Timber Frame – Closed Panel System

Key Information

General Process Description	1 m^2 of a closed panel timber frame system based on the UK consumption mix
Reference Flow/Declared Unit	1 m^2 of a closed panel timber frame system consisting of vertical and horizontal softwood beams, softwood structural noggins, mineral wool insulation, OSB or plywood sheathing and hot dip galvanised steel fixings.
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

Closed panel timber frames are generally pre-fabricated systems designed for use in external wall construction. Closed panel systems consist of vertical and horizontal softwood structural beams with mineral wool insulation housed within the frame. Horizontal structural noggins are used to give additional stability to the system and insulation is held in place with plywood or oriented strand board (OSB). Hot dip galvanised steel fixings are used to secure the assembly.

In this study, the modelled product is 1 m^2 of a closed panel timber frame system for use in external wall construction. The panel has a height of 2100 mm and a stud width of 600 mm and has been modelled based on information from High Castle Ltd [High Castle 2014]. Both the timber studs and timber structural noggins are assumed to have dimensions of 145 mm x 45 mm. Mineral wool insulation fills the space between the timber studs and noggins. The wood panels used to hold the mineral insulation in place (known as sheathing) can be made of OSB or plywood; for this study a hypothetical system with one side of plywood, one side of OSB has been modelled. Fixings are based on Strong-Tie SDW structural wood screws [Simpson 2014]. The mass of the modelled system is 30.5 kg/m^3 of which the timber stud and noggins account for 14.6 kg/m^2, OSB/plywood 13.3 kg/m^2, insulation 1.8 kg/m^2 and fixings 0.8 kg/m^2.

The dataset is designed to provide an indicative value for a typical timber close panel system and can therefore be used as a first approximation of the impact of similar closed panel systems. Users wishing to understand the impact of significantly different panel systems may need to refer to the individual datasets created as part of this project (kiln dried softwood, plywood, OSB, galvanised steel) combined with relevant published EPD data from other sources for insulation materials not published in the Wood for Good Lifecycle Database.

The kiln-dried sawn spruce used in the panel system is modelled using the same assumptions about forestry practices, sawmilling, kiln drying, transport, end-of-life and the country of origin of the wood as those in the "Kiln dried sawn softwood" dataset also produced as part of this project [Wood First 2014-1]. Similarly, OSB and plywood are modelled using datasets developed as part of this project [Wood First 2014-2; Wood First 2014-3]. Mineral wool and fixings are modelled using data from the GaBi life cycle database developed by PE International [PE International 2013]. Transport distances for these materials of 170km and 78km respectively were based upon Department for Transport statistics for construction products [DfT 2005].

The end-of-life of the steel screws is also modelled with the same three indicative scenarios used for timber: 100% recycling, 100% incineration with energy recovery and 100% landfill. The benefit of steel recycling and the burdens of remelting have been modelled based on the "value of scrap" approach used by the World Steel Association [worldsteel 2011]. As steel does not burn in waste to energy incinerators, no impacts associated with this option have been modelled. Steel in landfill has been modelled using models for inert material in landfill.

Mineral wool is assumed to be neither recyclable nor combustible so has been modelled as going to an inert landfill. Using this assumption mineral wool has almost no impact at end-of-life.

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.	-33.6	2.05
Ozone Depletion Potential	kg CFC11 eq.	3.64E-10	7.24E-12
Acidification Potential	kg SO2 eq.	0.0659	0.0351
Eutrophication Potential	kg PO4 eq.	0.00942	0.00408
Photochemical Ozone Creation Potential	kg Ethene eq.	0.00702	0.000354
Abiotic Depletion Potential (Elements)	kg Sb eq.	0.000199	5.66E-08
Abiotic Depletion Potential (Fossil)	MJ	170	26.5

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	662	0.421
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	477	0
Total use of renewable primary energy resources	MJ, net calorific value	559	0.421
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	185	26.6
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	185	26.6
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	0.188	0.000373

Other environmental information describing waste categories	Units	Production *(A1-A3)*	Distribution and Installation *(A4-A5)*
Hazardous waste disposed	kg	0.0112	4.07E-05
Non-hazardous waste disposed	kg	0.668	0.00132
Radioactive waste disposed	kg	0.00800	3.21E-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

Wood for Good Lifecycle Database

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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.	47.4	-1.82	49.1	-34.4	54.7	-4.64
Ozone Depletion Potential	kg CFC11 eq.	1.42E-11	-5.9E-12	1.92E-11	-1.5E-09	2.07E-11	-2.8E-10
Acidification Potential	kg SO2 eq.	0.00277	-0.00761	0.0465	-0.0885	0.0886	-0.0159
Eutrophication Potential	kg PO4 eq.	0.000449	-0.00092	0.00913	-0.0079	0.00606	-0.00133
Photochemical Ozone Creation Potential	kg Ethene eq.	0.000126	-0.00086	0.00466	-0.0055	0.0134	-0.0009
Abiotic Depletion Potential (Elements)	kg Sb eq.	3.4E-08	-3.6E-08	1.41E-07	-8.3E-07	3.89E-07	-1.4E-07
Abiotic Depletion Potential (Fossil)	MJ	15.6	-19	17.6	-480	40	-59.2

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	0.287	0.00349	477	-22.5	1.32	-4.28
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	-477	0	-477	0	0	0
Total use of renewable primary energy resources	MJ, net calorific value	-477	0.00349	0.329	-22.5	1.32	-4.28
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	16.4	-19.0	18.4	-564	41.1	-75.1
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	16.4	-19.0	18.4	-564	41.1	-75.1
Use of secondary material	kg	0	28.8	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	-0.000110	-0.00158	0.0333	-0.0935	-0.0273	-0.0177

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	0.000349	0.000513	0.000399	-0.0362	0.000921	-0.00679
Non-hazardous waste disposed	kg	2.45	-0.0248	1.94	-0.137	13.9	-0.0217
Radioactive waste disposed	kg	0.000323	-4.40E-05	0.000353	-0.0348	0.000435	-0.00654

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	28.8	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0
Exported energy from Electricity	MJ	0	0	159	0	29.9	0
Exported energy from Thermal Energy	MJ	0	0	164	0	0	0

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

References

References	
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Wood First 2014-3	PE International and Wood For Good. *Plywood.* Timber Trade Federation, London, UK
worldsteel 2011	World Steel Association, 2011. *World Steel Association Life Cycle Inventory Study for Steel Products*. World Steel Association (worldsteel), Brussels, Belgium