0 Environmental performance evaluation

0.1 Production of fibre cement siding façade panels

System description

Large format fibre cement boards are produced using a largely automated pressing process: The raw materials are mixed with water to produce a uniform material. Rotating strainer cylinders are immersed in this fibre cement pulp, draining it from the inside. The strainer surfaces produce a thin fibre cement mat, which is carried on a never-ending circulating conveyor. From there it arrives at a sizing roller, which gradually overlays an increasingly thicker layer of fibre cement. Once the required material thickness is reached, the still moist and malleable fibre cement layer (fibre cement fleece) is separated off and removed from the sizing roller. The fibre cement fleece is cut to size, with any off-cuts being fed back into the production process, meaning that there is no waste.

Using sidings, facades can be quickly constructed as horizontal or vertical floor-to-ceiling cladding on a wooden sub-framework and façade surfaces can be created right up to the tops of multi-story buildings. Sidings are weatherproof façade panels made from calcium silicate with an embedded wooden structure or a smooth surface. The water-repellent surface of these panels is available in various colours using an acrylate coating or primed in natural grey.

Declared unit

The declaration relates to the production of one tonne of average fibre cement façade panelling.

The gross density of one tonne of fibre cement façade panelling is 1300 (still needing to be checked) kg/m³.

The production of one tonne of siding has been calculated using specific data from Eternit, where available, or alternatively using average data records.

The usage phase is declared on the basis of 100 m².

System limits

The chosen system limits cover manufacture of the products, including obtaining raw materials, up to and including a finished packaged product at the factory gate (Cradle to gate).

The GaBi database (/GaBi 4/) has been used for power generation and transport. The analysis framework covers individually:

- Production of all ingredients (primary products)
- Transport and packaging of raw materials and primary products
- Production costs (energy, waste, emissions), including for primary products, and the provision of energy from resources
- Packaging

Cut-off criteria

On the input side, all material flows that enter the system and which are greater than 1 % of the total extent or make up more than 1 % of primary energy consumption, are taken into consideration. On the output side, all material flows that leave the system and whose environmental effect is greater than 1 % of the total effect for an effect category in question are recorded.

Transport

Transport of the raw and auxiliary materials used is taken into account.

Analysis period

The data for production of the products in question relates to the year 2005. The environmental performance evaluations have been carried for the reference area of Germany. The result of this is that, in addition to the production processes covered by these constraints, the relevant preliminary stages for Germany, including power or the provision of an energy source, have also been used.

Background data

The GaBi 4 software system has been used to model the lifecycle for the production of fibre cement siding panels. All the background data records relating to production has been supplied by Ecobilan or taken from the GaBi 4 software database. The majority of this data (processes) has been supplied as aggregated process data by Ecobilan.

Assumptions

The results of the current environmental performance evaluation study are based on the following assumptions.

Transportation of all raw materials and/or auxiliary materials is consolidated in a single transport process. Specific diesel consumption for individual materials is not known.

Data quality

The data for the fibre cement product in question has been collected directly in the plant. The overwhelming majority of data for previous stages comes from industrial sources, and has been compiled under consistent chronological and methodical conditions. The process data and the background data used is consistent. Great importance has been attached, in terms of both input and output, to a high degree of thoroughness in acquiring environment related factual performance data. The data used (processes) has been compiled by Ecobilan. The majority of this data (processes) has been supplied as aggregated process data and a detailed analysis of these processes has therefore not been possible. The data supplied (processes) has been checked for plausibility and the data quality is therefore identified as good.

Allocation

Relevant allocations (i.e. assigning the environmental harm of a process to several products) have not been made in the current environmental performance evaluation for the products under investigation.

Note on the usage phase

The life span of building products depends on the particular construction, the usage situation, the user himself, upkeep and maintenance.

For fibre cement siding products, no cleaning is anticipated during the usage phase.

0.2 Presentation of the results and evaluation

Factual results

Table 0-1 shows primary energy consumption (renewable and non-renewable) subdivided into production, raw material preparation, coating, transport and packaging of one tonne of siding.

Raw material preparation and production register the highest consumption of non-renewable primary energy at 44 % and 39 % respectively (production of electricity and natural gas among others). In terms of raw materials, Portland cement (69 %), cellulose (16 %) and quarry sand (13 %) record the highest contributions.

Renewable energy is only involved in production at a fundamentally lower level than non-renewable energy. The greatest contribution to renewable primary energy consumption comes from the use of wooden pallets for packaging. The production of wooden pallets accounts for the proportion of solar energy, which is stored in the wood when the trees are grown.

Table 0-1: Energy input for the production of fibre cement siding products

Eternit fibre cement siding product						
Scope of analysis	Units per tonne	Raw materials	Coating	Production	Transport	Packaging
Primary energy (non-renewable)	[MJ]	2311	139	2059	150	614
Primary energy (renewable)	[MJ]	6	0	38	0	1043

A closer evaluation of the energy consumed to produce one tonne of Eternit siding shows that crude oil is the most significant primary energy source (23 %), followed by uranium (19 %), renewable energy resources (17 %), anthracite or black coal (16 %), natural gas (15 %) and lignite or brown coal at 10 %.

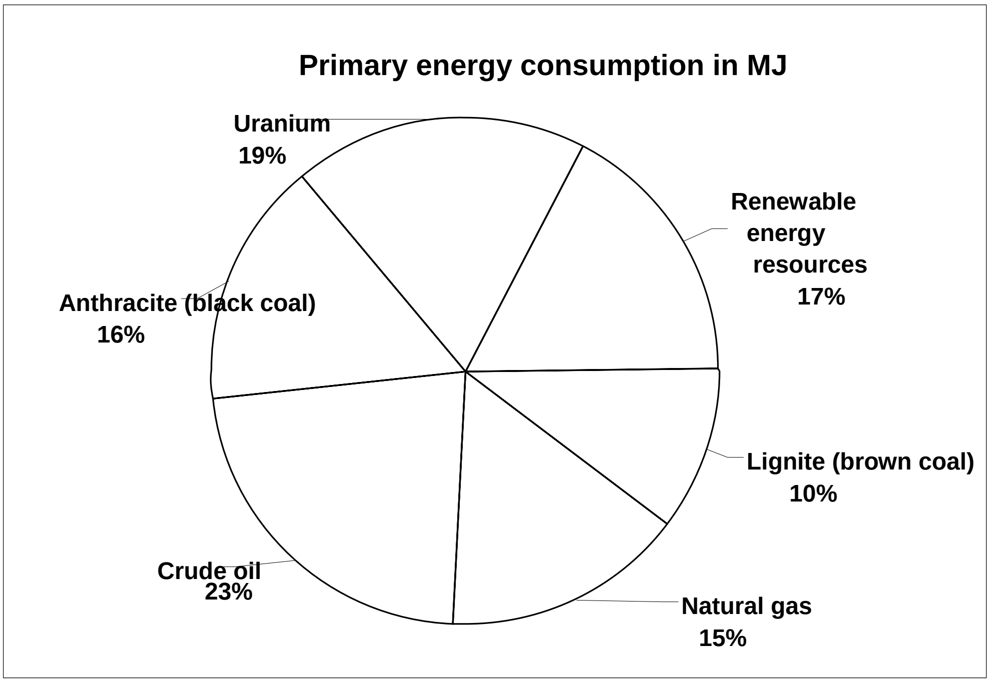

Fig. 0-1: Distribution of energy consumed in producing 1 tonne of siding

An evaluation of the waste generated in producing 1 tonne of siding is divided into three types: Spoil/tippable waste, industrial waste similar to household waste and hazardous waste including radioactive waste (Table 0-2).

Table 0-2: Waste generated in producing fibre cement siding products

Eternit fibre cement siding product	
Scope of analysis	Production [kg / t]
Spoil/tippable waste	1853
Industrial waste similar to household waste	0.70
Hazardous waste (including radioactive waste)	3.70

An evaluation of the effects

The following graph shows the contributions of production, raw material preparation, transport and packaging of one tonne of Eternit siding to the effect categories of global warming potential (GWP), ozone depletion potential (ODP), acidification potential (AP), over fertilization potential (eutrophication potential (EP) and summer smog potential (oxidant formation potential (POCP).

In the GWP, AP and EP environmental effect categories, raw material preparation and production (including electricity and thermal energy) of one tonne of siding account for almost 90%. In the GWP effect category, the packaging process achieves a credit. In the ODP and POCP effect categories, the proportion is almost 70 % and the influence of packaging is greater. Transport and coating processes follow behind with lower proportions.

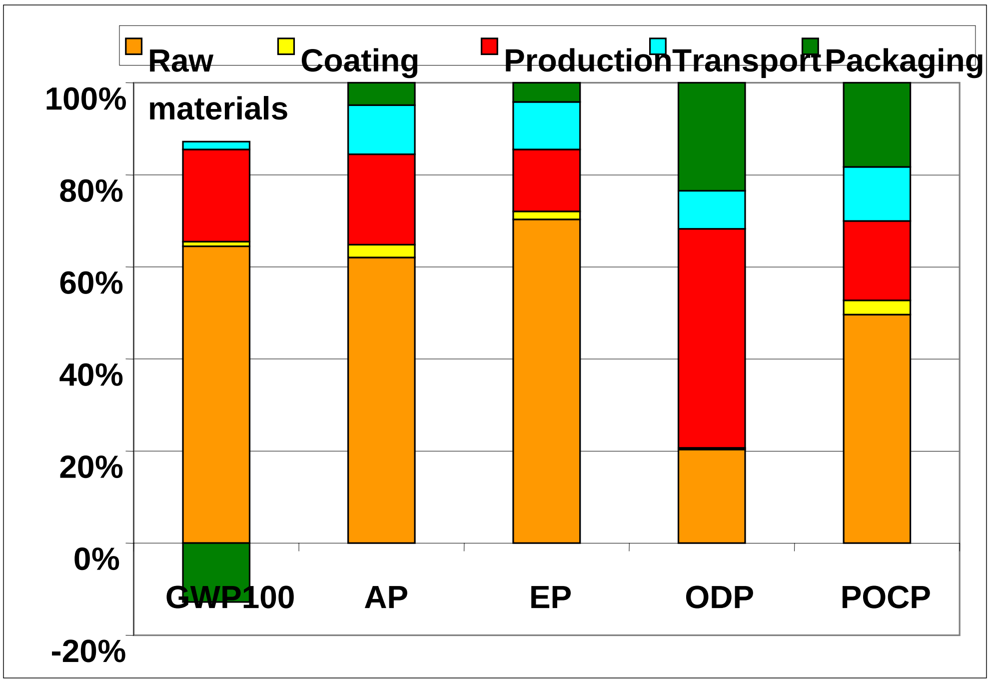

Fig. 0-2: Relative contributions of individual categories to the environmental effects of fibre cement siding products

Table 0-3 shows the absolute contributions of Eternit siding façade panels to the individual environmental effects divided into production, raw materials, coating, transport and packaging.

Table 0-3: Absolute contributions of fibre cement siding products per tonne

	Unit	Raw materials	Coating	Producti on	Trans- port	Packaging
Primary energy – non-renewable	MJ	2311	139	2059	150	614
Primary energy - renewable	MJ	6	0.1	38	0.0	1043
Global warming potential (GWP 100 years)	kg CO_2 equivalent s	399	5.6	123	11.5	-79
Ozone depletion potential (ODP)	kg R11 equivalent s	9.5*10-6	1.5*10-7	2.2*10-5	3.9*10-6	1.1*10-5
Acidification potential (AP)	kg SO_2 equivalent s	0.9	3.8*10-2	0.3	0.1	6.7*10-2
Eutrophication potential (EP)	kg phosphate equivalent s	0.1	3.3*10-4	2.5*10-2	1.9*10-2	7.5*10-3
Photochemical oxidant formation potential (POCP)	kg ethylene equivalent s	0.1	5.3*10-3	3.0*10-2	2.1*10-2	3.2*10-2

When evaluating **global warming potential** it is evident that almost 54 % the

560 kg CO_2 equivalents (gross) per tonne of siding can be ascribed to production of the cement material and 13 % to the production of cellulose material. The proportion of electrical energy amounts to 21 %. The credit from packaging results from the carbon dioxide bound up in the wooden pallets.

The **ozone depletion potential** is 45 % determined by power generation. Raw material preparation of cement has a proportion of 10 % and the production of cellulose has a proportion of 6 %. In addition to these two groups, packaging also has a significant affect of 23 %. This is mainly caused by the use of LDPE films.

As regards **acidification potential,** raw material preparation with around 62 % and production (20 %) are decisive. The production of cement (45 %) and cellulose (10 %) as well as power generation (19 %) largely contribute to these values.

Eutrophication potential is 71 % for raw material preparation and 13 % for production of the siding product. In terms of raw materials, cement (36 %) and cellulose at 29 % make a contribution, and in terms of production, power generation (12 %) is a prime contributing factor to eutrophication potential.

An evaluation of **summer smog potential (POCP)** shows that, except for coating, all groups have a significant influence on this effect category. Raw material production has a proportion of almost 50 %, production a proportion of 17 %, packaging has 18 % and transport contributes 12 %. The raw materials of cement (33 %) and cellulose (10 %) stand out in particular. Power generation contributes almost 10 %. In terms of packaging, the relevant process is the use of LDPE films.

In almost all the effects categories in question, coating, transport and packaging are of secondary importance.

Literature

/GaBi 4/ **GaBi 4:** Software and database for integrated environmental performance evaluation. IKP, University of Stuttgart and PE Europe GmbH, 2001-2005.