White Paper

Green IT

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Munich, March 2008
Germany

Communication for the open minded

Siemens Enterprise Communications
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Executive summary

Green IT is literally a hot issue in information technology. It has been calculated that the IT equipment deployed worldwide accounts for about the same amount of CO_2 emissions as international air traffic.

Looking at the bigger picture of today's energy and resource consumption, three key factors stand out:

1. The electrical power and energy requirements of communications systems such as telephone systems, VoIP softswitches, end devices, and unified communications solutions
2. CO_2 emissions and resource consumption associated with producing, shipping, and disposing communications systems
3. Potential energy savings and a smaller CO_2 footprint enabled by smarter use of enterprise communications

Modern unified communication solutions converge the different communication media and means within enterprises, boosting the productivity of the workforce and the entire company. More efficient enterprises use energy more efficiently. And this is precisely the point at which economics and ecology meet.

The time to go green is now!

Table of contents

Green IT

Green IT is literally a hot issue in information technology.

It has been calculated that IT equipment deployed worldwide accounts for about the same amount of CO_2 emissions as international air traffic. The purpose of energy-saving green solutions goes beyond assuaging decision-makers' conscience. They also aim to cut power consumption to drive down costs. This is the crossroads where ecology and economics meet. In the years ahead, a product's green credentials will be a key criterion in the buying decision, not only because energy costs will continue to rise, but also in view of ethical and moral considerations. The time to go green is now.

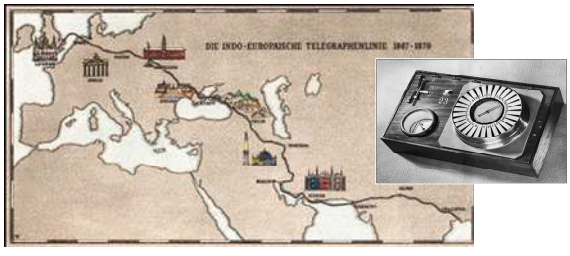
An example: **Google's energy-balance equation**

The Google computer cluster comprises 31,654 servers (2*2GHz, 2GB RAM, and 80GB HDD). Given 213 W per server power consumption and 93% capacity utilization, the cluster draws 150 megawatt hours per day. With cooling and infrastructural energy requirements added to the equation, total energy demand is 300 megawatt hours per day.
On the other side of the equation are 40 million searches per day in 2005, averaging to eight watt hours per search. With the transition to new Quad Core processor technologies, this figure drops to four watt hours per search, which comes to about 3g CO_2 per search. According to [1]

To date, interest in energy efficiency focused on IT, with discussions revolving around energy-saving PCs, thin clients, and laptops at the workplace, as well as server and storage solutions in "green" computing centers.
IT's overall power consumption breaks down to 53% for cooling and infrastructure, 10% for power supply units, and 37% for the actual IT components such as servers (18%), storage (13%), and network equipment (6%).

According to [2]

Telecommunication must also do its part in conserving resources. The EU Commission agrees - it is working on an initiative to boost energy efficiency in data centers. This EU plan also addresses IP-based communication devices.
Telecommunication has always been an efficiency enhancer; a powerful means of sparing resources. From telegraphy's inception, telecommunication has vastly reduced the amount of energy expended on transporting people and mail.



When the Indo-European telegraph line connecting London and Calcutta began operating in 1870, it not only made much travel unnecessary, it also transmitted news and messages at speeds approaching real time.

Looking at the bigger picture of energy savings opportunities today, three key factors stand out:

1. The electricity and energy requirements of communications systems such as telephone systems, softswitches, and end devices
2. CO_2 emissions and resource consumption associated with producing, shipping, and disposing communications systems
3. Potential energy savings and a smaller CO_2 footprint enabled by smarter use of enterprise communications

Green IT through optimized communications systems

In traditional TDM technology, all the intelligence resided primarily in phone systems comprising a lot of proprietary hardware and discrete components. It provided most of the computing power and of course consumed the lion's share of energy. Handsets required very little electrical power, easily supplied via the phone line. Phone displays were small, with a screen limited to the non-color gray.

Dedicated and discrete circuits were not the only big electricity consumers. Phone systems required convection cooling, which has a very big appetite for power. The total electrical connected load of phone systems with 1,000 extensions ranged up to 5.4 kilowatts, and their cooling systems consumed at least as much power.

Today newer models such as HiPath 4000 hardly consume more than one kilowatt of electrical power, and do without air-conditioning altogether. This reduces power consumption to less than one watt per subscriber!

An individual phone system's energy consumption is just part of the story. For networked phone systems, there is the overall system's power consumption to consider. Classic phone systems were distributed; that is, every company site had its own phone system. IP technology allows phone systems to be centralized so that remote offices need only small, energy-saving gateways to communicate. Sophisticated solutions based on IPDA and HiPath 4000 and spanning many sites clearly decreased overall

power consumption – by up to 38%, depending on the customer's configuration.

What is more, sophisticated systems such as this may be installed, operated, and maintained remotely. There is no need for service engineers to travel to the different locations, which also cuts back on CO_2 emissions. In other words, a centralized communications system residing at the data center reduces energy consumption directly as well as indirectly.

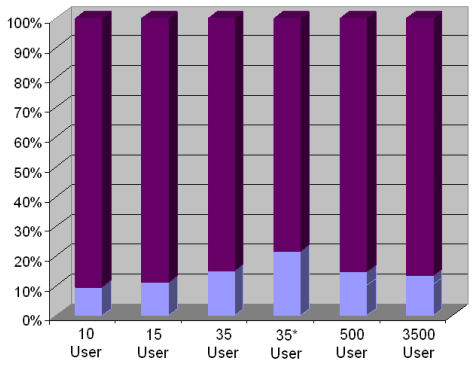
Large systems' power consumption may be reduced further by changing over to software-based VoIP solutions such as Siemens HiPath 8000 that run centrally on standard servers in the IT data center. Standard servers are preferable to proprietary hardware for big systems because they are more energy-efficient. Far fewer computers are needed for communications system centralized in a data center, which also reduces overall current consumption. Just two servers in the computer center are all it takes to provide phone services to as many as 100,000 subscribers. This centralized approach not only drives down the company's total cost of ownership for the communication system, it is also a greener IT solution than classic distributed VoIP systems, as a study conducted by ComConsult shows [3]

"With respect to the server infrastructure and end device connectivity, the described scenario - where telephony and voice mail services are provided to 10,000 subscribers in a central location and at several remote locations and/or branches – may be realized more energy-efficiently with Siemens components. Although the cited figures for power consumption are rough estimates, the fact that the Siemens scenario uses fewer servers already illustrates the savings potential. Also, the ability to integrate various extension modules into HiPath 4000 offers savings potential. In contrast to the Cisco Router, it also accommodates analog end devices.

The added functionality as a router stands in contrast to the option of connecting more TDM-based end devices because HiPath 4000 offers the full range of a hybrid PBX's functions.
The ascertained 540 W difference in energy demand adds up to about 4730 kWh in yearly savings. Given a price of 0.15 € or 0.1785 € including value-added tax, this yields 844.30 € annual savings. This may not seem very high, it is roughly the yearly consumption of a three-to-four person household (without electrical hot-water or room heating). The production of this amount of electricity generates about 2900 kg CO_2, depending on the underlying energy mix."

[3] ComConsult, December 2008

This centralization in the computer center is just one way of realizing energy-efficient communications systems. Another possibility for reducing infrastructural power consumption is to centralize functionality in a communications appliance such as HiPath OpenOffice that was developed for midsize enterprises. Rather than being installed on separate computers, functions such as e-mail, firewall, and other IT security applications, as well as WLAN controllers, reside as pure software applications on consumption-optimized hardware that runs the Linux operating system. This can slash infrastructural energy costs by more than 50%.



Typical power consumption mix of platform (blue) and end devices (purple) depending on the number of users
* = Power consumption mix for a communications appliance

However, reducing the infrastructure's power consumption merely makes a small contribution to green IT in communications systems. In typical communications systems configurations, IP end devices account for more than 75% of these systems' overall power consumption.
IP phones consume more power than traditional TDM devices. In a classic wireline setup, the device remains in energy-conserving standby mode by default until a call is initiated. IP-based systems, in contrast, must constantly analyze signaling information in the network.

This means the phone's processor and the IP interface always remain active. The higher the IP interface's clock speed, the more power it consumes, so gigabit Ethernet draws a considerable current. But power consumption can be reduced significantly by replacing traditional IP phones with innovative new designs. One way to do this is by using application-specific integrated circuits (ASICs) in place of discrete circuits; another is to use load-dependent clock speed modulation to control the main processor's frequency.
With these improvements, the new HiPath OpenStage end devices from Siemens consume about 35% less electrical power than their optiPoint predecessors. Projected across the full range of end devices, this efficiency reduces power consumption by 32 gigawatt hours, which is about the amount of electricity it takes to power some 8,000 households a year. It constitutes a 20,000-ton reduction in CO2 output.

The growing trend to do without classic phones altogether at many workplaces, with the workforce instead placing and receiving phone calls by was of soft clients that run on PCs, is having a positive effect. Soft clients consume a lot less electrical power, assuming that the PC or laptop would be running anyway. The USB handsets that afford such convenient access to soft clients also use far less electrical power than "proper" IP telephones.

With the introduction of remote access procedures, central management, and the ability to access to distributed components, technicians are compelled to travel far less frequently to remote sites. Easy-to-install communication solutions need little technical support, and self-installing solutions such as HiPath BizIP need none at all. Customers simply install their tailored communication solutions on site and on their own.

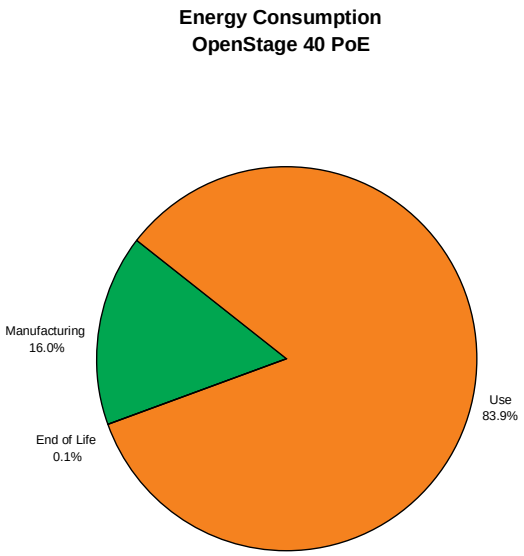
Wireless technologies are part of enterprise communication solutions, and merit consideration when assessing the amount of energy expended on telecommunications. WLAN access points require energy, and more powerful networks need more power to run. The new WLAN standard 802.11n is geared to support higher bandwidths ranging up to 300 megabits per second. If some vendors are to be believed, this performance increase comes at the price of far higher power consumption. Power-over-Ethernet (PoE) systems are unable to satisfy these access points' appetite for energy, so they need added power supplies that increase power consumption. The Siemens solution requires just 13 watts, thus meeting the pertinent PoE standards.

Green IT balance and Life Cycle Assessment (LCA)

A telecommunication system's service life merely spans the time it is in use. However, it has an effect on the environment across its full life cycle from the cradle to the grave; that is, from its production to its disposal. This effect merits systematic analysis, and such life cycle assessments have been mandatory at Siemens since 1993 and are documented in Siemens Standard SN 36350. Siemens also complies with national and international industry standards such as

- DIN ISO 11469 (Generic identification and marking of plastic products),
- IEC Guide 109 (Environmental Aspects - Inclusion in Electro-technical Product Standards)
- ISO 14001 (Environmental Management Systems - Specification) and
- ISO 14040 (Life Cycle Assessment - General Principles and Practices).

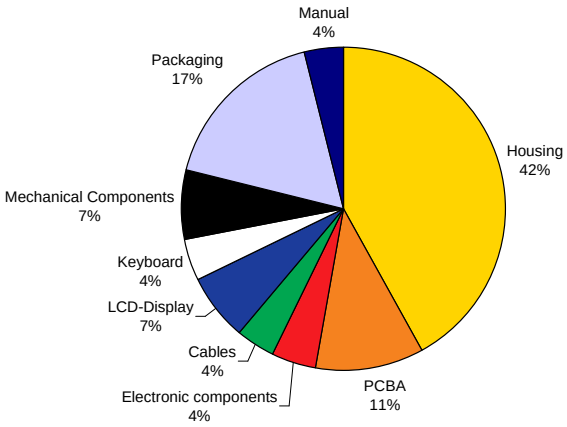
Siemens develops new products with energy consumption in mind, and with an eye to sustainable, resource-sparing use of raw materials and environmentally friendly production in compliance with ISO 14001. The company also applies DIN ISO 14021 standards for environmental product declarations (EPD) to communicate the environmental performance of products and systems.



The big-picture view:

The energy consumed by and for a Siemens OpenStage 40 SIP device

In this case, power consumption is calculated over nine year's service life, using power over Ethernet with an activity ratio of 0.15 erlangs.



Environmentally responsible selection of materials:

- Minimize the number of components
- Consider environmental performance when selecting components and suppliers
- Minimize packaging materials

Of course, all employed materials comply with international standards such as the EU's RoHS (Restriction of certain Hazardous Substances) directive and 76/769/EEC.

Green IT and business processes: Economics and ecology

Communication has always connected people and spared them unnecessary trips, and e-mail, telephones, and video conferences carry on the tradition. Often these sophisticated means evolved from humble beginnings, as the video conference's origins would attest. Students at Cambridge installed a video cam to keep an eye on the university's sole coffee machine, the idea being to constantly monitor its level. Even then, the students' main motivation was to avoid unnecessary trips - if only across campus. Today innovative unified communications, collaboration, and conferencing solutions enable efficient teamwork across remote locations.

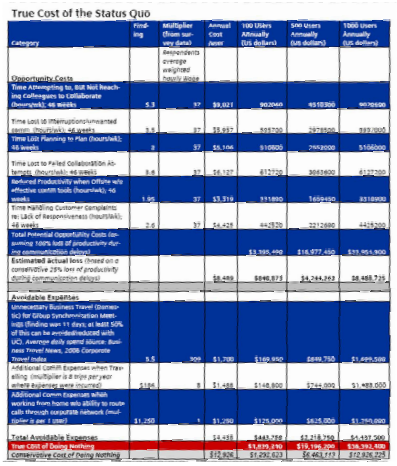
Technologies such as telepresence eliminate the need for travel. Connected by multimedia-enabled internets, employees at different sites can get together in virtual meetings. Modern video conference capabilities allow them to see and hear each other, and work on documents and presentations in a joint effort as if they were all in the same room. This renders many business trips superfluous. Video conferences are nothing new. The first solutions became available with ISDN, but the transmitted images' quality were a far cry from satisfying. Users were unwilling to accept gray-on-gray conferences as bland as this. Today the necessary bandwidth is available almost everywhere, and so are brilliant LCD and plasma screens that render high-definition images and come at affordable prices. This HD user experience and low latency make all the difference, so video conferences are becoming an accepted medium of collaboration. Technology in itself is without value – not until it gains acceptance does it become a key factor in company operations. Now video conferences are boosting productivity in enterprises.

Modern telecommunication solutions have made the home office increasingly viable and the commute to work unnecessary. With innovative teleworking tools, companies can commit far fewer resources to on-site working places. And with smart desk-sharing schemes, enterprises with a sales focus can operate with up to 70% fewer workstations. With less office equipment to buy and less office space to lease, maintain, heat, and air-condition, companies save on capital expenditures and energy costs. And more efficient communication also speeds up processes and boosts operating efficiency in the enterprise.

State-of-the-art communication solutions enabling efficient collaboration within virtual teams do more than merely cut energy costs and reduce CO_2 emissions.

- **Representative study with more than 500 subscribers in the USA and Europe**
- **Goal: Determine the opportunity costs of fragmented and redundant communication**
- **Upshot: Enterprises with 1,000 employees can incur productivity losses and opportunity costs ranging up to 10 million euros a year**

[4]


True Cost of the Status Quo

Category	Finding	Multiplier (from survey data) Respondents average weighted hourly wage	Annual Cost /user	100 Users Annually (US dollars)	500 Users Annually (US dollars)	1000 Users Annually (US dollars)
Opportunity Costs						
Time Attempting to, But Not Reaching Colleagues to Collaborate (hours/wk); 46 weeks	5.7	37	$9,021	902040	4510200	9020400
Time Lost to Interruptions/unwanted Sends (hrs/wk); 46 weeks	3.5	37	$5,537	553720	2768600	5537200
Time Lost Planning to Plan (hours/wk); 46 weeks	2	37	$3,164	316400	1582000	3164000
Time Lost to Failed Collaboration Attempts (hours/wk); 46 weeks	3.6	37	$5,127	512720	2563600	5127200
Reduced Productivity when Offline w/o effective comm tools (hours/wk); 46 weeks	1.95	37	$3,319	331880	1659400	3318800
Time Handling Customer Complaints re: Lack of Responsiveness (hours/wk); 46 weeks	2.6	37	$4,426	442520	2212600	4425200
Total Potential Opportunity Costs (assuming 100% lost of productivity during communication delays)				$3,395,480	$16,977,450	$33,954,900
Estimated actual loss (based on a conservative 25% loss of productivity during communication delays)			$8,489	$848,870	$4,244,363	$8,488,725
Avoidable Expenses						
Unnecessary Business Travel (Domestic) for Group Synchronization Meetings (finding was 11 days; at least 50% of this can be avoided/reduced with UC). Average daily spend source: Business Travel News, 2006 Corporate Travel Index	9.5	309	$1,709	$169,950	$849,750	$1,699,500
Additional Comm Expenses when Traveling (multiplier is 8 trips per year where expenses were incurred)	$185	8	$1,488	$148,800	$744,000	$1,488,000
Additional Comm Expenses when working from home w/o ability to route calls through corporate network (multiplier is per 1 user)	$1,250	1	$1,250	$125,000	$625,000	$1,250,000
Total Avoidable Expenses			$4,448	$443,750	$2,218,750	$4,437,500
True Cost of Doing Nothing				$3,839,230	$19,196,200	$38,392,400
Conservative Cost of Doing Nothing			$10,926	$1,292,623	$6,463,113	$12,926,225

A study conducted by the Canadian consulting firm **Insignia Research** in Toronto showed that companies with 1,000 employees could lose more than 10 million euros a year to productivity losses and avoidable expenses. The root cause of this potential loss is a fragmented communication environment lacking a consistent unified communications solution that brings e-mail, mobile phones, and wireline telephony together. These costs are an economic problem for enterprises; what is more, the extra effort and workflow delays are also an ecological problem. People work longer hours, but not more productively. This extra work also consumes resources - energy to power the office infrastructure and lighting, not to mention the unnecessary burden placed on IT systems.

Unified communications solutions not only make enterprises more successful, they also spare the environment.

More efficient Unified Communications speed up processes, boost operating efficiency in the enterprise, cut energy and resource consumption

Modern end devices leverage intelligent technology to reduce energy expenditure by 35% while providing the same functionality

Centralized IT and running Unified Communications as pure software use far electrical power than distributed VoIP systems

Reducing CO_2 emissions and using electrical energy wisely protects the environment – and pays dividends for enterprises. The direct costs of communications systems and end devices' power consumption have an impact on the company's bottom line, and so do the indirect but very real benefits of green enterprise telecommunication.

Modern unified communication solutions converge the different communication media and means within enterprises, boosting the productivity of the workforce and the entire company. More efficient enterprises use energy more efficiently. And this is precisely the point at which economics and ecology meet.

The time to go green is now!

You can START right now!

Appendix

[1] **Google - A Model for the Systems Architecture of the Future,**
Prof. Paul A. Strassmann George Mason University, December 5, 2005
Energieeffiziente IT Lösungen,
rolf.kersten@sun.com, Sun Microsystems, September 2007
Power Provisioning for a Warehouse-sized Computer,
Luiz AndrÚ Barroso et al., Google Inc , June 2007

[2] **Cisco Presentation at C-Scape 2007**

[3] **Energieverbrauch Siemens HiPath vs. Cisco CUCM,**
ComConsult Dezember 2007

[4] **"**Measuring the Pain: What Is Fragmented Communication Costing Your Enterprise?" **conducted by independent Insignia Research of Toronto, Canada and commissioned by Siemens Enterprise Communications.**

Glossary (www.wikipedia.org, www.siemens.com)

VoIP Voice over IP
A just intermediate step from the Plain Old Telephony Systems (POTS) world to Unified Communications solutions. VoIP is based upon
- Proprietary And Common Hardware And Software
- Converged IP Networks

Fundamental technology discontinuity will drive market disruption even more than VoIP

SIP The **Session Initiation Protocol** (**SIP**) is an application-layer control (signaling) protocol for communications. SIP is designed to be independent of the underlying transport layer.

SOA **Service Oriented Architecture** (**SOA**) is a computer systems architectural style for creating and using business processes, packaged as *services*, throughout their lifecycle. SOA also defines and provisions the IT infrastructure to allow different applications to exchange data and participate in business processes. These functions are loosely coupled with the operating systems and programming languages underlying the applications SOA separates functions into distinct units (services), which can be distributed over a network and can be combined and reused to create business applications.

UC **Unified** Communications

UC solutions are built on a strong voice foundations and focus on embedding communication and collaboration into business processes. This increases workplace productivity and effectiveness. UC solutions should be software-based, open, extensible and support customer choice of services such as:

- Enterprise grade voice with carrier-class scale and resiliency
- Presence across multiple media
- Instant messaging
- Person-to-person, and group audio and video conferencing
- Web conferencing (data and applications)
- Customer interaction centers
- Unified messaging
- Mobility solutions
- CEBP (Communications-Enabled Business Processes)

These elements are controllable as software services, or from the customer's existing business application software

OpenPath, Open Communications: When Siemens introduced LifeWorks vision in 2003, the idea of providing a unified user experience over a unified domain still seemed more visionary than deployable. Today, Siemens Enterprise Communications' approach to Open Communications, shows how tangible LifeWorks has become for enterprise customers. Siemens' Open Communications UC uniquely empowers business communities using its OpenPath migration strategies to converge voice, IT, and mobile communications through unified communications and collaboration solutions. Siemens Enterprise Communications' strategic concept for Open Communications is a human-centric and business-oriented approach of unifying different modes of communications based on products and services built on a foundation of open standards. It binds the voice, IT, and mobile domains together to accelerate the decision process by facilitating global conferencing and collaboration among individuals.

Munich-based Siemens Enterprise Communications GmbH & Co. KG, a wholly owned subsidiary of Siemens with more than 15,000 employees, is one of the world's leading vendors of Open Communications solutions for enterprises of all sizes. Our products, solutions and services make business processes more productive, faster and more secure - with any device, network or IT infrastructure.

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