INSULATION MATERIAL NEOPOR

BY

BASF SE

GUP/CE
Ludwigshafen

Documentation.

Case Study undertaken within the PCF Pilot Project Germany

Content

1 Preface

The case study “Insulation material Neopor” that follows was elaborated within the scope of the Product Carbon Footprint (PCF) Pilot Project Germany by BASF SE in association with BASF Eco-Efficiency group. For the PCF Pilot Project, BASF joined nine other companies to pursue, together with the project initiators – WWF Germany, Öko-Institut (Institute for Applied Ecology), the Potsdam Institute for Climate Impact Research (PIK) and THEMA1 – the following project objectives:

1. *Gaining experience*: On the basis of concrete case studies, the project initiators and the participating companies gain experience with the practical application of current methods for determining carbon footprints and examine the efficiency of these methods (ISO[1] standards for life cycle assessment, BSI[2] PAS 2050).
2. *Deriving recommendations:* Based on the findings of the case studies, recommendations are derived for the further development and harmonisation of a transparent, scientifically founded methodology for determining the carbon footprint of products. The pilot project explicitly refrains from developing its own methodology.
3. *Communicating results:* Consumers must be informed of the product carbon footprint in a scientifically sound and comprehensible manner. To this end, the project stakeholders are holding discussions on reliable communication on a sectoral, company and product level to foster climate-conscious purchase decisions and use patterns. The relevance in terms of increasing the climate consciousness of consumer decision making is crucial to these considerations. The pilot project explicitly refrains from developing its own climate-related label since the current methodological conventions are not sufficiently consistent and are still under discussion, meaning that its significance in terms of possible courses of action would therefore be low.
4. *Standardising internationally*: The findings reached and the recommendations derived contribute to a situation in which the PCF Pilot Project Germany actively helps to shape the international debate on the determination and communication of carbon footprints.

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[1] International Organization for Standardization.

[2] The British Standards Institution.

The definitions and uses of the term “product carbon footprint” differ internationally. Within the scope of the PCF Pilot Project Germany, the project stakeholders agreed on the following definition:

“Product carbon footprint describes the sum of greenhouse gas emissions accumulated during the full life cycle of a product (good or service) in a specified application.”

In this context, greenhouse gas emissions are understood as all gaseous materials for which a Global Warming Potential coefficient was defined by the Intergovernmental Panel on Climate Change (IPCC). The life cycle of a product encompasses the whole value chain – from the acquisition and transportation of raw materials and primary products over production and distribution to the use, recycling and disposal of the product. The term “product” is used as a generic term for goods and services.

The project initiators and participating companies regard the international standard for life cycle assessment (ISO 14040 and 14044) as the basic methodological framework for determining a product carbon footprint. Moreover, this standard is the most important foundation of the British PAS 2050 as well as of the above-mentioned dialogue processes of the ISO and the World Business Council for Sustainable Development/World Resources Institute[3]. Therefore, within the scope of the pilot project, ISO 14040/44 constituted an essential basis for the work carried out on methodologies and thereby for the case studies themselves.

Many of the basic methodological conditions of ISO 14040/44 can be applied in the case of the PCF methodology, but several have to be adapted. Some terms of reference of the ISO 14040/44 are loosely formulated, making it necessary to examine whether it is possible to develop less ambiguous terms of reference which have a comprehensive or product group-specific foundation. This would simplify the comparability of different PCF studies. In addition, within the course of the case studies, the significance of PCF compared to other environmental impacts in the product life cycle was analysed in varying detail. From the perspective of the PCF Pilot Project, this analysis is crucial to the securing of decisions and approaches to communication, which are made and developed on the basis of PCF. Furthermore, creating clearer terms of reference constitutes one of the greater methodological challenges in this context, also in respect of international harmonisation and all applications where public communication of the PCF is intended.

Each participating company selected at least one product from its portfolio for which a PCF was determined. In this way, methodological frameworks or rules of interpretation regarding the ISO 14040/44 could be practically tested using a specific case study. In turn, specific methodological issues also emerged from the case studies. The broad spectrum of products selected for the case studies made for a comprehensive discussion. The

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[3] With regard to the WBCSD/WRI process, a final decision has not yet been taken. However, it can be assumed, given the current status of the discussion, that a decision on the ISO 14040/44 will be taken in the coming weeks.

involvement of companies from very different sectors in the PCF Pilot Project was challenging but also fruitful, constituting an essential prerequisite for the development or optimisation of a methodology which could be used as broadly as possible. The case study “Insulation material Neopor” by BASF constituted an important component of the project, on the basis of which – together with the diverse experiences gathered in terms of carbon footprinting – the findings and recommendations were developed according to the project objectives.

The most important results of the pilot project are summarised in a paper entitled “*Product Carbon Footprinting – Ein geeigneter Weg zu klimaverträglichen Produkten und deren Konsum? – Erfahrungen, Erkenntnisse und Empfehlungen aus dem Product Carbon Footprint Pilotprojekt Deutschland* “. This paper, along with much more information on product carbon footprinting and the PCF Pilot Project, can be found at:

www.pcf-projekt.de

The work carried out within the pilot project should not be understood as the final word on the determination and communication of product carbon footprints. Therefore, the project partners are happy to receive intensive feedback from interested stakeholders, also with regard to the case study presented in the following. Based on this feedback and the project findings, the project initiators and partners wish to actively support international debates on the harmonisation of product carbon footprinting by virtue of their findings. Only in this way, with the help of an internationally accepted standard, can PCFs be determined, assessed and reliably communicated in a uniform and comparable fashion.

Ludwigshafen, 26 January 2009

2 Executive Summary

Neopor® is an innovative material for building insulation that can be applied to save heating energy. In the OECD countries the construction business is a very material and energy intensive business. Circa 30 % of all raw materials are used in this area. 30-40 % of all green house gas emissions are caused by the construction, use or disposal of a building. And finally the life cycle of a building causes 25 - 40 % of the total energy demand in the OECD countries especially during the use phase (heating periods) of a building. Such numbers show us clearly that it is very important to identify materials for a GHG reduction potentials in this area.

By this case study it can be shown that the GHG reduction potential of an insulated wall over a use phase of the building of 40 years leads to less GHG emissions than a not insulated wall. In our calculated scenario we have found total emissions of 490 tons for the insulated wall and 755 tons for the not insulated one. It is a reduction of 35 % of GHG gases caused by the wall insulation during the life cycle of a building.

As a quintessence out of this case study, the PCF of this case study has shown that it is very important to calculate all life cycle phases including the use phase to identify the GHG driver for a product. Furthermore it could be shown that in comparison with alternatives options for actions without these materials innovative materials have the potential to save much more GHG gases over the whole product life cycle than it is produced during the product production process.

For further developments, the basis for calculations should be ISO 14040 and 14044 and results and methodological recommendations from the PCF-project. To assess additional environmental factors beside the GHG, the eco-efficiency analysis is a preferred tool. There will be an ISO rule for it in the future.

So an intelligent use of high performance materials can contribute very well to the reduction of the PCF for house heating.

3 Company's Profile

- **Brief introduction to the company**

BASF is the world's leading chemical company – The Chemical Company. With over 95,000 employees, six Verbund sites and close to 400 production sites worldwide we serve customers and partners in almost all countries of the world.

In 2007, BASF posted sales of Euro 58.0 billion and income before special items of approximately Euro 7.6 billion. We help our customers to be more successful through intelligent system solutions and high-quality products. Through new technologies we can tap into additional market opportunities. We conduct our business in accordance with the principles of sustainable development.

BASF is the world's leading chemical company - The Chemical Company. As a reliable partner, we help our customers in almost all industries to be more successful. With high-value products and intelligent solutions, with innovations and new technologies, we open up new market opportunities for ourselves and our customers.

We aim to constantly increase the value of our company by growing profitably. With our products and services, we want to participate in successfully shaping the future of our customers, business partners and employees.

We combine economic success with social responsibility and environmental protection. We make our contribution to finding the answers to global challenges, such as climate protection, energy efficiency, nutrition and mobility. This is our contribution to a better future for us and for coming generations.

	Million €	%
Chemicals	9,358	16
Plastics	9,976	17
Performance Products	8,862	15
Functional Solutions	9,491	16
Agricultural Solutions	3,137	6
Oil & Gas	10,517	18
Other	6,610	12
Total	57,951	100.0

- **Description of importance and state of product related activities on climate change within the Company**

  BASF's innovative and energy-efficient products contribute to climate protection. BASF has long been making successful use of renewable raw materials in numerous processes and constantly researches new possible usages.

  We published a carbon balance in 2008, and were the first company in industry to do so. This balance contrasts the CO2 emission-savings that are achieved with BASF products and procedures with the emissions from raw material extraction, production and product disposal. The results that have also been confirmed by the Öko-Institut in Freiburg (Germany) show that BASF products can save three times more greenhouse gas emissions than the entire amount caused by the production and disposal of all BASF products.

  The carbon balance not only shows emissions from BASF's production, but for the first time also takes into account emissions from raw materials and precursors as well as the disposal of all products. In addition, we have looked at the product lifecycle of 90 key products that reduce CO2 emissions when used in end products.

  "Climate change is one of the main challenges faced by society," said Dr. Ulrich von Deessen, Climate Protection Officer of BASF SE. "We are facing up to this challenge and offering a wide range of solutions that help to protect the climate."

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4 Organisation and Procedures (Company)

- **Organisation of case study and activities within the Company (Set Up, Participation, Procedures)**

  Together with the business unit, the case studies were prepared. The Eco-Efficiency group of BASF (GUP/CE) worked out the studies based on the data of the business unit with the eco-efficiency methodology of BASF. The data were collected often in cooperation with customers and business partners supported by the know-how of the experts of BASF. The activities were accompanied and supported by a defined project team.

- **External partners of the case study**

  No, in some cases customers.

5 Goals and Scope

5.1 Objectives of the Case Study (Company)

- **Documentation of the basic motivation of the company as well as the specific objectives of the chosen case study**

  A better FUTURE – through improved consumer protection, efficient use of resources and reduced carbon dioxide emissions. As a reliable partner, BASF will continue to offer you solutions for today and tomorrow – with the FUTURE already built in. The way the FUTURE should be!

  Neopor is an expanded polystyrene especially developed for building insulation solutions.

  Our eco-efficient products and solutions help customers reduce carbon dioxide emissions, energy resources and cost. So consumers can simultaneously contribute to climate protection on the one hand and save money on the other hand. With reasonable and innovative product solutions a climate protection make sense from different points of view.

5.2 Product Selection and Definition of the Functional Unit

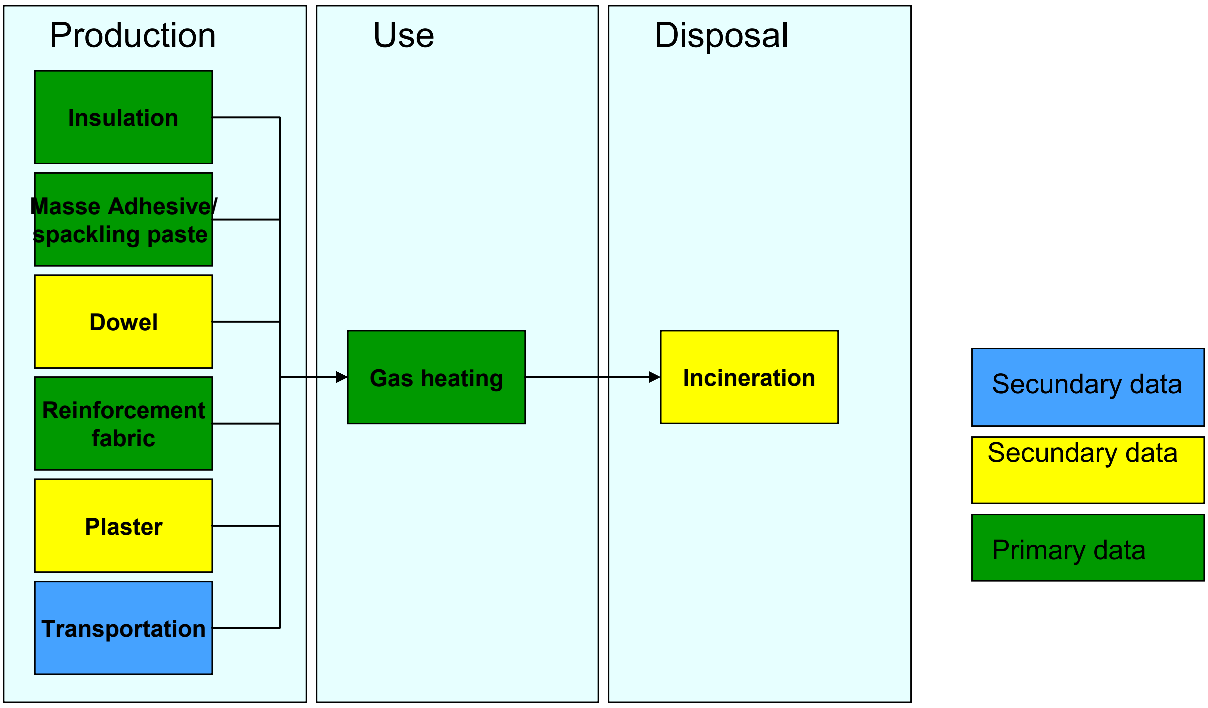
- **Explanation for product selection**

  Neopor: insulation material for buildings to save energy resources and emissions. It helps our customers to participate in climate protection. We have chosen a multifamily house in Middle Europe that has been refurnished by Luwoge. Luwoge calculated for the not insulated house an energy-consumption of 21l/(m2*a) and for a wall insulated house an energy consumption of 13l/(a*m2). In the case of an additional roof and basement insulation the energy consumption is decreased down to one-digit numbers. So we have chosen a very conservative approach for the saving potential by house insulation materials. Gas was chosen as heating source.

- **Definition and explanation of functional unit**
- *Comparison of an insulated house wall (1600 m2) and a not insulated one.*

5.3 System Boundaries

- **Description and explanation of system boundaries**



- **If applicable please describe specifically for:**
  - **Extraction of raw materials**

- **If applicable please describe specifically for:**
    - **Production**

- **If applicable please describe specifically for Capital goods:**

Capital goods have no important impact

5.4 Data Sources and Data Quality

- **Analysis and assessment of the share of primary and secondary Data**
  - **Activity data**
    - **About 80 % are primary data**
  - **Emission factors**
    - **About 80 % are primary data**
  -
- **Assessment concerning:**
  - **Specifity:**
    - **Reporting period** **2008**
    - **Geography** **Europe**
    - **Technology** **Actual house insulation technology**
  - **Accuracy** **> 90 % of relevant data were assessed**
  - **Preciseness** **10 % uncertainty**
  -
  - **Completeness (dealing with data gaps)** **No Major data gaps**
  - **Consistency** **given**
  - **Reproducibility** **given**

- **Referencing the main sources for secondary data**
  - **Activity data** **Boustead database**
  - **Emission factors** **Boustead database**

5.5 Allocation

- **Explanation of the generally used allocation procedures**
  - **Co-production: not relevant**
  - **Emissions from waste: not relevant**
  - **Recycling: not relevant**
  - **Emissions from energy processes**
    - **Combined Heat and Power (CHP) Generation**
  - **Transport: Truck and ship transportation**

5.6 Treatment of particular emission sources

- **Renewable resources: no**
- **Direct and Indirect Land Use Change: no**
- **Aircraft emissions: no**

Only if relevant for the case study under consideration.

6 Inventory and Calculation

- **Specific methodological procedures for the case study (especially regarding data collection [activity data and emission factors], involvement of suppliers)**
- **Presentations of used**
  - **Tools** — **Eco-Efficiency methodology, MS Excel, MS Access**
  - **Software** — **Boustead, SimaPro**
  - **databases for secondary data:** — **Boustead, SimaPro, BASF**

6.1 Extraction of Raw Materials

- **Brief description of the most relevant processes for the extraction of raw materials (incl. transports)**
  Extraction of oil and gas for plastics, energy production and transportation, iron for machines with no relevance.

- **Explanation of main activity data (indication of confidential information)**
  The most important activities are extraction of fuels. The most relevant resources are oil, gas and coal.

- **Important assumptions**

All raw materials (beside biomass, not used in this case study) were assessed with resource factors of the US Geographical survey.

Use phase of a wall insulation:: 40 years

Fuel consumption for a house without insulation: 21 l/(year*m2). This is approximately the fuel consumption of a not isolated house. The fuel consumption of a wall of an isolated house with Neopor concerning only wall insulation: 13 l/(year*m2).

- **Mentioning of main sources for primary and secondary data (activity data, emission factors)**

  Carbon dioxide emissions for raw materials were used from the Boustead database.
- **Depiction of data gaps**

  No data gaps
- **Explanation of System Boundaries and potential cut-off criteria**

  All data were assessed along the whole supply chain with cradle-to-gate approaches. Cut off are materials below 5 % contribution.
- **Allocations**

6.2 Production

- **Brief description of the most relevant production processes**

  The most important activities are the production of the insulation material Neopor and the adhesives/sparkling paste.
- **Explanation of main activity data (indication of confidential information)**

  The most important activities are the production of the Neopor insulation material and the adhesives/sparkling paste.

		Neopor
gedämmte Fassadenfläche		1600 m^2
k Wand		0,31 W/m^2K
WLG (λ)	W/(m*K)	0,032
Dämmdicke	m	0,08
Rohdichte		15,0 kg/m^3
Verschnitt		5%

- **Important assumptions**
- **Mentioning of main source for primary and secondary data (activity data, emission factors)**

Confidential information are the production data of Neopor. The data for adhesives and sparkling paste consist secondary data from Boustead database and primary confidential data from BASF. The confidential data were included from BASF as primary data.

- **Depiction of data gaps**

  No data gaps

- **Explanation of System Boundaries and potential cut-off criteria**

  All data were assessed along the whole supply chain with cradle-to-gate approaches. Cut off are materials below 5 % contribution.

- **Allocations**

6.3 Distribution

- **Brief Description of the most relevant processes for the distribution of the products**
- **Explanation of main activity data (indication of confidential information)**
- **Important assumptions**
- **Mentioning of main source for primary and secondary data (activity data, emission factors)**
- **Depiction of data gaps**
- **Explanation of System Boundaries and potential cut-off criteria**
- **Allocations**

6.4 Shopping Tour

- **Brief Description of the most important scenarios for last-mile transport to the end-use location (i.e. shopping tour)**
- **Explanation of main activity data (indication of confidential information)**
- **Important assumptions**
- **Mentioning of main source for primary and secondary data (activity data, emission factors)**
- **Depiction of data gaps**
- **Explanation of System Boundaries and potential cut-off criteria**
- **Allocations**

6.5 Product Use

- **Brief description of the most relevant processes and potential different scenarios for use phase of the product**

  The most important activity during the use phase is the heating of the house. We have compared the energy consumption of heating a house over 40 years with Neopor insulated walls and without insulated ones.
- **Explanation of main activity data (indication of confidential information)**

  The energy consumption for a house without insulated walls was calculated with 21 l/(m2*year). The alternative scenario for heating a house without insulated walls was calculated with 13 l/(m2*year). Energy source for house heating was gas.

- **Important assumptions**
- **Mentioning of main source for primary and secondary data (activity data, emission factors)**

  A Bousted modul for natural gas use was used to calculate the gas heating.
- **Depiction of data gaps**
- **Explanation of System Boundaries and potential cut-off criteria**
- **Allocations**

6.6 Recycling/Disposal

- **Brief description of the most relevant processes for the recycling/ disposal phase**

  The Neopor was incinerated for disposal.
- **Explanation of main activity data (indication of confidential information)**
- **Important assumptions**
- **Mentioning of main source for primary and secondary data (activity data, emission factors)**

  Primary data was used for the calculation of Neopor incineration.
- **Depiction of data gaps**
- **Explanation of System Boundaries and potential cut-off criteria**
- **Allocations**
- **Presentation and Analysis of Results**

7 Presentation of Results (best guess)

7.1 Overview

- **Overall results**
- **Share of individual life cycle stages and greenhouse gases**

  The GWP emissions of a house without insulated walls are around 54 % higher about the whole life cycle than the emissions of a not insulated one.

GWP balance, Neopor, insulation of 1600 m2 house wall					
GWP balance					
		Production	Use	Disposal	TOTAL
CO2	mg	16140307710	364332265528	3908870283	384381443521
CH4	mg	41845772	4193358119	-3948729	4231255162
Halog. HC's	mg	2760	0	4	2764
N2O	mg	1374705	0	-22063	1352642
GWP (g CO2)		17609224	469166219	3803597	490579039

GWP balance, not insulated house wall of 1600 m2					
GWP balance					
		Production	Use	Disposal	TOTAL
CO2	mg	0	585913017214	0	585913017214
CH4	mg	0	6743687948	0	6743687948
Halog.	mg	0	0	0	0

HC's					
N2O	**mg**	**0**	**0**	**0**	**0**
GWP (g CO2)		**0**	**754505216**	**0**	**754505216**

- **Driver – „Hot Spots“**

  The most important hot spot is the house heating during the use phase.

  The Neopor alternative has strong advantages because of the reduction of the Greenhouse gases of this important life cycle stage.

- **Uncertainties**

7.2 Extraction of Raw Materials

- **Overall footprint**
- **Share of most relevant processes and greenhouse gases**
- **Driver – „Hot Spots“**
- **Uncertainties**

7.3 Production

- **Overall footprint**

The GWP of the production phase is 17,6 tons.

- **Share of most relevant processes and greenhouse gases**
- **Driver – „Hot Spots“**

  The GWP drivers in this process are the production of the Neopor insulation material, followed by the production of the adhesives/sparkling paste.

- **Uncertainties**

7.4 Distribution

- **Overall footprint**
- **Share of most relevant processes and greenhouse gases**
- **Driver – „Hot Spots“**
- **Uncertainties**

7.5 Shopping Tour

- **Overall footprint**
- **Driver – „Hot Spots“**
- **Uncertainties**

7.6 Product Use

- **Overall footprint**
  The GWP of a house without insulated walls over 40 years is 755 tons, the GWP of a house with insulated walls over the same time is 490 tons, 35 % less GWP. Comparing these numbers during the use phase and the GWP of the production phase you can see that the part of the productions phase contains less than 5 % of the total GWP.
- **Driver – „Hot Spots“**
  The GWP driver during the use phase is the house heating by gas.
- **Uncertainties**

7.7 Disposal/Recycling

- **Overall footprint**
  The GWP of the incineration of the insulation material is around 3,8 tons.
- **Share of most relevant processes and greenhouse gases**
- **Driver – „Hot Spots“**
- **Uncertainties**

8 Assessment of the Results

8.1 Sensitivity Analysis

- **Scenarios in each life-cycle stage**

8.2 Uncertainty and Error Analysis (optional)

8.3 Handling of other Environmental Impact Categories

8.3.1 Analysis of other Environmental Impact Categories

8.3.2 Multicriterial Assessment (if relevant)

The Eco-Efficiency Analysis of BASF is seen as a life-cycle management tool and can be involved in assessments of the entire product life cycle, from concept development, to design and implementation, further to marketing, and finally, end-of-life issues. The analysis method may incorporate both economic and environmental aspects and lead to a comprehensive evaluation of products and processes over their entire life cycle.

In the method of Eco-Efficiency Analysis results are presented as aggregated information on costs and environmental impact and show the strengths and weaknesses of a particular product or process. The ecological calculations of the single results in each category are following the ISO-rules 14040 and 14044.

For the calculation and comparison of the environmental position of each alternative, data from the different production methods are assimilated and analysed to provide a value for

energy consumption,

raw-material consumption,

emissions, (The Greenhouse gases are a part of this category)

use of area,

risk potential and

toxicity potential.

All raw-materials required in the process and how these are derived, are factored into the study, as are the steps required to bring the product to the end-user.

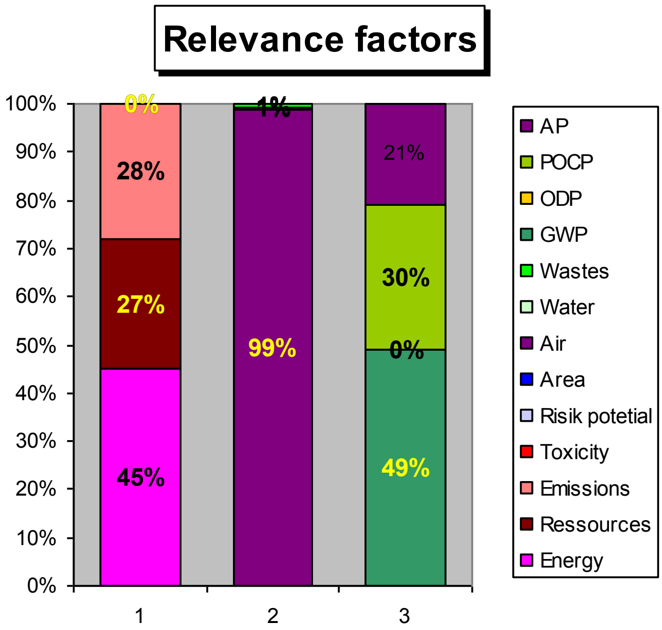
In the same manner economical data from the life-cycle chain of a product application or process evaluation, may also be calculated and summarized. At the end, this analysis can lead to better decisions with regard to product design, material utilization, and capital investment. The rationale behind this assessment tool has been described by Saling et al. (2002) and by Landsiedel and Saling (2002).

The values obtained in the material balance and impact estimate (greenhouse potential, ozone depletion potential, photochemical ozone formation potential, acidification potential, water emissions, solid waste, energy consumption, raw material consumption and area requirement) are aggregated with weighting factors to yield an overall environmental impact value. The weighting factors consist of the following:

- a *societal factor:*
  What value does society attach to the reduction of the individual potentials?
- a r*elevance factor*:
  What is the fractional contribution of the specific emission (or consumption) to the overall countrywide emissions?

In this case study, the eco-efficiency study was also used for the evaluation of the relevance of different environmental numbers compared to the numbers for the Greenhouse gases.

In this case study just the energy and resource consumption and the emissions (air, water and waste) have been judged. The highest impact after the eco-efficiency of BASF has the energy consumption, followed by the resource consumption and the emissions. In the class of emissions, air emissions are the most relevant category and herein the GWP is the most important environmental factor.



9 Interpretation and Perspectives (Company)

9.1 Challenges of the Case Study

9.2 Identification and Assessment for Further Reduction Options of the PCF

9.3 Measures under Consideration to Further Reduce the PCF

The most impact on the GWP has the use phase. It is possible to reduce the GWP of house heating during the use phase by around 40 % by insulation of the house walls. The additional GWP for the production of the insulation material has a part of less than 5 % compared to the total GWP of the calculated scenario. So the behaviour of the end-user is very important for the reduction potential of GWP.

9.4 Product Carbon Footprinting at [Name of the Company] in the Future (optional)

- **Put PCF in the wider company sustainability strategy (with a special focus on climate change)**

BASF will stick to the eco.-efficiency model which shows much more detailed information and which allows to support decision-making processes very well due to the evaluation of sustainability of products. Nevertheless, a Carbon Footprint can be out of this life cycle evaluation a helpful information for the awareness of Carbon dioxide along the supply chain and the opportunities of the reduction of it among other ecological criteria.

10 Recommendations (Company + Service)

10.1 International Methods for Calculation and Assessment of Product Carbon Footprints

Basis: ISO 14040 and 14044, results and methodological recommendations from the PCF-project. To assess additional environmental factors, the eco-efficiency analysis is a preferred tool. There will be an ISO rule for it in the future.

10.2 Proposals for Product Specific Definitions and Rules (EPD, PCR)

PCF case studies like this one for Neopor can be used for the definition of PCR. It was shown a range of CO2-e that can be obtained for these materials and where the main environmental contributions along the whole supply chain are. All the data sets together can be used for the definition of a PCR as well as showing the best available technology.

10.3 Reporting, Communication and Claims of Reductions to Customers and Consumers

11 References

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12 Annex

12.1 Documentation of the Data

12.1.1 Extraction of Raw Materials

					Data index			
Data Module (Output)	**Processes covered**	**Time related coverage**	**Geographical specificity**	**Technological specificity**	**Place of reference: in-house (I), literature (L), other (O and specify)**	**Single value (S); aggregated value (A) and specify the percentage or absolute amount of each part**	**Measured (M); calculated (C); estimated (E)**	**Data source**
Examples								

12.1.2 Production

					Data index			
Data Module (Output)	**Processes covered**	**Time related coverage**	**Geographical specificity**	**Technological specificity**	**Place of reference: in-house (I),**	**Single value (S); aggregated**	**Measured (M); calculated**	**Data source**

					literature (L), other (O and specify)	value (A) and specify the percentage or absolute amount of each part	(C); estimated (E)	
Examples								
Neopor	Production of insulation material	2008	Germany	Average BASF production process	I	S	M	BASF 2008
Adhesive/sparkling paste		2008	Germany	Average production process	L	A	E	BASF 2008
Dowel		1996	Germany	Average process	I, L	S, A	C	Bousted 1996, BASF 1996
Reinforcement fabric		2008	Germany	Average process	I, L	S, A	E	BASF 2008
Plaster		2008	Germany	Average process	I, L	S, A	E	BASF 2008
Road transportation		1996	Great Britain		L	S	C	Boustead

12.1.3 Distribution

					Data index			
Data Module (Output)	**Processes covered**	**Time related coverage**	**Geographical specificity**	**Technological specificity**	**Place of reference: in-house (I), literature (L), other (O and specify)**	**Single value (S); aggregated value (A) and specify the percentage or absolute amount of each part**	**Measured (M); calculated (C); estimated (E)**	**Data source**
Examples								

12.1.4 Product Use

					Data index			
Data Module (Output)	**Processes covered**	**Time related coverage**	**Geographical specificity**	**Technological specificity**	**Place of reference: in-house (I), literature (L), other (O and specify)**	**Single value (S); aggregated value (A) and specify the percentage or**	**Measured (M); calculated (C); estimated (E)**	**Data source**

						absolute amount of each part		
Examples								
Gas use for house heating without wall insulation	Heating by gas over 40 years, 21 l/(m2*year)	2008	Germany	K (wall) = 0,31 W/(m2*K), Insulation thickness = 0,08 m, density = 15 kg/m3	I	S	M	Luwoge Consult
Gas use for house heating with wall insulation	Heating by gas over 40 years, 13 l/(m2*year)	2008	Germany		I	S	M	Luwoge Consult
Natural Gas use		1996	Germany		L	S	C	Boustead

12.1.5 Disposal/Recycling

					Data index			
Data Module	Processes	Time related	Geographical	Technological	Place of	Single value	Measured	Data source

(Output)	covered	coverage	specificity	specificity	reference: in-house (I), literature (L), other (O and specify)	(S); aggregated value (A) and specify the percentage or absolute amount of each part	(M); calculated (C); estimated (E)	
Examples								
Incineration of polystyrene	Incineration of polystyrene		Germany		L	S	C	BUWAL 1998