White Paper
Green ICT.

The way to green business.

T Systems

Contents.

1. Introduction.

IT is playing an increasingly important role in professional and private lives worldwide and is thus also increasingly becoming a significant energy consumer and CO_2 emitter. Who would guess that its annual CO_2 emissions are equivalent to those produced by roughly 320 million small cars? According to calculations by the consultancy firm, A.T. Kearney, this sector generates CO_2emissions of around 600 million tons per year worldwide. If this trend continues to go unchecked, a further rise of 60% is predicted by 2020 in Germany alone. This trend can be stopped with the help of Green IT. Purely by consistently implementing existing energy saving concepts, IT can practically halve its total CO_2 emissions.

To analysts, manufacturers and providers, Green IT refers to all IT solutions which lead to energy savings in a company. "Green IT" therefore covers hardware, software and services: In the hardware area, energy-efficient desktop PCs, thin client architectures and data center hardware offer potential , as do energy supply and cooling systems. It also covers virtualization software and solutions for dynamic capacity management in particular, as well as data center planning or storage offshoring in the software and service area. Due to the increasing convergence of IT and TC, it is worth giving this more thought. Thus the positive approaches of Green IT must still be extended to include energy saving solutions from the telecommunications area, e.g., video conference systems: Green IT becomes Green ICT.

Green ICT essentially concerns the ways in which users and providers of ICT can take into account the ecological impacts of using ICT.

Detailed observations show that Green ICT covers other, seldom discussed aspects throughout entire life cycles: Resource-saving procurement, environmentally-aware behavior in the workplace and data center operation with sustainable energy through to the environmentally-friendly disposal of old electrical appliances and, where possible, large-scale recycling, also come under this term.

This White Paper should help companies to create awareness for Green ICT in their company, to reduce the CO_2 emissions generated and to become more successful both ecologically and economically. We will show the added value provided by Green ICT and describe possible starting points in the central deployment areas of the office workstation, data center and in core processes. Then we will present you with a few successful Green ICT projects and provide information on initiatives, more detailed information and action options for the topic of Green ICT.

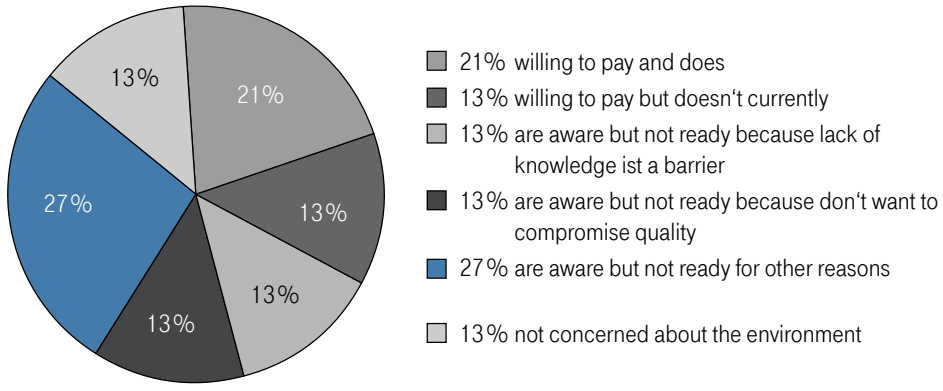
2. Added value through Green ICT.

The ultimate added value of Green ICT is often represented by an improvement in the environmental input/output balance and cost savings. This is because companies are consuming more and more energy, and thus emitting more greenhouse gases. A company's environmental input/output balance is measured using the carbon footprint, i.e., the total of these CO_2 emissions. Reducing its carbon footprint and thus improving its environmental input/output balance is a corporate responsibility which companies increasingly want and need to address. However, energy supply is becoming an increasingly important cost factor for companies. It is in this area in particular that Green ICT offers significant savings potential, through more efficient hardware and the intelligent use of structures, for example.

The conclusion is therefore obvious, the starting point for all considerations about the topic of "Green ICT" is actually the aspect of costs or the possibility of reducing costs. A comprehensive Green ICT strategy, however, offers numerous benefits for all relevant target groups of a company: It increases employee satisfaction, causes the capital market and society to rate the company more positively and opens up new customer groups.

Green ICT offers added value for all relevant target groups.

This is because there is a positive impact not only costs, but also on the company's revenue: According to a recent study by the market research company McKinsey, 21% of end customers already deliberately choose products from companies acting in a sustainable and environmentally-aware manner and accept the higher price for this. A further 13% are also prepared to "pay" for this commitment to the environment but have not yet put this willingness into action. The noticeable environmentally-aware behavior of the company thus represents an additional - and perhaps decisive selling point for end customers and thus also opens up new customer groups.



End-customers broken down by readiness to pay for eco-friendly products, worldwide, 2007, in %.

Fig. 1: McKinsey: Addressing consumer concerns about Climate Change, 2008.

Corporate obligations are also fulfilled outside the customer group which can be addressed. Environmentally-aware corporate actions and thus also dealing with ICT in the long-term is being increasingly observed and is therefore an important component of a comprehensive Corporate Social Responsibility strategy (CSR strategy). This is a significant factor for the development of brand value and corporate image vis-à-vis the public. Here a posivitive relationship with non-governmental organizations (NGOs) such as Greenpeace - joint projects or being referred to as an example by the NGO - is just as beneficial for the company's image as being top place in the sustainability rankings, such as in the "Good Company Ranking" by the German "manager magazin".

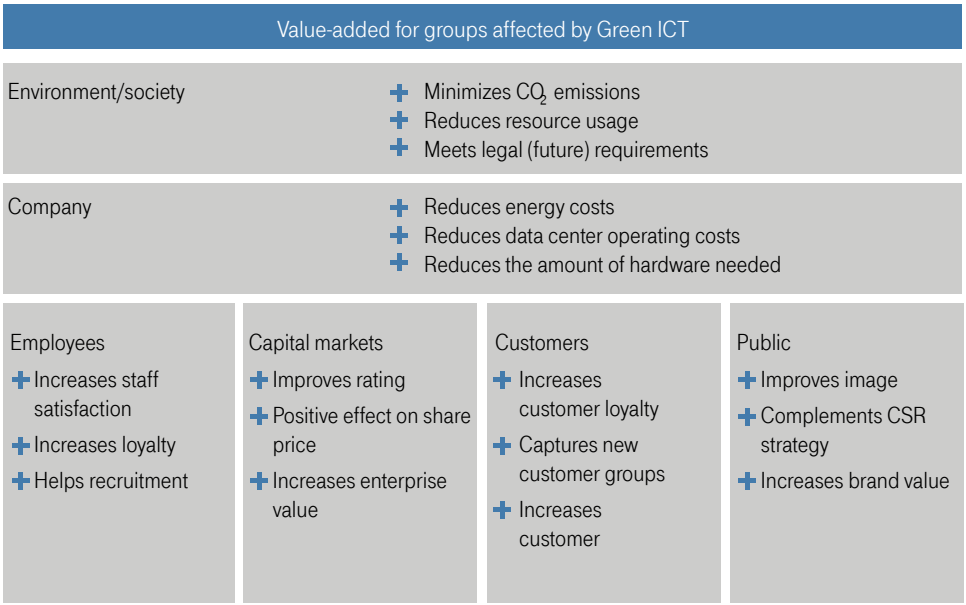


Fig.2: Added value for target groups through Green ICT - T-Systems, 2008.

The effect of a Green ICT strategy on the capital market is also often underestimated. The characteristics of a company's CSR activities are becoming increasingly significant at many rating agencies. Thus the use of Green ICT can have a positive impact on the share price and corporate value.

However, a well-thought-out Green ICT strategy does not just have an effect on the outside world, but also on the company itself: Various studies show that employees prefer to work for an environmentally-conscious company. Trust in the employer, loyalty and satisfaction at work are positive influences. The social commitment of a company is also an important factor in the competition for potential new employees, in the "war for talent".

With Green ICT you can now achieve positive image effects and anticipate legal regulations.

According to a user survey by the market research company Experton, the most important reason for deploying Green ICT technologies was, even before cost reductions, "compliance with legal specifications" even though there are currently no specific legal specifications for ICT technologies. This is because only the use of hazardous substances in electrical and electronic equipment and the disposal thereof is actually regulated by law in the EU at present. As part of the increasing political awareness of climate protection, it can however be assumed that special legal specifications will also be created for information and communications technology. According to the market research company, Gartner, by 2012 companies will be forced to take a first step towards disclosing the extent of their CO_2 emissions.

3. How can a company implement Green ICT?

The following section will now describe how the added value just described can be achieved. If we consider more closely where ICT emits CO_2, two main areas can be identified: The office workstation and the data center. A huge 40 % of ICT-related CO_2 emissions are caused by workstation PCs and the accompanying monitors, another 23 % by servers and cooling systems. For this reason, we will first present approaches as to how Green ICT can reduce CO_2 emissions at the office workstation (see Section 3.1) and in data centers (see Section 3.2).

Green ICT can also - especially if it is deployed consistently — contribute far more to protecting the environment than just directly reducing its own emissions. Green ICT can also optimize workflows in a company's core processes which were originally non-ICT related and drastically reduce CO_2 emissions throughout the entire process chain (see Section 3.3). It is only here that its true potential can be seen: This is because, according to information from Gartner's market researchers, "only" around 2 % of global CO_2 emissions are caused by ICT at present, whereby even this is a worryingly large percentage. However, the remaining 98 % of all CO_2 emissions which are not caused by ICT can also be reduced significantly with the help of Green ICT.

3.1 Green ICT at the office workstation.

3.1.1 Energy-efficient use of terminals and the use of energy-efficient terminals.

Each individual office workstation (by itself) offers the opportunity to save energy. This enables both the energy-efficient use of terminals and the use of energy-efficient terminals.

A photocopier which is left switched on overnight needs the same amount of energy as it does to make 1500 photocopies. [Experton 2007]

Even without using any resources, changes in the behavior of employees can bring about savings. The use of sleep modes and power management software for terminals or double-sided printing and generally avoiding hard copies can be specified by simple corporate guidelines and thus employees are made aware of Green ICT.

According to Experton, the latest generation of energy-saving desktop PCs can save over 60 % of energy costs with their optimized energy supply, storage technology and processors. Furthermore, using modern LCD monitors and thin client architectures offers numerous other opportunities.

It is a major challenge for companies to always have high performance and energy-efficient, and thus cost-saving, terminals. Outsourcing the entire ICT landscape in the office, in the context of Green ICT, offers the opportunity to minimize the number of workstation computers and printers and to maximize their efficiency at all times.

Excursus: Thin clients.

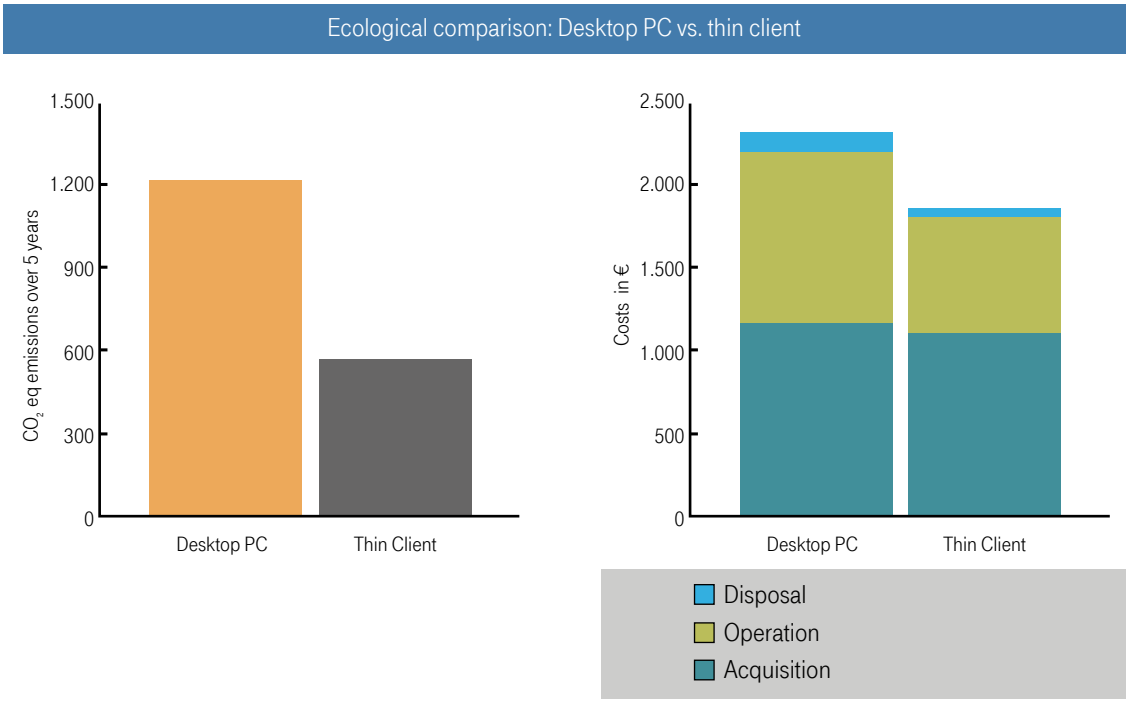


Fig. 3: Fraunhofer Umsicht, Ökologischer Vergleich der Klimarelevanz von PC und Ihm Client Arbeitsplatzgeräten [Environmental comparison of PC and thin client workstations], 2008.

A study by the Fraunhofer Society revealed that, compared with conventional desktop PCs, thin clients work significantly more energy efficiently and thus reduce both CO_2 emissions and procurement and operating costs. Replacing a desktop PC with a thin client, including the terminal, reduces CO_2 emissions from the workstation system by over 54 %; this equates to savings of 44 % for the entire system (including an LCD monitor for each). Thin clients weigh significantly less, have a lower volume and comprise fewer components, which has an impact primarily on transportation, disposal and material consumption.

An example calculation: A company with 300 workstations, whereby 5 % of its workstations are equipped with thin clients, can save around 148 tons of CO_2 over a 5-year period of use. By comparison: A VW Golf would need to cover a distance of over 1,093,000 km (corresponding to driving around the earth 27 times) to produce the same volume of emissions.

3.1.2 Communication and collaboration.

Even the journey to the office has a significant impact on the environment: Every day millions of commuters spend hours on roads, resulting in huge volumes of exhaust emissions. And this is the normal way to get to a business meeting —whether for an hour for a supplier discussion or for a week for an internal strategy meeting. The journey causes emissions which cannot be ignored and is also expensive: In 2007 German companies paid out almost EUR 50 billion on business travel - and this amount is increasing (see Figure 4).

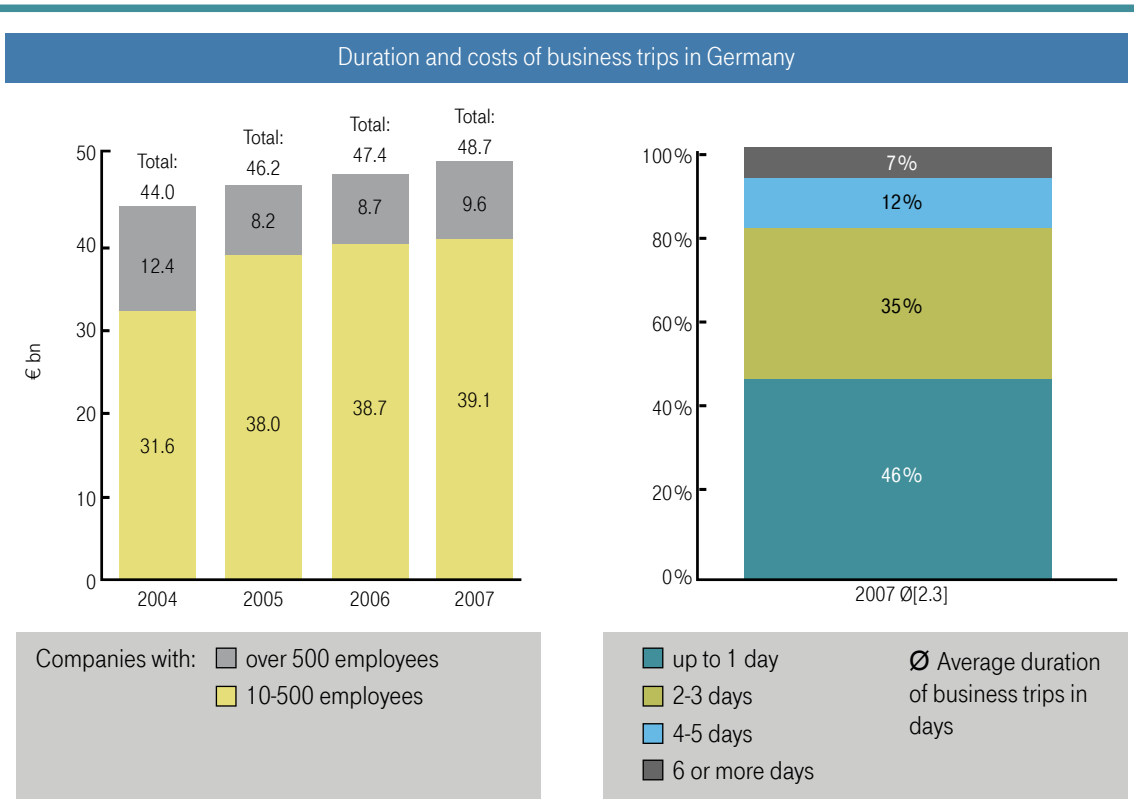


Fig.4: VDR [The German Business Travel Association], Geschäftsreiseanalyse [Business Travel Analysis], 2008.

Nearly half of business trips last less than one day – these short business trips in particular can often be almost as effectively replaced by communication or collaboration solutions. And this option is not just open to large groups: There are now also high quality systems for small and medium-sized enterprises which account for around 80 % of the costs of business travel.

In the office communication area, it is already almost a tradition to replace conventional communication means with ICT applications. In other areas, mail (and thus letter paper, transport and logistics) can be abolished through the use of e-mail and SMS. Now a new generation of communication and collaboration tools is making it possible to work together independent of location without any loss of quality.
Video conference systems enable realistic face-to-face communication and collaboration tools the simultaneous, joint access to documents and presentations to be edited. Thus virtual meetings are possible which are just as good as the real thing. These tools can effectively replace a high volume of business travel and support working methods such as flexi-work, i.e., working from the home office: Having employees working from home saves time, office space and, above all, cuts out the journey to work.

The most interactive form of virtual communication is video conferences. Although these have been used in isolated cases for years, recent technical innovations have now led to widespread acceptance amongst users. Various versions of this medium enable location-independent collaboration in nearly all situations. According to Forrester, four different types of video conference have essentially developed:

- PC-based solution: Smaller video window with handy access to collaboration tools and work product on work PCs improve effectiveness of collaboration efforts between two people.
- Room-based solution: Larger screens, e.g., 42-inch plasma, permanently installed in meeting rooms, give business meetings a human element. Often used with collaboration screen technologies.
- Auditorium-based solution: Very large screens, e.g., 120-inch projection screens, allow videoconferences to be viewed by entire organizations. Often used for corporate communications.
- Telepresence solution: High-definition-quality displays, custom room designs, and life-size representations make these videoconference room really feel like being there .

3.2 Green ICT in data centers.

Did you realize there are three million data centers worldwide? Data centers in Germany alone use almost 9 terawatt hours (TWh) of power each year. By 2010, this value will rise another 50 % if the current efficiency trends continue and the government, ICT manufacturers and, primarily, operators of data centers, do not take any additional efficiency measures.

Green ICT can achieve huge savings in all these data centers. If we assume that the best energy-efficient technologies and solutions available today (state-of-the-art) are widely used, the power consumption of servers and data center infrastructure may drop to 4.48 TWh by 2010. In the case of this "state-of-the-art" scenario, the power consumption of German data centers would therefore halve within just four years.

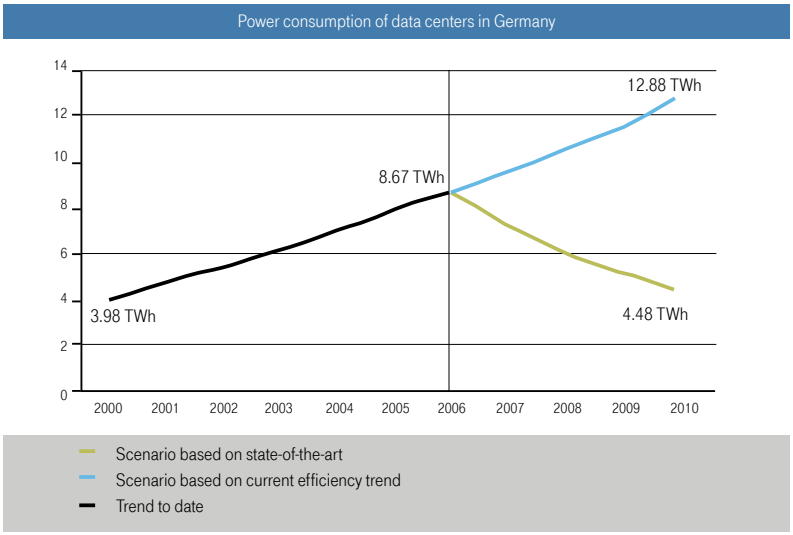


Fig. 5: Borderstep, Zukunftsmarkt energieeffiziente Rechenzentren [Future market of energy-efficient data centers], 2007.

The Experton Group also assumes energy saving potential in data centers of at least 50%. Here, 20% to 30% are gained through more efficient hardware (servers, repositories, network equipment, components for uninterruptible power supply) and optimized cooling and at least just as much again from using waste heat. Experton collected information on how much energy can be saved in which areas of data center operation:

- Improved network components 25%
- Power-saving CPUs 5-10%
- More efficient fans 10-15%
- Direct current through rack-based systems 10-15%
- Optimized cooling streams 5-10%

Another crucial factor in data center operation is utilization. According to Experton, the average server utilization in well-managed environments is 35% - 45%, for Unix servers, and just 15% - 30% for Intel servers. The average storage utilization is also only 25% - 40%. The consolidation of servers, storage and entire data centers significantly improves this utilization rate and thus saves a great deal of energy. Local data center landscapes which have grown over time can be consolidated into just a few data centers. Outsourcing plays a significant role here. A professional IT service provider can assist with the consolidation into large, efficient data centers, in which the provider supplies several of its customers.

The optimum utilization of data centers is achieved, as described previously, through virtualization and dynamic services solutions. Here logic systems are abstracted from the physical implementation. Resources are thus not dedicated, but are shared and therefore better utilized. The intelligent assignment and management of resources is therefore an important functionality within virtualization and guarantees maximum flexibility in the provision of resources. Countless servers which were previously only used to a limited extent are thus superfluous and shutting them down leads to maximum savings.

Virtualization reduces overall costs through the higher utilization of resources, primarily through the following central approaches:

- Efficient infrastructure management
- Migration, backups and data recovery are easier
- Server operation security: Several operating systems run side by side and are well isolated from one another

Furthermore, capacity extensions are easier, since virtual server and storage networks can be administered centrally.

Cost-effectiveness is improved overall since every server and every storage system that is not required:

- does not use any energy
- does not need to be cooled
- does not require a network connection and
- does not need to be administrated.

3.3 Supporting core processes through Green ICT.

ICT applications are increasingly used to also support non-ICT business processes. The intelligently combined, collective use of IT and TC, "real ICT", in particular offers systematic process-specific solutions. These solutions simplify the workflow of core processes and, through the optimized use and combination of all resources, offer significant savings potential, not only, but also as regards CO_2 emissions. In addition, using ICT makes it possible to measure energy consumption and CO_2 emissions in detail along the value chain and to optimize processes and structures accordingly. Here approaches in delivery, which is a decisive process in delivery-intensive sectors in particular, and the development and production of cars are presented as examples. However, ICT can also have an important influence on subordinate, supporting processes such as resource utilization in the office.

According to the European Commission, 50 % of fuel consumption is attributable to congestion and poor route planning.

Reducing the volume of traffic is the main starting point in delivery-intensive sectors. According to the European Commission, 50 % of fuel consumption is attributable to congestion and poor route planning. Intelligent transport systems for road transport combine a number of various individual applications and can save 30 % of fuel consumption with the same transport service – and thus also significantly reduce the percentage of CO_2 emissions.

Current and in-depth traffic information collected via a tight network of IT terminals and transmitted via tele-communications technologies form the basis for these systems. Route planners and navigation systems use this information to continually calculate and update the best possible route, optimized for vehicles and loading. This minimizes distances covered and therefore time, fuel costs and, to a large extent, CO_2 emissions. Other applications, such as satellite and RFID-aided exact positioning, support the optimum utilization of the entire vehicle fleet.

These technologies can be carried over to global waterways and air transport routes. If, for example, the air freight service is optimized, this could cut down on fuel by over 10 %.

Manufacturing industries such as the automotive sector work particularly resource intensively – this means that a particularly high savings potential can be found in the core processes of development and production through the intelligent use of ICT. Increasingly accurate and realistic computer-aided simulation and design applications (CAD, Computer Aided Design) are making physical prototypes in the development phase more and more superfluous – or mean that these can at least be reduced to a minimum. It is also increasingly worth taking a look at software-aided energy-saving functions for the users themselves here. Auto Start Stop functions in vehicles, for example, switch off the engine temporarily when the clutch is released and do not switch it on again until the clutch is depressed again.

Further CO_2 emissions can therefore be reduced along the entire value chain in the production phase. Setting up the network, delivery transportation and the utilization of capacities are managed in a much more environmentally-friendly manner using ICT.

A large number of help processes across different sectors can also be positively influenced by ICT. Energy management and dematerialization are proving to be particularly effective approaches here. Ideally, energy-saving aspects are already integrated in the planning for the construction of new office and production facilities, resulting in "smart buildings" which use as little energy as possible. However, innovative energy management systems can adapt energy consumption to the actual requirements of lighting, heating and cooling systems in existing buildings too, at no major expense.

Dematerialization measures such as the logical changeover of written correspondence to e-mails, invoice processes to ebilling and archiving systems to electronic formats can save tons of paper in nearly all companies. For cross-regional companies working with central archives in particular, this also leads to a drastic reduction in processing times, since transportation (and also the associated volume of traffic) is no longer necessary.

4. The way to the Green ICT action plan.

The topic of Green ICT has been continually present in specialist circles for months now, nobody making a decision about ICT could escape the articles in specialist publications, CeBIT and the intensive bids by providers. Green ICT technologies are now also being used more in practice: According to surveys carried out by the market research company, Forrester, the percentage of companies taking into account environmental protection aspects in the development and selection of their IT landscape increased from 25% to 38% between April and October 2007 – companies are acting.

However, unfortunately they act without a plan all too often: The same surveys revealed that only 15% of companies follow a comprehensive Green ICT action plan and another roughly 25% are working on such a plan. According to Forrester, over 60% of the companies questioned are implementing Green ICT technologies without any plan (see figure 6), of which barely 2/3 (39% of the companies questioned) are even considering creating a Green ICT action plan. The first step: Although many individual Green ICT projects are running without any such plan, there is no widespread, controlling framework. An action plan provides direction and, above all, an objective for Green ICT activities. These can thus be controlled in full and coordinated with each other, all individual actions can be orientated towards one target and implemented in a sensible time sequence. All target groups, whether management, employees or customers, can be orientated towards a well-thought-out action plan. It supports the realistic valuation of all savings potential, - both ecological and economic.

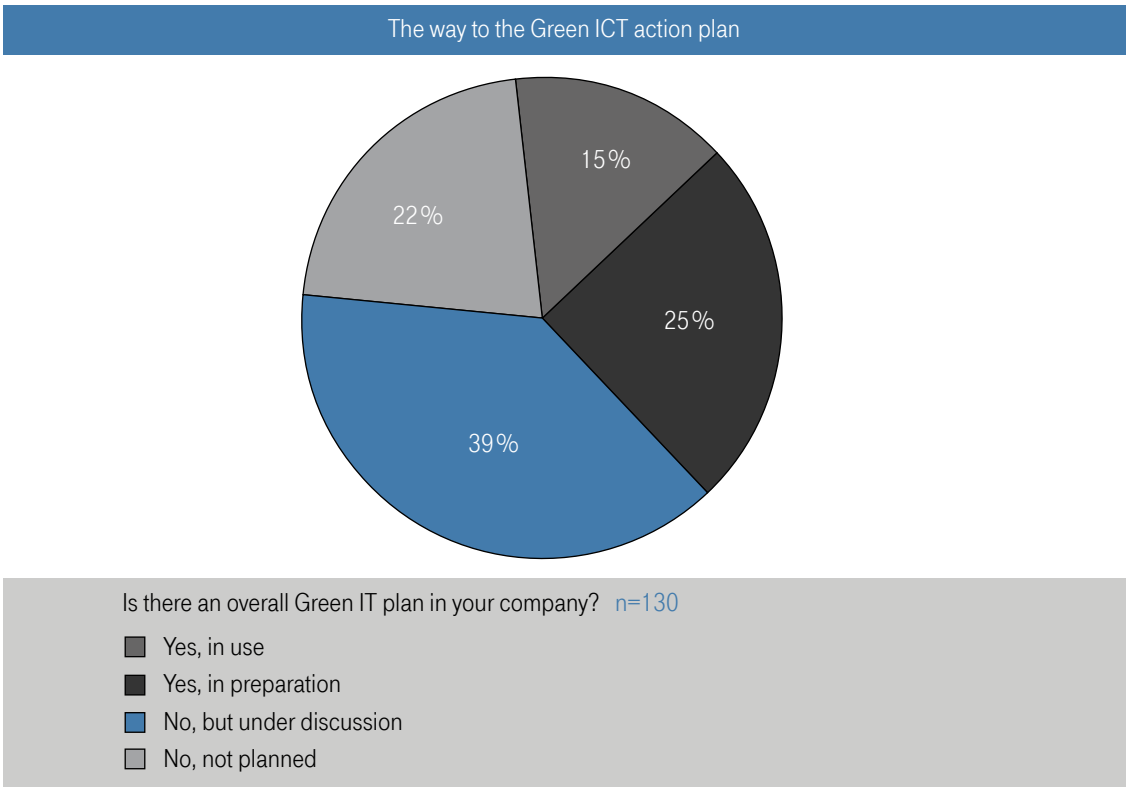


Fig. 6: Forrester, Green Progress in Enterprise IT, 2007.

According to T-Systems, the introduction of Green ICT technologies is based on various motivations — from an awareness of environmental protection through to reducing energy costs and improving image. These often very different targets and expectations must be bundled into a first step and assessed in order to create a starting situation which is accepted and understood by all.

Below is an example action plan:

1. Gather expectations
2. Determine status
3. Communicate action plan
4. Harvest any low-hanging fruit
5. Carry out measurements
6. Revise the selection process
7. Optimize use
8. Raise the awareness of employees
9. Reorganize ICT infrastructure
10. Support core processes

After gathering together expectations, a comprehensive inventory should follow: Which Green ICT activities have already been initiated? How can these be grouped together? How do you include the Green ICT plan in the higher-level CSR strategy? Which processes are the selection of hardware and suppliers based on? And an equally important point to be considered in advance: Which obstacles must be overcome, what restrictions must be complied with?

Identifying and using "low-hanging fruit" supports communication of the action plan. A few, simple to implement, targeted actions put into practice draw the attention of both employees and the public to the company's Green ICT efforts. Thus interest, acceptance and readiness for collaboration is generated through visible successes before the project actually begins. This effect has already been achieved through disposing of hardware which is not used, introducing a corporate-wide power management system or by joining an environmental protection organization.

Only then does the actual action plan enter into force in full. According to Forrester, this should include the following measures in particular: Revision of measuring methods and selection processes, optimization of the use of the existing ICT landscape, reorganization or creation of a new infrastructure and the use of ICT in core processes.

The introduction of more widespread measures is fundamentally necessary: In order to make the success of a Green ICT strategy visible, it must, for example, be possible to present in detail the energy consumption of the data center. Those responsible for ICT also generally do not currently know what power consumption they are responsible for — here ICT and building management must be merged more closely, measuring results must be available at all levels and the data center energy costs must be made known to the CIO. Existing processes, for example, for selecting hardware and suppliers, should now be extended to include measurable criteria taking into account environmental protection.

Excursus: Green Dynamics Model.
In order to create this transparency for CIOs, T-Systems developed the "Green Dynamics Model" together with Dr. Christian Hölzl (Communications & Simulation Engineering, University of Applied Sciences, St. Pölten), which analyzes and demonstrates the various influencing factors on energy consumption in data centers.

Using the "Green Dynamics Model", increases in efficiency and thus a reduction in energy requirements can be shown and measured through various technological measures.

This includes degrees of virtualization, pooling effects and improving the PUE value. Physical resources include computer power, CPU, storage or other objects of examination.

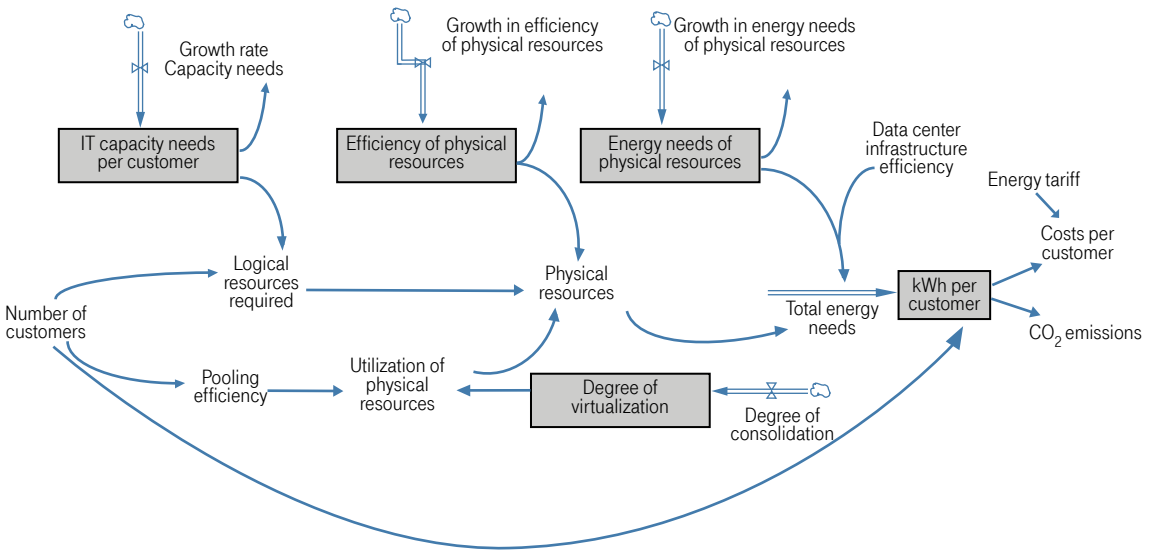


Fig. 7: Green Dynamics Modell – Simulation of interdependencies

The model omits excessive complexity in favor of comprehensibility and transparency and enables a fast, in depth assessment of the current and target conditions. This facilitates corporate decision-making without leaving out important aspects and shows potential ways to cut down CO_2 emissions.

The significance of the model can be shown using the example of CPU resources.

	Scenario 1: In-house operation in typical infrastructure environment	Scenario 2: Operation in optimized data center at a service provider
Simulation over 1 year		
kWh per customer	262,800	48,159
Costs in EUR per customer[2]	18,396	3,371
Costs	100 %	18 %
CO_2 emissions in tons	45.99	8.73
CO_2 emissions	100 %	18 %
Equivalent to km by car[3]	287,438	52,673
Saving in km by car	-	234,764
Simulation over 5 years		
kWh per customer	728,820	110,231
Costs in EUR per customer[4]	51,017	7,716
Costs	100 %	15 %
CO_2 emissions in tons	127.54	19.29
CO_2 emissions	100 %	15 %
Equivalent to km by car[5]	797,147	120,565
Saving in km by car	-	676,582

[2] Assumption: Market price EUR 0.07 per kWh
[3] Assumption: 160 g CO_2 emissions per km
[4] Assumption: Market price EUR 0.07 per kWh
[5] Assumption: 160 g CO_2 emissions per km

Figure 8: Simulation of in-house operation vs. operation in the optimized data center of a service provider (for 1 and 5 years).

The simulation results calculated confirm the dynamic behavior of the ICT infrastructure and the impact on energy consumption.

Overview of results (5-year simulation)

- Energy reduction of 618,589 kWh
- Cost reduction of EUR 43,301
- CO_2 reduction of 108.25 tons (this corresponds to driving a car more than 676,000 kilometers)

These savings result from a reduction in hardware (up to 4/5 achieved through virtualization), a reduction in mainframes (up to 50% through pooling and reducing server utilization from 15% to 70%) and optimized infrastructure operation (a PUE value of 1.5 is possible, typical data centers here have a value of 2.5).

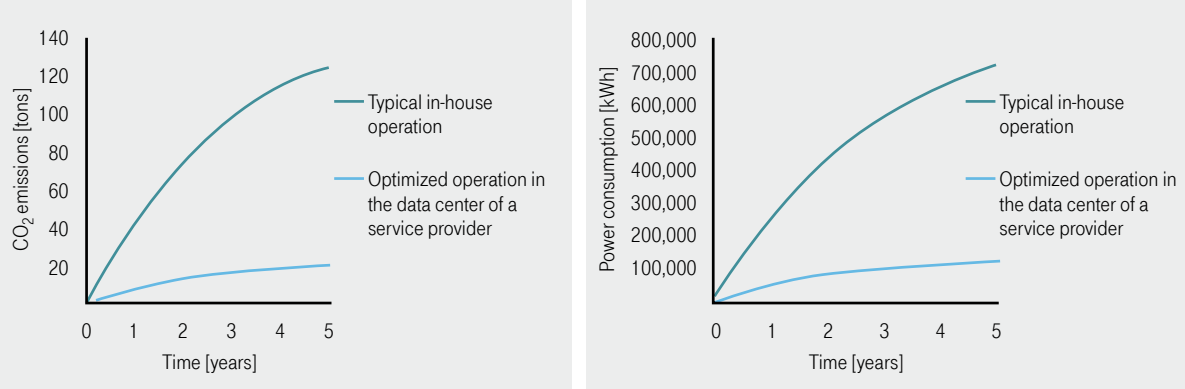


Fig. 9: A comparison of CO_2 emissions and power consumption: In-house operation vs. optimized operation in the service provider's data center

Using the "Green Dynamics Model", - transparency and awareness of Green IT is increased both internally and externally, whilst at the same time demonstrating the contribution of the ICT industry to a global CO_2 reduction.

Even without investing millions in new structures, the existing ICT landscape offers numerous optimization potential, as described in Section 3, from the correct disposal of hardware through to improved cooling of the data center.

This should be followed up with extensive staff training: Employees must be aware where they can reduce their impact on the environment through simple actions, and they must take these to heart. Only if the employees know the environmental protection objectives of the company and contribute to them will they follow the appropriate guidelines and further develop these actively.

Major, long-term projects are to be assigned to reorganizing or creating a new infrastructure. Unlike the "low-hanging fruit", these projects cannot be carried out ad hoc but require tailed planning. Example reorganizations include the introduction of a thin client landscape, the extensive replacement of hardware in the data center, or the subsequent outsourcing of all data centers.

The use of ICT in the company's core processes, as described in Section 3.3, should also be a fixed component of the action plan. Based on a "green" ICT landscape, ICT reveals its full potential in the core processes and thus helps to make every corporate division "greener". Avoiding unnecessary paper consumption, reducing traffic volume and optimizing industrial workflows provides much greater CO_2 reduction potential. At this stage, every company should review how its own core processes can be simplified and made leaner by the use of ICT. At the same time, the company's entire CO_2 emissions can be reduced by the intelligent use of ICT.

5. Summary.

The topics of climate change and environmental protection have been discussed for decades. Now they have become a reality for companies, which are now also taking responsibility for the CO_2 emissions they have produced, and are also taking action.

ICT is playing an important role here in several ways. It causes around 2% of the global CO2 emissions - this must, and can, be reduced. Furthermore, ICT can also be used intelligently in all other business processes to help to reduce the impact on the environment.

Companies which use Green ICT are thus making a valuable contribution to protecting the environment. And they are also benefiting from it in many respects. Many of the approaches presented here are associated with cost reductions, and of course the reduction in energy consumption in particular. Corporate image and both customer and employee satisfaction is noticeably better. If the politization of the climate debate continues, various legal ICT regulations will also emerge in the near future — companies are therefore well advised to act now.

Some approaches are already in use: According to the VDR (The German Business Travel Association), for example, 65% of German companies already use telephone and video conference systems to avoid travel, and, according to findings of the Experton Group, nearly 60% of German companies use server virtualization.

Every company has different starting requirements. These should be analyzed first. We have already familiarized ourselves with possible starting points in core processes and in the areas of the data center and office workstation. Rapid success can be achieved primarily through "low-hanging fruit", for example through the energy-efficient use of terminals or double-sided printing. Greater potential can be achieved more easily together with an ICT service provider.

Its know-how in video telephony, electronic archiving or, as with dynamic services, its professional data center structures, can, for example, create significant added value for any company. But be careful! Interventions in core processes must be carefully planned - although these measures promise excellent and, above all, sustainable results. It is crucial in all approaches that companies first proceed in a structured manner and secondly that they coordinate all their Green ICT efforts, or ideally even bundle these all together.

6. Environmental initiatives.

Various organizations have started environmental initiatives in the Green ICT area. A selection of the most prominent initiatives is given below:

BITKOM	Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e.V. [German Association for Information Technology, Telecommunications and New Media] BITKOM Guideline "Energieeffizienz von Rechenzentren" [Energy efficiency of data centers]. www.bitkom.de
THE GREEN GRID	Alliance of predominantly US IT companies and software manufacturers which set itself the target of increasing the energy efficiency of servers and data centers, "The Green Grid Metrics". www.thegreengrid.org
ETNO	The European Telecommunications Network Operators Association (ETNO) published its "Environment and sustainable development" charter in 1996 with the target of promoting a continual improvement process and best practices as regards environmentally-friendly activities and the shared use of other sustainability criteria. www.etno.be
UNITED NATIONS GLOBAL COMPACT	GLOBAL COMPACT is a global initiative concluded between companies and the United Nations to make globalization more socially and economically acceptable. Participating companies thereby declare their wish to strive for specific social and ecological minimum standards. www.unglobalcompact.org
GESI	GeSI, the Global e-Sustainability Initiative, is a global initiative by ICT companies to promote technologies for sustainable development. www.gesi.org
CLIMATE SAVERS	Initiative of companies (energy companies, environmental organizations, computer and server manufacturers, computer and server buyers) which want to increase their energy and cost efficiency. www.climatesaverscomputing.org
80 PLUS	80 plus is a North American initiative to promote PC network components which have an efficiency of at least 80%. The initiative also lists compliant devices and makes the appropriate test reports available on the Internet. Its objective is to increase the energy efficiency of servers and data centers. www.80plus.org

7. Glossary.

CAD	Computer Aided Design; software for computer-aided design.
Carbon footprint	The total CO_2 emissions of a company is described as the "carbon footprint".
CO_2 eq	Carbon dioxide equivalent: Every greenhouse gas can be converted into a volume of carbon dioxide (CO_2) as regards its potential global warming impact. 1 kg methane (CH4) corresponds, for example, to 21 kg CO_2 equivalent according to the Intergovernmental Panel on Climate Change.
Collaboration	Collaboration of several people, sometimes using Internet-based software.
CSR	Corporate Social Responsibility; describes the voluntarily responsible and sustainable behavior of the company in social, ecological and economical matters.
Dynamic Services	T-Systems' offer for the variable and requirements-based provision of ICT resources and services, e.g., computer capacity, data services or SAP applications.
NGO	Non-Governmental Organization; a non-governmental, non-profit organization.
PUE	Power Usage Effectiveness: Metric used to determine the effectiveness of power usage; the value is derived from the total power used and the output of IT devices (quotient); Source: Green Grid Organization
Real ICT	The ability to offer an end-to-end range of services and solutions across different technologies for all information and communications technology.
SLA	Service Level Agreement. This formally agreed document, which is generally part of the agreement governing an ICT service, establishes quantitative (or qualitative) measured variables which are regularly determined to inspect a service. The SLA includes all the required regulations and responsibilities. Typical SLAs describe operating times or availabilities, for example.
RFID	Radio Frequency Identification; a technology for identifying and querying information via radio.
Smart building	Building with IT and communications-based networked systems such as heating, lighting, multimedia systems, household appliances and sanitation systems and the connection to external networks such as the Internet.
Thin client	Workstation PCs the functionalities of which are restricted to input and output. Operating system and software are located on central servers and are administrated from there.
Virtualization	Provision of ICT resources which do not physically exist.
Workflow	Predefined sequence of activities.

Source: Based on the studies and articles documented in the list of sources.

8. List of figures.

9. List of sources.

[A.T. Kearney 2008]	Green IT – vom Umweltsünder zum Klimaretter [Green IT - from environmental polluter to cliamate saver]
[BitKom 2006] Brochure	Virtualisierung [Virtualization]
[Borderstep 2007]	Zukunftsmarkt energieeffiziente Rechenzentren [Future market in energy-efficient data centers]
[EICTA 2008]	High Tech – Low Carbon
[Experton 2007.1]	Green IT – Was für Anwender sinnvoll ist [Green IT - What is worthwhile for users]
[Experton 2007.2]	Building a Green Server Infrastructure
[Experton 2008]	"Green IT“ - im Spannungsfeld zwischen Modewort und wirtschaftlicher Notwendigkeit ["Green IT" - in the area of conflict between a buzz word and economic necessity]
[Fraunhofer Umsicht 2008.1]	PC vs. Thin Client. Wirtschaftlichkeitsbetrachtung. [PC vs. Thin Client. Economic assessment]
[Fraunhofer Umsicht 2008.2]	Ökologischer Vergleich der Klimarelevanz von PC und Ihm Client Arbeitsplatzgeräten [Environmental comparison of PC and thin client workstations]
[Forrester 2007.1]	Green Progress in Enterprise IT
[Forrester 2007.2]	Creating the Green IT Action Plan
[Gartner 2007.1]	IT Organizations will need eight Technologies to provide "Greener" Services
[Gartner 2007.2]	Conceptualizing ‚Green‘ IT and Data Center Power and Cooling Issues
[IfKom Lexikon 2008]	Was ist eigentlich... Green IT? [What actually is Green IT?]
[McKinsey 2008]	Addressing consumer concerns about Climate Change
[MFG Stiftung 2007]	IT-basierte Öko-Effizienz [IT-based eco-efficiency]
[Sterman, John D.]	Thinking and Modeling for a Complex World
[T-Systems 2008]	White Paper Dynamic Services
[T-Systems 2008]	White Paper Real ICT
[VDR 2007]	Geschäftsreiseanalyse [Business travel analysis]
[VDR 2008]	Geschäftsreiseanalyse [Business travel analysis]

Published by:
T-Systems Enterprise Services GmbH
Mainzer Landstrasse 50
D-60325 Frankfurt am Main, Germany

Responsible for content:
Corporate Business Development

Contact:
T-Systems Enterprise Services GmbH
Corporate Marketing & Communications
Hermann Hänle
Fasanenweg 5
70771 Leinfelden-Echterdingen, Germany
E-mail: Hermann.Haenle@t-systems.com

T-Systems Enterprise Services GmbH
Officer for environmental protection and sustainability
Dr. Ralf Bündgen
Godesberger Allee 117
53175 Bonn, Germany
E-mail: Ralf.Buendgen@t-systems.com

T Systems