Wood for Good Lifecycle Database

PE INTERNATIONAL EXPERTS IN SUSTAINABILITY

Wood for Good

Plywood

Key Information

General Process Description	1 m^2 of softwood plywood based on the UK consumption mix
Reference Flow/Declared Unit	1 m^2 of 12 mm-thick softwood, 5% moisture content (dry basis), average product density of 491 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

Softwood plywood is manufactured from a number of thin softwood timber veneers. The process begins with the transport to the manufacturing site of softwood logs which are cut into sections. These sections are soaked to soften the wood and are then undergo peeling to create thin veneers, each individual veneer generally being around 1-4mm thick. After drying, multiple veneers are glued together at right angles and pressed to give a finished plywood product, which is cut to a specific board size for the customer.

The modelled product is a 5-ply, 12 mm softwood plywood product for outdoor use. A water-resistant phenol formaldehyde adhesive is used to bind the veneers. For plywood of a different thickness, impacts can be estimated by assuming that the impacts will scale linearly with thickness.

All plywood consumed in the UK is imported [UNECE 2013]. Research compiled by Timbertrends on wood imports into the UK for 2012 was used to determine the countries of origin for plywood [Timbertrends 2012]. For reasons of practicality only countries representing a cumulative total of more than 95% of softwood plywood were included in the import mix. These figures were scaled up to 100% to account for production in the countries below the 5% cut-off (see Table). The six countries listed account for 95.6% of total imports, with another 24 countries accounting for the remaining 4.4%.

Origin	Percentage of Consumption Mix
Brazil	*48.2%*
Finland	*23.8%*
China	*17.2%*
Chile	*7.9%*
Canada	*1.7%*
Ireland	*1.3%*

Forestry practice and tree growth was modelled based on research by the Life Cycle Engineering department (LBP) of the University of Stuttgart and represents typical conditions in Europe [LBP 2013]. These generic data were adapted with country-specific energy and fuel inputs. Wood transported from the forest to sawmill was assumed to have an average moisture content of 79%.

Plywood manufacturing is based on information compiled by PE International and its industrial partners for the manufacture of plywood board in Finland [PE International 2010]. Although Finland only represents 24% of plywood imports to the UK, it is not expected that there will be significant technological differences in production processes in different regions. However, the energy mix is likely to have a significant impact on the life cycle results so has been adapted to reflect the specific electricity and fuel mix in each production country. The manufacturing steps included are: Sawing, soaking, peeling, drying, gluing, pressing and finishing (trimming and sanding).

Transport to UK customers 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]

This yielded values for plywood transport of 9888 km by sea and 681 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 during recycling.

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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.	-8.17	1.11
Ozone Depletion Potential	kg CFC11 eq.	1.01E-10	4.02E-12
Acidification Potential	kg SO2 eq.	0.0183	0.0264
Eutrophication Potential	kg PO4 eq.	0.00252	0.00282
Photochemical Ozone Creation Potential	kg Ethene eq.	0.00291	0.00107
Abiotic Depletion Potential (Elements)	kg Sb eq.	6.13E-07	3.02E-08
Abiotic Depletion Potential (Fossil)	MJ	27.2	14.1

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	37.9	0.139
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	103	0
Total use of renewable primary energy resources	MJ, net calorific value	141	0.139
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	29.1	14.1
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	29.1	14.1
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	0.150	0.00015

Other environmental information describing waste categories	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Hazardous waste disposed	kg	0.000479	1.92E-05
Non-hazardous waste disposed	kg	0.0751	0.000422
Radioactive waste disposed	kg	0.000787	1.73E-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 CO2 eq.	10.2	-0.0981	10.9	-7.64	11.6	-0.984
Ozone Depletion Potential	kg CFC11 eq.	2.89E-12	-2.60E-12	5.06E-12	-3.20E-10	4.19E-12	-5.90E-11
Acidification Potential	kg SO2 eq.	0.000551	-0.00049	0.0100	-0.0195	0.0187	-0.00337
Eutrophication Potential	kg PO4 eq.	8.97E-05	-9.10E-05	0.00196	-0.00174	0.00124	-0.000280
Photochemical Ozone Creation Potential	kg Ethene eq.	2.41E-05	-2.40E-05	0.00100	-0.00121	0.00283	-0.00019
Abiotic Depletion Potential (Elements)	kg Sb eq.	5.92E-09	-1.90E-09	5.32E-08	-1.80E-07	7.80E-08	-2.90E-08
Abiotic Depletion Potential (Fossil)	MJ	3.18	-1.27	3.71	-107	8.15	-12.6

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	0.0556	-0.0410	103	-4.95	0.266	-0.910
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	-103	0	-103	0	0	0
Total use of renewable primary energy resources	MJ, net calorific value	-103	-0.0410	0.0741	-4.95	0.266	-0.910
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	3.34	-1.42	3.91	-125	8.37	-16.0
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	3.34	-1.42	3.91	-125	8.37	-16.0
Use of secondary material	kg	0	5.89*	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	9.52E-05	-0.000160	0.00829	-0.0206	-0.00538	-0.00376

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	6.99E-05	-6.20E-05	9.18E-05	-0.00784	0.000186	-0.00144
Non-hazardous waste disposed	kg	0.295	-0.00117	0.0690	-0.0300	2.37	-0.0046
Radioactive waste disposed	kg	6.56E-05	-6.00E-05	7.87E-05	-0.00755	0.000088	-0.00139

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	5.89	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0
Exported energy from Electricity	MJ	0	0	34.4	0	6.34	0
Exported energy from Thermal Energy	MJ	0	0	36.9	0	0	0

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

References

BRE 2013	Anderson, J., Adams, K. and Shiers, D., 2013. Personal communication: Survey of UK Construction Waste Sites. BRE, Watford, UK
DfT 2005	Department for Transport, 2005. Continuous Survey of Road Goods Transport. Department for Transport, London, UK.
Eunomia 2011	Eunomia Research & Consulting 2011. *Inventory Improvement Project – UK Landfill Methane Emissions Model: Final Report to DEFRA.* Eunomia Research and Consulting Ltd., Bristol, UK.
LBP 2011	LBP, 2011. Forestry practice and tree growth as modelled in GaBi database for PE International: Original research by University of Stuttgart, Life Cycle Engineering department (LBP). LBP, Stuttgart, Germany.
PE International 2010	PE International, 2010. *GaBi 6 Software and Database for Life Cycle Engineering.* Data on the industrial manufacture of plywood in Finland. LBP, University of Stuttgart and PE International, Stuttgart, Germany
Sawmill DB 2014	The Sawmill Database. www.sawmilldatabase.com, last accessed February 2014.
Timbertrends 2012	Timbertrends, 2012. *Timber Products - Imports and Exports.* Statistics compiled by Timbertrends for 2012 production. Timbertrends, Alicante, Spain
UNECE 2013	UNECE, 2013. *UNECE Timber Forecast Questionnaire (Roundwood).* UNECE, Geneva, Switzerland.