Chipboards

Environmental product declaration

UNILIN

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UNILIN

1. General

1.1 Company information / declaration owner

Manufacturer	UNILIN Group
Production Location	UNILIN Panels, Spano (HQ)
Address	Production location 1: Ingelmunstersteenweg 229, 8780 Oostrozebeke, Belgium Production location 2: UNILIN Panels Bospan, Breestraat 4, 8710 Wielsbeke, Belgium
E-mail	info@unilin.com
Website	www.unilin.com

1.2 EPD information

EPDs are not comparable when they are not created following the same method.
This EPD was created following the method described below.

EPD for	Chipboards
Calculation number	EPD-NIBE-20210317-18170
Date of issue	14/12/2021
End of validity	14/12/2026
Version NIBE's EPD Application	v2.0
Version Environmental Profile database	v3.04 (2021-07-06)
PCR	NMD Determination method Environmental performance Construction works v1.0 July 2020

1.3 Scope of declaration

This is a cradle to grave with options EPD. The life cycle stages included are as shown below:

A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X

X = included MND = module not declared

Module A1 = Raw material supply	Module B2 = Maintenance	Module C1 = De-construction / Demolition
Module A2 = Transport	Module B3 = Repair	Module C2 = Transport
Module A3 = Manufacturing	Module B4 = Replacement	Module C3 = Waste Processing
Module A4 = Transport	Module B5 = Refurbishment	Module C4 = Final Disposal
Module A5 = Installation process	Module B6 = Operational energy use	Module D = Benefits and loads beyond the system boundaries
Module B1 = Emissions during use stage	Module B7 = Operational water use	

1.4 Verification of the declaration

CEN standard EN 15804+A2 serves as the core PCR. In compliance with ISO 14040:2006 and 14044:2006.
EPDs of construction products may not be comparable if they do not comply with NEN-EN15804 and additional PCR.

Independent verification of the declaration. according to EN ISO 14025:2010.

☐ Internal ☑ External, by A.K. Jeeninga (Advieslab v.o.f.)

2. Product

2.1 Product description

General product description

Chipboards are wood based panels with 3 layers: two surface layers with a fine structure and a core layer with a coarser structure. The layers consist out of wood chips that are bonded by a thermoharding resin and mixed with additives to add application specific properties such as fire retardancy or moisture resistance.

Applications

Chipboards are commonly used for furniture, interior and building applications. The different surfaces allow the application of many different types of finishes or coatings, making it easy to use the material as the basis for many different designs and applications.

Production sites

This EPD is representative for chipboards produced by UNILIN in the Spano and Bospan factories located in Oostrozebeke and Wielsbeke, Belgium. The results shown in this EPD are representative for the average board produced in the Spano and Bospan factories, weighted by production volume. The impact difference between both plants is discussed in the Sensitivity Analysis.

Composition

Typical composition:

- 84 % wood chips.
- 10 % binder: mainly (melamine) ureum formaldehyde glue.
- 6 % moisture (water).
- 0.5 % water repellent agent: wax.

The wood chips are a combination of recycled and recovered wood sourced in and around Belgium. About 90 % of the wood is pre- or post-consumer recycled. The panels are available with PEFC or FSC sustainable wood certificates.

The carbon content of the panels equals about 45 %: 42 % biogenic carbon contained in the wood chips and 3 % fossil carbon contained in the binder. The wood chips are of course biobased, so the biobased content equals about 84 %. This means that the panels store about 1009 kg atmospheric CO_2 (EN 16449:2014). The background datasets used to calculate the carbon footprint reported in this EPD assume that only 968 kg atmospheric CO_2 is stored in the used wood, so this flow is slightly underestimated in the biogenic global warming potential results (GWP-b).

Dimensions

Available from stock in various finishes, thicknesses and dimensions. Consult the complete UNILIN Panels stock range at www.unilinpanels.com. For our technical capabilities on custom thicknesses and dimensions, as well as minimum order requirements, please contact our sales team or email info.panels@unilin.com.

Technical properties

- Gross density: 430-760 kg/m^3, varying by product variant.
- Moisture content: 6-10 %.

The EPD calculations were based on a density of 652 kg/m^3. Panels with different densities will yield different results. E.g. transport impacts will be higher when opting for panels with higher densities and vice versa. The impact of different variants can be approximated assuming a linear relation between density and impact results.

Technical characteristics vary by product variant and thickness. For more detailed data, please consult our website: www.unilinpanels.com.

2.2 Description of the manufacturing process

Production

Manufacturing process

1. After roughly cutting, sorting and cleaning, the wood is cut into small chips.
2. The fresh chips are dried to the required moisture content.
3. The dry chips are mixed with a thermohardening resin and additives.
4. The mixture is spread out in a 3 layer cake shaped board and compressed at high pressure and temperature to bind the wood particles and the glue into a solid chipboard.
5. The endless board that leaves the press is cut into large panels and passively cooled.
6. After cooling down, the panels can be sanded, cut to final size, and optionally finished further depending on the intended application.

Input and output data

2019 year total energy and material data were collected for both chipboard plants in 2020 based on officially reported numbers and interviews with topic specialists at both plants. As A&U was only finished in 2020, the energy data from Bospan were adapted to the new situation by substituting the 2019 energy streams to the new energy composition established in 2020.

The glue factory, Dynea, was taken into account based on 2020 data provided by the site manager and HSE manager. The impact of the different glue recipes was based on the ingredient lists of the individual recipes.

Moisture contents of in- and output streams are regularly measured. Intermediate moisture contents were estimated based on expert opinion, for as far as relevant for the calculations.

Energy consumption

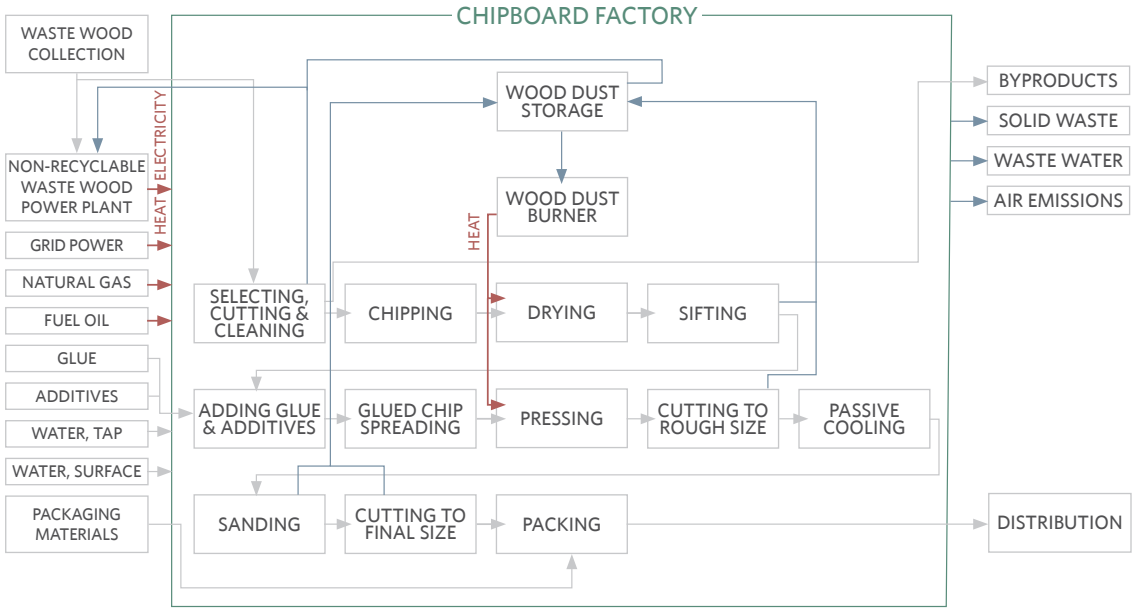
Both chipboard plants have substituted most of their fossil energy use by renewable energy:

- Both plants use non-recyclable wood dust resulting from on-site processes such as cutting and sanding to dry the wood chips down to the moisture levels required for chipboard production.
- Spano uses electricity provided by A&S, a joint-venture between Aspiravi and Unilin that produces electricity from non-recyclable wood waste. Only when A&S undergoes its yearly maintenance Spano switches to grid power.
- Bospan goes a step further, using both heat and power provided by A&U, a second joint-venture between Aspiravi and Unilin. The plant was finished in 2020 and covers all the electricity and most of the remaining heat needs of Bospan, except during the yearly maintenance.

Production waste

Production waste is taken into account based on the year total waste data from the plants. Most of the production waste consists out of woody waste streams that are incinerated either on-site or in biomass plants A&S and A&U. The burned wood waste streams function as an energy source, so they are included in the energy production models. They are not reported as part of the waste streams to avoid double counting.

Sidestreams that result from the wood waste recycling process, such as ferromagnetic streams, are not considered a waste as they are sold to external recyclers. As the streams are fairly small and only add minimal income for the plants, no impacts or benefits are allocated to them.



Contruction

Chipboards are mostly used in the furniture and construction sectors for a large number of different applications, from kitchen cabinet doors to airtight construction layers in energy efficient buildings. Before application, the panels are typically cut to size and possibly covered by a surface finishing coating, melamine or HPL layer.

Transport to the construction stage consists the following:

Transport conveyance	Distance	Weight x distance
Lorry (Truck), unspecified (default)	225 km	144.85 tkm

3. Calculation rules

3.1 Declared unit

m^3 chipboard
One cubic meter of chipboards. This FU is chosen to allow the EPD user to calculate the impact of the chipboard thickness of their choice as the plants produce many different board thicknesses.

3.2 Environmental profile and representativeness

The input data are representative for chipboards produced by UNILIN. The results are based on the production weighted average results of both production sites.

3.3 Cut-off criteria

Product Stage (A1-A3)
The production stage consists of the extraction of raw materials, transportation of the raw materials, processing the raw materials into materials and the production of the product. The required energy for production, ancillary materials, and production emissions are included. Energy and material in- and output data were collected at both UNILIN chipboard factories (Spano and Bospan) and the UNILIN glue factory (Dynea).

Construction process stage (A4-A5)
This stage consists of the transport of the product from the production plant to the construction site, which was modeled based on the average transport distance by road from both chipboard factories to Utrecht.

It also includes the loss of material during construction. The additional needed production, transport and end-of-life of the lost material during construction is included.

The end-of-life of packaging material up to the end-of-waste state or disposal of final residues is also included.

The installation of the product including manufacture, transportation and end-of-life of ancillary materials and any energy or water use required for installation or operation of the construction site are taken into account.

Use stage (B1-B3)
This stage consists of the impacts arising from components of the building and construction works during their use.

The stage also covers the combination of all planned technical and associated administrative maintenance actions during the service life to maintain the product installed in a building, in a construction works or its parts in a state in which it can perform its required functional and technical performance, as well as to preserve the aesthetic qualities of the product. This will include preventative and regular maintenance activities.

Product replacement (B4) and renovation (B5) only apply when the product is considered in a lifespan (of a building, work , etc.).

Operational water and energy use are not considered.

End of life stage (C1-C4)
When the end of the life stage of the building is reached, the de-construction/demolition begins. This EPD includes de-construction/ demolition (C1), the necessary transport (C2) from the demolition site to the sorting location and distance to final disposal. The end of life stage includes the final disposal to landfill (C4), incineration (C3) and needed recycling processes up to the end-of-waste point (C3). Loads and benefits of recycling, re-use and exported energy are part of module D.

The default end-of-life scenarios of the annex (november 2020) to the NMD Determination method v1.0 have been used for the various materials in the product.

Benefits and Loads beyond the system boundary (Module D)
This stage contains the potential loads and benefits of recycling and re-use of raw materials/products. The loads contain the needed recycling processes from end-of-wastepoint up to the point-of-equivalence of the substituted primary raw material and a load for secondary material that will be lost at the end-of-life stage.

The loads and benefits of recycling and reuse are included in this module. The benefits are calculated based on the primary content and the primary equivalent.

In addition, the benefits of energy recovery are granted at this stage. The amount of avoided energy is based on the Lower Heating Values of the materials and the efficiencies of the incinerators as mentioned in the NMD Determination method v1.0 or EcoInvent 3.5 (2018).

3.4 Allocation

There is no allocation applied for the environmental profiles / datasets used in this LCA.

3.5 Source of background data

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
Raw material(s)					
0.49 m^3 Chipboard SPANO (excluding glue) | m^3					
wood, recyc, RPLAK	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%
wood, recyc, Palet	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%
wood, recyc, RPUUR	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
38.7 kg UMF 10% (11G325)					
wood, plaf	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%
wood, stam	Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m^3)| Market for (EU)	1/700,66m^3 Pulpwood, softwood, measured as solid wood under bark {Europe without Switzerland}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	SimaPro process is per m^3. A density of 700,66kg/m^3 is used to calculate the environmental profile for 1 kg.
wood, resh	Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m^3)| Market for (EU)	1/700,66m^3 Pulpwood, softwood, measured as solid wood under bark {Europe without Switzerland}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	SimaPro process is per m^3. A density of 700,66kg/m^3 is used to calculate the environmental profile for 1 kg.
wood, houtvezels	Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m^3)| Market for (EU)	1/700,66m^3 Pulpwood, softwood, measured as solid wood under bark {Europe without Switzerland}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	SimaPro process is per m^3. A density of 700,66kg/m^3 is used to calculate the environmental profile for 1 kg.
Anionic 45% paraffin-wax emulsion	Paraffin | production (EU)	Paraffin {RER}| production | Cutoff, U	EcoInvent 3.6 (2019)	no	
Ammonium nitrate	Ammonium nitrate | production (EU)	Ammonium nitrate, as N {RER}| ammonium nitrate production | Cut-off, U	EcoInvent 3.5 (2018)	no	0,52 ammonium nitrate, dataset withholds 2,86 ammonium nitrate (dry) (measurred in kg N)
0.51 m^3 Chipboard BOSPAN (excluding glue) | m^3					
wood, recyc, RPLAK	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%
wood, recyc, Palet	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%
wood, recyc, RPUUR	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
wood, plaf	Waste wood, postconsumer {GLO}| Recycled Content cut-off	Waste wood, post-consumer {GLO}| waste wood, postconsumer, Recycled Content cut-off | Cut-off, U	EcoInvent 3.5 (2018)	no	The process does not contain Biogenic CO_2 storage. This is adapted to 1,731kg per kg wood with a moister content of 6%
wood, stam	Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m^3)| Market for (EU)	1/700,66m^3 Pulpwood, softwood, measured as solid wood under bark {Europe without Switzerland}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	SimaPro process is per m^3. A density of 700,66kg/m^3 is used to calculate the environmental profile for 1 kg.
wood, resh	Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m^3)| Market for (EU)	1/700,66m^3 Pulpwood, softwood, measured as solid wood under bark {Europe without Switzerland}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	SimaPro process is per m^3. A density of 700,66kg/m^3 is used to calculate the environmental profile for 1 kg.
wood, houtvezels	Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m^3)| Market for (EU)	1/700,66m^3 Pulpwood, softwood, measured as solid wood under bark {Europe without Switzerland}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	SimaPro process is per m^3. A density of 700,66kg/m^3 is used to calculate the environmental profile for 1 kg.
Anionic 45% paraffin-wax emulsion	Paraffin | production (EU)	Paraffin {RER}| production | Cutoff, U	EcoInvent 3.6 (2019)	no	
Ammonium nitrate	Ammonium nitrate | production (EU)	Ammonium nitrate, as N {RER}| ammonium nitrate production | Cut-off, U	EcoInvent 3.5 (2018)	no	0,52 ammonium nitrate, dataset withholds 2,86 ammonium nitrate (dry) (measurred in kg N)
wood, vlaslemen	Straw | market for (EU)	Straw {RER}| market for straw | Cut-off, U	EcoInvent 3.6 (2019)	no	
66 kg UF-E1 0% (11F350)					
Methanol	Methanol | market for (GLO)	Methanol {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Urea	Urea, as N | production (EU)	Urea, as N {RER}| production | Cut-off, U	EcoInvent 3.5 (2018)	no	Dataset withholds 2,17kg Urea, because it's measured as N. The weight Unilin measures is kg Urea not N.
Melamine	Melamine | production (EU)	Melamine {RER}| production | Cut-off, U	NIBE/EcoInvent 3.6 (2019)	no	
Acetic Acid 40%, active matter	Acetic acid, without water, in 98% solution state | market for (GLO)	Acetic acid, without water, in 98% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
Sodium hydroxide 25%, active matter	Sodium hydroxide, without water, in 50% solution state | market for (GLO)	Sodium hydroxide, without water, in 50% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Sodium acetate	NIBE Sodium acetate | market for (GLO)	NIBE Sodium acetate {GLO} | market for	EcoInvent 3.5 (2018)	no	Industrially made sodium acetate trihydrate is prepared by reacting acetic acid with sodium hydroxide using water as the solvent. Based on the mol mass of acetic acid and sodium hydroxide a combined process is modelled. The process contains 23/82 sodium hydroxide and 60/82 acetic acid.
Water	Water - Tap water	Tap water {RER}| market group for | Cut-off, U	EcoInvent 3.6 (2019)	no	
1.7 kg UF-E0 3% (10G400)					
Methanol	Methanol | market for (GLO)	Methanol {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Urea	Urea, as N | production (EU)	Urea, as N {RER}| production | Cut-off, U	EcoInvent 3.5 (2018)	no	Dataset withholds 2,17kg Urea, because it's measured as N. The weight Unilin measures is kg Urea not N.
Melamine	Melamine | production (EU)	Melamine {RER}| production | Cut-off, U	NIBE/EcoInvent 3.6 (2019)	no	
Acetic Acid 40%, active matter	Acetic acid, without water, in 98% solution state | market for (GLO)	Acetic acid, without water, in 98% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Sodium hydroxide 25%, active matter	Sodium hydroxide, without water, in 50% solution state | market for (GLO)	Sodium hydroxide, without water, in 50% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Sodium acetate	NIBE Sodium acetate | market for (GLO)	NIBE Sodium acetate {GLO} | market for	EcoInvent 3.5 (2018)	no	Industrially made sodium acetate trihydrate is prepared by reacting acetic acid with sodium hydroxide using water as the solvent. Based on the mol mass of acetic acid and sodium hydroxide a combined process is modelled. The process contains 23/82 sodium hydroxide and 60/82 acetic acid.
Water	Water - Tap water	Tap water {RER}| market group for | Cut-off, U	EcoInvent 3.6 (2019)	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
27.6 kg UMF-E1 14% (10H120)					
Methanol	Methanol | market for (GLO)	Methanol {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Urea	Urea, as N | production (EU)	Urea, as N {RER}| production | Cut-off, U	EcoInvent 3.5 (2018)	no	Dataset withholds 2,17kg Urea, because it's measured as N. The weight Unilin measures is kg Urea not N.
Melamine	Melamine | production (EU)	Melamine {RER}| production | Cut-off, U	NIBE/EcoInvent 3.6 (2019)	no	
Acetic Acid 40%, active matter	Acetic acid, without water, in 98% solution state | market for (GLO)	Acetic acid, without water, in 98% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Sodium hydroxide 25%, active matter	Sodium hydroxide, without water, in 50% solution state | market for (GLO)	Sodium hydroxide, without water, in 50% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Sodium acetate	NIBE Sodium acetate | market for (GLO)	NIBE Sodium acetate {GLO} | market for	EcoInvent 3.5 (2018)	no	Industrially made sodium acetate trihydrate is prepared by reacting acetic acid with sodium hydroxide using water as the solvent. Based on the mol mass of acetic acid and sodium hydroxide a combined process is modelled. The process contains 23/82 sodium hydroxide and 60/82 acetic acid.
Water	Water - Tap water	Tap water {RER}| market group for | Cut-off, U	EcoInvent 3.6 (2019)	no	
2.1 kg UMF-E2 16% (10H122)					
Methanol	Methanol | market for (GLO)	Methanol {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Urea	Urea, as N | production (EU)	Urea, as N {RER}| production | Cut-off, U	EcoInvent 3.5 (2018)	no	Dataset withholds 2,17kg Urea, because it's measured as N. The weight Unilin measures is kg Urea not N.
Melamine	Melamine | production (EU)	Melamine {RER}| production | Cut-off, U	NIBE/EcoInvent 3.6 (2019)	no	
Acetic Acid 40%, active matter	Acetic acid, without water, in 98% solution state | market for (GLO)	Acetic acid, without water, in 98% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
Sodium hydroxide 25%, active matter	Sodium hydroxide, without water, in 50% solution state | market for (GLO)	Sodium hydroxide, without water, in 50% solution state {GLO}| market for | Cut-off, U	EcoInvent 3.5 (2018)	no	
Sodium acetate	NIBE Sodium acetate | market for (GLO)	NIBE Sodium acetate {GLO} | market for	EcoInvent 3.5 (2018)	no	Industrially made sodium acetate trihydrate is prepared by reacting acetic acid with sodium hydroxide using water as the solvent. Based on the mol mass of acetic acid and sodium hydroxide a combined process is modelled. The process contains 23/82 sodium hydroxide and 60/82 acetic acid.
Water	Water - Tap water	Tap water {RER}| market group for | Cut-off, U	EcoInvent 3.6 (2019)	no	

Ancillary material(s)

0.49 m^3 Chipboard SPANO (excluding glue) | m^3					
Vaporised moisture content	Vaporised moisture/water content	Empty processs, onbehalve of calculating A2	n.a.	no	
Factory	Wooden board factory, organic bonded boards | construction (EU)	Wooden board factory, organic bonded boards {RER}| construction | Cut-off, U	EcoInvent 3.5 (2018)	no	The amount per m3 as used in the process Medium density fibreboard {RER}| medium density fibre board production, uncoated | Cut-off, U is adapted.
Lubricating and other mineral oils	Lubricating oil | production (EU)	Lubricating oil {RER}| production | Cut-off, U	EcoInvent 3.6 (2019)	no	
0.51 m^3 Chipboard BOSPAN (excluding glue) | m^3					
Vaporised moisture content (from wood)	Vaporised moisture/water content	Empty processs, onbehalve of calculating A2	n.a.	no	
Vaporised moisture content (from glue)	Vaporised moisture/water content	Empty processs, onbehalve of calculating A2	n.a.	no	
Factory	Wooden board factory, organic bonded boards | construction (EU)	EcoInvent 3.5 (2018)			The amount per m3 as used in the process Medium density fibreboard {RER}| medium density fibre board production, uncoated | Cut-off, U is adapted.
Lubricating and other mineral oils	Lubricating oil | production (EU)	Lubricating oil {RER}| production | Cut-off, U	EcoInvent 3.6 (2019)	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
66 kg UF-E1 0% (11F350)					
Glue factory	Chemical factory, organics | construction (EU)	1p Chemical factory, organics {RER}| construction | Cut-off, U	EcoInvent 3.6 (2019)	no	
1.7 kg UF-E0 3% (10G400)					
Glue factory	Chemical factory, organics | construction (EU)	1p Chemical factory, organics {RER}| construction | Cut-off, U	EcoInvent 3.6 (2019)	no	
27.6 kg UMF-E1 14% (10H120)					
Glue factory	Chemical factory, organics | construction (EU)	1p Chemical factory, organics {RER}| construction | Cut-off, U	EcoInvent 3.6 (2019)	no	
2.1 kg UMF-E2 16% (10H122)					
Glue factory	Chemical factory, organics | construction (EU)	1p Chemical factory, organics {RER}| construction | Cut-off, U	EcoInvent 3.6 (2019)	no	
Energy use					
0.49 m^3 Chipboard SPANO (excluding glue) | m^3					
Electricity (grid)	Electricity (BE) - medium voltage (1kV - 24kV)	Electricity, medium voltage {BE}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	
Electricity (wood waste)	Electricity, high voltage (BE)| heat and power cogeneration, wood chips, 6667 kW, state-of-the-art 2014	Electricity, high voltage {BE}| heat and power co-generation, wood chips, 6667 kW, state-ofthe- art 2014 | Cut-off, U	EcoInvent 3.5 (2018)	no	
Fuel oil	Diesel, burned in machine (incl. emissions)	0095-pro&Diesel, gasolie, gebruik, liter (o.b.v. 35,8 MJ Diesel, burned in building machine {GLO}| processing | Cut-off, U)	NMD/EcoInvent 3.6 (2019)	no	The combustion emissions of diesel are included in the environmental profile.
Heat from natural gas	Heat production, natural gas, at industrial furnace >100kW (Europe)	Heat, district or industrial, natural gas {Europe without Switzerland}| heat production, natural gas, at industrial furnace >100kW | Cut-off, U	EcoInvent 3.6 (2019)	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
Heat for drum drier (wood waste)	Heat production, wood pellet, at furnace 300kW (CH)	Heat, central or small-scale, other than natural gas {CH}| heat production, wood pellet, at furnace 300kW | Cut-off, U	EcoInvent 3.5 (2018)	no	The process 'Heat, central or small-scale, other than natural gas {CH}| heat production, wood pellet, at furnace 300kW | Cut-off, U' uses 0,07115 kg of wood as input. So 1 kg of wooddust/ biomass equals 1/0,07115 = 14,05848 MJ
0.51 m^3 Chipboard BOSPAN (excluding glue) | m^3					
Electricity (grid)	Electricity (BE) - medium voltage (1kV - 24kV)	Electricity, medium voltage {BE}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	
Electricity (wood waste)	Electricity, high voltage (BE)| heat and power cogeneration, wood chips, 6667 kW, state-of-the-art 2014	Electricity, high voltage {BE}| heat and power co-generation, wood chips, 6667 kW, state-ofthe- art 2014 | Cut-off, U	EcoInvent 3.5 (2018)	no	
Fuel oil	Diesel, burned in machine (incl. emissions)	0095-pro&Diesel, gasolie, gebruik, liter (o.b.v. 35,8 MJ Diesel, burned in building machine {GLO}| processing | Cut-off, U)	NMD/EcoInvent 3.6 (2019)	no	The combustion emissions of diesel are included in the environmental profile.
Heat from natural gas	Heat production, natural gas, at industrial furnace >100kW (Europe)	Heat, district or industrial, natural gas {Europe without Switzerland}| heat production, natural gas, at industrial furnace >100kW | Cut-off, U	EcoInvent 3.6 (2019)	no	
Heat for drum drier (wood waste)	Heat production, wood pellet, at furnace 300kW (CH)	Heat, central or small-scale, other than natural gas {CH}| heat production, wood pellet, at furnace 300kW | Cut-off, U	EcoInvent 3.5 (2018)	no	The process 'Heat, central or small-scale, other than natural gas {CH}| heat production, wood pellet, at furnace 300kW | Cut-off, U' uses 0,07115 kg of wood as input. So 1 kg of wooddust/ biomass equals 1/0,07115 = 14,05848 MJ
Heat for thermal oil (wood waste)	Heat, district or industrial, other than natural gas (BE)| heat and power cogeneration, wood chips, 6667 kW, state-of-the-art 2014	Heat, district or industrial, other than natural gas {BE}| heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014 | Cut-off, U	EcoInvent 3.5 (2018)	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
66 kg UF-E1 0% (11F350)					
Heat (light fuel oil)	Heat production, light fuel oil, at boiler 10kW, nonmodulating (EU)	Heat, central or small-scale, other than natural gas {Europe without Switzerland}| heat production, light fuel oil, at boiler 10kW, non-modulating | Cut-off, U	EcoInvent 3.5 (2018)	no	The fuel oil can be used for several purposes, therefore the ' heat production, light fuel oil, at boiler 10kW, non-modulating' is used. Of the light fuel, at boiler process this is the 'worst case' option. The process is per MJ and Unilin has their amount available in liters. A conversion is needed; the process contains an input of 0,0249kg light fuel oil, and a density of 0,86kg/l is assumed. So 1 liter equals 1/ (0,0249/0,86) = 34,54 MJ.
Electricity	Electricity (BE) - medium voltage (1kV - 24kV)	Electricity, medium voltage {BE}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	
1.7 kg UF-E0 3% (10G400)					
Heat (light fuel oil)	Heat production, light fuel oil, at boiler 10kW, nonmodulating (EU)	Heat, central or small-scale, other than natural gas {Europe without Switzerland}| heat production, light fuel oil, at boiler 10kW, non-modulating | Cut-off, U	EcoInvent 3.5 (2018)	no	The fuel oil can be used for several purposes, therefore the ' heat production, light fuel oil, at boiler 10kW, non-modulating' is used. Of the light fuel, at boiler process this is the 'worst case' option. The process is per MJ and Unilin has their amount available in liters. A conversion is needed; the process contains an input of 0,0249kg light fuel oil, and a density of 0,86kg/l is assumed. So 1 liter equals 1/ (0,0249/0,86) = 34,54 MJ.
Electricity	Electricity (BE) - medium voltage (1kV - 24kV)	Electricity, medium voltage {BE}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	
2.1 kg UMF-E2 16% (10H122)					
Heat (light fuel oil)	Heat production, light fuel oil, at boiler 10kW, nonmodulating (EU)	Heat, central or small-scale, other than natural gas {Europe without Switzerland}| heat production, light fuel oil, at boiler 10kW, non-modulating | Cut-off, U	EcoInvent 3.5 (2018)	no	The fuel oil can be used for several purposes, therefore the ' heat production, light fuel oil, at boiler 10kW, non-modulating' is used. Of the light fuel, at boiler process this is the 'worst case' option. The process is per MJ and Unilin has their amount available in liters. A conversion is needed; the process contains an input of 0,0249kg light fuel oil, and a density of 0,86kg/l is assumed. So 1 liter equals 1/ (0,0249/0,86) = 34,54 MJ.

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
Electricity	Electricity (BE) - medium voltage (1kV - 24kV)	Electricity, medium voltage {BE}| market for | Cut-off, U	EcoInvent 3.6 (2019)	no	
Production emissions					
0.49 m^3 Chipboard SPANO (excluding glue) | m^3					
BOD emission to water	Emission to Water - BOD5, Biological Oxygen Demand	characterisation factor of the substance per impact categorie	characterisation method	no	
COD emission to water	Emission to Water - COD, Chemical Oxygen Demand	characterisation factor of the substance per impact categorie	characterisation method	no	
Arsenic emission to water	Emission to Water - Arsenic	characterisation factor of the substance per impact categorie	characterisation method	no	
Chromium emission to water	Emission to Water - Chromium III	characterisation factor of the substance per impact categorie	characterisation method	no	
Zinc emission to water	Emission to Water - Zinc	characterisation factor of the substance per impact categorie	characterisation method	no	
Copper emission to water	Emission to Water - Copper	characterisation factor of the substance per impact categorie	characterisation method	no	
Cadmium emission to water	Emission to Water - Cadmium	characterisation factor of the substance per impact categorie	characterisation method	no	
Lead emission to water	Emission to Water - Lead	characterisation factor of the substance per impact categorie	characterisation method	no	
Mercury emission to water	Emission to Water - Mercury	characterisation factor of the substance per impact categorie	characterisation method	no	
Nickel emission to water	Emission to Water - Nickel	characterisation factor of the substance per impact categorie	characterisation method	no	
Nitrogen emission to water	Emission to Water - Nitrogen, total	characterisation factor of the substance per impact categorie	characterisation method	no	
Phosphorus emission to water	Emission to Water - Phosphorus, total	characterisation factor of the substance per impact categorie	characterisation method	no	
Formaldehyde emission to water	Emission to Water - Formaldehyde	characterisation factor of the substance per impact categorie	characterisation method	no	
Formaldehyde	Emission to Air - Formaldehyde	characterisation factor of the substance per impact categorie	characterisation method	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
0.51 m^3 Chipboard BOSPAN (excluding glue) | m^3					
Arsenic emission to water	Emission to Water - Arsenic	characterisation factor of the substance per impact categorie	characterisation method	no	
Chromium emission to water	Emission to Water - Chromium III	characterisation factor of the substance per impact categorie	characterisation method	no	
Zinc emission to water	Emission to Water - Zinc	characterisation factor of the substance per impact categorie	characterisation method	no	
Copper emission to water	Emission to Water - Copper	characterisation factor of the substance per impact categorie	characterisation method	no	
Cadmium emission to water	Emission to Water - Cadmium	characterisation factor of the substance per impact categorie	characterisation method	no	
Lead emission to water	Emission to Water - Lead	characterisation factor of the substance per impact categorie	characterisation method	no	
Mercury emission to water	Emission to Water - Mercury	characterisation factor of the substance per impact categorie	characterisation method	no	
Nickel emission to water	Emission to Water - Nickel	characterisation factor of the substance per impact categorie	characterisation method	no	
Nitrogen emission to water	Emission to Water - Nitrogen, total	characterisation factor of the substance per impact categorie	characterisation method	no	
Phosphorus emission to water	Emission to Water - Phosphorus, total	characterisation factor of the substance per impact categorie	characterisation method	no	
Water BOD contents emitted to surface water	Emission to Water - BOD5, Biological Oxygen Demand	characterisation factor of the substance per impact categorie	characterisation method	no	
Water COD contents emitted to surface water	Emission to Water - COD, Chemical Oxygen Demand	characterisation factor of the substance per impact categorie	characterisation method	no	
Formaldehyde	Emission to Air - Formaldehyde	characterisation factor of the substance per impact categorie	characterisation method	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
66 kg UF-E1 0% (11F350)					
CO_2 from CO oxidation	Emission to Air - Carbon dioxide, fossil	characterisation factor of the substance per impact categorie	characterisation method	no	
Methanol	Emission to Air - Methanol	characterisation factor of the substance per impact categorie	characterisation method	no	
Dimethylether	Emission to Air - Dimethyl ether	characterisation factor of the substance per impact categorie	characterisation method	no	
Formaldehyde	Emission to Air - Formaldehyde	characterisation factor of the substance per impact categorie	characterisation method	no	
1.7 kg UF-E0 3% (10G400)					
CO_2 from CO oxidation	Emission to Air - Carbon dioxide, fossil	characterisation factor of the substance per impact categorie	characterisation method	no	
Methanol	Emission to Air - Methanol	characterisation factor of the substance per impact categorie	characterisation method	no	
Dimethylether	Emission to Air - Dimethyl ether	characterisation factor of the substance per impact categorie	characterisation method	no	
Formaldehyde	Emission to Air - Formaldehyde	characterisation factor of the substance per impact categorie	characterisation method	no	
27.6 kg UMF-E1 14% (10H120)					
CO_2 from CO oxidation	Emission to Air - Carbon dioxide, fossil	characterisation factor of the substance per impact categorie	characterisation method	no	
Methanol	Emission to Air - Methanol	characterisation factor of the substance per impact categorie	characterisation method	no	
Dimethylether	Emission to Air - Dimethyl ether	characterisation factor of the substance per impact categorie	characterisation method	no	
Formaldehyde	Emission to Air - Formaldehyde	characterisation factor of the substance per impact categorie	characterisation method	no	

Description	Shortened name in application	Processes used	Source	Thirdparty verified	Comments
2.1 kg UMF-E2 16% (10H122)					
CO_2 from CO oxidation	Emission to Air - Carbon dioxide, fossil	characterisation factor of the substance per impact categorie	characterisation method	no	
Methanol	Emission to Air - Methanol	characterisation factor of the substance per impact categorie	characterisation method	no	
Dimethylether	Emission to Air - Dimethyl ether	characterisation factor of the substance per impact categorie	characterisation method	no	
Formaldehyde	Emission to Air - Formaldehyde	characterisation factor of the substance per impact categorie	characterisation method	no	

4. Results

The results shown in this section are representative for the average board produced in the Spano and Bospan factories, weighted by production volume. The impact difference between both plants is discussed in the Sensitivity Analysis

4.1 Declared unit

Impact category	Unit	Total amount
Depletion of abiotic resources-elements	kg Sb	1.79E-3
Depletion of abiotic resources-fossil fuels	kg Sb	1.67E+0
Global warming	kg CO_2 Equiv.	1.63E+2
Ozone layer depletion	kg CFC-11 Equiv.	2.34E-5
Photochemical oxidants creation	kg Ethene Equiv.	2.16E-1
Acidification of soil and water	kg SO2 Equiv.	3.58E-1
Eutrophication	kg PO43- Equiv.	2.64E-3
Human toxicity	kg 1.4 DB	4.77E+1
Ecotoxicity. fresh water	kg 1.4 DB	4.51E+0
Ecotoxicity. marine water (MAETP)	kg 1.4 DB	6.40E+3
Ecotoxicity. terrestric	kg 1.4 DB	5.21E-1
Acidification (AP)	mol H+ eqv.	3.97E-1
Global warming potential (GWP-total)	kg CO_2 eqv.	1.60E+2
Global warming potential - Biogenic (GWP-b)	kg CO_2 eqv.	-5.13E+0
Global warming potential - Fossil (GWP-f)	kg CO_2 eqv.	1.64E+2
Global warming potential - Land use and land use change (GWP-luluc)	kg CO_2 eqv.	1.07E+0
Ecotoxicity, freshwater (ETP-fw)	CTUe	-5.54E+3
Particulate Matter (PM)	disease incidence	5.42E-6
Eutrophication marine (EP-m)	kg N eqv.	7.85E-2

Impact category	Unit	Total amount
Eutrophication, freshwater (EP-fw)	kg P eqv.	2.70E-3
Eutrophication, terrestrial (EP-T)	mol N eqv.	4.10E-1
Human toxicity, cancer (HTP-c)	CTUh	3.09E-6
Human toxicity, non-cancer (HTP-nc)	CTUh	-4.16E-8
Ionising radiation, human health (IR)	kBq U235 eqv.	7.71E+0
Land use (SQP)	Pt	-2.88E+3
Ozone depletion (ODP)	kg CFC 11 eqv.	2.90E-5
Photochemical ozone formation - human health (POCP)	kg NMVOC eqv.	6.21E-1
Resource use, fossils (ADP-f)	MJ	3.35E+3
Resource use, minerals and metals (ADP-mm)	kg Sb-eqv.	1.79E-3
Water use (WDP)	m^3 world eqv.	1.81E+2

Parameter	Unit	A1
Renewable primary energy ex. Raw materials	MJ	-2.51E+3
Renewable primary energy used as raw materials	MJ	1.60E+4
Renewable primary energy total	MJ	1.23E+4
Non-renewable primary energy ex. Raw materials	MJ	3.38E+3
Non-renewable primary energy used as raw materials	MJ	3.39E+2
Non-renewable primary energy total	MJ	3.64E+3
Use of secondary material	kg	5.59E+2
Use of renewable secondary fuels	MJ	0.00E+0
Use of non-renewable secondary fuels	MJ	0.00E+0
Use of net fresh water	M^3	3.97E+0
Hazardous waste disposed	kg	8.49E-3
Non hazardous waste disposed	kg	8.03E+1

Parameter	Unit	A1
Radioactive waste disposed	kg	1.02E-2
Components for re-use	kg	0.00E+0
Materials for recycling	kg	7.23E+1
Materials for energy recovery	kg	0.00E+0
Exported energy	MJ	3.97E+3
Exported energy thermic	MJ	2.51E+3
Exported energy electric	MJ	1.46E+3

4.2 Product stage (A1 - 3)

- A1. raw material extraction and processing. processing of secondary material input (e.g. recycling processes)
- A2. transport to the manufacturer
- A3. manufacturing

Impact category	Unit	A1	A2	A3
Depletion of abiotic resources-elements	kg Sb	7.47E-4	2.08E-4	4.08E-4
Depletion of abiotic resources-fossil fuels	kg Sb	1.02E+0	6.23E-2	3.71E-1
Global warming	kg CO_2 Equiv.	8.10E+1	8.57E+0	4.85E+1
Ozone layer depletion	kg CFC-11 Equiv.	1.40E-5	1.50E-6	7.90E-6
Photochemical oxidants creation	kg Ethene Equiv.	4.18E-2	5.16E-3	7.90E-2
Acidification of soil and water	kg SO2 Equiv.	3.93E-1	3.94E-2	2.48E-1
Eutrophication	kg PO43- Equiv.	6.54E-2	7.86E-3	6.93E-2
Human toxicity	kg 1.4 DB	3.22E+1	3.50E+0	2.56E+1
Ecotoxicity. fresh water	kg 1.4 DB	2.13E+0	1.01E-1	1.03E+0
Ecotoxicity. marine water (MAETP)	kg 1.4 DB	4.57E+3	3.63E+2	8.52E+2

Impact category	Unit	A1	A2	A3
Ecotoxicity. terrestric	kg 1.4 DB	2.15E-1	1.26E-2	2.18E-1
Acidification (AP)	mol H+ eqv.	5.45E-1	5.27E-2	3.65E-1
Global warming potential (GWP-total)	kg CO_2 eqv.	-8.85E+2	8.65E+0	4.41E+1
Global warming potential - Biogenic (GWP-b)	kg CO_2 eqv.	-9.68E+2	4.72E-3	-5.08E+0
Global warming potential - Fossil (GWP-f)	kg CO_2 eqv.	8.31E+1	8.64E+0	4.89E+1
Global warming potential - Land use and land use change (GWP-luluc)	kg CO_2 eqv.	7.53E-2	4.10E-3	1.83E-1
Ecotoxicity, freshwater (ETP-fw)	CTUe	1.03E+3	1.15E+2	2.36E+3
Particulate Matter (PM)	disease incidence	8.18E-6	7.36E-7	5.24E-6
Eutrophication marine (EP-m)	kg N eqv.	6.33E-2	1.90E-2	1.18E-1
Eutrophication, freshwater (EP-fw)	kg P eqv.	3.64E-3	8.84E-5	1.27E-3
Eutrophication, terrestrial (EP-T)	mol N eqv.	1.51E+0	2.10E-1	1.62E+0
Human toxicity, cancer (HTP-c)	CTUh	3.47E-8	3.79E-9	8.80E-7
Human toxicity, non-cancer (HTP-nc)	CTUh	8.28E-7	1.23E-7	1.28E-6
Ionising radiation, human health (IR)	kBq U235 eqv.	2.91E+0	5.41E-1	2.72E+0
Land use (SQP)	Pt	6.68E+	3 1.11E+2	1.05E+4
Ozone depletion (ODP)	kg CFC 11 eqv.	1.66E-5	1.88E-6	8.51E-6
Photochemical ozone formation - human health (POCP)	kg NMVOC eqv.	2.04E-1	5.91E-2	4.14E-1
Resource use, fossils (ADP-f)	MJ	1.99E+3	1.29E+2	8.07E+2
Resource use, minerals and metals (ADP-mm)	kg Sb-eqv.	7.47E-4	2.08E-4	4.08E-4
Water use (WDP)	m3 world eqv.	1.42E+2	4.70E-1	6.47E+0

Parameter	Unit	A1	A2	A3
Renewable primary energy ex. Raw materials	MJ	1.15E+3	1.70E+0	.01E+3
Renewable primary energy used as raw materials	MJ	8.22E+3	0.00E+0	1.21E+3
Renewable primary energy total	MJ	8.17E+3	1.70E+0	3.10E+3
Non-renewable primary energy ex. Raw materials	MJ	1.92E+3	1.37E+2	8.71E+2
Non-renewable primary energy used as raw materials	MJ	3.23E+2	0.00E+0	6.72E+0
Non-renewable primary energy total	MJ	2.17E+3	1.37E+2	8.71E+2
Use of secondary material	kg	5.02E+2	0.00E+0	4.11E+1
Use of renewable secondary fuels	MJ	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	MJ	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	M^3	3.36E+0	1.62E-2	1.54E-1
Hazardous waste disposed	kg	2.00E-3	3.27E-4	5.58E-3
Non hazardous waste disposed	kg	5.06E+0	7.71E+0	1.11E+1
Radioactive waste disposed	kg	3.87E-3	8.45E-4	3.13E-3
Components for re-use	kg	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	kg	0.00E+0	0.00E+0	5.10E+0
Materials for energy recovery	kg	0.00E+0	0.00E+0	0.00E+0
Exported energy	MJ	0.00E+0	0.00E+0	2.97E+2
Exported energy thermic	MJ	0.00E+0	0.00E+0	1.88E+2
Exported energy electric	MJ	0.00E+0	0.00E+0	1.09E+2

4.3 Construction process stage (A4 - 5)

- A4. transport to the building site
- A5. installation into the building

Impact category	Unit	A4	A5
Depletion of abiotic resources-elements	kg Sb	4.95E-4	7.10E-5
Depletion of abiotic resources-fossil fuels	kg Sb	1.43E-1	5.33E-2
Global warming	g CO_2 Equiv.	1.94E+1	5.56E+0
Ozone layer depletion	kg CFC-11 Equiv.	3.44E-6	9.39E-7
Photochemical oxidants creation	kg Ethene Equiv.	1.17E-2	5.07E-3
Acidification of soil and water	kg SO2 Equiv.	8.52E-2	3.05E-2
Eutrophication	kg PO43- Equiv.	1.67E-2	6.70E-3
Human toxicity	kg 1.4 DB	8.16E+0	2.86E+0
Ecotoxicity. fresh water	kg 1.4 DB	2.38E-1	1.30E-1
Ecotoxicity. marine water (MAETP)	kg 1.4 DB	8.57E+2	2.38E+2
Ecotoxicity. terrestric	kg 1.4 DB	2.88E-2	1.56E-2
Acidification (AP)	mol H+ eqv.	1.13E-1	4.32E-2
Global warming potential (GWP-total)	kg CO_2 eqv.	1.96E+1	5.27E+0
Global warming potential - Biogenic (GWP-b)	kg CO_2 eqv.	9.02E-3	-3.29E-1
Global warming potential - Fossil (GWP-f)	kg CO_2 eqv.	1.95E+1	5.59E+0
Global warming potential - Land use and land use change (GWP-luluc)	kg CO_2 eqv.	7.16E-3	6.51E-3
Ecotoxicity, freshwater (ETP-fw)	CTUe	2.63E+2	1.49E+2
Particulate Matter (PM)	disease incidence	1.76E-6	6.04E-7
Eutrophication marine (EP-m)	kg N eqv.	3.99E-2	1.15E-2

Impact category	Unit	A4	A5
Eutrophication, freshwater (EP-fw)	kg P eqv.	1.97E-4	1.77E-4
Eutrophication, terrestrial (EP-T)	mol N eqv.	4.40E-1	1.65E-1
Human toxicity, cancer (HTP-c)	CTUh	8.53E-9	9.27E-8
Human toxicity, non-cancer (HTP-nc)	CTUh	2.88E-7	1.08E-7
Ionising radiation, human health (IR)	kBq U235 eqv.	1.24E+0	2.66E-1
Land use (SQP)	Pt	2.56E+2	5.85E+2
Ozone depletion (ODP)	kg CFC 11 eqv.	4.31E-6	1.10E-6
Photochemical ozone formation - human health (POCP)	kg NMVOC eqv.	1.26E-1	3.63E-2
Resource use, fossils (ADP-f)	MJ	2.95E+2	1.07E+2
Resource use, minerals and metals (ADP-mm)	kg Sb-eqv.	4.95E-4	7.10E-5
Water use (WDP)	m3 world eqv.	1.05E+0	5.29E+0

Parameter	Unit	A4	A5
Renewable primary energy ex. Raw materials	MJ	3.69E+0	1.09E+2
Renewable primary energy used as raw materials	MJ	0.00E+0	2.68E+2
Renewable primary energy total	MJ	3.69E+0	3.37E+2
Non-renewable primary energy ex. Raw materials	MJ	3.13E+2	1.09E+2
Non-renewable primary energy used as raw materials	MJ	0.00E+0	9.90E+0
Non-renewable primary energy total	MJ	3.13E+2	1.16E+2
Use of secondary material	kg	0.00E+0	1.63E+1
Use of renewable secondary fuels	MJ	0.00E+0	0.00E+0
use of non-renewable secondary fuels	MJ	0.00E+0	0.00E+0

Parameter	Unit	A4	A5
use of net fresh water	M^3	3.59E-2	1.16E-1
hazardous waste disposed	kg	7.47E-4	2.94E-4
non hazardous waste disposed	kg	1.87E+1	2.94E+0
radioactive waste disposed	kg	1.94E-3	3.58E-4
Components for re-use	kg	0.00E+0	0.00E+0
Materials for recycling	kg	0.00E+0	2.11E+0
Materials for energy recovery	kg	0.00E+0	0.00E+0
Exported energy	MJ	0.00E+0	0.00E+0
Exported Energy Thermic	MJ	0.00E+0	0.00E+0
Exported Energy Electric	MJ	0.00E+0	0.00E+0

A4. transport to the building site

Parameter	Unit / functional unit
Fuel type and consumption of vehicle – or – vehicle type used for transport	not available Lorry (Truck), unspecified (default)
Distance	225 km
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

A5. installation of the product in the building

Parameter	Unit / functional unit
Ancillary materials, water use and energy use for installation	
Waste materials on the building site before waste processing generated by the product's installation	
Output materials as result of waste processing at the building site	3% of Chipboards

4.4 Use stage (B1 - 7)

- B1. use or application of the installed product (m.n.d.)
- B2. maintenance (m.n.d.)
- B3. repair (m.n.d.)
- B4. replacement (m.n.d.)
- B5. refurbishment (m.n.d.)
- B6. operational energy use (m.n.d.)
- B7. operational water use (m.n.d.)

Reference Service Life

Parameter	RSL
Product: Chipboards	50 years
wood, recyc, RPLAK | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, recyc, Palet | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, recyc, RPUUR | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, plaf | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, stam | Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m3)| Market for (EU)	100 years
wood, resh | Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m3)| Market for (EU)	100 years
wood, recyc, RPLAK | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, houtvezels | Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m3)| Market for (EU)	100 years

Parameter	RSL
wood, recyc, Palet | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, recyc, RPUUR | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, plaf | Waste wood, post-consumer {GLO}| Recycled Content cut-off	100 years
wood, stam | Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m3)| Market for (EU)	100 years
wood, resh | Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m3)| Market for (EU)	100 years
wood, houtvezels | Pulpwood, softwood, measured as solid wood under bark (700.66 kg/m3)| Market for (EU)	100 years
Anionic 45% paraffin-wax emulsion | Paraffin | production (EU)	100 years
Ammonium nitrate | Ammonium nitrate | production (EU)	100 years
Anionic 45% paraffin-wax emulsion | Paraffin | production (EU)	100 years
Ammonium nitrate | Ammonium nitrate | production (EU)	100 years
wood, vlaslemen | Straw | market for (EU)	100 years
Methanol | Methanol | market for (GLO)	100 years
Urea | Urea, as N | production (EU)	100 years
Melamine | Melamine | production (EU)	100 years
Acetic Acid 40%, active matter | Acetic acid, without water, in 98% solution state | market for (GLO)	100 years
Sodium hydroxide 25%, active matter | Sodium hydroxide, without water, in 50% solution state | market for (GLO)	100 years
Sodium acetate | NIBE Sodium acetate | market for (GLO)	100 years
Methanol | Methanol | market for (GLO)	100 years
Water | Water - Tap water	100 years
Urea | Urea, as N | production (EU)	100 years
Melamine | Melamine | production (EU)	100 years
Acetic Acid 40%, active matter | Acetic acid, without water, in 98% solution state | market for (GLO)	100 years

Parameter	RSL
Sodium hydroxide 25%, active matter | Sodium hydroxide, without water, in 50% solution state | market for (GLO)	100 years
Sodium acetate | NIBE Sodium acetate | market for (GLO)	100 years
Methanol | Methanol | market for (GLO)	100 years
Urea | Urea, as N | production (EU)	100 years
Water | Water - Tap water	100 years
Melamine | Melamine | production (EU)	100 years
Acetic Acid 40%, active matter | Acetic acid, without water, in 98% solution state | market for (GLO)	100 years
Sodium hydroxide 25%, active matter | Sodium hydroxide, without water, in 50% solution state | market for (GLO)	100 years
Sodium acetate | NIBE Sodium acetate | market for (GLO)	100 years
Methanol | Methanol | market for (GLO)	100 years
Urea | Urea, as N | production (EU)	100 years
Melamine | Melamine | production (EU)	100 years
Water | Water - Tap water	100 years
Acetic Acid 40%, active matter | Acetic acid, without water, in 98% solution state | market for (GLO)	100 years
Sodium hydroxide 25%, active matter | Sodium hydroxide, without water, in 50% solution state | market for (GLO)	100 years
Sodium acetate | NIBE Sodium acetate | market for (GLO)	100 years
Water | Water - Tap water	100 years

4.5 End of life stage (C1 - 4)

- C1. de-construction. Demolition (m.n.d.)
- C2. transport to waste processing
- C3. waste processing for reuse. recovery and/or recycling
- C4. disposal

Impact category	Unit	C2	C3	C4
Depletion of abiotic resources-elements	kg Sb	3.03E-4	1.29E-5	3.70E-6
Depletion of abiotic resources-fossil fuels	kg Sb	8.71E-2	3.47E-2	3.97E-3
Global warming	kg CO_2 Equiv.	1.18E+1	5.94E+0	2.47E+0
Ozone layer depletion	kg CFC-11 Equiv.	2.10E-6	6.53E-7	8.54E-8
Photochemical oxidants creation	kg Ethene Equiv.	7.15E-3	2.28E-2	7.70E-4
Acidification of soil and water	kg SO2 Equiv.	21E-2	1.22E-1	2.27E-3
Eutrophication	kg PO43- Equiv.	1.02E-2	3.13E-2	9.34E-4
Human toxicity	kg 1.4 DB	4.99E+0	1.44E+1	2.13E-1
Ecotoxicity. fresh water	kg 1.4 DB	1.46E-1	6.28E-1	4.19E-3
Ecotoxicity. marine water (MAETP)	kg 1.4 DB	5.24E+2	3.68E+2	1.51E+1
Ecotoxicity. terrestric	kg 1.4 DB	1.76E-2	1.61E-2	6.92E-4
Acidification (AP)	mol H+ eqv.	6.93E-2	1.79E-1	3.00E-3
Global warming potential (GWP-total)	kg CO_2 eqv.	1.20E+1	9.65E+2	3.64E+0
Global warming potential - Biogenic (GWP-b)	kg CO_2 eqv.	5.51E-3	9.59E+2	3.25E+0
Global warming potential - Fossil (GWP-f)	kg CO_2 eqv.	1.19E+1	6.04E+0	3.87E-1
Global warming potential - Land use and land use change (GWP-luluc)	kg CO_2 eqv.	4.38E-3	2.87E-3	1.69E-4
Ecotoxicity, freshwater (ETP-fw)	CTUe	1.61E+2	1.62E+2	8.19E+0
Particulate Matter (PM)	disease incidence	1.07E-6	1.44E-6	5.68E-8
Eutrophication marine (EP-m)	kg N eqv.	2.44E-2	8.13E-2	1.93E-3

Impact category	Unit	C2	C3	C4
Eutrophication, freshwater (EP-fw)	kg P eqv.	1.21E-4	2.57E-4	7.21E-6
Eutrophication, terrestrial (EP-T)	mol N eqv.	2.69E-1	9.36E-1	1.11E-2
Human toxicity, cancer (HTP-c)	CTUh	5.21E-9	2.15E-6	2.27E-10
Human toxicity, non-cancer (HTP-nc)	CTUh	1.76E-7	5.31E-7	8.75E-9
Ionising radiation, human health (IR)	kBq U235 eqv.	7.55E-1	2.03E-1	3.20E-2
Land use (SQP)	Pt	1.56E+2	1.94E+1	1.93E+1
Ozone depletion (ODP)	kg CFC 11 eqv.	2.64E-6	7.11E-7	1.07E-7
Photochemical ozone formation - human health (POCP)	kg NMVOC eqv.	7.68E-2	2.44E-1	3.96E-3
Resource use, fossils (ADP-f)	MJ	1.80E+2	6.54E+1	8.17E+0
Resource use, minerals and metals (ADP-mm)	kg Sb-eqv.	3.03E-4	1.29E-5	3.70E-6
Water use (WDP)	m3 world eqv.	6.45E-1	2.48E+1	3.50E-1

Parameter	Unit	C2	C3	C4
renewable primary energy ex. raw materials	MJ	2.26E+0	3.51E+0	1.44E-1
renewable primary energy used as raw materials	MJ	0.00E+0	0.00E+0	0.00E+0
renewable primary energy total	MJ	2.26E+0	3.51E+0	1.44E-1
non-renewable primary energy ex. raw materials	MJ	1.91E+2	7.01E+1	8.68E+0
non-renewable primary energy used as raw materials	MJ	0.00E+0	0.00E+0	0.00E+0
non-renewable primary energy total	MJ	1.91E+2	7.01E+1	8.68E+0
use of secondary material	kg	0.00E+0	0.00E+0	0.00E+0
use of renewable secondary fuels	MJ	0.00E+0	0.00E+0	0.00E+0
use of non-renewable secondary fuels	MJ	0.00E+0	0.00E+0	0.00E+0
use of net fresh water	M^3	2.19E-2	2.65E-1	8.53E-3

Parameter	Unit	C2	C3	C4
hazardous waste disposed	kg	4.57E-4	3.38E-4	1.26E-5
non hazardous waste disposed	kg	1.14E+1	4.37E+0	3.27E+1
radioactive waste disposed	kg	1.18E-3	2.17E-4	4.86E-5
Components for re-use	kg	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	kg	0.00E+0	6.51E+1	0.00E+0
Materials for energy recovery	kg	0.00E+0	0.00E+0	0.00E+0
Exported energy	MJ	0.00E+0	0.00E+0	0.00E+0
Exported Energy Thermic	MJ	0.00E+0	0.00E+0	0.00E+0
Exported Energy Electric	MJ	0.00E+0	0.00E+0	0.00E+0

4.6 Benefits and loads beyond the system boundary (D)

Impact category	Unit	D
Depletion of abiotic resources-elements	kg Sb	-4.56E-4
Depletion of abiotic resources-fossil fuels	kg Sb	-1.10E-1
Global warming	kg CO_2 Equiv.	-2.01E+1
Ozone layer depletion	kg CFC-11 Equiv.	-7.15E-6
Photochemical oxidants creation	kg Ethene Equiv.	4.22E-2
Acidification of soil and water	kg SO2 Equiv.	-6.14E-1
Eutrophication	kg PO43- Equiv.	-2.06E-1
Human toxicity	kg 1.4 DB	-4.42E+1
Ecotoxicity. fresh water	kg 1.4 DB	1.05E-1
Ecotoxicity. marine water (MAETP)	kg 1.4 DB	-1.39E+3
Ecotoxicity. terrestric	kg 1.4 DB -	3.74E-3
Acidification (AP)	mol H+ eqv.	-9.74E-1
Global warming potential (GWP-total)	kg CO_2 eqv.	-1.39E+1
Global warming potential - Biogenic (GWP-b)	kg CO_2 eqv.	5.85E+0
Global warming potential - Fossil (GWP-f)	kg CO_2 eqv.	-2.05E+1
Global warming potential - Land use and land use change (GWP-luluc)	kg CO_2 eqv.	7.91E-1
Ecotoxicity, freshwater (ETP-fw)	CTUe	-9.79E+3
Particulate Matter (PM)	disease incidence	-1.37E-5
Eutrophication marine (EP-m)	kg N eqv.	-2.81E-1
Eutrophication, freshwater (EP-fw)	kg P eqv.	-3.06E-3
Eutrophication, terrestrial (EP-T)	mol N eqv.	-4.75E+0
Human toxicity, cancer (HTP-c)	CTUh	-8.22E-8
Human toxicity, non-cancer (HTP-nc)	CTUh	-4.37E-6

Impact category	Unit	D
Ionising radiation, human health (IR)	kBq U235 eqv.	-9.44E-1
Land use (SQP)	Pt	-2.12E+4
Ozone depletion (ODP)	kg CFC 11 eqv.	-6.81E-6
Photochemical ozone formation - human health (POCP)	kg NMVOC eqv.	-5.43E-1
Resource use, fossils (ADP-f)	MJ	-2.27E+2
Resource use, minerals and metals (ADP-mm)	kg Sb-eqv.	-4.56E-4
Water use (WDP)	m3 world eqv.	-5.59E-1

Parameter	Unit	D
Renewable primary energy ex. Raw materials	MJ	-5.80E+3
Renewable primary energy used as raw materials	MJ	6.31E+3
Renewable primary energy total	MJ	7.26E+2
Non-renewable primary energy ex. Raw materials	MJ	-2.38E+2
Non-renewable primary energy used as raw materials	MJ	-1.55E-3
Non-renewable primary energy total	MJ	-2.38E+2
Use of secondary material	kg	0.00E+0
Use of renewable secondary fuels	MJ	0.00E+0
Use of non-renewable secondary fuels	MJ	0.00E+0
Use of net fresh water	M^3	-1.68E-2
Hazardous waste disposed	kg	-1.27E-3
Non hazardous waste disposed	kg	-1.37E+1
Radioactive waste disposed	kg	-1.39E-3
Components for re-use	kg	0.00E+0
Materials for recycling	kg	0.00E+0

Parameter	Unit	D
Materials for energy recovery	kg	0.00E+0
Exported energy	MJ	3.67E+3
Exported energy thermic	MJ	2.32E+3
Exported energy electric	MJ	1.35E+3

5. Sensitivity analysis

Two sensitivity analyses are performed to evaluate the impact of decisions made when creating this EPD.

Production in the Spano or the Bospan factory

The first analysis is performed to check the difference between those panels produced in the Spano factory and those produced in the Bospan factory. This EPD discusses the average impact of both plants because the same panel types are made at both locations and they cannot be distinguished by customers.

The main difference between both sites is the energy mix: Bospan was recently updated with a new, large-scale power plant that supplies both heat and electricity to the factory, contrasting with the power plant at Spano which only supplies green electricity to the factory.

The effect of this difference is quite pronounced: panels produced in the Bospan factory perform 11-123 % better than the average of both plants, while those produced in Spano have impacts of 11-162 % higher than average.

Different densities

The panels are produced in different densities for different applications. The results of this EPD are expressed per volume (1 m^3 chipboard), determined for the average density of the produced panels.

The impact results are correlated to the mass, and therefore the density, of the panels:

- Lighter panels essentially underwent less compaction, so they contain less wood, resins and additives and required less energy than denser panels of the same volume.
- The lighter panels also have a lower transport impact per m^3 as the transport capacity is mass-limited rather than volume-limited for relatively high density products such as chipboards.
- End-of-life emissions are also correlated directly to the mass. For example higher mass panels contain more carbon and will therefore cause more CO_2 emissions upon oxidation.
- Packaging materials probably wouldn't be related directly to the density of the product.But chipboards are sold in bulk, so there's practically no use of packaging materials.

This means that the impact of the different panel types can easily be approximated based on their density, assuming a linear correlation between impact and mass. The densest panels have a density of 760 kg/m^3, so their impacts are 17 % higher than those of the average panels which have a density of 652 kg/m^3. On the other end of the spectrum, the lightest panels weigh only 430 kg/m^3 and have impacts that are 34 % lower than those reported for the average panels.

As the range of deviations is fairly large it's recommended to adjust the EPD results based on the product's density when it differs significantly from the average panel's density reported on in this EPD. This is especially important in the case of ultralight panels: applying the results presented in this EPD would cause an overestimation by up to 52 %.

		Total impact/m^3			Deviation from weighted average	
NMD set 1 indicators	Unit	Weighted average	Spano	Bospan	Spano	Bospan
Depletion of abiotic resources-elements	kg Sb	6.27E-04	7.13E-04	5.46E-04	14%	-13%
Depletion of abiotic resources-fossil fuels	kg Sb	1.74E+00	2.14E+00	1.36E+00	23%	-22%
Global warming	kg CO_2 Equiv.	1.71E+02	2.13E+02	1.31E+02	25%	-23%
Ozone layer depletion	kg CFC-11 Equiv.	2.55E-05	3.14E-05	1.99E-05	23%	-22%
Photochemical oxidants creation	kg Ethene Equiv.	2.20E-01	2.44E-01	1.97E-01	11%	-10%
Acidification of soil and water	kg SO2 Equiv.	3.89E-01	5.13E-01	2.70E-01	32%	-31%
Eutrophication	kg PO43- Equiv.	1.88E-02	4.92E-02	-4.30E-03	162%	-123%
Human toxicity	kg 1.4 DB	4.83E+01	5.81E+01	3.89E+01	20%	-19%
Ecotoxicity. fresh water	kg 1.4 DB	4.20E+00	4.68E+00	3.73E+00	11%	-11%
Ecotoxicity. marine water (MAETP)	kg 1.4 DB	6.49E+03	7.49E+03	5.53E+03	15%	-15%
Ecotoxicity. terrestric	kg 1.4 DB	4.03E-01	4.59E-01	3.49E-01	14%	-13%

6. References

ISO 14040

ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044

ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025

ISO 14025:2011-10: Environmental labels and declarations - Type III environmental declarations - Principles and procedures

EN 15804+A2

EN 15804+A2: 2019: Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products

NMD verification protocol

NMD verification protocol version 1.0 (July 2020)

NMD Determination method

NMD Determination method Environmental performance Construction works v1.0 July 2020, foundation NMD

Ecoinvent 3.6

Version 3.6 (2019) of the Ecoinvent LCA database

EN 16449:2014

Wood and wood-based products - Calculation of the biogenic carbon content of wood and conversion to carbon dioxide