Documentation of changes implemented in the ecoinvent database v3.5
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1 Introduction

This report covers the changes to the ecoinvent database between version 3.4, released in 2017 and version 3.5, released in 2018. It describes both the database-wide changes that affect the whole database as well as the specific changes in the different sectors. These changes consist in the addition of new datasets, in the deletion of outdated ones, and in the re-modelling or corrections of others.

All changes described in this report potentially affect or modify impact assessment results, even when they seem as minor as changing an activity link. The description of the changes has been provided to help the users with the interpretation and understanding of the possible changes in results they might encounter when comparing the new version (v3.5) with the old one (v3.4).

For a full comparison between the versions of the database, containing a list of all added activities, as well as a detail record of all changes in existing activities (the fields affected by changes and the actual amounts changed), the Change Report Annex can be downloaded as an excel file from the “Files” section of the EcoQuery by license holders only.

Correspondence files for each system model, as well as for the Undefined database are provided together with this report; they can be checked for equivalences in case of deletion or disaggregation of activities.

2 Database-wide changes

2.1 Renamed exchanges and activities

Some activities or products were renamed for version 3.5. The changes are listed in the following tables, and also treated in the following chapters if associated to a change in the modelling.

Table 1. Intermediate exchanges renamed for version 3.5. *Most of the changes aim to improve the product name, or to prepare the database to receive new technologies in the upcoming versions. (*) check the Chemical chapter for more details on this change. (**) only in incineration "with fly ash extraction" activities.*

Name of exchange in version 3.4	Name of exchange in version 3.5
green bell pepper	bell pepper
waste polyethylene terephtalate	waste polyethylene terephthalate
paper, woodcontaining, supercalendred	paper, woodcontaining, supercalendered
linerboard	containerboard, linerboard
fluting medium	containerboard, fluting medium
epoxy resin (*)	epoxy resin, liquid (*)
methylene diphenyldiisocyanate (*)	methylene diphenyl diisocyanate (*)
methylpyrrolidone (*)	N-methyl-2-pyrrolidone (*)
zinc concentrate (**)	metalliferous hydroxide sludge (**)

Table 2. Activities renamed for v3.5. Most of the changes aim to better define the scope of the activity. *More details of some changes are given in the corresponding chapters. (*) check the Chemical chapter for more details on this change*

Activity name in v3.4	Activity name in v3.5
blow moulding production	blow moulding
calendering production, rigid sheets	calendering, rigid sheets
epoxy resin production (*)	epoxy resin production, liquid (*)
extrusion production, plastic film	extrusion, plastic film
extrusion production, plastic pipes	extrusion, plastic pipes
fluting medium production, semichemical	containerboard production, fluting medium, semichemical
green bell pepper production	bell pepper production
linerboard production, kraftliner	containerboard production, linerboard, kraftliner
market for bauxite, without water	market for bauxite
market for epoxy resin (*)	market for epoxy resin, liquid (*)
market for fluting medium	market for containerboard, fluting medium
market for green bell pepper	market for bell pepper
market for linerboard	market for containerboard, linerboard
market for methylene diphenyldiisocyanate (*)	market for methylene diphenyl diisocyanate (*)
market for methylpyrrolidone (*)	market for N-methyl-2-pyrrolidone (*)
market for paper, woodcontaining, supercalendred	market for paper, woodcontaining, supercalendered
market for waste polyethylene terephtalate	market for waste polyethylene terephthalate
methylene diphenyldiisocyanate production (*)	methylene diphenyl diisocyanate production (*)
methylpyrrolidone production (*)	N-methyl-2-pyrrolidone production (*)
paper production, woodcontaining, supercalendred	paper production, woodcontaining, supercalendered
planting tree	planting, tree
potato planting	planting, potato
stretch blow moulding production	stretch blow moulding
thermoforming production, with calendering	thermoforming, with calendering
treatment of recovered paper to fluting medium, semichemical fluting, 40% recycled content	containerboard production, fluting medium, semichemical, 40% recycled content
treatment of recovered paper to fluting medium, wellenstoff	containerboard production, fluting medium, recycled
treatment of recovered paper to linerboard, testliner	containerboard production, linerboard, testliner
treatment of waste paperboard, sorting plant	treatment of waste paperboard, unsorted, sorting
treatment of waste polyethylene terephtalate, municipal incineration	treatment of waste polyethylene terephthalate, municipal incineration
treatment of waste polyethylene terephtalate, municipal incineration with fly ash extraction	treatment of waste polyethylene terephthalate, municipal incineration with fly ash extraction
treatment of waste polyethylene terephtalate, sanitary landfill	treatment of waste polyethylene terephthalate, sanitary landfill

2.2 Changes in geography

The geography location of some activities has been changed in the v3.5, these activities are mentioned below.

Table 3. Activities whose geographical location changed from v3.4 to v3.5. *Details about the merging in geographies are given in the corresponding chapters.*

Activity name	Geography in v3.4	Geography in v3.5
acetylene production	CH	RER
transport, pipeline, long distance, natural gas	RER w/o DE+NL+NO+RU	RER w/0 DE+NL+RU
aluminium production, primary, ingot aluminium production, primary, liquid, Söderberg aluminium production, primary, liquid, prebake electricity production, coal, aluminium industry electricity production, hydro, aluminium industry electricity production, natural gas, aluminium industry electricity production, nuclear, aluminium industry electricity voltage transformation from high to medium voltage, aluminium industry market for electricity, high voltage, aluminium industry market for electricity, medium voltage, aluminium industry	CA-QC; IAI Area, North America, without Quebec	RNA
hard coal mine operation and hard coal preparation market for hard coal	PL; WEU	Europe, without Russia and Turkey

2.1 Changes in classification

Every product present in the ecoinvent database has to have two types of classification for the two attributional system models:

- Allocation, cut-off by classification (recyclable, waste, allocatable)
- Allocation, allocation at the point of substitution (APOS) (MFT or non-MFT)

The classification of the product is essential to determine how allocation will happen in those two system models, so changes in this regard can strongly affect the impact results.

Table 4. Products which had their classification changed from v3.4 to v3.5. *Products that were reclassified from MFT to non-MFT in APOS were also remodelled in the consequential system model with the introduction of a constrained market (see chapter 11.2).*

Product name	APOS classification		cut-off classification	
	V3.4	***V3.5***	***V3.4***	***V3.5***
meat and bone meal	MFT	Non-MFT	Waste	Allocatable

2.2 Changes in price

Changes in price affect the results of the activities, when economic allocation is used. The products listed in the following table have had their prices adjusted in v3.5.

Table 5. Products that had a price change in v3.5. *If other changes are to be associated to the production of these products, those will be listed in the corresponding chapter.*

Product name v3.5	Relative change (price v3.5/price v3.4)
apple	0.67
bell pepper	0.50
cattle for slaughtering, live weight	1.04
chlorine, gaseous	0.76
chlorine, liquid	0.74
epoxy resin, liquid	1.83
lithium	0.24
lithium carbonate	3.95
lithium chloride	3.51
maize grain	2.65
maize grain, feed	1.37
maize silage	2.05
mandarin	0.47
methylene diphenyl diisocyanate	1.38
orange, fresh grade	0.30
orange, processing grade	0.30
pear	0.65
soybean meal	2.77
soybean oil, crude	2.70
soybean oil, refined	2.70
wheat grain	1.68

2.3 Impact assessment methods

2.3.1 Corrections in implemented methods

2.3.1.1 Impact2002+

All characterisation factors (CFs) in the aquatic, terrestrial ecotoxicity and human toxicity category for the radioactive substances, in categories others than ionizing radiation, have been now corrected to zero. This correction have a strong impact on the score of many datasets for these four categories, but the 3.5 scores should be preferred over the 3.4 scores.

2.3.1.2 Ecological scarcity 2013

CF for Ethylene, Trichloroethylene, Dimethyl carbonate, Nitric oxide and “VOC, volatile organic compounds, unspecified origin” emitted to air have been amended in v3.5.

2.3.1.3 ReCiPe, legacy implementation

CFs for Phosphate emitted to ocean have been corrected to zero for ecosystem quality.

2.3.1.4 IPCC 2013

Nitric oxide and “VOC, volatile organic compounds, unspecified origin” CFs were missing from the IPCC 2013 method and have now been added. Very small score changes in a limited number of datasets are observed.

2.3.2 New methods

The European Joint Research Centre (JRC) has published an updated package of recommended methods (ILCD), version 2.0. Both the previous version of the ILCD methods (1.0.8), and the newest one are available with ecoinvent v3.5.

The latest ReCiPe version (1.13) is also available with ecoinvent 3.5. As with the ILCD methods, the previous ReCiPe implementation is still available.

We strongly encourage users to access scores with the latest implemented LCIA methods. For more information on the implementation of the LCIA methods, please check the “LCIA implementation” section on the “Files” section of the ecoQuery.

3 Aluminium supply chains

The ecoinvent v3.4 contained datasets supplied by International Aluminium Institute (IAI) based on mainly primary data collected for the reference year of 2012. In the new ecoinvent v3.5 all the supply chains are updated using the IAI data collected for the reference year of 2015. In some cases, the geographical resolution of the datasets provided has been improved or edited.

3.1 Aluminium supply chain new and updated activities

Table 6 lists of all new and update activities; in general, the entire supply chain of aluminium from bauxite to aluminium ingot is updated. In version 3.4, “aluminium hydroxide production” and “aluminium oxide production” were available only as global averages, these activities are now available for all relevant aluminium industry regions. Similarly, in version 3.4 the activities “anode production, paste, for aluminium electrolysis” and “anode production, prebake, for aluminium electrolysis” were available only for the geographies CA-QC and GLO, while now they are supplied for all relevant aluminium industry regions.

The activities producing “aluminium, primary, liquid” and “aluminium, primary, ingot” were already split into regions, these activities are updated.

The geographies of CA-QC and IAI Area, North America, without Quebec are now replaced by RNA (Northern America), see also Table 3. One of the consequences of that change, is that the activity “aluminium, ingot, primary, import from North America_Canada, IAI Area, EU27 & EFTA, 2012 – 2012” has been deleted.

***Table 6. List of all modified and new aluminium activities**. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the column v3.5, "N" stands for "New Activity" and "U" stands for "Updated". The symbol "**" reminds that the geography RNA substitutes version 3.4 geographies CA-QC and IAI Area, North America, without Quebec.*

Activity name	Geography	Time period	v3.5
aluminium hydroxide production	CN; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; RNA; UN-OCEANIA	2015-2015	N
aluminium hydroxide production	GLO	2015-2015	U
aluminium ingot, primary, to aluminium, cast alloy market	GLO	2015-2015	U
aluminium ingot, primary, to aluminium, wrought alloy market	GLO	2015-2015	U
aluminium oxide production	CN; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; RNA; UN-OCEANIA	2015-2015	N
aluminium oxide production	GLO	2015-2015	U
aluminium production, primary, ingot	RNA	2015-2015	U**
aluminium production, primary, ingot	CN; GLO; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; UN-OCEANIA	2015-2015	U
aluminium production, primary, liquid, prebake	RNA	2015-2015	U**
aluminium production, primary, liquid, prebake	CN; GLO; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; UN-OCEANIA	2015-2015	U
aluminium production, primary, liquid, Söderberg	RNA	2015-2015	U**
aluminium production, primary, liquid, Söderberg	GLO; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America	2015-2015	U
aluminium, ingot, primary, import from Africa	IAI Area, EU27 & EFTA	2015-2015	U
aluminium, ingot, primary, import from Asia (excluding China)	IAI Area, EU27 & EFTA	2015-2015	U
aluminium, ingot, primary, import from Middle East (Gulf cooperation Council)	IAI Area, EU27 & EFTA	2015-2015	U
aluminium, ingot, primary, import from Northern America	IAI Area, EU27 & EFTA	2015-2015	U
aluminium, ingot, primary, import from Oceania	IAI Area, EU27 & EFTA	2015-2015	U
aluminium, ingot, primary, import from Rest of Europe	IAI Area, EU27 & EFTA	2015-2015	U
aluminium, ingot, primary, import from South America	IAI Area, EU27 & EFTA	2015-2015	U
anode production, paste, for aluminium electrolysis	GLO	2015-2015	U
anode production, paste, for aluminium electrolysis	RNA	2015-2015	N**
anode production, paste, for aluminium electrolysis	IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area,	2015-2015	N

Activity name	Geography	Time period	v3.5
	Russia & RER w/o EU27 & EFTA; IAI Area, South America; UN-OCEANIA;		
anode production, prebake, for aluminium electrolysis	GLO	2015-2015	U
anode production, prebake, for aluminium electrolysis	RNA	2015-2015	N**
anode production, prebake, for aluminium electrolysis	CN; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; UN-OCEANIA	2015-2015	N
bauxite mine operation	GLO	2015-2015	U
market for aluminium hydroxide	GLO	2011-2011	U
market for aluminium oxide	GLO	2015-2015	U

3.2 Electricity for the aluminium industry

Aluminium producers are aware of the electricity mix they use. For this reasons ecoinvent offers specific datasets producing “electricity, high voltage, aluminium industry”. The transforming activities for each region, activity links and production volume, have been updated based on the newly electricity mixes provided by the International Aluminium Institute.

Table 7. List of all modified and new electricity for the aluminium industry activities. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the column v3.5, "N" stands for "New Activity" and "U" stands for "Updated". The symbol "**" reminds that the geography RNA substitutes version 3.4 geographies CA-QC and IAI Area, North America, without Quebec.*

Activity name	Geography	Time Period	v3.5
electricity production, coal, aluminium industry	CN; GLO; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Russia & RER w/o EU27 & EFTA; RNA; UN-OCEANIA	2015-2015	U**
electricity production, hydro, aluminium industry	CN; GLO; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; RNA; UN-OCEANIA	2015-2015	U**
electricity production, natural gas, aluminium industry	GLO; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area, South America; RNA	2015-2015	U**
electricity production, nuclear, aluminium industry	GLO; IAI Area, EU27 & EFTA; IAI Area, Russia & RER w/o EU27 & EFTA; RNA	2015-2015	U**
electricity production, oil, aluminium industry	GLO; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; UN-OCEANIA	2015-2015	U
electricity voltage transformation from high to medium voltage, aluminium industry	CN; GLO; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; RNA; UN-OCEANIA	2015-2015	U**
market for electricity, high voltage, aluminium industry	CN; GLO; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; RNA; UN-OCEANIA	2015-2015	U**
market for electricity, medium voltage, aluminium industry	CN; GLO; IAI Area, Africa; IAI Area, Asia, without China and GCC; IAI Area, EU27 & EFTA; IAI Area, Gulf Cooperation Council; IAI Area, Russia & RER w/o EU27 & EFTA; IAI Area, South America; RNA; UN-OCEANIA	2015-2015	U**

3.3 Change in results and future improvements

One of the main contributors to the impact scores of aluminium is "aluminium oxide". This product is traded globally, therefore has only one global market in the ecoinvent database. As the contribution of aluminium oxide from China increased with this update, the overall impact of the product supplied by this market increased as well.

Despite the fact that aluminium oxide is clearly a globally traded product, the aluminium industry has data on the flows of aluminium oxide between the different regions making further regionalisation possible. The regionalisation of aluminium oxide supply will be done in the future releases on the ecoinvent database.

Another important source of impacts in aluminium production is electricity. The market shares of different types of electricity production is provided by IAI, but the datasets on electricity production come from the ecoinvent database.

4 Chemical sector

4.1 New and updated markets

The ecoinvent database contains datasets that cover the production of approximately 550 chemical products. For most of them, the default assumption up to v3.4 was that the chemical product is generally traded globally, and correspondingly, only a global market activity was included. Since many of the transforming activities for chemical products have the geography of Europe (RER) or another regional geography, the option of having a market activity at the regional level was re-assessed for v3.5. Through this assessment, it was determined whether changes to the geography of market activities or the transport requirements were necessary to improve the modelling of the supply chains of the entire chemical sector in ecoinvent, with a consistent approach for all chemical products contained in v3.4.

The need for action for each chemical was determined by evaluating its relevance for the database, in combination with expert judgement and, when deemed necessary, by consulting trade statistics from the Eurostat database (Eurostat, 2018a). The assessment of the chemical market activities resulted in the implementation of one of the following actions:

- A regional market activity was created: only a global market activity existed for the product in question in v3.4. A regional market, which covers either the geography RER or another regional geography (in cases where the transforming activity is located outside of Europe), was created, so that any transforming activity located in the regional geography which consumes that product is now supplied by the new regional market activity instead of the global market. In some cases, the new regional market does not contain any transport, as the product is considered to be an intermediate, which means it is usually consumed on the site where it is produced. Those markets are listed in Table 9. Sometimes, in addition to creating a regional market activity, a regional transforming activity was also created in order to provide a regionalized dataset for the production of the chemical in question. The transforming activities that were created are listed in Table 12.

- A regional market activity was deleted: a regional market activity existed in v3.4. The assessment concluded that the regional market activity is not valid anymore because the chemical product in question is at present generally traded globally. Those markets are listed in Table 10.

- The transport inputs in the existing market activity were updated: the transport inputs in the market activity were updated in order to better reflect the actual transportation of the product in question. The markets edited under this premise are listed in Table 11.

4.1.1 Transport distances for new market activities located within Europe

New transport inputs were calculated for the RER market activities that were created for v3.5. Transport data for goods were extracted from the Eurostat database (Eurostat, 2018b). The data that were extracted cover transport of goods by road, railway and inland waterways, which were assumed to be the exclusive transport means within the new RER markets generated.

Table 8 shows the transport distances calculated for the chemical product group, along with the ecoinvent exchange names that are used in the new RER market activities.

Table 8. Transport distances and ecoinvent exchanges used for the transport inputs in the new RER markets for chemical products. *The values are those calculated for the NST 2007 code " GT08 - Chemicals, chemical products, and man-made fibers; rubber and plastic products; nuclear fuel". The average distance indicates the average distance travelled by a product that was transported by the given mode of transported. The fraction of total mass transported is the mass transported by a mode transport, divided by the sum of the mass transported by all three modes of transport. The weighted transport distance is the average distance multiplied by the fraction of total mass transported. The last column gives the ecoinvent exchange names used in the market activities.*

Transport mode	Average distance (km)	Fraction of total mass transported	Weighted transport distance (km)	ecoinvent exchange name
road	216	79.3%	171	transport, freight, lorry, unspecified
railway	297	14.7%	44	transport, freight train
inland waterways	365	6.0%	22	transport, freight, inland waterways, barge

To calculate the amounts to be added in the new RER chemical market activities, the weighted transport distances listed in Table 8 were multiplied by the wet mass of the chemical products.

Table 9. New markets added in the chemical sector for the v3.5. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period
market for 2-butanol	RER	2018-2018
market for 4-tert-butyltoluene	RER	2018-2018
market for acetone cyanohydrin	RER	2018-2018
market for acetone, liquid	RER	2018-2018
market for acetylene	RER	2018-2018
market for acrylic acid	RER	2018-2018
market for acrylic binder, without water, in 34% solution state	RER	2018-2018
market for acrylic dispersion, without water, in 65% solution state	RER	2018-2018
market for acrylic filler	RER	2018-2018
market for acrylic varnish, without water, in 87.5% solution state	RER	2018-2018
market for adhesive, for metal	RER	2018-2018
market for alkyd paint, white, without solvent, in 60% solution state	RER	2018-2018
market for alkyd paint, white, without water, in 60% solution state	RER	2018-2018
market for alkyd resin, long oil, without solvent, in 70% white spirit solution state	RER	2018-2018
market for alkylketene dimer sizing agent, for paper production	RER	2018-2018
market for allyl chloride	RER	2018-2018
market for aluminium sulfate, powder	RER	2018-2018
market for aminopyridine	RER	2018-2018
market for ammonium bicarbonate	RER	2018-2018
market for ammonium carbonate	RER	2018-2018
market for aniline	RER	2018-2018
market for anionic resin	RER	2018-2018
market for argon, liquid	RER	2018-2018
market for benzal chloride	RER	2018-2018
market for benzaldehyde	RER	2018-2018
market for benzoic acid	RER	2018-2018
market for benzyl chloride	RER	2018-2018
market for butadiene	RER	2018-2018
market for butene, mixed	RER	2018-2018
market for butyl acetate	RER	2018-2018
market for butyl acrylate	RER	2018-2018
market for butyrolactone	RER	2018-2018
market for calcium carbide, technical grade	RER	2018-2018
market for calcium carbonate, precipitated	RER	2018-2018
market for calcium chloride	RER	2018-2018
market for carbon tetrachloride	RER	2018-2018
market for cationic resin	RER	2018-2018
market for chlorine dioxide	RER	2018-2018
market for chlorine, liquid	RER	2018-2018
market for chloroacetic acid	RER	2018-2018
market for chlorodifluoromethane	RER	2018-2018
market for chloromethyl methyl ether	RER	2018-2018
market for chlorosulfonic acid	RER	2018-2018
market for coating powder	RER	2018-2018
market for cyanoacetic acid	RER	2018-2018
market for cyclohexanol	RER	2018-2018
market for cyclohexanone	RER	2018-2018
market for deinking emulsion, in paper production	RER	2018-2018
market for dichloromethane	RER	2018-2018
market for diethyl ether, without water, in 99.95% solution state	RER	2018-2018
market for dimethyl ether	RER	2018-2018

Activity name	Geography	Time period
market for dimethyl sulfate	RER	2018-2018
market for dimethylamine	RER	2018-2018
market for dioxane	RER	2018-2018
market for dipropylene glycol monomethyl ether	RER	2018-2018
market for DTPA, diethylenetriaminepentaacetic acid	RER	2018-2018
market for epoxy resin, liquid	RER	2018-2018
market for esterquat	RER	2018-2018
market for esters of versatic acid	RER	2018-2018
market for ethanol, without water, in 99.7% solution state, from ethylene	RER	2018-2018
market for ethoxylated alcohol (AE3)	RER	2018-2018
market for ethoxylated alcohol (AE7)	RER	2018-2018
market for ethyl benzene	RER	2018-2018
market for ethylene bromide	RER	2018-2018
market for ethylene dichloride	RER	2018-2018
market for ethylene glycol monoethyl ether	RER	2018-2018
market for ethylene oxide	RER	2018-2018
market for ethylene vinyl acetate copolymer	RER	2018-2018
market for ethylene, average	RER	2018-2018
market for ethylene, pipeline system	RER	2018-2018
market for ethylenediamine	RER	2018-2018
market for formaldehyde	RER	2018-2018
market for glycerine	RER	2018-2018
market for glyoxal	RER	2018-2018
market for hydrazine	RER	2018-2018
market for hydrogen cyanide	RER	2018-2018
market for hydrogen fluoride	RER	2018-2018
market for hydrogen peroxide, without water, in 50% solution state	RER	2018-2018
market for hydrogen sulfide	RER	2018-2018
market for hydroxylamine	RER	2018-2018
market for indium tin oxide powder, nanoscale, for sputtering target	RER	2018-2018
market for iron sulfate	RER	2018-2018
market for isobutanol	RER	2018-2018
market for isopropanol	RER	2018-2018
market for isopropyl acetate	RER	2018-2018
market for latex	RER	2018-2018
market for lubricating oil	RER	2018-2018
market for melamine formaldehyde resin	RER	2018-2018
market for metallization paste, back side	RER	2018-2018
market for metallization paste, back side, aluminium	RER	2018-2018
market for metallization paste, front side	RER	2018-2018
market for methyl ethyl ketone	RER	2018-2018
market for methyl methacrylate	RER	2018-2018
market for methylamine	RER	2018-2018
market for methylchloride	RER	2018-2018
market for methylene diphenyl diisocyanate	RER	2018-2018
market for monochlorobenzene	RER	2018-2018
market for nitric acid, without water, in 50% solution state	RER	2018-2018
market for nitrobenzene	RER	2018-2018
market for nitrous dioxide	RER	2018-2018
market for nylon 6, glass-filled	RER	2018-2018
market for nylon 6-6, glass-filled	RER	2018-2018
market for o-chlorotoluene	RER	2018-2018
market for o-dichlorobenzene	RER	2018-2018
market for o-nitrophenol	RER	2018-2018
market for optical brighteners, for paper production	RER	2018-2018

Activity name	Geography	Time period
market for p-dichlorobenzene	RER	2018-2018
market for phenolic resin	RER	2018-2018
market for phosphorous chloride	RER	2018-2018
market for phosphoryl chloride	RER	2018-2018
market for polycarboxylates, 40% active substance	RER	2018-2018
market for polyester resin, unsaturated	RER	2018-2018
market for polyol	RER	2018-2018
market for polyurethane, flexible foam	RER	2018-2018
market for polyurethane, rigid foam	RER	2018-2018
market for polyvinylidenchloride, granulate	RER	2018-2018
market for printing ink, offset, without solvent, in 47.5% solution state	RER	2018-2018
market for printing ink, rotogravure, without solvent, in 55% toluene solution state	RER	2018-2018
market for propanal	RER	2018-2018
market for propylene	RER	2018-2018
market for propylene glycol, liquid	RER	2018-2018
market for propylene oxide, liquid	RER	2018-2018
market for propylene, pipeline system	RER	2018-2018
market for retention aid, for paper production	RER	2018-2018
market for silicon tetrachloride	DE	2018-2018
market for silicon, multi-Si, casted	CA-QC; RER	2018-2018
market for silicon, single crystal, Czochralski process, electronics	RER	2018-2018
market for silicon, single crystal, Czochralski process, photovoltaics	RER	2018-2018
market for silicone product	RER	2018-2018
market for sodium amide	RER	2018-2018
market for sodium chlorate, powder	RER	2018-2018
market for sodium cyanide	RER	2018-2018
market for sodium dithionite, anhydrous	RER	2018-2018
market for sodium formate	RER	2018-2018
market for sodium hypochlorite, without water, in 15% solution state	RER	2018-2018
market for sodium metasilicate pentahydrate, 58% active substance, powder	RER	2018-2018
market for sodium nitrite	RER	2018-2018
market for sodium oxide	RER	2018-2018
market for sodium perborate, tetrahydrate, powder	RER	2018-2018
market for sodium percarbonate, powder	RER	2018-2018
market for sodium phosphate	RER	2018-2018
market for sodium silicate, solid	RER	2018-2018
market for sodium silicate, spray powder, 80%	RER	2018-2018
market for sodium silicate, without water, in 37% solution state	RER	2018-2018
market for sodium silicate, without water, in 48% solution state	RER	2018-2018
market for sodium sulfite	RER	2018-2018
market for soft solder, Sn97Cu3	RER	2018-2018
market for SOx retained, in hard coal flue gas desulfurisation	RER	2018-2018
market for sulfite	RER	2018-2018
market for sulfur dichloride	RER	2018-2018
market for sulfur hexafluoride, liquid	RER	2018-2018
market for sulfur trioxide	RER	2018-2018
market for sulfuric acid	RER	2018-2018
market for tetrachloroethylene	RER	2018-2018
market for thionyl chloride	RER	2018-2018
market for toluene diisocyanate	RER	2018-2018
market for toluene, liquid	RER	2018-2018
market for trichloroacetic acid	RER	2018-2018
market for trichloromethane	RER	2018-2018
market for trichloropropane	RER	2018-2018

Activity name	Geography	Time period
market for triethylene glycol	RER	2018-2018
market for trifluoroacetic acid	RER	2018-2018
market for trimethylamine	RER	2018-2018
market for uranium hexafluoride	CN; US	2018-2018
market for urea formaldehyde resin	RER	2018-2018
market for vinyl chloride	RER	2018-2018
market for xenon, gaseous	RER	2018-2018
market for xylene	RER	2018-2018
market for zeolite, slurry, without water, in 50% solution state	RER	2018-2018
market for zinc monosulfate	RER	2018-2018

Table 10. Deleted markets in the chemical sector, for v3.5. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. When the product appears in the column "Product name", it means that the product has also been deleted from the database (in these cases, renamed, see* ***Table 1****).*

Activity name	Geography	Time period	Product name
market for acetic anhydride	RER	2005-2006	
market for fatty alcohol sulfate	RER	1992-1995	
market for maleic anhydride	RER	1997-2000	
market for epoxy resin	GLO	2015-2020	epoxy resin
market for methylene diphenyldiisocyanate	GLO	2015-2020	methylene diphenyldiisocyanate
market for methylpyrrolidone	GLO	2015-2020	methylpyrrolidone

Table 11. Markets that were updated for v3.5 in the chemical sector. *The update concerns transport distances, as detailed in the text.*

Activity Name	Geography	Time Period
market for 2,4-di-tert-butylphenol	GLO	2015-2020
market for 2,5-dimethylhexane-2,5-dihydroperoxide	GLO	2015-2020
market for 2,6-di-tert-butylphenol	GLO	2015-2020
market for acetylene	GLO	2011-2011
market for activated carbon, granular	GLO	2005-2015
market for alkyl sulphate (C12-14)	GLO	2015-2020
market for aluminium chloride	GLO	2015-2020
market for aluminium sulfate, without water, in 4.33% aluminium solution state	GLO	2013-2013
market for amine oxide	GLO	2015-2020
market for ascorbic acid	GLO	2015-2020
market for azodicarbonamide	GLO	2015-2020
market for barium carbonate	GLO	2015-2020
market for barium hydroxide	GLO	2015-2020
market for barium oxide	GLO	2015-2020
market for barium sulfide	GLO	2015-2020
market for benzaldehyde-2-sulfonic acid	GLO	2015-2020
market for bromine	GLO	2010-2010

Activity Name	Geography	Time Period
market for butene, mixed	GLO	2011-2011
market for butyldiglycol acetate	GLO	2015-2020
market for calcium carbonate, precipitated	GLO	2015-2020
market for carbon tetrachloride	GLO	2011-2011
market for chlorine dioxide	GLO	2011-2011
market for chlorine, gaseous	GLO	2011-2011
market for chlorine, gaseous	RER	2011-2011
market for chlorodifluoromethane	GLO	2011-2011
market for chlorosulfonic acid	GLO	2010-2010
market for cocamide diethanolamine	GLO	2015-2020
market for decabromodiphenyl ether	GLO	2015-2020
market for dichloromethane	GLO	2011-2011
market for dichloropropene	GLO	2012-2012
market for diethyl ether, without water, in 99.95% solution state	GLO	2011-2011
market for dimethyl carbonate	GLO	2015-2020
market for dimethyl hexanediol	GLO	2015-2020
market for dimethyl sulfate	GLO	2011-2011
market for dimethylaminopropylamine	GLO	2015-2020
market for dodecanol	GLO	2015-2020
market for enzymes	GLO	2015-2020
market for ethoxylated alcohol (AE>20)	GLO	2015-2020
market for ethylene bromide	GLO	2012-2012
market for ethylene dichloride	GLO	2011-2011
market for ethylene oxide	GLO	2011-2011
market for glucose	GLO	2015-2020
market for hydrazine	GLO	2012-2012
market for hydrazine sulfate	GLO	2015-2020
market for hydrochloric acid, without water, in 30% solution state	RER	1997-2000
market for hydrogen cyanide	GLO	2011-2011
market for iron (III) chloride, without water, in 40% solution state	GLO	2011-2011
market for iron(II) chloride	GLO	2013-2013
market for iron(III) chloride, without water, in 14% iron solution state	GLO	2013-2013
market for iron(III) chloride, without water, in a 12% iron solution state	GLO	2013-2013
market for iron(III) sulfate, without water, in 12.5% iron solution state	GLO	2013-2013
market for lithium carbonate	GLO	2011-2011
market for lithium chloride	GLO	2011-2011
market for magnetite	GLO	2011-2011
market for methanol	GLO	2011-2011
market for molybdenum trioxide	GLO	2008-2008
market for nitric acid, without water, in 50% solution state	GLO	2011-2011
market for non-ionic surfactant	GLO	2015-2020
market for octabenzone	GLO	2015-2020
market for phosphorus oxychloride	GLO	2015-2020
market for polyaluminium chloride	GLO	2015-2020
market for polydimethylsiloxane	GLO	2015-2020
market for propylene oxide, liquid	GLO	2011-2011
market for purified terephthalic acid	GLO	2011-2011
market for refrigerant R134a	GLO	2011-2011
market for silicon tetrachloride	GLO	2011-2011
market for silicon, metallurgical grade	GLO	2011-2011
market for soda ash, light, crystalline, heptahydrate	GLO	2011-2011
market for sodium chloroacetate	GLO	2015-2020
market for sodium cumenesulphonate	GLO	2015-2020
market for sodium hydrogen sulfate	GLO	2015-2020
market for sodium hypochlorite, without water, in 15% solution state	GLO	2011-2011

Activity Name	Geography	Time Period
market for sodium silicate, without water, in 48% solution state	GLO	2011-2011
market for stearic acid	GLO	2015-2020
market for succinic acid	GLO	2015-2020
market for sulfamic acid	GLO	2015-2020
market for sulfur	GLO	2011-2011
market for sulfur trioxide	GLO	2011-2011
market for tetrachloroethylene	GLO	2011-2011
market for tetrafluoroethylene	GLO	2011-2011
market for thionyl chloride	GLO	2010-2010
market for trichloromethane	GLO	2011-2011
market for trichloropropane	GLO	2012-2012
market for triphenyl phosphate	GLO	2015-2020
market for tris(2,4-ditert-butylphenyl) phosphite	GLO	2015-2020
market for trisodium phosphate	GLO	2015-2020
market for vinyl acetate	GLO	2011-2011
market for vinyl fluoride	GLO	2011-2011
market for wax, lost-wax casting	GLO	2018-2018

4.2 New and updated transforming activities

Several producing activities were updated in this sector: their Production Volumes were adjusted, specific links to regional suppliers of a specific input were set (in the case of links to services and immobile infrastructure, this is also reported in Chapter 11.1), or they were corrected some exchange amount. They are all documented in Table 12.

In version 3.4 the products “epoxy resin, liquid”, “N-methyl-2-pyrrolidone” and “methylene diphenyl diisocyanate” were modelled in two supply chains: “epoxy resin, liquid” (older data) and “epoxy resin” (more recent data); “methylene diphenyl diisocyanate” (older data) and “methylene diphenyldiisocyanate” (more recent data); "N-methyl-2-pyrrolidone production" (older data) and "methylpyrrolidone production" (more recent data). The older data was the only one used by consumers. For version 3.5, the more recent data is the only one available to consumers, but the new activities are renamed to the older nomenclature (see Table 1, Table 2; Table 10, Table 11, Table 12).

The activity names “epoxy resin production”, “methylene diphenyldiisocyanate production” and “methylpyrrolidone production” are then deleted from the database (Table 2).

Table 12. Activities that have been updated or added new to the v3.5, in the chemical sector. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the column v3.5, "N" stands for "New Activity"; "U" stands for "Updated", and "N*" indicates the addition of a new product to the database; in this case "sodium bicarbonate" (kg).*

Activity name	Geography	Time period	v3.5
acetone production, from isopropanol	GLO	2015-2020	U
argon production, liquid	RER	1997-2001	U
cadmium chloride production, semiconductor-grade	US	2004-2005	U
cadmium sulfide production, semiconductor-grade	US	1981-1999	U
cadmium telluride production, semiconductor-grade	US	1985-2005	U
calcium chloride to generic market for de-icer	RER	2012-2012	N
chlor-alkali electrolysis, diaphragm cell	GLO; RER	2000-2000	U
chlor-alkali electrolysis, membrane cell	GLO; RER	2000-2000	U
chlor-alkali electrolysis, mercury cell	GLO; RER	2000-2000	U
chlorine production, liquid	RER	2000-2000	N
compressed air production, 1000 kPa gauge, <30kW, average generation	GLO	1990-2010	U
cryolite production	GLO; RER	2000-2000	U
dehydrogenation of butan-1,4-diol	RER	2000-2007	N
dodecanol production, from coconut oil	GLO	2015-2020	U
epichlorohydrin production from allyl chloride	GLO; RER	1998-2004	U
epoxy resin production, liquid	GLO; RER	2015-2020	U
ethoxylated alcohol (AE7) production, palm kernel oil	GLO; RER	1992-1995	U
fatty alcohol sulfate production, coconut oil	GLO; RER	1992-1995	U
fatty alcohol sulfate production, from palm kernel oil	GLO; RER	1992-1995	U
fatty alcohol sulfate production, palm oil	GLO; RER	1992-1995	U
glucose production	GLO; RER	2015-2020	U
hydrogen fluoride production	RER	1979-2020	N
iron (III) chloride production, product in 40% solution state	CH; GLO	1995-2001	U
market for butene, mixed	GLO	2011-2011	U
market for N-methyl-2-pyrrolidone	GLO	2011-2011	U
market for sodium bicarbonate	GLO	2011-2011	N*
methylene diphenyl diisocyanate production	GLO; RER	2015-2020	U
N-methyl-2-pyrrolidone production	GLO; RER	2015-2020	U
non-ionic surfactant production, ethylene oxide derivate	GLO	2015-2020	U
non-ionic surfactant production, fatty acid derivate	GLO	2015-2020	U
permanent magnet production, for electric motor	GLO	1995-2002	U
phosphoric acid production, dihydrate process	GLO; MA; US	1986-2001	U
photovoltaic laminate production, a-Si	US	1997-2005	U
photovoltaic laminate production, CdTe	US	2004-2005	U
photovoltaic panel production, a-Si	US	1997-2005	U
polyvinylfluoride production	GLO; US	2005-2006	U
polyvinylfluoride production, dispersion	GLO; US	2005-2006	U
polyvinylfluoride, film production	GLO; US	2005-2006	U
potassium hydroxide production	GLO; RER	1998-2004	U
soda production, solvay process	GLO; RER	1999-1999	U
sodium bicarbonate, to generic market for neutralising agent	GLO	1999-1999	N
sodium chloride electrolysis	RER	2010-2010	U

4.3 Other corrections

4.3.1 Replacement of inputs of "chlorine, gaseous" with inputs of "chlorine, liquid"throughout the database.

Chlorine is provided in two different forms in the ecoinvent database: in the gaseous form with the product "chlorine, gaseous", and in the liquid form with the product "chlorine, liquid". The product "chlorine, gaseous" is supplied almost entirely by the chlor-alkali electrolysis datasets, while the product "chlorine, liquid" is produced by the activity "chlorine, production, liquid", which only models the compression of gaseous chlorine.

The markets for the two types of chlorine, as well as the choice of chlorine input in the activities that consume chlorine, were revised for v3.5. The aim of this revision was to remodel the supply chain of chlorine so that it is consistent with the fact that "commercial chlorine is transported as a liquid, either in small containers (cylinders and drums) or in bulk (road and rail tankers, barges, and ISO containers)" (Schmittinger, 2011).

For v3.5, the transport inputs in the "market for chlorine, gaseous" (GLO and RER) were removed, as it is assumed that the product "chlorine, gaseous" is not transported (or only over very short distances), and the European supply chain for “chlorine, liquid” was improved with the addition of local suppliers and market (mentioned in Table 9 and Table 12).

Furthermore, to be consistent with the fact that chlorine is transported after compression, all datasets that had an input of "chlorine, gaseous" without an activity link in v3.4 (meaning that they automatically link to one of the markets for chlorine, gaseous) had the input of chlorine switched to "chlorine, liquid". With this approach, the energy consumed for compressing the chlorine gas is systematically taken into account for activities that consume chlorine that is not produced onsite. All activities affected by this change are listed in Table 13.

Table 13. Activities where the input "chlorine, gaseous" has been changed to "chlorine, liquid" in the ecoinvent v3.5. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column*

Activity name	Geography	Time period
[sulfonyl]urea-compound production	GLO; RER	2000-2010
[thio]carbamate-compound production	GLO; RER	2000-2010
acetamide-anillide-compound production, unspecified	GLO; RER	2000-2010
aclonifen production	GLO; RER	2000-2010
allyl chloride production, reaction of propylene and chlorine	GLO; RER	1998-2004
aluminium chloride production	GLO	2015-2020
anthraquinone production	GLO; RER	1995-2000
assembly of liquid crystal display, auxilliaries and energy use	GLO	2001-2001
benzal chloride production	GLO; RER	2000-2006
benzene chlorination	GLO; RER	1986-2005
benzimidazole-compound production	GLO; RER	2000-2010
benzo[thia]diazole-compound production	GLO; RER	2000-2010
benzoic-compound production	GLO; RER	2000-2010
benzyl chloride production	GLO; RER	2000-2006
bipyridylium-compound production	GLO; RER	2000-2010
cane sugar production with ethanol by-product	BR; GLO	1994-2006
captan production	GLO; RER	2000-2010
cathode-ray tube production, cathode ray tube display	GLO	1998-2001
chemical production, inorganic	GLO	2000-2000
chloroacetic acid production	GLO; RER	1997-2000
chlorofluorination of ethylene	GLO	2000-2006
chlorothalonil production	GLO; RER	2000-2010
chlorotoluron production	GLO; RER	2000-2010
cyanuric chloride production	GLO	2005-2010
cyclic N-compound production	GLO; RER	2000-2010
dewatering of ethanol from biomass, from 95% to 99.7% solution state	CN	1992-2006
diazine-compound production	GLO; RER	2000-2010
diazole-compound production	GLO; RER	2000-2010
dimethenamide production	GLO; RER	2000-2010
dinitroaniline-compound production	GLO; RER	2000-2010
diphenylether-compound production	GLO; RER	2000-2010
electricity production, hard coal	ASCC; AT; AU; BE; BG; BR; CA-AB; CA-NB; CA-NS; CA-ON; CA-PE; CA-QC; CL; CN-AH; CN-BJ; CN-CQ; CN-FJ; CN-GD; CN-GS; CN-GX; CN-GZ; CN-HA; CN-HB; CN-HE; CN-HL; CN-HN; CN-HU; CN-JL; CN-JS; CN-JX; CN-LN; CN-NM; CN-NX; CN-QH; CN-SA; CN-SC; CN-SD; CN-SH; CN-SX; CN-TJ; CN-XJ; CN-XZ; CN-YN; CN-ZJ; CZ; DE; EE; ES; FI; FR; FRCC; GB; GLO; HICC; HR; IE; IN-AP; IN-BR; IN-CT; IN-DL; IN-GJ; IN-HR; IN-JH; IN-KA; IN-MH; IN-MP; IN-OR; IN-PB; IN-RJ; IN-TN; IN-UP; IN-WB; IT; JP; KR; MRO, US only; MX; MY; NL; NPCC, US only; PE; PT; RFC; SERC; SPP; TH; TR; TRE; TW; TZ; UA; WECC, US only	1980-2015
electricity production, hard coal	LV; RU	2016-2018
electricity production, hard coal, at coal mine power plant	CN; GLO	1999-2015
electricity production, lignite	ASCC; AU; BA; BG; BR; CA-AB; CA-MB; CA-NS; CA-ON; CA-SK; CZ; DE; ES; FRCC; GLO; GR; HICC; HR; HU; ID; IN-GJ; IN-RJ; IN-TN; IT; KR;	1980-2015

Activity name	Geography	Time period
	MK; MRO, US only; MX; NPCC, US only; RFC; RO; RS; SERC; SI; SPP; TH; TR; TRE; TW; WECC, US only	
electricity production, peat	FI; IE	1980-2015
electricity production, wood, future	GLO	2016-2030
epichlorohydrin production from allyl chloride	GLO; RER	1998-2004
ethanol production from sugarcane	BR; GLO	2000-2006
ethanol production from sweet sorghum	CN; GLO	1992-2006
ethanol production from wood	CH; GLO	1999-2006
ethanol production from wood	SE	2000-2008
ethylene dichloride production	GLO; RER	1997-2000
folpet production	GLO; RER	2000-2020
fuel cell production, stack solid oxide, 125kW electrical, future	CH; GLO	2000-2005
glyphosate production	GLO; RER	2000-2010
heat and power co-generation, hard coal	AT; BG; CZ; DE; DK; FI; GLO; IT; KR; NL; NO; PL; RU; SE; SK; TR; TW; UA	1980-2015
heat and power co-generation, lignite	AU; BA; BG; CZ; DE; GLO; GR; HU; PL; RO; RS; RU; SI; SK; TR	1980-2015
heat and power co-generation, wood chips, 2000 kW	CH; GLO	2000-2015
heat and power co-generation, wood chips, 2000 kW, state-of-the-art 2014	CH; GLO	2012-2015
heat and power co-generation, wood chips, 6667 kW	BG; CH; CL; EE; GLO; HR; ID; LT; LV; MX; MY; PE; RU; TH; TR; TW; TZ; UA; ZA	2010-2015
heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014	ASCC; AT; AU; BE; BG; BR; CA-AB; CA-BC; CA-NS; CA-ON; CA-PE; CA-QC; CH; CL; CN-GD; CN-SH; CY; CZ; DE; DK; EE; ES; FI; FR; FRCC; GB; GLO; GR; HICC; HR; HU; IE; IN-TN; IT; JP; KR; LU; LV; MRO, US only; MT; NL; NO; NPCC, US only; PL; PT; RFC; RO; RU; SE; SERC; SI; SK; SPP; TRE; WECC, US only; ZA	2010-2015
heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014, label-certified	CH; GLO	2010-2015
hydrochloric acid production, from the reaction of hydrogen with chlorine	GLO; RER	1997-2020
liquid crystal display production, minor components, auxilliaries and assembly effort	GLO	2001-2001
mecoprop production	GLO; RER	2000-2010
metamitron production	GLO; RER	2000-2010
metolachlor production	GLO; RER	2000-2010
napropamide production	GLO; RER	2000-2010
nitrile-compound production	GLO; RER	2000-2020
nitro-compound production	GLO; RER	2000-2010
orbencarb production	GLO; RER	2000-2010
organophosphorus-compound production, unspecified	GLO; RER	2000-2010
palm oil mill operation	GLO; MY	1995-2006
paper production, woodcontaining, lightweight coated	CA-QC; GLO; RER	2000-2000
paper production, woodcontaining, supercalendered	CA-QC; GLO; RER	2000-2000
pesticide production, unspecified	GLO; RER	2000-2010
petroleum refinery operation	CH; Europe without Switzerland	1980-2000
petroleum refinery operation	GLO	2005-2005
phenoxy-compound production	GLO; RER	2000-2010
phosgene production, liquid	GLO; RER	2000-2000
phosphorous chloride production	GLO; RER	2000-2000
phosphorus pentachloride production	CN; GLO	2009-2010
phthalimide-compound production	GLO; RER	2000-2010
propylene oxide production, liquid	GLO; RER	2000-2000

Activity name	Geography	Time period
pyrethroid-compound production	GLO; RER	2000-2010
pyridazine-compound production	GLO; RER	2000-2010
pyridine-compound production	GLO; RER	2000-2010
refrigerant R134a production	GLO; RER	1999-2000
silicon tetrachloride production	GLO	1986-2010
sodium hypochlorite production, product in 15% solution state	GLO; RER	1997-2000
sulfuryl chloride production	GLO	2002-2002
titanium dioxide production, chloride process	GLO; RER	2005-2005
treatment of aluminium scrap, new, at refiner	GLO; RER	2005-2005
treatment of aluminium scrap, new, at remelter	GLO; RER	2005-2005
treatment of aluminium scrap, post-consumer, prepared for recycling, at refiner	GLO; RER	2005-2005
treatment of aluminium scrap, post-consumer, prepared for recycling, at remelter	GLO; RER	2005-2005
treatment of bagasse, from sugarcane, in heat and power co-generation unit, 6400kW thermal	GLO	2000-2001
treatment of bagasse, from sweet sorghum, in heat and power co-generation unit, 6400kW thermal	GLO	2000-2001
triazine-compound production, unspecified	GLO; RER	2000-2010
trichloroborane production	GLO	2000-2006
trichloroethylene production	GLO; RER	2015-2020
trichloromethane production	GLO; RER	1998-1999
wafer production, fabricated, for integrated circuit	GLO	2000-2006

5 Electricity

5.1 New data on electricity production in South Africa

Within the context of the SRI project, all electricity related data in South Africa have been updated and/or extended. Besides the work on hard coal mining and power plants (see chapter 6), datasets for electricity production with concentrated solar power (CSP) plants have been introduced to the database. These are specific to South Africa but are also being used to model electricity from CSP plants in other countries as a first approximation.

The new activities and products added for improved modelling of the South African electricity markets are shown in Table 14 and Table 15. The remaining technologies supplying the markets have not been updated. The technology market shares are now based on information by South African electricity providers directly instead of using the statistics by the International Energy Agency (IEA) as in v3.4 and as for most other country electricity mixes modelled in ecoinvent.

Table 14. New products added to the electricity sector in v3.5. *All products are related to solar electricity production.*

Product name	Unit
collector field area, solar thermal parabolic trough, 50 MW	unit
collector field area, solar tower power plant, 20 MW	unit
concentrated solar power plant, solar thermal parabolic trough, 50 MW	unit
concentrated solar power plant, solar tower, 20 MW	unit
heat transport fluid system, solar thermal parabolic trough, 50 MW	unit
power block, solar thermal parabolic trough, 50 MW	unit
power block, solar tower power plant, 20 MW	unit
receiver system, solar tower power plant, 20 MW	unit
steam generation system, solar tower power plant, 20 MW	unit
thermal storage system, solar thermal parabolic trough, 50 MW	unit
thermal storage system, solar tower power plant, 20 MW	unit

Table 15. New activities added related to solar power. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time Period
collector field area construction, solar thermal parabolic trough, 50 MW	GLO; ZA	2010-2020
collector field area construction, solar tower power plant, 20 MW	GLO; ZA	2010-2020
concentrated solar power plant construction, solar tower power plant, 20 MW	GLO; ZA	2010-2020
concentrated solar power plant, solar thermal parabolic trough, 50 MW	GLO; ZA	2010-2020
electricity production, hard coal, conventional	ZA	2016-2017
electricity production, hard coal, conventional	GLO	2016-2017
electricity production, hard coal, supercritical	ZA	2016-2017
electricity production, hard coal, supercritical	GLO	2016-2017
electricity production, solar thermal parabolic trough, 50 MW	ES; FRCC; GLO; WECC, US only; ZA	2010-2020
electricity production, solar tower power plant, 20 MW	AU; ES; GLO; WECC, US only; ZA	2010-2020
heat transport fluid system construction, solar thermal parabolic trough, 50 MW	GLO; ZA	2010-2020
market for collector field area, solar thermal parabolic trough, 50 MW	GLO	2010-2020
market for collector field area, solar tower power plant, 20 MW	GLO	2010-2020
market for concentrated solar power plant, solar thermal parabolic trough, 50 MW	GLO	2010-2020
market for concentrated solar power plant, solar tower, 20 MW	GLO	2010-2020
market for heat transport fluid system, solar thermal parabolic trough, 50 MW	GLO	2010-2020
market for power block, solar thermal parabolic trough, 50 MW	GLO	2010-2020
market for power block, solar tower power plant, 20 MW	GLO	2010-2020
market for receiver system, solar tower power plant, 20 MW	GLO	2010-2020
market for steam generation system, solar tower power plant, 20 MW	GLO	2010-2020
market for thermal storage system, solar thermal parabolic trough, 50 MW	GLO	2010-2020
market for thermal storage system, solar tower power plant, 20 MW	GLO	2010-2020
power block installation, solar thermal parabolic trough, 50 MW	GLO; ZA	2010-2020
power block installation, solar tower power plant, 20 MW	GLO; ZA	2010-2020
receiver system construction, solar tower power plant, 20 MW	GLO; ZA	2010-2020
steam generation system construction, solar tower power plant, 20 MW	GLO; ZA	2010-2020
thermal storage system construction, solar thermal parabolic trough, 50 MW	GLO; ZA	2010-2020
thermal storage system construction, solar tower power plant, 20 MW	GLO; ZA	2010-2020

5.2 Updates to the market mixes

Since version v3.4, electricity from autoproducers as defined in the IEA statistics (IEA a) is not supplying the electricity markets anymore, with the exception of electricity from photovoltaics. As the electricity markets in ecoinvent are thought to provide the electricity mix of public grids, this approach comes closer to this goal. An exception is made for electricity from photovoltaics, which is mainly supplied to the grid by autoproducers. Not including this electricity would result in photovoltaics not contributing to the electricity mix in most countries, even if it is often sold to the grid.

New datasets for electricity production from concentrated solar power have been introduced to the database (see chapter 5.1) and are now supplying the electricity market, high voltage where appropriate. In previous versions, this electricity type was approached with datasets modelling electricity from photovoltaics. The production volume from photovoltaics is decreased accordingly.

The supply of electricity from hydro, pumped storage in the US NERC regions is now modelled to be zero. According to the EIA statistics (IEA b), "Pumped storage hydroelectricity generation is negative because most pumped storage electricity generation facilities use more electricity than they produce on an annual basis.". In order to consistently use the information in the EIA statistics, the information from the IEA statistics on electricity from pumped hydropower plants is not considered. According to the IEA statistics, electricity from pumped hydro was 0.4% of in 2014. All electricity from hydropower plants as given by EIA statistics is now modelled with run-of-river and reservoir plants.

5.3 Corrections to the market mixes

Version 3.4 contained several errors in the electricity market mixes in both the attributional and the consequential system models. The corrections are listed in Table 16.

Table 16. Corrections in the attributional and consequential electricity markets on high, medium and low voltage level.

Geography	v3.4	v3.5	Impact on electricity market LCIA scores (minor/major)
Attributional system models			
High voltage			
SE	Electricity from nuclear plants: Shares of Pressure Water Reactors (PWR) and Boiling Water Reactors (BWR) were switched: 12% from BWR and 28.5% from PWR.	Shares of PWR (12%) and BWR (28.5%) are corrected.	Minor
IS	Electricity from hydro, reservoir, non-alpine region was dropped.	Reintroduced.	Minor
CH	Electricity imports: The data from IEA statistics were used instead of Messmer et al. [1], which was the basis for all other Swiss electricity data.	Electricity import data from Messmer et al. are used now for consistency reasons.	Minor
US NERC regions	All markets had an entry of heat and power co-generation, lignite linking to the RoW dataset, supplying a tiny share of 3.16E-07 to 5.52E-05.	Removed this entry for lignite.	Minor
EE,GB, LT, LV, SI, TW	electricity from hydro, run-of-river was dropped	Reintroduced.	Minor: EE, LT Major: LV, SI, TW, GB
GB, SE, TW, UA	Electricity from hydro, pumped storage was dropped	Reintroduced.	Minor: SE, UA Major: GB, TW
AE, SY, TJ	Input of pumped hydro, even if this should be other hydro.	Switched from pumped hydro to run-of-river hydro	Minor: AE, SY Major: TJ
BE, CZ, DE, ES, FI, FR, GLO, HU, IT, JP, KR, NL, NO, PL, SE, TR, UA	Input of treatment of blast furnace gas, in power plant was dropped.	Reintroduced.	Minor
BE, CZ, DE, EE, ES, FI, FR, GLO, HU, IT, JP, KR, NL, PL, SE, TR	Input of treatment of coal gas, in power plant was dropped.	Reintroduced.	Minor
Medium voltage			
AT, BE, CH, CZ, DE, DK, EE, ES, FI, FR, GLO, HU, IE, IT, JP, LT, LU, NO, PH, PL, SE, SG, SI, TR, TW	Electricity from waste was missing on all medium voltage markets.	Reintroduced	Mostly minor
Low voltage			
DK, FI, HU, LU, MT, PL, TZ	Low voltage markets: Electricity from photovoltaics was dropped	Reintroduced	Minor

[1] Messmer, 2016.

Geography	v3.4	v3.5	Impact on electricity market LCIA scores (minor/major)
General			
GB	This electricity market was wrong in v3.4. The following technologies didn't supply the markets: High voltage: nuclear, hydropower, wind Medium voltage: waste Low voltage: Photovoltaics	The markets are correct now	Major
Canadian provinces	Some of the Canadian markets were not correct	Corrected based on the latest available statistics from statcan, which also contains some corrections	Partly major
Chinese provinces	Some provinces were translated wrongly, so that the wrong mix was attributed to some provinces. This didn't affect the final results of the two markets "SGCC" and "CSG"	Corrected	None
Namibia	Markets for Namibia were missing	Introduced	Minor
GLO electricity market		Adapted to all changes mentioned above.	
Consequential system model			
High voltage			
AU	Electricity from hard coal missing	Introduced	Major
CN, IN	Electricity from wood missing	Introduced	Minor

5.4 Change of modelling in the electricity voltage transformation activities

The modelling of the electricity voltage transformation activities has been changed in the way the losses are represented. In v3.4, the losses were linked to the lower voltage level in the transformation activity, i.e. to medium voltage electricity during the transformation from high to medium voltage and to low voltage electricity during the transformation from medium to low voltage. In v3.5, these losses are now linked to the higher voltage level, i.e. to high voltage electricity in the first case and medium voltage electricity in the second case. Each activity listed in the following table has had the link to the losses changed as described above.

Table 17. Updated transformation activities for v3.5*. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period
electricity voltage transformation from high to medium voltage	AE; AL; AM; AO; ASCC; AT; AU; AZ; BA; BD; BE; BG; BH; BJ; BN; BO; BR; BW; BY; CA-AB; CA-BC; CA-MB; CA-NB; CA-NF; CA-NS; CA-NT; CA-NU; CA-ON; CA-PE; CA-SK; CA-YK; CD; CG; CH; CI; CL; CM; CR; CSG; CU; CW; CY; CZ; DE; DK; DO; DZ; EC; EE; EG; ER; ES; ET; FI; FR; FRCC; GA; GB; GE; GH; GI; GLO; GR; GT; HICC; HK; HN; HR; HT; HU; ID; IE; IL; IN-Eastern grid; IN-North-eastern grid; IN-Northern grid; IN-Southern grid; IN-Western grid; IQ; IR; IS; IT; JM; JO; JP; KE; KG; KH; KP; KR; KW; KZ; LB; LK; LT; LU; LV; LY; MA; MD; ME; MK; MM; MN; MRO, US only; MT; MU; MX; MY; MZ; NA; NE; NG; NI; NL; NO; NP; NPCC, US only; NZ; OM; PA; PH; PK; PL; PT; PY; QA; RFC; RO; RS; RU; SA; SD; SE; SERC; SG; SGCC; SI; SK; SN; SPP; SS; SV; SY; TG; TH; TJ; TM; TN; TR; TRE; TT; TW; TZ; UA; UY; UZ; VE; VN; WECC, US only; XK; YE; ZA; ZM; ZW	2012-2012
electricity voltage transformation from high to medium voltage	CA-QC	2012-2015
electricity voltage transformation from high to medium voltage	AR; PE	2012-2017
electricity voltage transformation from high to medium voltage	CO	2014-2017
electricity voltage transformation from high to medium voltage, label-certified	CH; GLO	2011-2015
electricity voltage transformation from medium to low voltage	AE; AL; AM; AO; ASCC; AT; AU; AZ; BA; BD; BE; BG; BH; BJ; BN; BO; BR; BW; BY; CA-AB; CA-BC; CA-MB; CA-NB; CA-NF; CA-NS; CA-NT; CA-NU; CA-ON; CA-PE; CA-SK; CA-YK; CD; CG; CH; CI; CL; CM; CR; CSG; CU; CW; CY; CZ; DE; DK; DO; DZ; EC; EE; EG; ER; ES; ET; FI; FR; FRCC; GA; GB; GE; GH; GI; GLO; GR; GT; HICC; HK; HN; HR; HT; HU; ID; IE; IL; IN-Eastern grid; IN-North-eastern grid; IN-Northern grid; IN-Southern grid; IN-Western grid; IQ; IR; IS; IT; JM; JO; JP; KE; KG; KH; KP; KR; KW; KZ; LB; LK; LT; LU; LV; LY; MA; MD; ME; MK; MM; MN; MRO, US only; MT; MU; MX; MY; MZ; NA; NE; NG; NI; NL; NO; NP; NPCC, US only; NZ; OM; PA; PH; PK; PL; PT; PY; QA; RFC; RO; RS; RU; SA; SD; SE; SERC; SG; SGCC; SI; SK; SN; SPP; SS; SV; SY; TG; TH; TJ; TM; TN; TR; TRE; TT; TW; TZ; UA; UY; UZ; VE; VN; WECC, US only; XK; YE; ZA; ZM; ZW	2012-2012
electricity voltage transformation from medium to low voltage	CA-QC	2012-2015
electricity voltage transformation from medium to low voltage	AR; PE	2012-2017
electricity voltage transformation from medium to low voltage	CO	2014-2017
electricity voltage transformation from medium to low voltage, label-certified	CH; GLO	2011-2015

6 Hard coal supply chains

As one of the environmentally most impactful sectors, hard coal contributes considerably to the impacts of countless downstream activities. After revising the entire sector, version 3.5 covers more than 95% of the global hard coal supply chains. New data on coal supply in India and South Africa include different types of mines and preparation. Key emissions from coal mines were updated and consistently implemented for all geographies. Furthermore, import and market datasets depict global trade flows and regional hard coal mixes, respectively.

6.1 Changes in the modelling of mining and preparation of hard coal

6.1.1 Uncontrolled coal fires

Uncontrolled coal fires occur when coal deposits in untapped coal beds, in active or abandoned underground coal mines or in waste dumps of open pit mines ignite. This can happen spontaneously, for example when coal is exposed to oxygen and hot sunlight. Coal fires already occurred in prehistoric times, ignited for example by volcanoes. Today completely spontaneous fires without human involvement are less common (Künzer & Stracher, 2011).

Song and Künzer (2014) estimate that Chinese coal fires accounted for 40% of GHG emissions from coal fires in 2002. At that time China mined about 40% of global hard coal. In absolute terms, van Dijk (2011) estimates that a maximum of 20 million tonnes of coal is burnt in uncontrolled fires in China per year. Song and Künzer (2014) point out, that due the investment in firefighting efforts over the past years this number is likely to have decreased since then. However, no more recent quantitative estimate is available to confirm that.

For geographies other than China we carefully evaluated the available data and found them insufficient to make reliable estimates. For this reason, China continues to be the only geography in ecoinvent which accounts for the impacts of coal fires in the hard coal mining activity. While this is consistent with previous versions of the database, the update is an important improvement in data accuracy. The estimate of 0.33kg CO2 emitted per kg of hard coal mined in China, made by Dones et al. (2007) for ecoinvent version 2 relies on meanwhile disproved research which largely overestimated the significance of coal fires.

We calculated the current emissions from coal fires based on the conservative estimate of 20Mt lost to such fires each year. This means we relate the current annual rate of burnt coal seams to the current coal production volumes in China and neglect the fact that past mining activities are responsible for the coal burning today, while today's mining activities will be responsible for emissions occurring in the near to distant future. The combustion is modelled as open burning of the average Chinese coal composition according to USGS's World Coal Quality Inventory (USGS, 2010) with an average carbon content of 0.635 kg carbon per kg hard coal. This means that we assume complete combustion conditions, while a major share of coal actually combusts under a lack of oxygen. The CO2 emissions from incomplete combustion would be lower. The CH4 emission factor for incomplete combustion is said to be uncertain, ranging between 0.1% and 0.9% of CO2 emissions. In our approach we apply a factor of 0.3% CH4 emissions of CO2 emissions. Given the current state of knowledge on coal fires, we consider this the best available approximation. As better data for China and other geographies will become available in the future, we are eager to integrate them.

The amount of coal corresponding to the assumed losses of 20Mt/year has been added to the coal resources consumption.

6.1.2 Fugitive methane emissions from coal mining and handling

The activities of mining, processing, storage and transportation of hard coal as well as abandoned coal mines can be considerable sources of fugitive CH4 emissions. The IPCC provides in its "Guidelines for National Greenhouse Gas Inventories of 2006" the methodology applied by Annex I and non-Annex I countries to report their emissions. In the national greenhouse gas inventory reports of these countries, the fugitive CH4 emissions are commonly reported as cumulative value for the coal mining and handling steps. Therefore, we include emissions from both, coal mining and handling, in the hard coal mining datasets of the respective geographies. ecoinvent version 3.4 and lower applied CH4 emission factors from Dones et al. (2007). For version 3.5 these were updated to the latest available data as follows:

- For countries listed by UNFCCC as Annex I Parties to the Convention, CH4 emissions were calculated as the sum of fugitive CH4 emissions reported in the categories "1.B. 1. a. Coal mining and handling" and "1.B. 1. b. Solid fuel transformation" of the National Greenhouse Gas Inventory (NIRs), retrieved from the respective common reporting format (CRF) files released by the UNFCCC in 2018 (reporting year 2016). Both documents (NIR and CRF) are accessible for each country or region at https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2018, last accessed August 2018 (UNFCCC, 2018).
- For non-Annex I countries the average emission factors suggested in the IPCC Guidelines for National Greenhouse Gas Inventories of 2006 were applied. These were evaluated as more reliable by the ecoinvent sector experts than the emission estimates non-Annex I countries provide in their "National Communication on Climate Change" reports, because the latter are not sufficiently transparent and documented.

Table 18. Fugitive methane emissions from coal mining and coal handling: comparison v3.4 values with updates in v3.5.

V3.4		V3.5		change v3.4/v3.5
Geography	*kg CH4/kg hard coal*	*Geography*	*kg CH4/kg hard coal*	*%*
WEU	0.0136	RER	0.012104	89.00%
EEU (PL)	0.0082	contained in RER		
AU	0.0027	AU	0.001999	74.05%
RU	0.0092	RU	0.006402	69.59%
ZA	0.0035	ZA	0.000197	5.64%
RNA	0.003	RNA	0.003403	113.44%
RLA	0.00016	RLA	0.000871	544.38%
CPA	0.0066	replaced by CN, IN, ID		
-		CN	0.013092	198.36%
-		IN	0.001689	25.59%
-		ID	0.001000	33.32%
GLO	0.009907	GLO	0.007960	80.34%

6.2 New and updated datasets

A readjustment in the geographical differentiation of Europe meant that the activities located in WEU and PL before, are now substituted by the more relevant "Europe without Russia and Turkey" (see Table 3). This concerns mining activities and markets, and this change has also shaped the new imports according to the new geographies. Similarly, the modelling in South Africa as detailed below has now a better resolution, resulting in the deletion of the old mining activity.

Table 19. Deleted activities in the sector, as a result of the update. *The geographies WEU and PL are now represented by "Europe without Russia and Turkey".*

Activity name	Geography	Time Period
hard coal mine operation and hard coal preparation	PL	1990-2002
hard coal mine operation and hard coal preparation	WEU	1990-2002
hard coal mine operation and hard coal preparation	ZA	1990-2002
market for hard coal	PL	1977-1989
market for hard coal	WEU	1977-1989

Table 20 gives an overview of the new and updated activities related to the operation of hard coal mines and the beneficiation of the coal. New data were collected for India and South Africa, which allows separate datasets for mine operation and coal preparation in these geographies. In the case of South Africa even different types of mines and preparation paths could be distinguished. Regardless of the different system boundaries for Indian and South African activities, they function in parallel to the aggregated "hard coal mine operation and hard coal preparation" activity in the remaining geographies.

Similarly, new products were added to the database in the framework of this update. They are present in Table 21.

***Table 20. New and updated activities related to hard coal mine operation and hard coal preparation**. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In column v3.5, "U" stands for "Updated", and "N" stands for "New activity". The symbol "**" reminds that the geographies WEU and PL have been now substituted by Europe without Russia and Turkey.*

Activity Name	Geography	Time period	V3.5
hard coal mine operation and hard coal preparation	Europe without Russia and Turkey; RLA; RNA; RU	1990-2002	U**
hard coal mine operation and hard coal preparation	ID	1990-2008	U
hard coal mine operation and hard coal preparation	GLO	1999-2002	U
hard coal mine operation and hard coal preparation	AU	2014-2020	U
hard coal mine operation	IN; GLO	2006-2020	N
hard coal preparation	IN; GLO	2006-2020	N
hard coal mine operation, open cast, dragline	ZA; GLO	2014-2014	N
hard coal mine operation, open cast, truck and shovel	ZA; GLO	2014-2014	N
hard coal mine operation, underground	ZA; GLO	2014-2014	N
hard coal preparation, coal washing	ZA; GLO	2014-2014	N
hard coal preparation, crushing and destoning	ZA; GLO	2014-2014	N
hard coal preparation plant construction	GLO	2000-2020	N
lignite mine operation	IN	2006-2020	N
transport, freight, conveyor belt	GLO	2000-2020	N
lignite mine operation	GLO	1983-1994	U
lignite mine operation	RER	1983-1994	U

Table 21. New products introduced in the coal sector for v3.5.

Product name	Unit
hard coal, run-of-mine	kg
hard coal preparation plant	unit
transport, freight, conveyor belt	metric ton*km

6.2.1 Market datasets

With the update of the hard coal sector a new supply chain structure was introduced. Each hard coal market is now supplied not only by domestic mines but also by imports from other geographies.

In alignment with this structure, transport distances were updated for all hard coal market dataset. The distances now reflect hard coal movements within the geography of the market, i.e. the average distance between domestic mines and domestic consumers. Where available, country specific transport data was used. This was complemented with estimations based on the location of major producers (mines) and consumers in google earth. Any transport required for international hard coal

trade, which exceeds this average domestic distance is covered in the respective import datasets. This is, for example, the case for transport from the mines to coal loading terminals at the port.

Moreover, markets include average coal losses, dust emissions from transportation, from loading and unloading, as well as average emissions to water due to leaching from coal heaps at storage.

Table 22. New and updated activities related to hard coal markets. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In column v3.5, "U" stands for "Updated", and "N" stands for "New activity". The symbol "**" reminds that the geographies WEU and PL have been now substituted by Europe without Russia and Turkey.*

Activity Name	Geography	Time period	V3.5
market for hard coal	AU; CN; Europe without Russia and Turkey; ID; RLA; RNA; RU	2014-2020	U**
market for hard coal	GLO	2011-2011	U
market for hard coal	ZA; IN	2014-2014	N
market for hard coal, run-of-mine	IN; GLO	2010-2020	N
market for hard coal preparation plant	GLO	2000-2020	N
market for lignite	IN	2010-2020	N
market for transport, freight, conveyor belt	GLO	2000-2020	N

6.2.2 Import datasets

Datasets for hard coal imports were introduced. They represent the trade flows between the major coal producing and consuming regions.

Transport distances are based on geography specific information. Where such information was not available, average distances between importing and exporting ports of trade partners were estimated using maps of global shipping routes and google earth.

The trade volumes were retrieved from UN statistics at comtrade.org for the commodity codes 270111 (Coal; anthracite, whether or not pulverised, but not agglomerated), 270112 (Coal; bituminous, whether or not pulverised, but not agglomerated), 270119 (Coal; (other than anthracite and bituminous), whether or not pulverised but not agglomerated. The UN statistics were validated against other sources and in case of discrepancies a reasonable in-between value was chosen. Discrepancies of hard coal trade volumes between different statistical sources as well as between import and export statistics of the same source may occur due to differences in coal classification methodologies, which are not uniform on a global basis.

The supply mixes resulting from domestic production and international trade represent 2015 statistical data and can be seen in Table 23. Table 24 gives an overview of new the import activities in version 3.5.

Table 23. Hard coal market mix for the nine hard coal market in ecoinvent, composed of domestic production and imports.

	Europe without Turkey and Russia		CN		IN		RLA		RNA		ZA		ID		RU		AU	
origin of coal	kg	%	kg	%	kg	kg	%	kg	%	kg	%	kg	%	%	kg	%	kg	%
domestic production	8.70E+10	28.55%	3.36E+12	96.26%	6.39E+11	2.62E+11	99.32%	4.91E+11	99.55%	3.84E+11	100%	4.33E+11	100%	77.97%	9.10E+10	77.76%	7.26E+11	98.73%
AU	2.26E+10	7.42%	7.10E+10	2.03%	4.67E+10	1.50E+09	0.57%	2.20E+09	0.45%					5.69%	1.30E+10	11.11%	5.50E+07	0.01%
CN	2.70E+07	0.01%																
ID	8.59E+09	2.82%	3.70E+10	1.06%	9.13E+10									11.14%	3.30E+07	0.03%	7.50E+08	0.10%
IN			0.00E+00	0.00%														
RLA	5.76E+10	18.91%	2.45E+05	0.00%	1.20E+09									0.15%			8.50E+09	1.16%
RNA	3.58E+10	11.76%	5.50E+09	0.16%	7.40E+09	2.90E+08	0.11%							0.90%	1.30E+10	11.11%		
RU	7.51E+10	24.65%	1.70E+10	0.49%	3.00E+09									0.37%				
ZA	1.79E+10	5.89%	0.00E+00	0.00%	3.10E+10									3.78%				

Table 24. New activities related to hard coal imports. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In column v3.5, "U" stands for "Updated", and "N" stands for "New activity". (*) In those activity names, "Australia" and "Indonesia" are used instead of "AU" and "ID".*

Activity Name	Geography	Time Period	v3.5
hard coal, import from AU	CN; Europe without Russia and Turkey; ID; IN*; RLA; RNA; ZA	2015-2016	N
hard coal, import from ID	CN; Europe without Russia and Turkey; IN*; RLA; RNA	2015-2016	N
hard coal, import from RLA	CN; Europe without Russia and Turkey; IN; RNA	2015-2016	N
hard coal, import from RNA	CN; Europe without Russia and Turkey; ID; IN; RLA; ZA	2015-2016	N
hard coal, import from RU	CN; Europe without Russia and Turkey; IN	2015-2026	N
hard coal, import from ZA	Europe without Russia and Turkey; IN	2014-2015	N

7 Fish capture and aquaculture

This sector has been newly introduced for the v3.5, it is described in detail in Avadí, 2018. It brings to the v3.5 data on fish capture and aquaculture, together with the needed vessels construction, operation and treatment. Fish meal and oil production is also covered with detail, as well as the production of feeds for aquaculture. Similarly, the needed infrastructure (plants etc) for those processes has also been added as new data to the database. Finally, fish processing services together with the needed processing plants can also be found in the v3.5 of the database.

7.1 Capture and aquaculture infrastructures

Several infrastructures (construction, maintenance and dismantling/treatment) have been introduced to fulfil the modelling needs of the sector. The activities and products generated are detailed in the following tables.

Table 25. New activities modelling infrastructure construction, maintenance and dismantling in the fish sector. *All the activities in the table are new to the ecoinvent database. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period
diesel, burned in fishing vessel	GLO	2016-2017
fish canning plant construction and maintenance	GLO; RLA	2011-2012
fish curing plant construction and maintenance	GLO; PE	2011-2012
fish freezing plant construction and maintenance	GLO; PE	2011-2012
fishmeal and fish oil plant construction and maintenance	GLO; PE	2010-2020
floating collar net cage for aquaculture 25 m construction and maintenance	GLO	2010-2020
floating hexagonal metal cage for aquaculture 6 m construction and maintenance	GLO	2017-2017
marine electric motor construction	GLO	2010-2020
marine engine construction	GLO	2010-2020
purse seiner construction, steel	GLO; RLA	2010-2020
purse seiner construction, wood	GLO; RLA	2010-2020
purse seiner maintenance, steel	GLO; RLA	2010-2020
purse seiner maintenance, wood	GLO; RLA	2010-2020
trawler construction, steel	GLO; PE	2010-2020
trawler maintenance, steel	GLO; PE	2010-2020
treatment of Cu-based antifouling paint emissions	GLO; PE	2010-2010
treatment of Sn-based antifouling paint emissions	GLO; PE	2010-2010
treatment of used steel purse seiner	GLO; RLA	2010-2020
treatment of used steel trawler	GLO; PE	2010-2020
treatment of used wooden purse seiner	GLO; RLA	2010-2020

Table 26. New markets and products added to the v3.5 to model infrastructure related to fish capture or aquaculture.

Activity name	Geography	Time period	Product name	Unit
market for antifouling paint emissions	GLO	2010-2010	antifouling paint emissions	kg
market for diesel, burned in fishing vessel	GLO	2016-2017	diesel, burned in fishing vessel	MJ
market for fish canning plant	GLO	2011-2012	fish canning plant	unit
market for fish curing plant	GLO	2011-2012	fish curing plant	unit
market for fish freezing plant	GLO	2011-2012	fish freezing plant	unit
market for fishmeal plant	GLO	2017-2017	fishmeal plant	unit
market for floating collar cage	GLO	2017-2017	floating collar cage	m
market for floating hexagonal metal cage	GLO	2017-2017	floating hexagonal metal cage	m
market for marine electric motor	GLO	2017-2017	marine electric motor	unit
market for marine engine	GLO	2017-2017	marine engine	unit
market for purse seiner maintenance, steel	GLO	2017-2017	purse seiner maintenance, steel	kg
market for purse seiner maintenance, wooden	GLO	2017-2017	purse seiner maintenance, wooden	kg
market for purse seiner, steel	GLO	2017-2017	purse seiner, steel	kg
market for purse seiner, wooden	GLO	2017-2017	purse seiner, wooden	kg
market for trawler maintenance, steel	GLO	2017-2017	trawler maintenance, steel	kg
market for trawler, steel	GLO	2017-2017	trawler, steel	kg
market for used purse seiner, steel	GLO	2017-2017	used purse seiner, steel	kg
market for used purse seiner, wooden	GLO	2017-2017	used purse seiner, wooden	kg
market for used trawler, steel	GLO	2017-2017	used trawler, steel	kg

7.2 Feed production and supply

Several activities have been added to the sector, in order to supply the feed to the aquaculture processes. In the same line, new very detailed activities for fish oil and fish meal production have been incorporated to the database. The following tables detail the activities and products added new to the v3.5.

Table 27. New activities related to feed production for fish or from fish. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period
fishmeal and fish oil production, 63-65% protein	GLO; PE	2010-2020
fishmeal and fish oil production, 63-65% protein, from fish residues	GLO; PE	2010-2020
fishmeal and fish oil production, 63-65% protein, from fresh anchovy and fish residues	GLO; PE	2010-2020
fishmeal and fish oil production, 65-67% protein	GLO; PE	2010-2020
fish oil to generic market for energy feed	GLO	2016-2017
tilapia feed production, commercial	GLO; PE	2012-2013
trout feed production, commercial	GLO; RLA	2012-2013

Table 28. New markets, and new products generated around feed production from or for fish.

Activity name	Geography	Time period	Product name	Unit
market for fish oil	GLO	2016-2016	fish oil, from anchovy	kg
market for fish residues	GLO	2017-2017	fish residues	kg
market for fishmeal, 63-65% protein, from anchovy	GLO	2017-2017	fishmeal, 63-65% protein, from anchovy	kg
market for fishmeal, 65-67% protein, from anchovy	GLO	2017-2017	fishmeal, 65-67% protein, from anchovy	kg
market for tilapia feed, 24-28% protein	GLO	2012-2013	tilapia feed, 24-28% protein	kg
market for trout feed, 42% protein	GLO	2012-2013	trout feed, 42% protein	kg

7.3 Fish capture or aquaculture activities

This section details the activities modelling the capture or aquaculture of fish added new to the ecoinvent v3.5. They concern the capture of anchovy, hake, and tuna, and their corresponding by-catches; as well as the aquaculture of tilapia and trout.

Table 29. New activities related to fish capture and fish aquaculture. *All activities in the table are new to the database. If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period
anchovy, capture by steel purse seiner and landing whole, fresh	GLO; PE	2010-2020
anchovy, capture by wooden purse seiner and landing whole, fresh	GLO; PE	2010-2020
hake, capture by trawler and landing whole, fresh	GLO; PE	2010-2020
tilapia production, extensive aquaculture, in pond	GLO; RLA	2014-2017
trout, production in semi-intensive system, in lake	GLO; RLA	2012-2013
tuna, capture by purse seiner and landing whole, frozen	EC; GLO	2012-2013

Table 30. New markets and products added new to the ecoinvent v3.5, representing captured or cultured fish and by-catches. *The (*) indicates constrained markets (read more on chapter 0). If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period	Product name	Unit
market for demersal fish (*)	GLO	2017-2017	demersal fish, fresh	kg
market for landed anchovy, fresh	GLO; PE	2017-2017	landed anchovy, fresh	kg
market for landed hake, fresh	GLO	2017-2017	landed hake, fresh	kg
market for landed tuna, frozen, EPO	GLO	2017-2017	landed tuna, frozen, EPO	kg
market for marine fish	GLO	2017-2017	fish, marine	kg
market for small pelagic fish, fresh (*)	GLO	2017-2017	small pelagic fish, fresh	kg
market for tilapia	GLO	2014-2017	tilapia	kg
market for trout, from aquaculture	GLO	2012-2013	trout, from aquaculture	kg

7.3.1 Constrained markets for by-catches and generic market for marine fish

With the introduction of new datasets in the fishing sector new markets were added in order to complete the supply chains of the new products (Figure 1). All fishes are driven to the market for marine fish, which aggregates all various wild fish that are captured and are meant for human consumption. Renaming activities transform each fish into marine fish so they are then fed into the market for marine fish. This market does not have transportation as it is included in the market activity for each fish. As by-catches are produced solely as by-products, market modelling with constrained markets was established for them. Constrained markets will react in the consequential system model only (see Figure 1 B).

The aggregation in the market for marine fish is calculated by using the production volume of each catch and by-catch. At the user level, all markets (specific or generic) are available, and each user can decide whether to use the specific fishes or the marine fish generic product for his or her projects.

See Table 31 for all activities added to the v3.5 in this context.

Table 31. New activities added to the v3.5 in the context of the constrained markets for by-catches. *The reference product of all of them is "marine fish".*

Activity name	Geography	Time period	Unit
demersal fish to generic market for marine fish	GLO	2017-2017	kg
landed anchovy to generic market for marine fish	GLO	2017-2017	kg
landed hake to generic market for marine fish	GLO	2017-2017	kg
landed tuna to generic market for marine fish	GLO	2017-2017	kg
small pelagic fish to generic market for marine fish	GLO	2017-2017	kg

Figure 1. Constrained markets for by-catches, and their functioning in all system models. *A: attributional system models; B: consequential system model.*

7.4 Fish processing services

Several activities modelling the processing of fish are also now proposed to the users of ecoinvent v3.5. Those activities (canning, curing, and freezing) are modelled as services, this means that they must be used with an input of fish, which will then be canned, cured or frozen.

The following tables list all the new services, markets and products related to fish processing.

Table 32. New services related to fish processing. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period
fish canning, large fish	EC; GLO	2012-2013
fish canning, small fish	GLO; PE	2011-2012
fish curing, small fish	GLO; PE	2010-2012
fish freezing, small fish	GLO; PE	2011-2012

Table 33. New markets and new products introduced related to fish processing. *(*) indicates a constrained market. Fish residue is processed and contribute to the unconstrained market for fishmeal, 63-65% protein, from anchovy.*

Activity name	Geography	Time period	Product name	Unit
market for fish canning, large fish	GLO	2012-2013	fish canning, large fish	kg
market for fish canning, small fish	GLO	2011-2012	fish canning, small fish	kg
market for fish curing, small fish	GLO	2010-2012	fish curing, small fish	kg
market for fish freezing, small fish	GLO	2011-2012	fish freezing, small fish	kg
market for fish residues (*)	GLO	2017-2017	fish residues	kg

8 Pulp and containerboard update

8.1 Pulp

The pulp sector was revised and updated with the latest primary data on sulfate pulp production collected by the European Pulp Industry Sector Association (EPIS). This allowed to restructure the kraft pulp supply chains to a higher level of granularity. On an activity level, sulfate pulp production is now distinguished by type of pulpwood (hardwood and softwood) rather than by the bleaching technology (elementary chlorine free and totally chlorine free). On a product level, bleached and unbleached sulfate pulp are now distinct products in v3.5, while the generic product “sulfate pulp” does no longer exist.

While sulfate pulp is the dominating type of pulp in both market pulp and integrated pulp production, other types of pulp, namely sulfite pulp, thermo mechanical pulp and chemi-thermomechanical pulp, play a lesser role and are mostly used for specific applications. For the production of the latter pulps no recent data was available. Therefore, the revision of these activities focused on the update of production volumes and largely enhanced dataset documentation. The following tables give an overview of the new and updated activities related to pulp production.

The new activities and products are listed in Table 35 and Table 36. Table 37 list deleted activities for the remodelling of the sector.

As introduced, “sulfate pulp” was replaced with “sulfate pulp, bleached”, “sulfate pulp, unbleached” or with the appropriate shares of both products in the demanding activities. The distinction was made based on the available documentation from the datasets; where it was not specified which type of pulp is required, average market shares of 5% unbleached pulp and 95% bleached pulp were applied. Table 34 gives an overview of the implemented replacements for activities demanding sulfate pulp.

Table 34: Replacement of sulfate pulp input with sulfate pulp, bleached and sulfate pulp, unbleached. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the "Split" column, the exact replacement of the "sulfate pulp" flow is documented. "Average": 5% unbleached pulp and 95% bleached pulp.*

Activity Name	Geography	Time Period	Split
carboxymethyl cellulose production, powder	GLO; RER	1993-1993	average
chipboard production, white lined	GLO; RER	2000-2000	bleached
containerboard production, fluting medium, semichemical	GLO; RER	2009-2015	unbleached
containerboard production, linerboard, kraftliner	CA-QC; GLO; RER	2009-2015	bleached,62% unbleached, 38%
fibre cement corrugated slab production	CH; GLO	1991-2001	unbleached
fibre cement facing tile production, large format	CH; GLO	2007-2008	bleached,80% unbleached, 20%
fibre cement facing tile production, small format	CH; GLO	2007-2008	unbleached
fibre cement roof slate production	CH; GLO	1991-2001	unbleached
folding boxboard production	GLO; RER	2000-2000	bleached
graphic paper production, 100% recycled	GLO; RER	2008-2014	average
kraft paper production, bleached	GLO; RER	1993-1993	bleached
paper production, newsprint, recycled	CH; Europe without Switzerland; GLO	2000-2000	average
paper production, newsprint, virgin	CA-QC	2012-2012	bleached
paper production, newsprint, virgin	GLO; RER	2000-2000	average
paper production, woodcontaining, lightweight coated	CA-QC; GLO; RER	2000-2000	average
paper production, woodcontaining, supercalendered	CA-QC; GLO; RER	2000-2000	average
paper production, woodfree, coated, at integrated mill	GLO; RER	2000-2000	average
paper production, woodfree, coated, at non-integrated mill	GLO; RER	2000-2000	average
paper production, woodfree, uncoated, 30% recycled content, at integrated mill	CA-QC; GLO	2011-2012	bleached
paper production, woodfree, uncoated, 50% recycled content, at non-integrated mill	CA-QC; GLO	2009-2009	bleached
paper production, woodfree, uncoated, at integrated mill	CA-QC	2011-2012	bleached
paper production, woodfree, uncoated, at integrated mill	GLO; RER	2000-2000	average
paper production, woodfree, uncoated, at non-integrated mill	GLO; RER	2000-2000	average
solid bleached board production	CA-QC; GLO; RER	2000-2000	bleached
viscose production	GLO	1997-2007	bleached

Table 35. New and updated activities related to pulp production. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In column v3.5, "U" stands for "Updated", and "N" stands for "New activity".*

Activity name	Geography	Time period	v3.5
chemi-thermomechanical pulp production	GLO; RER	2000-2000	U
rosin size production, for paper production	GLO; RER	2000-2000	U
sulfate pulp production, from eucalyptus, bleached	RLA; GLO	2017-2020	N
sulfate pulp production, from hardwood, bleached	RER; GLO	2017-2020	N
sulfate pulp production, from hardwood, bleached	CA-QC	2011-2018	U
sulfate pulp production, from softwood, bleached	RER; GLO	2017-2020	N
sulfate pulp production, from softwood, unbleached	RER; GLO	2017-2020	N
sulfite pulp production, bleached	GLO; RER	1997-2000	U
tall oil refinery operation	GLO	2010-2020	N
thermo-mechanical pulp production	GLO; RER	1993-2000	U
turpentine to generic market for solvent for paint	GLO	2017-2020	N
sulfate pulp production, from eucalyptus ssp. from sustainable forest management, unbleached	GLO; TH	2000-2005	U
kraft paper production, unbleached	GLO; RER	2000-2000	U

Table 36. New markets added around the pulp production sector. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. The column v3.5 indicates if the product supplied by the market is also new to the database with "N". (*) signals a constrained market.*

Activity name	Geography	Time period	Product name	Unit	v3.5
market for pitch despergents, in paper production	RER	2018-2018	pitch despergents, in paper production	kg	-
market for rosin size, for paper production	RER	2018-2018	rosin size, for paper production	kg	-
market for sulfate pulp, bleached	GLO; RER	2017-2020	sulfate pulp, bleached	kg	N
market for sulfate pulp, unbleached	GLO; RER	2017-2020	sulfate pulp, unbleached	kg	N
market for tall oil, crude	GLO	2017-2020	tall oil, crude	kg	N
market for turpentine	GLO	2017-2020	turpentine	kg	N (*)
market for solvent for paint	GLO	2017-2020	solvent for paint	kg	N

Table 37. Activities deleted in the remodelling of the pulp sector.

Activity Name	Geography	Time Period
import of sulfate pulp, unbleached, from eucalyptus ssp. from sustainable forest management, TH	RER	2000-2005
market for sulfate pulp	GLO	2011-2011
market for sulfate pulp, unbleached, from eucalyptus ssp. from sustainable forest management, TH	GLO	2011-2011
sulfate pulp production, elementary chlorine free bleached	CA-QC	2011-2012
sulfate pulp production, elementary chlorine free bleached	GLO; RER	1997-2000
sulfate pulp production, totally chlorine free bleached	GLO; RER	1997-2000
sulfate pulp production, unbleached	GLO; RER	1993-2000

Aditionnally, the products “sulfate pulp” and “sulfate pulp, unbleached, from eucalyptus ssp. from sustainable forest management, TH” have also been deleted from the database.

The new sulfate pulp production data come with the generation of two new by-products, turpentine and crude tall oil. Currently, turpentine in the ecoinvent database is exclusively produced as a by-product of sulfate pulp and containerboard production. This means its supply cannot respond to a fluctuation in the demand of turpentine in the consequential system model. As a major use of turpentine is as solvent for paints, where its function can be substituted with white spirit, turpentine is, therefore, constrained to the market for solvents for paint. To make the system work, the activity “white spirit to generic market for solvent for paint, GLO, 2017 – 2020” was also added to the database.

8.2 Containerboard

The European corrugated board supply chain was updated with the latest LCI data from the Federation of Corrugated Board Manufacturers (FEFCO, 2015). Moreover, activities and products were renamed for improved usability, see Table 1 and Table 2. Table 38 shows the updated activities in v3.5.

Table 38. New and updated activities related to containerboard production. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In column v3.5, "U" stands for "Updated", and the symbol "*" refers to the additional name changes happening between v3.4 and v3.5.*

Activity name	Geography	Time period	v3.5
containerboard production, fluting medium, recycled	GLO; RER	2009-2015	U*
containerboard production, fluting medium, semichemical	GLO; RER	2009-2015	U*
containerboard production, linerboard, kraftliner	GLO; CA-QC; RER	2009-2015	U*
containerboard production, linerboard, testliner	GLO; CA-QC; RER	2009-2015	U*
corrugated board box production	CA-QC	2008-2008	U
corrugated board box production	GLO	2009-2022	U
corrugated board box production	RER	2009-2015	U
market for containerboard, fluting medium	GLO; CA-QC; RER	2008-2008	U*
market for containerboard, linerboard	GLO; CA-QC; RER	2013-2013	U*
market for corrugated board box	CA-QC	2008-2008	U
market for corrugated board box	GLO	2011-2011	U
market for corrugated board box	RER	2009-2015	U

9 Transport sector

Most of the changes in this sector aim to improve the resolution of the regional supply chains, with the introduction of new regional markets, and market groups.

9.1 Road freight transport

Regional markets and market groups have been introduced for a number of road freight transport services, in order to improve the geographical coverage of the supply.

Table 39. New market activities on road freight transport, added in v3.5. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period
market for transport, freight, light commercial vehicle	CH; Europe without Switzerland	2011-2011
market for transport, freight, lorry >32 metric ton, EURO3	RER	2011-2011
market for transport, freight, lorry >32 metric ton, EURO4	RER	2011-2011
market for transport, freight, lorry >32 metric ton, EURO5	RER	2011-2011
market for transport, freight, lorry >32 metric ton, EURO6	RER	2009-2013
market for transport, freight, lorry 16-32 metric ton, EURO3	RER	2011-2011
market for transport, freight, lorry 16-32 metric ton, EURO4	RER	2011-2011
market for transport, freight, lorry 16-32 metric ton, EURO5	RER	2011-2011
market for transport, freight, lorry 16-32 metric ton, EURO6	RER	2009-2013
market for transport, freight, lorry 28 metric ton, vegetable oil methyl ester 100%	CH	2011-2011
market for transport, freight, lorry 3.5-7.5 metric ton, EURO3	RER	2011-2011
market for transport, freight, lorry 3.5-7.5 metric ton, EURO4	RER	2011-2011
market for transport, freight, lorry 3.5-7.5 metric ton, EURO5	RER	2011-2011
market for transport, freight, lorry 3.5-7.5 metric ton, EURO6	RER	2009-2013
market for transport, freight, lorry 7.5-16 metric ton, EURO3	RER	2011-2011
market for transport, freight, lorry 7.5-16 metric ton, EURO4	RER	2011-2011
market for transport, freight, lorry 7.5-16 metric ton, EURO5	RER	2011-2011
market for transport, freight, lorry 7.5-16 metric ton, EURO6	RER	2009-2013
market for transport, freight, lorry, unspecified	RER	2012-2012
market group for transport, freight, light commercial vehicle	GLO; RER	2011-2011
market group for transport, freight, lorry 28 metric ton, vegetable oil methyl ester 100%	GLO	2011-2011
market group for transport, freight, lorry, unspecified	GLO	2012-2012

9.2 Rail freight transport

The market composition of the freight transport by train has been adjusted, so the European activities contribute now to a new market group in Europe. Diesel inputs have also been corrected when relevant.

Similarly, the global market composition has been adjusted to reflect the most up-to-date situation. This implied the adjustment of Production Volumes in the supplying activities.

Table 40. List of all modified and new rail transport activities. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In column v3.5, "U" stands for "Updated", and "N" stands for "New activity".*

Activity name	Geography	Time period	V3.5
transport, freight train	AT; BE; DE; FR, IT	2000-2007	U
transport, freight train	GLO	2000-2000	U
transport, freight train, diesel	GLO	1999-2004	U
transport, freight train, diesel, with particle filter	CH	2000-2000	U
transport, freight train, electricity	GLO	1999-2004	U
market group for transport, freight train	RER	2016-2016	N

9.3 Inland waterways freight transport

New European markets, and GLO market groups have been introduced for inland waterways freight transport.

Table 41. List of the new inland waterways transport activities added to the v3.5.

Activity name	Geography	Time period
market for transport, freight, inland waterways, barge	RER	2011-2011
market for transport, freight, inland waterways, barge tanker	RER	2011-2011
market group for transport, freight, inland waterways, barge	GLO	2011-2011
market group for transport, freight, inland waterways, barge tanker	GLO	2011-2011

10 Waste sector

10.1 New municipal waste treatments and markets mixes

In ecoinvent version 3.5, we have updated the municipal waste sector, in an effort to offer more modelling options to our users and specifically data of higher granularity. The update is focused in the broader urban waste category, representing five different material fractions such as plastics, paper, glass, wood and finally mixed MSW. More specifically thirteen different wastes that are considered to be the most common urban waste streams are included in this update. The wastes, selectively present three paper subfractions, seven plastic subfractions, a glass fraction, a waste wood fraction and municipal solid waste. Their composition used remains constant in all datasets which results in variations of LCIs only due to climatic conditions (Doka, 2018). The wastes being updated are found in Table 42.

Table 42. Wastes that constitute part of the waste update in ecoinvent version 3.5.

Waste category	Material Fraction	Material Subfraction
Urban waste streams	Plastic	waste polypropylene
		waste polystyrene
		waste polyurethane
		waste polyvinylchloride
		waste polyethylene
		waste polyethylene terephthalate
		waste plastic, mixture
	Paper	waste graphical paper
		waste packaging paper
		waste paperboard
	Glass	waste glass
	Organic	waste wood, untreated
	Municipal solid waste	

10.1.1 New treatment activities

In this update, new treatment and/or disposal datasets have been introduced to better picture the situation of waste management at regional levels.

For that, we introduced to the ecoinvent database activities modelling the informal waste disposal methods of open burning and open dumping, as well as the treatment unsanitary landfill. The datasets describing those processes are modelled with the same methodology that envelops the whole sector in ecoinvent; emission transfer coefficients are applied in the primary composition of the waste to derive the LCI. The new models and their methodology are described in detail in Doka, 2017a and b respectively.

As the climate of a specific location can affect the emissions from the treatment and disposal (unsanitary landfill and open dump) activities, climatic conditions such as precipitation, temperature and evapotranspiration are now considered in the LCI model as it is described in Doka, 2017c and 2018, generating inventories for each waste, in each defined climatic condition (see Table 43). As a result, countries are classified in one of the five infiltration classes based on their average national climatic data. This country classification offers high granularity data on a national level.

Table 43. Five infiltration classes for open dumping and unsanitary landfill. *Source: Doka G. (2018).*

Infiltration class	Infiltration class boundaries		Mean infiltration I in class	Mean precipitation P in class	Mean evaporation E in class	Countries in this class
	lower	upper	mm/yr	mm/yr	mm/yr	n
5) very wet	800		1000	1900	900	20
4) wet	400	800	500	1100	600	41
3) moist	200	400	300	900	600	46
2) dry	0	200	100	550	450	35
1) hyperarid		0	-250	350	600	12

Table 44 lists all the activities that have been introduced to model treatment or disposal of municipal wastes. As mentioned, the activities represent specific climatic conditions, and using this distinction, the different disposal scenarios for the different countries have been modelled.

Table 44. New treatment activities added to dispose the beforementioned wastes. *All activities have the geography GLO, and are new to the ecoinvent database.*

Activity name	Time period
treatment of waste glass, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste glass, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste glass, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste glass, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste glass, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste glass, sanitary landfill	2010-2017
treatment of waste glass, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste glass, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste glass, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste glass, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste glass, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste graphical paper, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste graphical paper, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste graphical paper, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste graphical paper, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste graphical paper, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste graphical paper, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste graphical paper, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste graphical paper, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste graphical paper, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste graphical paper, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste packaging paper, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste packaging paper, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste packaging paper, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste packaging paper, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste packaging paper, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste packaging paper, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste packaging paper, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste packaging paper, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste packaging paper, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste packaging paper, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste paperboard, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste paperboard, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste paperboard, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste paperboard, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste paperboard, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste paperboard, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste paperboard, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste paperboard, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste paperboard, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste paperboard, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste plastic, mixture, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste plastic, mixture, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste plastic, mixture, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste plastic, mixture, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste plastic, mixture, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste plastic, mixture, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste plastic, mixture, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste plastic, mixture, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste plastic, mixture, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste plastic, mixture, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste polyethylene terephthalate, open dump, dry infiltration class (100mm)	2006-2012

Activity name	Time period
treatment of waste polyethylene terephthalate, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyethylene terephthalate, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste polyethylene terephthalate, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyethylene terephthalate, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste polyethylene terephthalate, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyethylene terephthalate, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste polyethylene terephthalate, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste polyethylene terephthalate, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste polyethylene terephthalate, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyethylene, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste polyethylene, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyethylene, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste polyethylene, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyethylene, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste polyethylene, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste polyethylene, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyethylene, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste polyethylene, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyethylene, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste polypropylene, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste polypropylene, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polypropylene, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste polypropylene, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste polypropylene, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste polypropylene, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste polypropylene, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polypropylene, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste polypropylene, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste polypropylene, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste polystyrene, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste polystyrene, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polystyrene, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste polystyrene, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste polystyrene, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste polystyrene, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste polystyrene, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polystyrene, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste polystyrene, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste polystyrene, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste polyurethane, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste polyurethane, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyurethane, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste polyurethane, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyurethane, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste polyurethane, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste polyurethane, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyurethane, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste polyurethane, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyurethane, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste polyvinylchloride, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste polyvinylchloride, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyvinylchloride, open dump, moist infiltration class (300mm)	2006-2012

Activity name	Time period
treatment of waste polyvinylchloride, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyvinylchloride, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste polyvinylchloride, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste polyvinylchloride, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste polyvinylchloride, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste polyvinylchloride, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste polyvinylchloride, unsanitary landfill, wet infiltration class (500mm)	2006-2012
treatment of waste wood, untreated, open dump, dry infiltration class (100mm)	2006-2012
treatment of waste wood, untreated, open dump, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste wood, untreated, open dump, moist infiltration class (300mm)	2006-2012
treatment of waste wood, untreated, open dump, very wet infiltration class (1000mm)	2006-2012
treatment of waste wood, untreated, open dump, wet infiltration class (500mm)	2006-2012
treatment of waste wood, untreated, unsanitary landfill, dry infiltration class (100mm)	2006-2012
treatment of waste wood, untreated, unsanitary landfill, hyperarid infiltration class (-250mm)	2006-2012
treatment of waste wood, untreated, unsanitary landfill, moist infiltration class (300mm)	2006-2012
treatment of waste wood, untreated, unsanitary landfill, very wet infiltration class (1000mm)	2006-2012
treatment of waste wood, untreated, unsanitary landfill, wet infiltration class (500mm)	2006-2012

10.1.2 New market mixes

New treatment and/or disposal mixes have been created (or updated) for 37 European countries, plus Brazil, Colombia, India, Peru and South Africa for all 13 waste fractions mentioned above.

The creation of the mixes is made by coupling data on waste collection from United nations and national financial statistics from the World bank. GNI per capita is employed to estimate the amount of wastes that is driven to disposal rather than treatments. To its full extent, the methodology is described in Doka, 2018. This allows to describe a specific treatment/disposal mix for each waste in each country concerned by this update. This granularity of the mixes is further complemented by incorporating specific national transportation distances for wastes in all European countries. The approach used to calculate the distances is similar as described in chapter 4.1.1. The distances are compiled in Table 46.

Market groups for Europe have also been created, to facilitate the supply to activities located in RER instead of in a specific European country. Production volume of the waste fraction is used as key to calculate the weighted average of the market groups.

Table 45. New markets and market groups generated or updated for the v3.5. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In column v3.5, "U" stands for "Updated", and "N" stands for "New activity".*

Activity name	Geography	Time period	v3.5
market for municipal solid waste	AL; AT; BA; BE; BG; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PL; PT; RO; RS; SE; SI; SK; XK;	2018-2018	N
market for municipal solid waste	CH	2018-2018	U
market for waste glass	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste glass	CH	2018-2018	U
market for waste graphical paper	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste graphical paper	CH	2018-2018	U
market for waste packaging paper	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste paperboard	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste paperboard	CH	2018-2018	U
market for waste plastic, mixture	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste plastic, mixture	CH	2018-2018	U
market for waste polyethylene	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste polyethylene	CH	2018-2018	U
market for waste polyethylene terephthalate	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste polyethylene terephthalate	CH	2018-2018	U
market for waste polypropylene	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste polypropylene	CH	2018-2018	U
market for waste polystyrene	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste polystyrene	CH	2018-2018	U

Activity name	Geography	Time period	v3.5
market for waste polyurethane	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste polyurethane	CH	2018-2018	U
market for waste polyvinylchloride	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste polyvinylchloride	CH	2018-2018	U
market for waste wood, untreated	AL; AT; BA; BE; BG; BR; CO; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; HR; HU; IE; IN; IS; IT; LT; LU; LV; ME; MK; MT; NL; NO; PE; PL; PT; RO; RS; SE; SI; SK; XK; ZA;	2018-2018	N
market for waste wood, untreated	CH	2018-2018	U
market group for waste glass	RER; Europe without Switzerland;	2018-2018	N
market group for waste graphical paper	RER; Europe without Switzerland;	2018-2018	N
market group for waste packaging paper	RER; Europe without Switzerland;	2018-2018	N
market group for waste paperboard	RER; Europe without Switzerland;	2018-2018	N
market group for waste plastic, mixture	RER; Europe without Switzerland;	2018-2018	N
market group for waste polyethylene	RER; Europe without Switzerland;	2018-2018	N
market group for waste polyethylene terephthalate	RER; Europe without Switzerland;	2018-2018	N
market group for waste polypropylene	RER; Europe without Switzerland;	2018-2018	N
market group for waste polystyrene	RER; Europe without Switzerland;	2018-2018	N
market group for waste polyurethane	RER; Europe without Switzerland;	2018-2018	N
market group for waste polyvinylchloride	RER; Europe without Switzerland;	2018-2018	N
market group for waste wood, untreated	RER; Europe without Switzerland;	2018-2018	N

Table 46. Transport distances used for the transport inputs in the new markets for wastes. *The values are those calculated for the NST 2007 code " GT14 - Secondary raw materials; municipal wastes and other wastes". Though the EU category for this transport data mentions a minor part of train transport as well (5-10%) it was assumed that only road transport was considered as the update was meant for strictly urban waste streams. For all the markets the exchange "transport, freight, lorry, unspecified" was used. Countries marked with an Asterix "*" have the ecoinvent default transport distances.*

Country	km	t*km
EU	67.3	0.07
BE	137.7	0.14
BG	30.6	0.03
CZ	50.8	0.05
DK	41.5	0.04
DE	68.4	0.07
EE	69.8	0.07
IE	69.8	0.07
GR	9.9	0.01
ES	110.2	0.11
FR	75.2	0.08
HR	95.7	0.10
IT	73.0	0.07
CY	21.3	0.02
LV	43.2	0.04
LT	116.7	0.12
LU	69.8	0.07
HU	52.9	0.05
NL	68.8	0.07
AT	58.6	0.06
PL; PT	66.5	0.07
PT	66.5	0.07
RO	65.3	0.07
SI	66.7	0.07
SK	64.6	0.06
FI	102.8	0.10
SE	71.1	0.07
GB	71.7	0.07
NO	117.1	0.12
CH	28.7	0.03
AL; MK; ME; XK; MT; IS; BA; RS	67.3	0.07

The update of ecoinvent version 3.5 offers higher data granularity and more consistent modelling for the whole waste sector. In total, 121 new treatment datasets and more than 550 mixes and market groups are boosting the whole waste sector in terms of quantity and quality. The update primarily aims to accommodate ecoinvent users no matter their level of expertise. This is achieved by offering both predefined treatment mixes and market groups as well as offering very specific and regionalised waste treatment and disposal datasets. The composition of all the waste fractions is modelled to be the same and the treatment mixes remain constant in all three system models.

10.2 Other updates to the sector

10.2.1 Waste paperboard remodelling

In 3.5 we have remodelled the sorting of waste paperboard to align it with the rest of the recycling processes in the database. On the first place, the product being treated on the sorting plant was renamed to the new product “waste paperboard, unsorted”, representing the waste paperboard quality before the step of recycling, which was then a new product to the database.

The 81 datasets (43 activities in different geographies) producing “waste paperboard” as a by-product in v3.4 were then analysed to determine whether they intended to produce “waste paperboard”, or rather the new product “waste paperboard, unsorted”. Eventually, some case was identified to now produce waste paperboard, sorted. The following table summarises the changes.

The activity “waste paperboard, unsorted, sorting” has then been renamed since v3.4 (see Table 2), as well as remodelled, its reference product now being “waste paper, unsorted”, and products “waste paperboard, sorted” and “waste paperboard” being by-products from the sorting.

Table 47. Activities where the by-product "waste paperboard" was changed into another product. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period	Change
chassis production, internet access equipment	RER; GLO	2000-2009	waste paperboard, unsorted
container production, for collection of post-consumer waste plastic for recycling	CH; Europe without Switzerland; GLO; US	2010-2010	waste paperboard, unsorted
corrugated board box production	CA-QC; RER; GLO	2008-2008	waste paperboard, sorted
evacuated tube collector production	GB; GLO	2001-2002	waste paperboard, unsorted
expansion vessel production, 25l	CH; GLO	1993-1993	waste paperboard, unsorted
expansion vessel production, 80l	CH; GLO	1993-1993	waste paperboard, unsorted
explosive production, tovex	CH; GLO	1997-2001	waste paperboard, unsorted
flat plate solar collector production, Cu absorber	CH; GLO	2001-2002	waste paperboard, unsorted
foam glass production	GLO	2005-2005	waste paperboard, unsorted
foam glass production, electricity, label-certified	RER; GLO	2005-2005	waste paperboard, unsorted
foam glass production, without cullet	GLO	2005-2005	waste paperboard, unsorted
foam glass production, without cullet, electricity, label-certified	GLO	2005-2005	waste paperboard, unsorted
inverter production, 0.5kW	RER; GLO	2004-2006	waste paperboard, unsorted
inverter production, 2.5kW	RER; GLO	2004-2006	waste paperboard, unsorted
inverter production, 500kW	RER; GLO	2004-2006	waste paperboard, unsorted
offset printing, per kg printed paper	CH; GLO	2007-2011	waste paperboard, unsorted
oil boiler production, 100kW	CH; GLO	1993-1998	waste paperboard, unsorted
oil boiler production, 10kW	CH; GLO	1993-1998	waste paperboard, unsorted
photovoltaic module production, building-integrated, for slanted-roof installation	RER; GLO	1992-2008	waste paperboard, unsorted
photovoltaic mounting system production, for 570kWp open ground module	GLO	2008-2008	waste paperboard, unsorted
photovoltaic mounting system production, for facade installation	RER; GLO	1992-2008	waste paperboard, unsorted
photovoltaic mounting system production, for flat-roof installation	RER; GLO	1992-2008	waste paperboard, unsorted
photovoltaic mounting system production, for slanted-roof installation	RER; GLO	1992-2008	waste paperboard, unsorted
treatment of used toner module, laser printer, black/white, recycling	RER; GLO	2002-2005	waste paperboard, unsorted
treatment of used toner module, laser printer, colour, recycling	RER; GLO	2002-2005	waste paperboard, unsorted

10.2.2 Renaming of the zinc residue from incineration

In the incineration activities with fly ash extraction, the by-product “zinc concentrate” has been always using a different price of 0, to signal that it was not immediately substitutable with the regular “zinc concentrate”. We have now made this distinction clearer and more practical, by renaming the flow to “metalliferous hydroxide sludge” in those activities, maintaining the 0 price.

This sludge is then concentrated and can contribute to the regular “zinc concentrate” market. This supply chain resulted in the introduction of 2 new activities to the database: “metalliferous hydroxide sludge to market for zinc concentrate, GLO, 2018-2018”, and the constrained market “market for metalliferous hydroxide sludge, GLO, 2018-2018”

The activities listed in Table 48 have had the by-product “zinc concentrate” renamed to “metalliferous hydroxide sludge”.

Table 48. Activities where the by-product "zinc concentrate" has been renamed to "metalliferous hydroxide sludge" in v3.5. *All activities existed already in v3.4.*

Activity name	Geography	Time period
treatment of aluminium in car shredder residue, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of biowaste, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of copper in car shredder residue, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of digester sludge, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of lead in car shredder residue, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of liquid crystal display, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of municipal solid waste, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of raw sewage sludge, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from mechanical treatment, IT accessory, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from mechanical treatment, cathode ray tube display, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from mechanical treatment, desktop computer, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from mechanical treatment, industrial device, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from mechanical treatment, laptop computer, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from mechanical treatment, laser printer, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from mechanical treatment, liquid crystal display, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of residue from shredder fraction from manual dismantling, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of scrap tin sheet, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of spent anion exchange resin from potable water production, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of spent cation exchange resin from potable water production, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of steel in car shredder residue, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste bitumen sheet, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste building wood, chrome preserved, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste cement-fibre slab, dismantled, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste emulsion paint, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste expanded polystyrene, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste graphical paper, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste newspaper, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste packaging paper, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste paint, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste paperboard, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste plastic, consumer electronics, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste plastic, industrial electronics, municipal incineration with fly ash extraction	CH; GLO	2006-2012

Activity name	Geography	Time period
treatment of waste plastic, mixture, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste polyethylene terephthalate, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste polyethylene, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste polypropylene, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste polystyrene, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste polyurethane, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste polyvinylchloride, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste polyvinylfluoride, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste rubber, unspecified, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste sealing sheet, polyethylene, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste sealing sheet, polyvinylchloride, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste textile, soiled, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste vapour barrier, flame-retarded, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste wire plastic, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste wood pole, chrome preserved, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of waste wood, untreated, municipal incineration with fly ash extraction	CH; GLO	2006-2012
treatment of zinc in car shredder residue, municipal incineration with fly ash extraction	CH; GLO	2006-2012

10.2.3 New Swiss markets

New market mixes have been generated or updated in the Swiss context, in order to ensure a local supply to local activities. The concerned markets are listed in the following table.

Table 49. New Swiss markets added to the waste sector for v3.5.

Activity name	Geography	Time period
market for aluminium in car shredder residue	CH	2018-2018
market for ash from deinking sludge	CH	2018-2018
market for average incineration residue	CH	2018-2018
market for biogas	CH	2016-2016
market for condensate from light oil boiler	CH	2018-2018
market for condensate from light oil boiler	CH	2018-2018
market for copper in car shredder residue	CH	2018-2018
market for decarbonising waste	CH	2018-2018
market for decommissioned pipeline, natural gas	CH	2018-2018
market for decommissioned tram track	CH	2018-2018
market for drilling waste	CH	2011-2011
market for hard coal ash	CH	2018-2018
market for lead in car shredder residue	CH	2018-2018
market for lignite ash	CH	2018-2018
market for limestone residue	CH	2018-2018
market for pollutant from rail ballast	CH	2018-2018
market for raw sewage sludge	CH	2018-2018
market for residue from cooling tower	CH	2018-2018
market for residue from mechanical treatment, cathode ray tube display	CH	2018-2018
market for residue from mechanical treatment, desktop computer	CH	2018-2018
market for residue from mechanical treatment, industrial device	CH	2018-2018
market for residue from mechanical treatment, IT accessory	CH	2018-2018
market for residue from mechanical treatment, laptop computer	CH	2018-2018
market for residue from mechanical treatment, laser printer	CH	2018-2018
market for residue from mechanical treatment, liquid crystal display	CH	2018-2018
market for residue from shredder fraction from manual dismantling	CH	2018-2018
market for scrap tin sheet	CH	2018-2018
market for sewage sludge	CH	2018-2018
market for sewage sludge, dried	CH	2018-2018
market for spent anion exchange resin from potable water production	CH	2018-2018
market for spent cation exchange resin from potable water production	CH	2018-2018
market for steel in car shredder residue	CH	2018-2018
market for waste asphalt	CH	2018-2018
market for waste cement-fibre slab	CH	2018-2018
market for waste cement-fibre slab, dismantled	CH	2018-2018
market for waste concrete gravel	CH	2018-2018
market for waste electric wiring	CH	2018-2018
market for waste expanded polystyrene	CH	2018-2018
market for waste polyvinylfluoride	CH	2018-2018
market for waste sealing sheet, polyethylene	CH	2018-2018
market for waste textile, soiled	CH	2018-2018
market for waste wire plastic	CH	2018-2018
market for waste wood pole, chrome preserved	CH	2018-2018
market for wastewater from ceramic production	CH	2018-2018
market for wastewater from grass refinery	CH	2018-2018

10.2.4 Corrections to activities in the sector

The corrections reported in this section concern the adjustment of Production Volumes, or the connection to specific suppliers at a regional level. The obtention of representative treatment mixes at all levels (GLO and regional) was the main driver of those corrections.

Table 50. Updates in other activities from the waste sector. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column.*

Activity name	Geography	Time period	v3.5
anaerobic digestion of manure	CH; GLO	2009-2009	U
treatment of biowaste by anaerobic digestion	GLO; CH	2011-2015	U
treatment of drilling waste, landfarming	CH	2000-2000	U
treatment of drilling waste, residual material landfill	CH	1994-2000	U
treatment of sewage sludge by anaerobic digestion	CH; GLO	2000-2004	U
treatment of used vegetable cooking oil by anaerobic digestion	CH; GLO	2009-2009	U
treatment of waste cement-fibre slab, collection for final disposal	GLO	1994-2002	U
treatment of waste cement-fibre slab, recycling	GLO	1994-2002	U
treatment of waste concrete gravel, collection for final disposal	GLO	1994-2002	U
treatment of waste concrete gravel, recycling	GLO	1994-2002	U
treatment of waste concrete gravel, sorting plant	GLO	1994-2002	U
treatment of waste glass pane in burnable frame, collection for final disposal	GLO	1994-2002	U
treatment of waste glass pane in burnable frame, sorting plant	GLO	1994-2002	U
treatment of waste mineral plaster, collection for final disposal	GLO	1994-2002	U
treatment of waste mineral plaster, sorting plant	GLO	1994-2002	U
treatment of waste plastic plaster, inert material landfill	GLO	1995-1995	U
treatment of waste plastic plaster, sanitary landfill	GLO	1994-2000	U

10.2.5 Deleted activities from the sector

Most of the deletions occurring within the sector are due to the introduction of new data; and remove from the database datasets generated in Europe without Switzerland to accommodate European and Swiss supply chains.

Table 51. Deleted activities in the waste sector. *The deletions aim to better accommodate the new activities, and get rid of redundancies.*

Activity name	Geography	Time period
market for municipal waste collection service by 21 metric ton lorry	CH	2011-2011
market for waste glass	Europe without Switzerland	2011-2011
market for waste graphical paper	Europe without Switzerland	2011-2011
market for waste paperboard	Europe without Switzerland	2011-2011
market for waste plastic, mixture	Europe without Switzerland	2011-2011
market for waste polyethylene	Europe without Switzerland	2011-2011
market for waste polyethylene terephtalate	Europe without Switzerland	2011-2011
market for waste polystyrene	Europe without Switzerland	2011-2011
market for waste polyurethane	Europe without Switzerland	2011-2011
market for waste polyvinylchloride	Europe without Switzerland	2011-2011
market for waste wood, untreated	Europe without Switzerland	2011-2011
treatment of meat and bone meal, municipal incineration	GLO	2005-2013
treatment of waste glass, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste graphical paper, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste graphical paper, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste paperboard, inert material landfill	Europe without Switzerland	1995-1995
treatment of waste paperboard, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste paperboard, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste paperboard, sorting plant	Europe without Switzerland	1994-2002
treatment of waste plastic, mixture, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste plastic, mixture, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste polyethylene terephtalate, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste polyethylene terephtalate, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste polyethylene, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste polyethylene, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste polystyrene, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste polystyrene, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste polyurethane, inert material landfill	Europe without Switzerland	1995-1995
treatment of waste polyurethane, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste polyurethane, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste polyvinylchloride, municipal incineration	Europe without Switzerland	2006-2012
treatment of waste polyvinylchloride, sanitary landfill	Europe without Switzerland	1994-2000
treatment of waste wood, untreated, sanitary landfill	Europe without Switzerland	1994-2000

11 Updates in the remaining sectors

11.1 Infrastructure & Service Supply Chains

11.1.1 Services and immobile infrastructure

Direct linking is considered the preferable solution for inputs of services and immobile infrastructure to demanding activities with matching geographic scope (Moreno-Ruiz, 2017). Whereas services represent immaterial exchanges, i.e., without a physical good changing ownership, immobile infrastructure are identified in the ecoinvent database primarily by one or more of the following aspects: (i) the term 'construction', rather than 'production', in the activity name, (ii) transformation and occupation of land are included in the inventory, and (iii) decommissioning at the end of service life covered in the producing activity, i.e., the used product is 'treated' on the site of production, e.g., through demolition.

Activity links between supplying and demanding activities, thereby bypassing the corresponding market activity, are introduced for these products for all identified instances in which the geography of the demanding activity is enclosed within the geography of the supplying activity. In contrast, a direct activity link is not introduced by default in case a supplying activity is confined within (but not equal to) the geography of the demanding activity.

Similarly, no direct activity links are established between demanding activities confined within the geographic scope of a supplying activity in Rest-of-the-World (RoW). This is because the area covered by RoW is dynamic and may change with future submissions to the database. The market activities for services and immobile infrastructure should hence only exist with a global (GLO) scope, and merely consists of the input(s) of supply in RoW and any remaining capacity (i.e., otherwise unused) from regionally-specific supplying activities.

Following the aforementioned approach, a total of 1935 datasets were identified, for which 3278 direct links to 307 supplying activities were considered. Table 52 shows the breakdown between service and immobile infrastructure links. Out of the potential instances identified during the initial analysis, 99.6% of the links could be implemented for ecoinvent v3.5. Annex 1: activities with links to services or immobile infrastructures, contains a full list of activities which received activity links under the above approach.

Table 52. Summary of direct activity links introduced for the supply of services and immobile infrastructure in ecoinvent v3.5.

	number of demanding activities	number of supplying activities	number of direct activity links established
immobile infrastructure	1618	192	2312
services	482	126	968
total (unique activities only)	**1934**	**318**	**3280**

Complementary to the addition of activity links, regional markets for the identified immobile infrastructures or services have been deleted for the v3.5, as they became redundant. They are listed in the following table.

Table 53. Deleted markets for immobile infrastructure or services.

Activity Name	Geography	Time Period
market for municipal waste incineration facility	CH	2011-2011
market for railway track	CH	2011-2011
market for residual material landfill	CH	2011-2011
market for road	CH	2011-2011
market for sewer grid, 5E9l/year, 110 km	CH	2011-2011
market for slag landfill	CH	2011-2011
market for wastewater treatment facility, capacity 5E9l/year	CH	2011-2011
market for heavy fuel oil, burned in refinery furnace	CH	2011-2011

11.2 Agriculture and forestry sectors

Updates in these sectors are related to the general improvement of the connectivity of supply chains within the database. In this framework, activities have been updated or added new (see Table 54). Some markets existing in this sector were considered to be services, and following the logic of chapter 11.1, were deleted.

The product "meat and bone meal" has been reclassified and its supply remodelled (see also Table 4); now it has a constrained market, that is then connected to the generic market for protein feed where other by-products are also contributing.

Table 54. Changes in the agriculture and forestry sectors. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the column v3.5, "N" stands for "New Activity", "U" stands for "Updated Activity", "D" stands for "Deleted Activity", and (*) points to a constrained market.*

Activity Name	Geography	Time Period	v3.5
market for application of plant protection product, by field sprayer	CH	2011-2011	D
market for green manure, Swiss integrated production, until April	CH	2011-2011	D
market for green manure, Swiss integrated production, until February	CH	2011-2011	D
market for green manure, Swiss integrated production, until January	CH	2011-2011	D
market for green manure, Swiss integrated production, until March	CH	2011-2011	D
market for green manure, organic, until April	CH	2011-2011	D
market for green manure, organic, until January	CH	2011-2011	D
market for green manure, organic, until March	CH	2011-2011	D
market for palm fruit bunch	MY	2016-2016	N
cotton production	CN	2000-2010	U
cotton production	GLO	2000-2010	U
cotton production	US	2000-2010	U
maize grain production	GLO	2004-2006	U
maize grain production	US	2004-2006	U
market for cattle for slaughtering, live weight	GLO	2014-2014	U
market for meat and bone meal	GLO	2012-2012	U (*)
meat and bone meal to generic market for protein feed	CH; GLO	2016-2019	N
tomato production, fresh grade, in unheated greenhouse	GLO	2006-2012	U
willow stem cutting production, for planting	GLO	2005-2005	U
sawing and planing, paraná pine, kiln dried	BR	2000-2005	U
sawnwood production, hardwood, dried (u=20%), planed	GLO; RER	2014-2014	U
sawnwood production, softwood, dried (u=10%), planed	GLO; RER	2014-2014	U
sawnwood production, softwood, dried (u=20%), planed	GLO; RER	2014-2014	U
wood pellet production	RER	2011-2012	U

11.3 Building and construction

The changes in this sector aim to improve the regionalisation of supply chains. This was done by adding new regional markets or by ensuring a regional supply with direct links to specific suppliers.

The remodelling of the product "meat and bone meal" (see chapter 11.2) has affected some activities in this sector, like clinker production.

Table 55. Activities added or edited in the building and construction sector. *f several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the column v3.5, "N" stands for "New Activity", "U" stands for "Updated Activity".*

Activity name	Geography	Time period	v3.5
cement production, Portland	CA-QC	2005-2009	U
clinker production	CH	2009-2013	U
clinker production	Europe without Switzerland; GLO; US	1998-2003	U
fibre cement facing tile production	CH; GLO	2007-2008	U
glass wool mat production, Saint-Gobain ISOVER SA	GLO	2009-2009	U
gravel production, crushed	CA-QC	1997-2001	U
ground granulated blast furnace slag production	GLO; US	2001-2002	U
lime production, milled, loose	Europe without Switzerland	2000-2002	N
lime production, milled, packed	Europe without Switzerland	2000-2002	N
lime production, milled, packed	CH; GLO	2000-2002	U
market for dolomite	RER	2016-2016	N
market for lime	RER	2016-2016	N
market for lime, hydrated, packed	RER	2016-2016	N
market for lime, hydraulic	RER	2016-2016	N
market for lime, packed	Europe without Switzerland	2011-2011	N
market for lime, packed	CH; GLO	2011-2011	U
market for quicklime, milled, packed	RER	2016-2016	N
stone wool production, packed	CH; GLO	2000-2007	U

11.4 Fuel production and supply

As in other sectors, the regionalisation of supply chains and the enforcing of linking regional suppliers and consumers is the reason for most of the changes in this sector. For that, several new markets have been added, in order to ensure the local supply of identified products, and to avoid the connection with GLO supply chains at that level. Again, as in other sectors, updates to Production Volumes and market shares have been made, causing several adjustment in the listed activities.

Finally, many new import activities have been added, in order to better model the supply between regions, while existing imports were also adjusted, and the link directed to the exporter supplier when this was wrongly modelled.

Table 56. Activities updated related to fuel production and supply. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the column v3.5, "N" stands for "New Activity", "U" stands for "Updated Activity".*

Activity name	Geography	Time period	v3.5
dewatering of ethanol from biomass, from 95% to 99.7% solution state	CN	1992-2006	U
dewatering of ethanol from biomass, from 95% to 99.7% solution state	Europe without Switzerland	2002-2006	U
diesel production, low-sulfur	CH; Europe without Switzerland; GLO	2005-2005	U
diesel, low-sulfur, import from Europe	CH	2005-2005	N
heavy fuel oil, burned in refinery furnace	CH; Europe without Switzerland; GLO	1980-2000	U
kerosene, import from Europe	CH	2010-2010	U
light fuel oil, import from Europe	CH	2010-2010	U
liquefied petroleum gas, import	CH	2010-2010	U
market for biogas, from grass	CH	2016-2016	N
market for methane, 96% by volume	CH	2016-2016	N
market for methane, 96% by volume	CH	2016-2016	N
market for methane, 96% by volume, from biogas, from high pressure network, at service station	CH	2016-2016	N
market for methane, 96% by volume, from biogas, from low pressure network, at service station	CH	2016-2016	N
market for methane, 96% by volume, from biogas, from medium pressure network, at service station	CH	2016-2016	N
market for methane, 96% by volume, from biogas, high pressure, at user	CH	2016-2016	N
market for methane, 96% by volume, from biogas, low pressure, at user	CH	2016-2016	N
market for natural gas, high pressure	PL	2000-2000	N
market for transport, pipeline, long distance, natural gas	RER	2011-2011	N
market for transport, pipeline, offshore, long distance, natural gas	RER	2011-2011	N
market for transport, pipeline, onshore, long distance, natural gas	RER	2011-2011	N
market for transport, pipeline, onshore, petroleum	RER	2011-2011	N
methane production, 96% by volume, from synthetic gas, wood, fixed bed technology	CH	2008-2016	U
methane production, 96% by volume, from synthetic gas, wood, fluidised technology	CH	2008-2016	U
natural gas production, liquefied	GLO	2012-2012	U
natural gas production, liquefied	RME	2012-2012	U
natural gas, burned in gas motor, for storage	DE	1990-2000	U
natural gas, burned in gas motor, for storage	DZ	1990-2000	U
natural gas, burned in gas motor, for storage	NL	1990-2000	U
natural gas, burned in gas motor, for storage	NO	1990-2000	U
natural gas, burned in gas motor, for storage	RU	1990-2000	U
petrol production, low-sulfur	CH	2005-2005	U
petrol production, low-sulfur	Europe without Switzerland	2005-2005	U
petrol production, low-sulfur	GLO	2005-2005	U
petrol, low-sulfur, import from Europe	CH	2010-2010	U

11.5 Machinery related

New markets were added to this sector, to improve regional supply of the concerned products. The other activities listed here were linked to the specific heat source mentioned in their activity names.

Table 57. Activities added or edited related to machinery. *If several geographies of the same activity with the same time period exist, all of them are listed in the "Geography" column. In the column v3.5, "N" stands for "New Activity", "U" stands for "Updated Activity".*

Activity name	Geography	Time period	v3.5
market for liquid crystal display	CH	2018-2018	N
energy and auxilliary inputs, metal working machine, with process heat from hard coal	GLO; RER	2006-2007	U
energy and auxilliary inputs, metal working machine, with process heat from heavy fuel oil	GLO; RER	2006-2007	U
energy and auxilliary inputs, metal working machine, with process heat from light fuel oil	GLO; RER	2006-2007	U
energy and auxilliary inputs, metal working machine, with process heat from natural gas	GLO; RER	2006-2007	U
market for energy and auxilliary inputs, metal working machine	RER	2011-2011	N

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Annex 1: activities with links to services or immobile infrastructures

[sulfonyl]urea-compound production [RER]; [thio]carbamate-compound production [RER]; 1-propanol production [RER]; 2,4-dichlorophenol production [RER]; 2,4-dichlorotoluene production [RER]; 2-butanol production by hydration of butene [RER]; 2-methyl-2-butanol production [RER]; 2-nitroaniline production [RER]; 2-pyridinol production [RER]; 3-methyl-1-butyl acetate production [RER]; 4-methyl-2-pentanone production [RER]; 4-tert-butylbenzaldehyde production [RER]; 4-tert-butyltoluene production [RER]; absorption chiller production, 100kW [CH]; acetaldehyde oxidation [RER]; acetaldehyde production [RER]; acetamide-anillide-compound production, unspecified [RER]; acetanilide production [RER]; acetic acid production, product in 98% solution state [RER]; acetic anhydride production, ketene route [RER]; acetoacetic acid production [RER]; acetyl chloride production [RER]; aclonifen production [RER]; acrolein production [RER]; acrylic acid production [RER]; acrylic binder production, product in 34% solution state [RER]; acrylic dispersion production, product in 65% solution state [RER]; acrylic varnish production, product in 87.5% solution state [RER]; activated bentonite production [DE]; activated carbon production, granular from hard coal [RER]; adhesive mortar production [CH]; adhesive production, for metal [DE]; adipic acid production [RER]; air compressor production, screw-type compressor, 300kW [RER]; air compressor production, screw-type compressor, 4kW [RER]; air distribution terminal panel production, steel, 120 m3/h [CH]; air filter production, central unit, 600 m3/h [RER]; air filter production, decentralized unit, 180-250 m3/h [RER]; air filter production, decentralized unit, 250 m3/h [RER]; air filter production, in exhaust air valve [RER]; air separation facility construction [RER]; air separation, cryogenic [RER]; air separation, xenon krypton purification [RER]; airport construction [RER]; alkyd paint production, white, solvent-based, product in 60% solution state [RER]; alkyd paint production, white, water-based, product in 60% solution state [RER]; alkyd resin production, long oil, product in 70% white spirit solution state [RER]; alkylbenzene production, linear [RER]; alkylbenzene sulfonate production, linear, petrochemical [RER]; alkylketene dimer sizing agent production, for paper production [RER]; allyl chloride production, reaction of propylene and chlorine [RER]; alpha-naphthol production [RER]; alpha-picoline production [RER]; aluminium casting facility construction [RER]; aluminium drilling, computer numerical controlled [RER]; aluminium drilling, conventional [RER]; aluminium electrolysis facility construction [RER]; aluminium fluoride production [RER]; aluminium hydroxide factory construction [RER]; aluminium melting furnace production [RER]; aluminium milling, average [RER]; aluminium milling, dressing [RER]; aluminium milling, large parts [RER]; aluminium milling, small parts [RER]; aluminium oxide factory construction [RER]; aluminium production, primary, ingot [IAI Area, EU27 & EFTA]; aluminium production, primary, liquid, prebake [IAI Area, EU27 & EFTA]; aluminium production, primary, liquid, Söderberg [IAI Area, EU27 & EFTA]; aluminium sulfate production, powder [RER]; aluminium turning, average, computer numerical controlled [RER]; aluminium turning, average, conventional [RER]; aluminium turning, primarily dressing, computer numerical controlled [RER]; aluminium turning, primarily dressing, conventional [RER]; aluminium turning, primarily roughing, computer numerical controlled [RER]; aluminium turning, primarily roughing, conventional [RER]; amine oxide production [RER]; ammonia production, partial oxidation, liquid [RER]; ammonia production, steam reforming, liquid [RER]; ammonium bicarbonate production [RER]; ammonium carbonate production [RER]; ammonium nitrate phosphate production [RER]; ammonium nitrate production [RER]; ammonium nitrite production [RER]; ammonium sulfate production [RER]; anhydrite floor production [CH]; anhydrite production [CH]; anhydrite production, burned [CH]; aniline production [RER]; anionic resin production [CH]; anode factory construction [RER]; anode production, for metal electrolysis [RER]; anode refinery construction [SE]; anodising, aluminium sheet [RER]; anthranilic acid production [RER]; anthraquinone production [RER]; anti-reflex-coating, etching, solar glass [DK]; argon production, liquid [RER]; ascorbic

acid production [RER]; atrazine production [RER]; azodicarbonamide production [RER]; baling [CH]; barite production [RER]; barley grain, feed production, organic [CH]; barley grain, feed production, Swiss integrated production [CH]; barley seed production, organic, for sowing [CH]; barley seed production, Swiss integrated production, for sowing [CH]; basalt quarry operation [RER]; base plaster production [CH]; basic slag fertiliser production [RER]; battery production, NaCl, rechargeable [CH]; beam, hardwood, raw, kiln drying to u=10% [CH]; beam, hardwood, raw, kiln drying to u=20% [CH]; beam, softwood, raw, kiln drying to u=10% [CH]; beam, softwood, raw, kiln drying to u=20% [CH]; beet seed production, Swiss integrated production, for sowing [CH]; bentonite quarry construction [DE]; bentonite quarry operation [DE]; benzal chloride production [RER]; benzaldehyde production [RER]; benzene chlorination [RER]; benzimidazole-compound production [RER]; benzo[thia]diazole-compound production [RER]; benzoic-compound production [RER]; benzyl alcohol production [RER]; benzyl chloride production [RER]; bicycle production [RER]; biogas purification to methane 96 vol-% [CH]; bipyridylium-compound production [RER]; bisphenol A epoxy based vinyl ester resin production [RER]; bisphenol A production, powder [RER]; bitumen adhesive compound production, cold [RER]; bitumen adhesive compound production, hot [RER]; bitumen seal production [RER]; bitumen seal production, Alu80 [RER]; bitumen seal production, polymer EP4 flame retardant [RER]; bitumen seal production, V60 [RER]; bitumen seal production, VA4 [RER]; blast furnace production [RER]; blast oxygen furnace converter production [RER]; blister-copper conversion facility construction [SE]; blow moulding [RER]; blower and heat exchange unit production, Avent E 97 [RER]; blower and heat exchange unit production, central, 600-1200 m3/h [RER]; blower and heat exchange unit production, decentralized, 180-250 m3/h [RER]; blower and heat exchange unit production, GE 250 RH [CH]; blower and heat exchange unit production, KWL 250 [RER]; blower and heat exchange unit production, KWLC 1200 [RER]; blower and heat exchange unit production, Storkair G 90 [RER]; blower and heat exchange unit production, Twl-700 [RER]; board, hardwood, raw, kiln drying to u=10% [CH]; board, hardwood, raw, kiln drying to u=20% [CH]; board, softwood, raw, kiln drying to u=10% [CH]; board, softwood, raw, kiln drying to u=20% [CH]; borax production, anhydrous, powder [RER]; boric acid production, anhydrous, powder [RER]; brass drilling, computer numerical controlled [RER]; brass drilling, conventional [RER]; brass production [CH]; brass turning, average, computer numerical controlled [RER]; brass turning, average, conventional [RER]; brass turning, primarily dressing, computer numerical controlled [RER]; brass turning, primarily dressing, conventional [RER]; brass turning, primarily roughing, computer numerical controlled [RER]; brass turning, primarily roughing, conventional [RER]; brazing solder production, cadmium free [RER]; bromine production [RER]; bromopropane production [RER]; bronze production [CH]; building construction, hall [CH]; building construction, hall, steel construction [CH]; building construction, hall, wood construction [CH]; building construction, multi-storey [RER]; bus production [RER]; butane-1,4-diol production [RER]; butyl acetate production [RER]; butyl acrylate production [RER]; calcium ammonium nitrate production [RER]; calcium carbide production, technical grade [RER]; calcium carbonate production, precipitated [RER]; calcium nitrate production [RER]; calendering, rigid sheets [RER]; captan production [RER]; carbon dioxide production, liquid [RER]; carbon monoxide production [RER]; carboxymethyl cellulose production, powder [RER]; carrot seed production, for sowing [CH]; carrot seed production, Swiss integrated production, at farm [CH]; carton board box production service, with gravure printing [CH]; carton board box production service, with offset printing [CH]; cast iron drilling, computer numerical controlled [RER]; cast iron drilling, conventional [RER]; cast iron milling, average [RER]; cast iron milling, dressing [RER]; cast iron milling, large parts [RER]; cast iron milling, small parts [RER]; cast iron production [RER]; cast iron turning, average, computer numerical controlled [RER]; cast iron turning, average, conventional [RER]; cast iron turning, primarily dressing, computer numerical controlled [RER]; cast iron turning, primarily dressing, conventional [RER]; cast iron turning, primarily roughing, computer numerical controlled [RER]; cast iron turning, primarily roughing, conventional [RER]; casting, brass [CH]; casting, bronze [CH]; cathode production, for aluminium electrolysis [RER]; cationic resin production [CH]; cellulose fibre production, inclusive blowing in [CH]; cement factory

construction [CH]; cement mortar production [CH]; ceramic factory construction [CH]; ceramic tile production [CH]; chassis production, internet access equipment [RER]; chemical factory construction, organics [RER]; chichibabin amination [RER]; chichibabin pyridine synthesis [RER]; chipboard production, white lined [RER]; chipper production, stationary, electric [RER]; chlor-alkali electrolysis, diaphragm cell [RER]; chlor-alkali electrolysis, membrane cell [RER]; chlor-alkali electrolysis, mercury cell [RER]; chlorine dioxide production [RER]; chloroacetic acid production [RER]; chloroacetyl chloride production [RER]; chlorodifluoromethane production [NL]; chloromethyl methyl ether production [RER]; chloronitrobenzene production [RER]; chloropropionic acid production [RER]; chlorosulfonic acid production [RER]; chlorothalonil production [RER]; chlorotoluron production [RER]; chromium oxide production, flakes [RER]; chromium steel drilling, computer numerical controlled [RER]; chromium steel drilling, conventional [RER]; chromium steel milling, average [RER]; chromium steel milling, dressing [RER]; chromium steel milling, large parts [RER]; chromium steel milling, small parts [RER]; chromium steel turning, average, computer numerical controlled [RER]; chromium steel turning, average, conventional [RER]; chromium steel turning, primarily dressing, computer numerical controlled [RER]; chromium steel turning, primarily dressing, conventional [RER]; chromium steel turning, primarily roughing, computer numerical controlled [RER]; chromium steel turning, primarily roughing, conventional [RER]; citric acid production [RER]; cladding production, crossbar-pole, aluminium [RER]; clay brick production [RER]; clay pit construction [CH]; clay pit operation [CH]; clay plaster production [CH]; clear-cutting, primary forest to arable land, annual crop [UA]; clear-cutting, secondary forest to arable land, annual crop [UA]; clinker production [Europe without Switzerland, CH]; clover seed production, Swiss integrated production, for sowing [CH]; coating powder production [RER]; cocamide diethanolamine production [RER]; coking [DE]; compressed air production, 1000 kPa gauge, <30kW, average generation [RER]; compressed air production, 1000 kPa gauge, <30kW, optimised generation [RER]; compressed air production, 1200 kPa gauge, <30kW, average generation [RER]; compressed air production, 1200 kPa gauge, <30kW, optimized generation [RER]; compressed air production, 600 kPa gauge, >30kW, average generation [RER]; compressed air production, 600 kPa gauge, >30kW, best generation [RER]; compressed air production, 600 kPa gauge, >30kW, optimized generation [RER]; compressed air production, 700 kPa gauge, >30kW, average generation [RER]; compressed air production, 700 kPa gauge, >30kW, best generation [RER]; compressed air production, 700 kPa gauge, >30kW, optimized generation [RER]; compressed air production, 800 kPa gauge, <30kW, average generation [RER]; compressed air production, 800 kPa gauge, <30kW, optimized generation [RER]; compressed air production, 800 kPa gauge, >30kW, average generation [RER]; compressed air production, 800 kPa gauge, >30kW, best generation [RER]; compressed air production, 800 kPa gauge, >30kW, optimized generation [RER]; concrete mixing factory construction [CH]; container production, for collection of post-consumer waste plastic for recycling [CH, Europe without Switzerland, GLO]; containerboard production, fluting medium, recycled [RER]; containerboard production, fluting medium, semichemical [RER]; containerboard production, linerboard, kraftliner [RER]; containerboard production, linerboard, testliner [RER]; conveyor belt production [RER]; cooling energy, from natural gas, at cogen unit with absorption chiller 100kW [CH]; copper carbonate production [RER]; copper mine operation, sulfide ore [RER]; copper oxide production [RER]; core board production [RER]; cork forestry [PT]; cork slab production [RER]; corrugated board box production [RER]; cover plaster production, mineral [CH]; cover plaster production, organic [CH]; cryolite production [RER]; cumene production [RER]; cyanoacetic acid production [RER]; cyanogen chloride production [RER]; cyclic N-compound production [RER]; cyclohexane production [RER]; cyclohexanol production [RER]; cyclohexanone production [RER]; decabromodiphenyl ether production [RER]; decarboxylative cyclization of adipic acid [RER]; deep drawing, steel, 10000 kN press, automode [RER]; deep drawing, steel, 10000 kN press, single stroke [RER]; deep drawing, steel, 3500 kN press, automode [RER]; deep drawing, steel, 3500 kN press, single stroke [RER]; deep drawing, steel, 38000 kN press, automode [RER]; deep drawing, steel, 38000 kN press, single stroke [RER]; deep drawing, steel, 650 kN press, automode [RER]; deep drawing, steel, 650 kN press, single stroke [RER];

diammonium phosphate production [RER]; diazine-compound production [RER]; diazole-compound production [RER]; dicyclopentadiene based unsaturated polyester resin production [RER]; diesel production, low-sulfur [Europe without Switzerland, CH]; dimethenamide production [RER]; dimethyl carbonate production [RER]; dimethyl ether production [RER]; dimethyl malonate production [RER]; dimethyl sulfate production [RER]; dimethyl sulfide production [RER]; dimethyl sulfoxide production [RER]; dimethylamine production [RER]; dimethylaminopropylamine production [RER]; dinitroaniline-compound production [RER]; dioxane production [RER]; diphenylether-compound production [RER]; dipropyl amine production [RER]; dipropylene glycol monomethyl ether production [RER]; distribution network construction, electricity, low voltage [CH]; dithiocarbamate-compound production [RER]; dolomite production [RER]; door production, inner, glass-wood [RER]; door production, inner, wood [RER]; door production, outer, wood-aluminium [RER]; door production, outer, wood-glass [RER]; drawing of pipe, steel [RER]; dried roughage store construction, air dried, solar [CH]; dried roughage store construction, cold-air dried, conventional [CH]; dried roughage store construction, non ventilated [CH]; DTPA production [RER]; dung slab construction [CH]; dust collector production, electrostatic precipitator, for domestic use [CH]; dust collector production, electrostatic precipitator, for industrial use [CH]; dust collector production, multicyclone [CH]; EDTA production [RER]; electric arc furnace converter construction [RER]; electric bicycle production [RER]; electric motor production, vehicle [RER]; electricity production, deep geothermal [CH]; electricity production, hydro, pumped storage [HR, LT, SI, NO, RS, SK, BG, DE, ES, BE, UA, PT, BA, GR, SE, IE, GB, FR, CH, PL, LU, IT, RO, AT, CZ]; electricity production, hydro, reservoir, alpine region [FR, RS, CH, IT, BA, NO, LV, AT, HR, MK]; electricity production, hydro, reservoir, alpine region, label-certified [CH]; electricity production, hydro, reservoir, non-alpine region [PT, DE, SE, ES, IS, FI, SK, CZ]; electricity production, hydro, run-of-river [DK, FI, ES, EE, SI, BA, PL, GR, FR, SK, LU, CH, GB, HR, RO, LT, MK, DE, BE, UA, IE, AT, SE, BG, RS, HU, PT, LV, NL, IT, CZ, BG, AT, MK, FR]; electricity production, hydro, run-of-river, label-certified [CH]; electricity production, lignite [GR, DE, IT, UA, RS, HU, RO, MK, SI, BG, BA, HR, ES, CZ]; electricity production, natural gas, 10MW [DE, NL, CH]; electricity production, natural gas, combined cycle power plant [AT, PL, CH, GR, SI, FI, HU, PT, BG, ES, DE, IT, LU, IE, UA, SK, HR, MT, SE, GB, LV, RO, FR, BE, NL, NO, CZ, AT, BE, BG, DE, EE, ES, FI, FR]; electricity production, natural gas, conventional power plant [HU, FR, RO, SI, HR, PT, BG, GB, GR, FI, NL, AT, BE, ES, SK, DE, IE, NO, UA, IT, CZ]; electricity production, nuclear, boiling water reactor [CH, DE]; electricity production, nuclear, pressure water reactor [CH, DE, FR]; electricity production, oil [BG, SE, UA, EE, BA, LT, FR, PT, HU, MT, DE, MK, PL, RO, NL, LU, GB, BE, ES, IT, DK, FI, SI, AT, NO, SK, LV, GR, IE, IS, HR, CZ]; electricity production, peat [IE, LT, FI, SE, EE]; electricity production, photovoltaic, 3kWp facade installation, multi-Si, laminated, integrated [CH]; electricity production, photovoltaic, 3kWp facade installation, multi-Si, panel, mounted [CH]; electricity production, photovoltaic, 3kWp facade installation, single-Si, laminated, integrated [CH]; electricity production, photovoltaic, 3kWp facade installation, single-Si, panel, mounted [CH]; electricity production, photovoltaic, 3kWp flat-roof installation, multi-Si [CH]; electricity production, photovoltaic, 3kWp flat-roof installation, single-Si [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, a-Si, laminated, integrated [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, a-Si, panel, mounted [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, CdTe, laminated, integrated [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, CIS, panel, mounted [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, laminated, integrated [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted, label-certified [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, ribbon-Si, laminated, integrated [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, ribbon-Si, panel, mounted [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, laminated, integrated [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted [CH]; electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted, label-certified [CH]; electronics production, for

control units [RER]; enamelling [RER]; energy saving, from ventilation system, 1 x 720 m3/h, polyethylene ducts, with earth tube heat exchanger [CH]; energy saving, from ventilation system, 1 x 720 m3/h, steel ducts, with earth tube heat exchanger [CH]; energy saving, from ventilation system, 6 x 120 m3/h, polyethylene ducts [CH]; energy saving, from ventilation system, 6 x 120 m3/h, polyethylene ducts, with earth tube heat exchanger [CH]; energy saving, from ventilation system, 6 x 120 m3/h, steel ducts [CH]; energy saving, from ventilation system, 6 x 120 m3/h, steel ducts, with earth tube heat exchanger [CH]; epichlorohydrin production from allyl chloride [RER]; establishing orchard [CH]; esterquat production, from coconut oil and palm kernel oil [RER]; esters of versatic acid production [RER]; ethanol production from sugar beet molasses [CH]; ethanolamine production [RER]; ethoxylated alcohol (AE>20) production, palm oil [RER]; ethoxylated alcohol (AE11) production, palm oil [RER]; ethoxylated alcohol (AE3) production, coconut oil [RER]; ethoxylated alcohol (AE3) production, palm kernel oil [RER]; ethoxylated alcohol (AE3) production, petrochemical [RER]; ethoxylated alcohol (AE7) production, coconut oil [RER]; ethoxylated alcohol (AE7) production, palm kernel oil [RER]; ethoxylated alcohol (AE7) production, petrochemical [RER]; ethyl acetate production [RER]; ethyl benzene production [RER]; ethyl tert-butyl ether production, from bioethanol [RER]; ethylamine production [RER]; ethylene bromide production [RER]; ethylene dichloride production [RER]; ethylene glycol diethyl ether production [RER]; ethylene glycol dimethyl ether production [RER]; ethylene glycol monoethyl ether production [RER]; ethylene glycol production [RER]; ethylene hydration [RER]; ethylene oxide production [RER]; ethylene vinyl acetate copolymer production [RER]; ethylenediamine production [RER]; ethylvinylacetate production, foil [RER]; evacuated tube collector production [GB]; exhaust air outlet production, steel/aluminium, 85x365 mm [CH]; exhaust air roof hood production, steel, DN 400 [CH]; exhaust air valve production, in-wall housing, plastic/steel, DN 125 [CH]; expansion vessel production, 25l [CH]; expansion vessel production, 80l [CH]; explosive production, tovex [CH]; explosives factory construction [CH]; extrusion of plastic sheets and thermoforming, inline [FR]; extrusion, co-extrusion of plastic sheets [FR]; extrusion, plastic film [RER]; extrusion, plastic pipes [RER]; fatty acid production, from coconut oil [RER]; fatty acid production, from palm kernel oil [RER]; fatty acid production, from palm oil [RER]; fatty acid production, from soybean oil [RER]; fatty alcohol production, from coconut oil [RER]; fatty alcohol production, from palm kernel oil [RER]; fatty alcohol production, from palm oil [RER]; fatty alcohol production, petrochemical [RER]; fatty alcohol sulfate production, coconut oil [RER]; fatty alcohol sulfate production, from palm kernel oil [RER]; fatty alcohol sulfate production, palm oil [RER]; fatty alcohol sulfate production, petrochemical [RER]; fava bean production, organic [CH]; fava bean production, Swiss integrated production, at farm [CH]; fava bean seed production, for sowing [CH]; fava bean seed production, organic, for sowing [CH]; fava bean, feed production, Swiss integrated production [CH]; feldspar production [RER]; fibre cement corrugated slab production [CH]; fibre cement facing tile production, large format [CH]; fibre cement roof slate production [CH]; fibreboard production, hard [RER]; fibreboard production, soft, from wet & dry processes [Europe without Switzerland]; fibreboard production, soft, from wet processes [CH]; fibreboard production, soft, latex bonded [CH]; fibreboard production, soft, without adhesives [CH]; flat glass factory construction [RER]; flat glass production, coated [RER]; flat glass production, uncoated [RER]; flat plate solar collector production, Cu absorber [CH]; fleece production, polyethylene [RER]; flexible duct production, aluminium/PET, DN of 125 [RER]; fluorescent whitening agent production, DAS1, triazinylaminostilben type [RER]; fluorescent whitening agent production, distyrylbiphenyl type [RER]; fluorine production, liquid [RER]; foam glass factory construction [BE]; fodder beet production, Swiss integrated production, intensive [CH]; folding boxboard production [RER]; folpet production [RER]; formic acid production, methyl formate route [RER]; fosetyl-Al production [RER]; fruit tree seedling production, for plating [CH]; fuel cell production, polymer electrolyte membrane, 2kW electrical, future [CH]; fuel cell production, solid oxide, 125kW electrical, future [CH]; fuel cell production, stack polymer electrolyte membrane, 2kW electrical, future [CH]; fuel cell production, stack solid oxide, 125kW electrical, future [CH]; furnace production, logs, 30kW [CH]; furnace production, logs, 6kW [CH]; furnace production, logs, average storage area, 100kW

[CH]; furnace production, logs, average storage area, 30kW [CH]; furnace production, logs, average storage area, 6kW [CH]; furnace production, logs, hardwood storage area, 100kW [CH]; furnace production, logs, hardwood storage area, 30kW [CH]; furnace production, logs, hardwood storage area, 6kW [CH]; furnace production, logs, softwood storage area, 100kW [CH]; furnace production, logs, softwood storage area, 30kW [CH]; furnace production, logs, softwood storage area, 6kW [CH]; furnace production, pellet, 15kW [CH]; furnace production, pellet, 50kW [CH]; furnace production, pellets, 25kW [CH]; furnace production, pellets, 9kW [CH]; furnace production, pellets, with silo, 300kW [CH]; furnace production, wood chips, average storage area, 1000kW [CH]; furnace production, wood chips, average storage area, 300kW [CH]; furnace production, wood chips, average storage area, 50kW [CH]; furnace production, wood chips, hardwood storage area, 1000kW [CH]; furnace production, wood chips, hardwood storage area, 300kW [CH]; furnace production, wood chips, hardwood storage area, 50kW [CH]; furnace production, wood chips, softwood storage area, 1000kW [CH]; furnace production, wood chips, softwood storage area, 300kW [CH]; furnace production, wood chips, softwood storage area, 50kW [CH]; furnace production, wood chips, with silo, 1000kW [CH]; furnace production, wood chips, with silo, 300kW [CH]; furnace production, wood chips, with silo, 5000kW [CH]; furnace production, wood chips, with silo, 50kW [CH]; garage construction, wood, non-insulated, fire-protected [CH]; geothermal power plant construction [CH]; glass fibre production [RER]; glass fibre reinforced plastic production, polyamide, injection moulded [RER]; glass tube production, borosilicate [DE]; glass wool mat production [CH]; glass wool mat production, Saint-Gobain ISOVER SA [CH]; glazing production, double, U<1.1 W/m2K [RER]; glazing production, double, U<1.1 W/m2K, laminated safety glass [RER]; glazing production, triple, U<0.5 W/m2K [RER]; glucose production [RER]; glued laminated timber production, for indoor use [RER]; glued laminated timber production, for outdoor use [RER]; glycerine production, from epichlorohydrin [RER]; glycine production [RER]; glyoxal production [RER]; glyphosate production [RER]; gold-silver-zinc-lead-copper mine operation and refining [SE]; graphite production [RER]; grass seed production, organic, for sowing [CH]; grass seed production, Swiss integrated production, for sowing [CH]; gravel and sand quarry operation [CH]; gravel production, crushed [CH]; gravel/sand quarry construction [CH]; greenhouse construction, glass walls and roof, metal tubes [FR]; greenhouse construction, glass walls and roof, plastic tubes [FR]; greenhouse construction, plastic walls and roof, metal tubes [FR]; greenhouse construction, plastic walls and roof, plastic tubes [FR]; gypsum fibreboard production [CH]; gypsum plasterboard production [CH]; gypsum quarry operation [CH]; hard coal briquettes production [RER]; heat and power co-generation unit construction, 160kW electrical, common components for heat+electricity [RER]; heat and power co-generation unit construction, 1MW electrical, common components for heat+electricity [RER]; heat and power co-generation unit construction, 1MWel [CH]; heat and power cogeneration unit construction, 1MWel, 6.4 MWth [CH]; heat and power co-generation unit construction, 200kW electrical, common components for heat+electricity [RER]; heat and power co-generation unit construction, 200kW electrical, diesel SCR, common components for heat+electricity [RER]; heat and power co-generation unit construction, 500kW electrical, common components for heat+electricity [RER]; heat and power co-generation unit construction, 50kW electrical, common components for heat+electricity [RER]; heat and power co-generation unit construction, 6400kW thermal, building [CH]; heat and power co-generation unit construction, organic Rankine cycle, 1400kW thermal, building [CH]; heat and power co-generation, biogas, gas engine [HU, SI, FI, PT, SK, DE, BG, EE, BE, FR, SE, GR, ES, LV, PL, NL, IE, LT, HR, GB, IT, NO, DK, RO, RS, CH, AT, LU, CZ]; heat and power co-generation, biogas, gas engine, label-certified [CH]; heat and power co-generation, diesel, 200kW electrical, SCR-NOx reduction [CH]; heat and power co-generation, lignite [HU, RS, BA, SK, RO, GR, DE, SI, BG, PL, CZ]; heat and power co-generation, natural gas, 160kW electrical, Jakobsberg [CH]; heat and power co-generation, natural gas, 160kW electrical, lambda=1 [CH, Europe without Switzerland]; heat and power co-generation, natural gas, 1MW electrical, lean burn [CH, Europe without Switzerland]; heat and power co-generation, natural gas, 200kW electrical, lean burn [CH]; heat and power co-generation, natural gas, 500kW electrical, lean burn [CH]; heat and power co-generation, natural gas, 50kW

electrical, lean burn [Europe without Switzerland, CH]; heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical [IT, HR, ES, SK, PL, RO, MK, BG, HU, LU, DE, NL, GB, AT, LV, NO, BE, LT, PT, FI, GR, DK]; heat and power co-generation, wood chips, 2000 kW [CH]; heat and power co-generation, wood chips, 2000 kW, state-of-the-art 2014 [CH]; heat and power co-generation, wood chips, 6667 kW [CH]; heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014 [CH]; heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014, label-certified [CH]; heat production, anthracite, at stove 5-15kW [Europe without Switzerland]; heat production, at hard coal industrial furnace 1-10MW [Europe without Switzerland]; heat production, at hot water tank, solar+electric, flat plate, multiple dwelling [CH]; heat production, at hot water tank, solar+gas, flat plate, multiple dwelling [CH]; heat production, at hot water tank, solar+gas, flat plate, one-family house [CH]; heat production, at solar+gas heating, flat plate, one-family house, combined system [CH]; heat production, at solar+gas heating, tube collector, one-family house, combined system [CH]; heat production, at solar+wood heating, flat plate, one-family house, combined system [CH]; heat production, biogas, at diffusion absorption heat pump 4kW, future [CH]; heat production, hard coal briquette, stove 5-15kW [Europe without Switzerland]; heat production, hard coal coke, stove 5-15kW [Europe without Switzerland]; heat production, hardwood chips from forest, at furnace 1000kW [CH]; heat production, hardwood chips from forest, at furnace 1000kW, state-of-the-art 2014 [CH]; heat production, hardwood chips from forest, at furnace 300kW [CH]; heat production, hardwood chips from forest, at furnace 300kW, state-of-the-art 2014 [CH]; heat production, hardwood chips from forest, at furnace 5000kW [CH]; heat production, hardwood chips from forest, at furnace 5000kW, state-of-the-art 2014 [CH]; heat production, hardwood chips from forest, at furnace 50kW [CH]; heat production, hardwood chips from forest, at furnace 50kW, state-of-the-art 2014 [CH]; heat production, heavy fuel oil, at industrial furnace 1MW [CH]; heat production, light fuel oil, at industrial furnace 1MW [CH]; heat production, lignite briquette, at stove 5-15kW [Europe without Switzerland]; heat production, mixed logs, at furnace 100kW [CH]; heat production, mixed logs, at furnace 100kW, state-of-the-art 2014 [CH]; heat production, mixed logs, at furnace 30kW [CH]; heat production, mixed logs, at furnace 30kW, state-of-the-art 2014 [CH]; heat production, mixed logs, at wood heater 6kW [CH]; heat production, mixed logs, at wood heater 6kW, state-of-the-art 2014 [CH]; heat production, natural gas, at boiler condensing modulating >100kW [Europe without Switzerland]; heat production, natural gas, at boiler modulating >100kW [Europe without Switzerland]; heat production, natural gas, at industrial furnace >100kW [Europe without Switzerland]; heat production, natural gas, at industrial furnace low-NOx >100kW [Europe without Switzerland]; heat production, softwood chips from forest, at furnace 1000kW [CH]; heat production, softwood chips from forest, at furnace 1000kW, state-of-the-art 2014 [CH]; heat production, softwood chips from forest, at furnace 300kW [CH]; heat production, softwood chips from forest, at furnace 300kW, state-of-the-art 2014 [CH]; heat production, softwood chips from forest, at furnace 5000kW [CH]; heat production, softwood chips from forest, at furnace 5000kW, state-of-the-art 2014 [CH]; heat production, softwood chips from forest, at furnace 50kW [CH]; heat production, softwood chips from forest, at furnace 50kW, state-of-the-art 2014 [CH]; heat production, untreated waste wood, at furnace 1000-5000 kW [CH]; heat production, untreated waste wood, at furnace 1000-5000 kW, state-of-the-art 2014 [CH]; heat production, wood chips from industry, at furnace 1000kW [CH]; heat production, wood chips from industry, at furnace 1000kW, state-of-the-art 2014 [CH]; heat production, wood chips from industry, at furnace 300kW [CH]; heat production, wood chips from industry, at furnace 300kW, state-of-the-art 2014 [CH]; heat production, wood chips from industry, at furnace 5000kW [CH]; heat production, wood chips from industry, at furnace 5000kW, state-of-the-art 2014 [CH]; heat production, wood chips from industry, at furnace 50kW [CH]; heat production, wood chips from industry, at furnace 50kW, state-of-the-art 2014 [CH]; heat production, wood pellet, at furnace 25kW [CH]; heat production, wood pellet, at furnace 25kW, state-of-the-art 2014 [CH]; heat production, wood pellet, at furnace 300kW [CH]; heat production, wood pellet, at furnace 300kW, state-of-the-art 2014 [CH]; heat pump production, diffusion absorption, 4kW, future [CH]; heat storage production, 2000l [CH]; horticultural

fleece production [CH]; hot rolling, steel [RER]; hot water tank production, 600l [CH]; housing system construction, cattle, loose [CH]; housing system construction, cattle, tied [CH]; housing system construction, pig, fully-slatted floor [CH]; housing system construction, pig, label-certified [CH]; hydrazine production [RER]; hydrochloric acid production, from the reaction of hydrogen with chlorine [RER]; hydroformylation of butene [RER]; hydroformylation of propylene [RER]; hydrogen peroxide production, product in 50% solution state [RER]; hydrogen sulfide production [RER]; hydroquinone production [RER]; hydroxylamine production [RER]; imidazole production [RER]; impact extrusion of aluminium, 1 stroke [RER]; impact extrusion of aluminium, 2 strokes [RER]; impact extrusion of aluminium, 3 strokes [RER]; impact extrusion of aluminium, 4 strokes [RER]; impact extrusion of aluminium, 5 strokes [RER]; impact extrusion of steel, cold, 1 strokes [RER]; impact extrusion of steel, cold, 2 strokes [RER]; impact extrusion of steel, cold, 3 strokes [RER]; impact extrusion of steel, cold, 4 strokes [RER]; impact extrusion of steel, cold, 5 strokes [RER]; impact extrusion of steel, hot, 1 strokes [RER]; impact extrusion of steel, hot, 2 strokes [RER]; impact extrusion of steel, hot, 3 strokes [RER]; impact extrusion of steel, hot, 4 strokes [RER]; impact extrusion of steel, hot, 5 strokes [RER]; impact extrusion of steel, warm, 1 strokes [RER]; impact extrusion of steel, warm, 2 strokes [RER]; impact extrusion of steel, warm, 3 strokes [RER]; impact extrusion of steel, warm, 4 strokes [RER]; impact extrusion of steel, warm, 5 strokes [RER]; indium production [RER]; indium tin oxide powder production, nanoscale, for sputtering target [RER]; industrial machine production, heavy, unspecified [RER]; inert material landfill construction [CH]; injection moulding [RER]; insulation spiral-seam duct production, rockwool, DN 400, 30 mm [RER]; intral production [RER]; inverter production, 0.5kW [RER]; inverter production, 2.5kW [RER]; inverter production, 500kW [RER]; iodine production [RER]; iron (III) chloride production, product in 40% solution state [CH]; iron sulfate production [RER]; iron-nickel-chromium alloy production [RER]; irrigation [CH, ES, DE, FR]; isobutyl acetate production [RER]; isohexane production [RER]; isophthalic acid based unsaturated polyester resin production [RER]; isopropanol production [RER]; isopropyl acetate production [RER]; isopropylamine production [RER]; isoproturon production [RER]; kraft paper production, bleached [RER]; kraft paper production, unbleached [RER]; lactic acid production [RER]; laminated timber element production, for outdoor use [RER]; land already in use, perennial cropland to annual crop [FR, UA, FI, NL, ES, HU, IT, CH, DE]; laser machining, metal, with CO2-laser, 2000W power [RER]; laser machining, metal, with CO2-laser, 2700W power [RER]; laser machining, metal, with CO2-laser, 3200W power [RER]; laser machining, metal, with CO2-laser, 4000W power [RER]; laser machining, metal, with CO2-laser, 5000W power [RER]; laser machining, metal, with CO2-laser, 6000W power [RER]; laser machining, metal, with YAG-laser, 120W power [RER]; laser machining, metal, with YAG-laser, 200W power [RER]; laser machining, metal, with YAG-laser, 30W power [RER]; laser machining, metal, with YAG-laser, 330W power [RER]; laser machining, metal, with YAG-laser, 40W power [RER]; laser machining, metal, with YAG-laser, 500W power [RER]; laser machining, metal, with YAG-laser, 50W power [RER]; laser machining, metal, with YAG-laser, 60W power [RER]; lath, hardwood, raw, kiln drying to u=10% [CH]; lath, hardwood, raw, kiln drying to u=20% [CH]; lath, softwood, raw, kiln drying to u=10% [CH]; lath, softwood, raw, kiln drying to u=20% [CH]; layered sodium silicate production, SKS-6, powder [RER]; lean concrete production, with cement CEM II/A [CH]; lean concrete production, with cement CEM II/B [CH]; light commercial vehicle production [RER]; light fuel oil production, from waste polyethylene [CH]; light mortar production [CH]; lignite briquettes production [DE]; lignite mine operation [RER]; lime mortar production [CH]; lime production, algae [FR]; lime production, hydrated, loose weight [CH]; lime production, hydraulic [CH]; lime production, milled, loose [CH]; limestone production, crushed, for mill [CH]; limestone production, crushed, washed [CH]; limestone quarry construction [CH]; limestone quarry operation [CH]; linseed seed production, at farm [CH]; linseed seed production, for sowing [CH]; liquid manure storage and processing facility construction [CH]; liquid packaging board container production [RER]; lorry production, 16 metric ton [RER]; lorry production, 28 metric ton [RER]; lorry production, 40 metric ton [RER]; lubricating oil production [RER]; magnesium oxide production [RER]; magnesium sulfate production [RER]; maintenance, bicycle [CH]; maintenance, electric bicycle [CH];

maintenance, motor scooter [CH]; maintenance, polymer electrolyte membrane fuel cell 2kW electrical [CH]; maintenance, solid oxide fuel cell 125kW electrical, future [CH]; maintenance, train, passenger, long distance [CH]; maize grain production, organic [CH]; maize grain production, Swiss integrated production [CH]; maize grain, feed production, organic [CH]; maize grain, feed production, Swiss integrated production [CH]; maize seed production, organic, at farm [CH]; maize seed production, organic, for sowing [CH]; maize seed production, Swiss integrated production, at farm [CH]; maize seed production, Swiss integrated production, for sowing [CH]; maize silage production, organic [CH]; maize silage production, Swiss integrated production, intensive [CH]; maize starch production [DE]; maleic anhydride production by catalytic oxidation of benzene [RER]; maleic anhydride production by direct oxidation of n-butane [RER]; maleic unsaturated polyester resin production [RER]; malusil production [RER]; mancozeb production [RER]; Mannheim process [RER]; mastic asphalt production [CH]; mecoprop production [RER]; medium density fibre board production, uncoated [RER]; melamine formaldehyde resin production [RER]; melamine production [RER]; metal working machine production, unspecified [RER]; metal working, average for aluminium product manufacturing [RER]; metal working, average for chromium steel product manufacturing [RER]; metal working, average for copper product manufacturing [RER]; metal working, average for metal product manufacturing [RER]; metal working, average for steel product manufacturing [RER]; metaldehyde production [RER]; metallization paste production, back side [RER]; metallization paste production, back side, aluminium [RER]; metallization paste production, front side [RER]; metamitron production [RER]; methacrylic acid production [RER]; methane production, 96% by volume, from biogas, high pressure, at user [CH]; methane production, 96% by volume, from biogas, low pressure, at user [CH]; methane production, 96% by volume, from synthetic gas, wood, fixed bed technology [CH]; methane production, 96% by volume, from synthetic gas, wood, fluidised technology [CH]; methane sulfonic acid production [RER]; methyl ethyl ketone production [RER]; methyl formate production [RER]; methyl iodide production [RER]; methyl tert-butyl ether production [RER]; methylamine production [RER]; methylcyclohexane production [RER]; metolachlor production [RER]; micro gas turbine production, 100kW electrical [CH]; milking [CH]; milking parlour construction [CH]; mine construction, gold-silver-zinc-lead-copper [SE]; mini CHP plant construction, common components for heat+electricity [CH]; mini CHP plant production, components for electricity only [CH]; molecular sieve separation of naphtha [RER]; monoammonium phosphate production [RER]; motor scooter production [RER]; multi-Si wafer production [RER]; municipal waste collection service by 21 metric ton lorry [CH]; N,N-dimethylformamide production [RER]; naphthalene sulfonic acid production [RER]; napropamide production [RER]; natural gas production [DE]; natural gas, burned in gas turbine, for compressor station [NO, NL, DE]; natural gas, high pressure, import from GB [NL]; natural stone plate production, grounded [CH]; natural stone plate production, polished [CH]; nitric acid production, product in 50% solution state [RER]; nitrile-compound production [RER]; nitrobenzene production [RER]; nitro-compound production [RER]; nitrous dioxide production [RER]; nitrous oxide production [RER]; n-olefins production [RER]; nuclear power plant construction, boiling water reactor 1000MW [CH, DE]; nuclear power plant construction, pressure water reactor 1000MW [FR, DE, CH]; nuclear spent fuel conditioning facility construction [CH]; nuclear spent fuel reprocessing facility construction [RER]; nuclear waste storage construction, final repository for high level radioactive waste [CH]; nuclear waste storage construction, final repository for low level radioactive waste [CH]; o-aminophenol production [RER]; oat seed production, for sowing [CH]; oat seed production, Swiss integrated production, at farm [CH]; o-chlorobenzaldehyde production [RER]; o-chlorotoluene production [RER]; o-cresol production [RER]; offset printing, per kg printed paper [CH]; o-nitrophenol production [RER]; operation, computer, desktop, with cathode ray tube display, home use [CA-QC]; operation, computer, desktop, with liquid crystal display, home use [CA-QC]; operation, computer, desktop, with liquid crystal display, office use [CA-QC]; operation, computer, laptop, 68% active work with internet access 0.2 Mbit/s [CA-QC]; operation, computer, laptop, videoconference [CA-QC]; operation, dried roughage store, air dried, solar [CH]; operation, dried roughage store, cold-air dried, conventional [CH];

operation, dried roughage store, non ventilated [CH]; operation, housing system, cattle, loose [CH]; operation, housing system, cattle, tied [CH]; operation, housing system, pig, fully-slatted floor [CH]; operation, housing system, pig, label-certified [CH]; operation, liquid manure storage and processing facility [CH]; operation, solar collector system, Cu flat plate collector, multiple dwelling, for hot water [CH]; operation, solar collector system, Cu flat plate collector, one-family house, for combined system [CH]; operation, solar collector system, Cu flat plate collector, one-family house, for hot water [CH]; operation, solar collector system, evacuated tube collector, one-family house, for combined system [CH]; orbencarb production [RER]; organophosphorus-compound production, unspecified [RER]; oriented strand board production [RER]; orthophthalic acid based unsaturated polyester resin production [RER]; outside air intake production, stainless steel, DN 370 [RER]; oxidation of butane [RER]; oxidation of manganese dioxide [RER]; oxidation of methanol [RER]; ozone production, liquid [RER]; packaging film production, low density polyethylene [RER]; packaging glass factory construction [RER]; packaging glass production, brown [CH, DE, RER w/o CH+DE]; packaging glass production, green [RER w/o CH+DE, CH, DE]; packaging glass production, white [CH, DE, RER w/o CH+DE]; packing, cement [CH]; packing, clay product [CH]; packing, fibre cement product [CH]; packing, lime product [CH]; paper mill construction, integrated [RER]; paper mill construction, non-integrated [RER]; paper production, newsprint, recycled [Europe without Switzerland, CH]; paper production, newsprint, virgin [RER]; paper production, woodcontaining, lightweight coated [RER]; paper production, woodcontaining, supercalendered [RER]; paper production, woodfree, coated, at integrated mill [RER]; paper production, woodfree, coated, at non-integrated mill [RER]; paper production, woodfree, uncoated, at integrated mill [RER]; paper production, woodfree, uncoated, at non-integrated mill [RER]; paraffin production [RER]; particle board production, cement bonded [RER]; particle board production, for indoor use [RER]; particle board production, for outdoor use [RER]; particle board production, uncoated, average glue mix [RER]; p-chlorophenol production [RER]; pea seed production, for sowing [CH]; pea seed production, organic, for sowing [CH]; peat production [NORDEL]; pendimethalin production [RER]; pentaerythritol production in sodium hydroxide solution [RER]; perlite quarry operation [DE]; pesticide production, unspecified [RER]; petrol production, low-sulfur [CH, Europe without Switzerland, GLO]; petroleum and gas production, off-shore [NO]; petroleum refinery operation [CH, Europe without Switzerland, GLO]; phenol production [RER]; phenol production, from cumene [RER]; phenolic resin production [RER]; phenoxy-compound production [RER]; phenyl acetic acid production [RER]; phenyl isocyanate production [RER]; phosgene production, liquid [RER]; phosphorous chloride production [RER]; phosphorus production, white, liquid [RER]; phosphoryl chloride production [RER]; photovoltaic cell factory construction [DE]; photovoltaic laminate production, CdTe [DE]; photovoltaic laminate production, CIS [DE]; photovoltaic laminate production, multi-Si wafer [RER]; photovoltaic laminate production, ribbon-Si [RER]; photovoltaic laminate production, single-Si wafer [RER]; photovoltaic module production, building-integrated, for facade installation [RER]; photovoltaic module production, building-integrated, for slanted-roof installation [RER]; photovoltaic mounting system production, for facade installation [RER]; photovoltaic mounting system production, for flat-roof installation [RER]; photovoltaic mounting system production, for slanted-roof installation [RER]; photovoltaic panel production, multi-Si wafer [RER]; photovoltaic panel production, ribbon-Si [RER]; photovoltaic panel production, single-Si wafer [RER]; photovoltaic slanted-roof installation, 3kWp, CdTe, laminated, integrated, on roof [CH]; photovoltaic slanted-roof installation, 3kWp, single-Si, laminated, integrated, on roof [CH]; photovoltaic slanted-roof installation, 3kWp, single-Si, panel, mounted, on roof [CH]; photovoltaics, electric installation for 3kWp module, at building [CH]; phthalic anhydride production [RER]; phthalimide production [RER]; phthalimide-compound production [RER]; pipeline construction, liquid manure [CH]; pipeline construction, natural gas, high pressure distribution network [Europe without Switzerland, CH]; pipeline construction, natural gas, low pressure distribution network [CH]; pipeline construction, petroleum [RER]; piperidine production [RER]; planing mill production [RER]; planing, beam, hardwood, u=10% [CH]; planing, beam, hardwood, u=20% [CH]; planing, beam, softwood,

u=10% [CH]; planing, beam, softwood, u=20% [CH]; planing, board, hardwood, u=10% [CH]; planing, board, hardwood, u=20% [CH]; planing, board, softwood, u=10% [CH]; planing, board, softwood, u=20% [CH]; planing, lath, hardwood, u=10% [CH]; planing, lath, hardwood, u=20% [CH]; planing, lath, softwood, u=10% [CH]; planing, lath, softwood, u=20% [CH]; planting, tree [CH]; plaster mixing [CH]; plastic processing factory construction [RER]; plastic tunnel construction [FR]; plywood production, for indoor use [RER]; plywood production, for outdoor use [RER]; p-nitrophenol production [RER]; p-nitrotoluene production [RER]; polycarboxylates production, 40% active substance [RER]; polyester resin production, unsaturated [RER]; polyester-complexed starch biopolymer production [RER]; polyethylene pipe production, corrugated, DN 75 [RER]; polyethylene pipe production, DN 200, SDR 41 [RER]; polyethylene production, high density, granulate, recycled [CH]; polyethylene terephthalate production, granulate, amorphous [RER]; polyethylene terephthalate production, granulate, amorphous, recycled [CH]; polyethylene terephthalate production, granulate, bottle grade [RER]; polyethylene terephthalate production, granulate, bottle grade, recycled [CH]; polystyrene foam slab for perimeter insulation [CH]; polystyrene foam slab production [RER]; polystyrene foam slab production, 10% recycled [CH]; polystyrene foam slab with graphite, 6% recycled [CH]; polysulfide production, sealing compound [RER]; polyurethane production, flexible foam [RER]; polyurethane production, rigid foam [RER]; portachrom production [RER]; portafer production [RER]; potassium chloride production [RER]; potassium hydroxide production [RER]; potassium nitrate production [RER]; potassium sulfate production [RER]; potato grading [CH]; potato production, organic [CH]; potato production, Swiss integrated production, intensive [CH]; potato seed production, organic, at farm [CH]; potato seed production, organic, for setting [CH]; potato seed production, Swiss integrated production, at farm [CH]; potato seed production, Swiss integrated production, for setting [CH]; potato starch production [DE]; powder coating, aluminium sheet [RER]; powder coating, steel [RER]; power saw production, without catalytic converter [RER]; precious metal refinery construction [SE]; printing ink production, offset, product in 47.5% solution state [RER]; printing ink production, rotogravure, product in 55% toluene solution state [RER]; propanal production [RER]; propionic acid production [RER]; propyl acetate production [RER]; propyl amine production [RER]; propylene glycol production, liquid [RER]; propylene oxide production, liquid [RER]; prosulfocarb production [RER]; protein pea production, organic [CH]; protein pea production, Swiss integrated production, intensive [CH]; protein pea, feed production, Swiss integrated production [CH]; pulp factory construction [RER]; pulverised lignite production [DE]; pumice quarry operation [DE]; purification of wet-process phosphoric acid to industrial grade, product in 85% solution state [RER]; purified terephthalic acid production [RER]; pyrazole production [RER]; pyrethroid-compound production [RER]; pyridazine-compound production [RER]; pyridine-compound production [RER]; quicklime production, in pieces, loose [CH]; quicklime production, milled, loose [CH]; rape oil mill operation [CH]; rape seed production, for sowing [CH]; rape seed production, organic, for sowing [CH]; refractory production, basic, packed [DE]; refractory production, fireclay, packed [DE]; refractory production, high aluminium oxide, packed [DE]; reinforcing steel production [RER]; residential sewer grid construction, 0.087 km [CH]; residual material landfill construction [CH]; retention aid production, for paper production [RER]; road vehicle factory construction [RER]; rock crushing [RER]; rolling mill production [RER]; roof tile production [RER]; room-connecting overflow element production, steel, approx. 40 m3/h [RER]; rye grain, feed production, organic [CH]; rye grain, feed production, Swiss integrated production [CH]; rye seed production, organic, for sowing [CH]; rye seed production, Swiss integrated production, for sowing [CH]; sanitary ceramics production [CH]; sanitary landfill facility construction [CH]; sawing and planing, azobe, air dried [RER]; sawmill construction [CH, Europe without Switzerland]; scrap preparation facility construction [RER]; seal production, natural rubber based [DE]; sealing tape production, aluminium/PE, 50 mm wide [RER]; section bar extrusion, aluminium [RER]; section bar rolling, steel [RER]; selective coating, aluminium sheet, nickel pigmented aluminium oxide [SK]; selective coating, copper sheet, black chrome [RER]; selective coating, copper sheet, physical vapour deposition [DE]; selective coating, copper sheet, sputtering [DE]; selective coating, stainless steel sheet, black chrome

[CH]; selenium production [RER]; sewer grid construction, 1.1E10l/year, 242 km [CH]; sewer grid construction, 1.6E8l/year, 6 km [CH]; sewer grid construction, 1E9l/year, 30 km [CH]; sewer grid construction, 4.7E10l/year, 583 km [CH]; sewer grid construction, 5E9l/year, 110 km [CH]; shed construction [CH]; shed construction, large, wood, non-insulated, fire-unprotected [CH]; sheet rolling, aluminium [RER]; sheet rolling, chromium steel [RER]; sheet rolling, copper [RER]; silencer production, steel, DN 125 [CH]; silencer production, steel, DN 315, 50 mm [CH]; silicon carbide production [RER]; silicon production, electronics grade [DE]; silicon production, metallurgical grade [NO]; silicon production, multi-Si, casted [RER]; silicon production, single crystal, Czochralski process, electronics [RER]; silicon production, single crystal, Czochralski process, photovoltaics [RER]; silicon production, solar grade, modified Siemens process [RER]; silicone factory construction [RER]; silicone product production [RER]; single superphosphate production [RER]; single-Si wafer production, for electronics [RER]; single-Si wafer production, photovoltaic [RER]; slag landfill construction [CH]; soap production [RER]; soda production, solvay process [RER]; sodium amide production [RER]; sodium chlorate production, powder [RER]; sodium chloride electrolysis [RER]; sodium chloride production, brine solution [RER]; sodium chloride production, powder [RER]; sodium cumenesulphonate production [RER]; sodium cyanide production [RER]; sodium dichromate production [RER]; sodium dithionite production, anhydrous [RER]; sodium ethoxide production [RER]; sodium hydrogen sulfite production [RER]; sodium hydrosulfide production [RER]; sodium hypochlorite production, product in 15% solution state [RER]; sodium metasilicate pentahydrate production, 58% active substance, powder [RER]; sodium nitrate production [RER]; sodium nitrite production [RER]; sodium oxide production [RER]; sodium perborate production, monohydrate, powder [RER]; sodium perborate production, tetrahydrate, powder [RER]; sodium percarbonate production, powder [RER]; sodium phenolate production [RER]; sodium phosphate production [RER]; sodium silicate production, furnace liquor, product in 37% solution state [RER]; sodium silicate production, furnace process, solid product [RER]; sodium silicate production, hydrothermal liquor, product in 48% solution state [RER]; sodium silicate production, spray powder, 80% [RER]; sodium sulfate production, from natural sources [RER]; sodium sulfite production [RER]; sodium tripolyphosphate production [RER]; soft solder production, Sn97Cu3 [RER]; Sohio process [RER]; solar collector factory construction [RER]; solar collector system installation, Cu flat plate collector, multiple dwelling, hot water [CH]; solar collector system installation, Cu flat plate collector, one-family house, combined system [CH]; solar collector system installation, Cu flat plate collector, one-family house, hot water [CH]; solar collector system installation, evacuated tube collector, one-family house, combined system [CH]; solid bleached board production [RER]; solid unbleached board production [RER]; sorting and pressing of iron scrap [RER]; sour gas, burned in gas turbine [NO]; soybean production [CH]; soybean production, organic [CH]; soybean production, Swiss integrated production, intensive [CH]; soybean seed production, for sowing [CH]; soybean seed production, organic, for sowing [CH]; spiral-seam duct production, steel, DN 125 [RER]; spiral-seam duct production, steel, DN 400 [RER]; spodumene production [RER]; sputtering target production, sintered, indium tin oxide [RER]; sputtering, indium tin oxide, for liquid crystal display [RER]; steel drilling, computer numerical controlled [RER]; steel drilling, conventional [RER]; steel milling, average [RER]; steel milling, dressing [RER]; steel milling, large parts [RER]; steel milling, small parts [RER]; steel production, chromium steel 18/8, hot rolled [RER]; steel production, converter, chromium steel 18/8 [RER]; steel production, converter, low-alloyed [RER]; steel production, converter, unalloyed [RER]; steel production, electric, chromium steel 18/8 [RER]; steel production, electric, low-alloyed [RER]; steel production, low-alloyed, hot rolled [RER]; steel turning, average, computer numerical controlled [RER]; steel turning, average, conventional [RER]; steel turning, primarily dressing, computer numerical controlled [RER]; steel turning, primarily dressing, conventional [RER]; steel turning, primarily roughing, computer numerical controlled [RER]; steel turning, primarily roughing, conventional [RER]; stirling heat and power co-generation unit construction, 3kW electrical, future [CH]; stone groundwood pulp production [RER]; stone meal production [CH]; stone wool factory construction [CH]; stone wool production [CH]; stone wool production, packed [CH]; storage production, 10'000 l [RER];

storage production, 650 l mini CHP plant [CH]; strawberry production, in heated greenhouse [CH]; strawberry production, in unheated greenhouse [CH]; stretch blow moulding [RER]; stucco production [CH]; styrene production [RER]; sugar beet production [CH]; sulfite production [RER]; sulfur dichloride production [RER]; sulfur dioxide production, liquid [RER]; sulfur hexafluoride production, liquid [RER]; sulfur trioxide production [RER]; sulfuric acid production [RER]; sunflower production, Swiss integrated production, intensive [CH]; supply air inlet production, steel/SS, DN 75 [RER]; sweet gas, burned in gas turbine [NO]; synthetic gas production, from wood, at fixed bed gasifier [CH]; synthetic gas production, from wood, at fluidized bed gasifier [CH]; synthetic rubber production [RER]; technical wood drying facility construction [RER]; tert-butyl amine production [RER]; tetrafluoroethylene film production, on glass [RER]; tetrafluoroethylene production [RER]; tetrahydrofuran production [RER]; thermal plaster production, outdoor [CH]; thermoforming of plastic sheets [FR]; thermoforming, with calendering [RER]; thionyl chloride production [RER]; three layered laminated board production [RER]; tin plated chromium steel sheet production, 2 mm [RER]; tin production [RER]; tissue paper production [RER]; titanium dioxide production, chloride process [RER]; titanium dioxide production, sulfate process [RER]; titanium zinc plate production, without pre-weathering [DE]; toluene oxidation [RER]; tower silo production, plastic [CH]; train production, passenger, high speed [DE]; train production, passenger, long-distance [CH]; transmission network construction, electricity, high voltage [CH]; transmission network construction, electricity, medium voltage [CH]; transport, freight train [DE, AT, IT, BE, FR]; transport, freight train, diesel [Europe without Switzerland]; transport, freight train, electricity [Europe without Switzerland]; transport, freight, aircraft, intercontinental [RER]; transport, freight, aircraft, intracontinental [RER]; transport, freight, inland waterways, barge [RER]; transport, freight, inland waterways, barge tanker [RER]; transport, freight, light commercial vehicle [CH, Europe without Switzerland]; transport, freight, lorry 28 metric ton, vegetable oil methyl ester 100% [CH]; transport, passenger car, large size, diesel, EURO 3 [RER]; transport, passenger car, large size, diesel, EURO 4 [RER]; transport, passenger car, large size, diesel, EURO 5 [RER]; transport, passenger car, large size, natural gas, EURO 3 [RER]; transport, passenger car, large size, natural gas, EURO 4 [RER]; transport, passenger car, large size, natural gas, EURO 5 [RER]; transport, passenger car, large size, petrol, EURO 3 [RER]; transport, passenger car, large size, petrol, EURO 4 [RER]; transport, passenger car, large size, petrol, EURO 5 [RER]; transport, passenger car, medium size, diesel, EURO 3 [RER]; transport, passenger car, medium size, diesel, EURO 4 [RER]; transport, passenger car, medium size, diesel, EURO 5 [RER]; transport, passenger car, medium size, natural gas, EURO 3 [RER]; transport, passenger car, medium size, natural gas, EURO 4 [RER]; transport, passenger car, medium size, natural gas, EURO 5 [RER]; transport, passenger car, medium size, petrol, EURO 3 [RER]; transport, passenger car, medium size, petrol, EURO 4 [RER]; transport, passenger car, medium size, petrol, EURO 5 [RER]; transport, passenger car, small size, diesel, EURO 3 [RER]; transport, passenger car, small size, diesel, EURO 4 [RER]; transport, passenger car, small size, diesel, EURO 5 [RER]; transport, passenger car, small size, natural gas, EURO 3 [RER]; transport, passenger car, small size, natural gas, EURO 4 [RER]; transport, passenger car, small size, natural gas, EURO 5 [RER]; transport, passenger car, small size, petrol, EURO 3 [RER]; transport, passenger car, small size, petrol, EURO 4 [RER]; transport, passenger car, small size, petrol, EURO 5 [RER]; transport, passenger coach [CH]; transport, passenger train, high-speed [DE]; transport, passenger train, long-distance [CH]; transport, passenger train, regional [CH]; transport, passenger train, urban [CH]; transport, passenger, aircraft, intercontinental [RER]; transport, passenger, aircraft, intracontinental [RER]; transport, passenger, bicycle [CH]; transport, passenger, electric bicycle [CH]; transport, passenger, electric bicycle, label-certified electricity [CH]; transport, passenger, motor scooter [CH]; transport, pipeline, onshore, petroleum [RER]; transport, regular bus [CH]; transport, tram [CH]; transport, trolleybus [CH]; treatment of aluminium in car shredder residue, municipal incineration [CH]; treatment of aluminium in car shredder residue, municipal incineration with fly ash extraction [CH]; treatment of aluminium scrap, new, at refiner [RER]; treatment of aluminium scrap, new, at remelter [RER]; treatment of aluminium scrap, post-consumer, by collecting, sorting, cleaning, pressing [RER]; treatment of aluminium scrap, post-consumer, prepared for

recycling, at refiner [RER]; treatment of aluminium scrap, post-consumer, prepared for recycling, at remelter [RER]; treatment of ash from deinking sludge, residual material landfill [CH]; treatment of ash from paper production sludge, residual material landfill [CH]; treatment of automobile catalyst [RER]; treatment of average incineration residue, residual material landfill [CH]; treatment of basic oxygen furnace waste, residual material landfill [CH]; treatment of bilge oil, hazardous waste incineration [CH]; treatment of biowaste by anaerobic digestion [CH]; treatment of biowaste, industrial composting [CH]; treatment of biowaste, municipal incineration with fly ash extraction [CH]; treatment of blast furnace gas, in power plant [PL, DE, BE, SK, HR, ES, GB, BA, FR, EE, BG, AT, UA, IT, RO, HU, RS, NL, IE, SE, NO, FI, CZ]; treatment of coal gas, in power plant [RS, ES, UA, DE, IT, PL, BE, SK, RO, HR, SE, HU, AT, FR, BA, GB, BG, NL, FI, CZ]; treatment of coating from waste cathode ray tube display, municipal incineration with fly ash extraction [CH]; treatment of coating from waste cathode ray tube display, municipal waste incineration [CH]; treatment of condensate from light oil boiler, capacity 1.1E10l/year [CH]; treatment of conditioned spent nuclear fuel, in interim storage [CH]; treatment of copper in car shredder residue, municipal incineration [CH]; treatment of copper in car shredder residue, municipal incineration with fly ash extraction [CH]; treatment of copper scrap by electrolytic refining [RER]; treatment of decarbonising waste, residual material landfill [CH]; treatment of digester sludge, municipal incineration with fly ash extraction [CH]; treatment of digester sludge, municipal incineration, future [CH]; treatment of drilling waste, residual material landfill [CH]; treatment of dross from Al electrolysis, residual material landfill [CH]; treatment of dust, alloyed electric arc furnace steel, residual material landfill [CH]; treatment of dust, unalloyed electric arc furnace steel, residual material landfill [CH]; treatment of electronics scrap, metals recovery in copper smelter [SE]; treatment of filter dust from Al electrolysis, residual material landfill [CH]; treatment of fly ash and scrubber sludge, hazardous waste incineration [CH]; treatment of green liquor dregs, residual material landfill [CH]; treatment of H3PO4 purification residue, residual material landfill [CH]; treatment of hard coal ash, municipal incineration [CH]; treatment of hard coal ash, municipal incineration with fly ash extraction [CH]; treatment of hard coal ash, sanitary landfill [CH]; treatment of hazardous waste, hazardous waste incineration [CH]; treatment of heat carrier liquid, 40% C3H8O2, capacity 1.1E10l/year [CH]; treatment of high level radioactive waste for final repository [CH]; treatment of inert waste, sanitary landfill [CH]; treatment of lead in car shredder residue, municipal incineration [CH]; treatment of lead in car shredder residue, municipal incineration with fly ash extraction [CH]; treatment of lignite ash, municipal incineration [CH]; treatment of lignite ash, municipal incineration with fly ash extraction [CH]; treatment of lignite ash, sanitary landfill [CH]; treatment of liquid crystal display, municipal incineration with fly ash extraction [CH]; treatment of liquid crystal display, municipal waste incineration [CH]; treatment of low level radioactive waste for final repository [CH]; treatment of low level radioactive waste, in interim storage [CH]; treatment of low level radioactive waste, surface or trench deposit [CH]; treatment of metal part of electronics scrap, in blister-copper, by electrolytic refining [SE]; treatment of municipal solid waste, incineration [CH]; treatment of municipal solid waste, municipal incineration with fly ash extraction [CH]; treatment of municipal solid waste, sanitary landfill [CH]; treatment of nickel smelter slag, residual material landfill [CH]; treatment of pollutant from rail ballast, residual material landfill [CH]; treatment of poultry manure, drying, pelleting [CH]; treatment of precious metal from electronics scrap, in anode slime, precious metal extraction [SE]; treatment of rainwater mineral oil storage, in wastewater treatment plant, capacity 1.1E10l/year [CH]; treatment of raw sewage sludge, municipal incineration [CH]; treatment of raw sewage sludge, municipal incineration with fly ash extraction [CH]; treatment of redmud from bauxite digestion, residual material landfill [CH]; treatment of refinery sludge, hazardous waste incineration [CH]; treatment of refinery sludge, sanitary landfill [CH]; treatment of refractory spent pot liner from Al electrolysis, residual material landfill [CH]; treatment of residue from cooling tower, sanitary landfill [CH]; treatment of residue from mechanical treatment, cathode ray tube display, municipal incineration with fly ash extraction [CH]; treatment of residue from mechanical treatment, cathode ray tube display, municipal waste incineration [CH]; treatment of residue from mechanical treatment, desktop computer, municipal incineration with fly

ash extraction [CH]; treatment of residue from mechanical treatment, desktop computer, municipal waste incineration [CH]; treatment of residue from mechanical treatment, industrial device, municipal incineration with fly ash extraction [CH]; treatment of residue from mechanical treatment, industrial device, municipal waste incineration [CH]; treatment of residue from mechanical treatment, IT accessory, municipal incineration with fly ash extraction [CH]; treatment of residue from mechanical treatment, IT accessory, municipal waste incineration [CH]; treatment of residue from mechanical treatment, laptop computer, municipal incineration with fly ash extraction [CH]; treatment of residue from mechanical treatment, laptop computer, municipal waste incineration [CH]; treatment of residue from mechanical treatment, laser printer, municipal incineration with fly ash extraction [CH]; treatment of residue from mechanical treatment, laser printer, municipal waste incineration [CH]; treatment of residue from mechanical treatment, liquid crystal display, municipal incineration with fly ash extraction [CH]; treatment of residue from mechanical treatment, liquid crystal display, municipal waste incineration [CH]; treatment of residue from Na-dichromate production, residual material landfill [CH]; treatment of residue from shredder fraction from manual dismantling, municipal incineration with fly ash extraction [CH]; treatment of residue from shredder fraction from manual dismantling, municipal waste incineration [CH]; treatment of residue from TiO2 production, chloride process, residual material landfill [CH]; treatment of residue from TiO2 production, sulfate process, residual material landfill [CH]; treatment of salt tailing from potash mine, residual material landfill [CH]; treatment of scrap aluminium, municipal incineration [CH]; treatment of scrap aluminium, municipal incineration with fly ash extraction [CH]; treatment of scrap copper, municipal incineration [CH]; treatment of scrap copper, municipal incineration with fly ash extraction [CH]; treatment of scrap steel, municipal incineration [CH]; treatment of scrap steel, municipal incineration with fly ash extraction [CH]; treatment of scrap tin sheet, municipal incineration [CH]; treatment of scrap tin sheet, municipal incineration with fly ash extraction [CH]; treatment of scrap tin sheet, sanitary landfill [CH]; treatment of sewage sludge by anaerobic digestion [CH]; treatment of slag, unalloyed electric arc furnace steel, residual material landfill [CH]; treatment of sludge from pulp and paper production, sanitary landfill [CH]; treatment of sludge from steel rolling, residual material landfill [CH]; treatment of sludge, NaCl electrolysis Hg, residual material landfill [CH]; treatment of sludge, NaCl electrolysis, residual material landfill [CH]; treatment of sludge, pig iron production, residual material landfill [CH]; treatment of spent activated carbon, granular from hard coal, reactivation [RER]; treatment of spent anion exchange resin from potable water production, municipal incineration [CH]; treatment of spent anion exchange resin from potable water production, municipal incineration with fly ash extraction [CH]; treatment of spent antifreezer liquid, hazardous waste incineration [CH]; treatment of spent catalyst base from ethyleneoxide production, residual material landfill [CH]; treatment of spent cation exchange resin from potable water production, municipal incineration [CH]; treatment of spent cation exchange resin from potable water production, municipal incineration with fly ash extraction [CH]; treatment of spent Formox catalyst base from formaldehyde production, residual material landfill [CH]; treatment of spent nuclear fuel, conditioning [CH]; treatment of spent nuclear fuel, reprocessing [RER]; treatment of spent oxychlor catalyst for ethylene dichloride production, hazardous waste incineration [CH]; treatment of spent pot liner from Al electrolysis, carbon fraction, residual material landfill [CH]; treatment of spent sawing slurry from Si-wafer cutting [RER]; treatment of spent solvent mixture, hazardous waste incineration [CH]; treatment of steel in car shredder residue, municipal incineration [CH]; treatment of steel in car shredder residue, municipal incineration with fly ash extraction [CH]; treatment of tallow to esterquat [RER]; treatment of used capacitor, to hazardous waste incineration [CH]; treatment of used toner module, laser printer, black/white, recycling [RER]; treatment of used toner module, laser printer, colour, recycling [RER]; treatment of waste aluminium, sanitary landfill [CH]; treatment of waste asphalt, sanitary landfill [CH]; treatment of waste bitumen sheet, municipal incineration [CH]; treatment of waste bitumen sheet, municipal incineration with fly ash extraction [CH]; treatment of waste bitumen, sanitary landfill [CH]; treatment of waste brick, sorting plant [Europe without Switzerland, CH]; treatment of waste building wood, chrome preserved, municipal

incineration [CH]; treatment of waste building wood, chrome preserved, municipal incineration with fly ash extraction [CH]; treatment of waste bulk iron, excluding reinforcement, sorting plant [Europe without Switzerland, CH]; treatment of waste cement in concrete and mortar, sorting plant [Europe without Switzerland, CH]; treatment of waste cement, hydrated, residual material landfill [CH]; treatment of waste cement-fibre slab, dismantled, municipal incineration with fly ash extraction [CH]; treatment of waste cement-fibre slab, municipal incineration [CH]; treatment of waste concrete gravel, sorting plant [CH]; treatment of waste concrete, not reinforced, sorting plant [CH, Europe without Switzerland]; treatment of waste emulsion paint on wall, sorting plant [CH]; treatment of waste emulsion paint, hazardous waste incineration [CH]; treatment of waste emulsion paint, municipal incineration [CH]; treatment of waste emulsion paint, municipal incineration with fly ash extraction [CH]; treatment of waste emulsion paint, sanitary landfill [CH]; treatment of waste expanded polystyrene, municipal incineration [CH]; treatment of waste expanded polystyrene, municipal incineration with fly ash extraction [CH]; treatment of waste frit from cathode ray tube production, residual material landfill [CH]; treatment of waste glass from unsorted public collection, sorting [RER]; treatment of waste glass pane in burnable frame, sorting plant [CH]; treatment of waste glass sheet, sorting plant [Europe without Switzerland, CH]; treatment of waste glass, municipal incineration [CH]; treatment of waste glass, municipal incineration with fly ash extraction [CH]; treatment of waste graphical paper, municipal incineration [CH]; treatment of waste graphical paper, municipal incineration with fly ash extraction [CH]; treatment of waste graphical paper, sanitary landfill [CH]; treatment of waste gypsum plasterboard, sorting plant [CH]; treatment of waste gypsum, sanitary landfill [CH]; treatment of waste mineral oil, hazardous waste incineration [CH]; treatment of waste mineral plaster, sorting plant [CH]; treatment of waste mineral wool, sorting plant [CH, Europe without Switzerland]; treatment of waste newspaper, municipal incineration [CH]; treatment of waste newspaper, municipal incineration with fly ash extraction [CH]; treatment of waste newspaper, sanitary landfill [CH]; treatment of waste packaging paper, municipal incineration [CH]; treatment of waste packaging paper, municipal incineration with fly ash extraction [CH]; treatment of waste paint on metal, sorting plant [CH]; treatment of waste paint on wall, sorting plant [CH]; treatment of waste paint, hazardous waste incineration [CH]; treatment of waste paint, municipal incineration [CH]; treatment of waste paint, municipal incineration with fly ash extraction [CH]; treatment of waste paint, sanitary landfill [CH]; treatment of waste paper, unsorted, sorting [CH, Europe without Switzerland]; treatment of waste paperboard, municipal incineration [CH]; treatment of waste paperboard, municipal incineration with fly ash extraction [CH]; treatment of waste paperboard, sanitary landfill [CH]; treatment of waste paperboard, unsorted, sorting [CH]; treatment of waste plaster-cardboard sandwich, sorting plant [CH]; treatment of waste plastic plaster, sanitary landfill [CH]; treatment of waste plastic plaster, sorting plant [CH]; treatment of waste plastic, consumer electronics, municipal incineration [CH]; treatment of waste plastic, consumer electronics, municipal incineration with fly ash extraction [CH]; treatment of waste plastic, industrial electronics, municipal incineration [CH]; treatment of waste plastic, industrial electronics, municipal incineration with fly ash extraction [CH]; treatment of waste plastic, mixture, municipal incineration [CH]; treatment of waste plastic, mixture, municipal incineration with fly ash extraction [CH]; treatment of waste plastic, mixture, sanitary landfill [CH]; treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting [CH, Europe without Switzerland]; treatment of waste polyethylene terephthalate, municipal incineration [CH]; treatment of waste polyethylene terephthalate, municipal incineration with fly ash extraction [CH]; treatment of waste polyethylene terephthalate, sanitary landfill [CH]; treatment of waste polyethylene, for recycling, unsorted, sorting [CH, Europe without Switzerland]; treatment of waste polyethylene, municipal incineration [CH]; treatment of waste polyethylene, municipal incineration with fly ash extraction [CH]; treatment of waste polyethylene, sanitary landfill [CH]; treatment of waste polypropylene, municipal incineration [CH]; treatment of waste polypropylene, municipal incineration with fly ash extraction [CH]; treatment of waste polypropylene, sanitary landfill [CH]; treatment of waste polystyrene, municipal incineration [CH]; treatment of waste polystyrene, municipal

incineration with fly ash extraction [CH]; treatment of waste polystyrene, sanitary landfill [CH]; treatment of waste polyurethane seal, sorting plant [CH]; treatment of waste polyurethane, municipal incineration [CH]; treatment of waste polyurethane, municipal incineration with fly ash extraction [CH]; treatment of waste polyurethane, sanitary landfill [CH]; treatment of waste polyvinylchloride, municipal incineration [CH]; treatment of waste polyvinylchloride, municipal incineration with fly ash extraction [CH]; treatment of waste polyvinylchloride, sanitary landfill [CH]; treatment of waste polyvinylfluoride, municipal incineration [CH]; treatment of waste polyvinylfluoride, municipal incineration with fly ash extraction [CH]; treatment of waste reinforced concrete, sorting plant [Europe without Switzerland, CH]; treatment of waste reinforced plasterboard, sorting plant [CH]; treatment of waste reinforcement steel, sorting plant [CH]; treatment of waste rubber, unspecified, municipal incineration [CH]; treatment of waste rubber, unspecified, municipal incineration with fly ash extraction [CH]; treatment of waste sealing sheet, polyethylene, municipal incineration [CH]; treatment of waste sealing sheet, polyethylene, municipal incineration with fly ash extraction [CH]; treatment of waste sealing sheet, polyvinylchloride, municipal incineration [CH]; treatment of waste sealing sheet, polyvinylchloride, municipal incineration with fly ash extraction [CH]; treatment of waste textile, soiled, municipal incineration [CH]; treatment of waste textile, soiled, municipal incineration with fly ash extraction [CH]; treatment of waste vapour barrier, flame-retarded, municipal incineration [CH]; treatment of waste vapour barrier, flame-retarded, municipal incineration with fly ash extraction [CH]; treatment of waste wire plastic, municipal incineration [CH]; treatment of waste wire plastic, municipal incineration with fly ash extraction [CH]; treatment of waste wood pole, chrome preserved, municipal incineration [CH]; treatment of waste wood pole, chrome preserved, municipal incineration with fly ash extraction [CH]; treatment of waste wood, post-consumer, sorting and shredding [CH]; treatment of waste wood, untreated, municipal incineration [CH]; treatment of waste wood, untreated, municipal incineration with fly ash extraction [CH]; treatment of waste wood, untreated, sanitary landfill [CH]; treatment of waste, from silicon wafer production, inorganic, residual material landfill [CH]; treatment of wastewater from anaerobic digestion of whey, capacity 1E9l/year [CH]; treatment of wastewater from black chrome coating, capacity 1.1E10l/year [CH]; treatment of wastewater from cathode ray tube production, capacity 1.1E10l/year [CH]; treatment of wastewater from ceramic production, capacity 5E9l/year [CH]; treatment of wastewater from concrete production, capacity 5E9l/year [CH]; treatment of wastewater from glass production, capacity 1.1E10l/year [CH]; treatment of wastewater from grass refinery, capacity 5E9l/year [CH]; treatment of wastewater from liquid crystal display backlight production, capacity 1.1E10l/year [CH]; treatment of wastewater from liquid crystal display production, capacity 1.1E10l/year [CH]; treatment of wastewater from liquid crystal production, capacity 1.1E10l/year [CH]; treatment of wastewater from lorry production, capacity 4.7E10l/year [CH]; treatment of wastewater from maize starch production, capacity 1.1E10l/year [CH]; treatment of wastewater from pig iron production, capacity 5E9l/year [CH]; treatment of wastewater from plywood production, capacity 5E9l/year [CH]; treatment of wastewater from potato starch production, capacity 1.1E10l/year [CH]; treatment of wastewater from PV cell production, capacity 5E9l/year [CH]; treatment of wastewater from soft fibreboard production, capacity 5E9l/year [CH]; treatment of wastewater from tube collector production, capacity 1.1E10l/year [CH]; treatment of wastewater from wafer fabrication, capacity 1.1E10l/year [CH]; treatment of wastewater, average, capacity 1.1E10l/year [CH]; treatment of wastewater, average, capacity 1.6E8l/year [CH]; treatment of wastewater, average, capacity 1E9l/year [CH]; treatment of wastewater, average, capacity 4.7E10l/year [CH]; treatment of wastewater, average, capacity 5E9l/year [CH]; treatment of wastewater, from residence, capacity 1.1E10l/year [CH]; treatment of wastewater, unpolluted, capacity 5E9l/year [CH]; treatment of wastewater, unpolluted, from residence, capacity 1.1E10l/year [CH]; treatment of wood ash mixture, pure, municipal incineration [CH]; treatment of wood ash mixture, pure, municipal incineration with fly ash extraction [CH]; treatment of wood ash mixture, pure, sanitary landfill [CH]; treatment of zinc in car shredder residue, municipal incineration [CH]; treatment of zinc in car shredder residue, municipal incineration with fly

ash extraction [CH]; treatment, sludge from pulp and paper production, landfarming [CA-QC]; tree seedling production, in heated greenhouse [RER]; tree seedling production, in unheated greenhouse [RER]; trellis system construction, wooden poles, soft wood, tar impregnated [CH]; triazine-compound production, unspecified [RER]; trichloroacetic acid production [RER]; trichloroethylene production [RER]; trichloromethane production [RER]; triethyl amine production [RER]; trifluoroacetic acid production [RER]; trimethylamine production [RER]; triple superphosphate production [RER]; tube insulation production, elastomere [DE]; urea ammonium nitrate production [RER]; urea formaldehyde foam production, in situ foaming [CH]; urea formaldehyde foam slab production, hard [CH]; urea formaldehyde resin production [RER]; urea production, as N [RER]; ventilation components factory construction [RER]; ventilation control and wiring production, central unit [RER]; ventilation control and wiring production, decentralized unit [RER]; ventilation duct production, connection piece, steel, 100x50 mm [RER]; ventilation duct production, elbow 90°, steel, 100x50 mm [RER]; ventilation duct production, steel, 100x50 mm [RER]; ventilation of dwellings, central, 1 x 720 m3/h, polyethylene ducts, with earth tube heat exchanger [CH]; ventilation of dwellings, central, 1 x 720 m3/h, steel ducts, with earth tube heat exchanger [CH]; ventilation of dwellings, decentralized, 6 x 120 m3/h, polyethylene ducts [CH]; ventilation of dwellings, decentralized, 6 x 120 m3/h, polyethylene ducts, with earth tube heat exchanger [CH]; ventilation of dwellings, decentralized, 6 x 120 m3/h, steel ducts [CH]; ventilation of dwellings, decentralized, 6 x 120 m3/h, steel ducts, with earth tube heat exchanger [CH]; ventilation system production, central, 1 x 720 m3/h, polyethylene ducts, with earth tube heat exchanger [CH]; ventilation system production, central, 1 x 720 m3/h, steel ducts, with earth tube heat exchanger [CH]; ventilation system production, decentralized, 6 x 120 m3/h, polyethylene ducts, with earth tube heat exchanger [CH]; ventilation system production, decentralized, 6 x 120 m3/h, steel ducts, with earth tube heat exchanger [CH]; vinyl acetate production [RER]; wafer factory construction [DE]; waste collection lorry production, 21 metric ton [CH]; waste paper sorting facility construction [RER]; waste preparation facility construction [CH]; wastewater treatment facility construction, capacity 1.1E10l/year [CH]; wastewater treatment facility construction, capacity 1.6E8l/year [CH]; wastewater treatment facility construction, capacity 1E9l/year [CH]; wastewater treatment facility construction, capacity 4.7E10l/year [CH]; wastewater treatment facility construction, capacity 5E9l/year [CH]; water supply network construction [CH]; wheat grain, feed production, organic [CH]; wheat grain, feed production, Swiss integrated production [CH]; wheat seed production, organic, for sowing [CH]; wheat seed production, Swiss integrated production, for sowing [CH]; white spirit production [RER]; willow production, short rotation coppice [DE]; window frame production, aluminium, U=1.6 W/m2K [RER]; window frame production, poly vinyl chloride, U=1.6 W/m2K [RER]; window frame production, wood, U=1.5 W/m2K [RER]; window frame production, wood-metal, U=1.6 W/m2K [RER]; wire drawing, copper [RER]; wire drawing, steel [RER]; wood pellet factory production [RER]; wood pellet production [RER]; wood pellets, burned in stirling heat and power co-generation unit, 3kW electrical, future [CH]; wood preservative production, creosote [RER]; wood wool boards production, cement bonded [RER]; wood wool production [RER]; wooden board factory construction, cement bonded boards [RER]; wooden board factory construction, organic bonded boards [RER]; zeolite production, powder [RER]; zeolite production, slurry, without water, in 50% solution state [RER]; zinc monosulfate production [RER]; zinc oxide production [RER]; zinc sulfide production [RER]