

Ecological assessment

Recommended for internal use

■ FOAMGLAS® emits no substances, such as formaldehydes, styrenes, fire-proofing substances, fibres, chlorofluorocarbons (CFC/HCFC) etc, that are detrimental to health. Cellular glass insulation meets high health and environmental standards relating to its production, processing and eventual disposal.

■ Ecological and biologically safe FOAMGLAS® offers optimum construction solutions not only for rooms where a high degree of air purity is required (museums, hospitals, schools, offices, waiting rooms, high-tech production facilities, etc.), but also in locations where there are special bacteriological and hygienic requirements (slaughterhouses, cheese factories, dairies, industrial kitchens, canteens, restaurants, swimming pools, etc.).

■ All approved accessory products for the systems also aim to satisfy low-emission standards.

It is now common practice for building owners and investors to demand guarantees that only non-odour, low emission products which are not harmful to health are used in both the construction and interior finishes of their buildings. Large companies are pioneers of these developments and adopt it as their company culture - **to specify only Low-E products - non-toxic, non-odour products for their developments.**

The backdrop to this new philosophy is a growing awareness that the health of employees and increased productivity are closely related to good air conditions within the workplace. Coupled with this is the recent discovery that **safe, low-emission materials also bring substantial cost savings.**

When Low-E construction methods are fully adopted, the specification of the HVAC-installation can be reduced, with resultant lower investment costs, reduced energy consumption and operating costs, plus less space utilisation.

Recent research has demonstrated that by avoiding certain materials, the so called sick-building-syndrome and building related illnesses, such as allergy to chemicals, can be drastically reduced.

High priority is given to heat recovery in the plant.

Continued research and development has been necessary to incorporate high percentages of recycled glass into the production of FOAMGLAS® cellular glass insulation without any reduction in quality. This ensures that not only is less raw material needed but energy consumption is reduced.



Delivery of glass for recycling (post-consumer-waste).

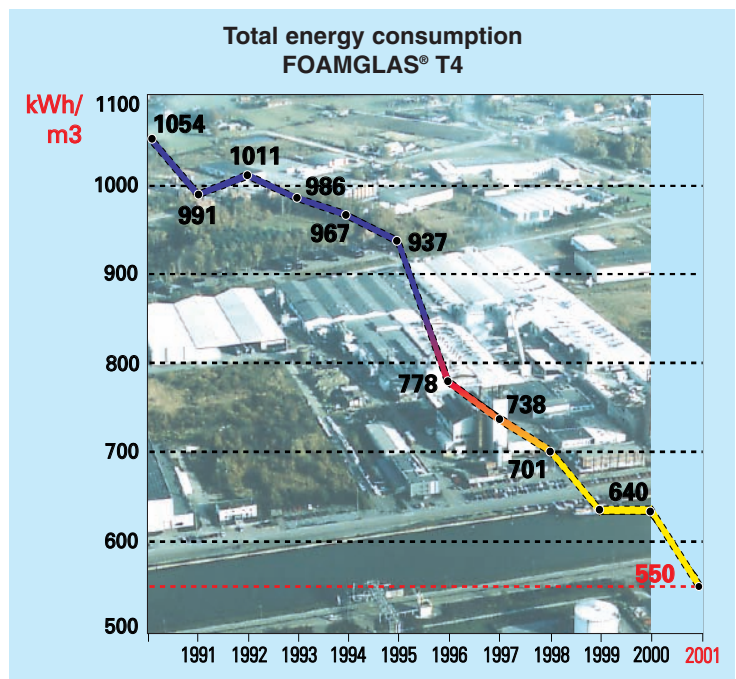
FOAMGLAS®

Pittsburgh Corning embraces environmental care as one of its main priorities

Technical progress in the manufacture of FOAMGLAS® repositioning the ecological profile

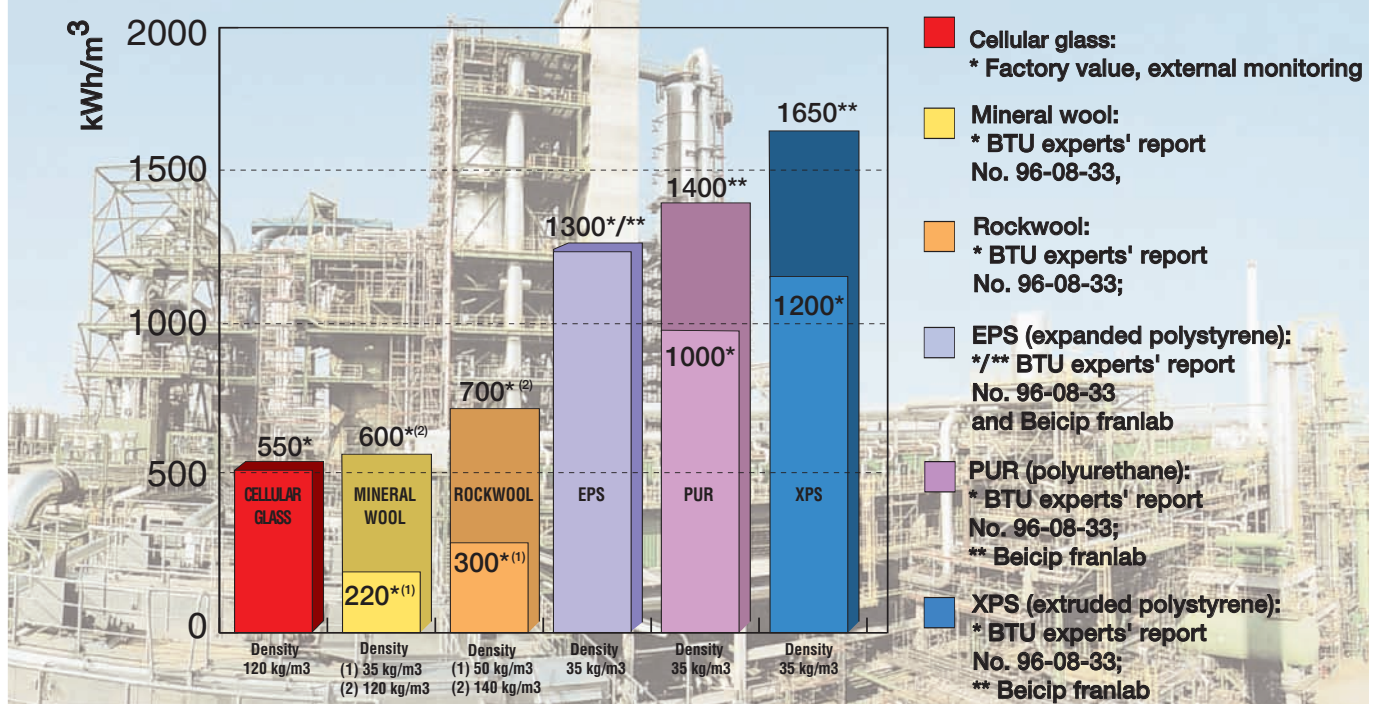
■ Since the end of the 1990's, important investments have been made and all the know-how available with regard to the manufacture of very high-quality glass has been put to good use in the production of FOAMGLAS® cellular glass, resulting in a really superior ecological classification. The proportion of **recycled glass** used in manufacture has been substantially increased and, on the other hand, the **thermal recycling yield** has also been optimised. The measures adopted contribute towards minimising emissions into the environment and re-adjust the ecological profile of FOAMGLAS®.

- 1 **Manufacturing energy** for 1 m³ of FOAMGLAS® is currently down to **550 kWh**.
- 2 **CO₂ emissions** have been reduced to a low level of 120 kg/m³ (this means 75 kg/m³ related to production and 45 kg/m³ for the preliminary phase of energy production).
- 3 **Dust emissions** have been reduced from 522 g/m³ to **0 g/m³** - i.e. non-existent.
- 4 The percentage of **recycled glass** (post-consumption residue) was 0 % in 1990; today it stands at **66 %**.



The graph above illustrates the technical progress achieved. Typical of this is the reduction in energy for manufacture for FOAMGLAS® T4. Instead of making long-term provisions for availability and the status of resources (as is the case with petroleum products) thermal insulation users can count on a cellular glass insulation product with a 100% mineral base.

★ Average energy consumption of industrially-manufactured thermal insulation materials



★ The combination of energy sources (coal, gas, fuel oil, nuclear energy) considered reflects the average mixed structure of energy supply in Europe. Because of the currently deregulated energy markets, this basis is the best available source for a comparative evaluation of environmental impact resulting from the energy required for the manufacture of insulating materials.

BTU: Büro für technischen Umweltschutz, Reiskirchen (D) - [Office for technical protection of the environment]
Beicip franlab: Institut français du pétrole

Ecological assessment

FOAMGLAS® is the front runner as far as ecological assessment of industrially-manufactured thermal insulation materials is concerned

■ Due to investments in production methods and technology FOAMGLAS® is amongst the elite in insulation products assessed for global ecology, related to primary energy parameters, CO₂ and other emissions (REFER TO TABLE 1 ON THE FOLLOWING PAGE AND THE FIGURE, PAGE BEFORE: PRIMARY ENERGY REQUIRED FOR INDUSTRIALLY-MANUFACTURED INSULATING MATERIALS).

Various studies and evaluations confirm the accolades for ecological quality awarded to FOAMGLAS® cellular glass insulation.

The following copies of evaluations and studies are available on request:

- Landesinstitut für Bauwesen und angewandte Bauschadensforschung NRW; Ökologischer baustoffratgeber: Umweltbewußte Bauteil- und Baustoffauswahl (1993).
- Niedersächsisches Sozialministerium: Gesundes Bauen und Wohnen. Baustoffinformation Wärmeschutz (1994).
- Arbeitsgemeinschaft Umweltverträgliches Bauprodukt e.V., Munich.
- BTU, Büro für technischen Umweltschutz, Reiskirchen; expertise n° 96-08-33.
- Schweizer-Ingenieur-Ring; Beurteilung von Bauteilen der Gebäudehülle nach wirtschaftlichen und ökologischen Grundsätzen. Bedarfsbilanzierung von ausgewählten Konstruktionen (1997).



Économic/ecological assessment by BTU¹⁾

■ The BTU institute has gathered data on different parameters (e.g. length of service-life, primary energy content, price, thermal conductivity, costs of disposal or recycling and technical or application polyvalence) of the principal industrially-manufactured insulation products in the market. By applying a mathematical formula and with the weighting coefficients (per category from 1 to 5, with 1 being "negative" and 5 "very positive"), an examination of the parameters under consideration leads to different results per group of products and is expressed by the profitability index (R). The higher the R-value, the better the product evaluation.

1) BTU - Büro für technischen Umweltschutz, Reiskirchen, Germany.

For FOAMGLAS® the profitability index - a characteristic value for ecological and economic evaluation, involving a number of parameters - leads to the value **45.5**. This result positions FOAMGLAS® amongst the leading products in overall economic/ecological assessment.

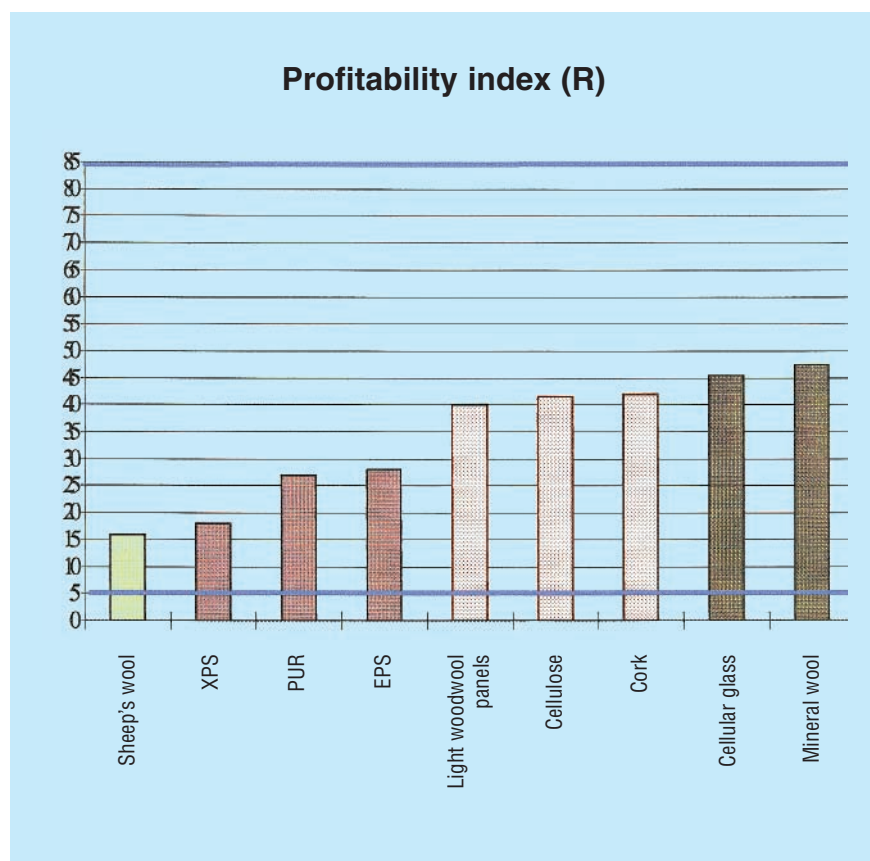


TABLE 1

- Emissions of CO₂-, SO_x, NO_x or other volatile organic compounds (VOC) and
- Consumption of water for the production of insulating materials and
- Return on energy investment

PRODUCTS	Density kg/m ³	Source	CO ₂ kg/m ³	SO _x kg/m ³	NO _x kg/m ³	Process effluents and VOC kg/m ³	Water consumption kg/m ³	Return on energy investment Months
Cellular glass T4	120	a	120 ^[1]	0.03	0.15	none	70★	9
Mineral wool	35 - 120	g	55 - 191	0.12 - 0.40	0.12 - 0.42	0.14 - 0.48	50 - 100 ^(#)	3.5 - 13
Rockwool	50 - 140	g	44 - 154	0.29 - 0.81	0.09 - 0.25	unkn.	50 - 100 ^(#)	3.5 - 13
EPS	30	c	162	0.99	0.38	15.5	291	22
		g		4.8	1.61			
PUR	35	c	150	0.86	0.32	30.84	301	23
XPS	35	c	215	1.32	0.50	14.20	298	25 - 30
[1] In the factory during production: 75 kg/m ³ ; energy supply prior to production: 45 kg/m ³			a factory value b calculated c Beicip - Franlab	g Ecolabel - Vito - Dk Teknik () estimated unkn. unknown	#) extrapolation ★ recycled in a closed circuit			

■ Volatile emissions during the production of a product are increasingly being considered and evaluated in the overall ecological balance sheet.

These relate in particular to SO_x emissions, i.e. SO₂ and SO₃ which are responsible for acid rain, the greenhouse gases CO, NO_x and CO₂, as well as emissions of VOC which have been found to have an adverse effect on health (respiratory tract).

The highest values of these emissions arise in the case of products with long-winded chemical processes and relate in particular to petroleum-based products. In the case of the XPS, EPS and PUR products in question, the emission values mentioned in **Table 1** (above) were taken from the Beicip Franlab report of the Institut Français du Pétrole¹⁾.

Other industrially-manufactured insulating materials produce emissions of the same order of magnitude. As, however, these are not mainly based on petroleum as the raw material, emissions are appreciably lower.

In the case of products made of mineral wool and rockwool, the order of magnitude of the values – in relation to primary energy required – can be estimated by extrapolation.

The information on CO₂ and other gaseous emissions given here apply for production sites operating in accordance with current technical standards and cannot be attributed to plants located in countries where protection of the environment is not recognised by law, particularly in third-world countries and developing countries.

In Switzerland, cellular glass complies with the MINERGIE standard for construction components promoted by the cantons, the Confederation and the commercial world.

Buildings meet a high level of quality and offer a remarkable level of comfort as regards soundproofing, health, indoor air quality and thermal protection; this concept is designed to preserve the value of a building over a longer period than average (certificate on request).

1) Beicip-Franlab, Ecological balance sheets; report Nr DIP - 93042 by Institut français du pétrole.

Process chains and the service life of an insulating material – an indicator of its ecological profile

■ “Advantageous construction materials are those having a long service life and a non-critical manufacturing process. Construction materials having a short service life should preferably not have a critical process chain, because their manufacture, use or disposal at their end of life causes problems for the environment. If one were to ignore this pollution and these risks, it would be most desirable for construction elements to have a longer service life.”¹⁾

lists do not have sufficient knowledge to be able to correctly evaluate the individual stages in a process, emissions, production waste and the primary energy required. It is therefore recommended that the complexity of subsequent production stages should be compared.

A short process chain is a valid indicator for a positive ecological profile. A long process chain requires complex technology, absolute control of which appears to be at least doubtful. Two process chains of different complexity are illustrated below.”¹⁾

INSULATING MATERIALS

Cellular glass:
with 12 process stages

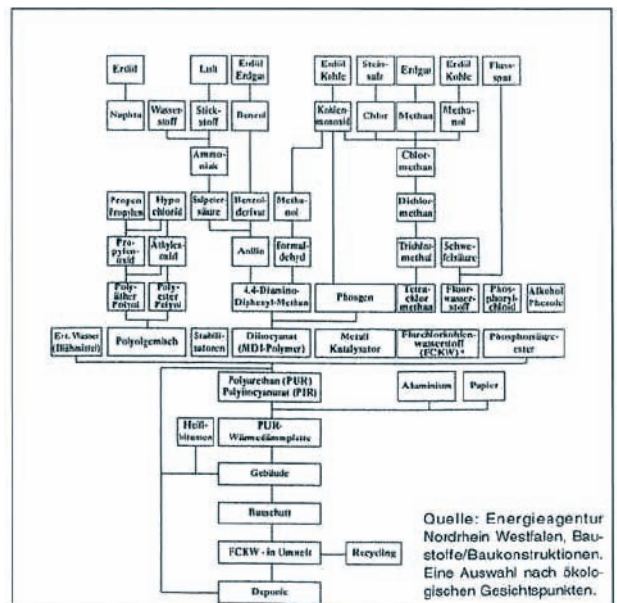
XPS:
with 48 process stages

PUR/PIR :
with 48 process stages

Short and uncomplicated process chain in the case of cellular glass

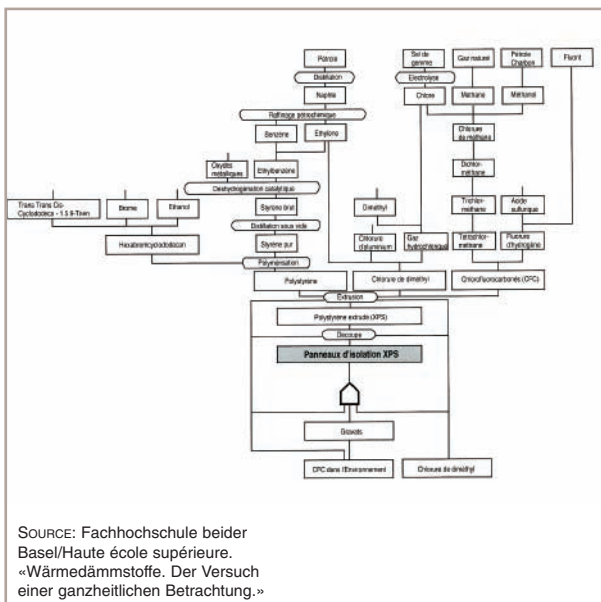
■ “Comparing the processes for the manufacture of products in the same group provides a preliminary indication about their environmental impact. Normally non-specia-

Complicated process chain, as in the case of PUR/PIR products



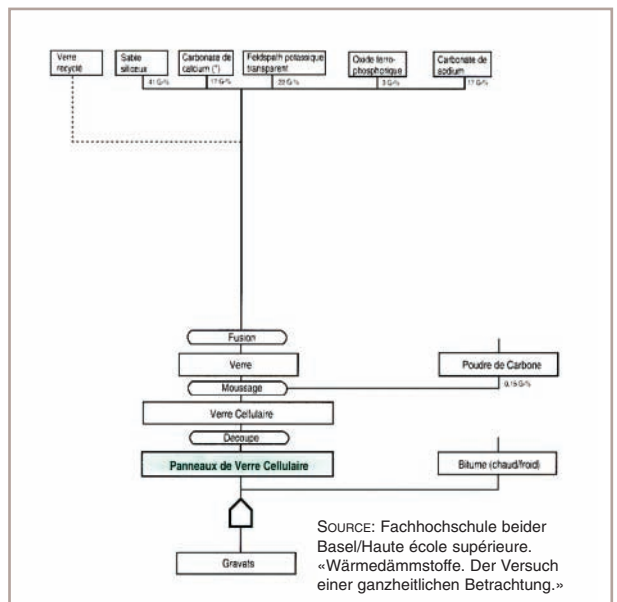
1) Source: Energieagentur Nordrhein-Westfalen, Baustoffe/Baukonstruktionen. Eine Auswahl nach ökologischen Gesichtspunkten. REN initiative for energy saving “Bau und Energie” [Construction and energy].

Complicated process chain, as in the case of XPS products



SOURCE: Fachhochschule beider Basel/Haute école supérieure. «Wärmedämmstoffe. Der Versuch einer ganzheitlichen Betrachtung.»

Uncomplicated process chain, as in the case of cellular glass



SOURCE: Fachhochschule beider Basel/Haute école supérieure. «Wärmedämmstoffe. Der Versuch einer ganzheitlichen Betrachtung.»

The time factor must be given more consideration

Service life

■ “In the past various methods have been developed to refine ecological analyses of construction products.

Energy and raw materials flows over the service life of the product must be taken into consideration in order to evaluate a construction product as a whole. Construction products are long-term goods – buildings are regarded as having a service life of 80 years. **The time factor therefore plays a predominant part.** Up to now, however, the time factor has not been adequately considered in most balance sheets.”¹⁾

The characteristics of a product deteriorate in the course of use and products have different service lives

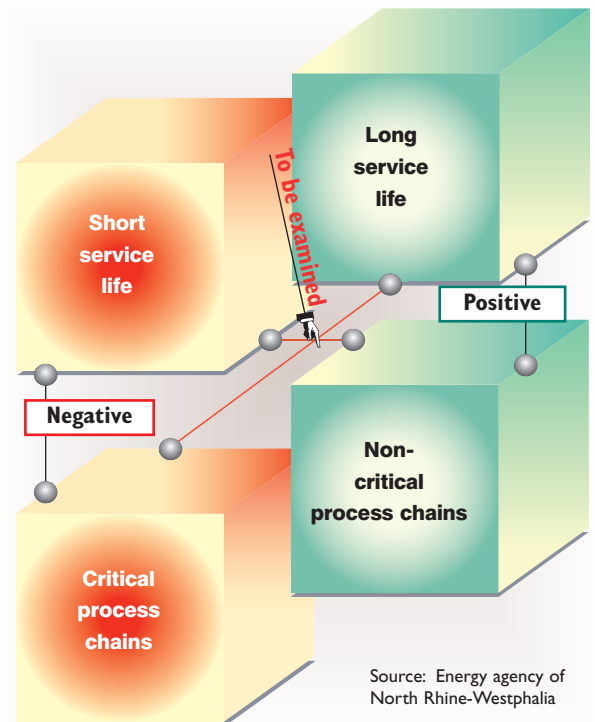
■ “When in use products do not remain new and undergo the effects of ageing and wear. Because of this, refurbishment measures become necessary and the characteristics of the product can change fundamentally.

The resistance of insulating materials to heat transfer can thus fall over the years and thermal transmission can increase as a consequence.

The additional heat flow produced in this way gives rise to flows of energy in the ecological balance sheet which can greatly exceed the energy flows required for the production of the insulating material.”¹⁾

1) Source: Prof. Dr.-Ing. habil. Dr.h.c.mult. Dr.E.h.mult. Karl Gertis, *Ökobilanz für Bauprodukte*, [Ecological balance sheet for construction products]. Fraunhofer Institut für Bauphysik, Stuttgart – Holzkirchen – Berlin. [Fraunhofer institute for the physics of buildings] Supplement to Bundesbaublatt 47 (1998), No. 11, pp. 17-20.

Selection criteria for construction materials based on process chains and the service life of the material



Source: Energy agency of North Rhine-Westphalia

Conclusion

An ecological assessment of construction products which fails to take the use stage or service life into account is not a valid one.

■ For an objective ecological evaluation comparing insulating materials, both changes in the thermal performance of the insulating material over time and differences in service life must be considered.

Products which offer constant thermal performance over the service life of a building and products with a long service life have an appreciably more advantageous ecological balance sheet than products whose thermal insulation properties decrease over the course of time and have a relatively short service life.

For this reason, greatest importance is to be attached to an ecological balance sheet related to service life which only allows for a correct comparative weighting of the ecological profile of insulating materials.