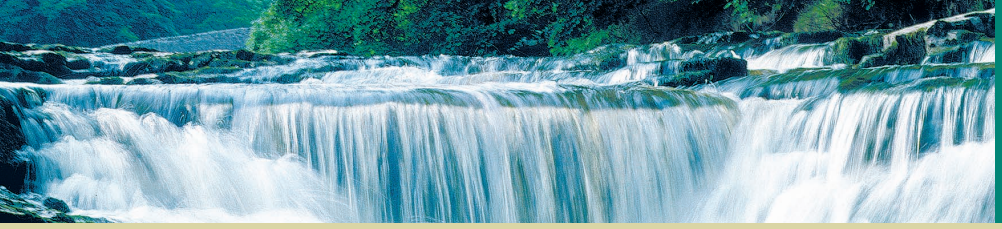
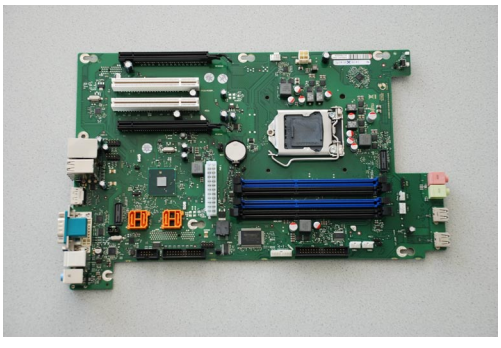


umberto®
know the flow.

SUCCESSFUL APPLICATION OF UMBERTO IN LIFE CYCLE ASSESSMENT OF COMPUTER HARDWARE

THE TASK

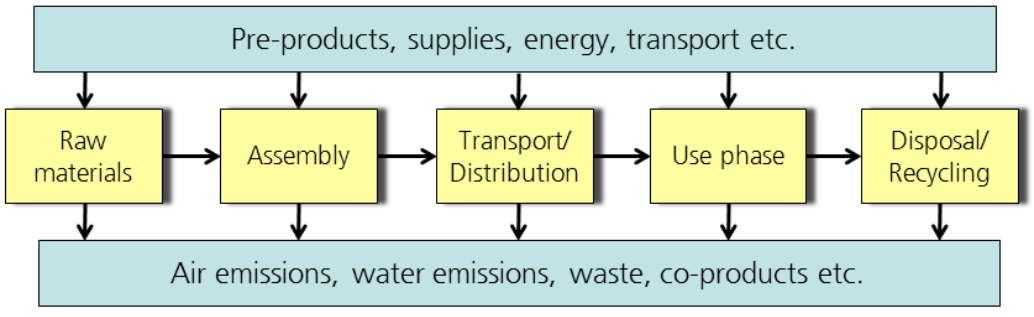
Fujitsu Technology Solutions GmbH assigned the bifa environmental institute to carry out a Life Cycle Assessment (LCA) for the desktop ESPRIMO E9900 and PRIMERGY TX/RX300 S5 servers based on the international standards ISO 14040 and ISO 14044. The LCA underwent a critical review by the Fraunhofer Institute for Reliability and Microintegration. The aim of the project was to identify and develop means of precisely analyzing the real emission values of products. Fujitsu wants to understand the ecological footprint of its products as part of the company's green strategy. Its goal is to reduce the CO_2 emissions during the entire product life cycle (cradle to grave) of the products, as well as helping the company to innovate more environmentally-conscious products.



STRATEGY AND IMPLEMENTATION

The results of the analysed impact categories were summed up throughout the complete life cycle of a product – from idea conception through to recycling. That includes the production of raw materials as well as the manufacturing of the supplier components, transport, assembly, use phase, and recycling or disposal. In case of the desktop ESPRIMO E9900 the system boundaries and basic assumptions for the assessment are as follows:

- Raw Materials: Include extractions, treatment, supply of raw materials, manufacturing of subassemblies and the energy consumption of all these processes. The following components have been taken into account: Chassis, power supply, mainboard components and printed circuit board, central processing unit (CPU), processor cooler, memory, graphic card incl. heat sink, hard disk drive (HDD), optical disk drive (ODD), cable, mouse, keyboard, manuals and packaging.
- Assembly: Mainboard and desktop assembly in the Augsburg plant include energy supply, scrap and waste management, installation of software and system test.
- Transport/Distribution: Almost all routes have been considered including the transport of:
  - Subassemblies from manufacturing in China to assembly in Augsburg by ship and airplane respectively.
  - Desktops from the Augsburg plant to the distribution centre by large truck and after that to the customer by van and car respectively or from the Augsburg plant to the customer directly by large truck.
  - Desktops from the customer to the place of collection by car and following to our recycling centre in Paderborn by mid-sized truck.



THE CLIENTS

bifa Umweltinstitut

bifa is an application-oriented environmental development and consulting institute and offers a wide range of services around environmental technologies. 40 employees develop individual solutions for customers from all industries and public institutions. The institute analyzes and assesses material and energy flows and develops technical processes and environmental protection concepts. The spectrum ranges from life cycle assessment to the operation of internet portals, from turnkey recycling plants to strategy and political consulting. bifa also offers expert reports regarding governmental emission control approvals which are accepted by authorities and the public. Since 1991 bifa carried out more than 700 projects for national and international companies and governmental authorities.

FUJITSU

Fujitsu Technology Solutions is the leading European IT infrastructure provider with a presence in all key markets in Europe, the Middle East and Africa, plus India, serving large-, medium- and small-sized companies as well as consumers. With its Dynamic Infrastructures approach, the company offers a full portfolio of IT products, solutions and services, ranging from clients to datacenter solutions, Managed Infrastructure and Infrastructure-as-a-Service. Fujitsu Technology Solutions employs more than 13,000 people and is part of the global Fujitsu Group.

RELEVANT BASIC FUNCTIONS OF UMBERTO

- Scenario analysis
- Impact assessment using an individual valuation system
- Definition of own modules
- Subnets
- Ecoinvent Database

- Use phase:
  - An average lifetime of 5 years.
  - Typical annual energy consumption for the desktop: 114kWh/year calculated similar to the energy calculation of Energy Star.
  - Use phase of the desktop in Germany and for comparison in Europe, Great Britain, France and Scandinavia in terms of sensitivity analyses (country specific energy mix).
  - Spare parts: processor, memory, mainboard, optical disk drive, hard disk drive, graphic card, power supply, keyboard, mouse (in relation to total failure rates).
- Recycling:
  - Recycling rate incl. thermal recovery >90%.
  - The desktop is recycled after the anticipated lifetime of 5 years.
  - No components are reused or resold (assumption only!).
  - Dismantling process at the recycling center in Paderborn, Germany, almost exclusively by hand.
  - Main material and components: iron, aluminum, copper, plastics, power supply, printed circuit boards, cable.
  - Additional recycling of keyboard, mouse, packaging and manuals is considered.

CUSTOMER TESTIMONIALS

"For many years Fujitsu has researched the factors that have a lasting impact on our ecological foot print. However, to be able to compare products with regard to their CO_2 emissions, we need international standards and a solid data basis for such comparisons."

Armin Kumpf, Senior Director Quality Management at Fujitsu Technology Solutions

"The way computers influence the environment depends less on their production, but mostly on their use. This is when the majority of greenhouse emissions are being produced. Fujitsu's distinctive willingness to invest in the analysis of its products via a life cycle assessment has greatly impressed us."

Dr. Siegfried Kreibe, Director at bifa environmental institute

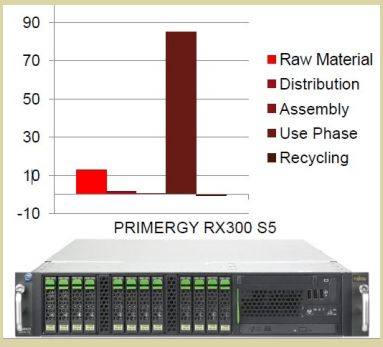


Figure: Greenhouse gas emissions server in %

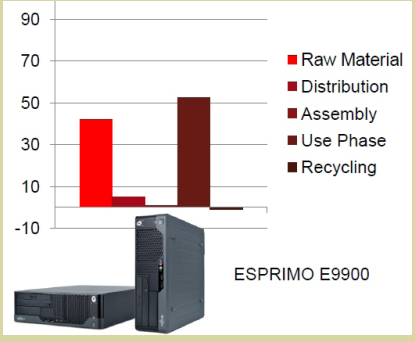


Figure: Greenhouse gas emissions desktop PC in %

RESULTS

The greenhouse gas emissions (or product carbon footprint) have been identified as the most relevant indicator for environmental performance.
In case of the desktop ESPRIMO E9900 with approximately 50% the use phase has the lion's share of the total carbon footprint (~700kg CO_2e), based on 5 years use phase, and German energy mix. The use phase and the raw material production are most important for future analyses and calculations.
As opposed to the PRIMERGY TX/RX300 S5 servers where with nearly 90% the use phase has by far the largest share of the total carbon footprint (~3 800kg CO_2e), assuming a 5 years use phase and based on the energy mix in Germany.
Fujitsu has attained a good transparency concerning CO2e-emissions along the entire value chain of the product in order to identify potential for additional reduction of emissions. Further insights:

- Optimize use of energy and raw materials in the production process, as well as adopting alternative raw materials with a lower environmental impact
- Reduction in transport emissions resulting from the changing to rail and ship
- Reuse and recycling of products and components in the Fujitsu Recycling Center in Paderborn and worldwide
- Development and provision of energy-efficient power supply units and products for the customer
- Optimal configuration of the main memory, graphics and energy options
- Use of energy-efficient ICT products (consider certificates such as "Blue Angel" and "Energy Star")

BACKGROUND INFORMATION

Analysed impact categories:

- Greenhouse effect: climate change
- Fossil cumulative energy demand: consumption of fossil fuels
- Acidification: acidic rain
- Terrestrial eutrophication: over-fertilization of soils by atmospheric emissions
- Aquatic eutrophication: over-fertilization of water bodies by atmospheric and water emissions
- Photochemical oxidant formation: ozone smog
- Human toxicity: toxic damage to man and organisms
- Eco-toxicity: toxic damage to organisms and ecosystems