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How to Reduce the power consumption of your district's technology system
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Primary Topic Channel:

Electricity--without it, computers are merely expensive doorstops. Yet, electricity is expensive and getting more so. And as the situation on the West Coast illustrates, there often isn't enough to go around.

These are pretty straightforward ideas, but until recently, they were largely ignored. It took rolling blackouts in California this winter to bring the issue of electrical use to the forefront of American thought. This new awareness has triggered an interest by many organizations in analyzing their overall electrical consumption and zeroing in on how the use of technology contributes to their operational costs.

Consumers on the West Coast and in many other parts of the country face a looming increase in electrical costs. With the cost of electricity expected to rise in the next year by up to 400 percent of current rates in some locations, it may be essential for school districts to analyze their energy use and find ways to reduce overall consumption. My own district anticipates an increase of more than $1.5 million in electrical billing next year, based on a conservatively estimated price hike of about 50 percent.

Districts that currently analyze their energy use tend to focus on big-ticket facility costs, such as HVAC systems, indoor and outdoor lighting, and other operational areas. Electrical consumption of computer technology and its related infrastructure often is overlooked. Yet, the portion of a school district's electrical bill that can be traced to computers and peripheral equipment can be quite significant. The Environmental Protection Agency (EPA) estimates that office equipment accounts for eight percent of commercial energy use.

As the cost of electricity rises, you need to understand where your money is going and what options are available for controlling these costs. Understanding the electrical needs of your schools' technology systems not only will help you formulate a plan for immediate conservation and good environmental stewardship, it also will help you plan for future challenges.

A quick overview

To understand your technology systems' electrical requirements and their related costs, let's lay a little basic groundwork. Using an office computer as an example can show how rapidly the electrical expenses in even a simple deployment can accumulate.

A typical desktop computer will cost a school district just under two cents for each hour of use. (This number may be higher or lower, depending on where your school is located and how much you pay for elecricity.) At first glance, this seems like a negligible expense. Assuming that the computer is left on for an entire eight-hour work day, the electrical cost is about 16 cents. Leaving it on overnight increases the total cost to about 48 cents. Still not much to worry about, is it?

However, multiply that amount by the 250 or so computers in an average administrative service center. Even if every unit is turned on when staff members arrive in the morning, and then turned off when they leave at night, the cost is around $40 a day, or about $200 a week. In a 261-day work year, that comes to about $10,440--certainly an expense worth taking into consideration, and even more so when the cost of electricity may double or quadruple in many parts of the country next year. When you extrapolate the cost to include, for example, my district's current deployment of almost 7,000 workstations and peripherals, the numbers become almost staggering.

Understanding and analyzing costs

Every school district's deployment of technology is different. The equipment types, manufacturers, and even the age of the equipment are all factors to consider when analyzing your systems' electrical consumption.

Begin by taking an inventory of your fixed assets. Once you've collected this information, you can calculate the power consumption for each type of device by looking at each model's "data plate." (For a list of terms you will need to know when preparing your survey, see the glossary below.)

Every piece of equipment should be labeled by the manufacturer with an electrical rating label, often referred to as a "data plate." On central processing units (CPUs) and monitors, this label generally is found in the rear of the device near the power cord. Examining a Dell 15-inch monitor, the numbers that you need for calculating power consumption are on a label that looks something like this:

Dell Computer Corporation
Model Number: E550
Input Rating: AC 100-240V, 50-60Hz
Current: 2a
Chassis Number: 7254e

The data you need to determine the rated load of the equipment are the AC voltage (e.g., 100 volts) and the current (2a, or 2 amps). The label often contains additional information as well, such as serial number, model number, and date of manufacture.

When examining equipment data plates, keep in mind that similar-looking equipment may not have the same power requirements. Monitors, for example, often look very similar, but a five-year-old 17-inch monitor and a new 17-inch monitor may have radically different electrical consumption ratings.

Examples of electricity use

Now that you have some basic information about electricity use and terminology, let's expand on our original overview and do a more in-depth analysis. Again, we'll use my desktop computer as an example. My computer is a Dell Optiplex GX1 with a 17-inch Dell monitor. Looking at the data plates, we can produce a spreadsheet with a rated load that looks like this:

	CPU: Dell Optiplex GX1	Monitor: Dell M770 17-in
Volts	115	100
Amps	4.00	180
Watts	460	180

The data plates do not list the information on wattage, but knowing the formula for wattage (volts multiplied by amps), it's easy to deduce. Now, if we know the current cost per kilowatt-hour of our electricity, we can further expand our information:

	CPU	Monitor
Volts	115	100
Amps	4.00	1.80
Watts	460	180
Cost per hour	$0.0143	$0.0056
Hours per day	8	8
Cost per day	$0.11	$0.04

Days per year	183	183
Cost per year	$20.94	$8.20

Looking at the table, you can see that my PC consumes about $30 in electricity per year. If I have 1,000 such PCs, my electrical cost may be around $30,000 per year--a pretty significant budgeting factor!

Be aware that this table makes some assumptions in its calculations. First, it does not take into account the measured load of actual electrical use. Unless the manufacture provides this information directly, such a load either has to be estimated or physically measured for each model of equipment over a given period of time. The actual energy consumption may be 20 percent to 40 percent of the rated load listed on the data plate. If you choose to measure the actual electrical draw for your analysis, you may be able to enlist your local power company to help you physically measure the loads for each type of equipment you own.

Second, the table assumes that the CPU and monitor are left on for eight hours a day, 183 days a year (the number of working days for my district's teaching staff). Your working days may vary according to your school's calendar, and if monitors and CPUs are not turned off every night and during holidays and weekends, your costs may more than triple.

Finally, the electrical costs here in my part of the Pacific Northwest are very low (3.1 cents per kilowatt-hour) compared to other places, where electricity sometimes runs as high as 16 cents per kilowatt-hour.

When you compile a survey of your technology systems' electrical use, remember to include printers, scanners, fax machines, and other peripherals and related devices. Many of these devices are left on continuously, so their energy use is not limited to the standard eight hours a day, 183 days a year.

Conservation today

Now that you have some guidelines to help you analyze the electrical costs of your schools' technology deployment, here are some things you can do today and in the future to conserve electricity and reduce those costs.

One of the strongest conservation tips for today's technology is simply this: When you're not using it, turn it off. Even if equipment is only off for brief periods, such as during lunches, meetings, or breaks away from the desk, you'll see an immediate reduction in your electricity costs.

The old practice of leaving a PC on because it's easier on the electronic components simply does not hold true any longer. The days when hard drives would seize from "stiction" and chips would work their way out of their sockets due to temperature changes are pretty much gone. New equipment is very robust, and such concerns can be alleviated completely by purchasing the manufacturer's extended warranty. The $100 or so you spend on the warranty will be recovered during the equipment's lifespan just by turning the equipment off when not in use and saving on electricity.

Alternatively, the next best solution is to enable the power-saving features of your particular system so it goes into "sleep mode" when it's not being used. According to the EPA, nearly 44 percent of computer users do not use the power-saving features of their equipment. New computers that have this feature will power down to as little as 15 watts or less while remaining connected to the network. Using this feature alone can reduce the overall electrical consumption of a given computer system by up to 50 percent.

If you're using a screen saver on your monitor, be aware that these normally don't save any power. Often, screen savers actually will prevent a computer from activating its power-saving feature. The best option is to turn off the monitor when you're not using it. It may be simplistic, but a monitor that is turned off uses no electricity.

The same goes for network printers and other peripherals. Many have easily configurable power-saving options and can power down into sleep mode when not in use, reducing the energy consumption of these devices anywhere from 15 to 45 watts. This saves electricity, but not as much as turning the devices off in the evenings or during the weekends and other times when they're not being used.

Some equipment, such as servers and network electronics, just can't be dimmed down or put into sleep mode without affecting the entire network's operation. Web sites and data services have to be available in many places 24 hours a day, seven days a week. Some districts with operational cultures that do not require 24-7 services are looking at ways to shut down back-end network services during non-business hours. If you're contemplating scheduled service blackouts, you must have a very sophisticated understanding of your district's technology infrastructure before attempting such changes.

In addition, if you are thinking of turning off your HVAC systems during the summer months to conserve electricity, it is necessary to have strong coordination between those in charge of such shutdowns and those in charge of technology, in order to maintain adequate environments in areas that contain networking equipment. Excessive heat and lack of ventilation will cause electronics to fail. A good rule of thumb is if the temperature is too hot for you, it's too hot for the equipment, and steps need to be taken to cool it down.

For more tips and ideas on how to save energy today, check out the resources listed in the box at right.

Planning for tomorrow

While turning off and powering down equipment may be sufficient for the present, here are three long-term technology solutions that can help you save on energy costs:

Uninterruptible power supplies (UPS)

A UPS is a battery backup system that kicks in when the regular power fails to keep your network equipment, servers, and other vital equipment operating. These become a necessity in areas that may be forecasting outages in the future. The size (and cost) of a UPS determines how long it can keep the attached equipment running before gracefully shutting the equipment down until line power returns. Even if you won't be experiencing predictable outages, a UPS is a "must have" to keep servers and other electronics available at all times. Keep in mind, the batteries that make a UPS work will need yearly maintenance and replacement according to the manufacturer's schedule.

Flat-panel technology

Flat-panel monitors use only a fraction of the electricity of a standard cathode-ray tube (CRT) monitor. Prices are dropping rapidly, and a good 15-inch flat-panel monitor can be purchased from Dell for under $450.

In a recent test, we found that the higher initial purchase price of the flat-panel monitors would not be offset by the savings in electrical costs we would experience by the fifth year of use. This analysis was based on a comparison of the rated load of each device at our projected electrical rate for the 2001-2002 school year (4.6 cents per kilowatt-hour):

	Dell M770 17-inch Monitor	Dell 15-inch Flatscreen TFT	Difference
Purchase cost	$220.00	$439.00	
Cost per year of electricity (fall rate)	$12.12	$1.63	
TCO - 1 year	$232.12	$440.63	$208.51
TCO - 3 years	$256.36	$443.89	$187.53
TCO - 5 years	$280.60	$447.15	$166.55

The total cost of ownership (TCO) refers to the combined cost of the purchase price per monitor and its electrical operation cost per year. Schools with a higher cost per kilowatt-hour will see a more rapid return on this investment, especially as the cost of flat-panel monitors continues to drop.

As a secondary note, flat-panel monitors run much cooler than CRTs and therefore save on HVAC costs as well.

Thin-client technology

Thin-client technology is attractive for many reasons, including lower purchase price, lower cost of ownership, and reliable centralized management. Combine these factors with the dramatic differences in the cost of powering thin-client appliances such as Wyse Technologies' Winterm (approximately $2.50 per year) versus PCs (approximately $30 per year), and this technology becomes even more attractive.

As an aside, most thin-client appliances run much cooler than PCs and, like flat-panel monitors, reduce the demand on HVAC systems.

One final note: When considering new technology purchases, make sure you choose systems that are rated "Energy

Star" compliant by the U.S. Department of Energy. For more information, see the box above.

As electricity costs climb dramatically in the coming years, reducing the power consumption of your district's technology systems will become increasingly important. By implementing simple electricity conservation practices today and reducing consumption through well-considered future equipment purchases, schools can get a rein on what threatens to be a thorny issue in years to come.

Electrical Terms to Know

Amps: An amp (more correctly an ampere) is a unit of electrical current within a circuit.

Volts: This is a measurement of "pressure" on the units of electrical current in a circuit; it basically measures electrical force.

Watts: This is the measure of how much energy an electrical device uses per hour. You're probably most familiar with the term "watt" in relationship to light bulbs. A 60-watt light bulb uses 60 watts of electricity per hour, a 100-watt bulb uses 100 watts per hour, and so on. The higher the wattage, the more electricity is used to drive the device.

Many high-tech equipment labels do not list the appliance's wattage. A simple mathematical formula, however, can calculate the wattage of a given piece of equipment, provided you have the appliance's voltage and amperage.
Wattage = Volts x Amps

For instance, a Dell M770 17-inch monitor is rated at 100 volts and 1.8 amps. Wattage is therefore 180 watts.

Kilowatt-hour: This is the basic unit of electrical energy used by the power company. All your billing is in kilowatt-hours and reflects the use of 1,000 watts (a kilowatt) of power per hour. Ten 100-watt light bulbs use 1 kilowatt of electricity per hour.

Rated load: This refers to the load calculated and presented by the manufacturer on its equipment's data plate. These are the numbers that most organizations use to estimate electrical power consumption for a given device.

Measured load: This term refers to the average energy use over a given period of time. A computer's energy use changes during the time it is left on. For instance, a Dell 15-inch multimedia monitor's draw for the first one-tenth of a second after the "on" switch is thrown is 207 watts. After that, its run-time output is 90 watts. This is less that the rated load of 200 watts.

It is important to understand that the actual measured loads for computer equipment may be 20 percent to 40 percent of the rated load shown on a device's data plate.

Resources

Before browsing the following sites, check out your local power company's web site. Most are chock-full of useful information, including electrical usage calculators, energy forecasts, and good tips for conservation at home and work.

Energy Star Program
http://www.energystar.gov

Energy Star is a partnership among the EPA, the Department of Energy, and industry executives. Its goal is to make it easy for businesses and consumers to save money and protect the environment by labelling energy-efficient equipment with the "Energy Star" seal. The Energy Star web site contains practical advice and energy-saving tips, a list of Energy Star-compliant products, and a special "For Schools" section with energy and financial management resources.

Saving Energy with Desktop Workstations
http://www.microtech.doe.gov/energystar

This Department of Energy web page explains how you can cut back on energy consumption of your desktop computers and peripherals by taking advantage of the Energy Star program and through other strategies.

Wyse Technologies
http://www.wyse.com

The Wyse Technologies web site contains information and white papers on thin-client technology and its total cost of ownership, including comparisons of electrical use.

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