DIBU EPD

Environmental Product Declaration

according to ISO 14025

FOAMGLAS®-slabs and FOAMGLAS®-elements

Pittsburgh Corning Europe NV

Declaration code
DIBU-PCE-11107-E

Deutsches Institut Bauen und Umwelt
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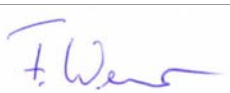
Short version

Environmental Product Declaration

(EPD)

Deutsches Institut Bauen und Umwelt e.V. **www.bau-umwelt.com** DIBU Deutsches Institut Bauen und Umwelt	**Program operator**
Pittsburgh Corning Europe NV Albertkade, 1 B-3980 Tessenderlo FOAMGLAS® Cellular Glass Insulation	**Owner of the Declaration**
DIBU-PCE-11107-E	**Declaration Code**
FOAMGLAS® slabs and pre-cut shapes This declaration is an Environmental Product Declaration according to ISO 14025. It describes the environmental performance of construction products and aims at fostering sustainable construction with respect to health and environment. In this verified declaration all relevant environmental data is made transparent. It is based on the PCR document: „mineral insulation products 2007“	**Declared Construction Product**
This verified declaration entitles to carry the logo of DIBU. This is restricted to the declared products, for 3 years after the date of publication. The owner of the declaration is liable for the declared information.	**Validity**
The **declaration** is complete and includes in its long version: - product definition and technical information - Information on basic materials and origin of raw materials - description of the production process - additional information for the installation stage - additional information for the use stage, for singular effects and end of life stage - results of the Life Cycle Assessment (LCA) - test results and other evidence	**Content of the Declaration**
01-11-2007	**Date of Validity**
 Prof. Dr.-Ing. Horst J. Bossenmayer (president of DIBU)	**Signatures**
This declaration and the PCR on which it is based, have been verified by the independent advisory board (SVA) of DIBU according to ISO 14025.	**Verification of the Declaration**
 Prof. Dr.-Ing. Hans-Wolf Reinhardt (chair of the DIBU advisory board)  Dr. Frank Werner (verifier designated by the DIBUadvisory board)	**Signatures**

Short version

Environmental Product Declaration (EPD)

Product description

FOAMGLAS® slabs and pre-cut shapes are insulation elements produced predominantly from recycled glass, i.e. from sand, dolomite, and lime, without any addition of binders. The following FOAMGLAS® products are declared: W+F (100 kg/m³) , T4+ (115 kg/ m³ density), T4 (120 kg/m³), S3 (130 kg/m³) and Type F (165 kg/m³) as well as Perinsul (165 kg/m³) and Perinsul SL (200 kg/m³)

Application

FOAMGLAS®-slabs are applied in buildings, construction works, technical insulation, as well as for building equipment.

FOAMGLAS®-slabs with densities 100 - 165 kg/m³ (W+F, T4+, T4, S3, F) are applicable for all types of buildings, especially for building services.

FOAMGLAS®-slabs with higher densities (Perinsul®165 kg/m³ & Perinsul SL, 200 kg/ m³) are applied as insulation elements in order to avoid thermal bridges

Life Cycle Assessment (LCA)

The LCA was carried out according to ISO 14040ff, the requirements of the DIBU guideline for Type III declarations and PCR for mineral insulation products. Specific data for the declared products was collected on site, background data was taken from the „GABI 4" database. The LCA covers the life cycle stages of raw material extraction, energy provision, production and respective transports. LCA results were calculated for all declared FOAMGLAS® products. The following table lists minimum and maximum values for environmental impacts and primary energy. These values depend in nearly linear fashion on the density of the slabs.

LCA Results

FOAMGLAS® slabs and pre-cut shapes (cradle to gate)

Results for: W+F (100 kg/m³) and Perinsul (200 kg/m³)	Unit	W+F Unit/m³	Perinsul SL Unit/m³	W+F Unit/kg	Perinsul SL Unit/kg	W+F R=2m²K/W Unit/m²	Perinsul SL R=2m²K/W Unit/m²
PE, non renewable	[MJ]	1525,9	3049,22	15,26	15,25	115,97	335,41
PE, renewable	[MJ]	920,6	1725,24	9,21	8,63	69,97	189,78
PE, non renewable	[kWh]	423,9	847,0	4,24	4,24	32,21	93,17
PE, renewable	[kWh]	255,7	479,2	2,56	2,40	19,43	52,72
Global warming (GWP)	[kg CO_2-Eqv.]	109,23	212,22	1,09	1,06	8,30	23,34
Ozone depletion (ODP)	[kg R11- Eqv.]	$0,74 \cdot 10^{-6}$	$1,72 \cdot 10^{-6}$	$7,40 \cdot 10^{-9}$	$8,60 \cdot 10^{-9}$	$56,2 \cdot 10^{-9}$	$0,19 \cdot 10^{-6}$
Acidification (AP)	[kg SO_2- Eqv.]	0,208	0,411	$2,08 \cdot 10^{-3}$	$2,06 \cdot 10^{-3}$	0,016	0,045
Eutrophication (EP)	[kg PO_4^{3-}- Eqv.]	0,023	0,046	$0,23 \cdot 10^{-3}$	$0,23 \cdot 10^{-3}$	$1,75 \cdot 10^{-3}$	$5,06 \cdot 10^{-3}$
Summersmog (POCP)	[kg Ethen- Eqv.]	0,019	0,036	$0,19 \cdot 10^{-3}$	$0,18 \cdot 10^{-3}$	$1,44 \cdot 10^{-3}$	$3,96 \cdot 10^{-3}$

(Explanation of abbreviations: PE: Primary energy; GWP: Global Warming Potential, ODP: Ozone depletion potential; AP: Acidification potential; EP: Eutrophication potential; POCP: Photochemical oxidant formation)

Developed by: Pittsburgh Corning Europe NV, B-3980 Tessenderlo
In co-operation with PE INTERNATIONAL, Leinfelden-Echterdingen and Five Winds International, Tübingen

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

FiveWinds
INTERNATIONAL

Test Results and other Certificates

The following additional **tests and evidences** are presented in this environmental declaration :

- Eluatanalyse: Institut für analytische Chemie, Dr. R. v. Nagel, Mannheim Friedrichsfeld, 1987. EMPA Untersuchungsbericht Eluattest für FOAMGLAS® Nr.123544A 1995
- Certificat „électricité renouvelable", certifié par TÜV SÜD, valid until 31.12.2008

Product group:	Mineral Insulation Products	date of validity
Owner of the declaration:	Pittsburgh Corning Europe	01-11-2007
Declaration code:	DIBU-PCE-11107-E	

Validity

This document is valid for FOAMGLAS®-boards and -elements. The LCA data was collected on site at Tessenderlo / Belgium.

0 Product definition

Product definition

FOAMGLAS® slabs and pre-cut shapes are produced without any addition of binders from recycled glass (predominantly windshields), i.e. from sand, dolomite, and lime. The insulation elements consist of cellular glass with closed cell structure. The following FOAMGLAS®-products are declared: W+F, T4+, T4, S3, Type F, 100 – 165 kg/m³, Perinsul, 165 kg/m³ and Perinsul SL, 200 kg/m³ density.

Application

FOAMGLAS® slabs and pre-cut shapes are applied for technical insulation of roofs, walls and floors, as well as for building equipment. All geometrical shapes can be served. Higher densities are used for load bearing requirements, lower densities for walls. The declared products are mainly applied in:

Table 0-1: Main application areas for the declared products

Product	Application
W+F T4+ T4 S3 F	• Warm roofing systems • Green roofs, parking decks • Roof decks • Ventilated façades • Indoor insulation • Floor insulation in industrial environment • Ground- and perimeter-insulation
Perinsul and Persinul SL	For special requirements, e. g. tank flooring, containers and insulation of thermal bridges

Product standards / concessions

- FOAMGLAS® slabs & boards: CEN KEYMARK CERTIFICATE OF CONFORMITY n° BCCA 001-BK-516-0001
- EN 13167: 2001/AC:2005 & CE certificate of conformity (AoC system 3)
- EN 13172: 2001/AC:2005
- Several national technical approvals issued by BUtgb/UBAtc, DIBt, CSTB, SIA, BBA, Intron according to EN 13167

Product quality certificates

ISO 9001: 2000, Belgian Construction Certification Association

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Product characteristics at delivery

Table 0-2: FOAMGLAS®-Products at the state of delivery

	Light products	**Perinsul & Perinsul SL**
Area:	600 x 450 mm, 300 x 450 mm or 600 x 600 mm, 300 x 600 mm	50 x 115 x 450 mm 50 x 175 x 450 mm 115 x 115 x 450 mm 115 x 175 x 450 mm
Thickness of boards:	40 – 180 mm	50 - 115

Table 0-3: Technical information of W+F, T4+, T4, S3, F

Technical characteristics	**unit**	**spread of values**
Density - ρ- (EN1602)	kg/m³	100 - 165
Thermal conductivity λ_D (based on λ_{10} – measurements and $\lambda_{90/90}$-calculation)	W/(m·K)	0,038 – 0,050
Compressive strength - CS (EN826)	N/mm²	≥ 0,40 – 1,60
Point load – Pt (EN 12430)	mm	≤ 1,0 – 1,5 – 2,0
Tensile strength perpendicular to faces – TR -(EN 1607)	N/mm²	≥ 0,1
Bending strength – BS - (EN12089)	N/mm²	≥ 0,4 – 0,45 – 0,55
Dimensional stability DS 48h70°C90%RH	%	≤ 0,5 (length & width) ≤ 1,0 (thickness)
Water absorption long & short term	kg/m²	≤ 0,5
Thermal expansion coefficient	K^{-1}	$8{,}5 \cdot 10^{-6}$
Resistance to water vapour μ (EN12524)		∞
Specific heat	kJ/(kg·K)	0,84

Table 0-4: Technical information of Perinsul & Perinsul SL

Technical characteristics	**unit**	**spread of values**
Density – ρ - (EN1602)	kg/m³	165 - 200
Thermal conductivity λ_D (based on λ_{10} – measurements and $\lambda_{90/90}$-calculation)	W/(m·K)	0,050 – 0,055
Compressive strength - CS (EN826)	N/mm²	≥ 1,6 - 3,0
Point load – Pt (EN12430)	mm	≤ 1,0
Tensile strength perpendicular to faces – TR -(EN1607)	N/mm²	≥ 0,1
Bending strength – BS - (EN12089)	N/mm²	≥ 0,55

Dimensional stability DS 48h70°C90%RH	%	≤ 0,5 (length & width) ≤ 1,0 (thickness)
Water absorption long & short term	kg/m²	≤ 0,5
Thermal expansion coefficient	K^{1}	$8,5 \cdot 10^{-6}$
Resistance to water vapour μ (EN12524)		∞
Specific heat	kJ/(kg·K)	0,84

The technical characteristics were measured according to the requirements of EN 13167: 2001/AC: 2005.

other EPDs

- FDES – NF 9/2006 & NF 01/2007 (France)

Fire safety

Reaction to fire – class A1 'no contribution to fire', according EN 13501-1:2007 and EC decision 96/603/EC.

Construction product category A1 according to DIN 4102, part 1

Melting point > 1000°C DIN 4102-17

Maximum working temperature t°: 430°C

1 Basic components

Basic components (pre-products) and raw materials

The basic components of FOAMGLAS® are shown in table 1-1. This composition is the same for all declared products.

Table 1-1: FOAMGLAS®-basic components

Basic components	**Weight-%**
Recycling glass	68,6
Feldspar	21,8
Sodium carbonate	3,9
Ferrous oxide	2,3
Manganese oxide	2,2
Carbon black	0,5
Sodium sulphate	0,5
Sodium nitrate	0,2

Ancillary materials

For foaming the glass powder stainless steel troughs are sprayed with clay and aluminium hydroxide. 42 g of clay and 768 g of aluminium hydroxide are needed per m^3 of FOAMGLAS® slabs.

Additional information on materials

The glass input consists of windshields and other windowpanes. This recycled glass is cleaned and provided by registered recycling companies.

Raw material extraction and sources

All basic materials are bought. The transport distances lie between 25 and 500 km. The main basic materials are transported for:

Recycling glass	100 km
Feldspar	350 km

	Sodium carbonate	75 km
	Ferrous - Manganese oxide	25 km

Availability of resources

According to current knowledge, the basic materials from which FOAMGLAS® is produced are not considered as scarce resources.

2 Production

Production

To begin with, the raw materials are weighed, ground up, mixed and melted in an electrode furnace at 1250°C. Application of energy via electrodes allows for a homogeneous molten mass.

When the molten mass has cooled down and solidified it is again ground finely using corundum cylinders. Part of the recycling glass can be ground directly for foaming, without an extra melting process. It is mixed with the other ground powder and filled into the stainless steel foaming troughs. The powder mix is foamed at 850°C. The foamed blocks are cooled down in a flattening furnace in a controlled process avoiding temperature stress and resulting discontinuities or cracks. Later the blocks are cut and packaged.

In Figure 2-1 the production process is visualized.

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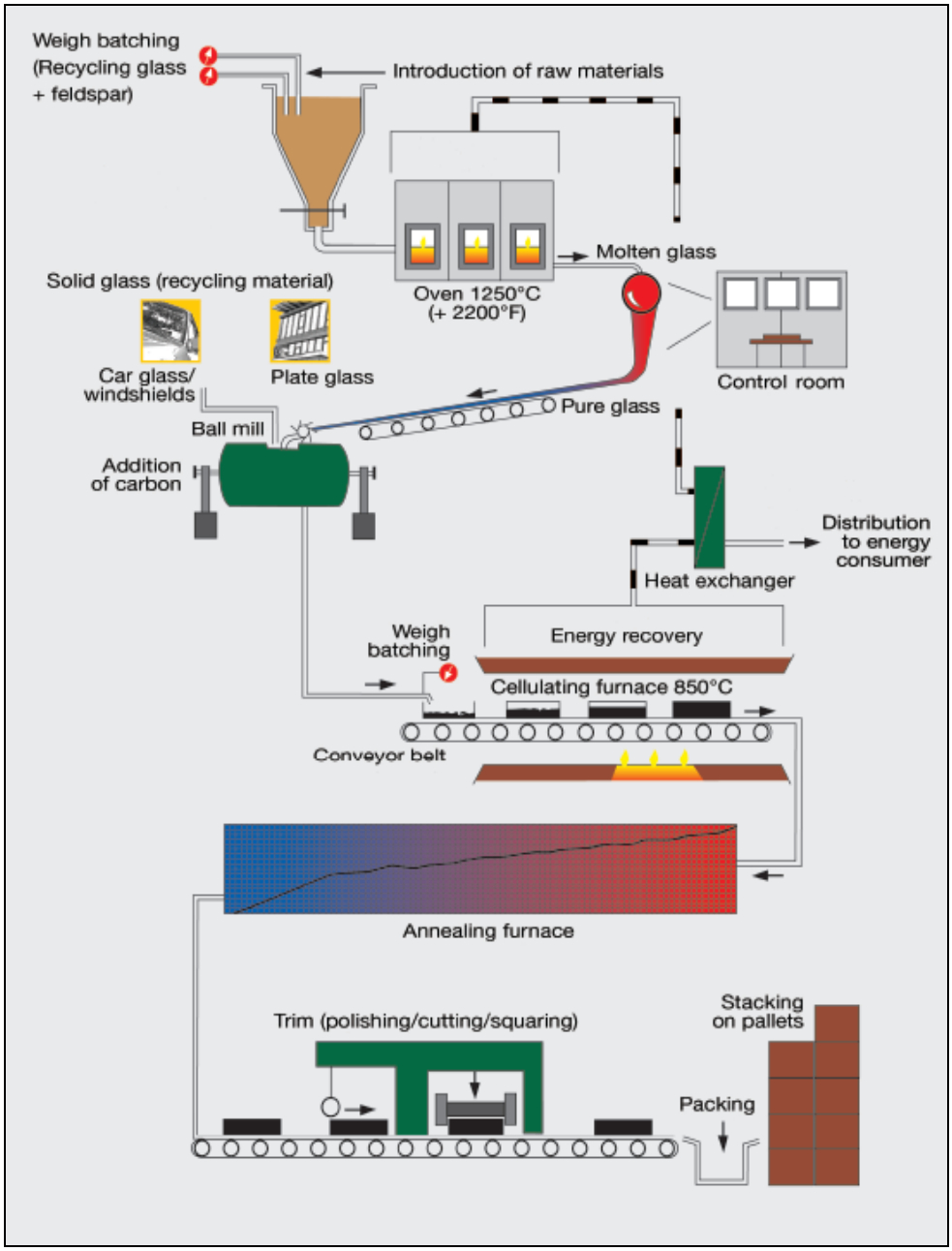

Figure 2-1: Schematic description of the FOAMGLAS®-Production

The complete electricity demand is met by certified green energy from Norwegian and Swiss Hydropower plants. The certificate is controlled by the Renewable Energy Certificate Systems (RECS) and TÜV SÜD (s. chapter 8).

The following energy carriers and amounts are inputs to the product system.

Table 2-1: Example: Energy input for 1 kg of FOAMGLAS® T4+

Energy carrier	per kg T4+
Natural gas	0,30 Nm³ (9,8 MJ)
Electricity hydropower (NO)	1,175 kWh

For Pittsburgh Corning Europe a new production site, applying new technologies will be available in 2008 in the Czech Republic. The foaming process changes from discontinuous foaming of FOAMGLAS® slabs in separate troughs to continuous foaming. This process will be more efficient with respect to resource input and energy use and accordingly less emission output. The improved data can be received on demand from Pittsburgh Corning Europe by spring 2008.

Health protection during production

No further health protection measures beyond the regulated measures for manufacturing firms are necessary during all production steps.

Environmental protection during production

- Water/soil: waste water from production or from cleaning the production site is treated mechanically in an on-site waste water plant and returned to the production process. Next to the sewage water complying with Belgian regulations, the small amount of Al_2O_3 –sediments supports the cleaning process of the water treatment used for public drinking.
- Noise: noise emissions of the production processes are below regulatory limit values.

3 Product installation

Packaging

Each package consisting of a number of FOAMGLAS®-slabs is shrink packed with PE-foil. 12 packages are then combined and shrink packed on a wooden pallet. In this way the slabs are protected from water and climatic influences.

Ancillary products

The following components are needed to install the slabs:

- Application flat roof: oxidised bitumen and cold applied adhesives
- Application façades: mineral or bitumen adhesives, with synthetic blends (for high moisture)

Recommendations for installation

When appropriately handled the product does not pose any health risks. The dust produced during sawing is inert and not crystalline.

FOAMGLAS® elements are rarely dry installed. In most cases mineral or bitumen adhesives are applied. The elements are staggered with open or glued seams and butt-joined

- Roofs: FOAMGLAS® insulation elements are part of the warm roof construction where the slabs are glued to a continuous support (steel, concrete, wood) and sealed with membranes or other appropriate roof coverings (e.g. metal covering, roofing tiles or discontinuously laid sheeting).
- Façades: FOAMGLAS® insulation elements for façades are glued to a continuous support (concrete or masonry) or/and are part of the ventilated façades or of the external rendered systems.
- Other applications: e. g. insulation of indoor walls, floors. For such cases Pittsburgh Corning Europe has prepared a detailed and readily available guide for installation.

Occupational health and safety

The regulation of the employers' liability insurance association applies.

When working with the declared products the safety measures provided in the producers safety guidelines shall be applied.

Environmental protection

According to current knowledge no negative impacts on water, soil or air can be expected when installing FOAMGLAS® slabs when following the installation practices proposed by the manufacturer.

Waste

Waste pieces of FOAMGLAS® slabs or packaging should be collected separately. For end of life management local regulations and indications in chapter 6 are to be considered.

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4 Use stage

Content of the product

No release of substances as installed, (see chapter 1)

Environmental and Health related impacts

Environment:

According to current knowledge no negative impacts can be expected on water, soil or air during intended use of FOAMGLAS®.

Health:

According to recent German emission testing for indoor air quality, FOAMGLAS® is considered an insulation material for which no VOC or carcinogenic emissions have been detected after 3 and 28 days.

Durability

The expected service life of FOAMGLAS®-products during intended use is nearly unlimited. The products are insensitive to moisture, frost, vermin, acids and other chemicals.

When renewing or refurbishing roofs and façades with cladding mounted on FOAMGLAS®, it is not necessary to remove the existing layer of FOAMGLAS®. This layer can serve as support for the new cladding or waterproofing.

5 Singular effects

Fire

FOAMGLAS® is categorized as class A1 according to EN13501-1:2007 and DIN 4102, part 1,.

Products of class A1 show no contribution to fire, risk potential in terms of smoke development, toxicity, flammability, and droplets

6 End of life stage

Recycling Further use

When collected separately the declared products can be ground and re-used as raw material to produce FOAMGLAS® (material recycling). In addition separately collected products contaminated with adhesive may be used as backfill e.g. for road construction, civil engineering works or noise barrier walls (material recycling).

Disposal

When recycling potentials cannot be realized, FOAMGLAS®- residues may be deposited without precautions or treatments on class 1 deposits since they contain only non-leaching mineral substances. Packaging materials are sent to thermal recycling.

European waste catalogue (EAC): Insulation material (mineral, no contaminations) EAC-Code 170604 FOAMGLAS®

7 Life Cycle Assessment

Functional unit

The declaration is based on 1 m³ FOAMGLAS®-slab or -element. The densities are as follows:

- W+F – 100 kg/m³,
- T4+ - 115 kg/m³,
- T4 - 120 kg/m³,
- S3 - 130 kg/m³,
- F - 165 kg/m³
- Perinsul - 165 kg/m³ und
- Perinsul SL – 200 kg/m³.

System boundaries

The system boundaries include the production stage from raw material extraction to the packaged product at the gate (cradle to gate)

In detail this includes:

- Production of basic components (pre-products)
- Energy provision
- Transports and packing of basic components (pre-products)
- FOAMGLAS®- production (energy, waste, emissions)

Due to the manifold applications and constructions, the use stage is not included in the LC-calculations.

Due to the long expected service life, data for the end of life processes of the declared products is not available with sufficient quality and therefore is not included in the assessment.

Cut-off rule

In case of insufficient input data, the applied cut-off rule is 1 % of primary energy usage and of the total mass as inputs into the process. All output emissions are part of the inventory when their contribution to the declared environmental impacts is more than 1 % per considered impact category.

Transports

All transports within the system boundaries were included.

Temporal and local boundaries

The data for the production stage was collected for the year 2006. The LCA was calculated based on specific data for the Tessenderlo site in Belgium. Background data (energy production, raw material extraction) was selected for Belgium.

Background data

The Software-System GaBi 4 was used to model the LCA for the declared FOAMGLAS®-products. All relevant background data for the slab production, e.g. energy production and transports were taken from the GABI 4 database.

Assumptions

The results of the LCA are not based on any special assumptions.

Data quality

The data used for the calculations is not older than 5 years. The LCA is based on specific data for the site in Tessenderlo/Belgium from the year of 2005 and has been updated for 2006. The majority of background data comes from industrial sources and have been collected under consistent temporal and technological conditions. The specific process data and the applied background data are consistent.

Allocation

Allocation is the procedure of partitioning the input or output flows of an information module (of the LCA) to the product system under study.

In compliance with the PCR no burdens from the previous product system was allocated to the recycled glass. No further allocations were needed for the foreground processes. Allocations were made for background data where relevant, e.g. for the electricity mix.

7.1 Description of the Assessment and Interpretation

Inventory

The following chapters describe the inventory results with respect to primary energy and waste.

Primary energy

The primary energy demand is dominantly caused by process of melting and of foaming and therefore is proportional to the density of the product.

Figure 7-1 illustrates the primary energy demand (PED) for the different gross densities of the declared FOAMGLAS® products

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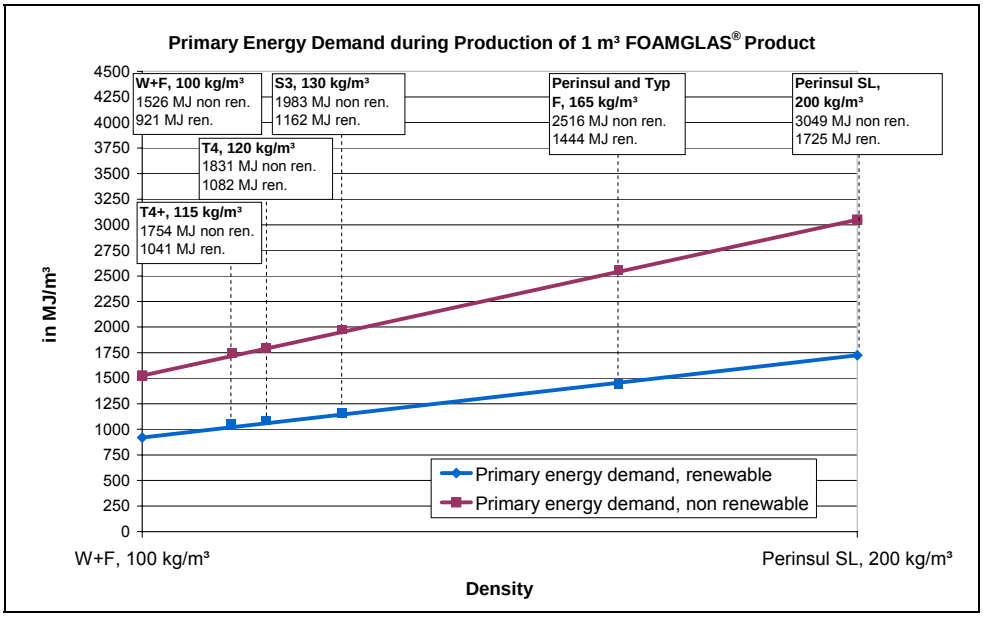

Figure 7-1: Primary energy demand during production of 1m³ of FOAM GLAS® Product

The influence of electricity use (e.g. melting process) on emissions and resource use prompted Pittsburgh Corning Europe to purchase electricity from renewable resources instead of conventionally produced electricity. In 2007 all electricity for the declared products was obtained from Norwegian and Swiss hydropower plants (see chapter 10 certificates) and the energy related emissions were reduced significantly.

1 kWh of conventional electricity production consumes ca 10 kWh of non renewable primary energy. The purchase of electricity from hydropower reduced the non renewable PED to 0,5 kWh per kWh electricity. In this EPD the „green“ electricity of 2007 was introduced into the calculation to document the improvement of the environmental performance of the products.

The largest part of renewable PED must be attributed to the production process. The remaining fossil PED is caused by the foaming process, where the heat is produced with natural gas (79-82 %), see Figure 7-2 and 7-3. Some fossil energy carriers (natural gas, oil, coal, lignite) and uranium are also needed to provide hydropower.

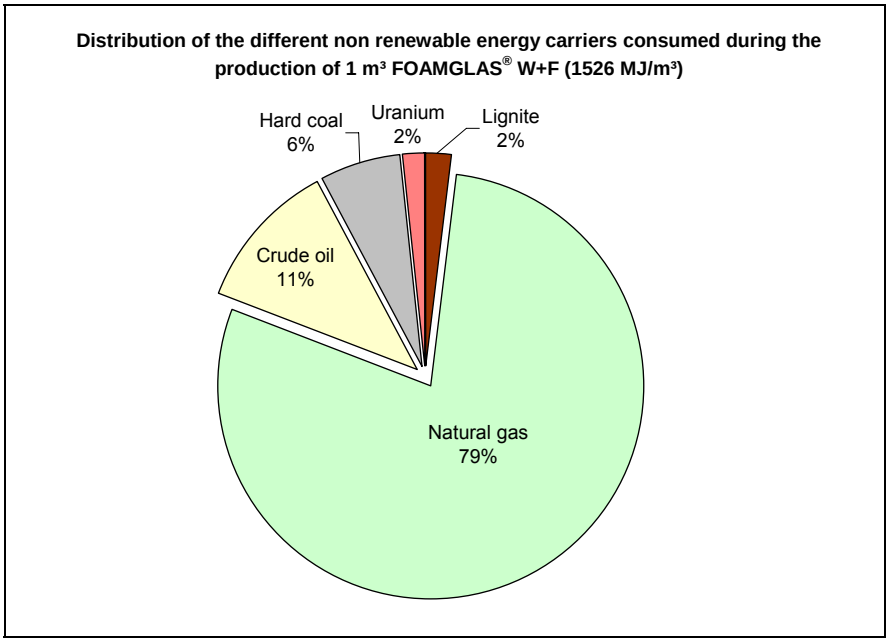

Figure 7-2: Distribution of the different non renewable energy carriers consumed during the production of 1 m³ FOAMGLAS® W+F

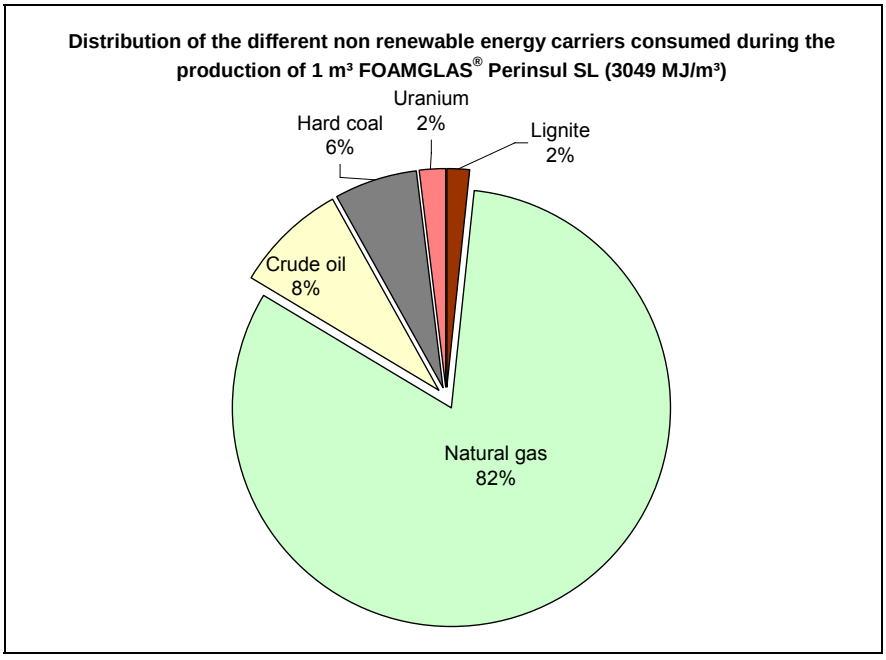

Figure 7-3: Distribution of the different non renewable energy carriers consumed during the production of 1 m³ FOAMGLAS® Perinsul SL

Waste

Waste produced during the production of 1 m³ FOAMGLAS® is sorted into 3 fractions: tailings, non hazardous waste (including domestic and industrial waste) and hazardous waste (including radioactive waste).

Table 7-1: Waste production in kg/m³ FOAMGLAS® of different density

Waste category [kg/m³]	W+F	Typ SL
Tailings	72,7	134,6
Non hazardous waste	0,017	0,020
Hazardous waste, incl. radioactive waste	5,3	10,6

The fraction of **tailings** originates mainly from coal mining for electricity.

The fraction **non hazardous waste** includes domestic wastes and comparable industrial wastes.

All end of life processes are calculated until final deposition. Therefore the amount of **hazardous waste** usually is quite small. However this calculation rule does not apply for radioactive waste, because no scenario for calculating the impacts connected to final deposition of radioactive waste has so far been agreed. Therefore this waste appears as a part of the hazardous waste fraction.

Hazardous waste is caused mainly by electricity production. Next to radioactive waste, slack from filtering processes and sewage from wastewater treatment is accounted for in this fraction.

Impact assessment

The indicators of this EPD are calculated as far as possible according to the emerging standards of CEN TC 350 (PCR - product category rules: prEN 15804).

Figure 7-4 shows global warming as part of the environmental impact potentials connected to FOAMGLAS®-products. This impact potential is closely related to the use of non renewable primary energy, and thus is - like the PED - proportional to the density of the different product types.

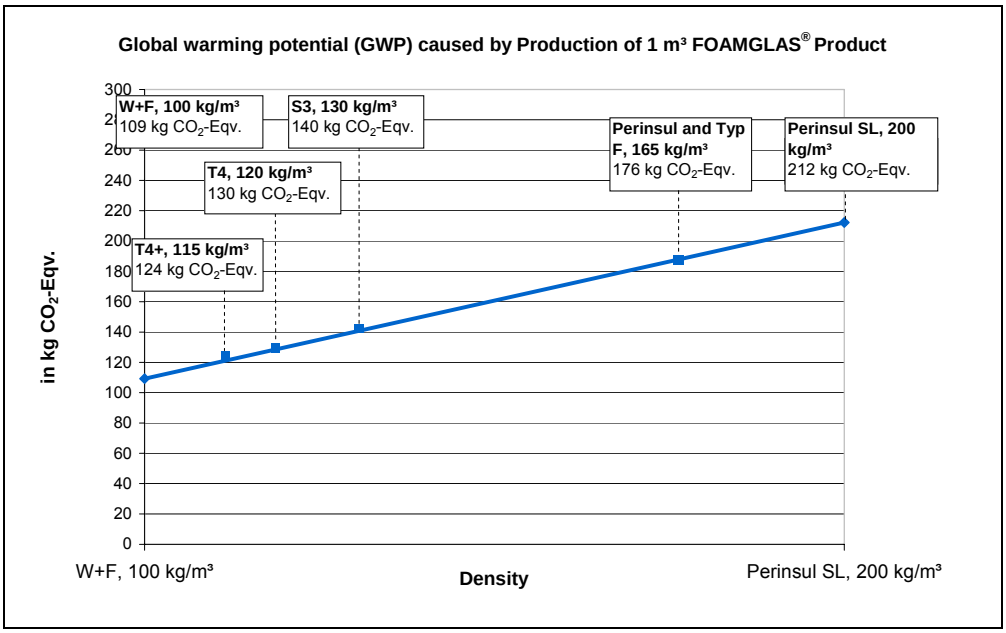

Figure 7-4: Global warming potential (GWP) caused by the production of 1 m³ FOAMGLAS® product

The following figures show the relative contributions of raw material extraction and production („cradle to gate“) to the impact categories: potentials of Abiotic (resource) depletion (ADP), global warming (GWP), ozone depletion (ODP), acidification (AP), Eutrophication (EP), and Photochemical Ozone Creation (POCP)

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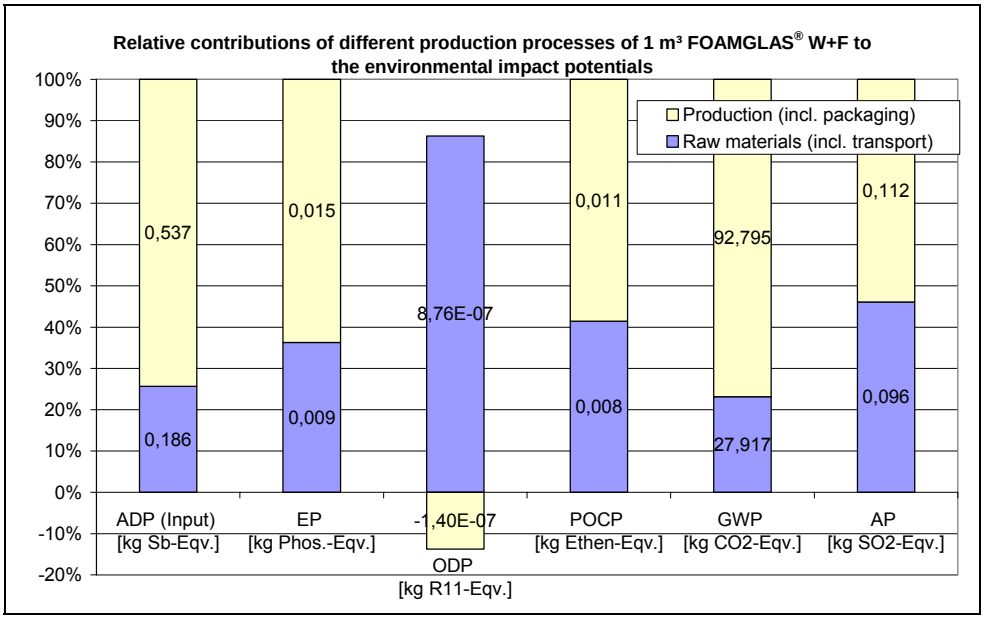

Figure 7-5: Relative contributions of different production processes of 1 m³ FOAMGLAS® W+F to the environmental impact potentials

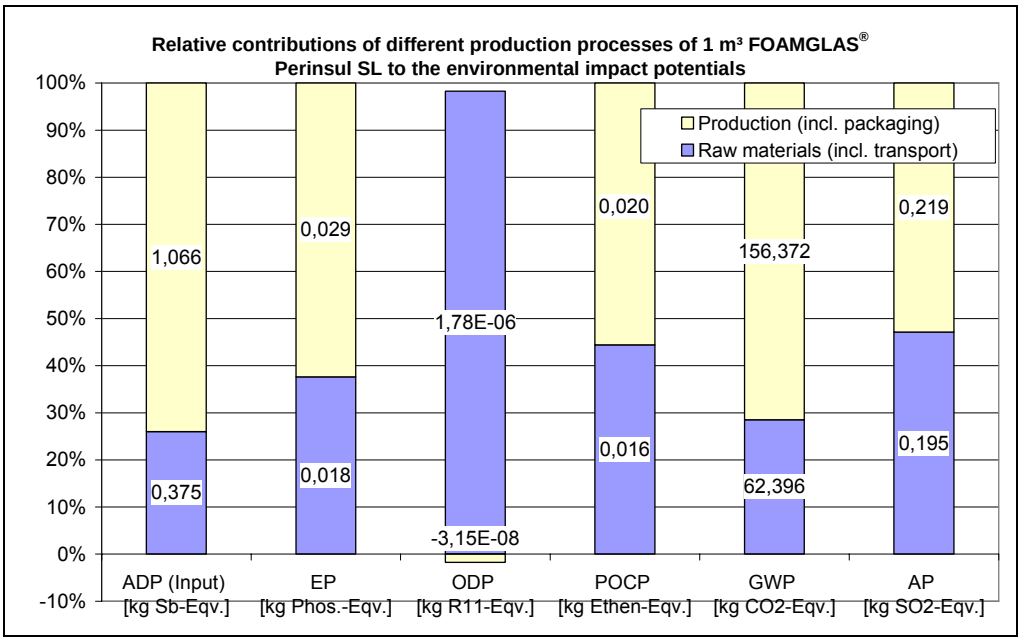

Figure 7-6: Relative contributions of different production processes of 1 m³ FOAMGLAS® Perinsul SL to the environmental impact potentials

The **abiotic depletion potential** (ADP) is mainly based on consumption of fossil energy carriers (>90 %). Therefore the distribution of fossil PED between the production processes is quite similar.

60% of the **global warming potential** (GWP) results from the production process and 40 % result from provision of energy (e.g. electricity) and pre-products.

41% or 43% of the **acidification potential** (AP) results from production and 57 % or 59 % (W+F or Typ SL) from raw material extraction.

The production process also produces direct emissions of NOx and SOx contributing to acidification. The rest of the acidifying emissions are connected to the production of thermal energy. With respect to raw materials most of the acidifying emissions have to be attributed to the extraction of Soda, Manganese and ferrous oxides as well as Kaolin.

50% of the **eutrophication potential** (EP) is caused by raw material extraction (mainly sodium nitrate) as well as provision of thermal energy from natural gas.

The **photochemical ozone creation potential** (POCP) is attributed largely to the production processes (energy provision). Considering raw material extraction, ferrous oxides, Kaolin and Soda are predominant with 42-50 % of contribution. Direct emissions of NOx and SOx make up for 47 % and 46 % of POCP.

Packaging contributes 11 % or 5,5 % to POCP. This is the impact category where packaging has the highest influence, due to emissions caused by the production of polyethylene foil.

Ozone depletion potential is caused exclusively by conventional electricity generation (due to raw material extraction, cooling agents in nuclear power plants or special extinguishing agents for oil platforms in the North Sea). Thermal recycling of packaging material gives rise to energy-credits exceeding the loads from emissions in this impact category and life cycle stage.

There are no direct emissions of halogenated hydrocarbons during the production of FOAMGLAS®

8 Certificates

Leaching

Institut für analytische Chemie, Dr. R.v. Nagel, Mannheim Friedrichsfeld, 1987. EMPA Untersuchungsbericht Eluattest für FOAMGLAS® Nr.123544A

- **Leaching test with CO_2-saturated water:**

Table 8-1: Contents of elements in CO2-eluates, respective limits of detection and threshold values according to German waste regulation

Element	Sample content mg/L	Detection limit (DL) mg/L	Threshold for inert substances- mg/L	Threshold for remaining substances mg/L
Al	< DL	0,050	1	10
As	< DL	0,0007	0,01	0,1
Ba	0,040	0,010	0,5	5
Pb	< DL	0,020	0,1	1
Cd	< DL	0,002	0,01	0,1
Cr	< DL	0,001	0,01	0,1
Co	< DL	0,010	0,05	0,5
Cu	< DL	0,010	0,2	0,5
Ni	< DL	0,020	0,2	2
Hg	< DL	0,0003	0,005	0,01
Zn	< DL	0,050	1	10
Sn	< DL	0,010	0,2	2

- **Leaching tests with water:**

Table 8-2: contents of substances in water-eluates, respective limits of detection and threshold values according to German waste regulation

Sample	Sample content mg/L	Detection limit (DL) mg/L	Threshold for inert substances- mg/L	Threshold for remaining substances mg/L
NH_4 + N	< DL	0,03	0,5	5
Cyanide	< DL	0,01	0,01	0,1
Fluoride	< 0,06	0,04	1	10
Nitrite	0,03	0,01	0,1	1
Sulfide	< 0,02 *	0,01	0,01	0,1
Phosphate	< DL	0,5	1,0	10
DCC	5 **	0,2	20	50
ECx	< DL	0,01	0,01	0,05
IKW	< DL	0,01	0,5	5
pH	7,1	x	6 - 12	6 - 12

* Sulfide content: 0,02 mg/L in 24-h-Eluate; < 0,01 mg/L in 48-h-Eluate

** DCC-content: results are spread between < 0,2 and 16 mg/L

Green electricity certificate

- Une Certificat renouvelable, certifié par TÜV SÜD, valid until Dec. 31st 2008
- RECS Certificate, Certificate No: 43-06-101, valid until Jan.-Dec. 2008

9 PCR-Document and verification

This declaration is based on the PCR document: “mineral insulation products 2007”

Review of the PCR-Documents by DIBU advisory board. Chair of advisory board: Prof. Dr.-Ing. Hans-Wolf Reinhardt (University of Stuttgart, IWB)
Independent verification of the EPD according to ISO 14025: ☐ internal ☒ external
Verification of the EPD by: Dr. Frank Werner

10 Literature

Further literature see PCR document

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Gondelstation Glacier 3000

FOAMGLAS trotzt Wind und Wetter

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