasets. This may also be applicable when revising some of the existing datasets from the ecoinvent version 2.2.

When manually updating datasets from version 2.2, we urge data suppliers to review the current content of the fields for “Included activities” (start and end of an activity), adding information according to the good practice described in the Chapter 5.9.1 of the Data Quality Guidelines, and removing redundant information, for example information on which raw materials, or infrastructure is included or which emissions are included, both types of information already being provided in the information on the exchanges.

## 15 Documentation from the ecoinvent version 2 reports

The reports from the ecoinvent version 2 will not be updated. The original report authors are duly acknowledged on the web-pages.

For new and updated datasets, the documentation has been entered into the datasets directly, using the commenting functions of the new ecospold2 data format, the long-term goal being that all datasets in the version 3 contain all necessary documentation.

Most of the existing datasets that were not updated or changed individually are still documented via the existing reports and such datasets refer to the reports for documentation. Nevertheless, a part of the documentation from the version 2 reports has already been transferred to some version 3 datasets.

**[By the time of release of version 3.0, the documentation from some of the version 2 reports has been transferred to the datasets for some activities, but not yet for all datasets, and with priority only to non-global datasets (when both global and non-global datasets exist for an activity). The remaining documentation is planned to be transferred in conjunction with the continuous updating of datasets.]**

## **16 Properties added**

### **16.1 Mass, water and carbon content added as properties**

Wet mass, dry mass, water mass, and water and carbon content (the latter divided in fossil and non-fossil) have been added as properties to all exchanges as a central updating task. Documentation is provided in the comment field of the individual properties.

### **16.2 Mass, water and carbon balances**

With the addition of wet mass, dry mass, water mass, and water and carbon as properties to all exchanges, it becomes possible to perform balances for mass, water and carbon per dataset. A feature for this has been added as part of the automatically performed validations during dataset creation and submission via the ecoEditor software.

The result of such calculated balances are presented as a validation warning in the dataset field “Review / Other details”, which should be seen as a recommendation to the data provider correct any imbalances by adjusting the inputs or outputs.

For activities involving oxidation, the datasets from version 2.2 will not show a mass balance due to the unreported input of oxygen from the air. This is one example of how datasets in ecoinvent continue to be not balanced for mass, and this is not a requirement of the database. Mass balances are provided for reference only.

For some datasets, such as the datasets “electricity production, hydro, pumped storage”, the elementary exchange (resource) “Carbon, organic, in soil or biomass stocks” still needs to be added to complete the carbon balance for these activities.

### **16.3 Price as a property**

Price is added as a property to all intermediate outputs, primarily for use in allocation. The prices currently added have been added as basic prices to each output of the transforming datasets, while the final prices will be added as purchaser’s prices to the outputs of the markets, allowing to back-calculate the basic prices from the information on net product taxes, transport costs and wholesale and retail margins provided in the market datasets. See the Chapter 5.6.5 of the Data Quality Guidelines for more information on this topic.

## 17 Changes in version 3.01

Many changes applied for version 3.01 have been already inserted in the preceding pages of this report. Changes applied in version 3.01 have been reflected in modifications of the content of Table 2.2, Table 3.1, Table 3.2, Table 4.1, Table 7.2, and Table 14.1; as well as in chapters 1, 3, 6, 7, and 9. At the same time, some mistakes have been corrected in Table 3.4, Table 4.2, Table 6.7; and in the overall text.

This chapter is now devoted to those changes that have not specifically been yet addressed in this report.

### 17.1 Modified supply chains

“Glass cullet, sorted” has been now considered to have a constrained market instead of being a material for treatment, and as such it has been added to the Table 3.1 of this report. This change has modified the whole supply chain that uses “glass cullet, sorted”. All the treatment activities treating “glass cullet, sorted” in version 3.0 have been turned into normal activities, where “glass cullet, sorted” is an input.

Table 3.2 of this report has been then edited according to the above described changes and the following activities (now ordinary Transforming activities) were removed from there: “foam glass production, electricity, label-certified”, “glass wool mat production”, “packaging glass production, brown”, “packaging glass production, green”, and “packaging glass production, white”.

The whole board and paper sector has been updated for version 3.0; but in some cases this update has been totally achieved in version 3.01. Precisely, the updated inventory for “corrugated board box production”, with new data from FEFCO, has only been correctly implemented now in version 3.01. A summary of this update can be found in Table 14.1. This new inventory for “corrugated board box production” groups and substitutes all corrugated board inventories from version 2.2. In that same update, local markets for linerboard and fluting medium have been created (see them in Annex 2).

### 17.2 Deleted activities

There are further activities that have been deleted in version 3.01, as more modern or representative datasets were uploaded in version 3.0. As usual, all deleted activities which were converted from version 2.2 can be spotted in the correspondence file. Table 2.2 also includes some activities that were deleted (for version 3.0 and version 3.01) as they have been considered outdated.

Those changes have modified Table 3.2, as the following activities have been removed from there and moved to Table 2.2: “treatment of aluminium scrap, new, by melting, alloying and casting”, “treatment of aluminium scrap, post-consumer, prepared for melting, by melting, alloying and casting”.

### 17.3 Dataset and property corrections

A few datasets were corrected at a data level. This is not the scope of this report, but it is detailed in our webpage (“Changes between ecoinvent v3.0 and v3.01”).

Production volumes and prices have been updated and corrected for several products. Production volumes of the different types of heat were recalculated, in order to better generate the new local markets mentioned in Chapter 6.2 and listed in Annex 2.

# Annex 1

This annex lists all RoW datasets that are generated as a direct copy of the GLO dataset in version 3.0. It includes mainly converted datasets from version 2.2, as well as some new or updated datasets.

cotton production  
 electricity production, geothermal  
 electricity production, hard coal  
 electricity production, hydro, pumped storage  
 electricity production, hydro, reservoir, alpine region  
 electricity production, hydro, reservoir, non-alpine region  
 electricity production, hydro, reservoir, tropical region  
 electricity production, hydro, run-of-river  
 electricity production, hydro, run-of-river, label-certified  
 electricity production, lignite  
 electricity production, natural gas  
 electricity production, natural gas, 10MW  
 electricity production, natural gas, at conventional power plant  
 electricity production, natural gas, at conventional power plant, 100 Mwe, without combined heat and power  
 electricity production, natural gas, combined cycle power plant  
 electricity production, nuclear, boiling water reactor  
 electricity production, nuclear, pressure water reactor  
 electricity production, oil  
 electricity production, peat  
 electricity production, photovoltaic, 3kWp facade installation, multi-Si, laminated, integrated  
 electricity production, photovoltaic, 3kWp facade installation, single-Si, laminated, integrated  
 electricity production, photovoltaic, 3kWp slanted-roof installation, a-Si, laminated, integrated  
 electricity production, photovoltaic, 3kWp slanted-roof installation, a-Si, panel, mounted  
 electricity production, photovoltaic, 3kWp slanted-roof installation, CdTe, laminated, integrated  
 electricity production, photovoltaic, 3kWp slanted-roof installation, CIS, panel, mounted  
 electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, laminated, integrated  
 electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted  
 electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted, label-certified  
 electricity production, photovoltaic, 3kWp slanted-roof installation, ribbon-Si, laminated, integrated  
 electricity production, photovoltaic, 3kWp slanted-roof installation, ribbon-Si, panel, mounted  
 electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, laminated, integrated  
 electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted  
 electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted, label-certified  
 electricity production, photovoltaic, at 3kWp facade installation, multi-Si, panel, mounted  
 electricity production, photovoltaic, at 3kWp facade installation, single-Si, panel, mounted  
 electricity production, photovoltaic, at 3kWp flat roof installation, multi-Si  
 electricity production, photovoltaic, at 3kWp flat roof installation, single-Si  
 electricity production, photovoltaic, at 570kWp open ground installation, multi-Si  
 electricity production, wind, <1MW turbine, onshore  
 electricity production, wind, <1MW turbine, onshore, label-certified  
 electricity production, wind, >3MW turbine, onshore  
 electricity production, wind, 1-3MW turbine, offshore  
 electricity production, wind, 1-3MW turbine, onshore  
 electricity production, wind, 1-3MW turbine, onshore, label-certified  
 heat and power co-generation, biogas, gas engine  
 heat and power co-generation, natural gas, 160kW electrical, Jakobsberg  
 heat and power co-generation, natural gas, 160kW electrical, lambda=1  
 heat and power co-generation, natural gas, 500kW electrical, lean burn  
 heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical  
 heat and power co-generation, natural gas, conventional power plant, 100MW electrical  
 heat and power co-generation, wood chips, 6400kW thermal, with extensive emission control  
 heat and power co-generation, wood chips, 6400kW thermal, with multicyclone emission control  
 heat and power co-generation, wood chips, 6400kWth, with extensive emission control  
 heat and power co-generation, wood chips, 6400kWth, with extensive emission control, label-certified

heat and power co-generation, wood chips, 6400kWth, with multicyclone emission control  
palm fruit bunch production  
petroleum and gas production, off-shore  
petroleum and gas production, on-shore  
treatment of blast furnace gas, in power plant  
treatment of coal gas, in power plant  
treatment of municipal solid waste, incineration

## Annex 2

This annex lists all local markets present in version 3.01. It includes converted datasets from version 2.2, as well as new or updated markets.

Market	Geography
market for acetic anhydride	RER
market for aluminium scrap, new	RER
market for ammonia, liquid	RER
market for biowaste	CH
market for cement, alternative constituents 21-35%	CH, Europe without Switzerland
market for cement, alternative constituents 6-20%	CH, Europe without Switzerland
market for cement, blast furnace slag 18-30% and 18-30% other alternative constituents	CH, Europe without Switzerland
market for cement, blast furnace slag 25-70%, US only	US
market for cement, blast furnace slag 31-50% and 31-50% other alternative constituents	CH, Europe without Switzerland
market for cement, blast furnace slag 36-65%	CH, Europe without Switzerland
market for cement, blast furnace slag 5-25%, US only	US
market for cement, blast furnace slag 66-80%	CH, Europe without Switzerland
market for cement, blast furnace slag 70-100%, US only	US
market for cement, blast furnace slag 81-95%	CH, Europe without Switzerland
market for cement, Portland	CH, Europe without Switzerland, US
market for cement, pozzolana and fly ash 11-35%	CH, Europe without Switzerland
market for cement, pozzolana and fly ash 15-40%, US only	US
market for cement, pozzolana and fly ash 36-55%	CH, Europe without Switzerland
market for cement, pozzolana and fly ash 5-15%, US only	US
market for coating from waste cathode ray tube display	CH
market for diesel	CH, Europe without Switzerland
market for diesel, low-sulfur	CH, Europe without Switzerland
market for electricity, high voltage	ASCC, AT, AU, BA, BE, BG, BR, CA-AB, CA-BC, CA-MB, CA-NB, CA-NF, CA-NS, CA-NT, CA-NU, CA-ON, CA-PE, CA-SK, CA-YK, CH, CL, CN, CZ, DE, DK, ES, FI, FR, FRCC, GB, GR, HICC, HR, HU, ID, IE, IN, IR, IT, JP, KR, LU, MK, MRO, US only, MX, MY, NL, NO, NPCC, US only, PE, PL, PT, Québec, RFC, RO, RS, RU, SA, SE, SERC, SI, SK, SPP, TH, TR, TRE, TW, TZ, UA, WECC, US only, ZA
market for electricity, high voltage, for Swiss Federal Railways	CH
market for electricity, high voltage, label-certified	CH
market for electricity, low voltage	ASCC, AT, AU, BA, BE, BG, BR, CA-AB, CA-BC, CA-MB, CA-NB, CA-NF, CA-NS, CA-NT, CA-NU, CA-ON, CA-PE, CA-SK, CA-YK, CH, CL, CN, CZ, DE, DK, ES, FI, FR, FRCC, GB, GR, HICC, HR, HU, ID, IE, IN, IR, IT, JP, KR, LU, MK, MRO, US only, MX, MY, NL, NO, NPCC, US only, PE, PL, PT, Québec, RFC, RO, RS, RU, SA, SE, SERC, SI, SK, SPP, TH, TR, TRE, TW, TZ, UA, WECC, US only, ZA
market for electricity, low voltage, label-certified	CH
market for electricity, medium voltage	ASCC, AT, AU, BA, BE, BG, BR, CA-AB, CA-BC, CA-MB, CA-NB, CA-NF, CA-NS, CA-NT, CA-NU, CA-ON, CA-PE, CA-SK, CA-YK, CH, CL, CN, CZ, DE, DK, ES, FI, FR, FRCC, GB, GR, HICC, HR, HU, ID, IE, IN, IR, IT, JP, KR, LU, MK, MRO, US only, MX, MY, NL, NO, NPCC, US only, PE, PL, PT, Québec, RFC, RO, RS, RU, SA, SE, SERC, SI,

	SK, SPP, TH, TR, TRE, TW, TZ, UA, WECC, US only, ZA
market for electricity, medium voltage, label-certified	CH
market for ethanol, without water, in 99.7% solution state, from fermentation, at service station	CH
market for fatty alcohol sulfate	RER
market for fluting medium	RER
market for formic acid	RER
market for hard coal	AU, CN, ID, PL, RLA, RNA, RU, WEU, ZA
market for heat, central or small-scale, natural gas	CH, Europe without Switzerland
market for heat, central or small-scale, other than natural gas	CH, Europe without Switzerland
market for heat, district or industrial, natural gas	CH, Europe without Switzerland
market for heat, district or industrial, other than natural gas	CH, Europe without Switzerland
market for heat, in chemical industry	RER
market for heavy fuel oil	CH, Europe without Switzerland
market for hydrochloric acid, without water, in 30% solution state	RER
market for irrigation	BR, CH, CN, DE, ES, FR, IN, MY, PH, US
market for kerosene	CH, Europe without Switzerland
market for light fuel oil	CH, Europe without Switzerland
market for lignite	RER
market for linerboard	RER
market for liquefied petroleum gas	CH
market for log, energy wood, split	RER
market for log, hardwood, piled in forest, air-dried	RER
market for log, softwood, piled in forest, air-dried	RER
market for maleic anhydride	RER
market for methanol, from biomass	CH
market for naphtha	RER
market for natural gas, high pressure	AT, BE, CH, CZ, DE, DK, ES, FI, FR, GB, GR, HU, IE, IT, JP, NL, RNA, SE, SK
market for natural gas, low pressure	CH
market for paper, newsprint	RER
market for paper, woodcontaining, lightweight coated	RER
market for paper, woodcontaining, supercalendred	RER
market for paper, woodfree, coated	RER
market for paper, woodfree, uncoated	RER
market for petrol, low-sulfur	CH, Europe without Switzerland
market for petrol, unleaded	RER
market for plywood, for indoor use	RER
market for plywood, for outdoor use	RER
market for rape oil, crude	CH
market for residual hardwood, wet	RER
market for sawlog and veneer log, hardwood, measured as solid wood under bark	RER
market for sawlog and veneer log, softwood, debarked, measured as solid wood	RER
market for sawnwood, hardwood, air / kiln dried, planed	RER
market for sawnwood, hardwood, kiln dried, planed	RER
market for sawnwood, hardwood, raw, air / kiln dried	RER

market for sawnwood, hardwood, raw, air dried	RER
market for sawnwood, hardwood, raw, debarked	RER
market for sawnwood, hardwood, raw, kiln dried	RER
market for sawnwood, softwood, air dried, planed	RER
market for sawnwood, softwood, kiln dried, planed	RER
market for sawnwood, softwood, raw, air dried	RER
market for sawnwood, softwood, raw, kiln dried, 10% water on dry mass basis	RER
market for sawnwood, softwood, raw, kiln dried, 20% water on dry mass basis	RER
market for sodium sulfate, anhydrite	RER
market for sugarcane	BR
market for tap water, at user	CH, Europe without Switzerland
market for titanium dioxide	RER
market for transport, freight train	CH, CN, Europe without Switzerland, US
market for transport, passenger car	RER
market for transport, passenger car with internal combustion engine	RER
market for transport, passenger car, EURO 3	RER
market for transport, passenger car, EURO 4	RER
market for transport, passenger car, EURO 5	RER
market for waste bitumen sheet	CH
market for waste building wood, chrome preserved	CH
market for waste paper, unsorted	CH, Europe without Switzerland
market for waste sealing sheet, polyvinylchloride	CH
market for waste vapour barrier, flame-retarded	CH
market for wood chips, dry, measured as dry mass	RER
market for wood chips, wet, measured as dry mass	RER
market for wood pellet	RER

## References

- Borken-Kleefeld & Weidema 2013      Borken-Kleefeld J, Weidema B P. (2013). Global default data for freight transport per product group. Manuscript for special ecoinvent 3.0 issue of the International Journal of Life Cycle Assessment.
- Weidema et al. 2013      Weidema B P, Bauer C, Hischer R, Mutel C, Nemecek T, Vadenbo C O, Wernet G. (2013). Overview and methodology. Data quality guideline for the ecoinvent database version 3. Ecoinvent Report 1. St. Gallen: The ecoinvent Centre

