PCF PILOTPROJEKT DEUTSCHLAND

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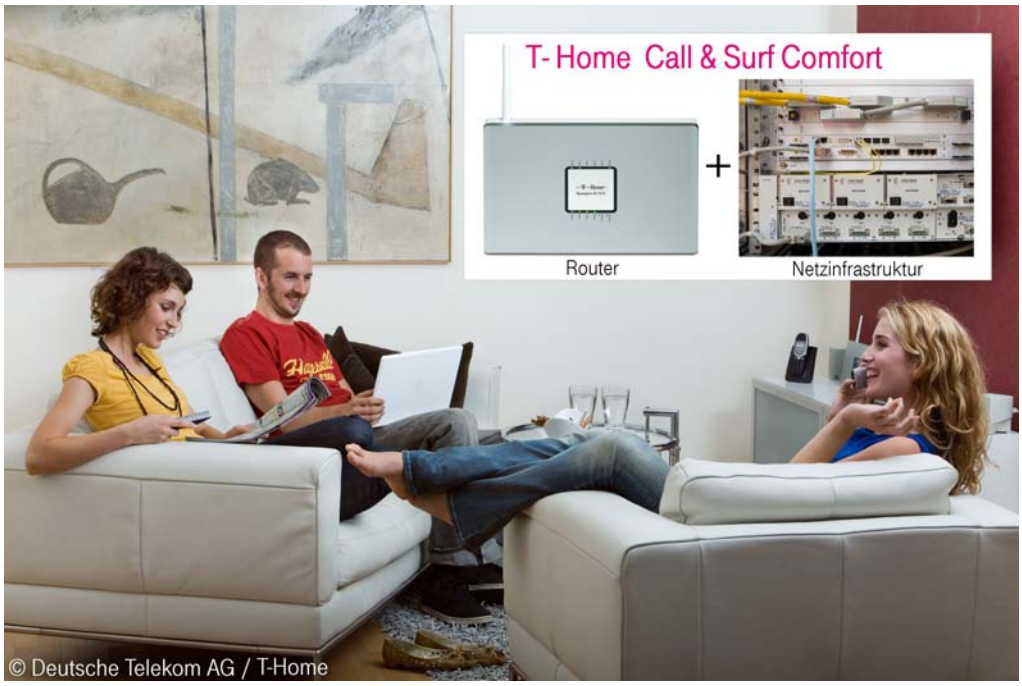
T-HOME

CASE STUDY “CALL & SURF COMFORT”



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1 Preface

The case study "Call & Surf comfort" that follows was elaborated within the scope of the Product Carbon Footprint (PCF) Pilot Project Germany by T-Home in association with Öko-Institut Freiburg. For the PCF Pilot Project, T-Home 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.

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:

[1] International Organization for Standardization.
[2] The British Standards Institution.

"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 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 "„Call & Surf comfort" by T-Home constituted an important component of the project, on the basis of which

[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.

– 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.

Berlin, 26 January 2009

2 Executive Summary

This case study assesses the carbon footprint for the Call & Surf all-inclusive offer on the T-Home Information and Telecommunications network, and the operation of the Integrated Access Device (IAD) Router Speedport W701V. A basic distinction was made between services generated in systems technology and services used on the customer end.

To assess these two areas, both production and operating data was used.

The carbon footprint assessment for T-Home‘s “Call & Surf comfort” all-inclusive offer and the Speedport W701V IAD router concluded that the usage phase of IT equipment is a determining factor in climate impact.

While in use, the router’s CO_2 emission (up to the LAN interconnection point) has a climate impact comparable with the operation of an ICT network. This calculation was based on the electrical energy factor required for both operating the hardware on the client side and as a production factor for the ICT infrastructure technology.

Calculations were based on data from the year 2007.

Results are documented below.

3 Company Profile

- **Brief introduction to the company**

Deutsche Telekom is one of the world's leading telecommunications companies. The Group offers customers the entire spectrum of state-of-the-art IT and telecommunications services from a single source. The Group supports personal and social networking using innovative products and services. Under the “T” umbrella of the Group’s company brand, the T-Home brand signifies “everything for at home“, and T-Mobile indicates “everything for on the move”. The T-Systems brand includes the Group’s worldwide offerings for medium and large companies.

T-Home is the project partner for the PCF pilot project in Germany. T-Home offers state-of-the-art fixed network infrastructures, fast internet connections and innovative multimedia services such as T-Home Entertain, combining TV, internet and telephony.

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

Climate protection within the Group: The Group’s efforts regarding the sustainable use of all resources are based on three mainstays: The climate protection concept, the Group’s own energy provider, and the development of energy-efficient products, services, and customer solutions.

Global climate change, a phenomenon caused by the rise in harmful greenhouse gases, is undoubtedly one of the greatest challenges of our time. As one of the world’s leading integrated telecommunications companies, Deutsche Telekom – as all major companies

– is a major power consumer and causes significant CO_2 emissions.

Since our company takes its responsibility towards investors, customers and employees seriously, we address the issue of CO_2 emissions generated in our business operations. We want to play an active role in reducing worldwide emissions of harmful greenhouse gases, not only in our own interest but also in the interest of future generations.

By adopting a climate protection policy and giving it Group-wide validity, Deutsche Telekom's Board of Management explicitly supports the Kyoto Protocol. This voluntary commitment involves obligatory targets for reducing greenhouse gas emissions, which scientists hold to be responsible for global warming.

The sustainable and efficient deployment of all resources has top priority in our climate protection concept. In it we have defined three main focus areas for our climate protection activities:

- Increasing our own energy efficiency and reducing CO_2 emissions by implementing optimization activities and making greater use of renewable energy sources.
- Identifying and developing innovative products, services, and solutions to promote the efficient use of resources by the customer.
- Public commitment to climate protection as well as to the Kyoto Protocol and efforts to increase awareness in society as a whole.

With the realignment of our CR activities in 2007, we decided to support the Low Carbon Society in the long term. Therefore, we support pro-active ecological and social assessments of the impact of ICT technologies and their CO_2 emissions. We want to contribute to an environmentally friendly society through energy and resource-efficient products and processes.

4 Organization and Procedures

- **Organization of case study and activities within the company (setup, participation, procedures)**

At T-Home, the Environmental Protection and Sustainable Development Team (Umweltschutz und Nachhaltige Entwicklung) is involved in the German PCF pilot project. The team has a variety of responsibilities, ranging from analyzing consumption and usage patterns to the assessment of the ecological and societal impact of T-Home products. Among other responsibilities, the team focuses on the technical optimization of ICT products, services, and solutions.

An internal T-Home project was conducted, which included this case study and the documentation.

- **External partners of the case study**

The project group received support from the Öko-Institut, Freiburg, which conducted a basic review of the process, the database, and the calculation methods.

5 Goals and Scope

5.1 Case Study Objectives

- **Documentation of the company's basic motivation and specific objectives of the chosen case study**

The IT- and telecommunications industry (ICT Networks) is responsible for about 2 percent of global CO_2 emissions. A rising trend is already noticeable.

Deutsche Telekom's / T-Home's efforts over the last few years to reduce CO_2 emissions have therefore proven to have been the right choice. To continue this strategy, Deutsche Telekom / T-Home will keep their focus on increasing the energy-efficiency of their processes, products, services, and solutions.

Since information and communication technologies (ICTs) place a high demand on energy and produce significant CO_2 emissions, it is important for Deutsche Telekom / T-Home to become a front-runner and maintain this position. Deutsche Telekom / T-Home already has a track record of improving energy and resource efficiency in technology by implementing various measures.

T-Home network infrastructure:

The future Next Generation Network will build on existing ICT networks. Temporarily, this will lead to an increase in use of electrical energy. The objective is to increase the ICT network infrastructure's energy efficiency by applying various optimization processes.

The carbon footprint assessment for the Call & Surf all-inclusive offer makes it possible to identify areas for improvement in the entire life-cycle and to increase efficiencies.

On the customer's side:

The objective is to reduce energy usage and CO_2 emissions on the customer side as well. The study's goal is to identify appropriate optimization approaches, such as on the network termination technology side.

5.2 Product Selection and Definition of the Functional Unit

- **Explanation of product selection**

In 2007, 8.5 million customers were using T-Home‘s Call & Surf full package (internet access, flat rate). The Call & Surf all-inclusive package was selected for the study due to its importance for T-Home.

- **Definition and explanation of functional unit**

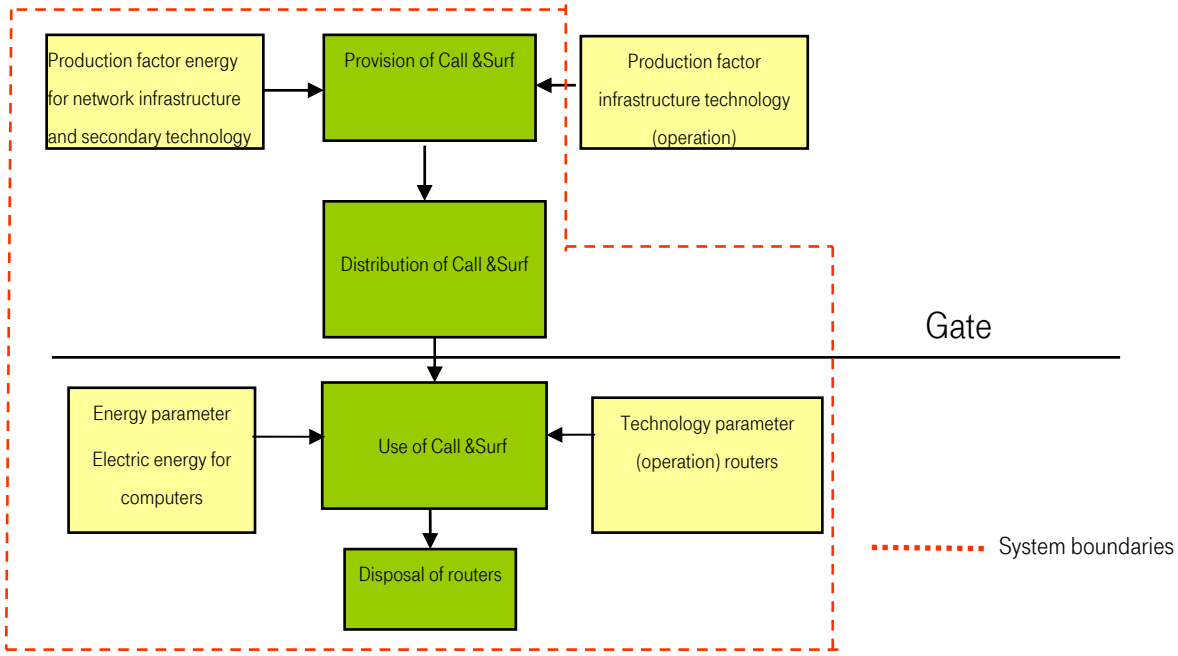
Functional unit: Operation and usage of T-Home’s Call & Surf full package in the last 12 months.

A clear distinction is made between the paths for the ICT network infrastructure and the IAD with router.

5.3 System Boundaries

- **Description and explanation of system boundaries**

System boundaries for Call & Surf:



Operator share:

The Call & Surf all-inclusive package is generated within the ICT network infrastructure.

The study does not analyze production and waste disposal for the network infrastructure, not only because of the assumption that both phases are negligible in comparison with usage (see Capital Equipment process), but also in light of the current reconstruction of various areas of the network infrastructure. An assessment of production and waste disposal would therefore make little sense at this point. The study thus focuses on the usage phase, which is dominated by the usage of electrical energy. A loss of air-conditioning cooling agents affecting the climate could not be taken into account because of insufficient data.

Another area of interest is the operational infrastructure (such as ventilation, rectifier technology).

User share:

This is an assessment of the usage phase. The analysis scenario includes a customer with a phone line upgrading to a Call & Surf all-inclusive package. The usage and analysis period is 12 months.

In order to make the surf share usable for the customer behind the LAN Interconnection Point (ICP), a PC with a monitor or similar is required. The PC (monitor) and Router IAD shares are analyzed separately.

Tough the individual parts of the IT and TC equipment are analyzed and calculated as one unit, in the total, they are shown separately.

Router system limits:

The router processes assessed include the router production, customer-side operation, and disposal.

Note (as of December 19, 2008): Since the supplier was unable to provide data, this part will be calculated after completion of the PCF project.

5.4 Data Sources and Data Quality

- **Analysis and assessment of the share of primary and secondary data**

  Primary data for the ICT network infrastructure was determined and provided by T-Home. This is the estimated usage/power consumption reported to the energy supplier. Experience has shown that this value closely matches actual usage.

  These values are checked and adjusted annually. Therefore, the error rate for these values is only minor.

- **Referencing the main sources for secondary data**

  For the provision of electrical energy and the production of the analyzed materials (such as packaging), GEMIS database 4.4, 4.5 emissions factors were used.In addition, statistical data was used for assessing the usage phase.

1) This data corresponds to the individual ICT network components' actual energy consumption. These values are verified yearly and published in internal reports. Due to the yearly verification, the error rate is low and values can be compared to actual measured values.

2) An older CO2e was used in the calculation. A current value would be lower (according to the Öko-Institut). Since the impact of the reference value is irrelevant, it was not updated.

3) The distribution of shares for the secondary technology is based on empirical values from system technology operation, which are generally accepted.

	Name	**Source**	**Date**	**value**
Primary data	Internal report data 1)	Report 2007	2007	
	Router energy consumption	Speedport W701V internal measurement	2008	
Secondary data	Paper/cardboard, newsprint 2)	GEMIS 4.4	DE 2000	
	DSL connection numbers	Federal Network Agency report	2006, 2007	
	Energy mix Germany 2005	GEMIS 4.5/Öko-Institut	2008	0.652 kg/kWh CO_2e
	Router energy consumption	Speedport W701V manual	2006	
	Sinus A201 energy consumption	Sinus A201 manual	2007	
Usage data	Average online usage 2008	ARD and ZDF online study	2008	
	Shopping trip	Öko-Institut/Task Force Project PCF	2008	
	Secondary technology shares 3)	Empirical data	2008	

5.5 Allocation

- **Explanation of generally used allocation procedures**

  The Call & Surf all-inclusive package is generated in the ICT network infrastructure. Since the network structure provides the basis for other products, services, and solutions, the Call & Surf shares must be identified. For this purpose, appropriate ratios were determined (see calculation).

5.6 Treatment of particular emission sources

The assessment of the network infrastructure focuses on the usage or provision of electrical energy. Emissions from air-conditioning cooling agents affecting the climate were not analyzed due to a lack of data. There are no other specific emission sources in the analyzed system.

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**
  - The methods are based on the procedures developed and coordinated methods in the workshops of the PCF pilot project in Germany, and on experiences from PAS 2050.
  - Databases for secondary data: GEMIS database 4.4, 4.5
  - Tools: MS Excel

6.1 Extraction of Raw Materials

The router production analysis takes into consideration the production of raw materials and preliminary products.

6.2 Production

Routers

Note (as of December 19, 2008): Since the manufacturer was unable to provide production data, this share will be calculated retrospectively prior to completion of the PCF project.

Packaging, Manual

The router and manual are shipped / delivered in a cardboard box.

Components: Cardboard box, cardboard interior, belt, bag for accompanying documents.

The box was measured and weighed for the components description

The belt and bag for accompanying documents were disregarded (sheet 23 x 14 cm, less than 1 g).

Type	Format [cm^2]	Cardboard/paper weight per unit [g]	Emission factor [kg CO_2e/kg]	Source*)
Outside box 30.5x19.5x13 cm	4254	210	1.022	GEMIS 4.4 paper/cardboard-/newsprint-DE 2000
Inside box	1701	68	1.022	GEMIS 4.4 paper/cardboard-/newsprint-DE 2000

For the shipping box, the value is thus 0.284 kg CO_2e.

Type	Format [cm^2]	Cardboard/paper weight per unit [g]	Emission factor [kg CO_2e/kg]	Source*)
Manual 15x21 cm		145	1.022	GEMIS 4.4 paper/cardboard-/newsprint-DE 2000

For the manual, the value is thus 0.148 kg CO_2e.

*) Current emissions factors can be lower than those this analysis was based on. However, with respect to the overall result, this difference is irrelevant.

T-Home Call & Surf all-inclusive package

Call & Surf is the name of a product bundle consisting of regular phone service and IP based internet access (DSL).

For the energy usage analysis of a Call & Surf complete package, both the customer side share and the ICT network infrastructure share are relevant.

The following explains where the phone (Call) and internet access (Surf) shares are generated, and the amount of energy required.

Call share (100 % share)

Call shares are comprised of the PSTN (Public Switches Telephone Network), i.e. the traditional phone network and transmission paths (ATM+GE).

A 100% share means that these energy values are to be unrestrictedly and clearly assigned to the phone network.

The sum should be directly assigned to the Call portion without any deductions. This energy share does not supply other services.

Surf share (100 % share)

Surf shares are comprised of the DSL/VDSL indoor and IP components.

Allocation among network component performance values in the ICT network infrastructure

In addition to the ICT network infrastructure in which the energy needs should be directly assigned to Call and Surf, there are areas in which only an indirect assignment is possible using an allocation key.

The telephony/internet usage ratio (3:1) is calculated from the phone and surfing shares.

Surfing share per year and line:

The value per line is calculated from the overall ratio:

DSL line numbers from the Federal Network Agency report 2006/2007 (in millions)	
T-Home lines	8.5
Other	9.1
Total	17.6
T-Home share	48.30%

For an inventory of 8,500,000 T-Home broadband lines, this results in a value of 9.46 kg CO_2e per line and year.

Call share per year and line:

The Call energy requirements and the switching units they are based on (from internal reports) result in 16.21 kg CO_2e per line and year.

Network termination (splitter, NTBA):

For power consumption via a splitter, NTBA, the result is 8.57 kg CO_2e per line and year (based on 8760 hours of usage per year).

ITC network infrastructure consumption per line and year:

Area	CO_2 volume **per line and year**
Surf share	+
Call share	+
Network termination:	+
Total	**34.24 kg**

Infrastructure energy consumption for ICT networks

The infrastructure for ICT includes ventilation, DC power supply and emergency power supply. Since figures were not available, the following realistic and common values were assumed:

- Ventilation technology share (20% of total ICT network infrastructure consumption)
- DC conversion loss share (10% of total ICT network infrastructure consumption)
- Share of battery charge for emergency power supply (6% of total ICT network consumption)

Secondary technology total: CO_2 volume per line and year: 12.32 kg

Comprehensive analysis of T-Home Call & Surf network share including ICT network:

Area	CO_2 volume per line and year
ICT network	**+**
ICT infrastructure	**+**
Total	**46.56 kg**

6.3 Distribution

Transport process from production location (PO) to T-Home interim storage location (ZI)

Transport process from T-Home interim storage location to client

Note (as of December 19, 2008): Since the supplier was unable to provide data, this share will be calculated retrospectively prior to completion of the PCF project.

6.4 Product Use /Shopping Trip

At this point the Product Use and Shopping Trip areas will be analyzed. The Shopping Trip includes only a one-time visit of the T-Shop by the customer. The remaining shares of the product usage phase are therefore significantly more relevant for the assessment.

Product Use

The following assumptions are made for the definition of the usage phase:

Usage: It is assumed that an ISDN line exists. This is a new Call & Surf customer. The required technical infrastructure is available (power outlet, phone, PC, monitor) so that only the splitter and router must be provided. Different usage scenarios (light, average, heavy phone/internet users) are taken into account in the calculation.

Ordering: The user must visit a Telekom Shop to order the Call & Surf full package. A 5 km trip to the store in an average passenger vehicle is assumed.

Call & Surf usage

The customer usage phase analyzed is limited to phone service and internet usage (online service). To determine the consumption data during the usage of telephony and online services, measured or statistically determined usage parameters must be included in the calculation.

a. Analysis of average Internet usage

The report analyzes the energy consumption of a T-Home Speedport W701V. This device is a wireless LAN router (WLAN router) with an integrated DSL modem and a 4 port switch. Several PCs can be connected to the DSL line by cable and WLAN using this hardware device. The router's maximum energy consumption when operating in WLAN mode is 8 W, as measured internally. In standby mode, 7.2 W are used when the WLAN is operational and 6.2 W without the WLAN.

An online study conducted on behalf of ARD and ZDF in 2008 concluded that users in the age range of 14 years old and up are "online" 120 minutes per day on an average 5.1 days per week. In this period (530.4 hours/year) load operation is assumed both for the PC (a 140 W energy consumption for the PC and monitor is assumed) and the T-Home Speedport W701V. Furthermore, the PC is assumed to be turned off, and the Speedport W710V router is assumed to be in standby mode, using 7.2 Watts.

b. Analysis of average phone usage

The report analyzes the energy consumption of a T-Home Sinus A201 phone. This is a cordless phone with an answering machine that was designed with an energy efficient switch-mode power supply and includes merely simple and important features for a variety of target groups.

The active usage period for the Sinus A201 is based on the connection times in the phone network and the number of phone customers. The average phone usage per customer was thus determined to be 58.91 hours/year (h/a). During the remaining time, the phone is in standby mode. During the usage period and in standby mode, the phone is supplied with power in accordance with the different charging cycles.

The energy used results depends on the following usage scenarios:

Prerequisites: Avg. telephony: c. 60 h/a; assumption: light telephony usage (min): 20 h/a; heavy telephony usage (max): 180 h/a)

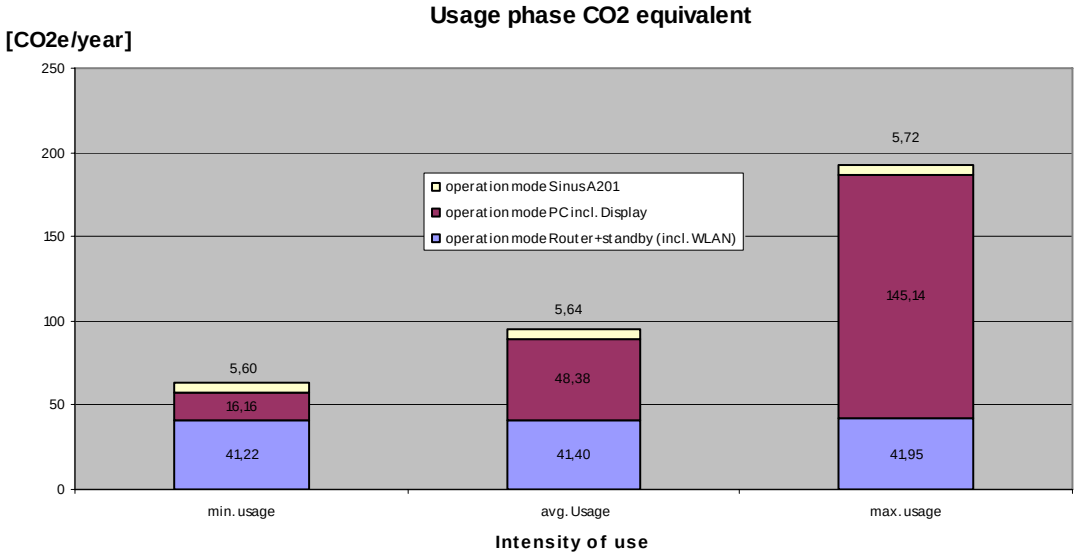
Status	Charging cycles			Charging time* [h]	Duration of charging intervals [h/a]		
	min.	avg.	max.		min.	avg.	max.
Charging in standby mode*)	87,4	87,0	85,8	14	1224	1218	1201
Charging in call mode*)	2	6	18	14	28	84	252
Total					1252	1302	1453

*) Operation manual Sinus A201: Charging time: 14h; operating period in standby mode c. 100 hours; in operation c. 10 hours

This results in the following power consumption:

Hardware	Status	Power [W]	Operating period [h/a]			Power [kW/a]			CO_2e [kg/a]		
			min.	avg.	max.	min.	avg.	max.	min.	avg.	max.
Sinus A201	**Telephony total**		---	---	---	**---**	**---**	**---**	**5.60**	**5.64**	**5.72**
Routers	Load operation	8.0	177	530	1590	1.42	4.24	12.72			
	Standby (with WLAN)	7.2	8583	8230	7170	61.8	59.3	51.6			
	Router total		---	---	---	**63.21**	**63.50**	**64.34**	**41.22**	**41.40**	**41.95**
PC	**PC+ Monitor total**	140	177	530	1590	**24.78**	**74.2**	**222.6**	**16.16**	**48.38**	**145.14**
Total						**96.59**	**146.35**	**295.71**	**62.98**	**95.42**	**192.81**

Product usage overview



Note: The PC/monitor share is disregarded from this point on.

Shopping Trip

It is assumed that the customer visits the Telekom Shop to sign the contract. The average distance to the store is assumed to be 5 km.

The router is mailed by postal mail, which is therefore irrelevant for the shopping trip. However, it was assumed that the sole purpose of the trip was to order Call & Surf and that no other errands were run.

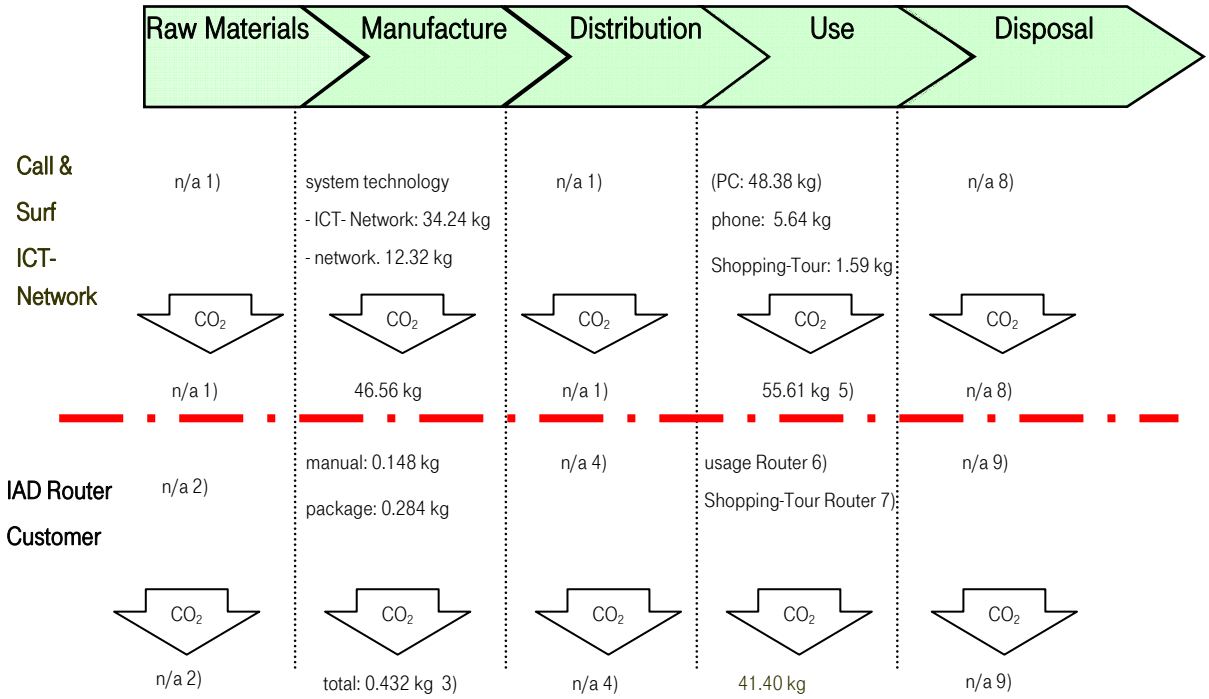
The basis for calculation is an average passenger vehicle (from GEMIS 4.4; 1P.km => 159.37*10-3 CO_2e [kg]). This results in a trip of 10 km and a CO_2e value of 1.5937 kg.

6.5 Recycling/Disposal

Note (as of December 19, 2008): Since the supplier was unable to provide data, this share will be calculated retrospectively prior to completion of the PCF project.

6.6 Presentation of Results (best guess)

6.6.1 Overview



Total CO_2-balance: 144.0 kg CO_2e

1) This block is not applicable, because it is a part of the grid.

2) The exploration of the raw materials can be omitted because these are includes in the phase „manufacture".

3) Once production-relevant data regarding the supplier of the router are available, the range will be supplemented and revised.

4) Once logistic-relevant data regarding the supplier of the router are available, the range will be supplemented and revised.

5) Here the scopes "product use" and "shopping tour" are reckoned. The shopping tour includes a single visit of a customer in our Telekom-Shop. So the rest parts of the production phase are more relevant for the balance.

6) The usage of the Routers includes the average usage and the operation mode incl. WLAN

7) The block is omitted, because the distribution happens only once by the parcel post. This part can be neglected in order of the balance.

8) The disposal of the grid technology is not reckoned. In future examinations this could be classified as an interesting option.

9) Once disposal-relevant data regarding the supplier of the router are available, the range will be supplemented and revised.

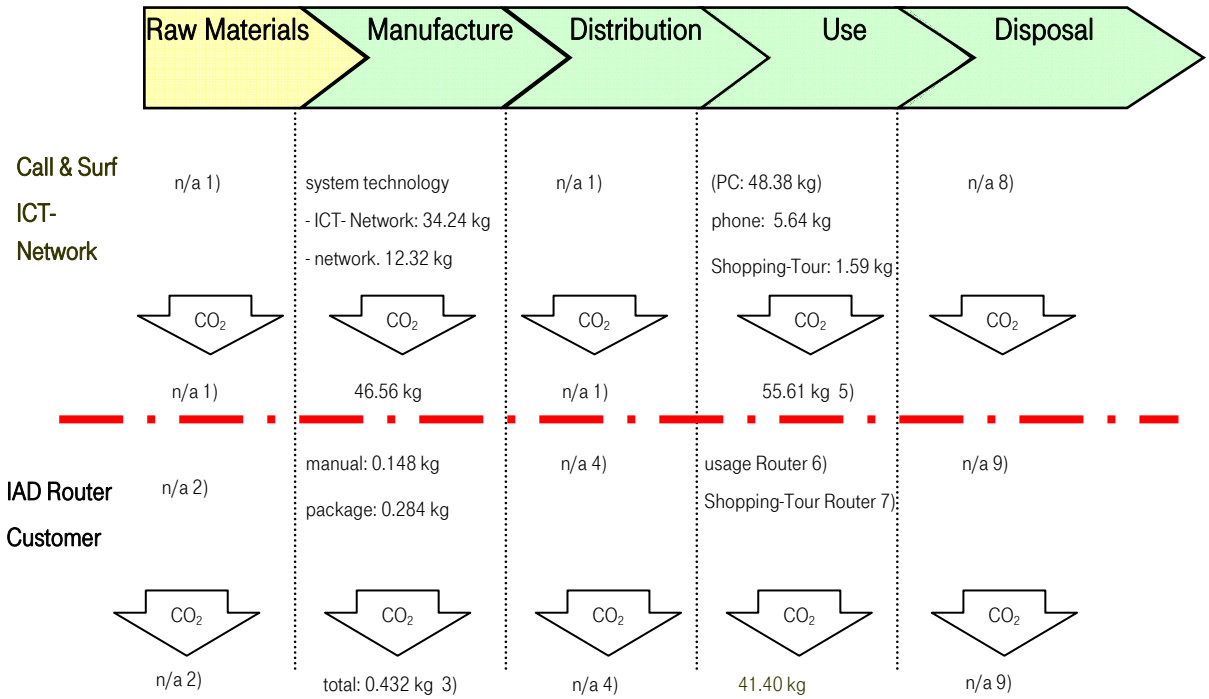
Brief description: The case study analyzes the Call & Surf full package and the production, distribution, usage phase and disposal of the Speedport W701V.

The following is a separate calculation and assessment of the Call & Surf network share and the IAD router hardware on the customer end.

The production, distribution, and product usage for the Call & Surf service is not directly comparable to the traditional production and distribution of an individual product (or commodity). Currently, the service generation is assigned to the “Manufacture” phase in the current assessment.

Additional energy consumption figures (such as for the PC, monitor, Sinus A201 phone) are provided as supporting information for assumed user behavior.

6.6.2 Extraction of Raw Materials



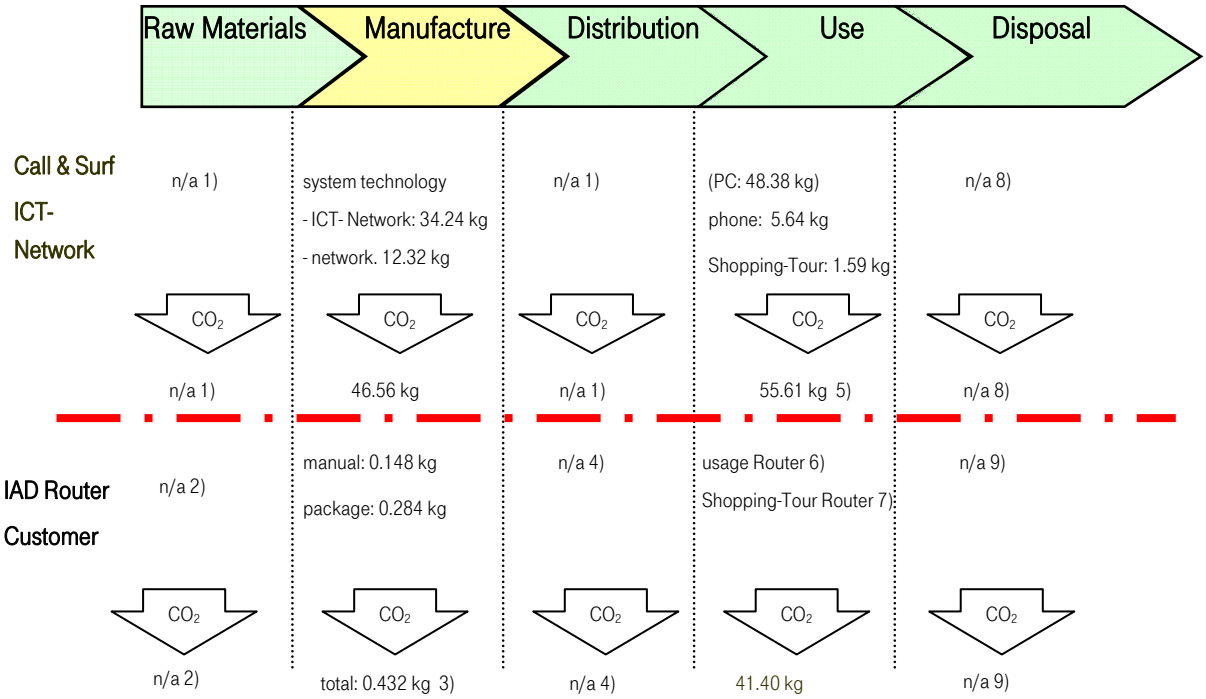
Total CO_2-balance: 144.0 kg CO_{2e}

1) This block is not applicable, because it is a part of the grid.

2) The exploration of the raw materials can be omitted because these are includes in the phase „manufacture".

Since figures are not available, statements regarding emission drivers and calculations cannot be made.

6.6.3 Production



Total CO_2-balance: 144.0 kg CO_{2e}

3) Once production-relevant data regarding the supplier of the router are available, the range will be supplemented and revised.

ICT Call & Surf network:

Main emissions drivers: ICT network infrastructure energy needs for service generation.

Main assumptions in calculation: Energy usage is based on ICT network infrastructure needs

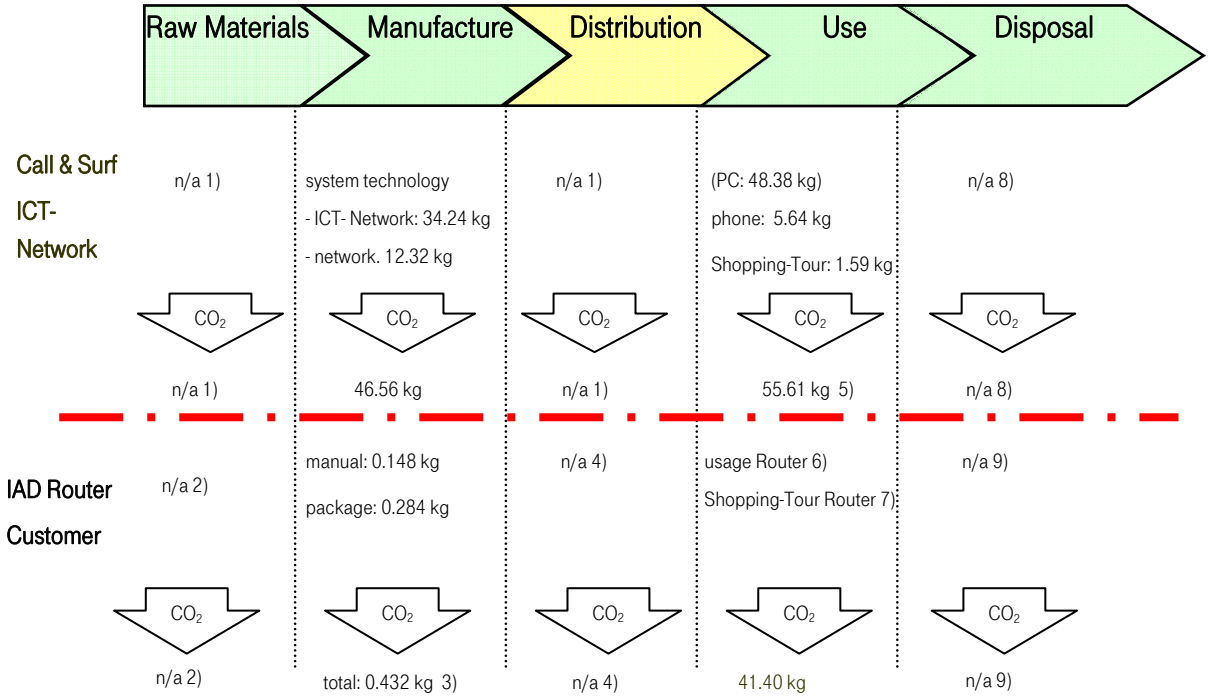
Key uncertainties in emissions inventory: Assumptions in the ICT secondary technology area

Router:

Note (as of December 19, 2008): Since the supplier was unable to provide data, this share will be calculated retrospectively prior to completion of the PCF project.

Manual, transportation, and packaging were already taken into account

6.6.4 Distribution



Total CO_2-balance: 144.0 kg CO_{2e}

1) This block is not applicable, because it is a part of the grid.

4) Once logistic-relevant data regarding the supplier of the router are available, the range will be supplemented and revised.

ICT Call & Surf network:

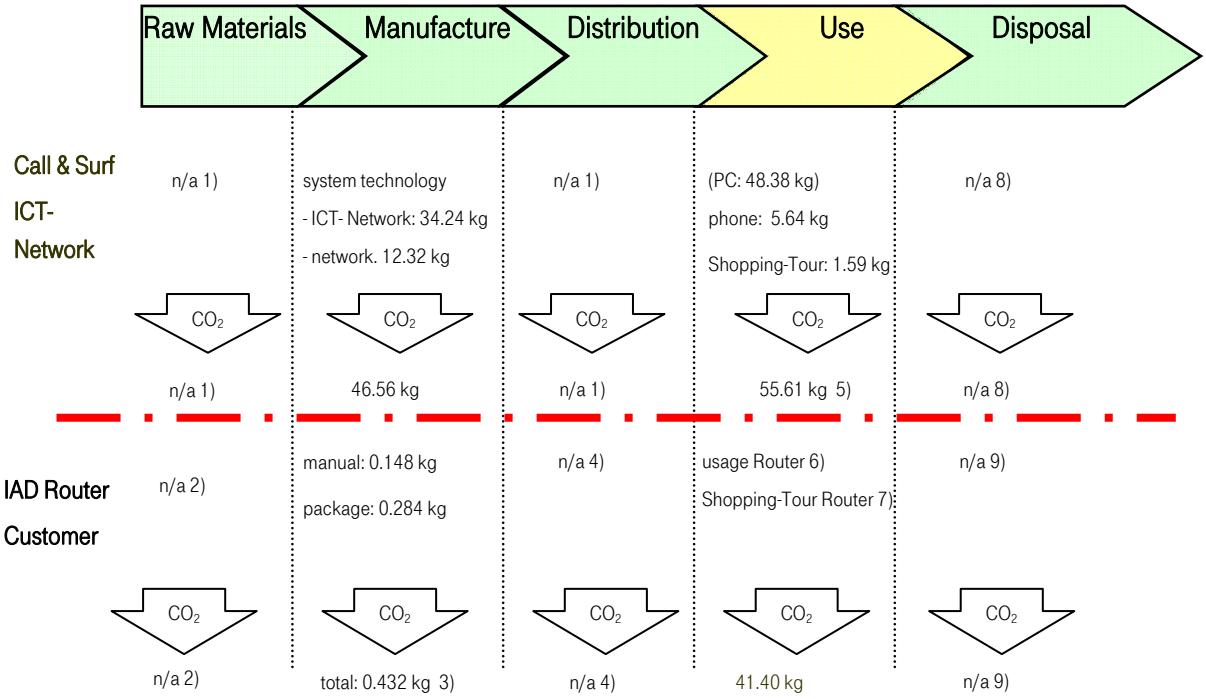
Since figures are not available, statements regarding emission drivers and calculations cannot be made.

Router:

Note (as of December 19, 2008): Since the supplier was unable to provide data, this share will be calculated retrospectively prior to completion of the PCF project.

6.6.5 Shopping Trip

6.6.6 Product Use



Total CO_2-balance: 144.0 kg CO_{2e}

15) Here the scopes "product use" and "shopping tour" are reckoned. The shopping tour includes a single visit of a customer in our Telekom-Shop. So the rest parts of the production phase are more relevant for the balance.

6) The usage of the Routers includes the average usage and the operation mode incl. WLAN

7) The block is omitted, because the distribution happens only once by the parcel post. This part can be neglected in order of the complete balance.

ICT Call & Surf network:

Main emissions drivers:

For network services, a precise analysis of the service generation/usage cannot be performed. Since the generation is shown in the "Manufacture" phase, there is no additional emissions driver (that can be impacted by the network). The customer PC/monitor, however, is another relevant variable which takes a mere secondary role in this analysis.

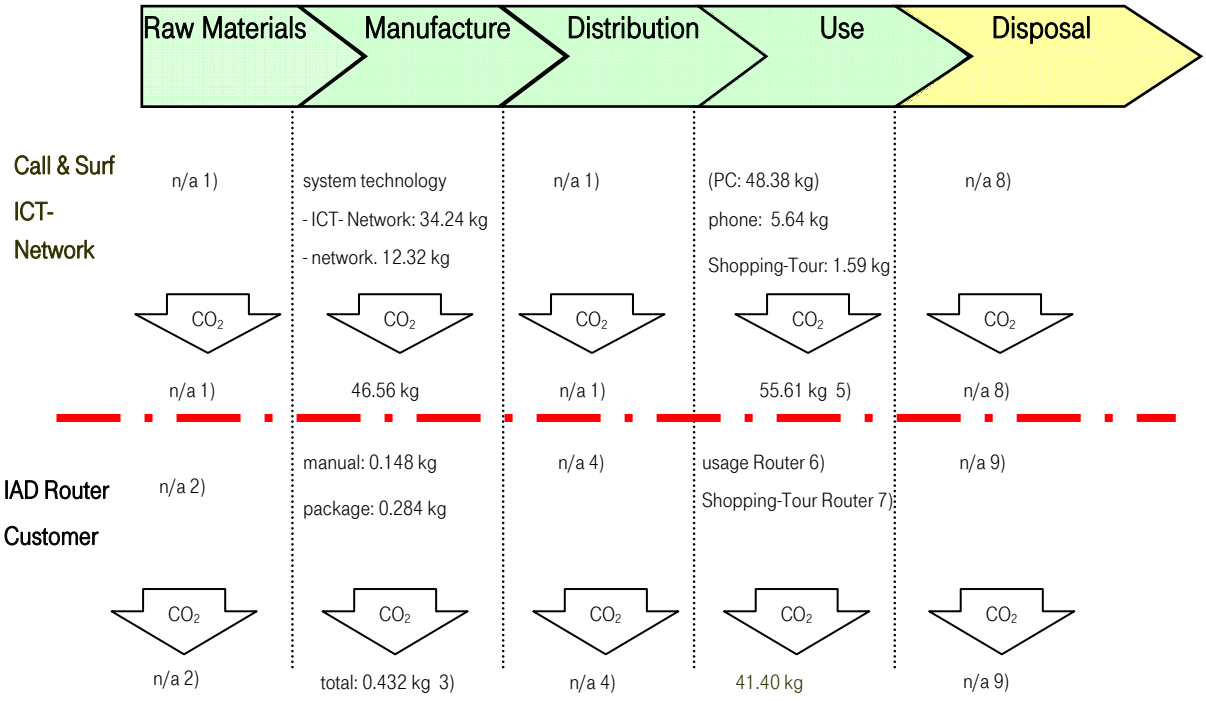
Main assumptions in calculation: Duration of use

Key uncertainties in emissions inventory: User behavior

Router:

Main emissions drivers: Router operation
Main assumptions in calculation: Duration of use
Key uncertainties in emissions inventory: User behavior

6.6.7 Disposal/Recycling



Total CO_2-balance: 144.0 kg CO_{2e}

8) The disposal of the grid technology is not reckoned. In future examinations this could be classified as an interesting option.

9) Once disposal-relevant data regarding the supplier of the router are available, the range will be supplemented and revised.

ICT Call & Surf network:

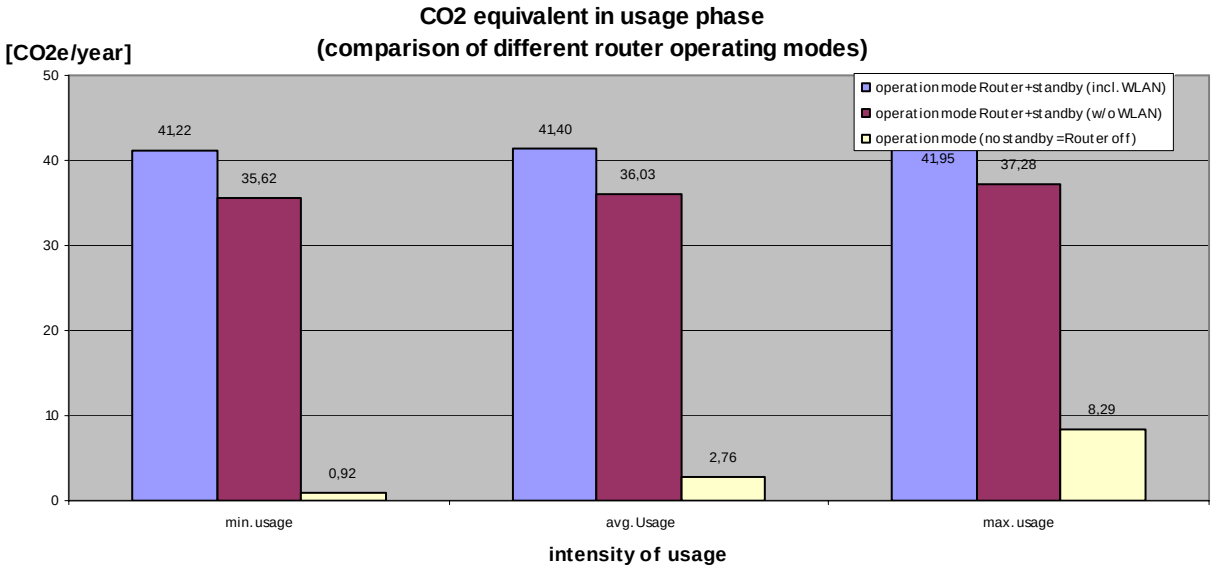
Because of technical changes in ITC networks, the existing infrastructure must be expanded and restructured. The restructuration includes dismantling of obsolete technologies. Since there are no reliable figures for this share, it is not taken into account in current analyses. However, the topic “Infrastructure Disposal” could be included in additional analyses.

Router:

Note (as of December 19, 2008): Since the supplier was unable to provide data, this share will be calculated retrospectively prior to completion of the PCF project.

6.7 Sensitivity Analyses

CO_2 progression for router operation under different usage intensities and modes of operation

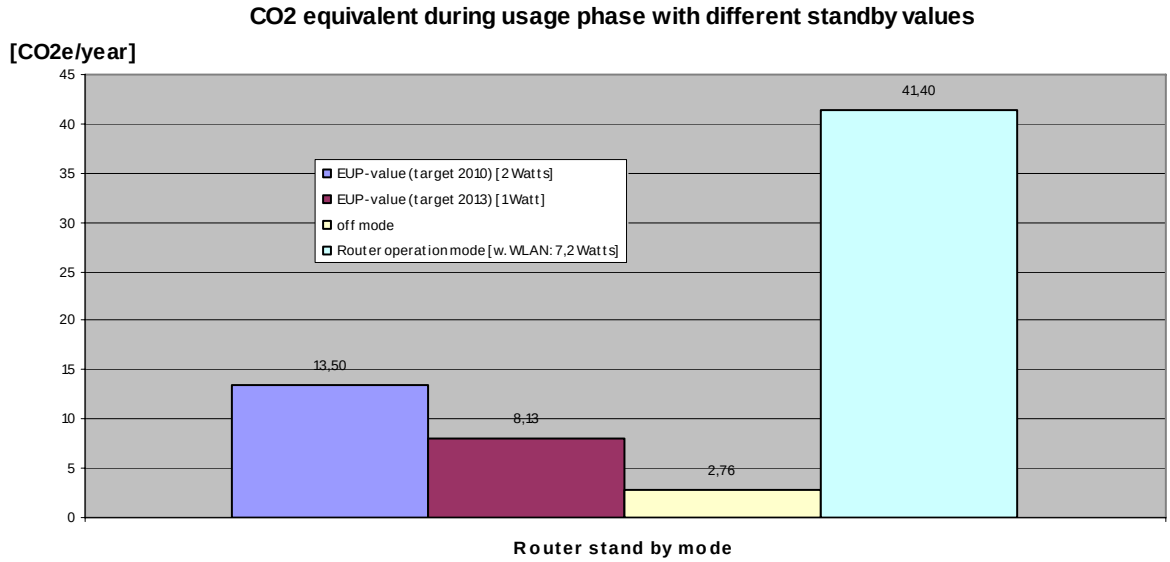


A sensitivity analysis regarding the network infrastructure currently does not seem to make sense. The ITC technology's energy usage depends on the utilization ratio of the ICT network. Since this area of utilization depends in part on values that cannot be influenced (the regulated telecommunications market) and this area is undergoing dramatic changes, further analyses are currently not being conducted.

Therefore, the analysis only looked at how user behavior impacts the PCF. For this purpose, PC usage was ignored.

The result shows that changes occur when the WLAN is switched off. However, when the router is consistently switched off, those changes are even more noticeable (no standby).

CO_2 progression for router operation in different modes and average usage in accordance with the Directive for energy using products



The EuP (Energy using Products) directive does not explicitly list routers as a separate product group. Regarding their energy demand, however, these devices can be assigned to the IT devices category. The directive requires these devices to lower their energy usage in standby mode to

- 2 Watts by the year 2010 and to
- 1 Watt by the year 2013.

This development was indicated using the scenario above, and it shows that the reduction of energy usage in standby mode has a strong impact on the assessment.

CO_2 progression for router operation, taking into account the integration of future features

Compared with legacy router, today's routers offer an increasing number of features (such as VoIP). Thus, hardware devices can now be combined into one unit, and this causes a change in the materials and energy usage. Analyses of this type currently do not make sense since there are no reliable figures that could be used for a calculation.

6.8 Uncertainty and Error Analyses

Primary data:

This data corresponds to the individual ICT network components' actual energy consumption. These values are verified yearly and published in internal reports. Due to the yearly verification, the error rate is low and the values can be compared to actual measured values.

The router performance values are measured values from a real application.

Secondary data:

The data used was taken exclusively from the GEMIS database, in consultation with the Öko-Institut.

Usage data:

ICT network side:

The distribution of shares for the secondary technology is based on empirical values from system technology operation, which are generally accepted. Therefore, these assumptions are uncertain. However, the error rate is probably low.

On the customer side: There are uncertainties in the assumptions for different usage scenarios. However, the scenarios show the potential scope of the usage spectrum.

6.9 Handling of other Environmental Impact Categories

Power consumption is crucial criteria for the Call & Surf service.
Consequently, the carbon footprint potential should be viewed as the main indicator.
Other value categories, such as acidification potential, overfertilization potential and summer smog potential were ignored since there is no significant impact in this assessment.

7 Interpretation and Perspectives

7.1 Challenges of the case studies

The specific challenge was establishing a verified assessment for T-Home products. The assessment focused on identifying the main impact factors that can be influenced not only by the network provider, but also by the customer.

7.2 Identification and Assessment for further reduction of the PCF

The results can be summarized as follows: The PCF for providing network services (46.56 kg CO_2e) is similar to operating an IAD router (41.40 kg CO_2e) on the client side.

By increasing the energy efficiency, the CO_2 emissions can be significantly reduced both on the client and on the network side.

It is evident that the router is a significant influencing factor for the PCF. By using energy-efficient devices, the network provider can support this development. User behavior also has a significant impact on the PCF. However, this applies to the usage of the entire equipment (PC, monitor).

Customers can be instructed as to their options for using the services in an energy-efficient and thus in an environmentally responsible manner.

7.3 Future Activities to reduce the PCF

In the future, further measures should be implemented on the network level (operator side), and the user (customer side) should be supported and instructed accordingly. On the network side, this would mean adding further calculations in additional development steps. This would require performing further analyses and establishing additional scenarios, such as in the secondary technology area. Furthermore, it is important to offer energy-efficient hardware (such as routers) on the market.

7.4 Product Carbon Footprinting at T-Home in the future

In Deutsche Telekom's sustainability strategy (CR strategy), "Low Carbon Society" is a well-established topic. In view of this, it would be consistent to apply Product Carbon Footprinting activities to other products in the future.

The new network structure plan uses all potential efficiencies to increase the energy efficiency by applying appropriate measures. This will ensure that communications services will continue being offered with applicable CO_2 reductions.

8 Recommendations

8.1 International Methods for Calculation and Assessment of PCF

The PCF calculation is impacted by many factors influencing the overall result with different intensities. Ideally, experiences from the PCF project would be applied to an international methodological harmonization.

The focus of this implementation should be on developing a solution that could be easily implemented by companies.

8.2 Proposals for Product Specific Definitions and rules

PCRs (Product Category Rules) should be set up to make the PCF more meaningful. In order to establish these PCRs, further coordination would be required with industry associations and network providers and others.

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

Merely indicating the CO_2value on the product would not provide the consumer with useful information. The customer can only select a climate-friendly product if comparable product groups display the PCF value as well.

9 References

References used:

Name	Source	Date
Internal report data	Report 2007	2007
Router energy consumption	Speedport W701V internal measurement	2008
Paper/cardboard, newsprint *)	GEMIS 4.4	DE 2000
DSL connection numbers	Federal Network Agency report	2006, 2007
Energy mix Germany 2005	GEMIS 4.5/Öko-Institut	2008
Router energy consumption	Speedport W701V manual	2006
Sinus A201 energy consumption	Sinus A201 manual	2007
Average online usage 2008	ARD and ZDF online study	2008
Shopping trip	Öko-Institut/Task Force Project PCF	2008
Secondary technology share	Empirical data	2008

*) An older CO_2e was used in the calculation. A current value would be lower (according to the Öko-Institut). Since the impact of the reference value is irrelevant, it was not updated.

10 Contact

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