Wood for Good Lifecycle Database

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Melamine Coated Particleboard

Key Information

General Process Description	1 m^2 of melamine coated particleboard based on the UK consumption mix.
Reference Flow/Declared Unit	1 m^2 of 25 mm-thick melamine coated particleboard, 8.5% moisture content (dry basis), average product density of 640kg/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

Particleboard is manufactured from mix of wood chips, sawdust, shavings, with an adhesive used to bind the mix of wood particles together. Wood arrives at the manufacturing site either pre-chipped or as larger pieces that are chipped on site. The chips are dried to the required moisture in a cylinder dryer and sorted by size to ensure the correct strength properties of the final product. The selected particles are bound together with an adhesive, generally urea formaldehyde, phenol formaldehyde or melamine formaldehyde, creating the particleboard mat. Mats are pressed and heated to form the boards, which are coated with a resistant melamine finish using a heat-bonding process. The finished boards are sawn to obtain final coated particleboard product ready for delivery to the customer.

Particleboards are graded according to their intended use by the EN 312

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standard [EN 312]. The standard specifies seven different grades of particleboard for load bearing and non-load bearing applications and taking into account the board's resistance to changes in humidity conditions.

For this study, the modelled product is a 25 mm-thick P5-grade melamine coated particleboard. P5 particleboard suitable for use as a load-bearing board in humid conditions. Melamine coated boards are commonly used in furniture, with a P5 board suitable for use in an environment where resistance to humidity is required (e.g. bathrooms). A water-resistant phenol formaldehyde adhesive is used to bind the veneers. The moisture content of the board is assumed to be 8.5% and the adhesive content is 9.5%. For particleboard of a different thickness, impacts can be estimated by assuming that the impacts will scale linearly with thickness. Results for boards of a different grade may vary from those presented here

Data from the United Nations Economic Commission for Europe's (UNECE) Timber Forecast Questionnaire were used to determine the split between UK produced particleboard and imported particleboard consumed in the UK [UNECE 2013]. This revealed that in 2012 UK producers accounted for 84.2% of particleboard consumed in the UK. Research compiled by Timbertrends on wood imports into the UK for 2012 was used to determine the countries of origin for imported particleboard [Timbertrends 2012]. For reasons of practicality only countries representing a cumulative total of more than 95% were included in the particleboard import mix. These figures were scaled up to 100% to account for production in the countries below the 5% cut-off (see Table). The seven countries listed account for 95.4% of total imports, with another 21 countries accounting for the remaining 4.6%.

Origin	Percentage of Consumption Mix
UK Produced Particleboard	**84.2%**
Imported Particleboard *Of which:*	**15.8%**
Germany	*5.6%*
France	*4.6%*
Belgium	*1.7%*
Ireland	*1.5%*
Portugal	*1.4%*
Italy	*0.6%*
Spain	*0.5%*

Particleboards are assumed to be made up of a mix of recycled wood, virgin woodchips and sawdust. 64% of total inputs were form post-consumer material based on information from the Wood Panel Industries Federation [WPIF 2013], with the remainder assumed to be formed from virgin woodchips and sawdust/shavings.

For virgin woodchips, sawmill shavings and sawdust, forestry practices and sawmill assumptions were the same as those used for the modelling of fresh sawn softwood [Wood First 2014], with the energy and fuel mix adapted to reflect the country of production.

Particleboard manufacturing and melamine coating is based on information compiled by PE International and represents European production [PE International 2012]. The energy mix has been adapted to reflect the specific electricity and fuel mix in each production country. The manufacturing steps included are: particle drying/sorting, mixing and gluing of particleboard mat, pressing and heating, melamine coating application and finishing (sawing).

Transport to customer from UK mills was 130 km based on data on the transport of timber construction products [DfT 2005]. 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 particleboard was estimated to be 496 km by sea and 571 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. It is acknowledged that this represents a “best case” as at present little particleboard is recycled in the UK.

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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.	-14.6	0.263
Ozone Depletion Potential	kg CFC11 eq.	4.94E-10	5.15E-13
Acidification Potential	kg SO2 eq.	0.0270	0.00129
Eutrophication Potential	kg PO4 eq.	0.00332	0.000222
Photochemical Ozone Creation Potential	kg Ethene eq.	0.00424	-0.000230
Abiotic Depletion Potential (Elements)	kg Sb eq.	2.15E-06	5.08E-09
Abiotic Depletion Potential (Fossil)	MJ	148	3.52

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	182	0.0433
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	254	0
Total use of renewable primary energy resources	MJ, net calorific value	436	0.0433
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	155	3.53
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	155	3.53
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	0.0454	4.06E-05

Other environmental information describing waste categories	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Hazardous waste disposed	kg	0.00332	4.75E-06
Non-hazardous waste disposed	kg	0.0484	0.000140
Radioactive waste disposed	kg	0.00302	3.68E-06

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

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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.	25.2	-0.25	29.5	-20.4	28.7	-2.43
Ozone Depletion Potential	kg CFC11 eq.	7.56E-12	-6.80E-12	2.02E-11	-8.40E-10	1.09E-11	-1.50E-10
Acidification Potential	kg SO2 eq.	0.00155	-0.00125	0.0256	-0.0511	0.0465	-0.00834
Eutrophication Potential	kg PO4 eq.	0.000252	-0.00023	0.00492	-0.00459	0.00319	-0.000700
Photochemical Ozone Creation Potential	kg Ethene eq.	7.13E-05	-6.10E-05	0.00251	-0.00321	0.00702	-0.000470
Abiotic Depletion Potential (Elements)	kg Sb eq.	2.04E-08	-4.90E-09	2.97E-07	-4.90E-07	2.04E-07	-7.10E-08
Abiotic Depletion Potential (Fossil)	MJ	8.67	-3.24	10.9	-287	21.4	-31.1

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	0.166	253	254	-12.9	0.693	-2.25
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	-254	0	-254	0	0	0
Total use of renewable primary energy resources	MJ, net calorific value	-253	-0.105	0.265	-12.9	0.693	-2.25
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	9.09	-3.61	11.5	-335	22.0	-39.4
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	9.09	-3.61	11.5	-335	22.0	-39.4
Use of secondary material	kg	0	16.0*	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	-0.0003	-0.000420	0.0266	-0.0537	-0.0143	-0.00929

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Wood for Good

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	0.000187	-0.000160	0.000315	-0.0205	0.000483	-0.00356
Non-hazardous waste disposed	kg	1.73	-0.00300	0.403	-0.0793	7.32	-0.0114
Radioactive waste disposed	kg	0.000171	-0.000150	0.000247	-0.0197	0.000228	-0.00343

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	16.0	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0
Exported energy from Electricity	MJ	0	0	89.8	0	15.7	0
Exported energy from Thermal Energy	MJ	0	0	104	0	0	0

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

References

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