Environmental Product Declaration

according to ISO 14025

EGGER
EUROSPAN® Raw Chipboard
EURODEKOR®
Melamine faced Chipboard

Declaration number
EPD-EHW-2008511-E

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

Institut Bauen
und Umwelt e.V.

	**Summary** **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-2008511-E	**Declaration number**
Egger raw / Melamine faced chipboard EUROSPAN® / EURODEKOR® 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 2014	**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**

Summary

Umwelt-Produktdeklaration

Environmental Product-Declaration

Product description

Raw / Melamine faced chipboard is a board-shaped wood-based material according to EN 312 and EN 14322.
The decorative design of melamine faced chipboard is achieved through the use of printed decorative paper. At the same time, a corresponding feel can also be applied to the surface during pressing.

Application

Raw / melamine faced chipboard is used in decorative interior design and furniture applications. It is also used, for example, in kitchen areas for bodies and front panels (cupboards, wall cladding…).

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 chipboard product mix was declared.

Results of the LCA

EUROSPAN raw boards (per m³)				
Evaluation variable	**Unit per m³**	**Total**	**Manu-facturing**	**End of Life**
Primary energy, non renewable	[MJ]	-7047	5297	-12345
Primary energy, renewable	[MJ]	12777	13000	-223,2
Global warming potential (GWP 100)	[kg CO_2 eqv.]	-354,0	-745,6	391,6
Ozone depletion potential (ODP)	[kg R11 eqv.]	-1,56E-05	1,95E-05	-3,51E-05
Acidification potential (AP)	[kg SO_2 eqv.]	1,02E+00	1,23E+00	-2,13E-01
Eutrophication potential (EP)	[kg PO_4 eqv.]	3,03E-01	2,32E-01	7,13E-02
Photochemical oxidant formation potential (POFP)	[kg C_2H_4 eqv.]	3,56E-02	1,05E-01	-6,94E-02
EURODEKOR boards (per m²)				
Evaluation variable	**Unit per m²**	**Total**	**anu-facturin**	**End of Life**
Primary energy, non renewable	[MJ]	-111	110	-221
Primary energy, renewable	[MJ]	226	230	-4,0
Global warming potential (GWP 100)	[kg CO_2 eqv.]	-5,4	-12,4	7,0
Ozone depletion potential (ODP)	[kg R11 eqv.]	-2,41E-07	3,90E-07	-6,31E-07
Acidification potential (AP)	[kg SO_2 eqv.]	2,09E-02	2,41E-02	-3,18E-03
Eutrophication potential (EP)	[kg PO_4 eqv.]	6,01E-03	4,59E-03	1,42E-03
Photochemical oxidant formation potential (POFP)	[kg C_2H_4 eqv.]	1,02E-03	2,25E-03	-1,23E-03

Prepared by: PE INTERNATIONAL, Leinfelden-Echterdingen
in cooperation with Fritz EGGER GmbH & Co. OG

Evidence and verifications

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

- Formaldehyde according to EN 120 / EN 717-1
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institut
- MDI (diphenylmethane-4-4'-diisocyanate) according to BIA 7670
  Testing institute: Wessling Beratende Ingenieure GmbH
- Testing of the pre-treatment of the component materials (scrap wood provision)
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institut
- Eluate analysis according to EN 71-3
  Testing institute: MFPA Leipzig GmbH
- EOX (extractable organic halogen compounds) according to DIN 38414-S17
  Testing institute: MFPA Leipzig GmbH
- Toxicity of the fire gases according to DIN 53436
  Testing institute: MFPA Leipzig GmbH
- Scrap wood provision (active ingredients in wood preservatives, heavy metals, etc.)
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institut

Area of application

This document applies to raw EUROSPAN® chipboard and to Melamine faced EURODEKOR® chipboard which are manufactured in the following group of company plants:

Fritz EGGER GmbH & Co. OG, Weiberndorf 20, A – 6380 St. Johann in Tyrol

Fritz EGGER GmbH & Co. OG, Tiroler Straße 16, A – 3105 Unterradlberg

Egger Holzwerkstoffe Brilon GmbH&Co.KG, Im Kissen 19, D – 59929 Brilon

Egger (UK) Limited, Anick Grange Road, Hexham-Northumberland, NE-46 4JS

Egger Panneaux & Décors. Avenue d'Albert, Boite Postale 1, F – 40371 Rion des Landes

Egger Panneaux & Décors, Z.I. de Blanchifontaine, F – 88700 Rambervillers

OOO « Egger Drevprodukt », Jushnoje Chaussee 1, RU – 155908 Shuya

SC Egger Romania SRL, Str. Austriei 2, RO – 725400 Radauti, Suceava

And in addition, for EUROSPAN® raw chipboard:

Fritz EGGER GmbH & Co., Fabrikweg 11, A – 6300 Wörgl

Austria Novopan Holzindustrie GmbH, Turmgasse 43, A – 8700 Leoben

Egger Barony Ltd., Barony Road, Auchinleck, Scotland KA18 2LL

0 Product definition

Product definition

Raw and Melamine faced chipboard (EUROSPAN® and EURODEKOR®) are board-shaped wood-based materials according to EN 312 and EN 14322. The decorative design of melamine faced chipboard is achieved through the use of printed decorative paper. At the same time, a corresponding feel can also be applied to the surface during pressing.

The board types are primarily divided based on their application as load-bearing or non-load-bearing elements in dry and humid areas:

- P 1 General-purpose boards for use in dry conditions
- P 2 Boards for interior fixtures (including furniture) for use in dry conditions
- P 3 Boards for non-load-bearing applications in humid conditions
- P 4 Boards for load-bearing applications in dry conditions
- P 5 Boards for load-bearing applications in humid conditions
- P 6 High-strength boards for load-bearing applications in dry conditions (is not produced)
- P 7 High-strength boards for load-bearing applications in humid conditions (is not produced)

Application

Raw / melamine faced chipboard is used primarily in decorative interior design and furniture applications. They are used, for example, in kitchen areas for body and front panel applications (cabinets, wall cladding…).

Product standard / approval

- EN 312 – Chipboard - requirements
- EN 14322 – Melamine coated boards for use in interior areas
- EN 13986 – CE-labelling of wood-based material for use in construction

Accreditation

- CE-labelling according to EN 13986 – Notified Body WKI – Braunschweig, D
- PEFC, Chain of Custody HCA-CoC-183
- EN ISO 9001:2000 – ÖQS Vienna, A

Delivery status, characteristics

Table 1: Delivery sizes for chipboard (selection)

Board type	Size (mm)	Standard thicknesses [mm]																	
		8	10	12	13	14	15	16	18	19	22	24	25	28	30	32	38	40	44
E1 P2 CE	5610 x 2070	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	5310 x 2070	x	x	x	x		x	x	x	x	x		x	x	x	x	x		
	4110 x 2070	x						x	x	x	x		x	x			x		
	2800 x 2070	x	x	x				x	x	x	x		x	x	x	x	x	x	
E1 P3 CE	5610 x 2070			x			x	x		x	x								
	4110 x 1850			x				x		x	x			x	x		x		
	3660 x 2070							x		x									
	2800 x 2070			x				x		x	x								
E1 P4 CE	4110 x 1850									x									
E1 P5 CE	5610 x 2070							x		x	x		x						
	2800 x 2070			x				x	x	x	x		x	x		x	x		
E1 P6 CE	4905 x 1860																x		

Table 2: Delivery sizes for thin chipboard (selection)

Board type	Size (mm)	Standard thicknesses [mm]							
		2.8	3	3.2	4	5	6	7	8
Thin chipboard E1 P2	2800 x 2100		x		x	x	x	x	x

Table 3: General requirements upon delivery (also see EN 312, table 1)

General tolerances	Unit	Requirements
Board moisture EN 322	[%]	5-13
Maximum deviation of density EN 323 from average value	[%]	±10.0
Thickness tolerance EN 324 sanded boards	[mm]	±0.3
Length and width tolerance EN 324	[mm]	±5.0
Straightness of edges tolerance EN 324	[mm/m]	±1.5
Squareness EN 324	[mm/m]	±2.0
Thermal conductivity EN 12524	[W/mK]	0.12
Water vapour diffusion resistance number EN 12524	[μ]	μ moist 15; μ dry 50
Fire protection EN 13986		D-s2, d0 (thickness ≥ 9mm; density ≥ 600kg/m³) E (thickness < 9mm; density < 600kg/m³)
Formaldehyde content EN 120	[mg/100g]	E1*, E1 EPF-S**

* Perforator value (photometric) = 8 mg/100 g dry matter (material moisture 6.5 %); moving half-year average = 6.5 mg/100 g dry matter
** Perforator value (photometric) = 4/100 dry matter (material moisture 6.5%)

Table 4: Classification requirements P1 (see EN 312, table 2):

Mechanical properties Average board values	Unit	Board thicknesses					
Thickness ranges	[mm]	3-6	>6-13	>13-20	>20-25	>25-32	>32-40
Raw density	[kg/m³]	-	-	-	605	590	590
Transverse tensile strength EN 319	[N/mm²]	0.31	0.28	0.24	0.20	0.17	0.14
Bending strength EN 310	[N/mm²]	14	12.5	11.5	10	8.5	7

Table 5: Classification requirements P2 (see EN 312, table 3):

Mechanical properties Average board values	Unit	Board thicknesses						
Thickness ranges	[mm]	3-4	>4-6	>6-13	>13-20	>20-25	>25-32	>32-40
Raw density	[kg/m³]	≥ 780	≥ 760	≥ 730	≥ 670	≥ 640	≥ 620	≥ 600
Transverse tensile strength EN 319	[N/mm²]	0.45	0.45	0.40	0.35	0.30	0.25	0.20
Bending strength EN 310	[N/mm²]	13	14	13	13	11.5	10	8.5
Bending elasticity modulus EN 310	[N/mm²]	1800	1950	1800	1600	1500	1350	1200
Surface soundness EN 311	[N/mm²]	0.80						

Table 6: Classification requirements P3 (see EN 312, table 4):

Mechanical properties Average board values	Unit	Board thicknesses						
Thickness ranges	[mm]	3-4	>4-6	>6-13	>13-20	>20-25	>25-32	>32-40
Raw density	[kg/m³]	-	-	720	675	660	645	635
Transverse tensile strength EN 319	[N/mm²]	0.5	0.5	0.45	0.45	0.40	0.35	0.3
Bending strength EN 310	[N/mm²]	13	14	15	14	12	11	9
Bending elasticity modulus EN 310	[N/mm²]	1800	1950	2050	1950	1850	1700	1550
24h swelling EN 317	[%]	17	16	14	14	13	13	12
Moisture resistance EN 321 Transverse tensile strength according to cycle test	[N/mm²]	0.18	0.18	0.15	0.13	0.12	0.10	0.09
Moisture resistance EN 321 Thickness swelling according to cycle test	[%]	15	14	14	13	12	12	11

Table 7: Classification requirements P4 (see EN 312, table 5):

Mechanical properties Average board values	Unit	Board thicknesses						
Thickness ranges	[mm]	3-4	>4-6	>6-13	>13-20	>20-25	>25-32	>32-40
Raw density	[kg/m³]	-	-	730	705	705	-	-
Transverse tensile strength EN 319	[N/mm²]	0.45	0.45	0.40	0.35	0.30	0.25	0.20
Bending strength EN 310	[N/mm²]	15	16	16	15	13	11	9
Bending elasticity modulus EN 310	[N/mm²]	1950	2200	2300	2300	2050	1850	1500
24h swelling EN 317	[%]	23	19	16	15	15	15	14

Table 8: Classification requirements P5 (see EN 312, table 6):

Mechanical properties Average board values	Unit	Board thicknesses						
Thickness ranges	[mm]	3-4	>4-6	>6-13	>13-20	>20-25	>25-32	>32-40
Raw density	[kg/m³]	-	-	740	720	690	665	640
Transverse tensile strength EN 319	[N/mm²]	0.50	0.50	0.45	0.45	0.40	0.35	0.30
Bending strength EN 310	[N/mm²]	20	19	18	16	14	12	10
Bending elasticity modulus EN 310	[N/mm²]	2550	2550	2550	2400	2150	1900	1700
24h swelling EN 317	[%]	13	12	11	10	10	10	9
Moisture resistance EN 321 Transverse tensile strength according to cycle test	[N/mm²]	0.30	0.30	0.25	0.22	0.20	0.17	0.15
Moisture resistance EN 321 Thickness swelling according to cycle test	[%]	12	12	12	12	11	10	9

Table 9: Melamine-coated board requirements (also see EN 14322):

General tolerances Testing standard	Unit	Thickness ranges		
		< 15 mm	15 – 20 mm	> 20 mm
Thickness relative to nominal dimensions EN 14323	[mm]	±0.3 for abrasion class 1 and 2 +0.5/-0.3 for abrasion class 3A, 3B as well as for shiny surfaces		±0.5
Length and width EN 14323 - standard dimensions - Cuts	[mm]	±5 ±2.5		
Warping EN 14323	[mm/m]	-	≤2	
Edge breakage EN 14323 - standard dimensions - Cuts	[mm]	- ≤10 ≤3		

Surface properties	Testing stan-	Unit	Value
Surface defects Points Longitudinal imperfections	EN 14323	[mm^2/m^2] [mm/m]	≤2 ≤20 ±2.5
Behaviour under exposure to scratching	EN 14323	[N]	≥1.5
Resistance to stains	EN 14323	[Level]	≥3
Susceptibility to cracking	EN 14323	[Level]	≥3
Resistance to abrasion Different levels can be attained depending on the coating structure.	EN 14323	[Rotations]	Class / IP / WP 1 / <50 / <150 2 / ≥50 / ≥150 3A / ≥150 / ≥350 3B / ≥250 / ≥650

Information about some of the properties listed below may be required for particular applications. These must be stipulated separately and can be determined upon request according to the testing procedures specified by EN 14322.

Additional properties	Testing standard
Resistance to cigarette burns	EN 14323
Resistance to water vapour	EN 14323
Resistance to impact loads from falling large-diameter steel ball	EN 14323
Light fastness (xenon arc lamp)	EN 14323
Gloss level	EN 14323
Surface soundness	EN 311

1 Raw materials

Raw materials Primary products

Raw chipboard with thicknesses between 3 and 40 mm with an average density of 670kg/ m^3 consisting of (specified in mass-% per 1 m^3 of production):

- Wood chips, primarily spruce and pine wood, approx. 84-86 %

Secondary materials / additives

- Water approx. 4-7 %
- UF-glue (urea resin) approx. 8-10 %
- Paraffin wax emulsion <1 %
- Decorative paper with a grammage of 60-120 g/m^2

- Melamine formaldehyde resin

Material explanation

Wood compound: The production of chipboard utilizes only fresh wood from thinning measures as well as sawmill leftovers, primarily spruce and pine wood. A significant percentage of the raw material is recycled wood which can be used as material.

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

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

Melamine formaldehyde resin: aminoplastic resin for impregnation of décor paper for lamination; in the press, the resin hardens fully into a hard and hard-wearing surface.

Raw material extraction and origin

Wood from indigenous, predominantly regional forests is used in the manufacturing of raw and Melamine faced chipboard. The wood is sourced from forests within a radius of approx. 200 km from the production site. The short transportation distances contribute a considerable measure to minimizing the logistical costs of raw materials acquisition. In the selection process, preference is given to woods that are certified according to FSC or PEFC regulations.

PEFC and FSC certified finished goods are indicated separately by the manufacturer and do not represent the entire product range. The bonding agents and impregnating resins or, as the case may be, the raw materials for manufacturing them come from suppliers located at a maximum distance of 450 km from the production site.

Local and general availability of the raw materials

The wood used in the production of Melamine faced chipboard is sourced exclusively from cultivated forests managed in a sustainable manner. The selection is composed exclusively out of greenwood from thinning and silviculture as well as sawmill leftovers (wood chips, shavings). A significant percentage of the wood compound being processed stems from recycled wood material which can be reused. The bonding agents and/or impregnating resins MUF and urea as well as the paraffin emulsion are synthesised out of crude oil, a fossil raw material with limited availability.

2 Manufacturing of the building product

Manufacturing of the building product

Structure of the manufacturing process:

2.1 Production of the rawboard:

1. Log wood chipping
2. Chip processing
3. Waste wood processing
4. Drying the chips to approx. 2-3 % residual moisture content
5. Gluing the chips
6. Spreading of the glued chips onto a moulding conveyor
7. Compression of the chip mass using a continuous hot press (ContiRoll®)
8. Cutting and edge-trimming of the board strip into raw board sizes
9. Cooling of the rawboard in radial coolers
10. Sanding of the top and bottom surfaces
11. Destacking onto large stacks

2.2 Production of the impregnating substances for lamination:

1. Unrolling of the base papers
2. Uptake of impregnating resin (MUF) in the system
3. Drying of the impregnated paper in heated dryers
4. Dimensioning of the endless paper by a crosscutter
5. De-stacking of the dimensioned boards onto pallets

2.3 Production of the Melamine faced chipboard:

1. Placement of the impregnating material on the top and bottom surfaces of the rawboard

2. Pressing of the board in a hot press using various textured pressing plates
3. Quality sorting and destacking
4. Climatisation phase of up to 14 days

All leftovers which arise during production (trimming, cutting, and milling leftovers) are, without exception, routed to a thermal utilisation process.

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 the German 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 show 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

Egger chipboard can be sawn and drilled with normal (electric) tools. Hard metal-tipped tools are recommended, especially for circular saws. Wear a respiratory mask if using hand tools without a dust extraction device.

Detailed information and processing recommendations are available at:

www.egger.com.

Job safety, Environmental protection

Apply all standard safety measures when processing / installing Egger chipboard (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

Particle board and corrugated cardboard covering as well as PET or steel straps are used.

4 Usage condition

Components

Components in usage condition:
The components of raw and Melamine faced chipboard correspond in their fractions to those of the material composition in point 1 “Raw Materials”. During pressing the aminoplastic resin (UF) is cross-linked three-dimensionally through a non-reversible polycondensation reaction under the influence of heat. The binding agents are chemically inert and bonded firmly to the wood. Very small quantities of formaldehyde are emitted (see formaldehyde certificate chapter 8.1).

Interactions

Environment - Health

Environmental protection:

According to the current state of knowledge, hazards to water, air, and soil cannot occur during proper use of the described products (see point 8. Evidence).

Health protection:

Health aspects: No damage to health or impairments are expected under normal use corresponding to the intended use of chipboard. 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 8.1 Formaldehyde, 8.2 MDI, 8.3 Scrap wood provision, 8.4 Eluate analysis, 8.5 EOX, 8.6 Toxicity of fire gases).

Long term durability in usage condition

The durability under usage conditions is defined through the class of application (P1-P7) (see chapter 0 "Product definition" as well as tables 1 through 7).

5 Unusual effects

Fire

Reaction to fire: Flammability rating D according to EN 13501-1
Smoke development S2 – normally smoky
d0 – non-dropping

Toxicity of fire gases (test report chapter 8)

Change of phase (dripping by combustion/precipitation): Dripping by combustion is not possible, since Egger chipboard does not liquefy when hot.

Water effects

No component materials which could be hazardous to water are washed out. Chipboard is not resistant to sustained exposure to water, but damaged areas can be replaced easily on site.

Mechanical destruction

The breaking pattern of chipboard illustrates relatively brittle behaviour, and sharp edges can form at the breaking edges of the boards (risk of injury).

6 End of life phase

Reuse

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

Reclamation

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

Energy utilisation (in correspondingly approved systems): With a high calorific value of approx. 14.6 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

Egger chipboard 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).

Packaging: The transport packaging of chipboard and steel / PET 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 chipboard

Declared unit

The declaration refers to the manufacturing of one cubic meter of raw EUROSPAN® board and one square meter of Melamine faced EURODEKOR® board.

The average raw density of the boards is 670 kg/m³ (5.5% moisture) for raw and (thickness Ø17.6 mm, 11.79 kg/m²) for Melamine faced chipboard.

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

System boundaries

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

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

- Forestry processes for the provisioning and transporting of wood
- Production of all raw materials, primary products, and secondary materials
- Transportation and packaging of raw materials and primary products
- Production processes of the raw and Melamine faced chipboard (energy, waste, thermal utilisation of production wastes, emissions) and the energy supply starting with the resource
- Packaging including its thermal utilisation

The usage phase of the raw and Melamine faced chipboard 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 involves all 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.

Background data

To model the life cycle for the manufacturing and disposal of raw and Melamine faced chipboard, 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 CO_2 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 is calculated according to the means of transportation (truck and rail) 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 as "combustible materials". 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 thermal utilisation in a biomass generating plant and modelled according to the 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 raw and Melamine faced chipboard are small.

Data quality

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

Data capture for the product mix took place directly in the production facilities by the Egger company. All input and output data of the Egger company from operational data capturing and measurements were made available and tested for plausibility. Therefore it can be assumed that the data used is very representative and of good quality.

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 utilized background data are consistent. Great value was placed on a high degree of completeness in the capturing of environmentally relevant material and energy flows.

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 raw and Melamine faced chipboard manufacturing system in question and the associated energy supply do not require any allocations; waste materials are utilized 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 gas produced in the biomass generating plant is done based on the calorific value of the input. The credit for the gas is calculated based on “EU-25 steam from natural gas”; the credit for electricity from the EU-25 power mix. The calculation of emissions (e.g. CO_2, HCl, SO_2 or heavy metals) which is 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 raw and Melamine faced chipboard must be accounted for under consideration of the stress and loading aspects.

7.2 Thermal utilisation of raw and Melamine faced chipboard

Choice of disposal process

For this life cycle assessment basis, thermal utilisation in a biomass generating plant was assumed for all products and modelled according to the board composition for the individual products. 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 EU-25: electricity and EU-25: 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 10 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 1 m³ of raw / 1 m² of Melamine faced chipboard (average thickness weighted according to the production percentages 17.6 mm) board mix.

The consumption of non-renewable energy for the raw / Melamine faced board production (cradle to gate) is 5297 MJ per m^3 / 110 MJ per m², where production makes up 18% / 19%, provisioning of raw materials 79% / 78%, and transportation and packaging a total of 3%.

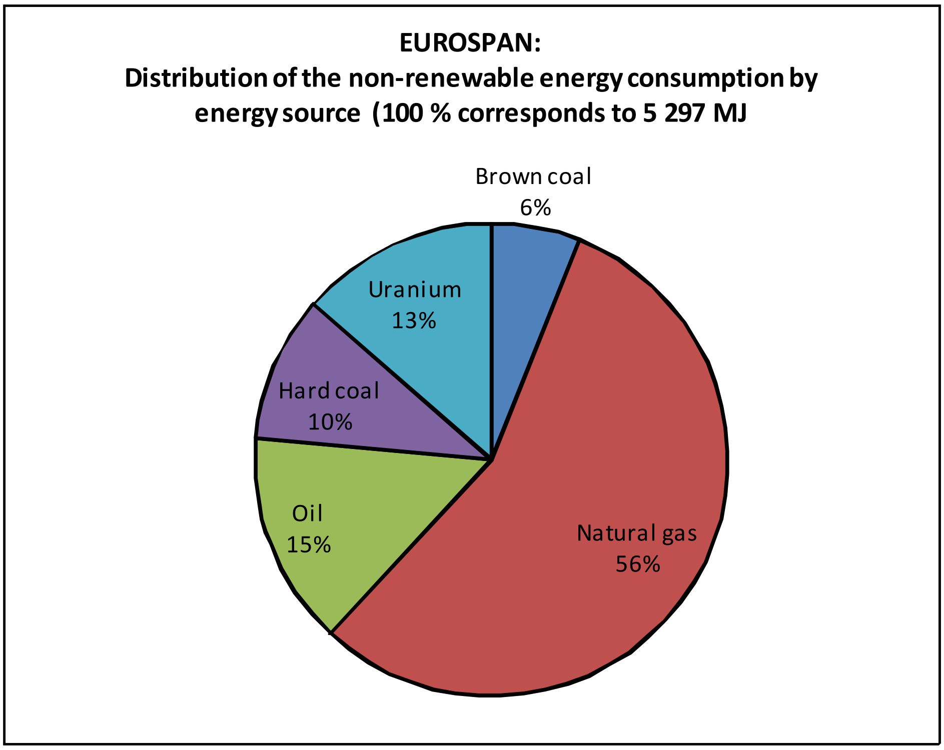
An additional 13 000 MJ / 230 MJ of renewable energy (mostly solar energy stored in the biomass) is used for the production of 1 m³ raw / 1 m² of Melamine faced board.

Table 10: Primary energy consumption for the manufacturing of 1 m³ of raw or 1 m² of Melamine faced board.

EUROSPAN® boards product mix per m³				
Evaluation variable	Unit per m³	Total	Manufacturing	End of Life
Primary non-renewable energy	[MJ]	-7047	5297	-12 345
Primary renewable energy	[MJ]	12 777	13 000	-223
EURODEKOR® boards product mix per m²				
Evaluation variable	Unit per m²	Total	Manufacturing	End of Life
Primary non-renewable energy	[MJ]	-111.02	110.39	-221.42
Primary renewable energy	[MJ]	226.10	230.10	-4.01

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 raw / Melamine faced chipboard product until its “end of life”. 1 m³ of finished raw chipboard has a lower calorific value of approx. 11 189 MJ. 1 m² of finished Melamine faced board has a lower calorific value of approx. 197.8 MJ.

A more detailed evaluation of the non-renewable energy required to produce 1 m³ of raw / 1 m² of Melamine faced board shows that the primary energy source used is natural gas, which makes up approx. 55% / 57% of the primary energy consumption. About 10% / 9% of the required energy is provided by hard coal and 6% each by brown coal, while another 14% / 13% is 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 respective power mix at the production sites, which also includes atomic energy. The remaining 15% each is covered by crude oil.



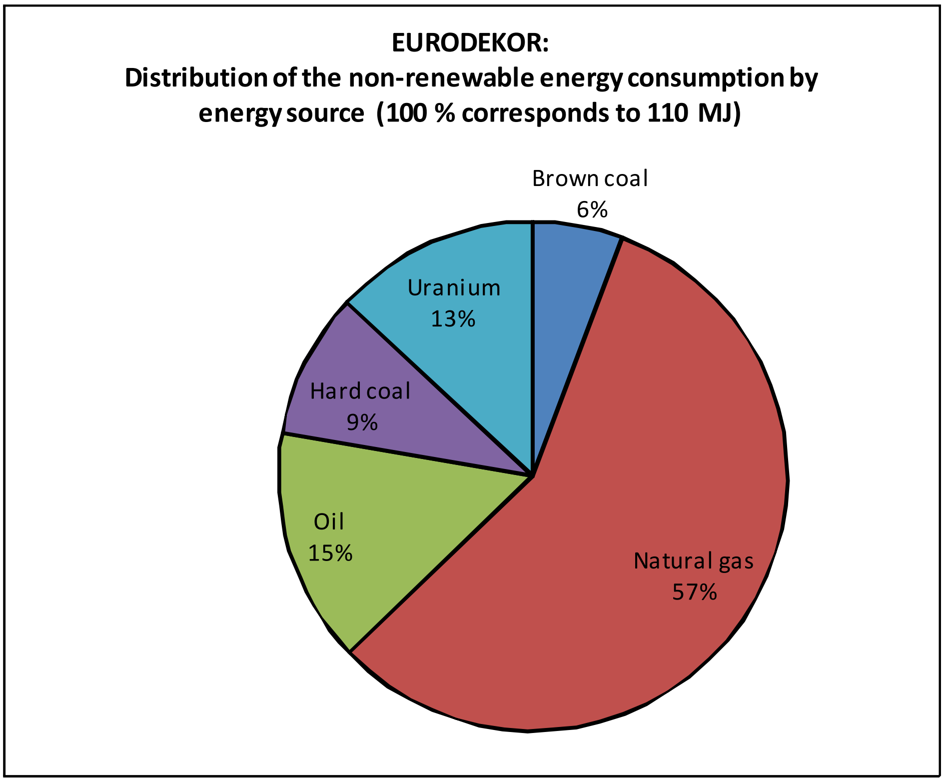
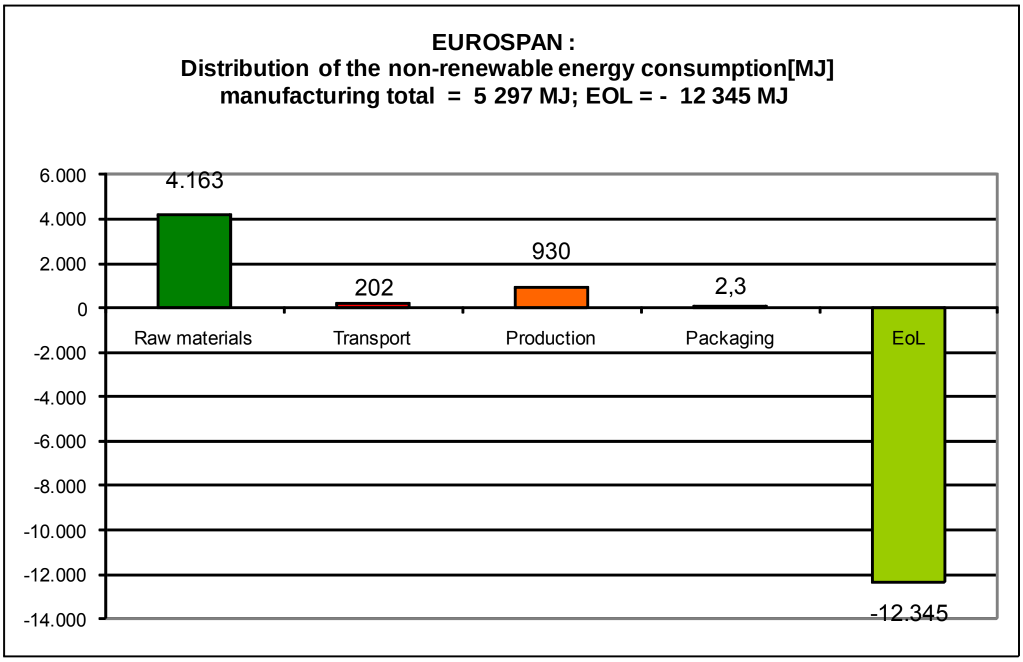


Figure 1: **Distribution of non-renewable energy consumption by energy source for the manufacturing of 1 m³ of EUROSPAN®/ 1 m² of EURODEKOR® board (product mix)**

Figure 2 does not provide a further level of detail for the non-renewable energy consumption. A credit of 12 345 / 221 MJ from the end of life is created.

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 and allocated to production. 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 raw board or m² of Melamine faced board. Wood wastes are utilized in a biomass generating plant. This also results in credits.



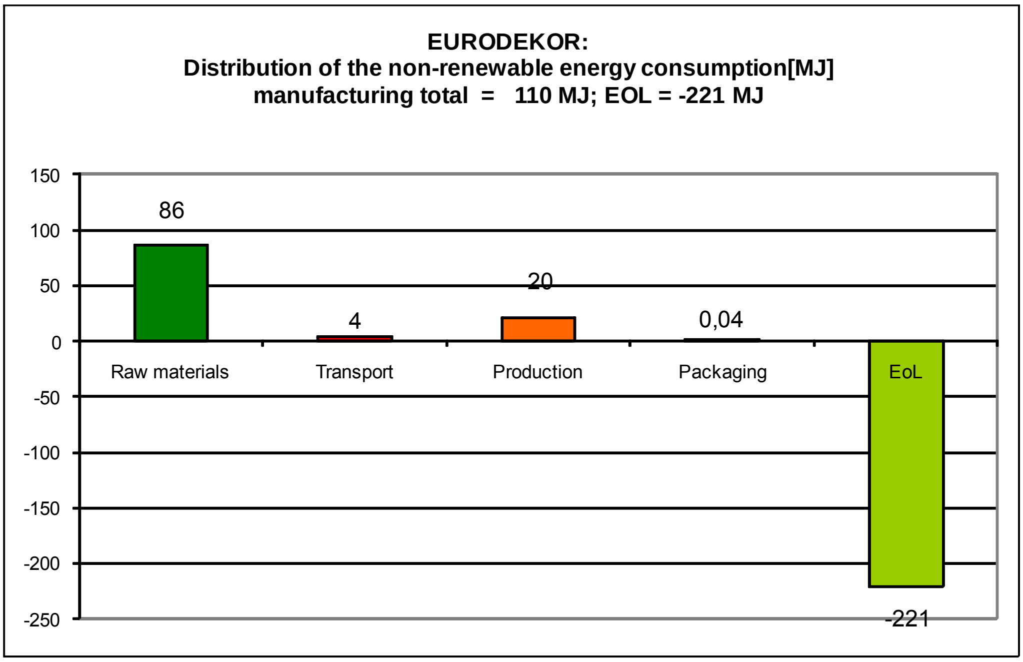
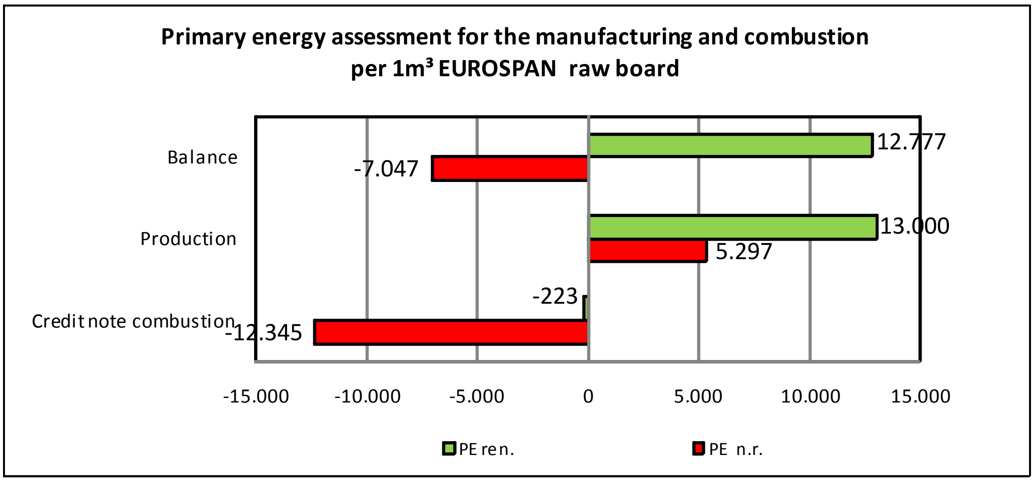


Figure 2: Distribution of the non-renewable energy consumption for the manufacturing of 1 m³ of raw / 1 m² of Melamine faced board.

If one considers manufacturing and end of life (combustion of the average raw / Melamine faced board in a biomass generating plant), then one discovers that the energy credit for electricity and steam (credit for EU-25 power mix and EU 25 thermal energy from natural gas) amounts to 12 345 / 221 MJ of non-renewable energy sources per m^3 of EUROSPAN / m² of EURODEKOR board. This reduces the non-renewable primary energy consumption of 5297 MJ/m³ / 110 MJ/m² to a negative value of -7047 MJ/m³ / -111 MJ/m² when manufacturing and combustion are calculated. This means that through utilisation of the renewable energy stored in a EUROSPAN/EURODEKOR board, more non-renewable energy is replaced than was required to manufacture it.



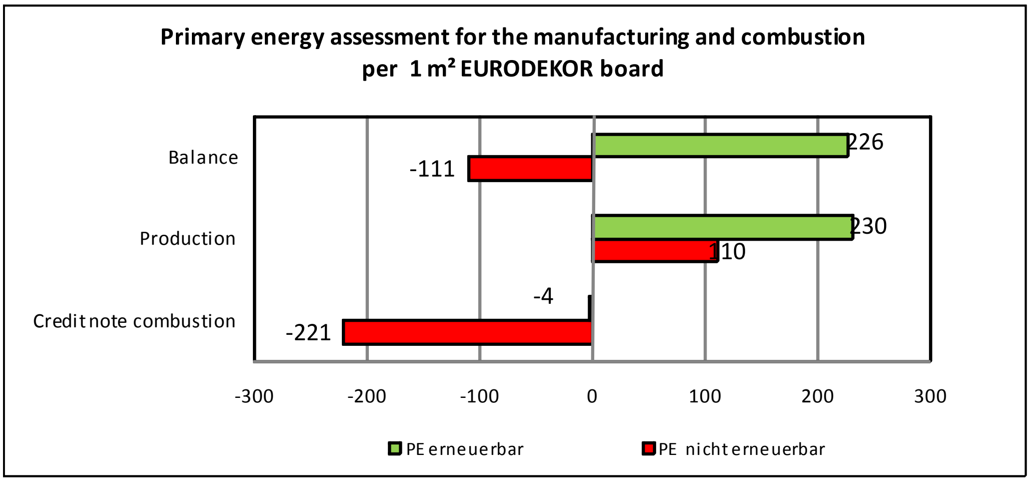
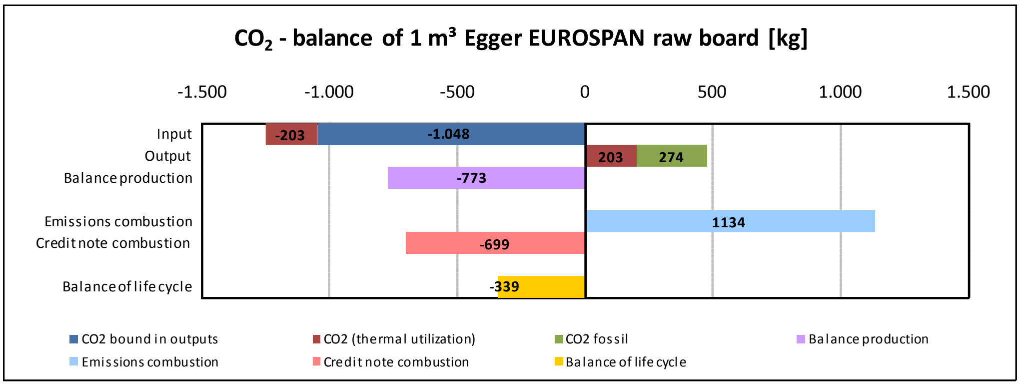


Figure 3: Primary energy assessment of renewable and non-renewable energy sources for the manufacturing and combustion of 1 m³ of raw/ 1 m² of Melamine faced board.

CO_2 balance sheet

The CO_2 balance sheet in figure 4 shows that manufacturing causes 477 / 9.5 kg of CO_2 emissions per m³ of raw / m² of Melamine faced board, of which 203 / 4 kg of CO_2 are the result of the direct thermal utilisation of wood during the production phase and an additional 274 / 5.5 kg of CO_2 are fossil emissions. On the other hand, a total of 1251 / 22 kg of CO_2 per m³ of raw/ m² of Melamine faced board is removed from the air and stored in the wood through photosynthesis as the trees grow, of which 1048 / 18 kg of CO_2 per m³ / m² remains bound. The CO_2 component bound in the wood and paper of the raw / Melamine faced board is only released again at the end of the life-cycle, e.g. 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 773 / 13 kg per m³ of raw / m² of Melamine faced board through binding in the product and substitution of non-renewable energy sources. This storage effect is effective throughout the utilisation phase. During combustion at the end of life in the modelled waste incineration, the carbon stored in the board is released back into the atmosphere, mostly in the form of CO_2. At the same time, however, a substitution of fossil fuels takes place, and therefore CO_2 from the combustion of these fossil energy sources of -699 / -13 kg. This energy substitution effect results in a total balance of -339 / -5.16 kg CO_2 over the entire life cycle.



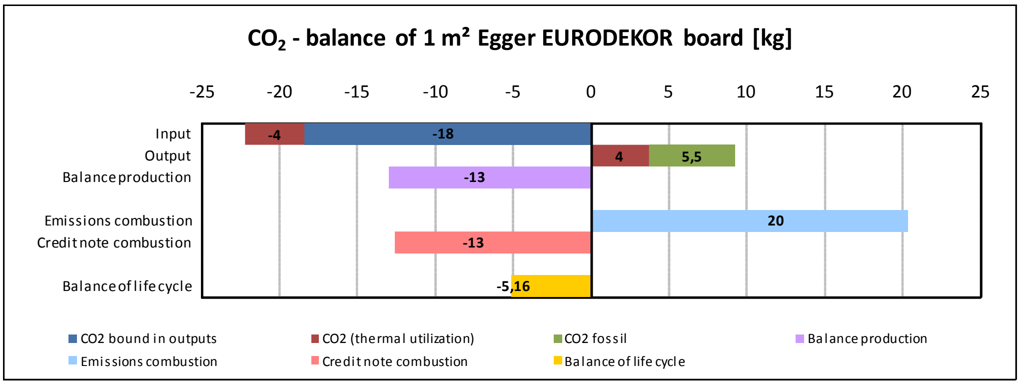


Figure 4: **CO_2 balance sheet for the manufacturing of 1 m³ of raw / 1 m² of Melamine faced board.**

Waste

The evaluation of waste produced to manufacture 1 m³ of raw / 1 m² of Melamine faced 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 11).

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

For the **mining debris** the rubble generated during manufacturing is by far the most significant quantity at over 93% (410 kg) / 94% (8.3 kg), followed by the respective 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 the lifecycle substitutes mining debris from energy provisioning in the amount of 566 kg/m³ of raw / 10.17 kg/m² of Melamine faced board.

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

Table 11: Waste accumulation during the manufacturing and combustion of 1 m³ of raw / 1 m² of Melamine faced board.

Waste [kg / m³ of EUROSPAN® board]			
Evaluation variable	**Manufacturing**	**End of Life**	**Total**
Residues / mining debris	409.55	-566.09	-156.54
Municipal waste	4.96	0.00	4.96
Hazardous waste	0.98	-0.48	0.50
of which is radioactive waste	0.214	-0.30	-0.086
Waste [kg / m² of EURODEKOR® board]			
Evaluation variable	**Manufacturing**	**End of Life**	**Total**
Residues / mining debris	8.28	-10.17	-1.89
Municipal waste	0.09	0.00	0.09
Hazardous waste	0.02	-0.01	0.01
of which is radioactive waste	0.01	-0.01	0.00

Hazardous wastes here are primarily the wastes produced during the upstream stages. The “sludge” fraction contains the largest amount of hazardous waste at 0.50 kg/m³ / 0.01 kg/m² of produced raw / Melamine faced board. 0.214 / 0.01 kg of radioactive waste is also produced per m³ of raw/ m² of Melamine faced board, of which 98 % 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.

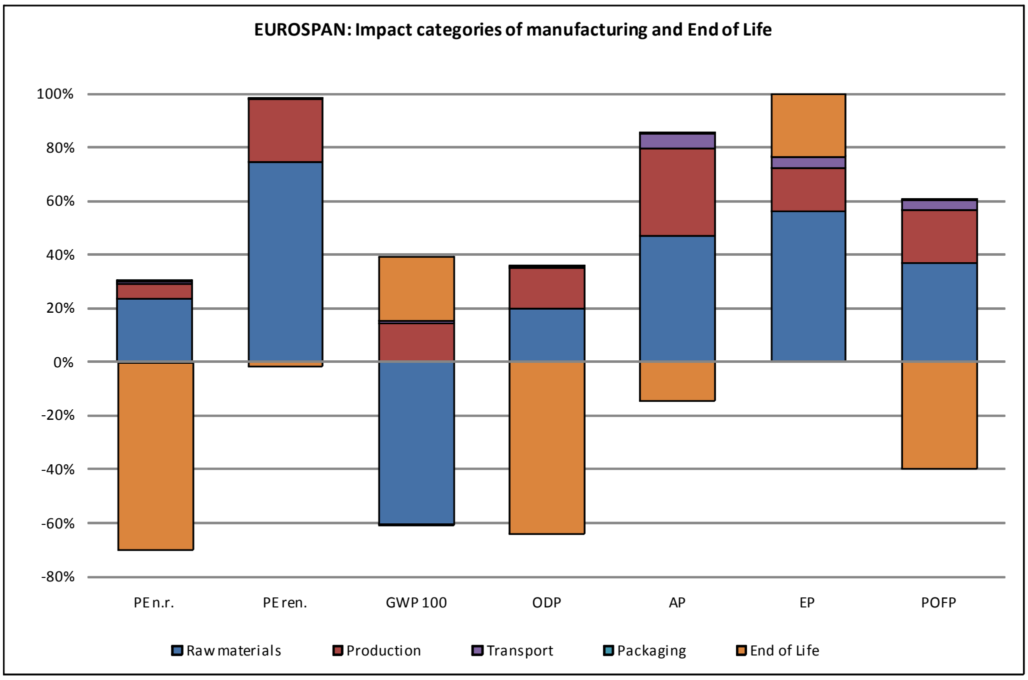
Impact assessment

The following table shows the manufacturing and combustion contributions of 1 m³ of raw / 1 m² of Melamine faced 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 POCP). In addition the renewable primary energy (PE reg.) and the non-renewable primary energy (PE ne) are listed again.

Table 12: Absolute contributions of manufacturing and end of life per m³ of raw / per m² of Melamine faced board mix to PE ne, PE reg, GWP 100, ODP, AP, EP and POCP.

EUROSPAN raw boards (per m³)				
Evaluation variable	**Unit per m³**	**Total**	**Manu-facturing**	**End of Life**
Primary energy, non renew able	[MJ]	-7047	5297	-12345
Primary energy, renew able	[MJ]	12777	13000	-223,2
Global w arming potential (GWP 100)	[kg CO_2 eqv.]	-354,0	-745,6	391,6
Ozone depletion potential (ODP)	[kg R11 eqv.]	-1,56E-05	1,95E-05	-3,51E-05
Acidification potential (AP)	[kg SO_2 eqv.]	1,02E+00	1,23E+00	-2,13E-01
Eutrophication potential (EP)	[kg PO_4 eqv.]	3,03E-01	2,32E-01	7,13E-02
Photochemical oxidant formation potential (POFP)	[kg C_2H_4 eqv.]	3,56E-02	1,05E-01	-6,94E-02
EURODEKOR boards (per m²)				
Evaluation variable	**Unit per m²**	**Total**	**anu-facturin**	**End of Life**
Primary energy, non renew able	[MJ]	-111	110	-221
Primary energy, renew able	[MJ]	226	230	-4,0
Global w arming potential (GWP 100)	[kg CO_2 eqv.]	-5,4	-12,4	7,0
Ozone depletion potential (ODP)	[kg R11 eqv.]	-2,41E-07	3,90E-07	-6,31E-07
Acidification potential (AP)	[kg SO_2 eqv.]	2,09E-02	2,41E-02	-3,18E-03
Eutrophication potential (EP)	[kg PO_4 eqv.]	6,01E-03	4,59E-03	1,42E-03
Photochemical oxidant formation potential (POFP)	[kg C_2H_4 eqv.]	1,02E-03	2,25E-03	-1,23E-03

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 1.



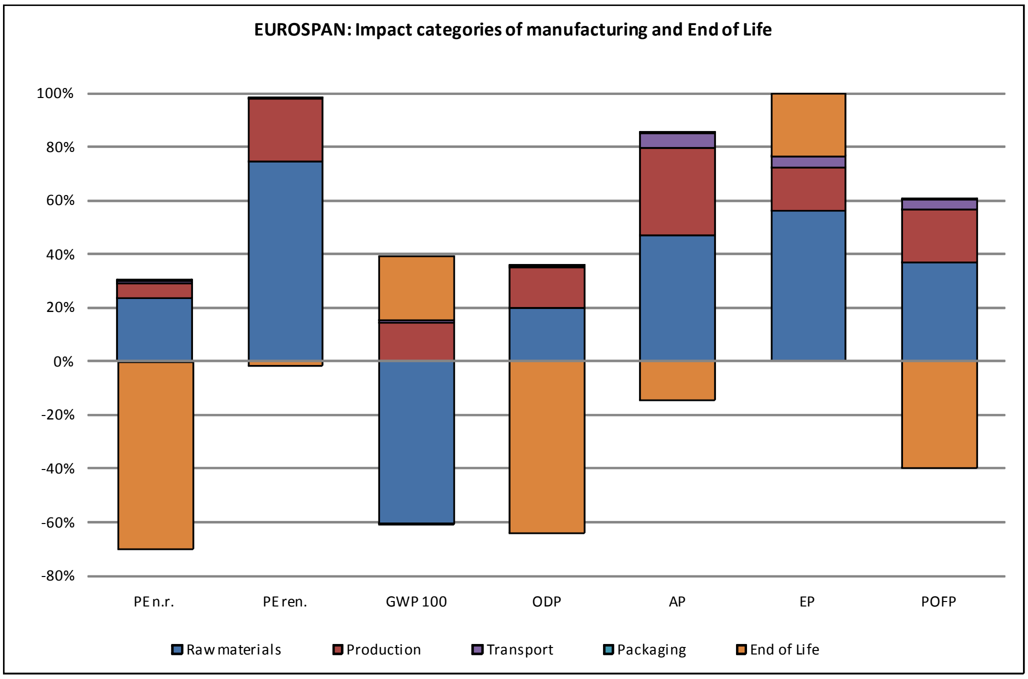


Figure 5: **Proportion of the processes relative to the impact categories – factory gate system boundary and combustion of the raw / Melamine faced board at end of life.**

The illustrated end of life fractions result from the allocation of the emissions resulting from the combustion process against the emissions avoided for the generation of electricity and steam. This is the difference between the emissions for combustion of the raw/Melamine faced 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 non-renewable energy sources and, to a small degree, the need for renewable energy sources as well as the ozone depletion potential, the acidification potential and the summer smog potential (POCP) are reduced. All other environmental categories show an increase, since the substituted emissions are lower than the emissions which result from the combustion of the raw / Melamine faced board in a biomass generating plant.

The **global warming potential** in manufacturing is dominated by carbon dioxide. 1048 / 18 kg CO_2 are bound in the re-growing raw materials contained in the product per m³ of raw / m² of Melamine faced board mix. Another 203 / 4 kg CO_2 equivalent are bound in the wood utilized 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. This results in a balance over the product lifespan of approx. negative 745 / 12.4 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 average steam production) for the energy utilisation of 1 m³ of finished raw / 1 m² of Melamine faced board of 392 / 7 kg CO_2 equivalent. Within the system being considered (manufacturing and end of life) this results in a global warming potential of -354 / -5.4 kg CO_2 equivalent per m³ of raw / m² of Melamine faced board. The energy substitution effects for both the raw and Melamine faced chipboard are therefore higher than the fossil emissions required for production.

The provisioning of raw materials (approx 42 %) and production (50 %) are the main contributors to the **ozone depletion potential**. A total ozone depletion potential of 1.95E-05 kg / 3.90E-07 kg R11 equivalent per m³ of raw / m² of Melamine faced board is caused during manufacturing. The substitution of electricity at the end of life causes an ozone depletion potential value of approx. -1.56E-05 / -2.41E-07 kg R11 equivalent for the overall system.

Production (38% / 39%), provisioning of raw materials (55% / 55%) and transportation (7 %) are the main contributors to the **acidification potential**. During the production phase 1.23 / 2.41E-02 kg SO_2 equivalent are emitted per m³ of raw / m² of Melamine faced board. The emissions from combustion are a bit lower than the emission credits due to energy utilisation of the raw board at its end of life. This results in an acidification potential of approx. 1.02 / 2.09E-02 kg SO_2 equivalent for the overall system under consideration.

Production (20% / 20%), provisioning of raw materials (73% / 74%) and transportation (6%) are the main contributors to the **eutrophication potential**. For manufacturing, the eutrophication potential is 0.232 kg / 0.00459 kg phosphate equivalent. The EoL increases the eutrophication potential again to between 0.303 and 0.00601 kg phosphate equivalent under consideration of the substitution effects.

Provisioning of raw materials (approx. 29% / 26%), production (65% / 69%) and transportation (5% / 5%) contribute to the **photochemical oxidant creation potential (ground-level ozone formation)**. Overall the POCP within the factory gate system boundary is 0.105 / 0.00225 kg ethylene equivalent. The EoL reduces the POCP to 0.0356 / 0.00102 kg ethylene equivalent through energy substitution.

8 Evidence and verifications

8.1 Formaldehyde

Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institut

Testing, monitoring, and certification site, Braunschweig, Germany

Test report, date: B2841/2008 raw chipboard EPF-S from 15/08/2008
B2205/2008 raw chipboard E1 from 26/06/2008
B1856/2008 Melamine faced chipboard from 05/06/2008

Result: The testing of the formaldehyde content was performed according to the perforator method according to EN 120 and according to the gas analysis method according to EN 717-2. For the raw boards the results are well below the maximum permissible value of 4.0 mg HCHO /100g dry matter (at 6.5% material moisture content) according to the EPF-S standard. The average results are

- 3.5 mg HCHO/100g according to EN 120 for a board thickness of 18mm
- 4.8 mg HCHO/100g according to EN 120 for a board thickness of 18mm
- 0.1 mg HCHO/m² h according to EN 717-2 for a board thickness of 16mm

8.2 MDI

Testing institute: Wessling Beratende Ingenieure GmbH, Germany

Test report, date: IAL-08-0310 from 04/09/2008

Result: The boards being tested with a total area of 1 m² were placed in a 1000 litre test chamber with an air exchange of 1 h^{-1}. The edges of the test samples were sealed using aluminium tape. The samples were taken 24 h after the chamber was loaded. The obtained samples were analyzed for MDI emissions together with a blank value from the emission test chamber. The isocyanate analysis was performed according to BIA 7670.

After 24 hours, the emissions of MDI and other isocyanates in the test chamber were below the detection limit for the analysis method.

The test method is identical to the test required in the PCR document according to NIOSH P&CAM 142.

Scrap wood provision

Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institut

Testing, monitoring, and certification site, Braunschweig, Germany

Test report, date: 2964/2008 from 27/08/2008

Result: The result of the test for pre-treatment of the component materials provided the following results for the following analysis methods:

- Pentachlorophenol PCP: 1mg/kg (limit value 3 mg/kg)
- Heavy metals: not detectable
- Polychlorinated biphenyls PCB: not detectable
- Total chlorine compounds: 140 mg/kg (limit value 600 mg/kg)
- Total fluorine compounds: 12 mg/kg (limit value 100 mg/kg)

8.4 Eluate analysis

Testing institute: MFPA Leipzig GmbH, Division I – Construction Materials

Accredited testing laboratory, Leipzig Institute for Materials Research and Testing for the construction industry, Leipzig, Germany

Test report, date:

UB 1.1 / 08 – 162 – raw and Melamine faced chipboard from 15/08/2008

Result for raw chipboard: Determination of elutable heavy metals was performed according to EN 71-3. The following values were determined [mg/kg]: Antimony 3, Arsenic <0.5, Barium 100, Cadmium 0.13, Chrome 0.8, Lead 8, Mercury <0.01, Selenium <1.

Result for Melamine faced chipboard: Determination of elutable heavy metals was performed according to EN 71-3. The following values were determined [mg/kg]: Antimony <1, Arsenic <0.5, Barium 105, Cadmium 0.07, Chrome 0.6, Lead 1.6, Mercury <0.01, Selenium <1.

8.5 EOX (extractable organic halogen compounds)

Testing institute: MFPA Leipzig GmbH, Division I – Construction Materials

Accredited testing laboratory, Leipzig Institute for Materials Research and Testing for the construction industry, Leipzig, Germany

Test report, date:

UB 1.1 / 08 – 162 – raw and Melamine faced chipboard from 15/08/2008

Result: Determination of the extractable organic halogen compounds (EOX) was done according to DIN 38414-S17 and resulted in a measured value <2 mg/kg.

8.6 Toxicity of the fire gases according to DIN 53436

Testing institute: MFPA Leipzig GmbH, Division I – Construction Materials

Accredited testing laboratory, Leipzig Corporation for Materials Research and Testing for the Construction Industry, Leipzig, Germany

Test report, date:

UB 1.1 / 08 – 162 – 2.1 raw and Melamine faced chipboard from 15/08/2008

Result for raw chipboard: The determination of toxic fire gases was performed according to DIN 4102 part 1 – class A at 400° C. The results show that after 30 minutes, 4000 ppm of carbon monoxide was measured in the inhalation space, while all other chemical compounds were not detectable within this timeframe. After 60 minutes, the following concentrations were found in the inhalation space: Carbon monoxide 10 000 ppm (hence calculated >50% COHb), carbon dioxide 20 000 ppm, hydrogen cyanide 10 ppm, and hydrocarbons (styrol) 400 ppm. Ammonia and hydrogen chloride were not detectable. The relative weight reduction at a test temperature of 400° C was 59 %.

At the end of the test, dense white smoke was present in the inhalation space.

The gaseous emissions released under the selected test conditions largely correspond to the emissions released from wood under the same test conditions.

Result for Melamine faced chipboard: The determination of toxic fire gases was performed according to DIN 4102 part 1 – class A at 400° C. The results show that after 30 minutes, 3300 ppm of carbon monoxide was measured in the inhalation space. After 60 minutes, the following concentrations were found in the inhalation space: Carbon monoxide 10 000 ppm (hence calculated >50% COHb), carbon dioxide 15 000 ppm, ammonia 1500 ppm, and hydrocarbons (styrol) 300 ppm. Hydrogen cyanide and hydrogen chloride were not detectable. The relative weight reduction at a test temperature of 400° C was 48.4 %.

At the end of the test, dense white smoke was present in the inhalation space.

9 PCR Document and Verification

The declaration is based on the PCR document "Wood-based materials", year 2009-1.

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

/PCR Wood-based materials/ Institut Bauen & Umwelt; PCR Wood-based materials; www.bau-umwelt.com; version 2009-01

/GaBi 2006/ GaBi 4: Software and database for comprehensive accounting. PE INTERNATIONAL GmbH, Leinfelden-Echterdingen, 2006

/Schweinle & Thoroe/ Schweinle, J. and C. Thoroe 2001: Comparative ecological accounting of log wood production in different forestry operations. Memoranda from the Bundesforschungsanstalt für Forst- und Holzwirtschaft (German federal research institute for forestry), Hamburg. No. 204

/Hasch 2002/ Hasch, J.: Ecological considerations of particle board and wood fibre boards. Dissertation, Hamburg, 2002 - - revised 2007: Rueter, S. (BFH HAMBURG; wood technology), Albrecht, S. (Uni Stuttgart, GaBi)

Standards and Laws

/DIN EN 13986/ DIN EN 13986: 2005-03, Wood-based materials for use in construction: properties, evaluation of conformity and labelling, German and English versions EN 13986:2005

/DIN EN 312/ DIN EN 312:2003-11, Chipboard - requirements; German version EN 312:2003

/DIN EN 14322/ DIN EN 14322:2004-06, Wood-based materials – melamine-coated boards for use in interior areas – Definition, requirements and classification, German version EN 14322:2004

/ISO 14025/ ISO 14025: 2007-10, Environmental labelling and declarations – type III environmental declarations - principles and methods (ISO 14025:2006); German and English text

/ISO 14040/ DIN EN ISO 14040:2006-10, Environmental management - life cycle assessment – principles and framework conditions (ISO 14040:2006); German and English versions EN ISO 14040:2006

/ISO 14044/ DIN EN ISO 14044:2006-10, Environmental management - life cycle assessment - requirements and instructions (ISO 14044:2006); German and English version EN ISO 14044:2006

For further literature see the PCR document

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