Kiln Dried Sawn Hardwood

Key Information

General Process Description	1 m^3 of kiln dried hardwood based on the UK consumption mix
Reference Flow/Declared Unit	1 m^3 of kiln dried hardwood, 12% moisture content (dry basis), average product density of 698 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

Kiln-dried hardwood is modelled as being produced from a broad mix of tree species. For the UK, the mix of hardwood species was estimated using quantitative data on broadleaved species grown in the UK [FC 2012] and qualitative information on the availability and use of UK grown hardwood species in the construction sector [TRADA 2012]. Based this information, five UK-grown species were included: Oak, beech, ash, birch and chestnut. Other species are known to form part of the mix of commercially exploited UK-grown hardwood, but these five species were considered representative of the majority of the species used. UK-grown hardwood accounts for 10.2% of the overall UK hardwood consumption mix.

Data for 2012 provided to the United Nations Economic Commission for Europe's (UNECE) Timber Forecast Questionnaire were used to determine the split between UK produced and imported hardwood consumed in the UK [UNECE 2013]. Research compiled by Timbertrends on wood imports into the UK for 2012 was used to determine the countries of origin for imported hardwood [Timbertrends 2012].

Data on hardwood imported into the UK from Timbertrends were used to establish the species mix for imported hardwood and the countries of origin for temperate and tropical hardwood species.

For temperate hardwoods, the species listed were oak, beech, poplar, ash, maple and cherry. Maple and cherry accounted for only 2.2% of total imported temperate hardwood and so have been omitted from this assessment as they are unlikely to be significant to the overall results. Broader categories were listed for tropical hardwoods, many of which covered several species of tree. Here, indicative species were used to model each group. The species included in the assessment are: sapelli, teak, azobe, meranti and iroko. Hardwood in these categories accounted for 97% of tropical hard wood imports where the species was declared. Tropical hardwood where the species was not declared accounted for 10% of total tropical hardwood imports.

Countries of origin were categorised in terms of temperate, tropical and “other sawn hardwood”, but the data do not contain information on the country of origin for each individual species. Consequently, imported hardwoods are modelled as a temperate and tropical hardwood species mix with corresponding mixes of country of origin and a separate species mix for temperate and tropical hardwoods (see table).

Origin/Species		Percentage of Consumption Mix	
UK Hardwood *Of which:*		**10.8%**	
Oak		*4.5%*	
Beech		*2.1%*	
Ash		*2.1%*	
Birch		*1.2%*	
Chestnut		*0.4%*	
Imported Temperate Hardwood *Of which:*		**57.8%**	
Species Mix		***Production Country Mix***	
Oak	*42.2%*	*USA*	*23.1%*
Beech	*7.1%*	*Italy*	*7.1%*
Ash	*4.4%*	*France*	*6.0%*
Poplar	*4.1%*	*Germany*	*4.9%*
		Latvia	*4.1%*
		Canada	*3.2%*
		Poland	*2.2%*
		Estonia	*2.1%*
		Ireland	*1.7%*
		Finland	*1.0%*
		Austria	*0.8%*
		Belgium	*0.8%*
		Spain	*0.7%*
Imported Tropical Hardwood *Of which:*		**32.0%**	
Species Mix		***Production Country Mix***	
Sapelli	*10.1%*	*Cameroon*	*12.5%*
Teak	*7.7%*	*Malaysia*	*8.7%*
Azobe	*7.6%*	*Ivory Coast*	*4.2%*
Meranti	*4.2%*	*Ghana*	*2.0%*
Iroko	*2.3%*	*Indonesia*	*1.4%*
		Rep. of Congo	*1.3%*
		Uruguay	*1.3%*
		Guyana	*0.6%*

For tropical hardwoods, some timber is imported via ports in other European countries, principally the Netherlands, Germany and Belgium. These countries have been excluded from the import mix as they do not represent the country of origin for the wood.

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

A mean transport distance of 101 km from forest to sawmill is included for UK produced wood based on data from UK producers. For imported products a transport distance of 100 km from forest to sawmill has been assumed.

Information from Wood First's industrial partners was used to model UK sawmills. This included information on the average consumption of power, thermal energy and fuel use per m^3 of sawn wood. Sawmills were split into mills with outputs greater than 50,000 m^3, which account for 76% of UK production and mills with production of less than 50,000 m^3, which account for the remaining 24%, with lower production mills modelled as having lower biomass energy usage than larger mills.

Average splits of sawn wood, woodchips, sawdust and bark were also provided by UK producers. Sawmill inputs and outputs were allocated to individual sawmill products on the basis of price, with price ranges provided based on research into UK sawmills. Feedstock energy (the inherent energy contained in the wood) and sequestered carbon are allocated on a physical basis to the wood.

For imported products, sawmill data for European mills compiled by PE International [PE International 2013] were used alongside data for production in Canada [Natural Resources Canada 2010] and data from AHEC for the United States [AHEC 2012]. Splits of sawn wood, woodchips, sawdust and bark were gathered from the same sources.

Data on the average energy demand and energy mix for kilning were provided by UK timber producers. These data were used to estimate the average drying energy consumption per day for UK produced wood. For imported wood kilning data for European, Canadian and US production were used [PE International 2013][Natural Resources Canada 2010][AHEC 2012]. Kiln drying times to reduce the wood moisture content from 79% to 12% were estimated using guidance from the BRE's Timber Drying Manual [Pratt 2011] with data from the USDA used as a cross-reference to ensure consistency for temperate hardwood species not grown in the UK [USDA 2000].

The density of the final product has been calculated from information related to wood densities of the relevant species at 15% moisture content [TRADA 2013], which have been adapted to reflect the moisture content of the final product.

Transport to customer from UK mills was 130 km based on data on the transport of timber construction products [DfT 2005]. For imported products, 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 20114] 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]

For imported temperate hardwood average transport is 7663 km by sea and 508 km by road. For imported tropical hardwood average transport is 10081 km by sea and 528 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.

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 hardwood.

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.	-878	103
Ozone Depletion Potential	kg CFC11 eq.	3.70E-08	3.65E-10
Acidification Potential	kg SO2 eq.	1.13	2.42
Eutrophication Potential	kg PO4 eq.	0.148	0.258
Photochemical Ozone Creation Potential	kg Ethene eq.	0.595	0.0985
Abiotic Depletion Potential (Elements)	kg Sb eq.	1.82E-05	2.75E-06
Abiotic Depletion Potential (Fossil)	MJ	2530	1300

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	328	12.2
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	11300	0
Total use of renewable primary energy resources	MJ, net calorific value	11600	12.2
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	2840	1300
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	2840	1300
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	0.786	0.0135

Other environmental information describing waste categories	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Hazardous waste disposed	kg	0.0787	0.00175
Non-hazardous waste disposed	kg	1.40	0.0370
Radioactive waste disposed	kg	0.123	0.00159

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.	1100	-16.4	1100	-840	1290	-109
Ozone Depletion Potential	kg CFC11 eq.	3.53E-10	-4.4E-10	3.54E-10	-3.60E-08	5.16E-10	-6.50E-09
Acidification Potential	kg SO2 eq.	0.0635	-0.0819	1.16	-2.18	2.08	-0.372
Eutrophication Potential	kg PO4 eq.	0.0103	-0.0152	0.228	-0.194	0.153	-0.0313
Photochemical Ozone Creation Potential	kg Ethene eq.	0.00265	-0.00398	0.117	-0.135	0.314	-0.0212
Abiotic Depletion Potential (Elements)	kg Sb eq.	5.39E-07	-3.20E-07	5.65E-07	-2.00E-05	9.54E-06	-3.2E-06
Abiotic Depletion Potential (Fossil)	MJ	375	-212	408	-11700	997	-1390

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	6.37	-6.85	11300	-556	32.6	-100
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	-11300	0	-11300	0	0	0
Total use of renewable primary energy resources	MJ, net calorific value	-11300	-6.85	6.39	-556	32.6	-100
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	395	-237	428	-13800	1020	-1760
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	395	-237	428	-13800	1020	-1760
Use of secondary material	kg	0	698*	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	0.0325	-0.0274	0.763	-2.31	-0.654	-0.415

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	0.0084	-0.0103	0.00843	-0.88	0.0229	-0.159
Non-hazardous waste disposed	kg	0.0681	-0.196	0.0682	-3.33	310	-0.508
Radioactive waste disposed	kg	0.00806	-0.00995	0.00809	-0.848	0.0109	-0.153

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	698	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0
Exported energy from Electricity	MJ	0	0	3870	0	700	0
Exported energy from Thermal Energy	MJ	0	0	3870	0	0	0

*Represents use of secondary material in next product system

Wood for Good Lifecycle Database

PE INTERNATIONAL EXPERTS IN SUSTAINABILITY

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