Environmental Product Declaration

according to ISO 14025

EGGER
EUROSTRAND® OSB
EGGER OS'Brace®

Declaration number
EPD-EHW-2008112-E

Institut Bauen und Umwelt e.V.
www.bau-umwelt.de

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und Umwelt e.V.

Umwelt-Produktdeklaration

Environmental Product-Declaration

Institut Bauen und Umwelt e.V. **www.bau-umwelt.com**	**Program holder**
Fritz EGGER GmbH & Co. OG Holzwerkstoffe Weiberndorf 20 A – 6380 St. Johann in Tyrol	**Declaration holder**
EPD-EHW-2008112-E	**Declaration number**
EGGER EUROSTRAND® OSB boards for construction This declaration is an environmental product declaration according to ISO 14025 and describes the environmental rating of the building products listed herein. It is intended to further the development of environmentally compatible and sustainable construction methods. All relevant environmental data is disclosed in this validated declaration. The declaration is based on the PCR document "Wood-based materials", year 2009-01.	**Declared building products**
This validated declaration authorises the holder to bear the official stamp of the Institut Bauen und Umwelt. It only applies to the listed products for one year from the date of issue. The declaration holder is liable for the information and evidence on which the declaration is based.	**Validity**
The **declaration** is complete and contains in its full form: - Product definition and physical building-related data - details of raw materials and material origin - description of how the product is manufactured - instructions on how to process the product - data on usage condition, unusual effects and end of life phase - life cycle analysis results - evidence and tests	**Content of the declaration**

25. February 2011		**Date of issue**
Prof. Dr.-Ing. Horst J. Bossenmayer (President of the Institut Bauen und Umwelt)		**Signatures**
This declaration and the rules on which it is based have been examined by an independent expert committee (SVA) in accordance with ISO 14025.		**Verification of the declaration**
Prof. Dr.-Ing. Hans-Wolf Reinhardt (chairman of the expert committee)	Dr. Frank Werner (tester appointed by the expert committee)	**Signatures**

Umwelt-Produktdeklaration

Environmental Product-Declaration

Product description

OSB boards (Oriented Strand Board) is a synthetic-resin bonded, wood-based material board product with a three-layer structure made out of micro-veneer oriented long wood chips called strands according to EN 300 "OSB". "Strands" with a defined thickness and shape which are primarily produced using logwood which is glued in several layers. The middle layer is oriented at a 90° angle relative to the outer layers. The OSB boards are glued with a MUF resin in the outer layers and a polyurethane resin in the middle layer, or only with polyurethane resin. The boards are manufactured in thicknesses of 6-40 mm (different depending on the board type), the raw density of the boards is approx. 600 kg/m³.

Application

OSB board can be used in all load-bearing and reinforcing components (ceilings, wall cladding, roof shell, subfloor, sill plates) for which the national technical approvals of the respective product or the CE mark according to DIN EN 13986 is a prerequisite for use. Furthermore, OSB boards can be used for non-load-bearing applications in interior design or as wood packing and concrete forms.

Scope of the LCA

The **Life Cycle Assessment (LCA)** was performed according to DIN ISO 14040 following the requirements of the IBU guideline for type III declarations. Both specific data from the reviewed products and data from the “GaBi 4” database were used. The life cycle assessment encompasses the raw material and energy production, raw material transport, the actual manufacturing phase and the end of life in a biomass generating plant with energy recovery. The OSB board product mix was declared.

Results of the LCA

EUROSTRAND® OSB boards

Evaluation variable	Unit per m³	Total	Manufacturing	End of Life
Primary energy, non renewable	[MJ]	-7651	4109	-11 760
Primary energy, renewable	[MJ]	12 564	12 701	-137.6
Global warming potential (GWP 100)	[kg CO_2 eqv.]	-537.9	-864.1	326.2
Ozone depletion potential (ODP)	[kg R11 eqv.]	-7.59E-06	2.13E-05	-2.89E-05
Acidification potential (AP)	[kg SO_2 eqv.]	1.10E+00	9.82E-01	1.23E-01
Eutrophication potential (EP)	[kg Phosphate eqv.]	1.80E-01	1.62E-01	1.83E-02
Photochemical oxidant formation potential (POFP)	[kg ethylene eqv.]	9.59E-02	1.32E-01	-3.62E-02

Prepared by: PE INTERNATIONAL, Leinfelden-Echterdingen
in cooperation with EGGER Holzwerkstoffe Wismar GmbH & Co.KG

Evidence and verifications

In addition, the results of the following tests are shown in the environmental product declaration:

- Formaldehyde according to EN 120
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, Brunswick
- MDI (diphenylmethane-4,4’-diisocyanate) according to procurement regulation RAL ZU-76 and NIOSH (P&CAM 142)
  Testing institute: Wessling Beratende Ingenieure GmbH
- Eluate analysis according to DIN 38406-4 and EN 71-3
  Testing institute: ECO – Institute, Cologne
- EOX (extractable organic halogen compounds) according to DIN 38414-S17
  Testing institute: ECO – Institute, Cologne
- Toxicity of the fire gases according to DIN 53 436
  Testing institute: University Osnabruck, Chemical laboratory
- Lindane/PCP according to PA-C-12:2006-02
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, Brunswick

Area of application

This document refers to OSB boards used in construction, which are produced in the following group of company plants:

Egger Holzwerkstoffe Wismar GmbH & Co. KG, Am Haffeld 1, D – 23970 Wismar

0 Product definition

Product definition

EUROSTRAND® OSB board (Oriented Strand Board) is a synthetic-resin bonded, wood-based material board produced with a three-layer structure made out of micro-veneer oriented long wood chips called strands according to EN 300 "OSB". "Strands" with a defined thickness and shape are primarily produced using logwood wich is glued in several layers. The middle layer is oriented at a 90° angle relative to the outer layers.

EUROSTRAND® OSB/2, OSB/3, EGGER OSB/3, EGGER OS'Brace (according to DIN EN 13986) are glued using a MUF resin in the outer layers and a PMDI resin (Diphenylmethane-diisocyanate) in the middle layer; the latter is converted to PUR (polyurethane) and polyurea during production.

EUROSTRAND® OSB TOP (Z-9.1-566) and EUROSTRAND® OSB 8000 (Z-9.1-562) are glued using a PMDI resin in both the outer and middle layers.

Application

EUROSTRAND® OSB boards can be used in all load-bearing and reinforcing components (ceilings, wall cladding, roof shell, subfloor, sill plates) for which the national technical approvals of the respective product or the CE mark according to DIN EN 13986 is a prerequisite for use.

Furthermore, OSB boards can be used for non-load-bearing applications in interior design or as wood packing and concrete forms.

Product standard / approval

Quality	CE marking according to EN 13986 / EN 300 6 to 40 mm	National technical approval, DIBt
EUROSTRAND® OSB/2	0765-CPD-0352	/
EUROSTRAND® OSB/3	0765-CPD-0353	/
EGGER OSB/3, EGGER OS'Brace*	0765-CPD-0353	/
EGGER OSB/3 Z	0765-CPD-0353	Z-9.1-504
EUROSTRAND® OSB TOP	0765-CPD-0354	Z-9.1-566, 8-40 mm
EUROSTRAND® OSB 8000	0765-CPD-0354	Z-9.1-562, 20-30 mm

PSI PS2-04 (USA, Canada), PSI – JAS (Japan), KOMO 32810 (Netherlands), BBA 08/4546 (England), GOST No. 064921 (Russia)
*H2 brand 527.70 (QLD, NSW, Australia)

Accreditation

The accreditation used is aimed at the target market for the OSB boards.

- CE-marking according to EN 13986 – Notified Body WKI – Brunswick, D
- DIBt Z-9.1- 504 / 562 / -566 – External monitoring by WKI Brunswick, D
- PS2-04 – PSI Eugene Oregon, USA
- JAS – PSI Eugene Oregon, USA
- KOMO – SKH Wageningen, NL
- BBA – Watford, UK
- GOST – GOST Moskau, RUS
- FSC, Chain of Custody GFA-COC-1067, GFA Hamburg, Germany
- PEFC, Chain of Custody HCA-CoC-183, HolzCert Vienna, Austria
- EN ISO 9001:2000 – ÖQS Vienna, A
- H2 preservative treatment, QLD Government / NSW State Forests, AU

Product group	Wood-based materials OSB - Oriented Strand Boards	Version
Declaration holder:	Fritz EGGER GmbH & Co. OG	08-12-2008
Declaration number:	EPD-EHW-2008112-E	

Delivery status, characteristics

Table 1: Delivery sizes

Sizes (mm)	EUROSTRAND OSB/2	EUROSTRAND OSB/3 EGGER OSB/3	EGGER OS'Brace OS'Brace H2	EUROSTRAND OSB/3 Z-9.1-504	EUROSTRAND OSB 4 TOP Z-9.1-566	EUROSTRAND OSB 8000 Z-9.1-562
5000 x 2500					X	
5000 x 1250					X	
2800 x 1250		X			X	
2650 x 1250					X	
2500 x 1250		X			X	
2070 x 2770	X	X				
3000 x 1250					X	
2960 x 2500					X	
2960 x 2440				by request	X	in industry-standard lot sizes up to 11500 x 2800
2440 x 1200/900	X		X			
2745 x 1200/900			X			
3050 x 1200/900			X			
2500 x 1250 4N&F					X	
2500 x 675 4N&F		X			X	
1830 x 675 4 N&F		X				
3000 x 1250 2 N&F					X	
6250 x 675 2 N&F					X	
Thickness range (See manufacturer publications for distribution of thickness/size)	6 - 25 mm	6 - 25 mm	6 - 25 mm	8 - 40 mm	8 - 40 mm	20 - 30 mm
	Custom thicknesses / sizes by request					
Raw density DIN EN 323	>= 570 kg/m³	>= 600 kg/m³	>= 600 kg/m³	>= 600 kg/m³	>= 600 kg/m³	>= 600 kg/m³
Weight by surface area	3.5 - 14.3 kg/m²	3.6 - 15 kg/m²	3.6 - 15 kg/m²	5.1 - 24 kg/m²	5.1 - 24 kg/m²	12 - 18 kg/m²

Table 2: Strength properties / physical construction properties

Property	Testing standard	EUROSTRAND OSB/2			EUROSTRAND OSB/3			EGGER OS'Brace		
	Thickness ranges [mm]	6-10	>10-<18	18-25	6-10	>10-<18	18-25	6-10	>10-<18	18-25
Bending strength ǁ	DIN EN 310	22	20	18	22	20	18	22	20	18
Bending strength ⊥	DIN EN 310	11	10	9	11	10	9	11	10	9
Modulus of elasticity ǁ	DIN EN 311	3500	3500	3500	3500	3500	3500	3500	3500	3500
Modulus of elasticity ⊥	DIN EN 312	1400	1400	1400	1400	1400	1400	1400	1400	1400
Transverse strength dry	DIN EN 319	0.34	0.32	0.30	0.34	0.32	0.30	0.34	0.32	0.30
Transverse strength after boiling test	DIN EN 1087-1; DIN EN 300	/	/	/	0.15	0.13	0.12	0.15	0.13	0.12
Emission class	DIN EN 120	E1			E1			E1		
Thermal conductivity	DIN 4108-4	λ = 0.13 W/mK			λ = 0.13 W/mK			λ = 0.13 W/mK		
μ - value	DIN 52615	200/300			200/300			200/300		
Moisture	DIN EN 322	9 ± 4 %			9 ± 4 %			9 ± 4 %		
Building material class	DIN 4102-1	B2			B2			B2		
Reaction to fire	DIN EN 13986	D-s2, d0			D-s2, d0			D-s2, d0		
Dimensional change due to moisture	DIN EN 318	0.04 %/%			0.03 % / %			0.03 % / %		

Property	Testing standard	EUROSTRAND OSB 4 TOP Z-9.1-566					EUROSTRAND OSB 8000 Z-9.1-562
	Thickness range [mm]	8-10	>10-<18	18-25	>25-30	>30-40	20 - 30
Bending strength ǁ	DIN EN 310	36	33	31	29	25	35
Bending strength ⊥	DIN EN 310	23	20	18	16	15	12
Modulus of elasticity ǁ	DIN EN 310	5600	5300	5200	5000	4800	6500
Modulus of elasticity ⊥	DIN EN 310	2700	2500	2300	2100	1900	1600
Transverse strength dry	DIN EN 319	/	/	/	/	/	/
Transverse strength after boiling test	DIN EN 1087-1; DIN EN 300	0.17	0.16	0.13	0.10	0.08	0.10
Emission class	DIN EN 120	E1					E1
Thermal conductivity	DIN 4108-4	λ = 0.13 W/mK					λ = 0.13 W/mK
μ - value	DIN 52615	200/200					100/300
Moisture	DIN EN 322	9 ± 4 %					9 ± 4 %
Building material class	DIN 4102-1	B2					B2
Reaction to fire	DIN EN 13986	D-s2, d0					D-s2, d0
Dimensional change due to moisture	DIN EN 318	0.03 % / %					0.03 % / %

Specified strength characteristics are typical values (5%- fractile value in [N/mm2]

1 Raw materials

Raw materials Primary products

Secondary materials / additives

Table 3: Raw materials in mass % for 1 m³ of finished goods

Component	EUROSTRAND OSB/2	EUROSTRAND OSB/3 EGGER OSB/3	EUROSTRAND OSB 4 TOP* Z-9.1-566	EUROSTRAND OSB 8000* Z-9.1-562
Softwood, primarily pine	approx. 88.5 %	approx. 85.5 %	approx. 83.5 %	approx. 81 %
Surface layer glue - MUF or PMDI	approx. 3.5 %	approx. 4.5 %	approx. 5 %	approx. 7 %
Core layer glue - PMDI	approx. 2 %	approx. 3 %	approx. 3.5 %	approx. 4 %
Wax emulsion	approx. 1 %	approx. 1 %	approx. 1 %	approx. 1 %
Water (wood moisture)	approx. 5 %	approx. 6 %	approx. 7 %	approx. 7 %

* DS and MS are glued using PMDI.

Component	EGGER OS'Brace H2	EUROSTRAND OSB/3 Z Z-9.1-504
Softwood, primarily pine	approx. 88.5 %	approx. 83.5 %
Surface layer glue - MUF	approx. 3.5 %	approx. 5 %
Core layer glue - PMDI	approx. 2 %	approx. 3.5 %
Wax emulsion	approx. 1 %	approx. 1 %
Termite protection agent	approx. 0.02 %	-
Water (wood moisture)	approx. 5 %	approx. 7%

Material explanation

Wood compound: The production of EUROSTRAND® OSB utilises only fresh, debarked wood from thinning measures (primarily pine softwood).

MUF glue: Mixed resin consisting of melamine-urea-formaldehyde resins. The aminoplastic adhesive hardens fully during the pressing process through polycondensation.

PMDI glue (PUR) : MDI (diphenylmethane – diisocyanate), a polyurea primary product which is converted to PUR (polyurethane) and polyurea during the OSB manufacturing process, is used. This originates from the category of polyurethane resins and serves to bind the OSB strands.

Wax emulsion: A paraffin wax emulsion is added to the formulation for hydrophobising (improving resistance to moisture).

Termite protection agent: In order to protect against termite infestations, an approved wood protection agent with the active ingredient Permethrin is added to the formulation for use of the OSB boards in Australia.

Raw material extraction and origin

Wood from indigenous, predominantly regional forests is used in the production of EUROSTRAND® OSB. The wood is sourced from forests within a radius of approx. 250 km around the plant site. Deliveries by ship from a distance of 1020 km make up approx. 7 %. The short transportation distances contribute considerably to minimizing the logistical acquisition costs of raw materials. In the selection process, preference is given to woods that are certified according to FSC[1] or PEFC regulations[2]. FSC / PEFC certified finished goods are indicated separately by the manufacturer and do not represent the entire product range. The bonding agents used come from suppliers located at a maximum distance of 1300 km from the production site.

Local and general availability of the raw materials

The wood used in the production of EGGER EUROSTRAND® OSB is sourced exclusively from cultivated forests managed in a sustainable manner. The selection is composed exclusively out of greenwood from thinning and silviculture. The bonding agents MUF, PMDI, and urea are synthesised out of crude oil, a fossil raw material with limited availability.

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[1] FSC: Forest Stewardship Council (www.fsc.org)

[2] PEFC Pan-European forestry certification system (www.pefc.org)

2 Manufacturing of the building product

Manufacturing of the building product

Structure of the manufacturing process:

1) Debarking of the logs
2) Chipping of the wood into "strands" (micro veneers), separately for the outer layer and middle layer
3) Drying the strands to approx. 3-4 % residual moisture content
4) Screening of the outer and middle layer strand fractions
5) Gluing of the outer and middle layers with resins
6) Orienting the strands on the moulding conveyor, outer layer strands are strewn lengthwise in the production direction, middle layer strands at a 90° relative to the outer layers.
7) Compression of the woodchip strands in a continuous press
8) Cutting and edge-trimming of the OSB strip to rough board sizes
9) Cooling of the rawboard in radial coolers
10) Destacking onto large stacks
11) Cutting of the rawboard into warehouse / customer sizes, package formation and packaging with paperboard, partially with PE foil and steel bands

All OSB strand leftovers generated during production are, without exception, routed back to the production process.

Granulates and dust which are produced during sanding and processing are routed to thermal utilisation in the combined heat and power generation plant or fired in the on-site dryer. In combination with further measures to optimise the system, it was possible to substitute for the use of natural gas to a large degree.

Production health and safety

Measures to avoid hazards to health / exposures during the production process:

Due to the manufacturing conditions, no health and safety measures above and beyond the ones required by law and other regulations are required. At all points on site, readings fall significantly below (Germany's) maximum allowable concentration values.

Environmental protection during production

- Air: The exhaust air resulting from production processes is cleaned according to legal requirements. Emissions are significantly below TA Luft (Technical Instructions on Air Quality Control).
- Water/soil: Contamination of water and soil does not occur. Effluent resulting from production processes is processed internally and routed back to production.
- Noise protection measurements have shown that all readings from inside and outside the production plant fall below German limit levels. Noise-intensive system parts such as chipping are structurally enclosed.

3 Working with the building product

Processing recommendations

Like solid wood, EUROSTRAND® OSB can be sawn, milled, planed, and drilled with the usual stationary and (electrical) handheld tools. Hard metal-tipped tools are recommended. Wear a respiratory mask if using hand tools without a dust extraction device. Detailed information and processing recommendations are available at www.egger.com/holzbau.

Job safety, Environmental protection

Apply all standard safety measures when processing / installing OSB boards (safety glasses, face mask if dust is produced). Observe all liability insurance association regulations for commercial processing operations.

Residual material

Residual material and packaging: Waste material accumulated on site (cutting waste and packaging) shall be collected and separated into waste types. Disposal shall comply with local waste disposal authority instructions and instructions given in no. 6 "End of life phase".

Packaging

Spacers out of wood-based material strips, paperboard, steel bands, and recyclable PE film (only for tongue and groove) are used.

4 Usage condition

Components

Components in usage condition:

The components of EUROSTRAND® OSB correspond in their fractions to those of the material composition in point 1 "Raw Materials". During pressing of OSB/2, OSB/3 and OS'Brace, the mixed resin (MUF) in the outer layers is cross-linked three-dimensionally through a non-reversible polycondensation reaction under the influence of heat. During pressing the MDI bonding agent in the middle layer of the board (OSB 4 TOP and OSB 8000) reacts fully and irreversibly with the moisture in the wood to form three-dimensionally cross-linked polyurethane (PUR) and polyurea. The binding agents are chemically inert and bonded firmly to the wood. Very small quantities of formaldehyde are emitted from the outer layer MUF resin (see formaldehyde certificate chapter 8.1).

The PUR gluing is formaldehyde-free. The selected bonding agents contribute to the high strength properties of EUROSTRAND® OSB and at the same time result in a consistent high board quality. EUROSTRAND® OSB boards distinguish themselves through their low sensitivity to changes in the relative humidity of the air. The Conti-Fine surface acts as temporary protection against directly applied moisture.

Due to the separate processing of the strands and the use of colourless resins in the outer layers, EUROSTRAND® OSB can also be used for decorative applications.

Interactions

Environment - Health

Environmental protection: No damage to health or impairment is expected under normal use corresponding to the intended use of EUROSTRAND® OSB. Natural wood substances may be emitted in small amounts. With the exception of small quantities of formaldehyde harmless to health, no emission of pollutants can be detected (see Evidence and verifications 8.1 Formaldehyde, 8.2 MDI, 8.3 Heavy metals, 8.4 Toxicity of fire gases, 8.5 PCP/lindane, 8.6 EOX).

Only those raw materials which correspond to the following recommendation of the BFR (German federal institute for risk assessment) synthetic materials commission for food product packaging, part A (according to section 31, paragraph 1 of the food products and articles of daily use law) are used in the manufacturing of EUROSTRAND® OSB TOP and OSB 8000. XLV, "Vernetzte Polyharnstoffe als Bindemittel für Holzspäne u. dgl.“ ("cross-linked polyurea materials as binding agents for wood chips and the like)

Environmental protection aspects: Hazards to water, air/atmosphere and soil cannot occur during proper use of EUROSTRAND® OSB (see Evidence and verifications 8.2 MDI, 8.3 Heavy metals, 8.4 Toxicity of the fire gases, 8. 5 PCP/lindane, 8. 6 EOX).

Long term durability in usage condition

Avoiding structural damage: When using EUROSTRAND® OSB in load-bearing or reinforcing elements, the DIN 68800-2 regulations "Protection of wood – preventative structural measures" apply. Furthermore, for structural applications the DIN 1052-1-3 or the ENV 1995-1-1 with NAD regulations apply.

5 Unusual effects

Fire

Reaction to fire:

- Building materials class B2 "Normal flammability" according to DIN 4102-1
- D-s2, d0 – according to EN 13986 Euro class D, smoke development s1, dropping class d0

Smoke gas development / smoke density: Corresponding to the smoke development and smoke density of solid wood.

Toxicity of fire gases: Due to the conversion processes during combustion, under certain fire conditions hydrogen cyanide is released from the PUR resins contained in the boards (see Evidence 8.4 Toxicity of the fire gases). Due to the extreme toxicity of the resulting gaseous hydrogen cyanide, waste from the named products may only be burned in correspondingly approved closed systems, but under no conditions in any type of open fire.

Change of phase (dripping by combustion/precipitation): Dripping by combustion is not possible, since the EUROSTRAND® OSB boards do not liquefy when hot.

Water effects

Water effects: No component materials which could be hazardous to water are washed out (see 8.3 Eluate analysis, 8.6 EOX). OSB boards are not resistant to sustained exposure to water, but damaged areas can be replaced easily on site.

Mechanical destruction

Fracture behaviour: The breaking pattern of EUROSTRAND® OSB illustrates relatively brittle behaviour, and smooth fracture faces do not form at the broken edges of the boards.

6 End of life phase

Reuse

During remodelling or at the end of the utilisation phase of a building, OSB boards can easily be separated and used again for the same application if selective deconstruction is practiced.

Reclamation

During remodelling or at the end of the utilisation phase of a building, OSB boards can easily be separated and used again for other applications if selective deconstruction is practiced. This is only possible if the wood-based material boards have not been bonded over their entire surface.

Energy utilisation (in correspondingly approved systems): With a high calorific value of approx. 17 MJ/kg, energy utilisation for the generation of process energy and electricity (cogeneration systems) from construction board leftovers as well as boards from deconstruction measures is preferable to putting them in the landfill.

Disposal

OSB board leftovers which arise on the construction site as well as those from deconstruction measures should primarily be routed to a material utilisation stream. If this is not possible, then they must be used for energy utilisation rather than being placed in the landfill (refuse code according to European Waste Catalogue: 170201/030103/030105).

Packaging: The transport packaging paper/cardboard and metal strapping can be recycled if they are sorted correctly. External disposal can be arranged with the manufacturer on an individual basis.

7 Life cycle assessment

7.1 Manufacturing of EGGER EUROSTRAND® OSB boards

Declared unit

The declaration refers to the manufacturing of one cubic meter of OSB board (product mix of OSB/2, OSB/3 and OSB/4).

The average raw density of the board is 614.81 kg/m³ (5 % moisture).

The end of life is calculated as thermal utilisation in a biomass generating plant with energy recovery.

System boundaries

The selected system boundaries encompass manufacturing of the OSB board including raw materials production through to the final packaged product at the factory gate (cradle to gate).

The database GaBi 4 (2006) was used for the energy generation and transport. In detail, the observed parameters encompass:

- Forestry processes for the provision and transporting of wood
- Production of all raw materials, primary products and secondary materials including the associated relevant transportation
- Transportation and packaging of raw materials and primary products
- Production processes for the OSB boards (energy, waste, thermal utilisation, production wastes, emissions) and energy provisioning ex resource
- Packaging including its thermal utilisation

All reviewed products were produced in the Wismar plant.

The usage phase of the OSB board was not investigated in this declaration. The end of life scenario was assumed to be a biomass generating plant with energy utilisation (credits according to substitution approach) ("gate to grave"). The assessment region begins at the factory gate of the utilisation facility. On the output side, it is assumed that the produced ash is placed in a landfill.

Cut-off criteria

On the input side, at least all those material streams which enter into the system and comprise more than 1% of its entire mass or contribute more than 1% to the primary energy consumption are considered. The output side involves at least all those material flows out of the system which comprise more than 1% of the total effects of the considered analysis effect categories. All inputs used as well as all process-specific waste and process emissions were assessed. In this manner the material streams which were below 1 % mass percent were captured as well. In this manner the cut-off criteria according to the IBU guideline are fulfilled.

Transportation

Transport of the raw materials and secondary materials used is included in principle.

Period under consideration

The data used refer to the actual production processes during the business year 1/5/2007 to 30/4/2008. The life cycle assessment was prepared for the reference area of Germany. This has the effect that in addition to the production processes under these framework conditions, the preliminary stages such as electricity or energy source provisioning which are relevant for Germany were used.

Background data

To model the life cycle for the manufacturing and disposal of Egger OSB boards, the software system for comprehensive accounting “GaBi 4” was used (GaBi 2006). All background data sets relevant to the manufacturing and disposal were taken from the GaBi 4 software database. The upstream chain for the harvesting was accounted for according to /Schweinle & Thoroe/ 2001 or, as the case may be, /Hasch 2002/ in the update from Rüter and Albrecht (2007).

Scrap wood is considered from the scrap wood dealer gate. A CO_2 content of 1.851 kg per kg of wood dry matter and a primary energy content of 18.482 MJ per kg of wood dry matter were considered. No impacts from the upstream chain were considered, but the chipping of the scrap wood as well as transportation from the scrap wood dealer to the production site (30% wood humidity) were included in the calculation.

Assumptions

The results of the life cycle assessment are based on the following assumptions:

The transportation of all raw materials and/or secondary materials are calculated according to the means of transportation (truck, bulk carrier - ocean-going vessel, diesel fuel consumption on site such as wheel loaders) with data from the GaBi database.

The energy carriers and sources used at the production site were considered for the energy supply.

All leftovers which arise during production and finishing (trimming, cutting, and milling leftovers) are routed to a thermal utilisation process in the company-owned generating plant. External thermally utilised leftovers are also considered. The credits from the energy extraction of the combustion systems are included in the balance sheet calculation.

The end of life scenario was assumed to be a biomass generating plant and modelled according to the average composition of the boards.

The results of the inventory life cycle and impact assessment are specified as product mix, in which the differences between the individual OSB boards are small.

Data quality

The age of the utilised data is less than 5 years.

Data capture for the product mix took place directly in the production facility of the Wismar plant. All input and output data of the Egger company were made available for the business year under consideration. Therefore it can be assumed that the data is very representative.

The predominant part of the data for the upstream chain comes from industrial sources, which were collected under consistent time and methodical framework conditions. The process data and the utilised background data are consistent. Great value was placed on a high degree of completeness in the capturing of environmentally relevant material and energy flows.

The delivered data (processes) were checked for plausibility. They come from the operational data capturing and measurements and the data quality can therefore be described as very good.

Allocation

Allocation refers to the allocation of the input and output flows of a life cycle assessment module to the product system under investigation /ISO 14040/.

The OSB product mix manufacturing system in question and the associated energy supply do not require any allocations; waste materials are utilised as a source of energy. The combustion is accounted for using GaBi 2006 and, similar to end of life, energy credits are assigned.

The modelled thermal utilisation of the boards in the end of life process takes place in a biomass generating plant. The allocation of energy credits for the electricity and thermal energy produced in the biomass generating plant is done based on the calorific value of the input. The credit for the thermal energy is calculated based on "Thermal energy from natural gas"; the credit for electricity from the German power mix. The calculation of emissions (e.g. CO_2, HCl, SO_2 or heavy metals) which are dependant on the input is performed based on the material composition of the introduced range. The technology-dependant emissions (e.g. CO) are assigned based on the exhaust gas volume.

Notes on usage phase The usage conditions as well as possible associated unusual effects were not researched in the life cycle assessment. For system comparisons, the lifespan of the OSB boards must be accounted for under consideration of the stress and loading aspects.

7.2 Thermal utilisation of OSB

Choice of disposal process For this life cycle assessment basis, thermal utilisation in a biomass generating plant was assumed for the OSB product mix and modelled according to the respective board composition. The system is equipped with SCNR exhaust gas denitrification, dry sorption for desulphurisation, and a fabric filter to remove particles. The fuel efficiency factor is 93%.

Credits The substitution approach is used for energy production. Credits are assigned to the generated products electricity and heat in a suitable manner. They represent the savings in fossil fuels and their emissions which would occur during conventional energy generation (also see allocation). The German: Electricity and German: Thermal energy from natural gas (GaBi 2006 in each case) are substituted.

7.3 Results of the assessment

Life cycle inventory In the following chapter, the life cycle inventory assessment with regard to the primary energy consumption and wastes and, in following, the impact assessment is shown.

Primary energy Table 4 shows the primary energy consumption (renewable and non-renewable, lower calorific value H_u respectively) subdivided for the sum total, production, and end of life for one cubic meter of OSB board mix.

The consumption of non-renewable energy for production of the OSB (cradle to gate) is around 4109 MJ per m^3, with production making up approx. 28 %, provisioning of raw materials 65 %, and transportation and packaging approx 7 %.

In addition, another 12 701 MJ of renewable energy (98.6 % of the solar energy stored in the biomass as well as about 1.5 % wind and water power) are used to produce one cubic meter of OSB board.

Table 4: Primary energy consumption for the Manufacturing of 1 cubic meter of OSB board

OSB boards (Product mix)				
Evaluation variable	Unit per m³	Total	Manufacturing	End of Life
Primary energy (non renewable)	MJ	-7651	4109	-11 760
Primary energy (renewable)	MJ	12 564	12 701	-138

A closer investigation of the composition of the primary energy consumption indicates that energy stored in the raw material through photosynthesis mainly stays in the OSB product until its “end of life”. 1 m³ of average OSB board has a lower calorific value of approx. 10 450 MJ.

A more detailed evaluation of the non-renewable energy required to produce one cubic meter of OSB board shows that the primary energy source used (approx. 36 %) is natural gas. Approximately 32% is covered by crude oil. About 9 % is provided by hard coal and 9 % by brown coal, with an additional approx. 14 % being covered by uranium. The uranium contribution to the primary energy consumption is due to the use of third-party electricity from the public networks according to the German power mix, which also includes atomic energy.

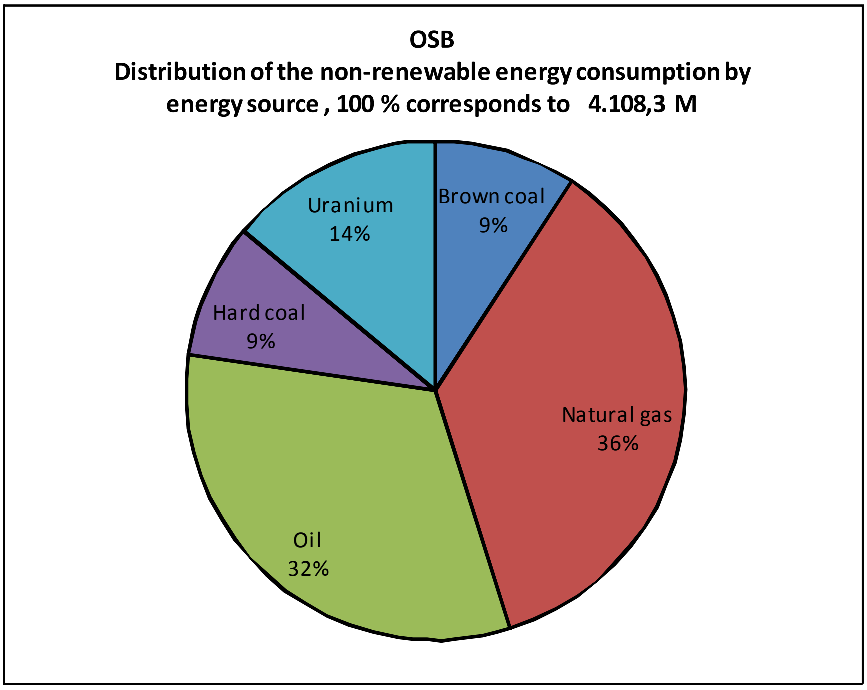

Figure 1: **Distribution of the non-renewable energy consumption by energy source for the manufacturing of 1 m³ of OSB board (product mix)**

Figure 2 does not provide a further level of detail for the non-renewable energy consumption. This is offset by a credit of 11 760 MJ from the end of life.

The thermal utilisation of the packaging and other wastes is modelled by the average waste incineration of the respective material fraction with steam and electricity generation. This results in electricity credits through the substitution of electricity in the public network according to the respective power mix and a steam credit according to the average production of steam from natural gas per produced m³ of finished thermal insulation. The use of wood wastes is modelled as a biomass generating plant with electricity credits and credits for thermal energy according to the Egger company power plant. The amount of energy obtained from the thermal utilisation of the OSB board is higher at 11 760 MJ than the total of 4109 MJ of non-renewable energy required for production.

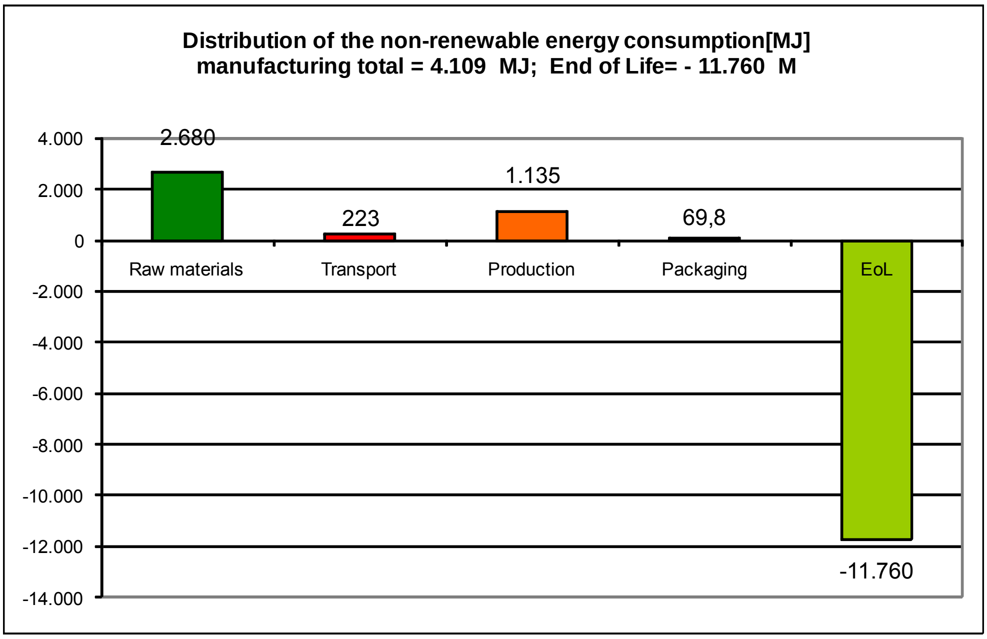

Figure 2: **Distribution of the non-renewable energy consumption for the production of one cubic meter OSB board**

If one considers manufacturing and end of life (combustion of the average OSB board in a biomass generating plant), then one discovers that the energy credit for electricity and steam (credit for German power mix and combustion of natural gas) amounts to 11 760 MJ of non-renewable energy sources per m^3 of OSB board. This reduces the non-renewable primary energy consumption of 4109 MJ/m³ to a value of -7651 MJ/m³ when manufacturing and combustion are calculated. This means that through utilisation of the renewable energy stored in a OSB board, more non-renewable energy is replaced than was required to manufacture it.

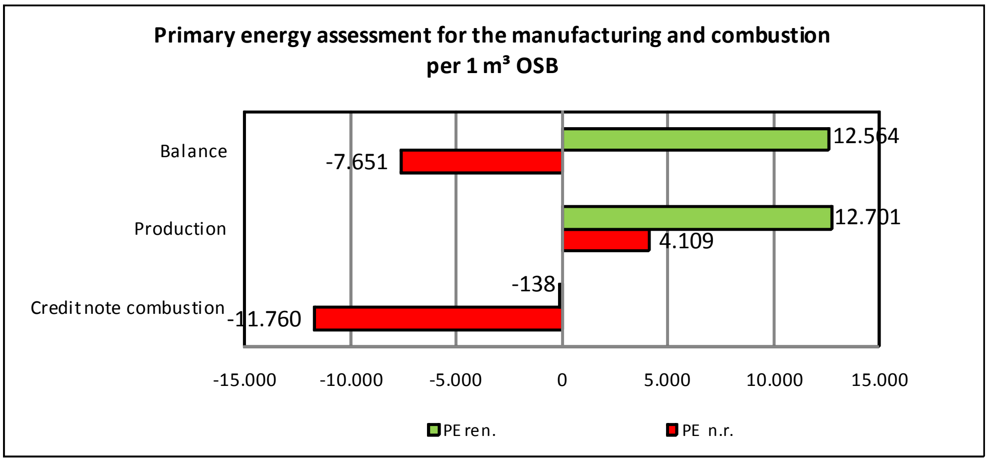

Figure 3 **Primary energy assessment of renewable and non-renewable energy sources for the manufacturing and combustion of 1 m³of OSB board.**

CO2 balance sheet

The CO_2 balance sheet in figure 4 shows that the manufacturing of one m^3 of OSB board causes 461 kg of CO_2 emissions, of which 336 kg of CO_2 come from the direct thermal utilisation of wood during the production phase and an additional 125 kg CO_2 are fossil emissions. On the other hand, through manufacturing a total of 1351 kg of CO_2 per m^3 of OSB board is removed from the air and stored in the wood through photosynthesis as the trees grow, of which 1015 kg of CO_2 per m^3 remains bound throughout the usage phase. The CO_2 component bound in the wood of the OSB board is only released again at the end of the lifecycle, that is, during the thermal utilisation of the board. If one allocates the manufacturing CO_2 intake (intake bar) and CO_2 emissions (output bar), one obtains, on balance, a CO_2 storage of -889 kg per m^3 of OSB board through binding in the product and substitution of non-renewable energy sources for the manufacturing phase. This storage effect is effective throughout the utilisation phase. During combustion at end of life in the modelled waste incineration, the carbon stored in the board is released back into the atmosphere, primarily in the form of CO_2. At the same time, however, a substitution of fossil fuels and therefore of CO_2 from the combustion of these fossil energy sources of -685 kg of CO_2 takes place. This energy substitution effect results in a total balance of -522 kg CO_2 over the entire life cycle.

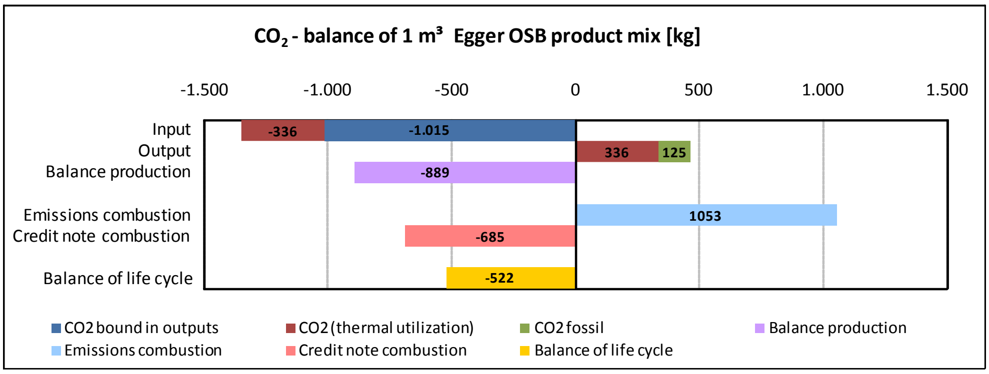

Figure 4: CO2 balance sheets for the manufacturing of 1 m³ of OSB board.

Waste

The evaluation of waste produced to manufacture 1 m³ of average OSB board is shown separately for the three segments construction/mining debris (including ore processing residues), municipal waste (including household waste and commercial waste) and hazardous waste including radioactive wastes (table 5).

Table 5: Waste accumulation during the manufacturing and combustion of 1 m³ of OSB board.

	Wastes [kg / m^3 OSB board]		
Evaluation variable	**Manufacturing**	**End of Life**	**Total**
Residues / mining debris	512.87	-989.86	-476.99
Municipal waste	0.28	0.00	0.28
Hazardous waste	0.81	-0.39	0.42
of which is radioactive waste	0.20	-0.39	-0.19

Quantitatively, the mining debris is by far the most significant fraction, followed by hazardous waste and municipal waste.

For the **mining debris** the rubble generated during manufacturing is by far the most significant quantity at 99.5% (510 kg), followed by ore dressing residues and landfill waste, etc. with a total fraction of less than 1 %. Rubble is produced primarily during the mining of mineral raw materials and coal in the production of raw materials and energy sources. The combustion of the thermal insulation at the end of its lifecycle substitutes mining debris in energy production in the amount of 990 kg/m^3 of OSB.

Significant fractions within the **municipal waste** segment are non-specific waste, sludge, and industrial waste similar to household waste. All other fractions play a minor role. The combustion at EoL results in a minor increase in total waste production.

Hazardous wastes here are primarily the waste produced during the upstream stages. The "sludge" fraction contains the largest amount of hazardous waste at 0.50 kg/m³ of produced OSB board. 0.20 kg of radioactive waste is also produced per m³ of produced OSB board, of which 98.5 % is ore dressing residue which is allocated to the power mix upstream chain. However, more radioactive waste is substituted through energy recovery at the end of life than is required for production, which results in an overall negative value.

Impact assessment

The following table shows the individual contributions and totals from the production and combustion of 1 m^3 of average OSB board to the impact categories global warming potential (GWP 100), ozone depletion potential (ODP), acidification potential (AP), eutrophication potential (EP), and photochemical oxidation formation potential (summer smog potential POFP). In addition the renewable primary energy (PE ren.) and the non-renewable primary energy (PE n.r.) are listed again.

Table 6: Absolute contributions of manufacturing and end of life per cubic meter of OSB board mix to PE n.r., PE reg, GWP 100, ODP, AP, EP, and POFP.

	PE n.r.	**PE ren.**	**GWP 100**	**ODP**	**AP**	**EP**	**POFP**
Unit	MJ	MJ	kg CO_2 eqv.	kg R11 eqv.	kg SO_2 eqv.	kg PO_4 eqv.	kg C_2H_4 eqv.
Raw materials	2680.43	624.6	-1214.88	1.04E-05	0.250	0.0538	0.06964
Production	1135.10	11908.7	327.82	1.07E-05	0.613	0.0878	0.05320
Transportation	223.19	0.355	15.80	3.92E-08	0.095	0.0160	0.00742
Packaging	69.79	167.62	7.12	1.59E-07	0.0240	0.0042	0.00180
Manufacturing total	**4108.5**	**12701.2**	**-864.14**	**2.13E-05**	**0.982**	**0.1618**	**0.13207**
End of Life	-11759.7	-137.58	326.23	-2.89E-05	0.123	0.0183	-0.03616
Total	**-7651.1**	**12563.6**	**-537.91**	**-7.59E-06**	**1.105**	**0.1801**	**0.09590**

When considering the **manufacturing system boundary under consideration of the end of life** in a biomass generating plant, the significance of the method of utilisation or disposal on the environmental impact over the entire life cycle becomes apparent. The resulting additional emissions or related substitution effects in the energy supply system are shown graphically in figure 5.

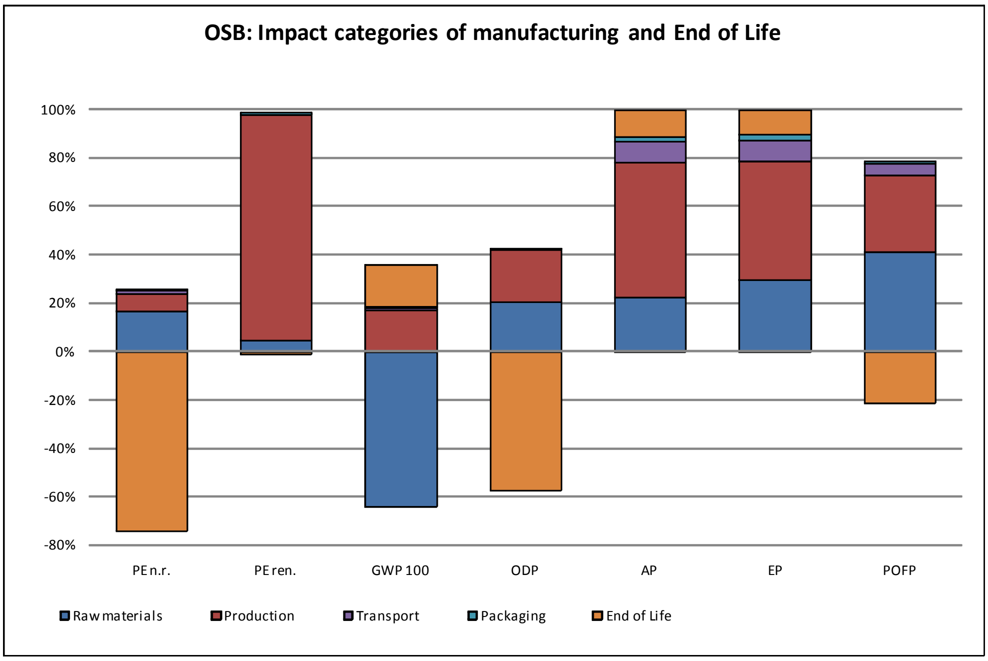

Figure 5 **Proportion of the processes relative to the impact categories – factory gate system boundary and combustion of the OSB board at end of life.**

The illustrated end of life fractions result from the allocation of the emissions resulting from the combustion process against the emissions avoided through the generation of electricity and steam.

This is the difference between the emissions for combustion of the OSB boards and the emissions avoided as a result in the average energy generation (credits).

Through this substitution effect at the end of life, the need for renewable energy sources as well as the ozone depletion potential and the summer smog potential (POFP) are reduced. All other environmental impact categories show an increase, since the substituted emissions are lower than the emissions which result from the combustion of the OSB board in the assumed biomass generating plant.

The **global warming potential** in manufacturing is dominated by carbon dioxide. 1015 kg of CO_2 are bound in the re-growing raw material contained in the product per m^3 of OSB mix. Another 336 kg of CO_2 equivalent is bound in the wood utilised for energy production. This binding of CO_2 in the tree growth phase is offset by further CO_2 emissions during the provisioning of raw materials, production, transportation, and packaging. A bit more than 95 % of the emissions are carbon dioxide, a scant 1 % is contributed by nitrous oxide, and a scant 4 % are VOC emissions (especially methane). This results in a balance over the product lifespan of approx. negative 864 kg CO_2 equivalent through the carbon stored in the product. The emission values at the end of life result from the combustion less the credit (substitution effect in the power mix as well as the average steam production) for the energy utilisation of 1 m^3 of finished OSB board of 326 kg CO_2. Within the system being considered (manufacturing and end of life) this results in a global warming potential of -538 kg of CO_2 equivalent per m³ of OSB board. The energy substitution effects are therefore higher than the fossil emissions required for production.

The provisioning of raw materials (approx. 49%) and production (50%) are the main contributors to the **ozone depletion potential**. A total ozone depletion potential of 2.13E-05 kg R11 equivalent is caused during production per m³ of OSB. The substitution of electricity at the end of life causes an ozone depletion potential value of approx. -7.59E-07 kg R11 equivalent for the overall system.

Provisioning of raw materials (25 %), production (62 %) and transportation (10 %) are the main contributors to the **acidification potential.** 0.982 kg of SO_2 equivalent are emitted during the production phase per m³ of OSB. The emissions from combustion less the emission credits through energy utilisation of the OSB board at end of life amount to 0.097 kg SO_2 equivalent. This results in an acidification potential of approx. 1.105 kg SO_2 equivalent for the overall system under consideration.

For the **eutrophication potential** the provisioning of raw materials (33%) and production (54%) are the most significant contributing factors from manufacturing. Transportation contributes 10 %. For manufacturing, the eutrophication potential is 0.1618 kg phosphate equivalent. The EoL increases the eutrophication potential again to 0.1801 kg phosphate equivalent under consideration of the substitution effects.

Provisioning of raw materials (approx. 52%) and production (40%) contribute to the **photochemical oxidant creation potential (ground-level ozone formation).** Overall the POFP within the factory gate system boundary is 0.132 kg ethylene equivalent. The EoL reduces the POFP to 0.096 kg ethylene equivalent through energy substitution.

8 Evidence and verifications

8.1 Formaldehyde

Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, testing, monitoring, and certification site, Brunswick

Test report, date: OSB/2: B404/04, 06.02.2004 + B405/04, 2004

OSB/3: B1727/07 + B1575/08, 2007, 2008

OSB 4 TOP: B1576/08 + B1577/08+ B1578/08, 2008

OSB 8000: B1242/07 + B3292/07, 2007

Result: The testing of the formaldehyde content was performed according to the perforator method according to EN 120. The results are well below the maximum permissible value of 8.0 mg HCHO/100 dry matter (at 6.5% material moisture content) according to the DIBt guideline 100 corresponding to the Chemikalienverbotsverordnung (banned chemicals provision) appendix to section 1, paragraph 3 in conjunction with publishing of the BGA (German health authority) in the Bundesgesundheitsblatt (German health gazette) dated October 1991 regarding the "test procedure for wood-based materials". The respective average results are:

- for OSB/2: 6.4 mg/100 g abs. dry (10 mm) + 6.5 mg/100 g abs. dry (15 mm)
- for OSB/3 : 3.9 mg/100 g abs. dry (10 mm) + 3.1 mg/100 g abs. dry (18 mm)
- for OSB TOP: 0.4 mg/100 g abs. dry (12 mm) + 0.3 mg/100 g abs. dry (22 mm)
- for OSB 8000: 0.5 mg/100 g abs. dry (25 mm) + 0.2 mg/100 g abs. dry (30) mm

The emission values for EUROSTRAND® OSB 4 TOP and OSB 8000 are below 0.05 ppm formaldehyde (= equilibrium concentration in the testing room) and are harmless to health.

8.2 MDI

Testing institute: Wessling – Beratende Ingenieure GmbH, Altenberge

Test report: Project-No.: IAL-08-0437

Result: The testing of PUR glued OSB 4 TOP boards was performed according to the procurement regulations RAL UZ 76 and NIOSH (P&CAM 142).

The emissions of MDI and other isocyanates were below the detection limit for the analysis method for both board types.
This fulfils the RAL-UZ 76 requirements for MDI emissions.

8.3 Eluate analysis

Testing institute: ECO – Iinstitute, Cologne

Test report: 415/2001

Result: The samples were fully dissociated using HNO3 and analyzed according to DIN 38406-E29-4. The metals and metalloids cadmium (detection limit 0.2 mg/kg), cobalt, mercury (detection limit 0.5 mg/kg), antimony, arsenic, barium, beryllium, lead, nickel and zirconium (detection limit 1.0 mg/kg) were undetectable. The detected concentrations of boron (150 mg/kg, detection limit 50 mg/kg), chrome (13 mg/kg, detection limit 1.0 mg/kg), copper (4 mg/kg, detection limit 1.0 mg/kg) and zinc (7 mg/kg, detection limit 1.0 mg/kg) can be classified as harmless.

Testing institute: University Osnabruck, Chemical laboratory

Test report: from 02/03/2005

Result: The samples were fully dissociated using HNO3 and analyzed according to DIN 38406-E29-4 and EN 71-3. Detection of the metals and metalloids: cadmium = detection limit = 0.2 mg/kg, antimony <0.05 mg/kg, arsenic >0.05 mg/kg, barium <5 mg/kg, lead = 0.25 mg/kg, chrome = 0.1 mg/kg, mercury <0.065 mg/kg, selenium <0.05 mg/kg.

All heavy metals were below the legal limits required by EN 71-3.

8.4 Toxicity of fire gases

Testing institute: University Osnabruck, IMFE material research Prof. Dr. Lechner

Test report: University Osnabruck from 21/02/2005

Result: The results according to DIN 53 436 show that the boards are practically free from chlorine and sulphur compounds. Hydrogen cyanide, HCN, was below the detection limit. The gaseous emissions during combustion therefore largely correspond to the emissions which result from the combustion of natural wood.

8.5 PCP / lindane

Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, testing, monitoring, and certification site, Brunswick

Test report: B353/04, B1640+1641+1642/2008, B2221/2007

Result: According to the testing method according to PA-C-12:2006-02 "Determining the pentachlorophenol (PCP) and γ-Hexachlorocyclohexane (lindane) in wood and wood-based materials", the pesticides PCP and lindane could not be detected (detection limit < 0.1 mg/kg).

8.6 EOX (extractable organic halogen compounds)

Testing institute: ECO – Institute, Cologne

Test report: 10350/2003

Result: After pentane extraction, combustion in oxygen flow and subsequently determining the EOX using coulometric titration according to DIN 38414-S17, extractable organic halogen compounds (EOX) could not be detected (12 substances, detection limit 1.0 mg/kg)

9 PCR Document and Verification

The declaration is based on the PCR document "Wood-based materials", year 2009.

Review of the PCR document by the expert committee. Chairman of the expert committee: Prof. Dr.-Ing. Hans-Wolf Reinhardt (University of Stuttgart, IWB (Institute for Materials in Construction))
Independent verification of the declaration according to ISO 14025: ☐ internal ☒ external
Validation of the declaration: Dr. Frank Werner

10 References

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For further literature see the PCR document

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