Environmental Product Declaration

according to ISO 14025

EGGER
EUROLIGHT® Raw and Laminated Lightweight Board

Declaration number
EPD-EHW-2008411-E

Institut Bauen und Umwelt e.V.
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Umwelt-Produktdeklaration

Environmental Product-Declaration

Program holder

Institut Bauen und Umwelt e.V.

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Declaration holder

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

Declaration number

EPD-EHW-2008411-E

Declared building products

Egger raw / laminated EUROLIGHT® lightweight building board

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.

Validity

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.

Content of the declaration

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 assessment results
- evidence and tests

Date of issue

25. February 2014

Signatures

Prof. Dr.-Ing. Horst J. Bossenmayer (President of the Institut Bauen und Umwelt)

Verification of the declaration

This declaration and the rules on which it is based have been examined by an independent expert committee (SVA) in accordance with ISO 14025.

Signatures

Prof. Dr.-Ing. Hans-Wolf Reinhardt (chairman of the expert committee)	Dr. Frank Werner (tester appointed by the expert committee)

Umwelt-Produktdeklaration

Environmental Product-Declaration

Product description

Raw / laminated lightweight building boards are board-shaped wood-based materials according to EN 312 and EN 14322. Raw or laminated thin chipboard boards are coated on one side with an adhesive and glued together with an expanded honeycomb cardboard intermediate layer.

Application

Applications for raw / melamine resin coated lightweight building board include decorative interior finishing, furniture, and door construction. They are found in applications in the kitchen area as worktops and in interior doors. Lightweight building boards are popular for use in applications where a massive appearance is desired.
Low weight, optimal stability and maximum design flexibility are requirements which a modern wood-based material must fulfil. Without also losing load bearing capacity, rigidity and other structural functions, a maximal weight reduction is only possible through the use of a sandwich board with a honeycomb core.

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. 1 m² of EUROLIGHT® with a thickness of 38 mm and surface layer thicknesses of 3, 4, and 8 mm as well as the corresponding cardboard honeycomb in the intermediate layer are declared.

Results of the LCA

EUROLIGHT raw board m²]

		3mm		4mm		8mm	
Evaluation variable	**Unit per m²**	**Manuf.**	**EoL**	**Manuf.**	**EoL**	**Manuf.**	**EoL**
Primary energy, non renewable	[MJ]	121,97	-85,05	129,04	-104,05	157,00	-178,29
Primary energy, renewable	[MJ]	73,77	-7,59	97,80	-9,26	193,94	-15,90
Global warming potential (GWP 100)	[kg CO_2 eqv.]	1,30	3,94	0,28	4,39	-3,83	8,22
Ozone depletion potential (ODP)	[kg R11 eqv.]	2,22E-07	-2,66E-09	2,33E-07	-3,61E-09	2,75E-07	-5,75E-09
Acidification potential (AP)	[kg SO_2 eqv.]	1,48E-02	7,41E-03	1,69E-02	8,73E-03	2,51E-02	1,64E-02
Eutrophication potential (EP)	kg Phosphate eqv	2,93E-03	1,42E-03	3,41E-03	1,63E-03	5,32E-03	2,93E-03
Photochemical oxidant formation potential (POFP)	[kg ethylene eqv.	1,86E-03	-1,03E-04	2,03E-03	-1,34E-04	2,69E-03	-1,71E-04

EUROLIGHT Melamine faced board [m²]

		3mm		4mm		8mm	
Evaluation variable	**Unit per m²**	**Manuf.**	**EoL**	**Manuf.**	**EoL**	**Manuf.**	**EoL**
Primary energy, non renewable	[MJ]	139,14	-92,33	146,21	-111,32	174,17	-185,56
Primary energy, renewable	[MJ]	75,01	-7,68	99,04	-9,36	195,18	-15,99
Global warming potential (GWP 100)	[kg CO_2 eqv.]	2,07	4,16	1,05	4,60	-3,06	8,43
Ozone depletion potential (ODP)	[kg R11 eqv.]	2,65E-07	-2,23E-08	2,75E-07	-2,33E-08	3,18E-07	-2,54E-08
Acidification potential (AP)	[kg SO_2 eqv.]	1,67E-02	7,04E-03	1,88E-02	8,36E-03	2,70E-02	1,60E-02
Eutrophication potential (EP)	kg Phosphate eqv	3,42E-03	1,38E-03	3,90E-03	1,59E-03	5,81E-03	2,90E-03
Photochemical oxidant formation potential (POFP)	[kg ethylene eqv.	2,24E-03	-1,40E-04	2,40E-03	-1,71E-04	3,06E-03	-2,08E-04

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
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institut
- MDI (diphenylmethane-4,4'-diisocyanate) according to BIA 7670
  Testing institute: Wessling Beratende Ingenieure GmbH
- 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

Area of application This document applies to EUROLIGHT® raw and laminated lightweight building board which is manufactured in the St. Johann plant:

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

0 Product definition

Product definition Raw or laminated thin chipboard boards are coated on one side with an adhesive and glued together with an expanded honeycombed cardboard intermediate layer.
The board thicknesses are primarily divided into three cover plate thicknesses – 3, 4, and 8 mm.

Application Applications for raw / melamine resin coated lightweight building boards include decorative interior design, furniture, and door construction. They are found in applications in the kitchen area as worktops and as interior doors, for example. Lightweight building boards are popular for use in applications where a massive appearance is desired.
Low weight, optimal stability and maximum design flexibility are requirements which a modern wood-based material must fulfil. Without losing load bearing capacity, rigidity and other structural functions, a maximum weight reduction is only possible through the use of a sandwich board with a honeycomb core.

Product standard / approval

- EN 14322 – Melamine coated boards for use in interior areas
- EN 312 – Chipboard requirements (applicable to surface layers)
- EN 13986 – CE-labelling of wood-based material for use in construction (applicable to surface layers)

Accreditation

- PEFC, Chain of Custody HCA-CoC-183
- EN ISO 9001:2000 – ÖQS Vienna, A

Delivery status, characteristics

Table 1: Lightweight building board delivery sizes (selection)

Board type	Size (mm)	Standard thicknesses [mm] with 8mm surface layer thickness		
		38	50	60
Raw board	5610 x 2070	X	x	x
	2800 x 2070	X	x	x
Board with laminated priming foil	2800 x 2070	X	x	x
Melamine coated board	2800 x 2070	X	x	
Raw board with two length wise headers	4110 x 610	X	x	x
Raw board with two length wise headers	4110 x 930	X	x	x

A more detailed listing of delivery options is not feasible due to the complex combination options of honeycomb heights and surface layer thicknesses. Various compositions can be made upon request.

Table 2: General requirements upon delivery

General tolerances	Unit	Requirements
Thickness tolerance EN 324	[mm]	±0.3
Length and width tolerance EN 324 - Full board - Cut to size with header	[mm]	±5.0 ±2.0
Warping EN 14322 - Full board - Cut to size with header	[mm/m]	±0.3
Squareness EN 324 - Full board - Cut to size with header	[mm/m]	≤2.0 ≤2.0
Straightness of edges EN 324 - Full board - Cut to size with header	[mm/m]	±1.5 ±1.5
Bond strength EN 319 - Between surface layer and honeycomb - Between surface layer and header	[N/mm²]	>0.15 10/38 mm header= 0.8; 65 mm header= 0.3
Formaldehyde content EN 120	[mg/100g]	E1*, E1 EPF-S**
Temperature resistance	[°C]	≤80

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

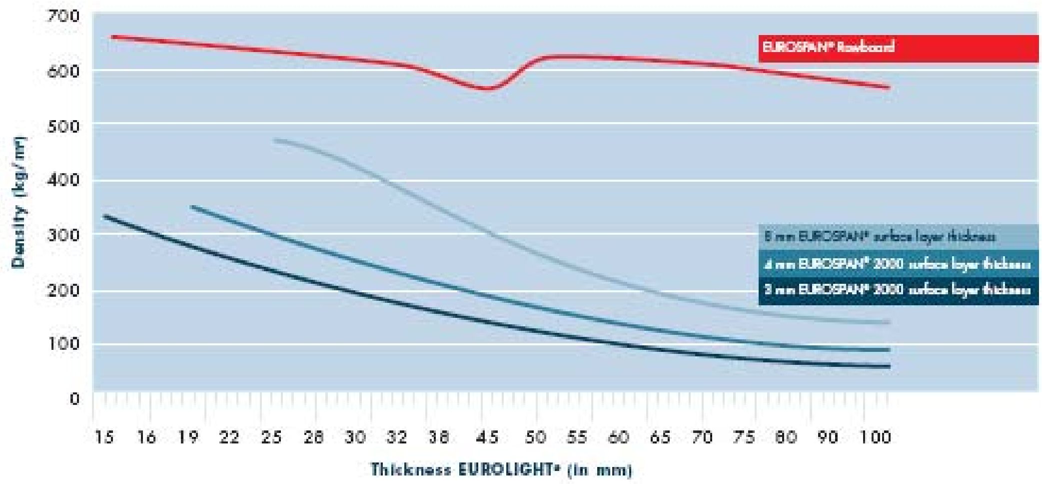
Table 3: Raw density distribution

Board thickness EUROLIGHT®	Surface layers			Egger EUROSPAN® Chipboard
	3 mm EUROSPAN®	4 mm EUROSPAN®	8 mm EUROSPAN®	
	Raw density [kg/m^3]			Raw density [kg/m^3]
15mm	338	-	-	670
16mm	319	-	-	660
19mm	274	346	-	650
22mm	240	303	-	640
25mm	215	270	478	630
28mm	195	245	430	621
30mm	184	230	404	615
32mm	175	218	380	610
38mm	152	188	325	595
45mm	133	164	279	580
50mm	123	150	254	570
55mm	114	140	234	621
60mm	107	130	217	615*
65mm	102	123	203	610*
70mm	96	116	190	610*
75mm	92	110	180	600*
80mm	88	105	170	595*
90mm	82	97	155	580*
100mm	77	90	142	570*

* theoretical values

Product group	Wood-based materials lightweight building board	Version
Declaration holder:	Fritz EGGER GmbH & Co. OG	16-12-2008
Declaration number:	EPD-EHW-2008411-E	

Figure 1: Raw Density Graph



Heat and moisture protection

Lightweight building boards are components composed out of surface layers and a honeycomb core. The thermal resistance of the sandwich board can be calculated based on the selected surface layer and the thickness of the honeycomb core:

Chipboard according to EN 312, heat transfer coefficient according to EN 13986, table 11:
- average raw density 600 kg/m² → □ = 0.12 W/m*K
- average raw density 900 kg/m² → □ = 0.18 W/m*K

Chipboard according to EN 312, diffusion resistance factor µ according to EN 13986, table 9:
- average raw density 600 kg/m³ → µ = 15/50 (wet cup / dry cup)
- average raw density 900 kg/m³ → µ = 20/50 (wet cup / dry cup)

Fire protection

With regard to the reaction to fire, the EUROLIGHT® lightweight building board was classified as class D-s2, d0 according to EN 13501-1.

Airborne sound insulation

Calculation of the airborne sound insulation factor R can be performed for a mass per unit area mA > 5 kg/m² over a frequency range of 1-3 kHz using the following formula according to EN 13986, paragraph 5.10:

R = 13 * lg (mA) +14

Further information is available at www.egger.com.

1 Raw materials

Raw materials
Primary products

Lightweight building board with a thickness between 15 and 100 mm and a density range of 80 – 480 kg/m³ consisting of (specifications in mass % per 1 m³ of production)

Surface layers:

Secondary materials / additives

- Wood chips, primarily spruce and pine wood, approx. 84-86 %
- Water approx. 4-7 %
- UF-glue (urea resin) approx. 8-10 %
- Paraffin wax emulsion <1 %

- Decorative paper with a grammage of 60-120 g/m²
- Melamine formaldehyde resin

Intermediate layers:

- Hexagonal honeycomb out of recycled cardboard with a cell width of 15 mm
- Corrugated cardboard honeycomb out of recycled cardboard

Gluing of intermediate and surface layers:

- PUR bonding system

Material explanation

Wood compound: The production of lightweight building board utilises only fresh wood from thinning measures as well as sawmill leftovers, primarily spruce and pine wood.

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.

PUR: Two-component formaldehyde-free bonding system consisting of the components polyol (elastopor H 1101/5) and isocyanate (IsoPMDI 92140); the bonding system reacts to form a solid mass through a polyaddition reaction without releasing any other substances.

Raw material extraction and origin

Wood from indigenous, predominantly regional forest stands is used in the production of raw and laminated lightweight building board. 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 raw and laminated lightweight building board 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). The bonding agents and/or impregnating resins MUF and urea as well as the paraffin emulsion and the PUR components 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 in a continuous roll-to-roll heat press
8. Sanding of the top and bottom surfaces
9. Cutting and edge-trimming of the board strip into raw board sizes
10. Destacking onto large stacks
11. Gluing of thin surface layers using PVAC adhesive along the edges for the

lamination

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 raw and laminated lightweight building board:

1. Separation of the two bonded raw and laminated boards using lengthwise circular saws and transverse cutting knife.
2. Gluing of the two surface layers with PUR bonding system
3. Expansion of the hexagonal honeycomb in a continuous dryer
4. Joining of the glued surface layer with the intermediate layer
5. Sizing of the joining element in a continuous sizing press
6. Edge-trimming and application of crosscuts
7. Destacking and packaging of the boards

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 (Austrian) 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 treated internally and routed back to production.
- Noise protection measurements show that all readings from inside and outside the production plant fall far below Austrian limit levels. Noise-intensive system parts such as chipping are structurally enclosed.
-

3 Working with the building product

Processing recommendations

Egger lightweight building board can be sawn and drilled with normal (electric) tools. 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 lightweight building board (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 notes in no. 6 "End of life phase".

Packaging

Particle board or additional corner protectors to protect the edges as well as PET strapping is used for packaging.

4 Usage condition

Components

Components in usage condition:
The components of raw and laminated lightweight building board correspond in their fractions to those of the material composition in point 1 “Raw Materials”. Production of surface layers: During pressing the aminoplastic resin (UF) is cross-linked three-dimensionally through an irreversible 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).
Production of the composite board: during gluing the components polyol and isocyanate are cross-linked three-dimensionally through an irreversible addition reaction. The gluing is formaldehyde-free (see MDI certificate chapter 8.2).

Interactions

Environmental protection:

Environment - Health

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 lightweight building boards. 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 certificates 8.1 formaldehyde, 8.2 MDI, 8.2 eluate analysis, 8.4 EOX, 8.5 toxicity of fire gases).

Long term durability in usage condition

The boards are only suitable for use in dry conditions.

5 Unusual effects

Fire

Reaction to fire: Flammability rating D according to EN 13501-1 (K3156/487/08-1-MPA BS)
Smoke development S2 – normally smoky
d0 – non-dropping

Toxicity of fire gases (test report chapter 8.5)
Change of phase (dripping by combustion/precipitation): Dripping by combustion is not possible, since the Egger lightweight building boards do not liquefy when hot.

Water effects

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

Mechanical destruction

The breaking pattern of a lightweight building board 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 lightweight building board can 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 lightweight building board can be separated and used again for other applications if selective deconstruction is practiced.

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) of lightweight building board construction leftovers as well as lightweight building board from deconstruction measures is preferable to putting them in the landfill.

Disposal

Egger lightweight building 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).

Packaging: The transport packaging chipboard and 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 lightweight building board

Declared unit

The declaration applies to the production of one square meter of raw and laminated EUROLIGHT® board (overall thickness of 38 mm with 3mm, 4mm, and 8mm thick surface layer).

The raw density of the uncoated boards is 138-304 kg/m³ (5.24 kg/m² (3mm), 6.50 kg/m² (4mm), 11.56 kg/m² (8mm)). The total weight of the double-sided lamination is 0.2634 kg/m².

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 board 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 including the associated relevant transportation
- Relevant transportation and packaging of raw materials and primary products
- Production processes for EUROLIGHT® boards (energy, waste, thermal utilisation, production waste, emissions) and energy provisioning ex resource
- Packaging including its thermal utilisation.

All reviewed products are produced in the St. Johann plant in Tyrol.

The usage phase of the boards 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 whose environmental impact comprises 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 EUROLIGHT® boards, the software system for comprehensive accounting "GaBi 4" was used (GaBi 2006). All background data sets relevant to 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 are calculated according to the means of transportation (truck, 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 (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 provided for the raw and laminated lightweight building board.

Data quality

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

Data capture for the boards took place directly in the production facility of the St. Johann plant. All input and output data of the Egger company were made available. 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 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.

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 board 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 "steam from natural gas"; the credit for electricity from the Austrian 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 boards must be accounted for under consideration of the stress and loading aspects.

7.2 Thermal utilisation of laminated and un-laminated lightweight building board

Choice of disposal process

For the life cycle assessment at hand, 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 SCR exhaust gas denitrification, dry sorption for desulphurisation, and a fabric particle filter. 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 during conventional electricity generation (also see allocation). The Austrian: electricity and 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 assessments are shown.

Primary energy

The following table 4 shows the energy consumption for the production of one square meter of average EUROLIGHT® (3mm, 4mm, 8mm, raw and laminated). The consumption of non-renewable energy for production (cradle to gate) is between 122/139 and 157/174 MJ per m² for laminated/un-laminated, with production making up approx. 30 %, provisioning of raw materials 68 %, transportation approx. 1 % and packaging approx. 0.05 % of the total.

In addition, between 74/75 and 194/195 MJ of renewable energy (99% of the solar energy stored in the biomass as well as approx. 1% wind and water power) per m² of laminated/un-laminated board are used in the production of one square meter of EUROLIGHT®.

Table 4: Primary energy consumption for the production of 1 m² of EUROLIGHT® board

EUROLIGHT Platten roh pro m²					
	Evaluation variable	**Unit per m³**	**Total**	**Manufacturi**	**End of Life**
3 mm	Primary energy, non-renewable	[MJ]	36,92	121,97	-85,05
	Primary energy, renewable	[MJ]	66,18	73,77	-7,59
4 mm	Primary energy, non-renewable	[MJ]	24,99	129,04	-104,05
	Primary energy, renewable	[MJ]	88,54	97,80	-9,26
8 mm	Primary energy, non-renewable	[MJ]	-21,30	157,00	-178,29
	Primary energy, renewable	[MJ]	178,04	193,94	-15,90
EUROLIGHT Platten beschichtet pro m²					
	Evaluation variable	**Unit per m³**	**Total**	**Manufacturi**	**End of Life**
3 mm	Primary energy, non-renewable	[MJ]	46,82	139,14	-92,33
	Primary energy, renewable	[MJ]	67,32	75,01	-7,68
4 mm	Primary energy, non-renewable	[MJ]	34,89	146,21	-111,32
	Primary energy, renewable	[MJ]	89,69	99,04	-9,36
8 mm	Primary energy, non-renewable	[MJ]	-11,40	174,17	-185,56
	Primary energy, renewable	[MJ]	179,19	195,18	-15,99

A closer investigation of the composition of the primary energy consumption indicates that energy stored primarily in the re-growing raw material through photosynthesis mainly stays in the lightweight building board product until its “end of life”. 1 m² of finished lightweight building board has, depending on the proportion of chipboard and honeycomb, a lower calorific value (respectively raw and laminated) of: 3mm: 93.2/97.3 MJ; 4mm: 113.7/117.2 MJ; 8mm: 195.9/200.1 MJ.

A more detailed analysis of the non-renewable energy consumption for the production of one square meter of lightweight building board (figure 2) shows that the two main energy sources are natural gas (around 50-60 %) and crude oil (around 20-30 %). About 7 % of the required energy is provided by hard coal and 5% by brown coal, with an additional approx. 7 % being covered by uranium. The uranium contribution to the primary energy consumption is due to the power consumed for the production of raw materials in the upstream chain, which is covered by a power mix which also includes atomic energy.

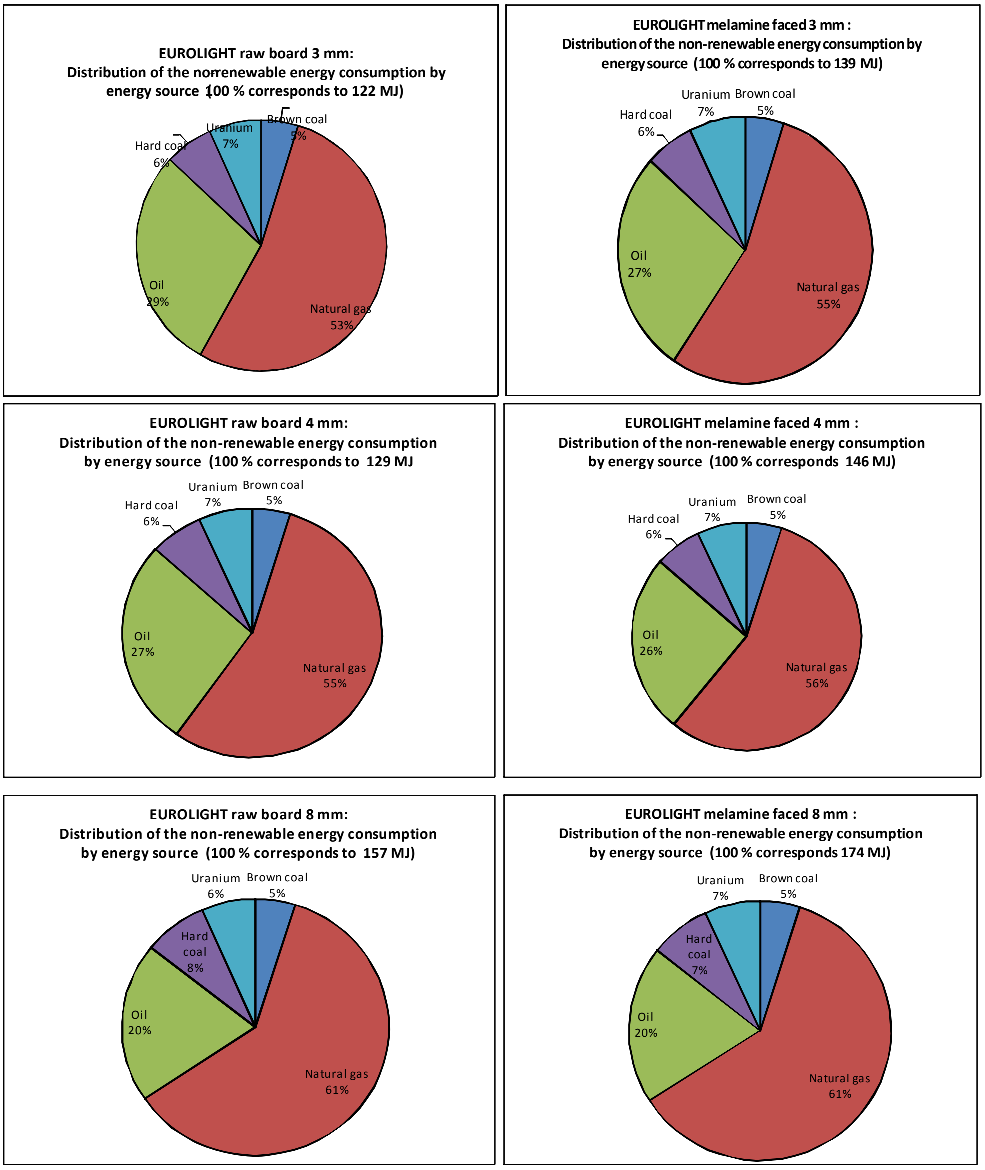
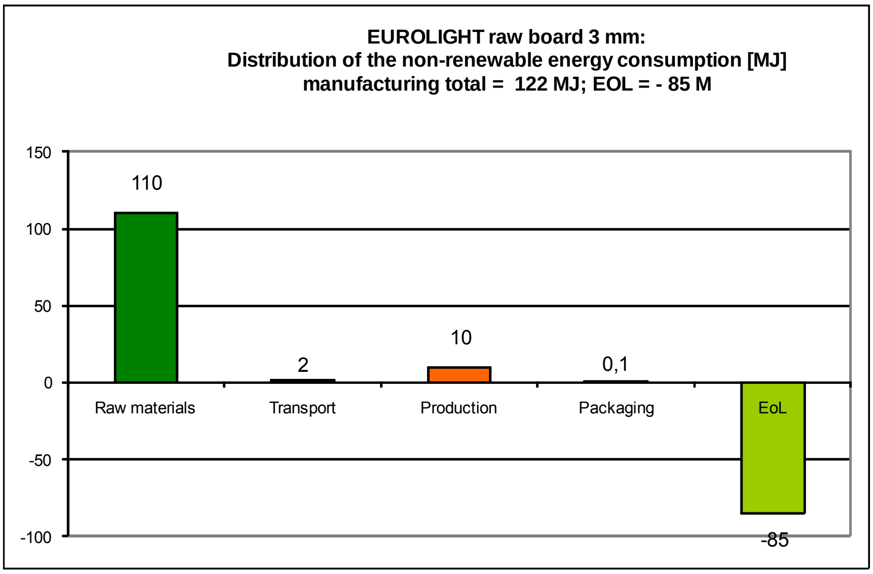
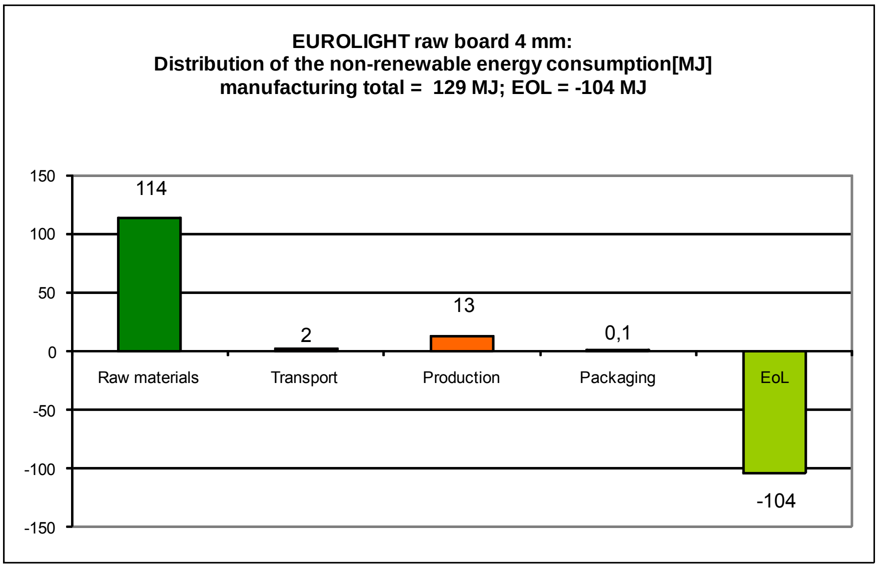


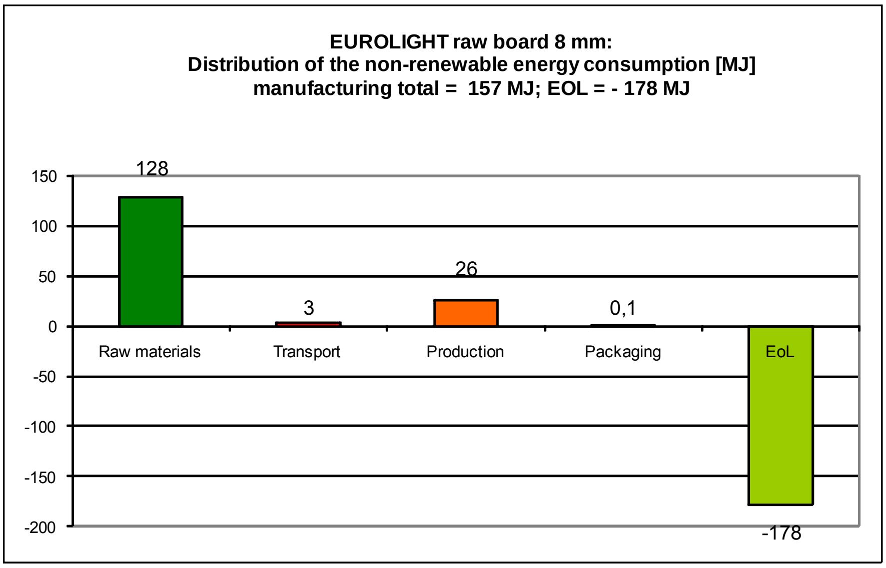
Figure 2: **Distribution of non-renewable energy consumption by energy source for the manufacturing of 1 m^2 of EUROLIGHT® board**

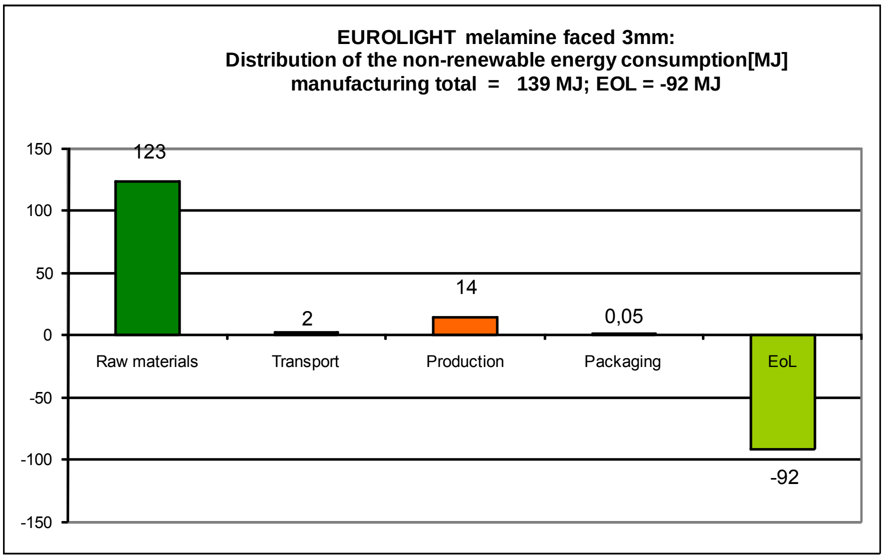
Figure 3 provides a further level of detail for the non-renewable energy consumption, where production accounts for approx. 15-30 %, supply of raw materials for around 70-80 %, and transportation and packaging make up around 1.3 %. This is offset by a credit of between 85 and 186 MJ from the end of life.

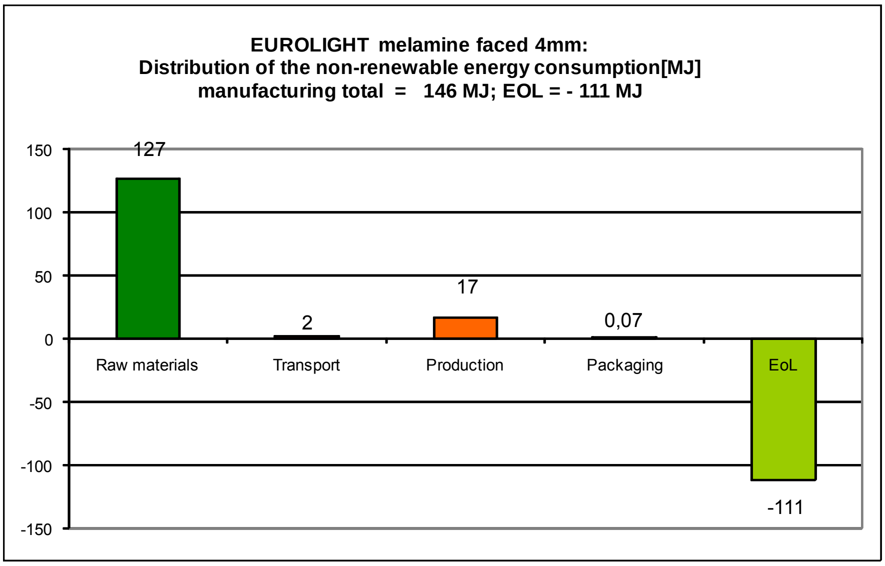
The thermal utilisation of the packaging and other wastes is modelled by the average waste incineration of the respective material fraction with steam and electricity generation. This results in electricity credits through the substitution of electricity in the public grid according to the Austrian power mix and a credit according to the average production of thermal energy from natural gas per produced m^2 of finished lightweight building board. Wood wastes are utilized in a biomass generating plant. Energy credits are also allocated for this.






EUROLIGHT raw board 8 mm:
Distribution of the non-renewable energy consumption [MJ]
manufacturing total = 157 MJ; EOL = - 178 MJ
150
100
50
0
-50
-100
-150
-200
128
3
26
0,1
-178
Raw materials
Transport
Production
Packaging
EoL


EUROLIGHT melamine faced 3mm:
Distribution of the non-renewable energy consumption[MJ]
manufacturing total = 139 MJ; EOL = -92 MJ
150
100
50
0
-50
-100
-150
123
2
14
0,05
-92
Raw materials
Transport
Production
Packaging
EoL


EUROLIGHT melamine faced 4mm:
Distribution of the non-renewable energy consumption[MJ]
manufacturing total = 146 MJ; EOL = - 111 MJ
150
100
50
0
-50
-100
-150
127
2
17
0,07
-111
Raw materials
Transport
Production
Packaging
EoL

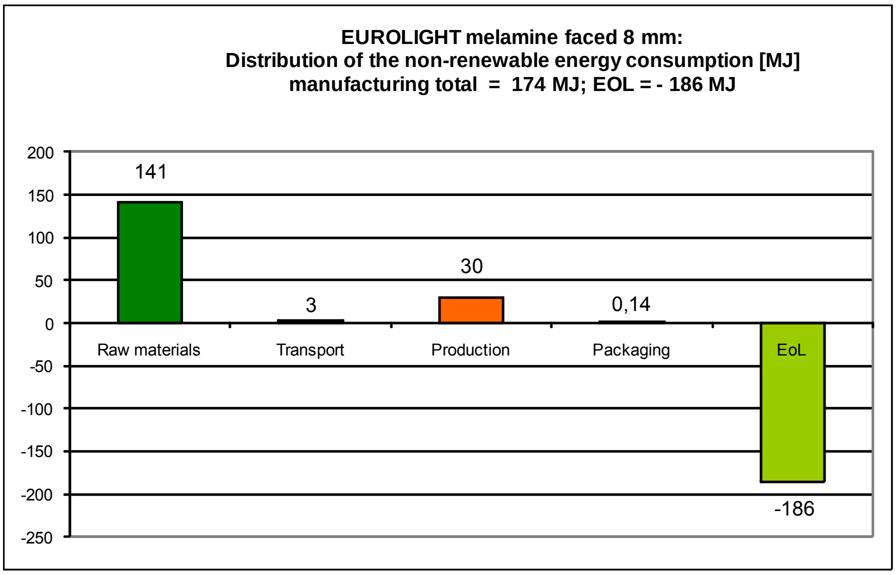
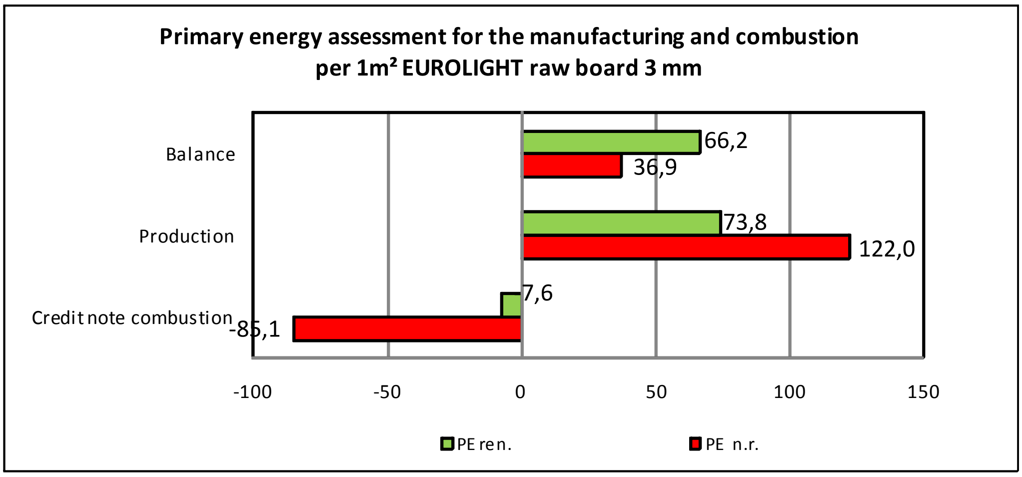
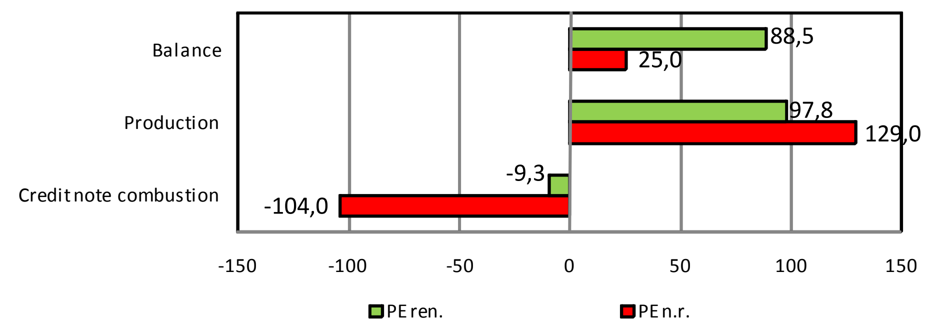


Figure 3: **Distribution of non-renewable energy consumption for the manufacturing of one square meter of lightweight building board.**

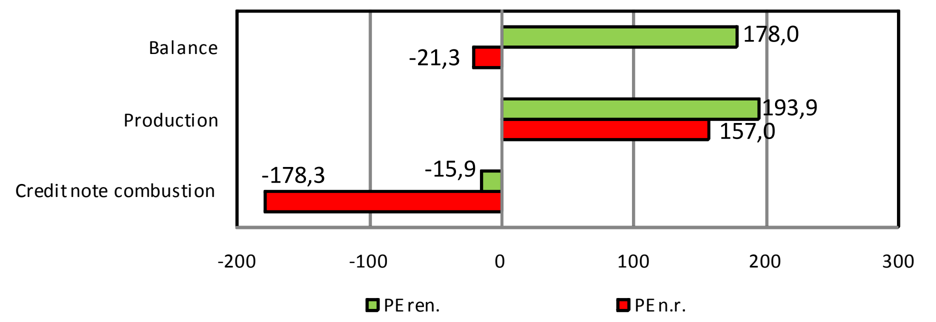
If one considers manufacturing and end of life (biomass generating plant) then one discovers that the energy credit for electricity and thermal energy is between 85 and 186 MJ of non-renewable energy sources per m² of lightweight building board. This reduces the non-renewable primary energy consumption of 122-174 MJ/m² to a value of between -21.3 and 47 MJ/m² (figure 4) when manufacturing and combustion are calculated.



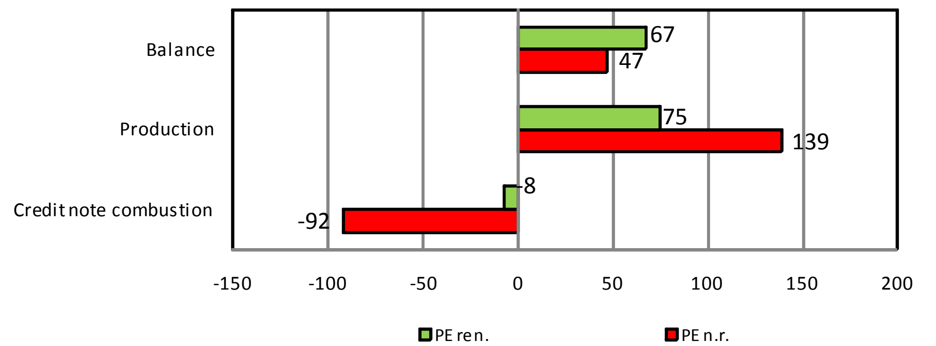
Primary energy assessment for the manufacturing and combustion per 1m² EUROLIGHT raw board 4 mm

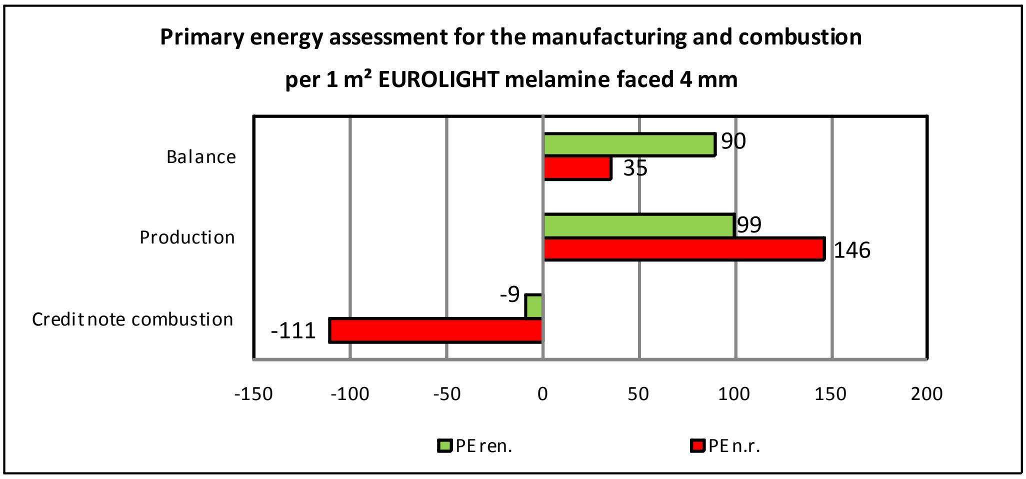


Primary energy assessment for the manufacturing and combustion per 1m² EUROLIGHT raw board 8 mm



Primary energy assessment for the manufacturing and combustion per 1 m² EUROLIGHT melamine faced 3 mm





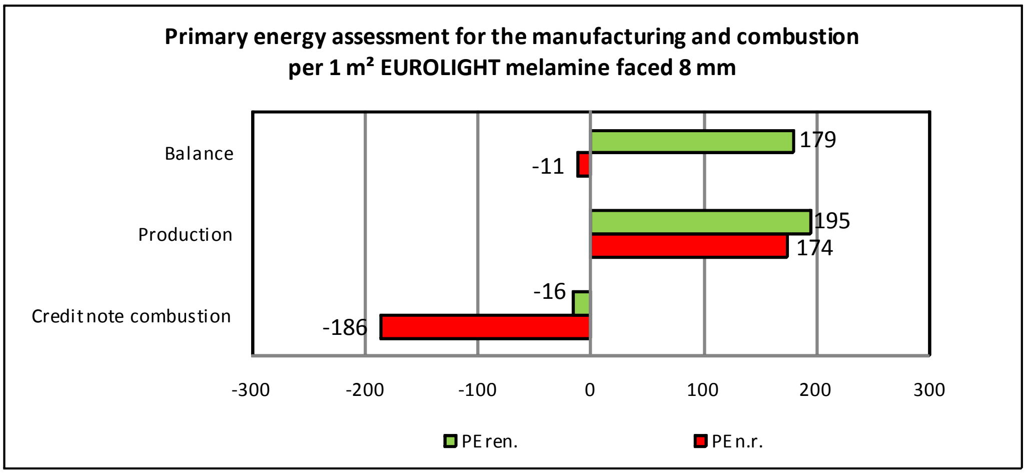
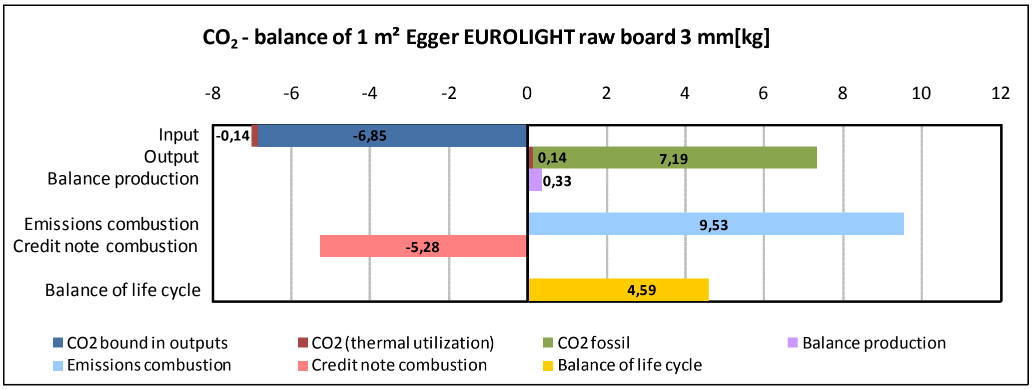


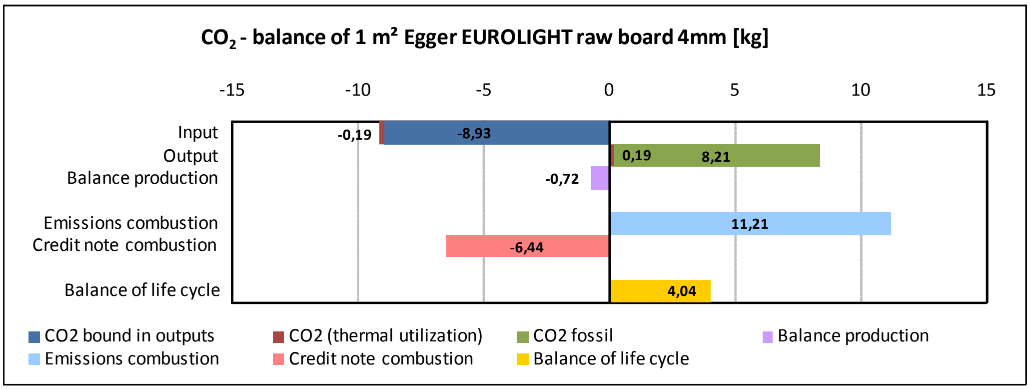
Figure 4: **Primary energy assessment of renewable and non-renewable energy sources for the manufacturing and combustion of 1 m² of lightweight building board.**

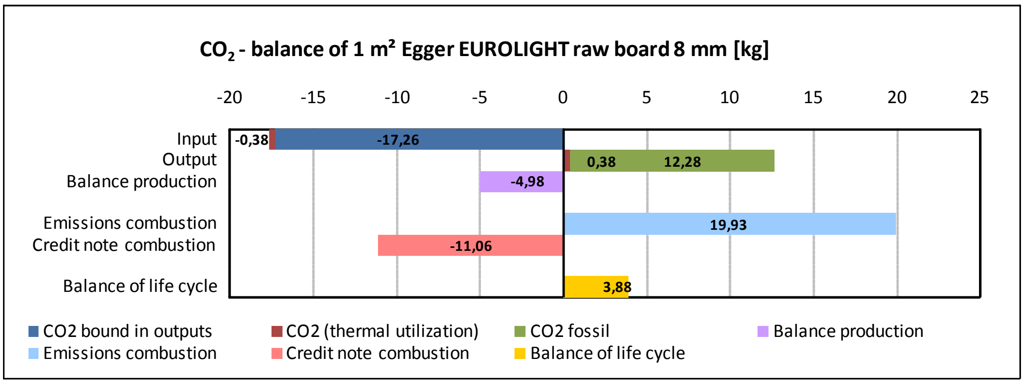
CO2 balance sheet

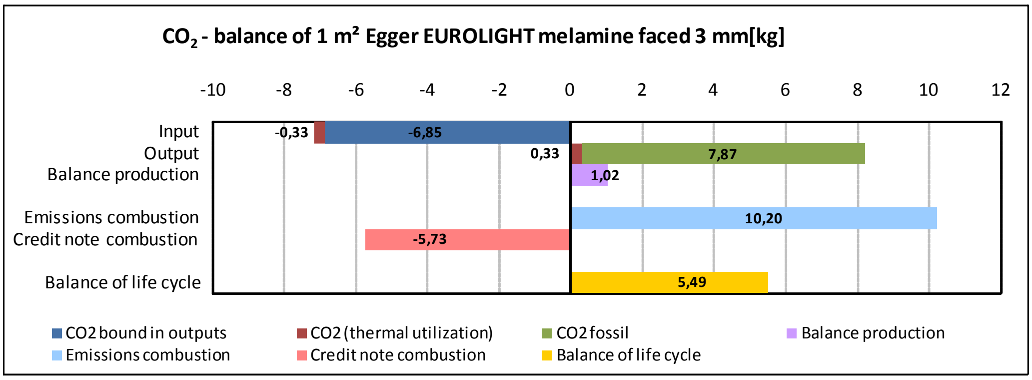
Die CO_2 balance sheet in figure 5 shows that the manufacturing of one m² of lightweight building board causes 7.33-13.53 kg of CO_2 emissions, of which 0.14-0.38 kg CO_2 come from the direct thermal utilisation of wood and paper waste during the production phase and an additional 7.19-13.34 kg of CO_2 are fossil emissions. On the other hand, through manufacturing CO_2 from the air is stored in the wood and paper through photosynthesis as the trees grow, some of which remains bound. The CO_2 component bound in the wood and paper of the lightweight building 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 balance of -4.98 to +1.02 kg per m² of lightweight building board through binding in the product and substitution of non-renewable energy sources. This storage effect is applicable throughout the utilisation phase. During combustion at end of life in the modelled biomass generating plant, 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 CO_2 from the combustion of these fossil energy sources of -5.28 to -11.51 kg CO_2 takes place. This energy substitution effect results in a total balance of 3.88-5.49 kg CO_2 over the entire life cycle.

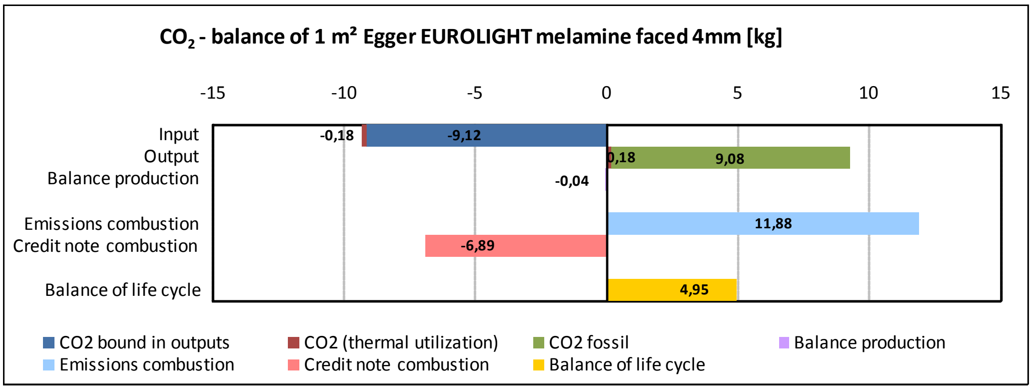
Product group	Wood-based materials lightweight building board	Version
Declaration holder:	Fritz EGGER GmbH & Co. OG	16-12-2008
Declaration number:	EPD-EHW-2008411-E	











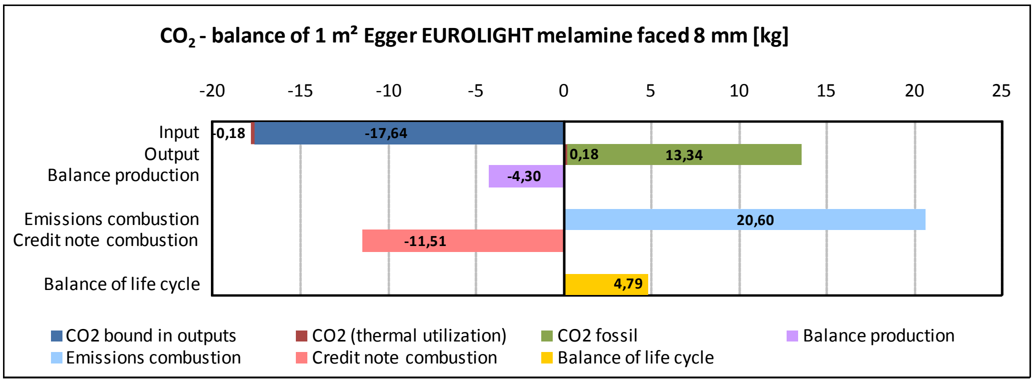


Figure 5: **CO_2 balance sheet for the manufacturing of 1 m² of lightweight building board.**

Waste

The evaluation of waste produced to manufacture 1 m² of lightweight building board (product mix) 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 m² of lightweight building board.

Waste [kg / m² EUROLIGHT raw board]				
	Evaluation variable	**Manufacturing**	**End of Life**	**Total**
3mm	Residues / mining debris	7,78	-1,46	6,32
	Municipal waste	2,70E-02	0,00E+00	2,70E-02
	Hazardous waste	1,73E-02	-1,29E-04	1,71E-02
	of which is radioactive waste	2,89E-03	-1,29E-04	2,76E-03
4mm	Residues / mining debris	8,17	-1,78	6,39
	Municipal waste	2,57E-02	0,00E+00	2,57E-02
	Hazardous waste	1,84E-02	-1,58E-04	1,82E-02
	of which is radioactive waste	3,03E-03	-1,58E-04	2,87E-03
8mm	Residues / mining debris	9,74	-3,06	6,68
	Municipal waste	2,02E-02	0,00E+00	2,02E-02
	Hazardous waste	2,28E-02	-2,71E-04	2,25E-02
	of which is radioactive waste	3,58E-03	-2,71E-04	3,31E-03
Waste [kg / m² EUROLIGHT Melamine faced]				
	Evaluation variable	**Manufacturing**	**End of Life**	**Total**
3mm	Residues / mining debris	9,25	-2,13	7,12
	Municipal waste	3,16E-02	0,00E+00	3,16E-02
	Hazardous waste	1,97E-02	5,96E-02	7,93E-02
	of which is radioactive waste	3,46E-03	-3,94E-04	3,06E-03
4mm	Residues / mining debris	9,64	-2,45	7,19
	Municipal waste	3,02E-02	0,00E+00	3,02E-02
	Hazardous waste	2,08E-02	5,96E-02	8,04E-02
	of which is radioactive waste	3,60E-03	-4,23E-04	3,17E-03
8mm	Residues / mining debris	11,20	-3,73	7,47
	Municipal waste	2,48E-02	0,00E+00	2,48E-02
	Hazardous waste	2,52E-02	5,94E-02	8,47E-02
	of which is radioactive waste	4,15E-03	-5,36E-04	3,61E-03

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 over 95 %, followed by ore dressing residues and landfill waste, etc. with a total fraction of less than 5%. 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 lightweight building board at the end of life substitutes mining debris in energy production in the amount of approx. 1.5 to 3.7 kg/m² of lightweight building board.

Significant fractions within the **municipal waste** segment are non-specific waste, sludge, and inert 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 per produced lightweight building board. Radioactive waste is also produced per m² of lightweight building board, of which > 98 % are ore dressing residues which are allocated to production in the upstream chains.

Impact assessment

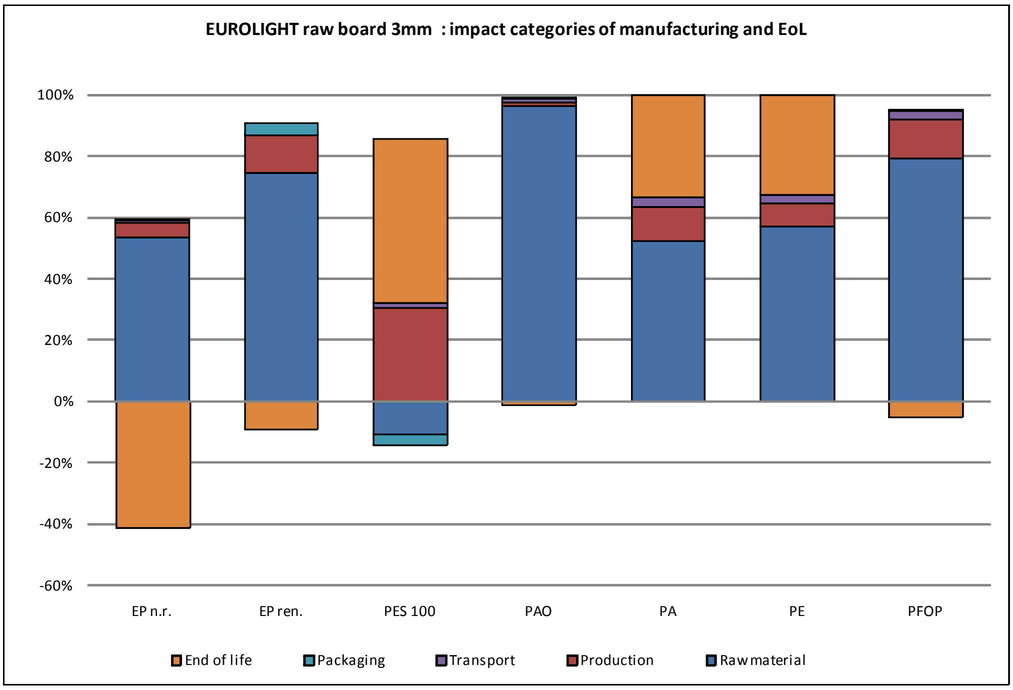
The following table shows the absolute contributions from the production and combustion of 1 m² of lightweight building board to the impact categories global warming potential (GWP 100), ozone depletion potential (ODP), acidification potential (AP), eutrophication potential (EP), and photochemical oxidation formation potential (summer smog potential POCP). In addition the renewable primary energy (PE reg.) and the non-renewable primary energy (PE nr.) are listed again.

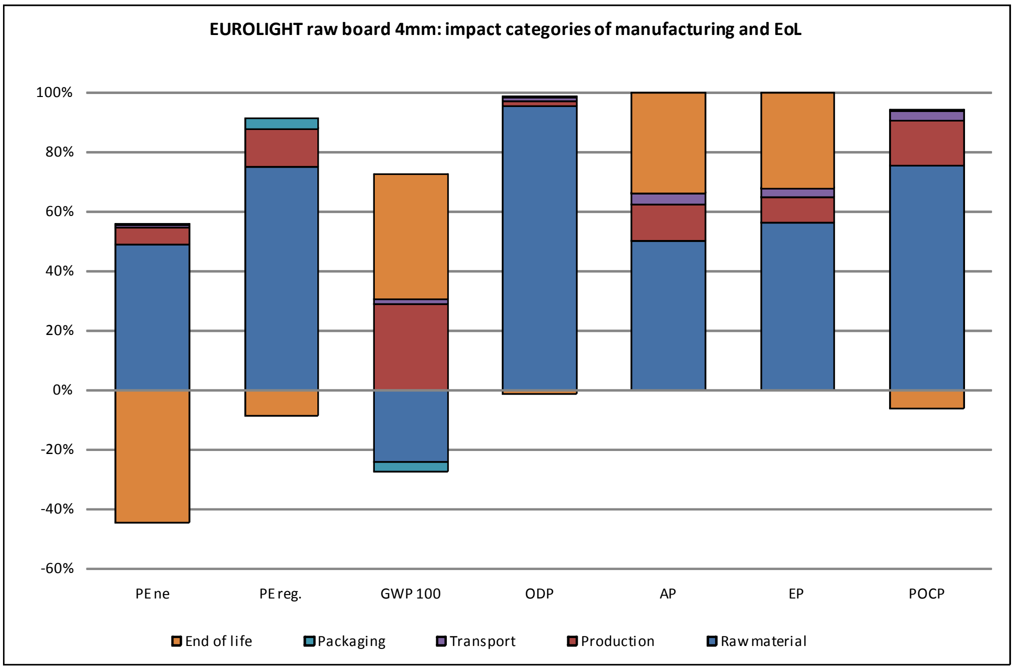
Table 6: Absolute contributions from production and end of life per square meter of finished lightweight building board mix to PE ne, PE reg, GWP 100, ODP, AP, EP and POCP.

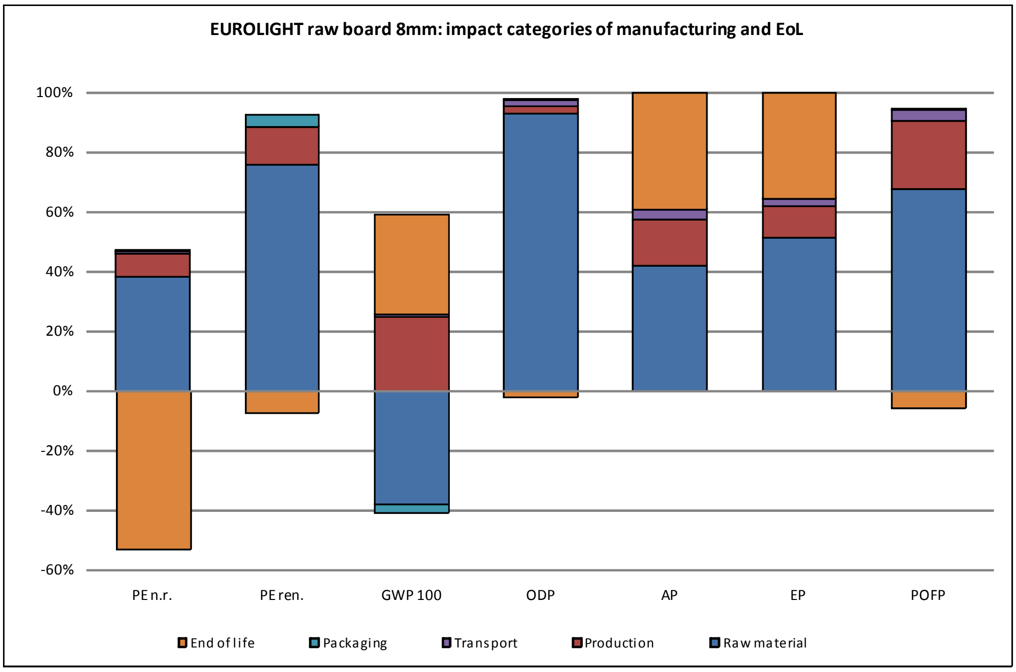
EUROLIGHT raw board m²]							
		3mm		4mm		8mm	
Evaluation variable	Unit per m²	Manuf.	EoL	Manuf.	EoL	Manuf.	EoL
Primary energy, non renew able	[MJ]	121,97	-85,05	129,04	-104,05	157,00	-178,29
Primary energy, renew able	[MJ]	73,77	-7,59	97,80	-9,26	193,94	-15,90
Global w arming potential (GWP 100)	[kg CO_2 eqv.]	1,30	3,94	0,28	4,39	-3,83	8,22
Ozone depletion potential (ODP)	[kg R11 eqv.]	2,22E-07	-2,66E-09	2,33E-07	-3,61E-09	2,75E-07	-5,75E-09
Acidification potential (AP)	[kg SO_2 eqv.]	1,48E-02	7,41E-03	1,69E-02	8,73E-03	2,51E-02	1,64E-02
Eutrophication potential (EP)	kg Phosphate eqv	2,93E-03	1,42E-03	3,41E-03	1,63E-03	5,32E-03	2,93E-03
Photochemical oxidant formation potential (POFP)	[kg ethylene eqv.	1,86E-03	-1,03E-04	2,03E-03	-1,34E-04	2,69E-03	-1,71E-04
EUROLIGHT Melamine faced board [m²]							
		3mm		4mm		8mm	
Evaluation variable	Unit per m²	Manuf.	EoL	Manuf.	EoL	Manuf.	EoL
Primary energy, non renew able	[MJ]	139,14	-92,33	146,21	-111,32	174,17	-185,56
Primary energy, renew able	[MJ]	75,01	-7,68	99,04	-9,36	195,18	-15,99
Global w arming potential (GWP 100)	[kg CO_2 eqv.]	2,07	4,16	1,05	4,60	-3,06	8,43
Ozone depletion potential (ODP)	[kg R11 eqv.]	2,65E-07	-2,23E-08	2,75E-07	-2,33E-08	3,18E-07	-2,54E-08
Acidification potential (AP)	[kg SO_2 eqv.]	1,67E-02	7,04E-03	1,88E-02	8,36E-03	2,70E-02	1,60E-02
Eutrophication potential (EP)	kg Phosphate eqv	3,42E-03	1,38E-03	3,90E-03	1,59E-03	5,81E-03	2,90E-03
Photochemical oxidant formation potential (POFP)	[kg ethylene eqv.	2,24E-03	-1,40E-04	2,40E-03	-1,71E-04	3,06E-03	-2,08E-04

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 6.

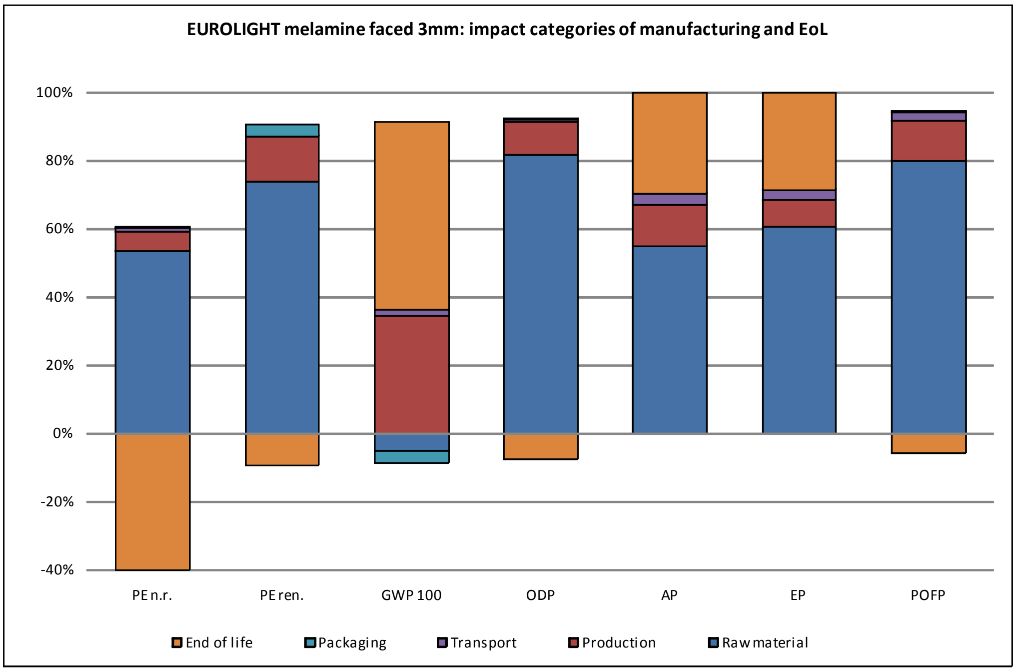
Product group	Wood-based materials lightweight building board	Version
Declaration holder:	Fritz EGGER GmbH & Co. OG	16-12-2008
Declaration number:	EPD-EHW-2008411-E	





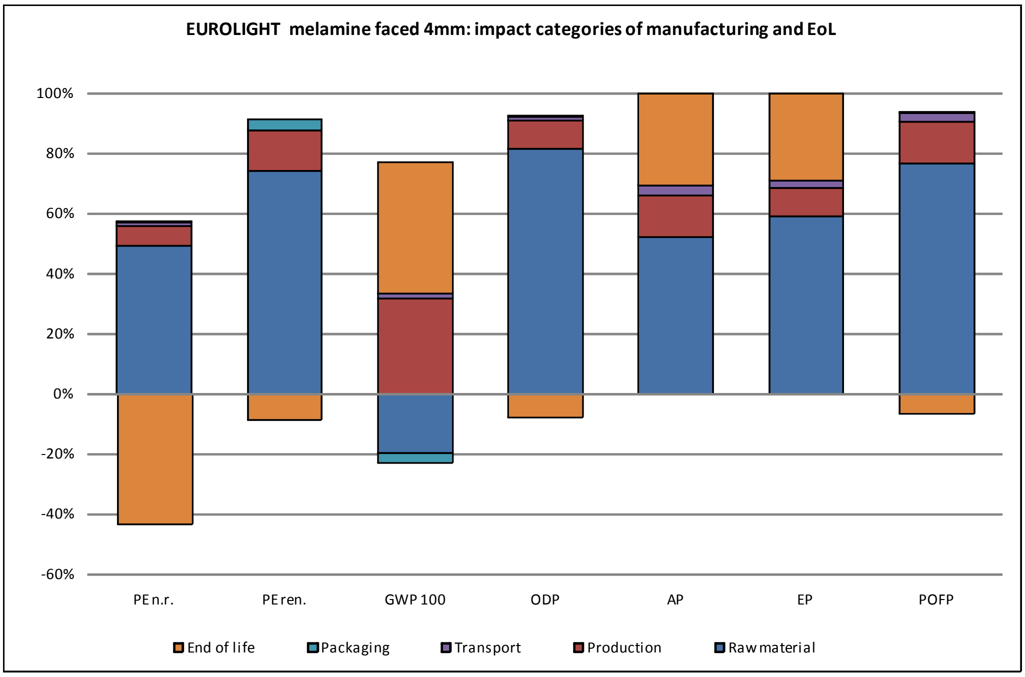


EUROLIGHT raw board 8mm: impact categories of manufacturing and EoL
100%
80%
60%
40%
20%
0%
-20%
-40%
-60%
PE n.r.
PE ren.
GWP 100
ODP
AP
EP
POFP
End of life
Packaging
Transport
Production
Raw material



EUROLIGHT melamine faced 3mm: impact categories of manufacturing and EoL
100%
80%
60%
40%
20%
0%
-20%
-40%
PE n.r.
PE ren.
GWP 100
ODP
AP
EP
POFP
End of life
Packaging
Transport
Production
Raw material

Product group	Wood-based materials lightweight building board	Version
Declaration holder:	Fritz EGGER GmbH & Co. OG	16-12-2008
Declaration number:	EPD-EHW-2008411-E	



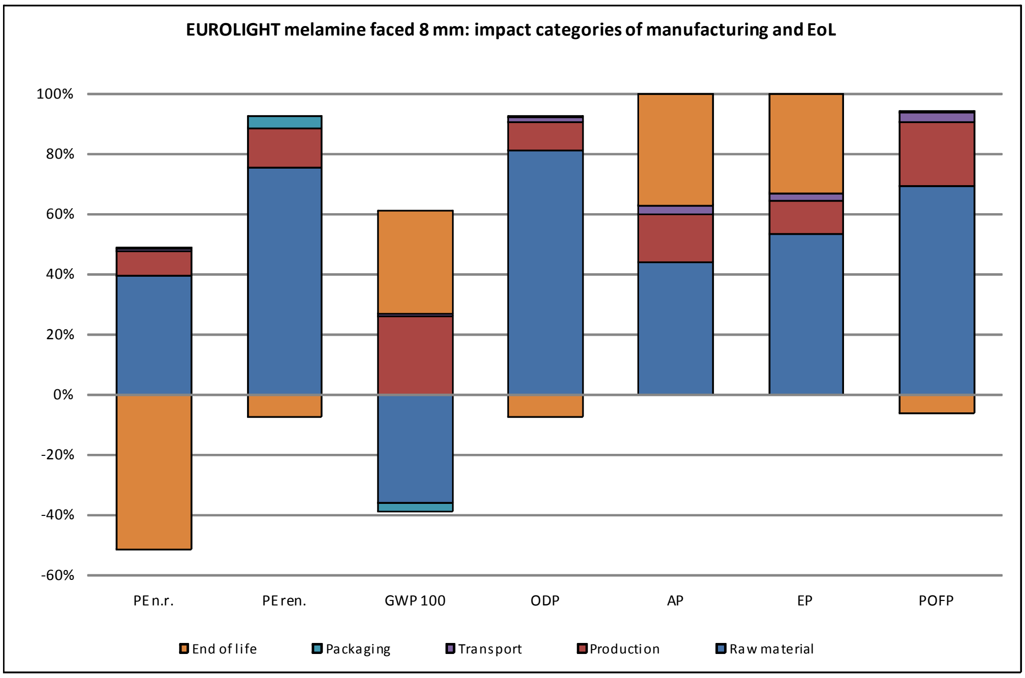


Figure 6: **Proportion of the processes relative to the impact categories – factory gate system boundary and combustion of the lightweight building board at end of life.**

The **global warming potential** in manufacturing is dominated by carbon dioxide. 6.9-17.8 kg of CO_2 is bound in the re-growing raw material contained in the product per m² of lightweight building board mix. Another 0.14-0.38 kg CO_2 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. From the factory gate, this gives a balance of approx. 2.07 to -3.83 kg CO_2 equivalent.

The emission values at end of life result from the combustion less the credits (substitution effect in the power mix as well as thermal energy from natural gas) for the energy utilisation of 1 m² of finished lightweight building board. Within the system under consideration (manufacturing and end of life) this results in a global warming potential between 4.39 and 6.23 kg CO_2 equivalent per m² of lightweight building board.

The provisioning of raw materials (approx. 80%) and production (20%) are the main contributors to the **ozone depletion potential**. A total ozone depletion potential between 2.22E-07 and 3.18E-07kg R11 equivalent is generated per m² of lightweight building board during production. Under consideration of the end of life, this results in an ozone depletion potential value of approx. 2.19E-07 to 2.93E-07 kg R11 equivalent for the overall system.

The provisioning of raw materials (around 60%) and production (around 20 %) as well as the EoL (around 20%) contribute to the **acidification potential**. Around 1.48E-02 to 2.70E-02 kg SO_2 equivalent are emitted per m² of lightweight building board during the production phase. Taking the emissions at the end of life into account results in an acidification potential of approx. 2.22E-02 to 4.30E-02 kg SO_2 for the overall system under consideration.

For the **eutrophication potential** the production of raw materials (around 70%) and the EoL (around 20%) are the most significant contributing factors. For manufacturing, the eutrophication potential is between 2.93E-03 and 5.81E-03 kg phosphate equivalent. The EoL increases the eutrophication potential again to between 4.35E-03 and 8.71E-03 kg phosphate equivalent under consideration of the substitution effects.

Provisioning of raw materials (approx. 80%) and production (around 15%) contribute to the **photochemical oxidant creation potential (ground-level ozone formation)**. Overall the POCP within the factory gate system boundary is between 1.86E-03 and 3.06E-03 kg ethene equivalent. Through the end of life and the associated substitution effects, the POCP is reduced to between 1.76E-03 and 2.86E-03 kg ethene equivalent.

8 Evidence and verifications

8.1 Formaldehyde

Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute

Testing, monitoring, and certification site, Braunschweig, Germany

Test report, date: B2741/2008 raw thin chipboard EPF-S from 05/08/2008 as surface layer of the sandwich structure

B2305/2008 raw thin chipboard E1 from 08/07/2008 as surface layer of the sandwich structure

B967/2008 laminated lightweight building board from 19/05/2008

Result: The testing of the formaldehyde content was performed according to the perforator method according to EN 120 and according to the test chamber method according to EN 717-1. The results for the raw and laminated boards were well below the limit values of 4.0 mg HCHO/100 g of dry matter (at a material moisture of 6.5 %) according to the EPF-S guideline. The average results are

- 1.9 mg HCHO/100g according to EN 120 for a board thickness of 4mm
- 5.1 mg HCHO/100g according to EN 120 for a board thickness of 3mm
- <0.005 ppm according to EN 717-1 for a board thickness of 38mm (8mm surface layer)

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.

In terms of the analysis method, the test method is identical to the test required in the PCR document according to NIOSH P&CAM 142.

8.3 Eluate analysis

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

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

Test report, date:

UB 1.1 / 08 – 162 – raw and laminated lightweight building board from 15/08/2008

Results for raw lightweight building board: Determination of elutable heavy metals is performed according to EN 71-3. The following values were determined [mg/kg]: Antimony <1, Arsenic <0.5, Barium 25, Cadmium 0.09, Chrome <0.2, Lead 0.5, Mercury <0.01, Selenium <1.

Results for laminated lightweight building board: Determination of elutable heavy metals is performed according to EN 71-3. The following values were determined [mg/kg]: Antimony <1, Arsenic <0.5, Barium 41, Cadmium 0.09, Chrome <0.2, Lead <0.5, Mercury <0.01, Selenium <1.

8.4 EOX (extractable organic halogen compounds)

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

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

Test report, date:

UB 1.1 / 08 – 162 – raw and laminated lightweight building board 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.

8.5 Toxicity of fire gases

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

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

Test report, date:

UB 1.1 / 08 – 162 – 2.1 raw and laminated lightweight building board from 15/08/2008

Results for raw lightweight building board: 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, 10 000 ppm of carbon monoxide was measured in the inhalation space. After 60 minutes, the following concentrations were found in the inhalation space: Carbon monoxide 14 000 ppm (hence calculated >50% COHb), carbon dioxide 20 000 ppm, hydrogen cyanide 45 ppm, ammoniac 80 ppm, and hydrocarbons (styrol) 300 ppm. Hydrogen chloride was not detectable. The relative weight reduction at a test temperature of 400° C was 61.6 %.

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

The concentrations of ammonia and hydrogen cyanide released under the selected test conditions do not correspond to the emissions which are released from wood under the same test conditions.

Results for laminated lightweight building board: 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, 4 000 ppm of carbon monoxide was measured in the inhalation space. After 60 minutes, the following concentrations were found in the inhalation space: Carbon monoxide 1000 ppm (hence calculated >50% COHb), carbon dioxide 10 000 ppm, ammoniac 2000 ppm, and hydrocarbons (styrol) 400 ppm. Hydrogen cyanide and hydrogen chloride were not detectable. The relative weight reduction at a test temperature of 400° C was 43.5 %.

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

The ammonia concentrations released under the selected test conditions do not correspond to the emissions released from wood under the same test conditions.

(Scrap wood provision) Not relevant for component materials free from scrap wood.

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

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For further literature see the PCR document

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In the case of a doubt is the original EPD “EPD-EHW-2008411-D” applicable.