Cost Down, Environment Up

How to leverage Green IT to achieve sustainable cost savings

Organizations may be tightening their belts in current economic times, but green IT's global momentum shows no sign of slowing down, according to the Arthur D. Little market survey in January 2009. The CIO must combine Green IT initiatives with cost improvement programs to convince executive management. Savings potentials of Sustainability IT programs are in the range of 6 to 11% of total IT costs.

General environmental issues

Over the last decade the widespread use of ICT, especially end-user devices, data centers and telecommunication networks, has significantly increased greenhouse gas emissions. By 2020, the ICT industry will be among the biggest greenhouse gas emitters.

PCs, laptops and mobile phones pose substantial environmental problems along the entire lifecycle, from their production to their disposal. IT energy consumption is rising, putting additional pressure on already overstressed electric grids and resources.

Data centers and servers, in particular, contribute to the surge in energy consumption in the ICT sector. 2.2 million server consumed approximately 10.1 TWh in 2008 in Germany. This is equal to four mid-sized coal power plants. Research institutes estimate the energy consumption to rise to reach 12.9 TWh by 2010.

Companies and society alike are obliged to minimize ICT's environmental impact. By improving energy efficiency, lowering greenhouse gas emissions, and using less harmful materials firms can help to create a more sustainable environment.

The carbon footprint of ICT

The total carbon footprint of ICT (PCs and peripherals, telecoms networks and devices and data centers) amounted to 830 million tons of CO_2. This represents 2% of total man-made CO_2 emissions. Carbon generated by ICT materials and manufacture accounts for 25% of ICT CO_2 footprint, the remaining 75% result from the use of ICT. Annual growth for ICT CO_2 is expected to amount up to 6% until 2020.

The highest growth in ICT emissions is expected to come from China, India and other developing countries. Today, only 10% of the Chinese population owns a PC. By 2020, seven out of ten Chinese will own a PC. This indicates an ownership level comparable to the U.S.

Just one of ten people in China own a PC today – by 2020 that figure will have grown to seven in ten, being comparable to ownership rates in the US today. Similar developments are expected in the whole ICT sector for most developing countries. By 2020, developing countries will be responsible for more than 60% of world wide ICT carbon emissions.

Energy efficiency optimization helps to cut costs significantly

By implementing energy-saving measures companies can save on average 20% of their energy costs.

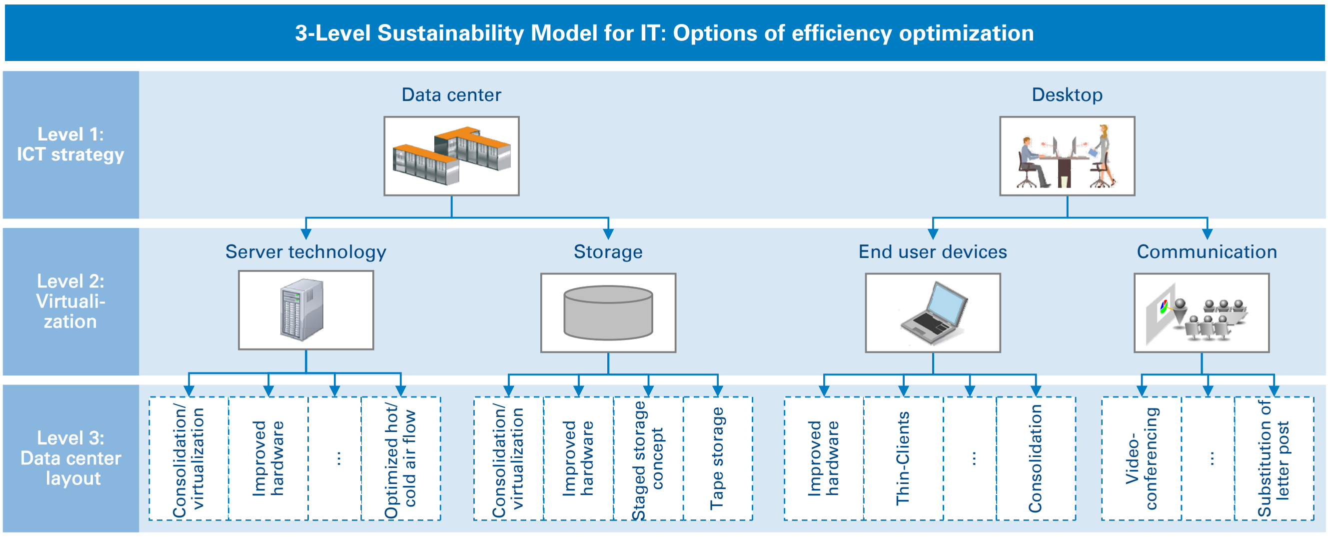
In the face of the current economic downturn, a sustainable IT strategy offers a tremendous opportunity to leverage reduced budgets and minimize the total cost of IT ownership.

The Arthur D. Little's 3-Level Sustainability Model for IT shows efficiency optimization options on three different levels of abstraction. (see figure 1 overleaf)

Trends and demands of sustainable ICT

As a business enabler, ICT must meet corporate expectations. CIOs need to be familiar with the following trends.

Figure 1: Our 3-Level Sustainability Model for IT support to identify several options for cost saving initiatives



- Companies and customers demand fast and convenient IT services at a low price and 24/7 availability.
- Because the need for processing power will increase markedly in the next five years, we will see the re-modeling of existing data centers as well as a building boom for new data centers.
- TCO calculation for new IT investments need to reflect energy consumption as a significant contribution for budget allocation.
- Shift from "One-Server for One-Application"-philosophy towards cost-efficient virtualization infrastructure.
- Availability of new technologies support continuous monitoring of energy consumption which leads to decrease of current IT operating costs.
- Global push of relocation or consolidation activities of data center operations towards low cost countries.

Taking into account these developments CIOs have to design a balanced ICT operations strategy that will meet the objectives of all stakeholders.

Measuring sustainable IT

During the design of the ICT operations strategy CIOs must decide how to control energy cost without affecting negatively the delivery of critical IT services. This requires metrics to be in place that allow for the continuous monitoring of data centers' effectiveness and efficiency. These metrics need to capture and quantify work output of a data center in relation to the amount of specific resources expended. Such frameworks have been developed and are now in place the ICT industry. (see figure 2 overleaf)

These metrics build the cornerstones to determine whether a data center is being operated in a power-efficient manner. The PUE (Power Usage Effectiveness) value is a compelling way to measure energy efficiency in data center facilities because it offers our industry an apples-to-apples comparison similar to the miles-per-gallon.

CIO agenda – Which actions to take?

To satisfy all stakeholders and nourish company profits CIOs need to have answers to rising energy consumption and growing environmental concerns. To tackle these demands we at Arthur D. Little put the focus on the following three levels:

A) Level 1: Redesign of ICT operations strategy

CIOs need to be prepared to rethink most of their IT Operations activities and to enforce systematic controls which ensure that defined goals are reached. Enforcing this "sustainable" mandate requires a comprehensive strategy shift that addresses both opportunities and risks associated with becoming more sustainable:

- Perform Sustainability Benchmark for current energy efficiency and performance of ICT operations.
- Assess energy black holes caused by data centers, networks end-user devices.
- Develop an energy dash board to monitor energy efficiency in ICT.
- Evaluate 'best-fit' virtualization strategies.
- Evaluate ICT policies and processes in terms of level of support for sustainability goals.

B) Level 2: Virtualization of ICT-infrastructure

a. **Consolidating physical server hardware and increasing storage efficiency**

The number of servers in data centers has increased six-fold to 30 million in the last decade while aggregate electricity

Figure 2: Framework of key metrics to support sustainable IT initiatives

Load distribution and PUE scenarios

Load distribution	kW	Share of total load
IT load	798	50%
Chiller plant	399	25%
RC/CRAC loads	192	12%
UPS/transformer loss	160	10%
Lighting	48	3%
Total load	1,596	
Total support load	798	
PUE	= 1,596 kW / 798 kW = 2.00	
DCE	= 1/ PUE = 50%	

#	Scenario options	PUE
1.	Current trends	1.9
2.	Improved operations	1.7
3.	Best practices	1.3
4.	State of the art	1.2

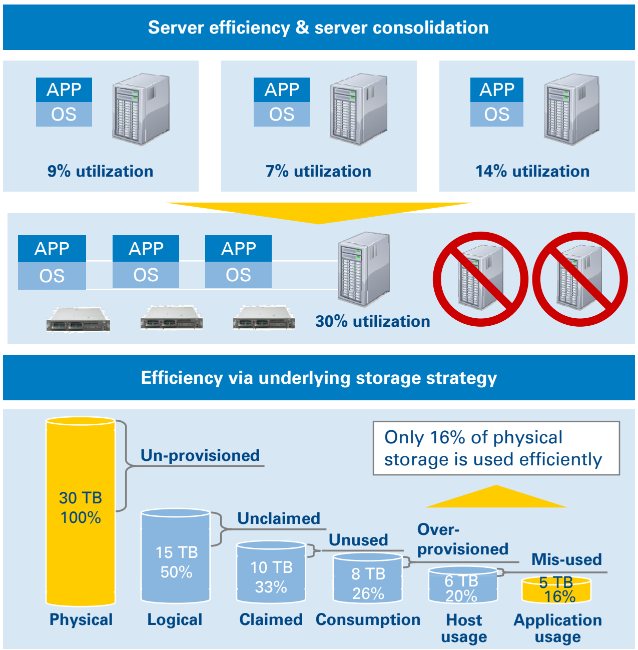
Source: Uptime institute, Arthur D. Little research

Key metrics for sustainable IT

PUE – (Power Usage Effectiveness)	Total power entering a data center / IT relevant energy consumption
DCE – Data Center Efficiency	IT relevant energy consumption / total power entering a data center (= 1/PUE)
IEP – IT Equipment Power	Sum of energy consumption for IT-processing, storage and deployment plus management
TFP – Total Facility Power	Total energy consumption of a data center (incl. cooling, energy supply, lighting, etc.)
IT-PEW – IT Productivity Per Embedded Watt	IT productivity / necessary power
DC-EEP – Data Center Energy Efficiency and Productivity Index	Composite result at the data center level of multiplying IT-PEW and SI-EER

use for servers doubled between 2000 and 2005. There is starting to be a growing awareness to consolidate physical server parks by hosting multiple virtual servers on a smaller number of more powerful servers. Increasing not only servers' utilization, companies can also save up to 85% of their energy consumption. (see figure 3)

Figure 3: Action #1: Server consolidation & storage efficiency



Basic storage strategy

SAN	Tier 0	FC	SAP ERP, MS-Exchange, SQL DB's SYSTEM (NAS, Vmware Server)	SAN: Storage Area Network
NAS	Tier 1	SATA	File shares	NAS: Network Attached Storage
NAS	Tier 2	SATA	CWORM'S (JPG's, PDF, ...) archive, clones, snapshots	NAS: Network Attached Storage
CAS	Tier 3	Centera	SAP / Opentext record archive Opentext MS-Exchange archive	CAS: Content Addressed Storage

Source: Arthur D. Little research, Voith IT solutions

b. Introducing of desktop virtualization concepts

Desktop virtualization or thin computing is per se "sustainable". Thin Clients and high-end servers offer centralized management and on-demand provisioning of resources compared to traditional client-server concepts. The introduction of virtualization concepts for desktops can thus translate into energy savings of up to 45%. (see figure 4)

Figure 4: Action #2: Desktop virtualization

Desktop virtualization – energy demands

Energy demands – A comparison between PC and Thin Client

1,000 PCs	Hardware assets	1,000 Thin Clients + Server
71	Power consumption [kW per hour]	7
147,000	Power consumption [kW per Year]	15,000
29,000	Energy cost (€) per year	3,000

Benefits – Thin computing

- 90% savings on energy consumption, thus 130,000 kWh less on energy bills
- Approximately €26,000 savings on yearly energy cost
- Savings of ~25 tons in electronic trash after six years of use

Desktop virtualization – KPIs for IT operations (in €)

	Blade PC	VM desktop	Terminal server desktop	Traditional/ unmanaged
Technical support/help desk	234	234	159	534
Administration of desktops	26	21	21	74
Application management	130	90	35	230
Standard components & office applications	215	195	160	225
Training	300	300	300	300
Planning and system mgmt.	103	103	103	120
Desktop server management	53	53	53	-
Annual costs	1,061	996	831	1,483

Source: Arthur D. Little research, Digital Reality Trust

C) Level 3: Re-thinking the data center layout

Data center layout and infrastructure are an important target for energy savings. Operational 24/7, they require an effective thermal load management. In the 1990s, only 17% of energy cost was spent on cooling. In the early 2000's the share jumped to approximately 50% and is expected to grow to 70% by 2010.

Effective air distribution has a significant impact on energy efficiency and equipment reliability. Air cooling improvements may include a cooled air short-circuit to air conditioning units and openings in racks to allow the air to-pass from hot areas to cold areas.

Innovative solutions such as "Hot-cold aisle arrangements" allow companies to minimize the mixing between cooling air supplied to the IT equipment and hot air emitted from the equipment.

Arthur D. Little's value proposition – 3-Level Sustainability Model for IT

Because ICT leaders must achieve cost effectiveness and improve their company's image, sustainable IT has increasingly been in the spotlight. However, most ICT organizations lack the methodology, experience or perspective to undertake the self-assessment and to develop a "sustainable" action plan.

We at Arthur D. Little have supported a large number of our clients across all industries to assess their situation on sustainable IT and improve their budget situation by following this successful approach:

- Perform a "sustainable ICT" benchmark based on our Arthur D. Little's 3-Level Potential Model .
- Identify gaps towards the 'best-fit' to-be scenario.
- Evaluate pain points and cost drivers of your ICT data center(s).
- Develop a target scenario taking into consideration industry benchmarks on sustainable IT and our best practice input on data center operations.
- Define and prioritize the defined actions with realistic timeframe and measurable targets.
- Establish energy dash boards and continuously monitor budget awareness and sustainability targets within ICT organization.

This approach indicates saving potentials in terms of energy consumption and process improvements achievable through implementation of best practices in design and operation of data centers.

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