ESU-services

fair consulting in sustainability

Life cycle inventory databases used for our consultancy projects

Supplementary information for tenders

ESU-services Ltd.
Vorstadt 10
CH-8200 Schaffhausen

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Commercial registry by the canton of Schaffhausen: CHE-112.959.660
VAT number Switzerland: 649 962

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Niels Jungbluth Dr. sc. Techn. Dipl. Ing. TU   CEO   www.esu-services.ch
ESU-services GmbH   Vorstadt 10   CH-8200 Schaffhausen
T +41 44 940 61 32   jungbluth@esu-services.ch

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About us	ESU-services Ltd. was founded in 1998. Its core objectives are research, consulting, review, and training in the fields of life cycle assessment (LCA), carbon footprints, water footprint in all sectors including e.g. energy, civil engineering, basic minerals, chemicals, packaging, telecommunication, food and lifestyles. Fairness, independence, and transparency are substantial characteristics of our consulting philosophy. We work in an issue-related manner and carry out our analyses without prejudice. We document our studies and work transparently and comprehensibly. We offer fair and competent consultation, which makes it possible for the clients to monitor and continuously improve their environmental performance. The company has worked for various national and international companies, associations, and authorities. In some areas, team members of ESU-services performed pioneering work such as development and operation of web based LCA databases or quantifying environmental impacts of food and lifestyles.
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Contents

1 Introduction

Reliable and transparent inventory data are the backbone of every good life cycle assessment (LCA). In this document we provide more information about the databases we use for our consulting projects or provide for our SimaPro customers.

ESU-services Ltd. is specialized in compiling high quality life cycle inventories with a fully transparent documentation. About 1000 out of 4100 unit process datasets available in the ecoinvent database v2.2 (status in 2010) were provided by ESU-services. We complied a range of additional and updated datasets which can be downloaded free of charge. The ESU-services database includes thousands of life cycle inventories (LCI) in the EcoSpold or SimaPro format, which can be purchased on demand. The data can be imported to common LCA software such as Gabi, openLCA, SimaPro, etc. If desired, we can collect and analyse detailed LCI-data for your studies. Several formats can be used for the import and export of such data. More detailed information about the contents and prices of datasets for sale can be in this document.

2 LCI background data

2.1 Overview

Since 2010 different updates and versions of the former ecoinvent v2.2 data have been developed. Fig. 2.1 provides an overview on the developments. They are further described in the following sub-chapters. The IFS database, which should combine ecoinvent v3.x data and the developments financed by Swiss authorities is presently under development.
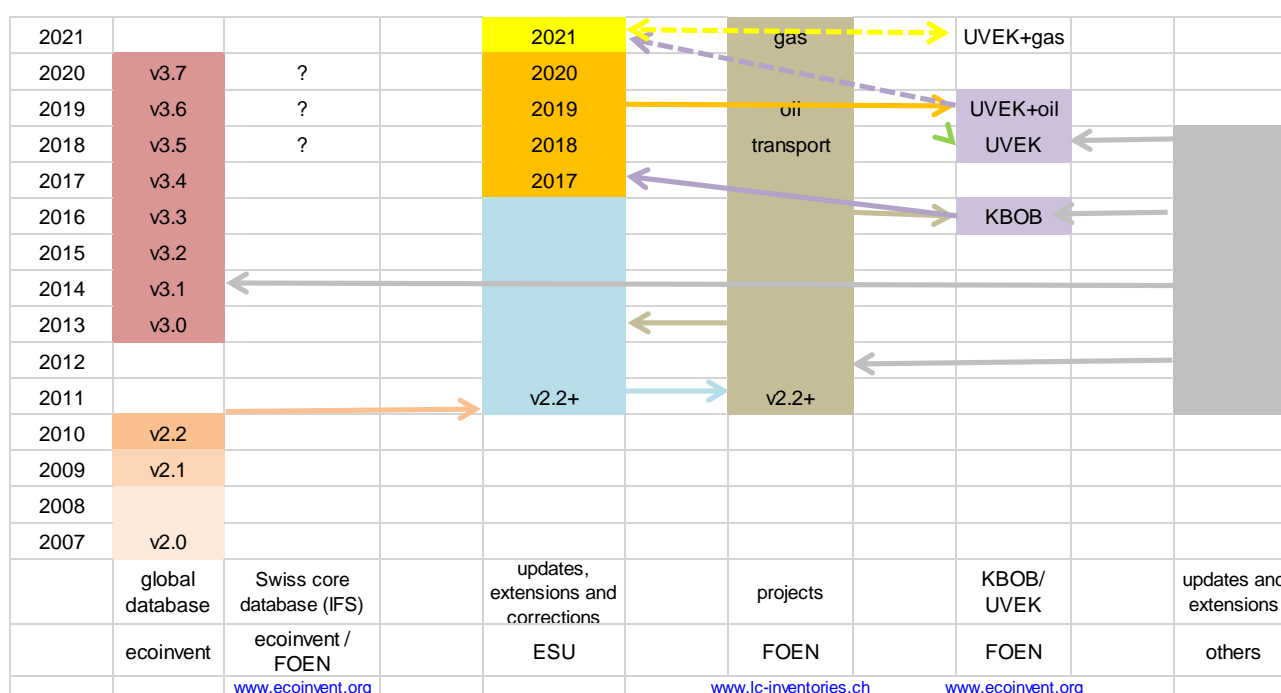
	global database	Swiss core database (IFS)		updates, extensions and corrections		projects		KBOB/ UVEK		updates and extensions
2021				2021		gas		UVEK+gas		
2020	v3.7	?		2020						
2019	v3.6	?		2019		oil		UVEK+oil		
2018	v3.5	?		2018		transport		UVEK		
2017	v3.4			2017						
2016	v3.3							KBOB		
2015	v3.2									
2014	v3.1									
2013	v3.0									
2012										
2011				v2.2+		v2.2+				
2010	v2.2									
2009	v2.1									
2008										
2007	v2.0									
	global database	Swiss core database (IFS)		updates, extensions and corrections		projects		KBOB/ UVEK		updates and extensions
	ecoinvent	ecoinvent / FOEN		ESU		FOEN		FOEN		others
		www.ecoinvent.org				www.lc-inventories.ch		www.ecoinvent.org		

Fig. 2.1   Overview of Swiss database developments since 2007

2.2 ESU database (2024)

Price: €850 for SimaPro library with unit processes

The ESU database (ESU-services 2024a) is based on the UVEK LCI Data 2018 (UVEK 2018). An update of LCI data for crude oil, natural gas and mineral oil products was integrated in this database

version (Bussa et al. 2023; Jungbluth et al. 2018a; Jungbluth et al. 2018b; Jungbluth & Meili 2018; Meili et al. 2023a, b). Further LCI datasets have been added e.g. on the provision of tap water in several countries (Meili et al. 2023c), updates on aluminium production (European Aluminium Association 2018) or new LCI data published by Plastics Europe (PlasticsEurope 2016). Many other data were corrected or slightly updated. There are more than 5000 datasets in this database. The ESU database contains several hundred new and about 1000 updated datasets (Tab. 2.1) compared to v2.2.

ESU-services charges a few for integration of the several updates available but is not the sole owner of all LCI available in this version. The prerequisites for using these datasets are an installation of the SimaPro software combined with a valid ecoinvent licence for v2.2. The data can be provided as a SimaPro database or in a CSV file that can be used as a new library instead of the existing "ecoinvent unit processes" library in SimaPro. It is not necessary to have a valid version of one of the databases provided by the FOEN (KBOB et al. 2022; UVEK 2018).

Tab. 2.1 Overview of corrections, updates and extensions imported into the ESU database

Changed: 1106	New: 475	Dataset	ESU database UVEK18	Error corrected
1		basalt, at mine/RER	OK	Fehler bei Berechnung der Gesamt-PM-Emissionen, Fehler bei Berechnung des Land Use
3		anaerobic digestion plant, biowaste; anaerobic digestion plant, agriculture und anaerobic digestion plant covered, agriculture	OK	Ersterer wurde mit Daten aus der Biogasanlage Wauwil (expo) ergänzt. Neue Daten für Landverbrauch, Beton und Stahl, restliche Daten sind gleich wie v2.2. Letzterer wurde mit "uncovered" harmonisiert, da davon ausgegangen wird, dass covered = uncovered & Folie. Zum Teil wurden die Werte neu gerechnet, zum Teil wurden die nachgefragten Materialien harmonisiert.
2		Irrigating/US and /CH	OK	Country specific water flows implmented
	18	Photovoltaics, Rockwool, Flexcell, flumroc	OK	Import LC-inventories
	42	Flooring Daten, Klingler, Umweltchemie	OK	Import LC-inventories, 42, viele DS Namen Änderungen
1		Bailing	OK	Added disposal of silage foil
1		Poultry manure, dried, at regional storehouse/CH U	OK	Added Nitrogen as a biotic resource input
57		wood cogen, furnaces	OK	Replace wood ash to landfarming to municipal incineration. Landfarming is not allowed for these plants
1		Process-specific burdens, municipal waste incineration/CH U	OK	Update Dioxin Emission gemäss Dinkel 2012 auf 0.0006 ug/kg
1		naphtha, APME mix, at refinery/kg/RER	OK	Links replaced with Naphtha, at refinery/kg/RER U
4		Datasets "heat, 10kW and 100kW non-modulating/CH U"	OK	Outdated technology. Links replaced with "light fuel oil, average/CH U"
5		waste management infrastructure	OK	Replacement of 10kW heatings with 100kW
3		at mine, datasets	OK	Replacement of 10kW heatings with 100kW
6	20	tap water	OK	Replaced and deleted the outdated datasets from v2.2 and KBOB 2016 with new LCI by ESU
1		Epichlorohydrin, from hypochlorination of allyl chloride, at plant/RER U	OK	Water consumption reduced by factor 1000
1		iron ore, 46% Fe, at mine/GLO	OK	Particles reduced by factor 10 according to Email by World Steel, project trade for BAFU
57	1	agricultural products updated emission factors	OK	Added impacts of peat and land transformation, corrected land use categories
1		Peat, at mine/NORDEL	OK	Update inventory
1		carbon black	OK	Crude oil input updated crude oil, import mix, at long distance transport/kg/RER U
12	10	rare earth metals update and Ruthenium	OK	Update with 674 Project data with new price allocation and additional by-products
1		electricity mix, DE	OK	Update 2019
1		natural gas mix, DE	OK	Update 2019
7		Natural gas, low pressure/ CH	OK	Input RER instead of CH for all RER datasets. RER DS linked to CH Input
2		tap water, at user CH/RER	OK	link to new nomenclature of data
	1	activated carbon	OK	new dataset
2		solid manure spreading	OK	nitrogen ressource added
1		crude coconut oil PH	OK	electricity mix adapted
	4	electricity PH	OK	imported
	1	operation barge	OK	old data imported
	1	disposal flumroc	OK	imported
	4	electricity, parameterized	OK	imported
1		methanol	OK	gas inputs corrected
	6	passenger car /DE	OK	rough assumption with fuel use
35		data biogas project 320	OK	Updated prices for allocation
1		vegetable oil, from waste cooking oil	OK	glyzerine changed also to waste input
16		operation datasets for transport	OK	import old KBOB datasets
1		zinc, primary, at regional storage	OK	zinc emissions to air updated
4	12	electricity mixes, renewable RER and DE	OK	Newly modelled
2		biogas, production mix CH/RER	OK	Update of input mix for 2018
1	36	crude coconut oil, at plant/PH	OK	Import of 36 datasets from WFLDB and replace the old dataset with "Coconut oil, at oil mill (WFLDB 3.1)/GLO" also relinking former links. Delete the original dataset.
1		Lithium carbonate, at plant/GLO	OK	Input natural gas/JP relinked to GLO dataset
	1	aluminium chloride	OK	Modelled with own data
6	7	Several plastics data	OK	Import of PlasticsEurope data later than 2012 as system process with own assumptions on waste disposal. Implementation of emission factor for methane harmonized with new oil and gas data.
225	125	Photovoltaics Update 2020 by Treeze	OK	Import of new and replaced LCI data for the PV
6		fuel oil, burned in heating	OK	fuel oil, burned in heating, LHV korrgiert
1	9	electricity and tap water VN	OK	extrapolation
65	8	electricity mixes	OK	Update with reference year 2021
10	8	aluminium production	OK	Update with reference year 2018
0	21	tap water DE, water pipes and other materials for water supply	OK	Update with data from DE
0	2	polyoxymethylene, copolymer, at plant	OK	New data
40	0	refinery products, water balance	OK	correction
2	0	discharge, oil production effluents	OK	update
350	75	crude oil and natural gas	OK	Update with reference year 2021, Additional crude oil and natural gas long-distance transports and markets
68	0	electricity mixes in several countries	OK	ESU update with reference year 2022
80	32	coal and fossil fuels update by ZHAW	OK	Update and new datasets published 2023, KBOB 22
1		hard coal, at mine/IN	OK	Uncertainty bug corrected. Lognormal instead of Normal
14	4	earthProbe_PV-Mixes_corrections	OK	photovoltaics updates KBOB 22
		Rename "inert material landfill" to "construction waste landfill" and import some updated datasets	OK	KBOB 22
	5	scrap and furnaces	OK	KBOB 22
	22	gas heatings	OK	KBOB 22
4		gas using processes e.g. CHP	OK	gas input (CH and RER) aligned with the regional code of the dataset, e.g. CHP with natural gas RER input was CH

2.1 KBOB-recommendation 2009/1:2022

Download: The database for SimaPro can be requested from Treeze.

The KBOB-recommendation (KBOB et al. 2022) is based on ecoinvent data v2.2 and methodology (ecoinvent Centre 2010; Frischknecht et al. 2007).

A full documentation of all changes vs. UVEK 2018 is not yet available. Another update is announced for 2023.

New and updated datasets included in this version are:

* natural gas: supply mix, LPG, production RU, distribution network, combined heat and power plants
* photovoltaic: silicon production, wafer thickness, CdTe technology, efficiencies of modules, disposal
* nuclear energy: haulage and processing of uranium, fuel supply chain, operation of nuclear plants
* hydropower: run-of-river, reservoir, small hydropower plants or pumping storage
* electricity: production (Europe and other countries), ENTSO-E mix, Swiss electricity mix, losses and distribution, infrastructure
* municipal waste incineration: update of existing datasets
* aluminium: update of the supply chain of primary and secondary aluminium production, update of aluminium mixes
* refinery products: crude oil mix of Swiss and European refineries, refinery products at regional storage in Switzerland

Since then, the life cycle inventories of individual building materials, technical building elements, energy systems, transport systems and waste disposal have been updated or added.

ESU offers a version of the database including the project which can be imported to the own SimaPro database as a library and thus used together with other existing databases.

2.2 ecoinvent v3.9 (2022)

The database is available with SimaPro.

In the past decade, ecoinvent has established itself as a global leader in creating the most transparent life cycle inventory databases. The ecoinvent database helps companies manufacture products that are less impactful on the natural environment, policy makers implement new policies, and consumers adopt more environmentally friendly behaviour (ecoinvent Centre 2023).

2.3 Industry data 2.0

This library was last updated in March 2023 and contains data collected by these industry associations: Plastics Europe, World Steel, Alliance for Beverage Cartons and the Environment (ACE), ERASM and International Molybdenum Association (IMOA).

This release includes newly added associations/datasets and - ACE - Liquid packaging board production (published 2020). The Worldsteel (published 2022) dataset was updated.

Year of last release: Plastics Europe – 2020, IMOA – 2020, ERASM – 2018.

2.4 Environmental Footprint database 3.1 (2020)

Price   Starts at €4750
Download: www.simapro.com/products/environmental-footprint-database/
Webinar: https://support.simapro.com/articles/Video/Recorded-Webinar-EF2-Database-in-SimaPro

The Environmental Footprint (EF) database (ELCD 2020) is designed to support the use of product environmental footprint (PEF) category rules (PEFCR) and organisation environmental footprint (OEF) sector rules (OEFSR). It is also applied for the Product Environmental Profile (PEP). It contains secondary EF-compliant life cycle inventory datasets and a compatible EF impact assessment method.

The Environmental Footprint database is part of the [European Commission's Single Market for Green Products Initiative](). The EF Database 2.0 contains:

- EF- and ILCD-compliant datasets (using EF package 2.0),
- EF impact assessment method 2.0,
- Default parameters to use with the Circular Footprint Formula (CFF), from Annex C of Guidance v6.3. They are implemented as database parameters in SimaPro and facilitate modelling of the CFF.

The EF Database 2.0 includes around 3200 datasets in the following categories:

- Agrofood
- Chemicals
- Chemicals for paint
- Cooling and freezing transport
- Electronics
- End of life
- Energy and transport
- Feed
- Glass recycling
- Incineration
- Metals
- Others
- Packaging
- Plastics

Unfortunately, the situation for using the EF Database outside the scope of the PEF/OEF is complicated. Each data provider has their own method of handling this or even allowing it at all. Therefore, prices and purchasing procedures depend on which data you want to use.

Energy and transport, Cooling and freezing transport, End of Life, Packaging, Metals, Incineration, Plastics, Electronics = €4,750 per seat. A core package of Energy and transport, Cooling and freezing transport, End of Life, Packaging, Incineration cost €2,250 per seat.

Agrofood, Others, Chemicals are free for SimaPro users with a valid service contract, if they also have the core package (otherwise this should be purchased). In addition, permission is required from the respective data providers and a EULA has to be signed.

Chemicals for Paint and Feed have not yet been made available for use outside the scope of the PEF.

Furthermore, part of the data lacks transparency. Sometimes missing data are recorded with dummy processes which leads to incomplete models.

We can help you order these data for your case studies. However, for the aforementioned reasons, ESU-services does not recommend buying or using this data unless absolutely necessary, e.g. because of participation in PEF pilots.

2.5   UVEK LCI Data 2018

Download: Download: The database for SimaPro can be downloaded after Login previous versions (ecoinvent version 1+2) on www.ecoinvent.org. in the section for ecoinvent v2.2 data. After login go to /files. It is not necessary to accept the EULA for ecoinvent v3.

This database is based on ecoinvent v2.2. Adaptations, updates and documentation available from www.lc-inventories.ch are incorporated in the database UVEK LCI Data 2018 (UVEK 2018). About 5147 datasets are included in this database.

New and updated datasets included in the UVEK LCI Data 2018 database are

- natural gas: supply mix, LPG, production RU, distribution network, combined heat and power plants
- photovoltaic: silicon production, wafer thickness, CdTe technology, efficiencies of modules, disposal
- nuclear energy: haulage and processing of uranium, fuel supply chain, operation of nuclear plants
- hydropower: run of river, reservoir, small hydropower plants, pumping storage
- electricity: production (Europe and other countries), ENTSO-E mix, Swiss electricity mix, losses and distribution, infrastructure
- municipal waste incineration: update of existing datasets
- aluminum: update of the supply chain of primary and secondary aluminum production, update of aluminum mixes
- refinery products: crude oil mix of Swiss and European refineries, refinery products at regional storage in Switzerland
- wood products: update of the supply chain of most wood products (based on ecoinvent data v3, implemented by Frank Werner)
- transport services: road, rail, water, air transport (based on mobitool v2.0)

Errors identified in ecoinvent v2.2 have been corrected.

2.6   Public LCI (2010-today)

Free download: https://esu-services.ch/data/public-lci-reports/

ESU-services and other companies provide life cycle assessment (LCA) reports and life cycle inventory (LCI) datasets.

All LCI data are compiled according to the ecoinvent v2.2 guidelines. The data were developed in various publicly or privately funded projects (e.g. Flury & Frischknecht 2012; Itten et al. 2012; Jungbluth et al. 2012; Schori et al. 2012). With these data, ecoinvent v2.2 can be updated and extended (ESU-services 2024b).

The data are provided in EcoSpold v1 format. This format can be imported to different LCA software. The Swiss Federal Office for the Environment supported the setting up and maintenance of this webpage.

2.7   ecoinvent v2.2 (until 2010)

This database is outdated and can be provided on request.

The first version of the ecoinvent data was released in 2003. The international ecoinvent database is the world leading life cycle inventory data source with more than 2,500 users in more than 40 countries (status 2010). Ecoinvent data are used in Life Cycle Assessment (LCA), Environmental

Product Declaration (EPD), Carbon footprinting (CF), Integrated Product Policy (IPP), Life Cycle Management (LCM), Design for Environment (DfE), ecolabelling and other applications.

The ecoinvent data include 4,161 life cycle inventory datasets for energy systems (electricity, oil, coal, natural gas, biomass, biofuels, bioenergy, hydro power, nuclear power, photovoltaics, wind power, biogas), materials (chemicals, metals, minerals, plastics, paper, biomass, biomaterials), waste management (incineration, landfill, waste water treatment), transport (road, rail, air, ship), agricultural products and processes, electronics, metals processing, and building ventilation.

The team at ESU-services managed and led the conception and creation of the database system for ten years until March 2008. This included the initial development and the introduction of Version 1.0, followed by expansion and updates, culminating in the release of version 2.2 (ecoinvent Centre 2010). The Swiss TS Technical Services AG certified the validation of ecoinvent data v2. Swiss TS approved that the working processes are reliable, the data are correct, and the database operation is secure and reliable. ESU-services compiled around 900 of the 4,100 ecoinvent data v2.2 life cycle inventory datasets. With this contribution, ESU-services Ltd. became the largest privately-owned partner providing data to the ecoinvent Centre.

3 Data on food production and consumption

There are various background databases available for our projects and our customers, with a total of about 10,000 data records in the food category. ESU-services can thus draw on the world's most comprehensive life cycle assessment data collection for the food sector. The available databases are described below.

3.1 ESU World Food LCA Database (1996-today)

Prices: €1900 for SimaPro library with system processes
        €7500 for SimaPro library with unit processes (including the ESU database)

The ESU World Food LCA database includes more than 2500 transparent life cycle inventories (LCI) related to agriculture, food processing and consumption activities (ESU-services 2024c). The data are fully documented in the electronic EcoSpold v1 format. More than 200 customers already rely on data from this database. The following features distinguish this database from others:

- Complete and consistent balancing of all food products relevant to the Swiss market
- Background data recommended by Swiss Federal Authorities
- The whole chain from field to mouth is covered for many products
- All data include information on food waste and water use
- Parameterization for key processes to allow easy adaptation
- All unit process datasets include also flow specific uncertainty information for Monte-Carlo simulations
- Proper electronic documentation for all inputs, outputs and general information in EcoSpold v1 format, many reports freely available on our webpage
- Ongoing development and updates

The food production and consumption inventories developed at ESU-services were initially based on a Ph.D. thesis investigating purchases of meat and vegetables (Jungbluth et al. 2000; Jungbluth 2000). The inventories have been continuously updated and extended since then and are representative for today's agricultural practice. Additional data have been collected in several consulting projects (e.g. Annaheim et al. 2019; Annaheim & Jungbluth 2019; Buchspies et al. 2011; Büsser et al. 2008; Büsser & Jungbluth 2008a, b, 2009a, b, c, d, e; Classen & Jungbluth 2002;

Doublet & Jungbluth 2013; Doublet et al. 2013a, b; Eggenberger & Jungbluth 2015a, b; Eggenberger et al. 2016; Flury & Jungbluth 2012; Flury et al. 2013a; Flury & Jungbluth 2013; Flury et al. 2013b; Jungbluth 1997; Jungbluth et al. 2001; Jungbluth & Faist Emmenegger 2005; Jungbluth et al. 2007; Jungbluth et al. 2012-2018; Jungbluth et al. 2013a; Jungbluth et al. 2013b; Jungbluth & König 2014; Jungbluth et al. 2014; Jungbluth et al. 2015; Jungbluth & Eggenberger 2015; Jungbluth et al. 2016a; Jungbluth et al. 2016b; Jungbluth et al. 2016c; Jungbluth et al. 2016d; Jungbluth et al. 2016e; Jungbluth et al. 2018c; Jungbluth & Eberhart 2020; Keller et al. 2016; Leuenberger & Jungbluth 2009; Meier et al. 2015; Stucki et al. 2012).

Most data are valid for Switzerland and are based on literature, while some are also based on direct information provided by producers and food industry.

Pesticide emissions are fully covered in the datasets of agricultural production. Data for feed production include imports to Switzerland. The methodology for agricultural emissions has been simplified compared to ecoinvent data. Constant emission factors for nitrate, N_2O, etc. are applied based on fertilizer use. Agricultural datasets include the detailed list of pesticides applied, where information is available. All agricultural datasets also include emissions from peat use and decomposition (Annaheim & Jungbluth 2019). Water use and consumption are included in the database with separate flows for each country and thus allows the use of regionalized impact assessment methodsFlury et al. 2012b; Flury & Jungbluth 2012. Since 2012, information about food waste resulting from the full life cycle of products has also been included in our datasets using a systematic approach (Flury et al. 2012a). Compared to the ecoinvent methodology v2.0, we have introduced more simplifications in general, but there are no major differences in methodological choices. The full database has been modelled using an attributional approach.

The database covers, among others, the following areas of interest:

- Agricultural production services: application of fertilizers, machinery hours
- Vegetable production: spinach, salad, tomatoes, lettuce, potatoes, onions, asparagus, etc.
- Fruits: apples, strawberries, cherries, grapes, oranges, bananas, vine, melons
- Animal products: pork, veal, beef, lamb, poultry, eggs
- Fish: codfish, herring, mackerel, salmon, shrimps, etc.
- Dairy products: butter, milk, milk powder, yoghurt, cheese
- Meat and dairy alternatives: tofu, falafel, quorn, soy vegetarian mince, vegetable drinks and creams, beyond meat burger, planted chicken, processed fish and meat alternatives, etc.
- Staple food: noodles, pasta, bread, wheat flour
- Drinks: apple & orange juice, mineral water, tap water, beer, wine, milk, coffee, tea, vegan milk drinks
- Sweets: chocolate, ice cream, cakes, bars
- Food processing and preservation (washing, blanching, chilling, freezing, canned food, extrusion, etc.)
- Meals: roast dinner, lasagne, soups, canteen meals, recipes
- Household appliances: cooking stoves and ovens, microwaves, refrigerators, carbonization devices, coffee machines
- Distribution in supermarkets for many products including packaging, storage etc. until the point of sale.
- Food consumption: packages, transports, cooking, consumption patterns
- Pet animals and feed: horses, dogs, cats, rabbits, birds, pet fish

The data can be bought as unit or system processes. Most unit processes are linked to the ESU database (see chapter 2.2) as a background database. Single datasets are linked to ecoinvent v3.x data or other databases on food products described in this chapter.

Environmental intensity data are also sold (e.g. carbon footprint (CO_2-eq per kg).

If desired, we can collect and analyse detailed LCI-data for your studies and can provide them in several data formats. Further information can be found on https://esu-services.ch/data/fooddata/

3.2 Agri-Footprint LCA food database (v6.3, 2023)

The database is available with SimaPro.

In 2009 Blonk Consultants started developing the Agri-footprint® LCA Food database to improve the transparency of information and facilitate faster transition to sustainable food supply chains. It covers data on agricultural products: feed, food, and biomass. Agri-footprint® contains more than 4,800 products and processes (Blonk Agri-footprint BV 2022).

Agri-footprint includes unit process inventories for crop cultivation, crop processing, animal production systems and processing of animal products for life cycle impact assessments.

Agri-footprint is available in three different libraries within SimaPro, based on mass, energy or economic allocation (the later used as default by ESU-services).

Agri-footprint uses several processes from ecoinvent v3.8 as background data.

For crop cultivation and crop processing, the economic value of the products is based on Vellinga et al. (2013), see appendix B of the data description report (Blonk Agri-footprint BV 2022). For the other products, the references to the economic value are given in the data description report (Blonk Agri-footprint BV 2022) per project.

Fossil CO_2 emissions resulting from direct land use change (dLUC) are estimated using the "Direct Land Use Change Assessment Tool (Version 2021)" (See: https://blonksustainability.nl/tools/LUC-impact). This tool provides a predefined way of calculating greenhouse gas emissions from dLUC based on FAO statistics and IPCC calculation rules, following the PAS 2050-1 methodology (BSI, 2012).

References:

Blonk Agri-footprint BV. (2022). Agri-Footprint - Part 1 - Methodology and basic principles. Gouda, the Netherlands.

Blonk Agri-footprint BV. (2022). Agri-Footprint - Part 2 - Description of data. Gouda, the Netherlands.

BSI. (2012). PAS 2050-1: 2012 Assessment of life cycle greenhouse gas emissions from horticultural products. BSI.

Vellinga, T. V., Blonk, H., Marinussen, M., Zeist, W. J. Van, Boer, I. J. M. De, & Starmans, D. (2013). Methodology used in feedprint: a tool quantifying greenhouse gas emissions of feed production and utilization.

3.3 Agribalyse database (v3.1., 2023)

The database is available for SimaPro. Download under
https://simapro.com/products/agribalyse-agricultural-database/.

This database has been produced as part of AGRIBALYSE program lead by ADEME and INRAE since 2009. It contains agricultural and food products produced and/or consumed in France. It follows CIQUAL nomenclature, the French nutritional database.

The new version 3.1, comprises of LCIs for 2500 agricultural and food products produced and/or consumed in France, combining a production-based approach and a consumption-based approach. It provides a homogenous and consensual LCI database to support environmental labelling policies and to help the agricultural sector improve its practices.

However, many of these data sets are proxies (e.g. for rarer agricultural products) or differently labelled copies of one and the same process (e.g. mineral water in 336 variants with the same result in each case. In addition, older background data (approx. 1800 DS) from ecoinvent, WFLDB, etc. are used. The actual differentiation is therefore much smaller than the large number of data sets would suggest.

AGRIBALYSE v3.1 is built upon previous work and datasets, in particular AGRIBALYSE v1.3 and v1.4 (French agricultural products); ACYVIA (food transformation), Ecoinvent v3.5 (imported products + "non food" datasets) and WFLDB v3.1 (imported products).

Methodology principles follow the key international guidelines as much as possible (ISO, LEAP, PEF). The database mainly contains LCIs for average French products, the functional unit is the product mass (kg) and the scope is cradle-to–farm-gate. The datasets are accompanied by a detailed methodology report (Koch et al. 2015).

All details and documentation available on www.agribalyse.fr. You can download the database in SimaPro 9 format after agreeing to the terms and conditions.

3.4 Quantis/Agroscope World Food database (WFLDB)

There are different versions freely accessible for SimaPro users.

The Quantis World Food LCA Database (WFLDB) is a comprehensive international life cycle inventory database and a global initiative led by Quantis in partnership with leaders in the agri-food sector. WFLDB was launched in 2012 in response to the growing need for reliable, transparent, and coherent environmental data and a consistent methodology for assessing the impacts of agri-food products. The datasets reflect country average practices and are now exclusively available for SimaPro users.

WFLDB contains 2300+ datasets for 120 products in 56 countries, but no specific data for Switzerland. From fertilizers to fruits and from coffee to cocoa, data for the whole production chain are available.

Since ecoinvent version v3.4, several hundred datasets developed for the World Food LCA Database by Agroscope and Quantis (Nemecek et al. 2015) are part of the normal ecoinvent data. For version v3.5, many other foods, e.g. fish, were balanced at the producer level. Almost 1300 data sets related to nutrition are available for the calculations in our projects. They are part of the ecoinvent data v3.x.

The following versions of WFLDB data are available for SimaPro users. Due to different versions and background data, calculation results can differ considerably, and some errors have been identified by ESU. Thus, it is recommended to check the results before applying in LCA case studies:

- WFLDB v3.1, linked to UVEK plus oil updates (UVEK/WFLDB) provided by FOEN. Can be requested at the FOEN. A link to the ESU database as a background database is also possible.
- WFLDB 2020 (phase 2+3), linked to ecoinvent v3.5 (available as a stand-alone library for SimaPro users[1]), linking to UVEK or ecoinvent v3.6 only possible with extra efforts). Some errors in background data have a relevant influence on the results in this version.

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[1]   https://simapro.com/products/quantis-world-food-lca-database/

- WFLDB v3.1 partly integrated in ecoinvent data v3.x (directly provided to all SimaPro users with a ecoinvent licence)
- Single datasets from WFLDB (v.?) integrated in Agrybalyse v3.0. linked to Ecoinvent v3.5 (available for SimaPro users with Agrybalyse library)

4 Input-Output Data

Environmental-extended input-output-data investigate environmental impacts of economies in relation to monetary spending for products from different sectors.

4.1 Swiss environmental extended input-output analysis (2011)

The database is available with SimaPro.

Environmental impacts of a country can be analysed from the production or the consumption perspective. The production perspective analyses environmental impacts within the national boundaries. The consumption perspective includes life-cycle thinking and considers goods and services consumed within national boundaries. Thus, impacts caused during the production of imported goods are included while these of exported goods are subtracted from the total balance.

For the Swiss environmental extended input-output database, for the first time, the total environmental impacts due to Swiss consumption and production was investigated, applying the ecological scarcity method 2006. Within this study, input-output analysis and environmental data were combined in order to get a true and fair overview of the total environmental impacts of consumption and production (Jungbluth et al. 2011).

4.2 EXIOBASE

Free download: The database for SimaPro can be downloaded from www.exiobase.eu.

EXIOBASE is a global, detailed Multi-regional Environmentally Extended Supply and Use / Input Output (MR EE SUT/IOT[2]) database. It was developed by harmonizing and detailing supply and use tables (SUT) for many countries, estimating emissions and resource extractions by industry, linking the countries EE SUT via trade to an MR EE SUT, and producing an MR EE IOT from this. This international input-output table can be used for the analysis of the environmental impacts associated with the final consumption of product groups (Tukker et al. 2014; Wood et al. 2015).

EXIOBASE has the following characteristics:

- 43 countries, 5 RoW[3] regions (and its 10% of the global GDP)
- Based on the year 2007
- 200 products
- 163 industries
- 15 land use types
- Employment monitored for three levels of skills
- 48 types of raw materials
- 172 types of water uses

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[2]   The letter „T" stands for table
[3]   RoW means rest of World

The extensions made in EXIOBASE can be aggregated to compile indicators such as global warming potential, acidification, total material requirement, and external costs. The latter were calculated by assessing the external costs of air emissions of a specific substance by a specific industry in a specific country, considering population density, rural or urban location, and stack height related to the emissions.

5 Add-on databases to SimaPro

ESU-services collaborates with several institutions to provide our customers with LCI data necessary for their studies. Therefore, we also provide the following databases in collaboration with partners. Please contact us directly for further information how to purchase these data.

Further examples can be found on our webpage https://esu-services.ch/simapro/database/.

5.1   Carbon Minds cm.chemicals database (2023)

Order: The different versions of the database in SimaPro format can be ordered from ESU-services as a library. Please contact us for a quote.

The database is based on ecoinvent 3.x (cut-off, system). The database is ISO 14040/14044 compliant and complementary to ecoinvent. The database is updated annually and certified by TÜV Rheinland. The reference year is 2019.

It contains technology, production, and consumption mixes. It covers more than 1000 chemicals and plastics. Two main databases are available: Essentials Data Package and Plastics Data Package.

5.1.1 Essentials Data Package

The Essentials Data Package by Carbon Minds contains system processes for the production of 78 of the most common chemicals. Three variants of the database are offered:

- Basic: production and consumption mixes of the 78 chemicals products for China, USA, Europe (Germany, Netherlands, Belgium, and EU-27 average), global average

- Technology insights: Main manufacturing technologies, production, and consumption mixes of the 78 chemicals for China, USA, Europe (Germany, Netherlands, Belgium, and EU-27 average), global average

- Global insights: Main manufacturing technologies, production, and consumption mixes of the 78 chemicals for more than 190 regions

5.1.2 Plastics Data Package

The Plastics Data Package by Carbon Minds contains system processes for the production of 92 of the most common plastics. Two variants of the database are offered:

- Technology insights: Main manufacturing technologies, production, and consumption mixes of the 92 plastics for China, USA, Europe (Germany, Netherlands, Belgium, and EU-27 average), global average

- Global insights: Main manufacturing technologies, production, and consumption mixes of the 92 plastics for more than 190 regions

5.2   WEEE electrical and electronic equipment (2022)

Free download: https://simapro.com/products/weee-lci-database/ and submit the download form.

WEEE LCI is a French database dedicated to the end-of-life of electrical and electronic equipment. It includes over 900 system processes, covering all the operations from waste collection to final destinations of the processes fractions (recycling, material, and energy recovery, elimination).

With this latest update, SimaPro users can now download datasets for recycled plastics as well. The datasets cover the main plastics recycled from Waste from Electrical and Electronic Equipment (WEEE) collected in France and regenerated in Europe:

- Acrylonitrile-butadiene-styrene (rABS), granulate
- Polypropylene (rPP), granulate
- Polystyrene (rPS), granulate

The two databases are developed to support different ecodesign projects. The WEEE LCI database helps quantify the impacts and benefits of EEE recycling and guide their design for better recyclability. The recycled plastics from WEEE LCI intends to support projects of recycled plastics integration into new products.

The databases cover all the materials frequently found in EEE, meaning over 900 processes, combining 86 materials and all categories of household appliances as well as certain professional equipment for the WEEE LCI database, and the three main plastics recycled from WEEE for the Recycled plastics from WEEE LCI database. Peer reviews have been conducted by external and independent experts for each database.

The two databases were originally developed in SimaPro thus fully compatible with the methods provided in SimaPro. Furthermore, thorough documentation was created to fulfill ILCD entry-level requirements and can be found on a dedicated platform.

5.3   GFLI Database (2022)

Publicly accessible database of the non-profit organization Global Feed LCA Institute (GFLI). The GFLI database is intended to serve as a global reference for LCA data on feed. It contains harmonized data on the feed production, livestock, and aquaculture sectors.

The database consists of a total of 1511 data sets in the form of system processes, which are based on data from the Agri-footprint Version 6.3 database. The data on energy production comes from the ecoinvent database.

5.4   Social Hotspots Database V5 (2022)

Order: The different versions of the database in SimaPro format can be ordered from ESU-services as a library. Please contact us for a quote.

The Social Hotspots Database (SHDB) was the first database created for Social Life Cycle Assessments (SLCA). It provides social risk data on a sector and country level and is integrated with a global input-output model derived from the GTAP database. The add-on database can be easily imported into SimaPro.

It allows modelling of social impacts and risks and identifying hotspots in the life cycle based on information on spending for certain categories of goods and services. A hotspot is a unit process of a product life cycle that has a potentially significant social impact. Social hotspots can be calculated for more than 160 indicators in 5 categories and 26 subcategories, for example:

- Labour Rights and Decent Work
  - Freedom of Association
  - Child Labour
  - Forced Labour

- Excessive working time
- Wage Assessment
- Poverty
- Migrant labour
- Unemployment
- Labour Laws
- Social Benefits
- Human Rights
  - Indigenous Rights
  - High Conflicts
  - Gender Equity
  - Human Health Issues
- Health and safety
  - Injuries and Fatalities
  - Toxics and Hazards
- Governance
  - Legal System
  - Corruption
- Community
  - Hospital Beds
  - Drinking Water
  - Sanitation
  - Children Out of School
  - Smallholder vs Commercial Farms

5.5   US-EI Database

Order: The different versions of the database in SimaPro format can be ordered from ESU-services as a library. Please contact us for a quote.

The US-EI is an amalgamated life cycle inventory (LCI) dataset of newly developed data, expanded US LCI data and modified ecoinvent 2.2 data. It is representative of the North American region. The data consists of a wide range of materials and processes inclusive of new US natural gas from hydraulic fracturing, updated (2010 actuals) US natural gas mix, geothermal electricity generation, new waste treatment processes for white goods and electronics and Chinese based pulp and paper data. The database is developed and maintained by our partner EarthShift with updates approximately every 6 months. The data build on the ecoinvent 2.2 library and can be used to extend this library in SimaPro.

5.6   ESU data-on-demand

Prices: Starting at 300 €/CHF per system or unit processes

ESU-services has developed thousands of life cycle inventories (LCI) in the EcoSpold or SimaPro format, which can be purchased on demand. The data can be imported to common LCA software such as Gabi, openLCA, SimaPro, etc. If desired, we can collect and analyse detailed LCI-data for your studies. Several formats can be used for the import and export of such data. Further information can be found on https://esu-services.ch/data/data-on-demand/. An Excel list of available

datasets is available under https://www.esu-services.ch/fileadmin/Images/projects/ESU_LCI_database.xlsx.

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