High Density Fibreboard (HDF)

Key Information

General Process Description

1 m^2 of high density fibreboard based on the UK consumption mix.

Reference Flow/Declared Unit

1 m^2 of 12 mm-thick high density fibreboard, 7.8% moisture content (dry basis), average product density of 850 kg/m^3.

Reference Year

2013

Methodological Approach

This generic dataset has been developed with reference to CEN/TR 15941:2010 *Environmental product declarations — Methodology for selection and use of generic data* and has made use of data from existing databases and EPD, compensated with data from UK industry and national statistics for the specific situation related to UK consumption of timber products. With regard to methodology, the datasets are in line with the core Product Category Rules given in EN 15804+A1: 2013 *Environmental product declarations — Core rules for the product category of construction products*, and further detailed in FprEN 16485:2013 *Round and sawn timber — Environmental Product Declarations — Product category rules for wood and wood-based products for use in construction* and the draft EN 16449, *Wood and wood-based products — Calculation of sequestration of atmospheric carbon dioxide*.

The generic dataset is intended for use as upstream data for UK consumed timber products within EPDs and building level LCA assessments to EN 15978:2011 *Assessment of environmental performance of buildings — Calculation method.*

Modelling & Assumptions

High density fibreboard (HDF) is manufactured from mix of internally produced and externally sourced wood fibres held together with wax and adhesive. Wood arrives at the manufacturing site either pre-chipped (both pre- and post-consumer woodchips can be used) or as logs that are chipped on site. The woodchips are squeezed through a screw-feeder which compresses and softens, while also removing water. The wood strands are then sent into a steam digester which removes fibres from the wood. The uniform wood pulp that emerges from the digester is mixed with wax and adhesive and formed into mats which are dried and pressed to form the finished HDF product, which is cut to size and sanded prior to distribution.

For this study, the modelled product is a 12 mm-thick HDF board. The urea formaldehyde adhesive and paraffin wax account for 14% of the total mass of the product. The moisture content of the board is assumed to be 7.8%.

For HDF of a different thickness, impacts can be estimated by assuming that the impacts will scale linearly with thickness.

Data from the United Nations Economic Commission for Europe's (UNECE) Timber Forecast Questionnaire indicates that no HDF is currently produced in the UK [UNECE 2013]. Research compiled by Timbertrends on wood imports into the UK for 2012 was used to determine the likely countries of origin for HDF [Timbertrends 2012]. This data does not separate HDF (also known as hardboard) from "other fibreboard" as the overall UNECE data does, but as HDF accounted for 69% of "other fibreboard" imports, it is likely to give a good indication of the import mix.

For reasons of practicality only countries representing a cumulative total of more than 95% were included in the HDF import mix. These figures were scaled up to 100% to account for production in the countries below the 5% cut-off (see Table). The 10 countries listed account for 95.8% of total imports, with another 26 countries accounting for the remaining 4.2%.

Origin	Percentage of Consumption Mix
Austria	*74%*
Germany	*9%*
Italy	*9%*
Switzerland	*4%*
Czech Republic	*2%*
Spain	*2%*

HDF is assumed to be manufactured from a mix of virgin woodchips and sawn logs, with used wood used for energy generation at the production site [Rüter 2012]. For virgin woodchips/sawn logs forestry practices and sawmill assumptions were the same as those used for the modelling of "Fresh sawn softwood" [Wood First 2014], with energy grids adapted to reflect the country of production.

HDF manufacturing is based on information compiled by PE International and represents production in Germany [Rüter 2012]. There are not expected to be significant technological differences between HDF production in Germany and other European countries, however, the energy mix, which is likely to have a significant impact on results, has been adapted to reflect the specific electricity and fuel mix in each production country. The manufacturing steps included are: chipping/sorting, screw feeding, pulp production, mixing with resin and adhesive, hot pressing and finishing (sawing, trimming and sanding).

Transport to UK customers for imported products was calculated based on:

- Truck transport from one of the country's largest sawmills listed in the online Sawmill Database [Sawmill DB 2014] to a large national port or where no sawmill is listed, from a heavily forested region in the country to a large national port.
- Sea transport from the designated port to Hull, Felixstowe, Southampton or Liverpool (dependent on country of origin)
- Transport of 130 km from port to customer [DfT 2005]

Using this method, transport of imported HDF was estimated to be 2500 km by sea and 520 km by road.

Product use and maintenance have not been included due to the wide range of potential uses and consequently the high level of uncertainty surrounding this stage of the lifecycle.

End-of-life data are provided for three scenarios: 100% of wood waste to recycling, 100% of wood waste to incineration with energy recovery and 100% of wood waste to landfill. Wood transport distances to landfill and recycling of 25km and 21km were taken from survey data related to construction end of life practices in the UK compiled by BRE [BRE 2013]. Transport to wood energy recovery plants was estimated to be 46km based on average transport to one of an estimated 25 suitable biomass or waste-to-energy plants.

The composition of the waste (water content, adhesive content) is taken into account in the end-of-life modelling to reflect the characteristics of the waste in each scenario, with adhesives modelled as inert in landfill.

Landfill gas production is modelled based on the MELMod model for landfill emissions in the UK. The values used in this project take into account improvements to the assumptions regarding organic carbon degradation suggested by Eunomia as a result of their review of MELMod for DEFRA [Eunomia 2011]. Using typical values for cellulose, hemicellulose and lignin, an organic carbon conversion of 38.5% has been calculated. The landfill gas is assumed to have a 50:50 methane to carbon dioxide ratio by volume. The landfill is assumed to be a modern "Type 3" landfill (large modern landfill with comprehensive gas collection) with a landfill gas extraction efficiency of 50%.

Wood waste sent for recycling is assumed to be used as woodchips and is assigned credits related to the avoided production of woodchips from virgin softwood. The adhesive component is assumed to be lost. It is acknowledged that this represents a "best case" as at present little fibreboard is recycled in the UK.

Environmental Parameters Derived from the LCA

Production & Distribution (Cradle-to-Site)

Parameters describing environmental impacts	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Global Warming Potential	kg CO2 eq.	-8.69	0.742
Ozone Depletion Potential	kg CFC11 eq.	4.98E-10	2.63E-12
Acidification Potential	kg SO2 eq.	0.0238	0.0126
Eutrophication Potential	kg PO4 eq.	0.00464	0.00147
Photochemical Ozone Creation Potential	kg Ethene eq.	0.00459	0.000106
Abiotic Depletion Potential (Elements)	kg Sb eq.	9.03E-07	2.06E-08
Abiotic Depletion Potential (Fossil)	MJ	66.4	9.62

Parameters describing primary energy	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	68.2	0.156
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	157	0
Total use of renewable primary energy resources	MJ, net calorific value	225	0.156
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	74.9	9.65
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	0	0
Total use of non-renewable primary energy resources	MJ, net calorific value	74.9	9.65
Use of secondary material	kg	0	0
Use of renewable secondary fuels	MJ, net calorific value	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0	0
Net use of fresh water	m^3	0.0282	0.000137

Other environmental information describing waste categories	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Hazardous waste disposed	kg	0.0128	1.49E-05
Non-hazardous waste disposed	kg	0.100	0.00049
Radioactive waste disposed	kg	0.00337	1.17E-05

Other environmental information describing output flows	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Components for re-use	kg	0	0
Materials for recycling	kg	0	0
Materials for energy recovery	kg	0	0
Exported energy	MJ per energy carrier	0	0

Environmental Parameters Derived from the LCA

End-of-Life

Parameters describing environmental impacts	Units	100% Recycling		100% Energy Recovery		100% Landfill	
		End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)
Global Warming Potential	kg CO_2 eq.	15.6	-0.154	19.2	-13.2	17.8	-1.50
Ozone Depletion Potential	kg CFC11 eq.	4.72E-12	-4.20E-12	1.52E-11	-5.30E-10	6.77E-12	-9.00E-11
Acidification Potential	kg SO_2 eq.	0.00101	-0.000770	0.0161	-0.0327	0.0288	-0.00516
Eutrophication Potential	kg PO_4 eq.	0.000164	-0.000140	0.00306	-0.00294	0.00197	-0.000430
Photochemical Ozone Creation Potential	kg Ethene eq.	4.75E-05	-3.70E-05	0.00156	-0.00206	0.00434	-0.000290
Abiotic Depletion Potential (Elements)	kg Sb eq.	1.45E-08	-3.00E-09	2.43E-07	-3.10E-07	1.28E-07	-4.40E-08
Abiotic Depletion Potential (Fossil)	MJ	5.54	-1.99	7.27	-186	13.4	-19.2

Parameters describing environmental impacts	Units	100% Recycling		100% Energy Recovery		100% Landfill	
		End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	0.102	-0.0643	157	-8.24	0.432	-1.39
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	-157	0	-157	0	0	0
Total use of renewable primary energy resources	MJ, net calorific value	-157	-0.0643	0.191	-8.24	0.432	-1.39
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	5.80	-2.22	7.69	-216	13.7	-24.4
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	0	0	0	0	0	0
Total use of non-renewable primary energy resources	MJ, net calorific value	5.80	-2.22	7.69	-216	13.7	-24.4
Use of secondary material	kg	0	10.2*	0	0	0	0
Use of renewable secondary fuels	MJ, net calorific value	0	0	0	0	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0	0	0	0	0	0
Net use of fresh water	m^3	-0.000390	-0.000260	0.0186	-0.0342	-0.00898	-0.00575

Parameters describing environmental impacts	Units	100% Recycling		100% Energy Recovery		100% Landfill	
		End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)
Hazardous waste disposed	kg	0.000118	-9.70E-05	0.000224	-0.0131	0.000300	-0.00220
Non-hazardous waste disposed	kg	1.43	-0.00184	0.333	-0.0509	4.83	-0.00703
Radioactive waste disposed	kg	0.000106	-9.30E-05	0.000169	-0.0126	0.000142	-0.00212

Parameters describing environmental impacts	Units	100% Recycling		100% Energy Recovery		100% Landfill	
		End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)	End-of-Life Processing (C1-C4)	Material and Energy Credits (D)
Components for re-use	kg	0	0	0	0	0	0
Materials for recycling	kg	10.2	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0
Exported energy from Electricity	MJ	0	0	57.3	0	9.69	0
Exported energy from Thermal Energy	MJ	0	0	69.2	0	0	0

***Represents use of secondary material in next product system**

References

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