PCF PILOTPROJEKT DEUTSCHLAND

CASE STUDY PERSIL MEGAPERLS BY HENKEL AG & CO. KGAA

Documentation

Case Study undertaken within the PCF Pilot Project Germany

Content

1 Preface

The case study PERSIL MEGAPERLS that follows was elaborated within the scope of the Product Carbon Footprint (PCF) Pilot Project Germany by the Henkel AG & Co. KGaA. For the PCF Pilot Project, Henkel 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 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.

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.”

---

[1] International Organization for Standardization.

[2] The British Standards Institution.

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 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 Persil Megaperls by Henkel 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 summarized in a paper entitled

---

[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.

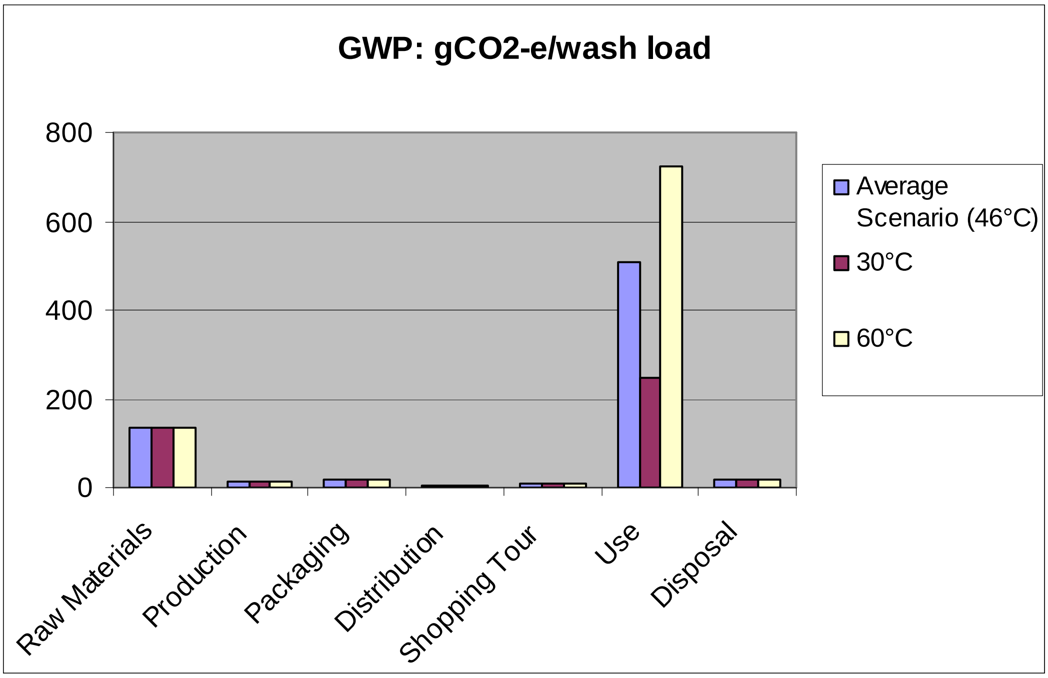
"*Product Carbon Footprinting – Ein geeigneter Weg zu klimaverträglichen Produkten und deren Konsum? – Erfahrungen, Erkenntnisse und Empfehlungen aus dem Product Carbon Footprint Pilotprojekt Deutschland* ". This paper, along with much more information on product carbon footprinting and the PCF Pilot 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.

Düsseldorf, January, 26 2009

2 Executive Summary

The calculation of the Product Carbon Footprint within the German pilot project confirmed the results of former life cycle assessments carried out by Henkel. The results of this case study clearly show that the use phase has the most significant impact on the total greenhouse gas emissions. During the use phase, the decisive parameters are time and temperature of the washing programme as well as the energy efficiency of the washing machine. The production and transport of raw materials represents the second most important lifecycle phase, even though emissions are significantly lower than the ones during the use phase. Raw materials of small volume such as enzymes contribute disproportionately high to the greenhouse gas emission during that phase. However, without these ingredients ever lower washing temperatures would not be possible.



Given the importance of the washing temperature for the use phase and therefore the reduction of the overall carbon footprint, the reduction of the washing temperature should be in the focus of further product improvements as well as communication measures. Still, one must consider that washing and cleaning activities are only responsible for 3% of the overall energy use in the household.

3 Company's Profile

For more than 130 years, Henkel has been a leader with brands and technologies that make people's lives easier, better and more beautiful. Henkel operates in three business areas – Home Care, Personal Care, and Adhesive Technologies – and ranks among the Fortune Global 500 companies. In fiscal 2007, Henkel generated sales of 13,074 million euros and operating profit of 1,344 million euros. Our more than 55,000 employees worldwide are dedicated to fulfilling our corporate claim, "A Brand like a Friend," and ensuring that people in more than 125 countries can trust in brands and technologies from Henkel.

Henkel considers climate change as a complex environmental issue and one of the global challenges of our time. As part of our commitment to sustainability, we take the reduction of our worldwide greenhouse gas emissions very seriously.

In addition to optimizing our own production processes, we focus on creating products and technologies that can be applied in an energy-saving manner by our customers and consumers. Through our activities we contribute to the more efficient utilization of energy resources worldwide and hence to climate protection.

At the same time, we try to influence the behavior of customers and consumers through targeted communication. Involving consumers in the debate on climate change will be crucial if we are to achieve substantial progress with regard to climate protection.

Sustainable development needs a systematic approach. As early as the 1990s Henkel started to carry out life cycle assessments. To enable us to assume responsibility as comprehensively as possible, our experts analyze and evaluate our products "from the cradle to the grave," with the aim of further improving safety and environmental compatibility in all phases of the product life cycle. Improvement measures should be applied, in particular, at the points where the consequences for the environment are especially relevant and improvements can be realized efficiently.

4 Organisation and Procedures

The detergent case study was carried out by Henkel's experts for life cycle assessments in close cooperation with the experts in our research and development department, in the production and the packaging development department.

5 Goals and Scope

5.1 Objectives of the Case Study

As importance of communicating information on carbon dioxide emissions and intensity along value chains is increasing while there is no standardized and broadly accepted methodology for product carbon footprinting, we are participating in the German PCF pilot project.

In order to promote and contribute to the development of a scientifically sound and robust methodology for measuring carbon footprints, Henkel will bring to the discussion years of experience in the evaluation and optimization of products and processes, e.g. based on life-cycle-assessments. The calculation of a carbon footprint based on the methodology outlined in the PAS 2050 is also a good opportunity to test the PAS 2050 in practice. Thereby we aim to contribute to the further development of the methodology by feeding our results back into the international discussion and standardization process.

We will furthermore use our experience in B2B and B2C communications to develop sensible tools to convey PCF results to our customers and consumers and to enable them to consider climate-friendly options when purchasing and using our products.

Within the pilot projects, the four executing organizations as well as the participating companies offer a unique opportunity to jointly work on a robust methodology and suitable communication concepts. By participating in the project, we aim to contribute to the international harmonization of the PCF methodology and the enhancement of communication tools.

This case study was chosen in particular to gain further knowledge and deeper insight on the carbon footprint of our detergents. Furthermore, the objective was to create transparency of the GHG-emissions along the value chain and to find potential leverages for process optimizations and product improvement.

5.2 Product Selection and Definition of the Functional Unit

The detergent segment is the most important product category of Henkel’s Laundry and Home Care business unit. A well-known brand like Persil serves as a good example for many other detergents which represent a considerable part of our consumer goods business. Furthermore, the Persil Megaperls case study is of particular interest for Henkel because it addresses the importance of the use phase for the calculation of the Product Carbon Footprint.

The functional unit is one wash load with Persil Megaperls.

5.3 System Boundaries

The study takes a comprehensive “cradle to grave” approach, considering all phases of a product’s lifecycle. Our approach includes the evaluation of all material and energy consumption.

The lifecycle phases in detail are:

- Production and transport of raw materials
- Production of the Persil Megaperls
- Packaging
- Distribution of the finished product to the point of sale
- Shopping tour of the end consumer
- Use of the product in different scenarios, an average washing temperature scenario (46°C) , a low washing temperature scenario (30°C) as well as a scenario with a high washing temperature (60°C).
- Disposal of the product packaging as well as treatment of the domestic waste water caused by the use of the product

A general material flow diagram including an indication of the system boundaries is shown below in figure 1 below.

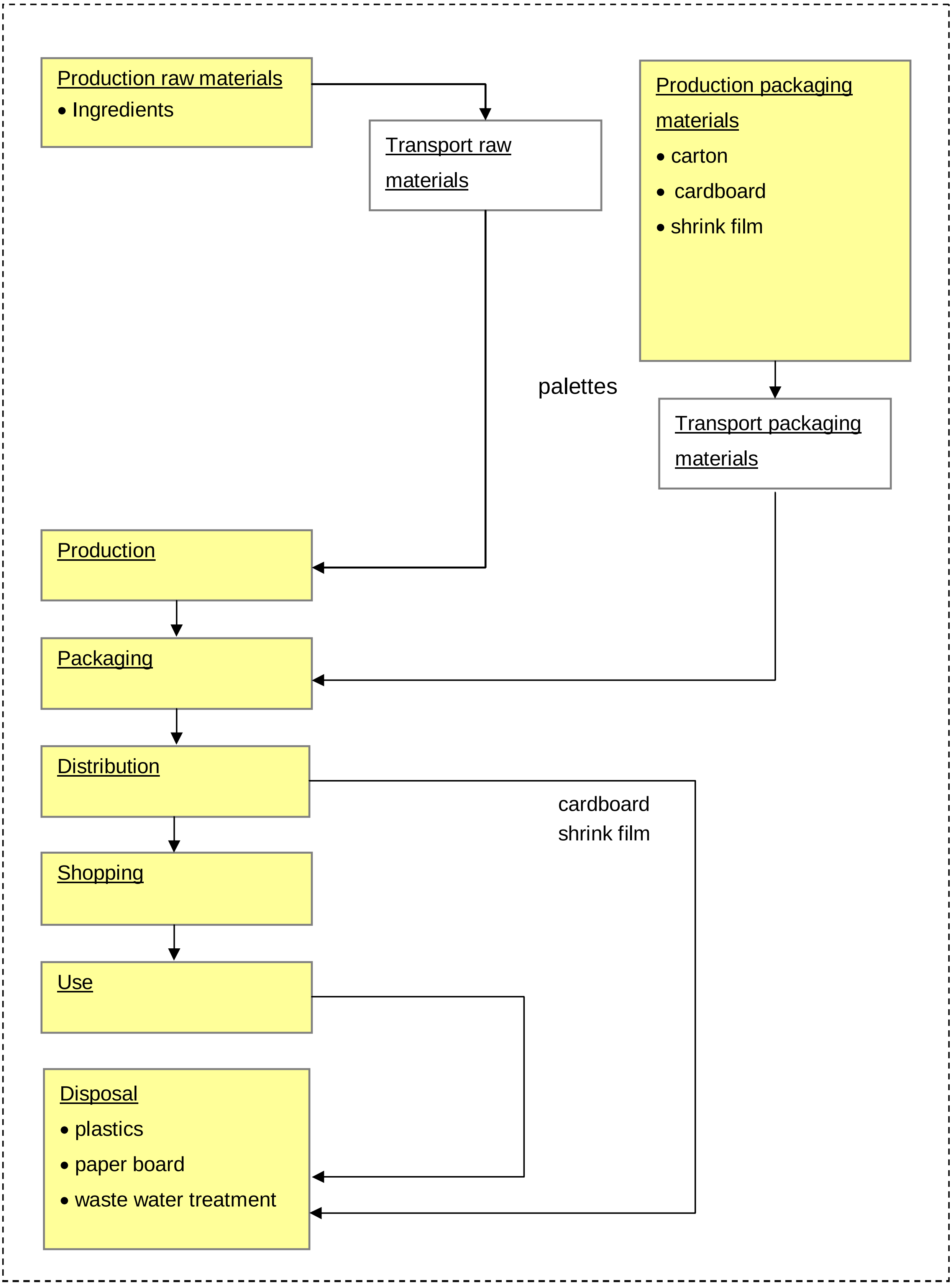


Fig.1: Material flows within the system boundaries

5.4 Data Sources and Data Quality

Whenever possible, primary data was used for the calculation. However, for the most part that kind of data is accessible only on a rather limited scale and processing is cumbersome and time-consuming.

As a matter of fact, most of the data used is of secondary origin. Primary data could be applied for the calculation of some of the ingredients of the detergent. Concerning the amounts of energy and water consumed during the production process of the detergent we could refer to the primary data reflecting the real situation at our production plant.

All necessary secondary data was taken from the “Ecoinvent database ver. 2.01”.

In some cases, for very small ingredients (> 1%) generic “Ecoinvent” data (“chemicals organic / anorganic) was used.

The study focuses on Germany as a regional scenario.

5.5 Allocation

In general, the allocation was done according to the mass content.

For lack of data, we have not considered any recycling of e.g. packaging materials.

6 Inventory and Calculation

The material flow network was set up with the software tool “Umberto ver. 5.5”. We applied the database “ecoinvent ver. 2.01” as source for secondary data and evaluation methods.

6.1 Extraction of Raw Materials

The “raw materials” phase covers all necessary raw materials of the detergent and, as far as possible, all downstream activities related to their production and their transportation to the Henkel production facility.

The detergent contains several complex surfactant mixtures, which basically descend from palm kernel and coconut oil as well as petrochemical material. Processes involved in the production of these surfactants are among others sulfation/sulfonation and ethoxylation.

To a minor extend there are also organic acids, herb extracts and perfumes contained.

If available, primary date was used for the calculation. For of the marjority of the raw materials, however, we retrieved the data from the “ecoinvent database”.

With respect to the primary and secondary packaging materials we also worked with data from the “ecoinvent” database. The primary packaging consists of paper carton. For secondary packaging, shrink film and corrugated paper board is used. Shipping units typically are stacked on wooden EUR flat palettes. Our suppliers informed us about the basic production technology for the packaging parts. Data for those materials themselves and for their manufacturing processes were taken from the “ecoinvent” database.

6.2 Production

The main technologies applied during the production of the detergent are spray drying and extrusion.

For the production process, electricity, natural gas, and water are required. All data used for the calculation are primary data directly obtained from our production plant. Regarding electricity and steam generation we could also use the data from our own power station.

After the filling process, product boxes are aggregated to so-called shipping units with shrink film and paper board and palletized on a EUR flat palette. The detergent is then ready to be distributed.

6.3 Distribution

The detergent is distributed from the production site to seven different regional warehouses. Two thirds are transported by train and one third by lorry. An average distance of 300 km was assumed for the calculation. From the warehouses to the retailers, transport is accomplished then by lorry at an average distance of 80 km (mean value of all transports).

We have assumed that the truck fleet on average is in compliance with the EUR 4 standard.

The data applied for the calculation is taken from the “ecoinvent” database without any modification. For lack of data, the energy consumption of the storage facilities was not taken into account.

We have further assumed that all packaging material is 100% incinerated and palettes are completely recycled.

6.4 Shopping Tour

The standard scenario defined by the pilot project was used to calculate the shopping tour.

6.5 Product Use

For the use phase, different scenarios were calculated. The average scenario assumed an average washing temperature of 46°C and an electric energy demand of 0,68 kWh per wash load (mean values for Germany). Additionally a scenario with a washing temperature of 30°C as well as one scenario with a washing temperature of 60°C was calculated.

As a by-product of the use phase, domestic waste water and solid waste which consists of the primary packaging materials are generated.

6.6 Recycling/Disposal

The disposed materials (primary packaging) are assumed to be incinerated in a municipal waste incineration plant. We have calculated a GWP credit based on the generated electricity by applying the emission factors from electricity mix, Germany as it is provided by ecoinvent.

We assume the waste water to be similar to typical domestic waste water since there are no exceptional substances or amounts of substances contained within. We therefore calculated the treatment of domestic waste water in a municipal waste water treatment plant.

7 Presentation of Results (best guess)

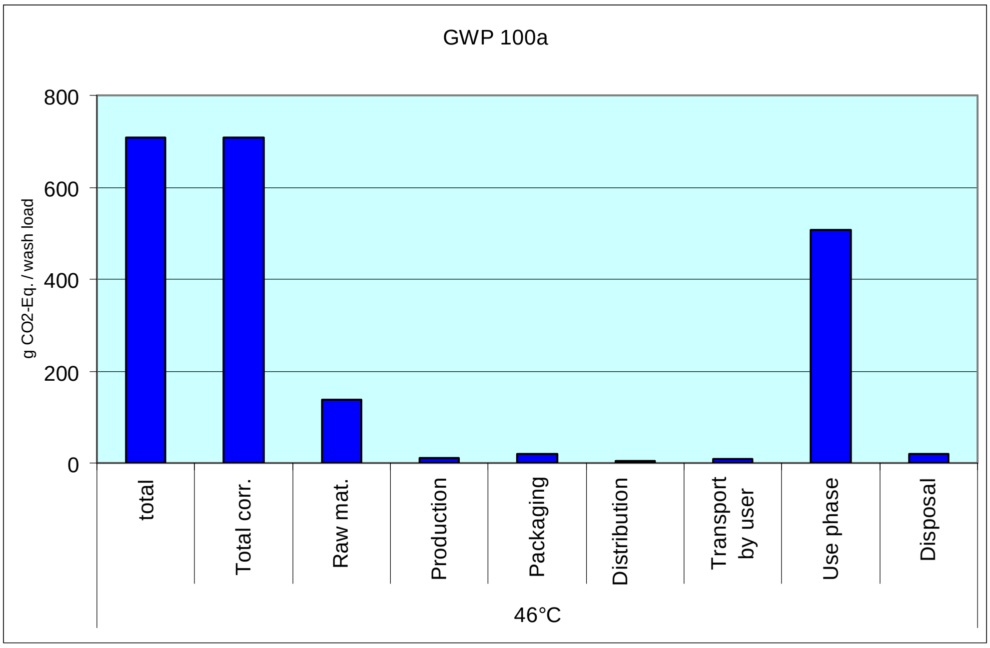
7.1 Overview

The Global Warming Potential (GWP) caused by running one wash load (wl) of domestic clothes amounts to approximately 700 g CO_2-Eq. This data includes all life cycle stages from the extraction of raw materials to the disposal of packaging material and treatment of the waste water.

The following table and diagram show the GWP of the different lifecycle stages.

The figure "Total corr." includes the credit of electricity produced by the incineration of packaging material which, however, is insignificant in the present case (< 0.5 g CO2-Eq./wl).

Life Cycle Stage	Share of greenhouse gas emissions [%]
Total	100.0
Total corr.	100.0
Raw Materials	< 20
Production	~ 10
Packaging	
Distribution	
Shopping	
Disposal	
Use	> 70



The main driver for the GWP and therefore the phase with the most significant impact on the overall carbon footprint is the use phase followed by the production and transport of the raw material.

7.2 Extraction of Raw Materials

Beside the use phase, the extraction and supply of the raw materials are the second largest emission source of greenhouse gases. Five out of 21 raw materials are responsible for more than 70 % of the GWP. However, these raw materials, for example enzymes, enable the use of the detergent at low washing temperature and are therefore the most important leverage for a significant reduction of the greenhouse gas emissions during the use phase.

7.3 Production

Only less than two percent of the overall GWP is caused by the production of the detergent. The figures of the production process are cumulated, since date for single production steps are not available.

7.4 Packaging

The figure of packaging covers the data for the primary, secondary and tertiary packaging. The pallets are recycled and influence only the distribution step.

7.5 Distribution

One-third of the products are distributed by lorry, two-thirds by train to seven distribution centers. The distribution by lorry is responsible for about 60 % of the GWP. About 13 % is caused by rail transport and the other 27 % are caused by the transport of the product to the retailer.

7.6 Shopping Tour

The shopping tour only accounts for 1.3% of the total carbon footprint. Though this figure is very low, it is almost three times higher than the greenhouse gas emissions of the distribution phase.

7.7 Product Use

Given that the use phase is the phase with the highest energy demand in the entire life cycle, it is therefore also the most important emitter of Greenhouse Gases.

7.8 Disposal/Recycling

The disposal covers the wastewater treatment and the incineration of the packaging materials. The wastewater treatment is with about 99 % of the greenhouse gas emissions the most significant step in this life cycle phase. Incineration plants produce electricity. The amount of electricity relating to the part of packaging based on one wash load causes a credit of less than 0.5 g CO_2-Eq, which however can be neglected for the total carbon footprint.

For lack of data, no recycling processes are included.

8 Assessment of the Results

8.1 Sensitivity Analysis

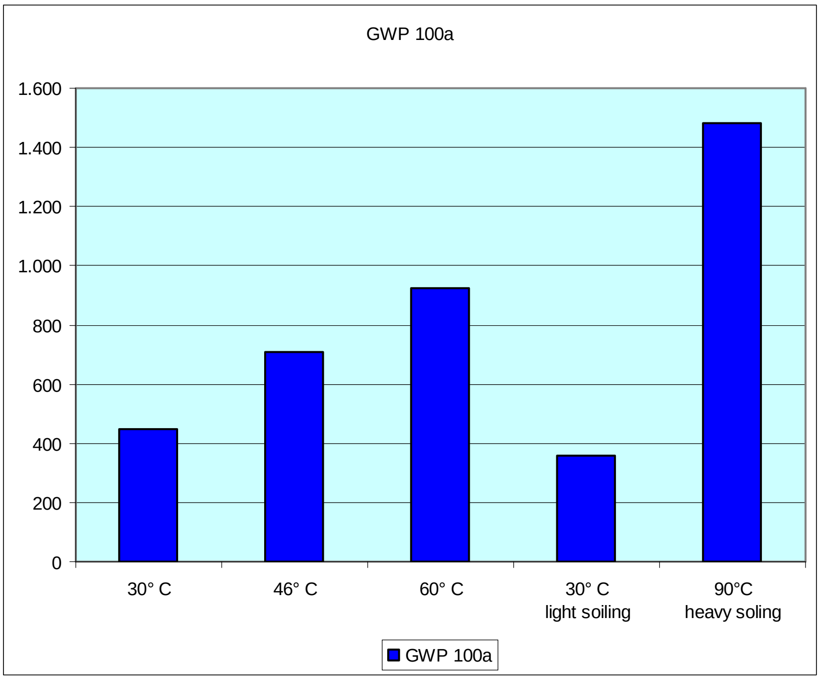
To evaluate the influence of the washing temperature two additional scenarios were calculated. Beside the above mentioned calculations with the average temperature of 46°C, scenarios with 30°C and 60°C have been calculated.

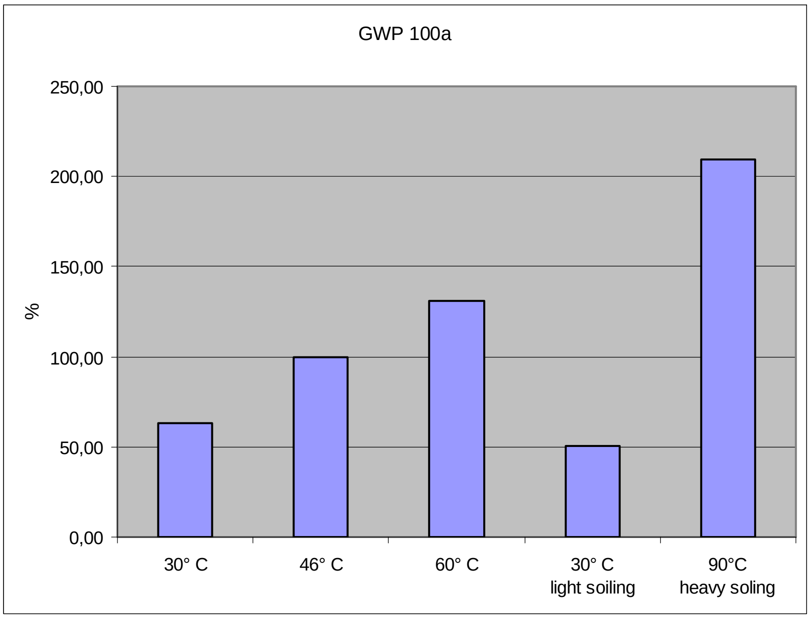
Furthermore, the influence of the dosage is interesting. Because the dosage is directly influenced by the degree of soiling, two border cases have been calculated.

The first one uses the dosage for light soiling, 35 g and a temperature of 30° C, the second the heavy soiling scenario with 116 g detergent and 90° C. The data in comparison with the other three scenarios are listed in the following table.

	30° C	46° C	60° C	30° C light soiling	90°C heavy soiling
g CO_2-Eq. / Wash load	~ 450	~ 700	~ 930	~ 360	~ 1480
% (Average Temp. = 100 %)	63	100	130	51	209

The differences can also be seen in the diagrams below.

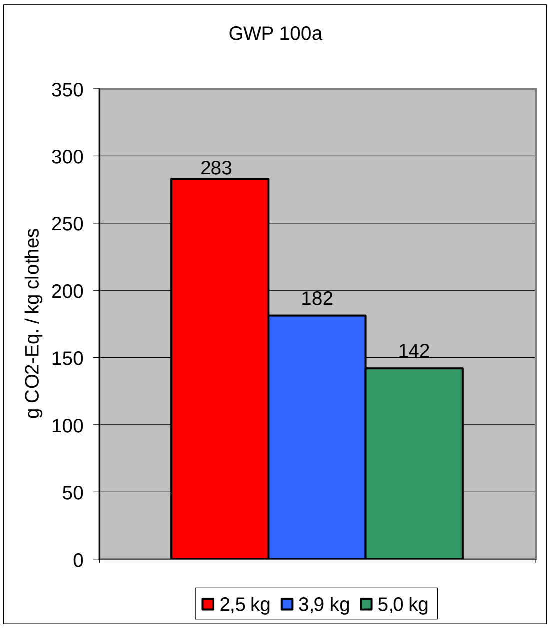


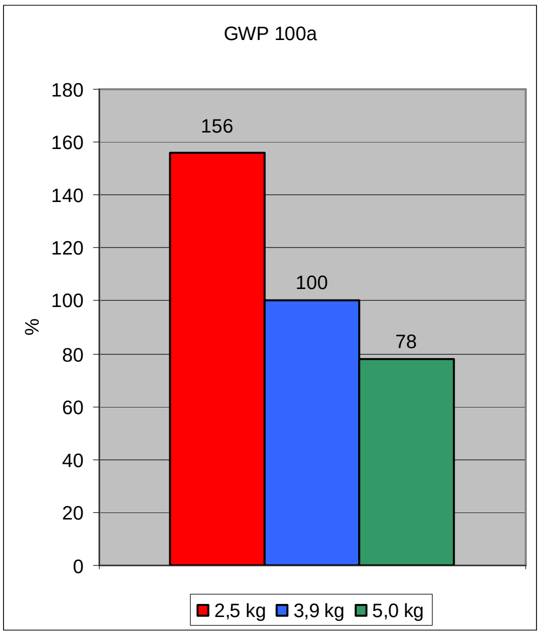


The previously described data are based on the functional unit of one wash load. To evaluate the influence of the amount of clothes washed, the functional unit has to be changed in 1 kg clothes.

The table shows the GWP per kg clothes 2.5 kg and 5.0 kg in comparison to the average load of 3.9 kg.

	2.5 kg	3.9 kg	5.0 kg
g CO_2-Eq. / kg clothes	~ 280	~ 180	~ 140
% (Average Load = 100 %)	156	100	78





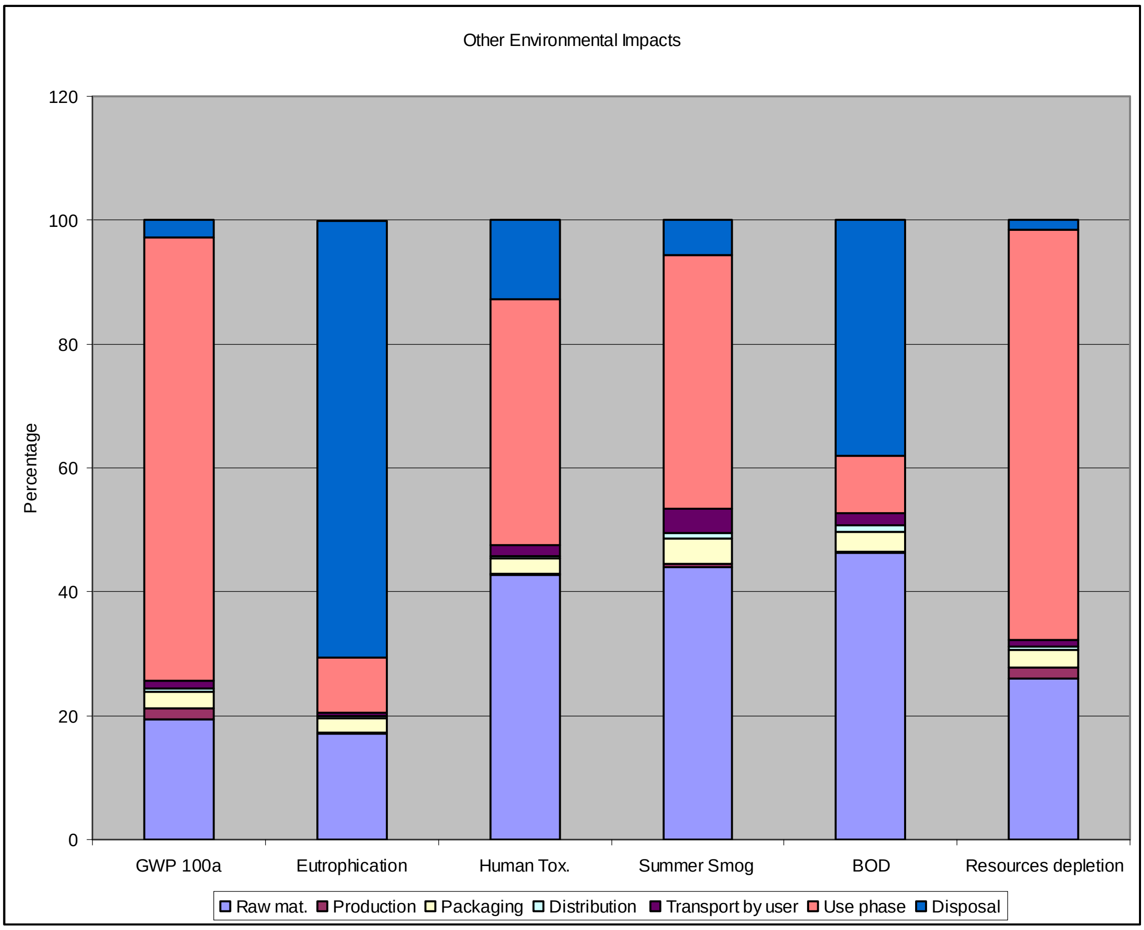
8.2 Handling of other Environmental Impact Categories

Although the global warming potential is the most popular environmental impact category, other burdens should also be taken into account. As shown in the table below, the contribution of each life cycle step to the total global warming potential varies for the different categories.

Percentage of Life Cycle Steps of Different Impacts

	Indicator	Raw mat.	Production	Packaging	Distribution	Transport by user	Use phase	Disposal
GWP 100a	kg CO_2-Eq	19,5	1,7	2,7	0,5	1,3	71,6	2,7
Eutrophication	kg PO_4-Eq.	17,1	0,2	2,2	0,4	0,5	8,9	70,5
Human Tox.	kg 1.4-DCB	42,7	0,3	2,4	0,3	1,9	39,6	12,8
Summer Smog	kg ethylene	43,9	0,5	4,2	0,8	3,9	41,0	5,6
BOD	kg	46,3	0,1	3,3	1,1	2,0	9,1	38,1
Resources depelation	kg antimon	26,0	1,8	2,9	0,5	1,1	66,2	1,6

The results are also visible in the following diagram.



9 Interpretation and Perspectives

As stated earlier, the results of the case study clearly show that the highest environmental impact is caused by the use phase. This holds also true for the global warming potential and thus the product carbon footprint. Still, one must consider that washing and cleaning activities are only responsible for 3% of the overall energy use in the household.

The energy demand of the washing machine has the most significant impact on the GWP of the system of washing clothes. Also in other relevant categories such as Human Toxicity, Summer Smog and Resources depletion, the use phase is the life cycle step with the highest contribution to the total number. On the categories eutrophication and BOD the use phase has not such an important influence. Within these categories, the waste water treatment is the dominant life cycle phase.

Nevertheless, to reduce the environmental impact the most effective measure is to reduce the washing temperature.

9.2 Challenges of the Case Study

In the course of the study it turned out that very often primary data are quite difficult to get. The availability depends on the (LCA) know-how along the whole supply chain. Typically suppliers don‘t have the opportunity to convert their original data into non critical data with no confidentiality concern e.g. by aggregation. They don’t share any original data e.g. energy data with us because they treat these data as confidential.

The outcome of a study therefore depends very much on the content and quality of commercially available databases like ecoinvent.

Logistics processes are difficult to assess due to complex business structures involving contractors and their sub-contractors as well. There is virtually no tracking in place in order to capture e.g. really driven distances instead of theoretical ranges. Further on there is nearly no information about vehicle fleet and whether or not the vehicles comply with certain EUR standards regarding emissions to air.

Such a study is extremely time and resource consuming. It seems to be not feasible to make such an effort for every product a company might have. Especially for smaller companies this is not possible.

9.3 Identification and Assessment for Further Reduction Options of the PCF

The outcome of this study indicates that the most important lifecycle stages with respect to the carbon footprint can hardly be influenced by the manufacturer of the detergent.

With respect to this finding the results should be considered as an opportunity to communicate to the customer the consequences of his own behaviour and decisions.

9.4 Measures under Consideration to Further Reduce the PCF

As a manufacturer of non-durable consumer products and industrial products and technologies our operations are not particularly energy and greenhouse gas intensive. Energy consumption and the associated carbon dioxide emissions during the use of our products are usually more significant. We therefore focus on creating energy efficient products and technologies while also optimizing our own production processes. This includes a continuous improvement also of our logistics together with business partners. We also evaluate relevant raw materials with regard to their cleaning performance and thus their influence on the Carbon Footprint of our detergents.

Furthermore, we set ourselves the company-wide target to reduce energy consumption and thus the related greenhouse gas emissions by 15 % in 2012 compared to a 2007 baseline.

10 Recommendations

10.1 International Methods for Calculation and Assessment of Product Carbon Footprints

If it really comes to comparisons of similar products in terms of their carbon footprint the existing standards are not sufficient. Even though the existing standards like ISO 14040ff also taken a lifecycle approach, they offer to much latitude and need for interpretation and assumptions. An international standard addressing the most important issues supplemented with product category rules is therefore required.

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

Due to the importance of the use phase in case of a detergent a framework of conditions (PCR) is required in order to specify this important lifecycle stage. Without a product category rule the comparison of carbon footprints of different detergents is not possible.

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

Climate change is a complex environmental issue and one of the major challenges of our time. As part of our commitment to sustainability, we focus on reducing the impact of our operations on climate change (Henkel Focal Area: “Energy & Climate”).

Involving consumers in the debate on climate change will be crucial if we are to achieve substantial progress with regard to climate protection, considering the important impact of the use phase on the overall Carbon Footprint.

However, looking at the product carbon labeling schemes currently presented in the market, we notice considerable short-comings regarding informative value, methodological background, transparency and meaningfulness.

To avoid consumer confusion, market distortion and extensive transaction costs, an internationally consolidated, scientifically robust methodology for PCF calculation and a meaningful approach to communicate PCF results will be necessary.

Overall, we consider product-related communication on climate change as useful <u>only if</u> it provides reliable guidance for customers and consumers to make sensible purchasing decisions and is a meaningful tool to drive more sustainable consumption.

References

Guinée J B, et al., 2001, Lifecycle assessments, An operational guide to the ISO standards, Part 1,2 and 3, Ministry of housing, spatial planning and environment (VROM) and Center of environmental science (CML), retrieved from: http://www.leidenuniv.nl/cml/ssp/index.htm

Römpp Lexikon Chemie, Online Ausgabe, Version 3.3., Georg Thieme Verlag KG

Ullmanns Encyclopedia of industrial chemistry, online edition, Copyright© 2008 by John Wiley & Sons, Inc.