ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	Sonae Arauco, S.A.
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SON-20150246-IBA1-EN
Issue date	17-02-2016
Valid to	16-02-2021

AGEPAN® and Greenline® OSB (Oriented Strand Board)

Sonae Arauco, S.A.

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

1. General Information

Sonae Arauco, S.A.	Oriented Strand Board, OSB
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** Sonae Arauco, S.A. C/Ronda de Poniente, 6 - B Centro Empresarial Euronova 28760 Tres Cantos (Madrid) España
Declaration number EPD-SON-20150246-IBA1-EN	**Declared product / Declared unit** AGEPAN® and Greenline® OSB (Oriented Strand Board), per m^3
This Declaration is based on the Product Category Rules: Wood based panels, 07.2014 (PCR tested and approved by the SVR)	**Scope:** This document refers to sanded and unsanded OSB manufactured in the following plant of the Sonae Arauco group: Sonae Arauco Deutschland GmbH Strohmweg 1 D-38489 Nettgau Germany The production volume of this plant covers 100 % of the total production of OSB by Sonae Arauco group.
Issue date 17-02-2016	The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Valid to 16-02-2021	**Verification** The CEN Norm /EN 15804/ serves as the core PCR Independent verification of the declaration according to /ISO 14025/ ☐ internally ☒ externally
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	Manfred Russ (Independent verifier appointed by SVR)
Dr. Burkhart Lehmann (Managing Director IBU)	

2. Product

2.1 Product description

AGEPAN® and Greenline® OSB (Oriented Strand Board) are wood materials comprising large longitudinal wood shavings ("strands") which are glued with formaldehyde-free glue, using a synthetic resin binding agent (PMDI). The strands are aligned in a process-controlled manner (oriented) and compressed in a continuous process (ContiRoll technology) in three layers ranging in thickness from 6 to 40 mm. The upper and lower layers are longitudinal while the middle layer runs transversal to the panel direction.

Both AGEPAN® and Greenline® OSB are targeted at similar applications, however the Greenline® OSB brand is focused on the retail and distribution channels.

2.2 Application

AGEPAN® and Greenline® OSB have a high load capacity and are dimensionally stable. They can be used for both constructive and decorative purposes.

A prerequisite for constructive application is represented by the performance characteristics to EN 13986 and the CE mark.

Areas of application include: supporting and bracing wall and ceiling paneling, floor installations and installation panels, shop and trade fair stand construction as well as packaging and furniture elements.

Various OSB qualities are numbered 1 to 4 according to EN 300.
The following classifications apply for various applications:

- OSB/1: Panels for general purposes and interior furnishings (incl. furniture) for use in dry conditions
- OSB/2: Panels for load-bearing purposes for use in dry conditions

- OSB/3: Panels for load-bearing purposes for use in wet conditions
- OSB/4: High load-capacity panels for load-bearing purposes for use in wet conditions

2.3 Technical Data

Values cover OSB/2, OSB/3 and OSB/4:

Name	Value	Unit
Gross density according to EN 300	590 - 640	kg/m³
Bending strength (longitudinal) according to EN 12369-1	14 - 25	N/mm²
Bending strength (transverse) according to EN 12369-1	7 - 13	N/mm²
E-module (longitudinal) according to EN 12369-1	4930 - 6780	N/mm²
E-module (transverse) according to EN 12369-1	1980 - 2680	N/mm²
Thermal conductivity according to EN 13986	0.13	W/(mK)
Water vapour diffusion resistance factor according to EN 13986 (only for OSB/3 and OSB/4)	150 - 250	-

Declaration of Performance (DoP)
For more details on technical information, please see the AGEPAN® and Greenline® OSB Declaration of Performance (DoP) at:

www.sonaearauco.com/dop

2.4 Placing on the market / Application rules

AGEPAN® and Greenline® OSB are permeable wood-based materials (in accordance with EN 13986 for constructive and decorative applications) and comply with the following product standards:

- EN 13986:2015, Wood-based panels for use in construction — Characteristics, evaluation of conformity and marking
- EN 300:2006, Oriented strand boards (OSB) — Definitions, classification and specifications
- EN 14964:2006, Rigid underlays for discontinuous roofing — Definitions and characteristics

They can be used in all static, load-bearing applications in accordance with:

- DIN 1052-10:2008-12, Design of timber structures — Part 10: Additional provisions
- EN 1995-1-1:2004, Eurocode 5: Design of timber structures – Part 1-1: General — Common rules and rules for buildings
- EN 1995-1-2:2004 + AC:2009, Eurocode 5: Design of timber structures — Part 1-2: General — Structural fire design

2.5 Delivery status

The gross densities of OSB are dependent on the quality (OSB/1 – OSB/4) and thickness and are between 590 and 640 kg/m³. Boards of 6 mm to 40 mm thickness are manufactured in various standard formats or to special customer specifications.

	Min value	Max value	Unit
Thickness	6	40	mm
Width	590	1250	mm
Length	1840	6250	mm

For updated information on available dimensions, please refer to www.agepan.de/produkt

2.6 Base materials / Ancillary materials

AGEPAN® and Greenline® with thicknesses of 6 to 40 mm with an average density of 600 kg/m³ comprise (details provided as mass % per 1 m³ of product):

- Wood chips, primarily pine, > 90 %
- Water (moisture), approx. 4.5 %
- PMDI adhesive (polymer 4.4’ diphenyl methane diisocyanate), approx. 3.5 %
- Paraffin wax emulsion, 0.5 % to 2 %

Pine logs from indigenous, largely regional forestry plantations are used for manufacturing AGEPAN® and Greenline® OSB. The wood is procured from forests within a radius of approx. 110 km of the plant location. When wood imports are required, the average wood procurement distances (to the plant) increase to around 180 km.

Short transport routes make a particular contribution towards minimising CO_2 emissions and the logistical effort involved in the provision of raw materials.

The entire OSB product range is PEFC™ certified. FSC® certified products can be made available on request.

2.7 Manufacture

The manufacturing of OSB comprises the following steps:

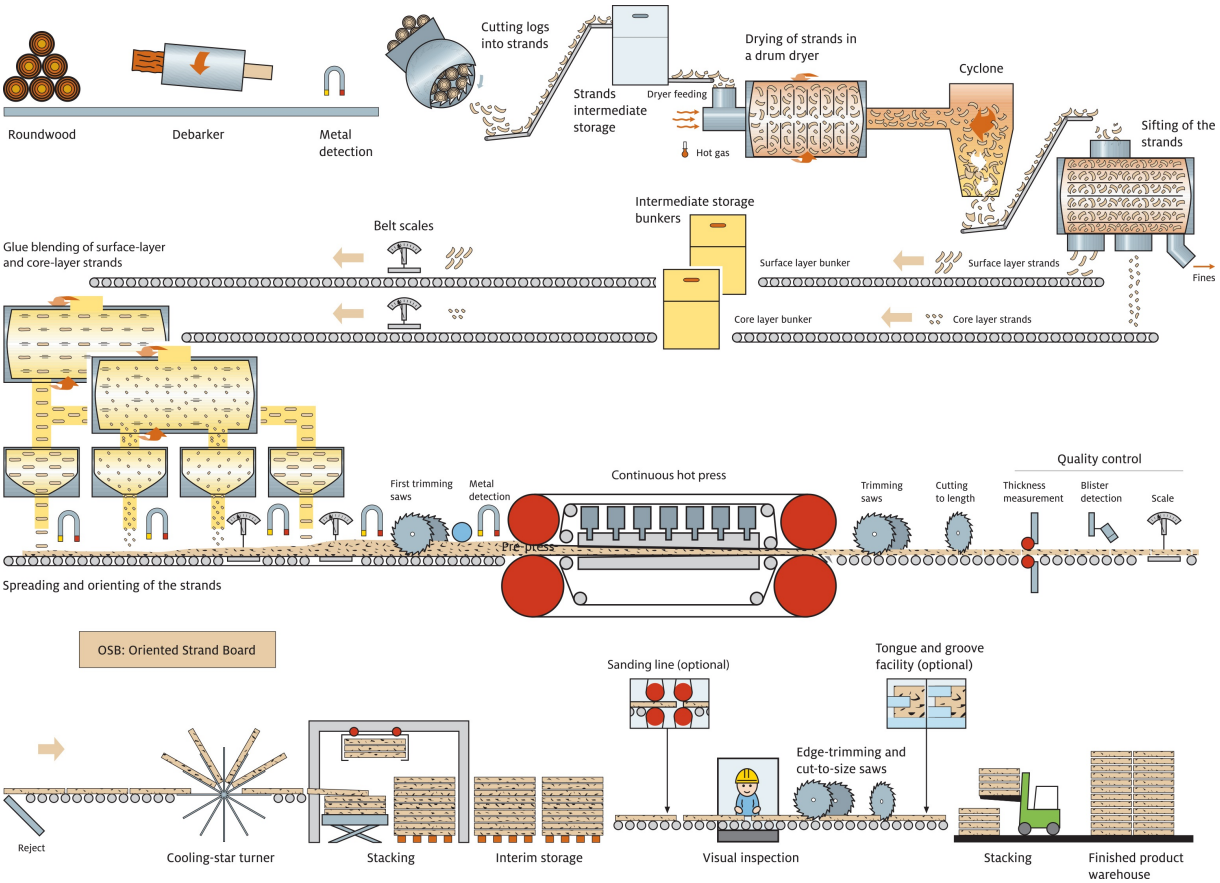
1. Debarking the logs
2. Chipping the wood in the knife ring flaker
3. Drying
4. Sifting in top and middle layer fractions
5. Interim storage in proportioning hoppers
6. Weight determination of strands with scale
7. Separate glueing of the top and middle layer strands
8. Scattering the OSB mat (alignment of the strands)
9. Compressing the OSB mat under high pressure in a continuous hot press
10. Cooling the raw boards in star coolers
11. Stacking
12. Optional: Sanding the top and underside
13. Optional: Distribution into fixed formats or tongue and groove panels

A process diagram is presented below.

The production site is certified according to the following standards:

- EN ISO 9001:2008;
- EN ISO 14001:2009;
- OHSAS 18001:2007;
- EN ISO 50001:2011.

Additionally, all range includes CE marked products, and PEFC™ and FSC® certified products can be made available on request.



2.8 Environment and health during manufacturing

Health protection: Due to the manufacturing conditions, no special health protection measures over and beyond the regulatory guidelines are required. The reference occupational exposure limit values are complied with.

Emissions into air: Waste air generated during production is cleaned in accordance with regulatory specifications. Emissions are below the limit values specified by the operation license of the site, specified according to the German law.

Emissions into water/soil: No normal process contamination of water or soil exists. The production site does not have any production-related waste water.

Noise: Sound protection analyses have established that all values communicated inside and outside the production facilities are below the standards applicable in Germany. Noise-intensive plant areas such as chipping are encapsulated appropriately by structural measures.

The production site is EN ISO 14001:2009 certified.

2.9 Product processing/Installation

AGEPAN® and Greenline® OSB can be sawn, drilled and milled using standard (electric) power tools. Carbide-tipped tools should be given preference, especially on circular saws. Respiratory protection should be worn when using hand-held equipment without suction devices.

2.10 Packaging

Particleboard, OSB and corrugated cardboard are used for covering while PET or steel tape packing bands are used for packing.

2.11 Condition of use

The materials used in AGEPAN® and Greenline® OSB comply with the percentages indicated in 2.6., whereby a polyurethane resin is used as a binding agent for the boards with formaldehyde-free gluing system.

VOC emissions: AGEPAN® and Greenline® OSB boards are labelled as class A according to the French regulation on the labelling of emissions of volatile pollutants from construction and decoration products (with reference to the wall scenario, as a worst case).

Additionally, part of the range for AGEPAN® and Greenline® OSB boards have been certified with the IBU environmental quality label.

AGEPAN® and Greenline® OSB at an average density of 600 kg/m^3 store 995 kg CO_2-eq/m^3 over their service life.

2.12 Environment and health during use

Environmental protection: According to current information, water, air and soil are not exposed to any dangers when AGEPAN® and Greenline® OSB boards are used as designated.

Health protection: According to current information, no damage to or impairment of health can be anticipated when AGEPAN® and Greenline® OSB boards are used as designated.

2.13 Reference service life

Due to the wide range of applications of AGEPAN® and Greenline® OSB, no reference service life is declared.

2.14 Extraordinary effects

Fire

Fire retardant classification of AGEPAN® and Greenline® OSB boards is done according to EN 13986. Fire retardant classes are defined in accordance with EN 13501-1.
The classification is D-s2, d0.

Fire protection (excluding flooring applications, and for thicknesses above 9 mm):

Name	Value
Building material class	D
Smoke gas development	S2
Burning droplets	d0

Water

No ingredients are washed out which could be hazardous to water. OSB boards are not resistant to permanent exposure to water; damaged areas can however be replaced locally.

Mechanical destruction

OSB board breakage features display relatively brittle performance, whereby sharp edges can arise on the broken panel edges (risk of injury).

2.15 Re-use phase

Recycling: AGEPAN® and Greenline® OSB boards from construction can be collected separately and utilised in the manufacture of particleboard. This is based on the condition that the wooden boards are not fully glued.

Energy recovery: due to the high heating value of approx. 15.7 MJ/kg at an assumed end-of-life moisture content of 20 %, AGEPAN® and Greenline® OSB boards can be used for energy recovery and the generation of heat and electricity (e.g. in CHP plants), following the cascading principle for wood.

2.16 Disposal

OSB leftovers and residual materials incurred as a result of demolition measures on the building site should be primarily directed towards material recycling. If this is not possible, they must be directed toward energy recovery instead of landfilling.

Waste code according to the European List of Waste: 17 02 01

2.17 Further information

Further information such as technical datasheets etc. can be downloaded under:

www.sonaearauco.com

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit for the LCA is 1 m^3 of AGEPAN® and Greenline® OSB.
The indicator values represent an average product of a density of 600 kg/m^3, which represents the (slightly rounded) weighted production mix of the reference year.

Information on the declared unit

Name	Value	Unit
Declared unit	1	m^3
Conversion factor to 1 kg	0.0016667	-
Mass reference	600	kg/m^3

3.2 System boundary

Type of the EPD: cradle to gate - with options

Modules A1 – A3 of the production stage cover the manufacturing of the products, including raw material extraction and processing, energy generation, the production of ancillary products and packaging materials, transport, as well as all waste treatment processes. Eventual benefits of recycling or energy recovery are neglected.
The resource aspects of wood were inventoried via material inherent properties as resource extraction of CO_2 from the atmosphere and the lower heating value as the use of renewable energy. Material inherent properties are subject to co-product allocation as ruled in EN 15804.

Module A5 covers the transport of the packaging material from the construction site and its disposal. Default end-of-waste states for the packaging materials from the packed products at the construction site are defined in analogy for wastes occurring in modules A1-A3. Eventual further inputs for the installation of the products are not considered due to the broad applicability of the assessed products.
The substituted primary material from the net amount of recycled material and from recovered energy exported from the product system in Module A5 are declared in Module D.

Module C3 covers the preparation of the post-consumer board to become a secondary fuel; the end-of-waste status for recycled wood-based boards is defined as the point where they have been sorted and chipped, ready to be used as secondary fuels.
In line with EN 16485, the export of the biogenic carbon stored in the board, expressed in CO_2-equivalent is also reported in module C3.

Module D compiles all the benefits and burdens associated with the secondary fuels, secondary materials and exported energy leaving the production system in the modules A5 and C3.

Therefore, module D covers the avoided burdens from recycling and from energy recovered from the waste treatment in module A5 as well as the transport of the obsolete boards to a biomass combustion plant, the combustion process itself and
the loads and benefits of the substitution of fossil fuels and/or electricity. Substitution effects in module D are always calculated for the net amount of secondary material or secondary fuel of the product system in line with EN 16485.

3.3 Estimates and assumptions

For the quantification of the net flows of recycled wood (input of post-consumer wood used as a fuel minus post-consumer wood exiting the product system into module D for energy recovery), it was assumed that all inputs of post-consumer wood are used as a fuel. Beyond that, no relevant estimates or assumptions had to be made beyond the information provided in this EPD.

3.4 Cut-off criteria

The applicable criteria for the exclusion of inputs and outputs are defined in EN 15804, clause 6.3.5, and in the IBU PCR part A (IBU 2013), respectively.
All data were taken into account that resulted from the data collection procedure in the plants, e.g. related to fuels, raw material input, use of ancillary materials, waste flows, emissions into air, water use, waste water, transport means and transport distances, etc..
Expenses for the general management, research & development, administration and marketing – if known – were not taken into account.
The production of eventual packaging of ancillary material or other inputs used during production (and some of the reported wastes) were generally neglected; in most cases reusable bins or containers are used. In addition, the amounts of reported (unspecific) wastes are that small that their production can be considered not relevant for the life cycle assessment. Additional plant specific information can be found in the respective chapters for each plant.
Beyond that some ancillary materials were cut off due to very small amounts and as inputs not directly related to production processes but to the maintenance of infrastructure, e.g. acetylene and oxygen for soldering, etc.
With this approach also mass and energy flows below 1 percent of total mass and energy flows caused by the declared products were included in the assessment.
Beyond that, no material or energy flows were neglected that would have been known by the persons responsible for the project and that could have been expected to contribute significantly to the environmental indicators declared. It can thus be assumed that the total contribution of the neglected processes is not higher than 5 % of the declared impact categories.

3.5 Background data

Datasets from ecoinvent v.2.2 including all updates available under www.lc-inventories.ch were used as background data exclusively; these updates include the update of energy mixes and some process chains, e.g. for the provision of natural gas. Therefore, the latest update of the background data took place in 2014.

3.6 Data quality

The requirements on the data quality and the background data correspond to the provisions in EN 15804 and the IBU PCR part A (IBU 2013) respectively:

- Data are as current as possible. Datasets used for calculations were updated within the last 10 years for generic data and within the last 5 years for producer specific data;
- Datasets are based on 1 year averaged data as a general rule;
- The time period over which inputs to and outputs from the system are accounted for is 100 years from the year for which the data set is deemed representative;
- The technological coverage reflects the physical reality for the declared products;
- The background datasets comply with the quality guidelines of ecoinvent 2.2; deviations from the methodological prescriptions of EN 15804 and the IBU PCR part A (IBU 2013) respectively are possible but acceptable according to IBU PCR part A (IBU 2013).

3.7 Period under review

The company data gathered for this EPD represents the year 2012.

3.8 Allocation

Specific data for the production line for the production of OSB was available for all relevant inputs. Airborne emissions were attributed based on the relative energy consumption of the different products produced in the plant, except for formaldehyde, which was allocated to the products using UF glues. The inventories for the wood inputs were taken from ecoinvent 2.2. In ecoinvent, the forestry and sawmilling processes are allocated based on revenues of the different co-products of a joint co-production process (Werner et al., 2007, based on Schweinle, 2000). In these datasets, resource corrections are made for incorporated biogenic carbon and renewable energy; these flows thus reflect the real physical flows.
No post-consumer secondary wood is used as an input to produce the OSB; for the end-of-life scenario the end-of-waste status was defined after the sorting and chipping of the wood-based board in line with EN 16485 (see also clause 3.2). Loads and benefits of energy recovery are thus reported in module D.
Waste packaging in module A5 was considered not to reach the end-of-waste state as a fuel. Its incineration is reported in A5, the benefits of energy recovery in module D. The benefits of the recycling of a minor amount of cardboard packaging are disregarded.
No co-product allocation was made in the modelling of the life cycle assessment underlying this EPD.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

Installation into the building (A5)
Eventual further inputs for the installation of the products are not considered due to the broad applicability of the assessed products.An average transport distance of 30 km was assumed for packaging waste from the construction site to the recycling plant or to the municipal waste incineration plant. The municipal waste incineration plant is assumed to have an overall energy efficiency of 53 % related to the lower heating value of the waste input; 92 % of the recovered energy is heat, 8 % is electricity (according to specifications of MWI plants in ecoinvent 2.2).

Waste treatment (C3)
683 kg of OSB are chipped and exported from the product life cycle into module D, assuming a moisture content of 20 % and a lower heating value of 15.7 MJ/kg.

Reuse, recycling, recovery potential (D)
According to default assumptions in other IBU EPDs, post-consumer wood is used as a secondary fuel for energy recovery in a biomass combustion plant with an overall energy efficiency of 93 % related to the lower heating value of the fuel input; 91 % of the recovered energy is heat, 9 % is electricity.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	X	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: Oriented Strand Board (OSB) AGEPAN®, per m³

Parameter	Unit	A1-A3	A5	C3	D
Global warming potential	[kg CO_2-Eq.]	-826.96	19.70	1001.85	-637.48
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	5.27E-6	2.40E-8	2.76E-7	-6.89E-5
Acidification potential of land and water	[kg SO_2-Eq.]	9.69E-1	3.63E-3	2.57E-2	-5.92E-1
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.72E-1	8.15E-4	3.37E-3	-5.57E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	5.55E-2	1.48E-4	1.16E-3	-5.80E-2
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.73E-4	1.43E-6	3.96E-6	-7.38E-5
Abiotic depletion potential for fossil resources	[MJ]	3.71E+3	7.38E+0	1.13E+2	-1.23E+4

RESULTS OF THE LCA - RESOURCE USE: Oriented Strand Board (OSB) AGEPAN®, per m³

Parameter	Unit	A1-A3	A5	C3	D
Renewable primary energy as energy carrier	[MJ]	4.05E+3	2.91E-1	1.37E+1	-2.84E+2
Renewable primary energy resources as material utilization	[MJ]	1.00E+4	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	1.41E+4	2.91E-1	1.37E+1	-2.84E+2
Non-renewable primary energy as energy carrier	[MJ]	2.80E+3	7.91E+0	1.31E+2	-1.20E+4
Non-renewable primary energy as material utilization	[MJ]	1.01E+3	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	3.81E+3	7.91E+0	1.31E+2	-1.20E+4
Use of secondary material	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	9.92E+3
Use of non-renewable secondary fuels	[MJ]	0.00	0.00	0.00	1010.00
Use of net fresh water	[m³]	8.68E+0	2.21E-2	2.34E-1	-3.81E+0

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: Oriented Strand Board (OSB) AGEPAN®, per m³

Parameter	Unit	A1-A3	A5	C3	D
Hazardous waste disposed	[kg]	4.74E-3	1.76E-5	1.52E-4	-4.23E-3
Non-hazardous waste disposed	[kg]	1.11E+1	1.97E-1	7.18E-1	5.63E+0
Radioactive waste disposed	[kg]	5.48E-3	2.21E-5	1.14E-3	-2.25E-2
Components for re-use	[kg]	0.00	0.00	0.00	0.00
Materials for recycling	[kg]	31.40	0.28	0.00	0.00
Materials for energy recovery	[kg]	0.00	0.00	683.00	0.00
Exported electrical energy	[MJ]	0.21	0.52	0.00	0.00
Exported thermal energy	[MJ]	0.67	59.70	0.00	0.00

6. LCA: Interpretation

Figure 1 illustrates the contribution of each life cycle stage to the overall indicator results of the impact assessment (impact from module A1-A3 = 100 %). The Figure illustrates that for the GWP, the ODP, the POCP and the ADP fossil, the benefits from the energy recovery of OSB AGEPAN® are higher that the impacts during the life cycle, notably the impacts from production. For other impact categories, the benefits of energy recovery lie between 10 % to 65 %, depending on the impact category under consideration.

The *global warming potential (GWP)* is an indicator for the contribution to climate change and is quantified based on the emissions of gases that absorb radiative forcing.
The production phase of OSB AGEPAN® dominates the GWP. Of the production phase, roughly 40 % of the GWP are caused related to the production of the glue (PMDI), 14 % related to the use of natural gas; about 20% of the GWP from production are associated with the generation of the electricity from the grid and roughly 10 % are caused by the transport of the wooden raw material.
Figure 2 illustrates that the biogenic carbon stored in the product, expressed as CO_2-equivalent, is much higher than the CO_2 emissions from fossil sources, leading to a negative GWP for the production module A1-A3. The potential substitution effect in module D more than offsets the GHG emissions during the production phase (module A1-A3).
The GWP is dominated by CO_2 emissions and removals.

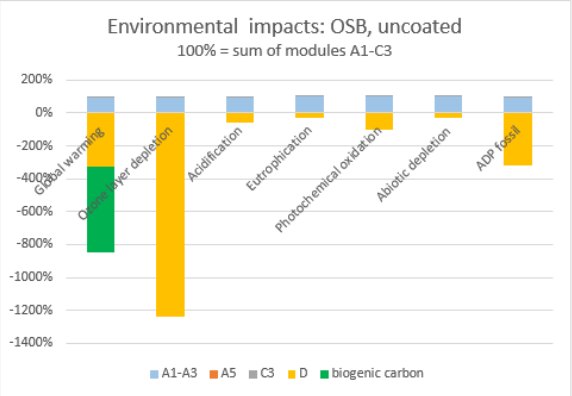


Figure 1: Environmental impacts of OSB AGEPAN® along its life cycle (impacts from production modules A1-A3 = 100 %; for illustrative purposes, the biogenic carbon included in the GWP is documented separately)

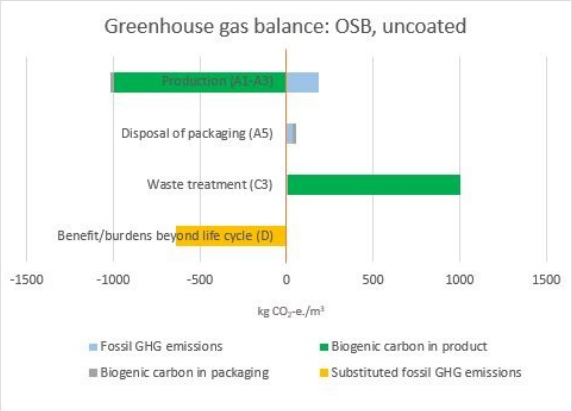


Figure 2: Carbon footprint of OSB AGEPAN®

The *ozone layer depletion potential (ODP)* is quantified based on the emissions of gases that can destroy stratospheric ozone.
The ODP is caused mainly by emissions of Halon 1211, which are associated with the production and transport of natural gas. Around 50 % of the ODP are associated with the use of natural gas on-site for the production of OSB AGEPAN®, the rest of the ODP is caused by the use of natural gas in upstream processes in line with the consumption patterns of natural gas in the process chain.

The *acidification potential (AP)* is created with the transformation of airborne emissions into acids, which among other can reduce soil fertility.
Roughly 35 % of the AP are associated with the production of PMDI; another 30 % are caused by the emissions of nitrogen oxides from on-site combustion processes related to the generation of heat and electricity. Further minor impacts are caused by transport and during the production of further ancillary materials.
The AP is caused in comparable shares by emissions of nitrogen oxides and sulphur dioxide.

The *eutrophication potential (EP)* quantifies the accumulation of nutrients in soils and watersheds, which can cause increased growth of algae and shifts in species composition.
The impacts on the EP stem from the same relevant processes as for the acidification potential, i.e. mainly from on-site and upstream combustion processes. A minor share is caused in disposal processes, e.g. of mining residues from lignite extraction related to the generation of electricity.
The EP is caused mainly by airborne emissions of nitrogen oxides and – to a minor share - phosphate emissions into the groundwater.

The *photochemical oxidation potential (POCP)* assesses the contribution of airborne emissions that contribute to summer ozone creation.
About 30% of the POCP are associated with the production the PMDI and roughly 10% stem from the chain sawing for the harvesting of roundwood; the large share of the POCP is caused on-site by emissions of carbon monoxide.
The POCP is caused by emissions for carbon monoxide and sulphur dioxide during the production of OSB AGEPAN®.

The *abiotic resource depletion potential of fossil resources (ADP fossil)* assesses the use of scarce fossil resources such a natural gas or crude oil.
The ADP (fossil resources) is caused by the consumption a) of natural gas for the production of the PMDI and for on-site-generation of heat and electricity, and b) of crude oil for the production of paraffin.
The abiotic resource depletion potential for mineral resource (ADP elements) assesses the use of scarce mineral resources such as ores and other mineral raw materials.

The *ADP (elements)* is caused almost completely by infrastructure processes, such as the buildings required for the production of chemicals; the main resources contributing to the ADP (elements) are copper, zinc, lead and gold.

The main use of *renewable primary energy* is the heating value of the wood in the OSB AGEPAN®; this amount of non-used renewable energy is exported in module C3 and used energetically as a renewable secondary fuel in module D. The renewable primary energy used as energy is mainly woody biomass.

The major share of the *non-renewable primary energy* is used energetically, mainly as natural gas in the upstream processes for the production of the components of the gluing system. A minor share is used as a material, i.e. as components of the gluing systems; this non-renewable primary energy used as a material is not used within the life cycle of OSB AGEPAN®; it is exported in module C3 and used energetically as a non renewable secondary fuel in module D.

The indicator values for *wastes* refers to the amount of wastes that is landfilled after an eventual pre-treatment of the wastes.
The main part of the wastes associated with the production of OSB AGEPAN® is non-hazardous waste, mainly resulting from the disposal of infrastructure associated with e.g. production halls or roads.
Hazardous wastes are generated throughout the production chain, e.g. related to disposal of ashes, production wastes from chemical industry or from the production of primary aluminium for infrastructure processes.
The generation of radioactive waste is associated with the production of nuclear power.

The *net consumption of fresh water* is caused mainly by cooling processes throughout the production chain as well as partly for the generation of electricity.

The *further indicators* on environmental aspects are singular values that result from the inventorying of waste streams into thermal waste treatment, energy recovery and recycling.

7. Requisite evidence

7.1 Formaldehyde

Measuring agency: Eurofins Product Testing A/S 8464 Galten / Denmark
Test report, date: 392-2014-00307701B (OSB/3) & 392-2014-00307702B (OSB/4), dated 12-02-2015
Result: Formaldehyde emissions tests were performed for OSB/3 and OSB/4 boards according to ISO16000-11, with the wall panel loading scenario. The measured formaldehyde emissions were lower than 60 mg/m^3, resulting in a classification A.

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg; D 16225 Eberswalde
Determination of the Formaldehyde content by the perforator method, according to DIN EN 120:

OSB/2
Test report: 31_15_7487_03E, dated 05-09-2015
Result: 6 mm board – 0.63 mg/100 g atro

OSB/3
Test report: 31_15_7487_04E, dated 05-09-2015
Result: 15 mm board – 0.49 mg/100 g atro

OSB/4
Test report: 31_15_7487_05E, dated 05-09-2015
Result: 22 mm board – 0.32 mg/100 g atro

Additionally, the determination of the formaldehyde content according to DIN EN 717-1 (chamber method) is below 0.05 ppm.

The OSB/2, OSB/3 and OSB/4 boards examined in accordance with DIN EN 120 comply with the requirements of the DIBt 100 “Guideline governing classification and monitoring of wood boards as regards formaldehyde emissions” and correspond with E1 quality, i.e. the formaldehyde emissions are far below the limit value of 0.1ppm.
The requirements of the German Chemicals Prohibition Regulation (ChemVerbotsV) dated 19 July 1996 are therefore fulfilled.

7.2. MDI

Measuring agency: Wessling – engineering consultants, Altenberge, Germany
Test report, date: IAL-10-0078 OSB (d = 15 mm), dated 12 January 2010
Result: Examination of wood-based materials in a test chamber (MDI). The test was carried out in accordance with the test guidelines stipulated by the RAL-UZ-76 (wood-based materials). Emissions of monomer MDI and other isocyanates could not be determined in the test chamber. The limit of detection was 0.1µg/m^3.

7.3 Checking for the pre-treatment of the substances used

No post-consumer wood is used in the production of AGEPAN® and Greenline® OSB.

7.4 TVOC emissions

Measuring agency: Eurofins Product Testing A/S 8464 Galten / Denmark
Test report, date: 392-2014-00307701B (OSB/3) & 392-2014-00307702B (OSB/4), dated 12-02-2015
Result: TVOC emissions tests were performed for OSB boards according to ISO16000-11, with the wall panel loading scenario.
The measured emissions were lower than 1500 mg/m^3, resulting in a classification A.

7.5 PCP/Lindane

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg GmbH, Germany
Test report, date:
31/15/2397/07, OSB/2, d = 6 mm, dated 30-04-2015;
31/15/2397/08, OSB/3, d = 18 mm, dated 30-04-2015;
31/15/2397/09, OSB/4, d = 22 mm, dated 30-04-2015.
Result: The analysis values are under the limit of detection of 0.10 mg/kg (process: CEN/TR 14823, EN 322).

8. References

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin(pub.): Generation of Environmental Product Declarations (EPDs);

General principles
for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013/04
www.bau-umwelt.de

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

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part B
Institut Bauen und Umwelt e.V, Berlin (pub.): Product Category Rules for Construction Products from the range of Environmental Product Declarations for Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD of wood based panels, 2013-10.

ISO 9001
ISO 9001:2008, Quality management systems – Requirements.

ISO 14001
ISO 14001:2009, Environmental management systems – Requirements with guidance for use.

OHSAS 18001
OHSAS 18001:2007, Occupational Health and Safety Management Systems – Requirements.

ISO 16000
ISO 16000-11:2006, Indoor air – Part 11: Determination of the emission of volatile organic compounds from building products and furnishing – Sampling, storage of samples and preparation of test specimens.

EN 717-1
EN 717-1:2005-01, Wood-based panels – Determination of formaldehyde release – Formaldehyde emission by the chamber method.

EN 13501
EN 13501-1:2010-01, Fire classification of construction products and building elements – Classification using test data from reaction to fire tests.

EN 13986
EN 13986:2015, Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking.

EN 300
EN 300: 1996, Oriented Strand Boards (OSB) – Definitions, classification and specifications.

EN 16485
EN 16485:14-07, Round and sawn timber – Environmental Product Declarations – Product category rules for wood and wood-based products for use in construction.

EN ISO 50001
EN ISO 50001:2011-06, Energy management systems – Requirements with guidance for use.

ecoinvent 2.2: Life cycle inventory data, May 2010. Ecoinvent Center, Duebendorf.

Schweinle, J. (2000): Analyse und Bewertung der forstlichen Produktion als Grundlage für weiterführende forst- und holzwirtschaftliche Produktlinien-Analysen. Mitteilungen der Bundesforschungsanstalt für Forst- und Holzwirtschaft Hamburg, Komissionsverl. Max Wiedebusch, Hamburg.

Werner, F., T. Künniger, H.-J. Althaus und K. Richter (2007): Life cycle inventories of wood as fuel and construction material, Duebendorf. Centre for life cycle inventories in the ETH domain, Duebendorf.

Publisher
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Programme holder
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Author of the Life Cycle Assessment
Werner Environment & Development
Idaplatz 3
8003 Zurich
Switzerland

Tel +41-44-241 39 06
Fax -
Mail frank@frankwerner.ch
Web **www.frankwerner.ch**

Owner of the Declaration
Sonae Arauco, S.A.
Centro Empresarial Euronova, C/Ronda de Poniente, 6 - B
28760 Tres Cantos (Madrid)
Spain

Tel (+34) 918 070 701
Fax (+34) 918 070 706
Mail products@sonaearauco.com
Web **www.sonaearauco.com**