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BASE IMPACTS® DATA DOCUMENTATION

CATEGORY: WOOD

3 levels of documentation are available for the datasets in Base Impacts®:

- A **general documentation** explaining general information on the datasets and data general requirements
- A **sectorial documentation:** one document per sector describing the available datasets and their characteristics (technological representativeness, geographical representativeness), and providing the information on the datasets in a common layout. Information comes from the consultation specifications, the dataset commissioner technical proposal and the metadata
- The **datasets metadata** can be viewed directly in the datasets sheets. They include more detailed information (flow diagrams, Etc.)

This document is the category documentation for wood.

CONTENTS

A. PRESENTATION OF THE DATASETS

1. List of available datasets

The following datasets are available:

Technological representativity			Geographical representativity	Dataset type
Lumber				
Hardwood lumber	1 inch thickness	Sustainable forestry	Europe United States	LCI Result
		Unsustainable forestry	Europe United States	LCI Result
	2 inches thickness	Sustainable forestry	Europe United States	LCI Result
		Unsustainable forestry	Europe United States	LCI Result
	Unspecified (maximising dataset)			LCI Result
Softwood lumber	1 inch thickness	Sustainable forestry	Europe United States	LCI Result
		Unsustainable forestry	Europe United States	LCI Result
	2 inches thickness	Sustainable forestry	Europe United States	LCI Result
		Unsustainable forestry	Europe United States	LCI Result
	Unspecified (maximising dataset)			LCI Result

Technological representativity			Geographical representativity	Dataset type
Wood products				
Tubular chipboard (honeycomb panel)	3mm	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
	4mm	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
	8mm	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
Plywood board		Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
High density fiberboard (HDF)		Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
Medium density fiberboard (MDF)	Coated	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
	(Non coated)	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
Particle board	Outside furniture	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
	Inside furniture	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
	Bathroom furniture	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
Particle board, melamin coated	Outside furniture	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
	Inside furniture	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result

Technological representativity			Geographical representativity	Dataset type
	Bathroom furniture	Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result
Wooden pallet				
Wooden pallet		Sustainable forestry	Europe	LCI Result
		Unsustainable forestry	Europe	LCI Result

Table 1 : Available datasets

2. Structure of available datasets

The data available in the Base IMPACTS® result from aggregated inventories, and can therefore be used separately.

3. Technical specifications

Two types of datasets are provided in the database: with and without carbon uptake, corresponding to sustainable and non sustainable wood. About the carbon balance of the modeling, please refer to paragraph 4.2.

WARNING: the metadata is the same for the datasets "sustainable forestry" and "unsustainable forestry" and mentions carbon uptake, but carbon uptake is taken into account only in the datasets "sustainable forestry".

B. SCOPE OF THE DATASETS

1. Reference flow, functional unit

The processes are provided for 1 kg of output.

2. System boundaries

2.1. General foreground system boundaries

Cut-off for each unit process:

Cut-off rules for each unit process: Coverage of at least 95 % of mass and energy of the input and output flows, and 98 % of their environmental relevance (according to expert judgment).

The cut-off criteria were set in accordance with the relevant ISO standard 14040 as follows:

- Mass: If a flow is less than 2 % of the cumulative mass of all the inputs and outputs of the LCI model, it may be excluded, provided its environmental relevance is not of concern.
- Energy: If a flow is less than 2 % of the cumulative energy of all the inputs and outputs of the LCI model, it may be excluded, provided its environmental relevance is not of concern.
- Environmental relevance: If a flow meets the above criteria for exclusion, yet is thought to potentially have a significant environmental impact, it will be included. All material flows which leave the system (emissions) and whose environmental impacts are higher than 1 % of the entire impact of an impact category that has been considered in the assessment, has been covered.

The sum of the neglected material flows does not exceed 5 % of mass, energy or environmental relevance. Cut-off criteria have been applied on unit processes and not on calculated inventories.

Infrastructures

Infrastructure of wood based product manufacturing is not considered.

All relevant material and energy flows were included in the system. Life cycle impacts of production equipment and infrastructure were not included in the system as no evidence could be justified that these are to any extent relevant and thus fell under the cut-off criteria. In mass production the impact of production equipment and infrastructure normally is in orders of magnitude lower than the impacts of material and energy supply.

2.2. Dataset-specific foreground system boundaries

2.2.1. Lumber

Provision of lumber for use as structural material for construction, raw material for furniture-making and other items requiring additional cutting and shaping.

The LCI dataset considers silvicultural production, saw mill, kiln drying and transport between those steps. Transports of the finished lumber from the factory to subsequent users are excluded.

The data set represents the geographical specific situation, focusing on the main technologies and the legislative boundary conditions.

- Wood species for hardwood:
  - EU: 50% Beech, 50% Oak
  - US: Oak, 37% of hardwood exported from the US is red and white oak (http://www.fas.usda.gov/ustrdscripts/DownLoad/us12072408751.csv). Other species contribute <14%.
- Wood species for softwood:
  - EU: 50% spruce, 50% Pine
  - US: Average softwood logs (spruce and pine).
- Kiln drying:
  - thermal energy mix: 90% biomass, 10% natural gas. Electric and thermal energy inputs are adapted depending on geographical situation.
  - hardwood: Average 31.5 days
  - softwood: average 2.75 days
- Transports: Silviculture to saw mill: 96 km by truck, Saw mill to drying facility: 117 km by truck. The datasets for trucks and diesel are adapted depending on geographical situation

Emissions arising from biomass left in the forest are not considered in the model.

For the datasets "sustainable forestry", the cradle-to-gate data set contains the CO_2 absorption in the forest.

For the datasets "unsustainable forestry", CO_2 uptake in the plant is not considered, forest is harvested (clear cut), land is transformed to agricultural land, direct land use change (dLUC) is attributed to logs.

dLUC is modelled according Newell (2012) and IPCC (2006). Yields are taken from FAO (2012):

$(Bbefore Bafter)*(Cfd)= Cremoval$

$Cremoval/yield=Closs$

Where:

- Bbefore=Biomass stocks before conversion in tons dry matter/hectare (IPCC 2006 factor of 120 tons dry matter/ha)
- Bafter=Biomass stock for annual cropland (IPCC 2006: factor of 5 tons dry matter/ha)
- Cfd=Carbon fraction of dry matter (IPCC factor of .5)
- Cremoval=Carbon removal in kg of carbon/hectare
- yield=Yield given in m3/hectare (FAO factor for each country). Yield EU: 107m3/ha; Yield US: 111m3/ha.
- Closs=kg of carbon per m3 of wood (for each country)

2.2.2. Wood products

Tubular chipboard, HDF and MDF are engineered wood product formed by breaking down softwood residuals into wood fibres. Other than wood fibres, they contain thermosetting binding agents. As a binding agent a urea-formaldehyde-resin is used. Paraffin is used for the hydrophobic treatment.

For the production of plywood, a minimum of 3 veneers are stuck together crosswise. The board must be built up so that their board thicknesses are symmetrical. The veneers are attained via peeling of dampened logwood. The veneer thickness must not be greater than 7 mm. Depending on the choice of glue, there are boards for dry, damp and outdoor environments.

For the production of particle board, wood of different origins (mainly wood scraps) are cut mechanically. The following drying of the wood shavings is carried out with the help of a drying cylinder. When they have reached their working moisture, they are glued together. In a moulding strap the various chip fractions are heaped up to form a mat. In a press, the mat is pressed with heat and pressure to form primary boards. The boards are processed application-specifically with cutter and sawing machine. The primary processing of the plates is finished with a smoothing. The boards can be further processed depending on their purpose. They are stacked and sealed with PE foil. Production residues (e.g. from smoothing and cutting) are reentered into the production production (e.g. for heat production).

P5 (V100) is a classification according to DIN EN 312-1 and describes the range of application.
P5 moisture-resistant particle boards are used in dry and wet / moist conditions.

For the coating:

- 9.19 kg coating per m3,
- 50% Melamin formaldehyde, 50% Urea-formaldehyde
- Electricity required 0,106 MJ/kg.
- Further it is assumed that 3% of coated particle boards are lost (e.g. first and last of a production cycle) and going to waste incineration.

	Tubular chipboard	Plywood board	HDF	MDF	Particle board, outside	Particle board, inside	Particle board, bathroom
Density (kg/m3)	272		850	738	738	650	620 - 700
Humidity	6%	5%	7,3%	6,4%	8,5%	8,5%	8,5%
Carbon content	43%		39%	40%	40%		

2.2.3. Wooden pallet

The Euro-pallet or EPAL-pallet - is the standard European pallet as specified by the European Pallet Association (EPAL). The European Pallet Association was founded in 1991 and only EPAL-licensed makers may produce EUR/EPAL-pallets.
The EUR-pallet must use at least 78 nails of a specific type that are subject to a prescribed nailing pattern.

Physical characteristics:

- Weight: 22 to 25 kg
- Humidity: 40%

2.3. Background system boundaries

Background system boundaries follow the rules defined by PE International.

C. DATA SOURCES AND QUALITY

1. Data quality requirements

Quality requirements for Base Impacts® datasets are detailed in the general Base Impacts® documentation.

No specific quality requirements were set for the wood datasets.

2. Types and sources of data

The data sources for the complete product system are sufficiently consistent: primary data from industry was supplemented and validated with different literature data (see technology description for references).

The datasets were created with the use of the following elements and references:

For lumber

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories
- Final report AHEC LCA Hardwood lumber with CR statement 2012-7-26
- Welling 2010 Dried Timber how to specify correctly
- Vogtländer 2010 Life Cycle Assessment of Accoya Wood and its applications
- Newell 2012 Accounting for forest carbon pool dynamics in product carbon footrpints Challenges and o
- Tooyerkani 2012 Steam treatment of four softwood species and bard to produce torrefied wood
- FAO 2005 Global forest resources assessment 2005 progress torwards sustainalbe forest management

For wood products

- Rüter, S. Dietriechs, S. 2012 Ökobilanz-Basisdaten für Bauprodukte aus Holz
- Ökologische Bilanzierung von Baustoffen und Gebäuden, 2000
- Ökologische Betrachtungen von Holzspan- und Holzfaserplatten, 2002
- Informationsdienst Holz: Ökobilanzen Holz, 1997
- Informationsdienst Holz: Erstellung von Ökobilanzen, 1997
- AUB-Zertifkat GLUNZ AG: Spanplatten (Zertifikat-Nr.: Z.GLU101), 2001
- AUB-Zertifikat Kunz GmbH & Co. Holzwerke: Spanplatten (Zertifikat-Nr.: Z.KUN102), 2002
- CEI-BOIS - European Confederation of woodworking industries
- EPF - European Panel Federation, www.europanels.org

3. Data quality

3.1. Technological representativeness

Very poor	Poor	Fair	**Good**	Very good

3.2. Time-related coverage

Reference year: 2011 (wood products) or 2012 (lumber, particle board)

Very poor	Poor	Fair	**Good**	Very good

3.3. Geographical coverage

Datasets were provided for Europe and USA

- Europe :

Very poor	Poor	Fair	**Good**	Very good

- USA :

Very poor	Poor	Fair	**Good**	Very good

3.4. Precision

Very poor	Poor	Fair	**Good**	Very good

3.5. Completeness

Very poor	Poor	Fair	**Good**	Very good

3.6. Consistency

Very poor	Poor	Fair	**Good**	Very good

4. Specific Life-Cycle Inventory modeling rules

4.1. Multi-functionality and allocation procedure

4.1.1. Foreground system allocation procedure

The mass flow of wood (carbon chain) is allocated by mass to secure the carbon dioxide balance within the life cycle. The energy demand of the sawmill is allocated by market value. Non-physical allocations were chosen to reflect the relationships of the products and

functions in an appropriate way. Within the particle board production allocation by volume is applied. For the combined heat and power production, allocation by exergetic content is applied. For the electricity generation and by-products, e.g. gypsum, allocation by market value is applied due to no common physical properties. Within the refinery allocation by net calorific value and mass is used. For the combined crude oil, natural gas and natural gas liquids production allocation by net calorific value is applied.

4.1.2. Background system allocation procedure

Background system allocation procedure follows the rules defined by PE International.

4.2. Carbon balance

For the datasets "sustainable forestry", the cradle-to-gate data set contains the CO_2 absorption in the forest.

For a complete life cycle assessment, a corresponding end-of-life scenario (burning, rotting, landfill) has to be included considering the specific carbon content[1].

D. CRITICAL REVIEW

All Base Impacts® datasets follow the ILCD Entry Level requirements, which require a review either internal with public report or external.

The leather datasets were reviewed by internal review:

- Raw data: Validation of data sources, Sample tests on calculations, Cross-check with other source, Expert judgement

- Unit process(es), single operation, black box: Energy balance, Element balance, Cross-check with other source, Cross-check with other data set, Expert judgement, Mass balance, Compliance with ISO 14040 to 14044

- LCI results or Partly terminated system: Energy balance, Element balance, Cross-check with other source, Cross-check with other data set, Expert judgement, Mass balance, Compliance with ISO 14040 to 14044

- LCIA results : Cross-check with other source, Cross-check with other data set, Expert judgement, Compliance with ISO 14040 to 14044

- Documentation: Expert judgement, Compliance with ISO 14040 to 14044, Documentation

- Life cycle inventory methods : Compliance with ISO 14040 to 14044

- LCIA results calculation : Expert judgement, Compliance with ISO 14040 to 14044

- Goal and scope definition: Expert judgement, Compliance with ISO 14040 to 14044

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[1] WARNING : specific carbon balance between wood material and wood end of life has not been taken into account. The user can access specific GHG emissions in the dataset.

E. REPORTS FOR MORE INFORMATION

The following documents should be used for more information:

- Gabi Modelling Principles 2013

- General Base Impacts® documentation

- Review report, available in the metadata of each dataset

F. ADMINISTRATIVE INFORMATION

1. Commissioner

PE International.

2. Dataset modeler

PE International.

APPENDIX: DATA NEED AND DATA SELECTION

A Technical Committee on wood datasets specifications was held on 24 April 2012 to identify the wood datasets required for environmental labeling.

So far, wood datasets are required by the following Product Category Rules:

- Furniture
- Hi-fi speakers
- Shoes
- Non electrical tools

The conclusions of this Technical Committee were a synthesis of data need for wood.

The datasets identified by the Technical Committee are provided in Base Impacts® as requested in the consultation specifications.