

Green Computing “Future of Computers”

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Abstract: Green computing, the study of efficient and eco-friendly computing resources is under the attention of environmental organizations, and businesses from other industries. In recent years, companies in the computer industry have come to realize that going green is in their best interest, both in terms of public relations and reduced costs. This paper presents at several green initiatives currently under way in the computer industry, as well as issues that have been raised regarding these initiatives and presents a study with an example to learn more about the future of green computing.

Keywords: Energy Star, Environment, Green Computing, Recycle, Sustainable.

I. INTRODUCTION

The field of "green technology" encompasses a broad range of subjects — from new energy-generation techniques to the study of advanced materials to be used in our daily life. Green technology focuses on reducing the environmental impact of industrial processes and innovative technologies caused by the Earth's growing population. It has taken upon itself the goal to provide society's needs in ways that do not damage the natural resources. This means creating fully recyclable products, reducing pollution, proposing alternative technologies in various fields, and creating a center of economic activity around technologies that benefit the environment. The huge amount of computing manufactured worldwide has a direct impact on environment issues, and scientists are conducting numerous studies in order to reduce the negative impact of computing technology on our natural resources. A central point of research is testing and applying alternative nonhazardous materials in the products' manufacturing process.

Why do we need a Green Computing Strategy?

Some organisations are recognising that there can be a genuine competitive advantage in adopting green policies and signing up to a low carbon emissions footprint. Therefore, these organisations are trying to develop and deliver a Green Computing Strategy.

They realise that going green is not just a policy for 'do-gooders' or those with few commercial pressures. Green Computing brings with it direct cost benefits, for example, in reductions to equipment, power, air-conditioning and support costs. These benefits apply throughout the organisation, not just to data-centres or server rooms but to desktop computers and mobile technology as well.

II. CORE OBJECTIVES OF A GREEN COMPUTING STRATEGY

Core objectives for a Green Computing Strategy could include:

- Minimising energy consumption from the IT (information technology) estate,
- Purchasing green energy and using green suppliers,
- Reducing the paper and other consumables used, and
- Minimising equipment disposal requirements.

The following may help you consider a Green Computing Strategy for your organisation.

Buying equipment:

With most electrical devices, you can look at the energy rating label to see how much energy they use. But this does not work so well with computers because the label gives the theoretical maximum, not the typical amount used. For example, a computer whose label or power supply says 300 watts might only use about 70 watts when it is actually running and 100 watts even in peak times when it is working hard.

When possible, try to purchase equipment that combines two functions: a combined printer/copier; a mobile and Personal Digital Assistant (PDA). On the whole, laptops draw significantly smaller amounts of power in operation than desktop systems although they can be more expensive to buy and to repair.

There are two main standards that are found in the European Union. Energy Star is an international standard for energy efficient consumer products. It was first created as a United States government programme in 1992, but Australia, Canada, Japan, New Zealand, Taiwan and the European Union have also adopted the programme. The Energy Star tag on computer equipment refers to the computer's support for power-saving modes, in other words, "Energy Stars" are energy-efficient computers, monitors, and printers that save energy by powering down and going to "sleep" when not being used. Devices carrying the Energy Star logo can typically save 20%-30% on average.



Many European-targeted products are labelled using a different standard, TCO Certification. A TCO certified piece of equipment means it has been produced to be more energy efficient, have a lower carbon emission and be recycled. This certification system is used for desktop computers, laptops, monitors, notebooks, keyboards, printers, mobile phones, and other computer equipment.

III. INSTALLING AND SETTING UP SYSTEMS

When setting up a computer system, there are measures you can take to reduce energy consumption. These include:

Computer virtualisation. This is where software carries out activities that might have been done by hardware, such as a computer or a memory card. Virtualisation can be used to make hardware more efficient and reduce support costs by, for example, installing several 'virtual' servers on a single server device.

Terminal servers. This is where all of the computing is done at the server level and there are multiple access points (terminals) to the server resources. The terminals can be monitors, printers, and other such devices. Use of terminal servers can result in lower energy consumption, depending on how the server and its terminals are set up.

Thin Clients. This is where the capabilities of a computer are limited only to essential applications. The computer acts as a low-cost, centrally-managed workstation devoid of extras such as CD-ROM players, diskette drives, or expansion slots. When computers are used in this way they are referred to as 'Thin clients'. Since a thin client is less complex and contains fewer components, it lasts longer and needs less maintenance and support costs. Thin clients can use up to 1/8 the amount of energy of a normal workstation.

Storage. On the whole, smaller hard disk drives often consume less power per gigabyte than physically larger drives. Do not assume that solid-state drives, which have no moving parts and store data in flash memory, use less energy than hard disk drives. Check the consumption rating of any disk devices before you purchase.

Display. A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures. [LCD monitors](#) are replacing the old style cathode ray tubes (CRTs) as the displays of

choice. Nearly all LCD monitors today use TFT (thin film transistor) technology. The TFT technology provides the best screen resolution of all the flat-panel techniques, but it is also the most expensive. LCD monitors offer up to 60% power savings over CRTs and produce less heat.

IV. DAY-TO-DAY USE

There are several simple measures that can be taken to ensure that your computer system runs as efficiently as possible.

Switch off equipment overnight. Save on your energy bills and reduce your carbon footprint by not leaving computers on standby, but switching them off overnight, at weekends and during long breaks. Consider making it company policy to switch off monitors and leave computers on standby or in hibernation when end-users are away from their desks for a long time during the day (see **Power management** below for more details). However, always check with your IT Department first about such policies otherwise you may unintentionally disrupt regular backups and system updates, which tend to take place overnight or at weekends.

Power management. The power management function allows an operating system to automatically turn off components such as monitors and hard drives after set periods of inactivity or force a system to hibernate (where most components are turned off until they are needed again). Earlier Windows versions before Microsoft Windows Vista did not allow power management features to be configured centrally. Although Vista has improved the situation, its power management functions have not proven flexible enough to meet the needs of all organisations.

Therefore, a number of software products have emerged that can save energy by automating computer shutdowns or forcing computers to go on standby when they are not used for a set period of time. Examples include Auto Shutdown Manager, Data Synergy PowerMAN, Faronics Power Save, and WakeupOnStandBy (WOSB) to name a few. Consider the use of these products if you are running a large number of machines on your organisation's network.

Screen saving. When screensavers were first introduced, their purpose was to prevent damage to early CRT monitors (see **Display** section above), which were susceptible to 'ghost images' due to phosphor burn. Modern CRT and LCD screens are no longer prone to this damage. A screensaver requires a computer and monitor to be in full power mode. So, in fact, from an energy management perspective, screensavers represent an opportunity to conserve energy and save money. Instead of using a screensaver, when a computer is not in use, set the power management functions to place it into a low power state instead.

V. DISPOSAL AND RECYCLING OF EQUIPMENT AND CONSUMABLES

Disposal. The Waste Electrical and Electronic Equipment Directive (WEEE Directive) became European Law in February 2003, setting collection, recycling and recovery targets for all types of electrical goods. The directive imposes the responsibility for the disposal of waste electrical and electronic equipment on the manufacturers of such equipment. Companies are compelled to use the collected waste in an ecologically-friendly manner.



Avoid unnecessary upgrading, and re-use and recycle computing equipment whenever possible. For the latest Government advice on disposal of equipment, see: www.direct.gov.uk/en/Environmentandgreenerliving/Wasteandrecycling/DG_069060

Your responsibilities under the WEEE can be found at:

www.environment-agency.gov.uk/business/topics/waste/32092.aspx

Recycling. Try and find a local company that will be able to recycle as many computer related items as you can, including batteries. You may find that reducing the use of consumables, such as paper, inks or toners, saves costs as well as reducing waste. Strategies you might employ include:

- Replacing older printers with more efficient devices such as multifunction printers,
- Replacing faxes with paperless solutions such as fax-to-email,
- Replacing copiers with scanners (scan and email),
- Changing default printer settings to double sided printing,
- Replacing memos and paper information distribution with an intranet.

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