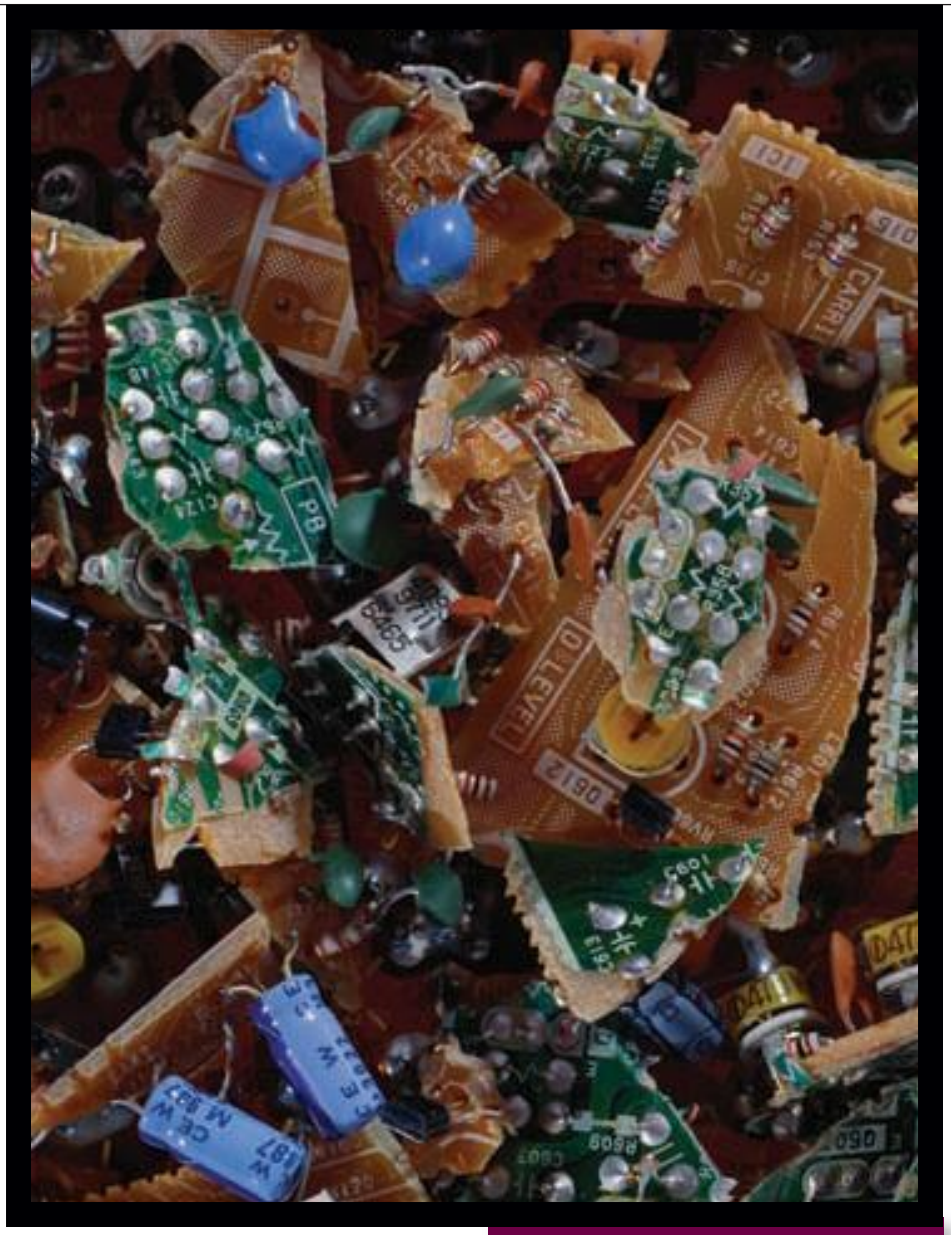
BY RICHARD HODGES

Green Machines

Green Computing Can Save School Districts Money While Helping Save the Planet.



Most people shopping for new information technology equipment tend to look at the price tag and stop there. They shouldn't. Today, the initial price of a device is only one piece of a large and complex puzzle of costs and effects that need to be considered, including global environmental costs.

Schools are turning to green computing efforts to save on energy consumption and decrease the lifecycle costs of computing equipment. Information technology systems consume a lot of energy, especially for school districts that support thousands of computers. Being environmentally smarter about how systems are designed and managed can substantially reduce costs for providing computing services to students, faculty and administrators freeing up money to use elsewhere.

The Environmental Cost of IT

Many components of information technology systems used by schools and districts may be small, but they have a big environmental footprint. Silicon wafers and semiconductor chips require a vast array of materials. Smart devices are also material- and energy-intensive to make. A desktop computer and monitor include more than 1,000 different materials and can have a materials-to-product ratio of 71-to-1. By comparison, a car or a refrigerator requires just one or two times its weight in natural resources.

Information technology systems are the fastest growing end-use for electric power around the world. The information technology systems in a standard commercial office building consume 25 percent or more of the power used by the building. Computer data centers are now estimated to consume 3 to 4 percent of all U.S. electricity. One researcher calculated that the annual lifecycle energy burden of a personal computer is 1.3 times that of a refrigerator, which is itself a high energy-use appliance.

One reason for high lifecycle energy use is that information technology equipment has a short useful lifespan, which drives other rapidly growing problems: e-waste (electronic waste) and u-waste (universal waste). Globally,

Energy Calculators

Online energy calculators help consumers estimate energy and dollar savings from activating power management on computer monitors and computer boxes, such as CPUs and hard drives. These include:

- The Power Management Sites Database: <http://pmdb.cadmusdev.com/powermanagement/quickCalc.html>
- Energy Star: <http://www.eu-energystar.org/en/en_008.htm>
- Dell: <http://www.dell.com/content/topics/global.aspx/corp/environment/en/energy?c=us&l=en&s=corp>
- Apple: <http://www.apple.com/environment/resources/calculator.html>

about 130 million new PCs are produced each year, while only about 12 percent of discarded computers are recycled. Much e-waste in the United States is exported to developing nations and disassembled by hand or burned in the open air the most dangerous method of disposal. Four states California, Maine, Maryland and Washington have e-waste controls in effect and a few more states may follow suit. Information technology systems also contribute significantly to universal waste with materials like batteries and they create ordinary solid waste with mass quantities of paper. Landfills and waste management are a significant source of greenhouse gas emissions in the United States.

Managing Product Lifetime and Waste

Reudiger Kuehr and Eric Williams, in their groundbreaking 2003 work *Computers and the Environment*, point out that the most effective short-term method for minimizing environmental impacts of information technology products is by extending useful lifetimes of the devices. In most cases, this has the added benefit of reducing the total cost of ownership (TCO). The rapid development of new information technology system capabilities and user demands drive replacement cycles, as do escalating maintenance and support costs. However, in most organizations, TCO calculations and replacement planning do not include environmental costs. While some of these costs may be global and unquantifiable, the costs and liabilities associated with management of waste can be calculated. No school wants their used computers to join the stream of e-waste shipped overseas or face liabilities that can arise from the disclosure of sensitive data on a disk drive in a surplus computer. The costs for proper end-of-life handling of information technology equipment should be explicitly included in all financial analyses for upgrade, replacement and new system purchase decisions.

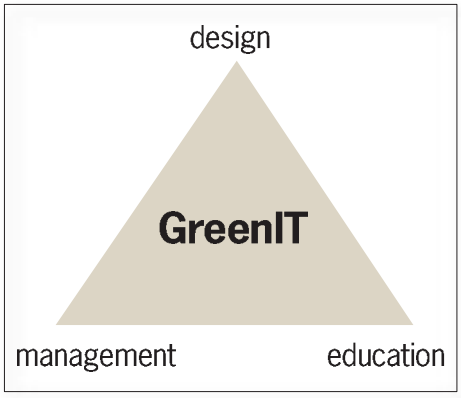
Waste reduction and cost management programs should also address the cost of creating and handling solid waste generated by information technology systems. Over a lifetime of use, the cost of print cartridges, paper and electricity can far exceed the cost of the printer itself. Simply buying the right printers and setting a default policy of two-sided printing can reduce costs for paper, energy consumption and waste removal, while producing a substantial environmental benefit.

Most information technology devices contain u-waste regulated by federal law. Fourteen states have their own restrictions on u-waste with varying requirements. In 2006, California banned u-waste, both household and commercial, from entering the solid waste stream. As with e-waste, organizations may be liable for improperly managed u-waste. A convenient and relatively cost-effective solution that also has wonderful educational value is clearly-marked collection boxes for batteries, cell phones and small electronic devices that come prepaid for shipment to the recycler.

Managing Costs Turn it Off

The biggest issue with power costs is that few organizations know the total electricity consumption of their systems including computers, printers, copiers, networking gear, telephone systems, audio-visual equipment and data centers.

The first item to tackle for energy conservation is desktop computers, many of which are left on 24 hours per day. As with any other electronic device, the simplest and quickest way to reduce energy consumption is to turn off equipment that isn't in use. For organizations with large numbers of desktop computers, PC power management software provides actual data on performance and savings. In California, electric companies offer rebates to offset the purchase cost of PC power management software, producing instant savings and carbon emissions reductions.



Environmentally-friendly IT policies stem from three main components.

Most information technology devices that are off still consume small amounts of electricity. Studies indicate that this power consumption accounts for 6 percent of total U.S. electricity use. Again, management directives and awareness certainly help, but manually or remotely-managed power control devices may also be cost effective.

The energy hogs of the technology world are data centers. A recent study indicates that electricity consumption by data centers doubled from 2000 to 2005. A careful process of measurement and assessment is the first step to understanding how much power data centers are actually using and what can be done to economize. The

The Electronic Product Environmental Assessment Tool

The Environmental Protection Agency and the Green Electronics Council launched a new tool in July 2006 designed to help purchasers evaluate, compare and select computer products based on their environmental attributes.

EPEAT is a system that will let people consider the environmental effect of select desktop computers, notebooks and monitors before they buy. EPEAT provides a clear and consistent set of performance criteria for the design of products, and provides an opportunity for manufacturers to secure market recognition for efforts to reduce the environmental impact of its products.

The EPEAT registry includes products that have been declared by their manufacturers to be in line with the environmental performance standard for electronic products. EPEAT operates a verif cation program to assure the credibility of the registry.

Source: http://www.epeat.net/default.aspx

plasma physics lab at Princeton University recently reported a 75 percent reduction in data center power consumption that also reduced carbon dioxide emissions by 28 tons. As with PCs, utility rebates are available for energy-efficient servers.

Design for Efficiency

The greatest financial and environmental benefits of fully accounting for information technology-related costs will come from rethinking and re-engineering existing systems and processes. These benefits can be realized not only from more efficient and environmentally benign information technology systems, but from less costly buildings, building infrastructure, building operations and more efficient use of space. However, achieving these benefits requires developing integrated, interdepartmental planning and financial management processes.

The first step in achieving simultaneous reductions in costs and environmental impacts is using the Green IT ER3 Principle eliminate, then reduce, reuse and recycle. In a recent school project, redundant and overlapping systems were simply eliminated from the building program, including overhead paging, synchronized telephone and clock systems and cable TV. The school's information technology systems were designed to provide the same services using converged IP voice and data systems and state-of-the-art wireless networks. One result was that the cost of network infrastructure was reduced by 60 percent and the amount of copper cable by 75 percent. The long-run cost savings on power, maintenance, service, replacement and disposal will certainly exceed the one-time construction cost savings.

If entire systems or sets of devices cannot be eliminated, then information technology systems should be designed to use long-lasting, energy-efficient equipment that can be upgraded over time. For example, virtual PCs or thin client devices network computers without a hard disk drive can be inexpensive and more environmentally friendly alternatives to desktop computers. Centralized management can reduce maintenance costs, reduce electricity and materials consumption, improve security, increase the usable lifetime of equipment and reduce e-waste. In some configurations resources can also be shared so that one computer per employee or student isn't needed.

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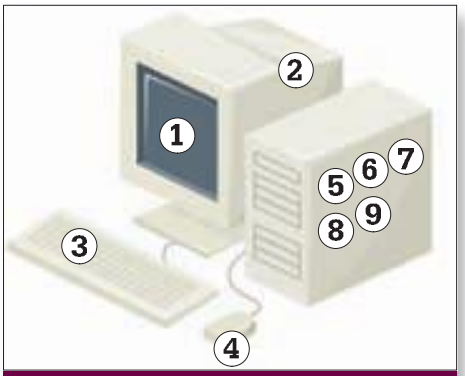
In addition to rethinking designs, the process of purchasing equipment needs to be revised as well. Many organizations now have environmentally preferable purchasing (EPP) standards that apply to information technology equipment. Product certifications such as Energy Star and the Electronic Product Environmental Assessment Tool (EPEAT) make compliance simpler, but those standards are just a start for organizations that have made a commitment to better financial and environmental performance. The financial justification for any product purchase should include a TCO analysis that considers complete product lifecycle, with focus on energy consumption, waste production, and end-of-life management.

Finally, the interaction and interconnection of greener information technology systems and green buildings is emerging as a significant opportunity to reduce costs and environmental impacts. Smart-building technologies allow for convergence of not just voice, data and audio-visual systems onto a single backbone, but building security, control and management systems as well. Though it is hard to imagine a day when schools will have fewer buildings accommodating more students, that day will come. Corporate enterprises are already producing models of integrated information technology and flexible building design that allow 40 percent more employees to be assigned to the same amount of space, with theoretical increases up to 300 percent. Information technology systems of the future and mobile tech-savvy students will define new educational models that rely less on space and more on networks of spaces. The long-term cost and environmental benefits will include building fewer and greener buildings, economizing on transportation and supporting more effective learning environments.



Hazardous Waste

1. Lead in cathode ray tube and solder
2. Arsenic in older cathode ray tubes
3. Antimony trioxide as f ame retardant
4. Polybrominated f ame retardants in plastic casings, cables and circuit boards
5. Selenium in circuit boards as power supply rectif er
6. Cadmium in circuit boards and semiconductors
7. Chromium in steel as corrosion protection
8. Cobalt in steel for structure and magnetism
9. Mercury in switches and housing

Source: http://news.bbc.co.uk/2/hi/business/6110018.stm