Saving Energy with Office Equipment

A Best Practices Resource Guide

COMPUTERS

PRINTERS & COPIERS

PERIPHERALS

SERVER ROOMS

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Contents

About this Guide

WHY A GUIDE?

While information technology (IT) equipment has become more energy efficient in recent years, computers, peripherals, imaging equipment, and data centers still use a lot of electricity. The IT ecosystem now consumes around 10 percent of the world's electricity, according to analyst firm Digital Power Group[1].

The good news is that there is a lot you can do to reduce your IT-related energy consumption – and cut your costs. Computers that take advantage of low-power sleep modes when inactive, for example, can cut energy consumption per unit in half – or more. The most efficient data centers and server rooms, use up to 80% less power, according to the US Department of Energy.

The purpose of this guide is to offer practical, actionable tips for saving energy with computers and computing equipment, as well as peripherals and imaging equipment. We review the biggest opportunities, explain them in layman's terms, and provide practical tips for leading an initiative to increase IT energy efficiency.

WHO SHOULD READ THIS?

This guide is primarily intended for non-technical audiences, including sustainability, facility, energy, procurement, and business managers. Our hope is that it will provide you with the information and resources you need to drive computer and office equipment energy savings in your organization – even if you don't work in IT. This guide also provides IT professionals with an overview of IT energy efficiency opportunities and resources.

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[1] Tim Worstall, "Links 17 Aug: Your iPhone Uses More Energy Than Your Refrigerator," *Forbes*, Aug. 17, 2013 (http://www.forbes.com/sites/timworstall/2013/08/17/links-17-aug-your-iphone-uses-more-energy-than-your-refrigerator/)

Saving Energy (and $) in IT
Major Opportunities

COMPUTER EQUIPMENT

LAPTOPS ARE MORE ENERGY EFFICIENT THAN DESKTOPS

Laptop (or notebook) computers use less energy than desktop computers. While an active desktop workstation might consume 80+ watts of power (50+ watts for the computer and roughly 30 watts for an LCD monitor), a typical notebook computer might use as little as 15-25 watts of power. However, be aware that the use of docking stations and external monitors can diminish notebook computer energy savings, since they use energy as well.

Bottom line: When considering whether to purchase laptops or desktops for your organization, don't forget the cost of energy in your cost/benefit calculation.

LCD DISPLAY TECHNOLOGIES ARE MORE ENERGY EFFICIENT THAN CRTS

If you're still using old-school CRT (cathode ray tube) computer monitors, energy consumption alone may make it cost-effective to replace them with energy-saving LCD flat panel displays. CRT monitors can consume 80-100 watts of power and more for larger screen sizes, whereas LCD displays might use about one-third as much. Even at average commercial electricity rates (e.g., $0.10 per kWh) a CRT monitor typically costs $25 more to operate annually.

Bottom line: When possible, replace CRT computer monitors with energy-saving LCD flat panel displays.

BUY EPEAT OR ENERGY STAR

EPEAT is a comprehensive environmental rating system that helps purchasers identify greener computers, displays and imaging equipment. EPEAT considers several categories of environmental attributes that cover the full lifecycle of electronic products, not just energy conservation. These categories include reduction/elimination of environmentally sensitive materials, end-of-life management, packaging, and more. **All EPEAT products must meet Energy Star requirements.**

Office technology and data center equipment can earn the Energy Star rating by meeting certain energy efficiency standards. Generally speaking, EPEAT and Energy Star qualified products don't cost any more than standard products. Energy Star maintains a list of certified products on its website, as does the EPEAT program. Don't overlook efficient products that aren't necessarily computer related. Energy Star also covers vending machines, water coolers, food service equipment, a wide range of electronics, and more.

If your organization has purchasing or procurement guidelines, you can add language specifying EPEAT or Energy Star. For example, you may wish to include the following language in requests for proposals (RFPs) and contracts:

> *The Vendor must provide [computers, printers, etc.] that are registered with EPEAT / earn the Energy Star and meet the Energy Star specifications for energy efficiency. The vendor is encouraged to visit www.epeat.net / www.energystar.gov for complete product specifications and an updated list of qualifying products.*

Bottom line: Be sure your organization purchases EPEAT registered or Energy Star certified products.

SAVE WITH THIN CLIENTS OR DESKTOP VIRTUALIZATION

A thin client is a computer or a computer program that depends heavily on a more powerful server to perform its work. This stands in contrast to the traditional desktop or notebook "fat client" computer, which is designed to do all of the computing work on its own.

A "virtual desktop" is a software simulation of a desktop computer. It executes programs just like a physical computer, but actually runs on a server that can be housed almost anywhere. When users work from their remote desktop, notebook, smart phone, or thin client, all of their programs, applications, processes, and data are actually running on the server.

Thin client and virtual desktops reduce hardware and IT support costs. And since most thin client and virtual desktop devices draw less power than their standard computer counterparts, organizations may be able to save a substantial amount of electricity with them. However, energy saved by thin clients or virtual desktops may be offset by an increase in energy use on the server side. In other words, organizations need to consider the energy used by additional servers and the infrastructure that supports them (such as server room/data center cooling, power distribution, etc.) It is possible for increased energy use in the data center to negate the energy saved by thin clients and virtual desktops.

Moving from a network of standard computers to a thin client or virtual desktop environment is a major change for most IT organizations, and may only make sense when a major computer refresh is under consideration.

COMPUTER POWER MANAGEMENT

CONFIGURE COMPUTERS TO "SLEEP" WHEN INACTIVE

Computer power management (CPM) features automatically place computers into a low-power "sleep mode" after a period of inactivity. Simply touching the mouse or keyboard "wakes" the computer in seconds (or less!) Think of computer power management as a sort of "occupancy sensor" for your computer, similar to the ones that control overhead lights in some offices and restrooms.

Using power management features saves more energy than simply asking people to turn off their computers every night. Why? Because a computer that's off still draws some power from the electrical outlet, and only saves a watt or two compared to the same computer in sleep mode. Forgetting to shut down your computer just a handful of times will erase an entire year's worth of incremental energy savings (compared to your computer in sleep mode). Surveys and interviews with IT managers consistently conclude that policies "requiring" users to turn off their PCs at night result in about 70–90% compliance at best. In short, CPM features are nearly as good as "off" in terms of energy consumption, plus they get you close to 100% compliance.

How can you tell for sure if sleep settings are enabled on your computer? To be sure, you need to check the power options/energy saver settings on your computer. Energy Star provides illustrated instructions about how to check the settings or make the necessary changes: simply select your computer's operating system on this web page for guidance. Generally speaking, if your monitor screen goes dark and appears to be off after a period of inactivity, *monitor* power management is enabled. If, in addition to the monitor darkening, the low hum of your hard drive stops after a period of inactivity, computer power management is probably enabled as well.

Don't be fooled though, just because your computer *monitor* goes dark after a period of inactivity, doesn't mean that the *computer* itself is sleeping. Energy Star believes that most US-based organizations configure monitors to sleep, but that only 20-25% of organizations properly configure computers to sleep as well.

Don't confuse screen savers with monitor and computer power management features. Screen savers can actually increase the energy used by *both* the display *and* the computer's processor. They were originally developed to prevent the permanent etching of patterns on older monochrome monitors, but modern display screens do not suffer from this problem. Today, screen savers are purely for entertainment. If you want to use your screen saver in conjunction with monitor power management, set the screen saver "wait time" to less than the period of time after which the monitor enters sleep mode. If your screen saver appears but your monitor never enters sleep mode, your screen saver may be the culprit: try disabling it.

REASONS FOR ACTIVATING COMPUTER "SLEEP" SETTINGS

The case for activating system power management settings on computers is compelling:

1. **Save money.** Computer power management features cut the electricity used by computers roughly in half; saving $10-50 per computer annually. If you aren't already using monitor power management features, your combined savings can be as high as $100 per workstation annually – or more.

   Your actual savings depends on a number of factors, including how much power the computer draws in the first place, how frequently users turn off their computers at night, and the sleep settings (if any) already in use. Free savings estimates are available via a number of online calculators such as the one offered by Energy Star's Low Carbon IT Campaign website (look under the "Quick Links" sidebar.)

2. **Use less air conditioning.** CPM features reduce office cooling loads, which can save an additional $5-10 per computer annually, and as much as $10-25 or more in warm climates. This is because computers and monitors generate a considerable amount of heat when in full operation.

3. **Enhance data security.** CPM features reduce the chance that sensitive information is displayed on unattended computers.

4. **Improve user productivity.** Computers wake up from sleep modes much faster than they boot up from "off." Eliminating the wait for computers to boot up can save as much as 5 minutes daily.

5. **Prevent pollution & minimize greenhouse gas emissions.** Saving energy prevents pollution associated with generating electricity and lowers your carbon footprint.

6. **Decrease the cost of electricity.** Depending on how your electricity rates are structured, using less electricity during office hours can result in a lower per kilowatt hour rate from your electric utility (by reducing what are known as "peak load demand charges."

7. **Earn positive publicity.** CPM initiatives make for good PR, and the media generally takes notice. Taxpayers, customers, and other stakeholders genuinely appreciate CPM projects because they save energy, money, and help protect the environment.

RECOMMENDED COMPUTER POWER MANAGEMENT SETTINGS

Power management features automatically put monitors and computers into a low-power sleep state after a period of inactivity. The duration of the period of inactivity is configurable to allow you to find the right balance between energy savings and end-user experience. For example, the shorter the period of inactivity before a computer sleeps, the more energy you save. However, if your computer dropped into sleep mode after just one minute of inactivity, the constant interruptions would diminish your user experience – and your productivity.

For optimal savings and user experience, Energy Star recommends:

1. Set display to enter sleep mode after 5-20 minutes of inactivity
2. Set computer to enter system standby/hibernate/sleep after 30-60 minutes

On laptops, be sure to change the "AC" or "Plugged in" power profile; if you only make these changes to the "DC" or "Battery" power profile, you won't see any energy savings. Also, it's okay to disregard the "Turn off hard disks" feature. Modern hard drives are very efficient, so turning off hard disks rarely saves as much as one watt of power.

ACTIVATING CPM ON INDIVIDUAL MACHINES

Activating power management features is straightforward in very small organizations (e.g., 10 or fewer computers). Computer-literate users will have no trouble activating power management themselves via the "Control Panel" on Windows computers or via "System Preferences" on Macs. See the Energy Star website for detailed instructions.

For individuals and small organizations without a network, computer software is generally pre-configured to automatically download and apply updates shortly after resuming from sleep mode. So there is no need to worry about computers failing to receive administrative software updates simply because they drop into sleep mode when inactive.

ACTIVATING CPM ON NETWORKED COMPUTERS

Activating power management features on networked computers requires some planning and coordination with your IT colleagues/contractors. Why? There are two primary challenges associated with activating power management features on networked computers:

1. Activating sleep settings on multiple computers at one time. (While it is certainly possible to manually configure sleep settings on each and every computer in your organization, most IT administrators would prefer to avoid such a labor-intensive approach.)
2. Ensuring that sleeping computers can still receive software updates and new anti-virus definitions. (Sleeping computers can't download and apply software updates without first being awakened.)

Fortunately, a number of solutions exist for addressing these challenges in almost any IT environment. Some of these solutions utilize free public domain software tools, and/or tools that your IT professional may already have at their disposal. Additionally, a number of commercial software packages provide computer power management functionality. Commercial software packages typically offer more feature-rich solutions and may deliver more energy savings, but they involve fees.

Energy Star offers free, personalized technical expertise and assistance to help determine the best way to activate power management features in your IT environment. The right power management solution for your network will depend on a number of factors, including the type(s) of computers, the software running on them, your network topography, and the way your IT staff manages software updates, to name a few. You can request a free conference call between your IT colleagues and a technical expert via the Energy Star website.

PRINTERS, SCANNERS, COPIERS

BUY EPEAT OR ENERGY STAR

Because printers, scanners, and copiers (sometimes referred to collectively as "imaging equipment") are commonly left on for 24 hours a day, energy-efficiency is an important purchasing consideration.

Office equipment that has earned the Energy Star certification helps save energy through special energy-efficient designs, which allow them to use less energy to perform regular tasks and to automatically enter a low-power mode when not in use. Energy Star copiers and printers also cut down on paper use by automatically printing on both sides of the paper.

Visit the Energy Star and EPEAT websites to find qualifying brands and models. (Note that all EPEAT products must meet Energy Star requirements.) If your organization has purchasing or procurement guidelines, don't forget to add language specifying Energy Star or EPEAT in requests for proposals and contracts. (For sample procurement language see page 3, above.)

CONFIGURE IMAGING EQUIPMENT TO UTILIZE ENERGY-SAVING FEATURES

Older printers, copiers, and fax machines may not be configured by default to automatically enter low-power sleep or standby modes when inactive. Ask your service vendor to make sure your machines are configured to take full advantage of these features, or review the owner's manual and make the setting changes yourself. If you can't find the owner's manual, search the internet for instructions using the manufacturer's name and model number.

MAKE DOUBLE-SIDED PRINTING THE NORM

In addition to saving energy, Energy Star certified copiers and printers also cut down on paper use by automatically printing on both sides of the paper. If your printer supports "automatic duplexing," configure it so that it defaults to double-sided printing. (Again, consult the owner's manual for instructions). Double-sided printing also saves energy since paper production – from wood pulping through fabrication -- is energy intensive.

CONSOLIDATE PRINTERS

Printer consolidation saves money by reducing the number of devices in an organization's printer "fleet," and by ensuring that the remaining devices are more cost effective to own and operate. Strategies include the sharing of "workgroup" printers, the elimination of inkjet or other high-cost printers, and the use of multi-function devices instead of stand-alone printers, copiers, fax machines, and scanners. Most organizations can achieve a ratio of one device (typically a networked multifunction device) per ten or more users. Benefits include lower costs for hardware, consumables (paper, ink, and toner), electricity, and maintenance.

If your organization still has a lot of non-networked printers in offices or cubicles, or still makes wide use of single-function copiers, fax machines, and scanners, then printer consolidation could substantially reduce your printing and electricity costs. Representative savings run between 30 and 40 percent per year and can range as high as 60 percent of total printing costs, according to various vendors.

PERIPHERALS

USE SMART POWER STRIPS

Consider using "smart" power strips to reduce the electricity consumed by desk lights, computer accessories, fans, and other miscellaneous "plug loads" in cubicles and offices. ("Plug load" refers to the energy used by products powered from an ordinary AC outlet. It generally excludes heating, ventilation, air conditioning, overhead lighting, and other major uses of power in a building.) Smart power strips save energy in two ways: 1) they automatically turn off items when people forget to do so, and 2) they eliminate "phantom load." (Many electronic products continue to draw power from the wall even when they are powered off – a phenomenon known as "phantom load." Since it's not always practical to completely unplug these items whenever you leave your desk, smart power strips can effectively do so for you.)

Each smart power strip can save $10-100 per year, and sometimes more. There are three types of smart power strips:

1. **Timer-equipped.** These power strips have outlets that are controlled by programmable timers. Devices plugged into them can be scheduled to automatically turn off or on at designated times of day or night.
2. **Occupancy sensing.** Occupancy sensing power strips have outlets that are controlled by a motion detector. Devices plugged into them can automatically turn off or on in response to your physical presence, or after a user-defined period of time elapses (e.g., anywhere from 30 seconds to 60 minutes).
3. **Current sensing.** These power strips can automatically turn several outlets off or on when they detect that a monitor (plugged into the "master outlet") either enters a low powered sleep mode, is turned off, or is turned on. Used in combination with monitor power management features, these power strips can turn just about any electric device off and on automatically.

Of the three types of smart power strips, the current sensing type generally saves a bit more energy, but it must be used in conjunction with monitor sleep features to reach its full potential. Timer-equipped or occupancy sensing types are better for work spaces with no computers.

Tip: Smart power strips are available from most electronics retailers, but it's also a good idea to check with your local utility. Many electric utilities offer smart power strips at a discount, or they might rebate a portion of the retail price.

SERVER ROOMS & DATA CENTERS
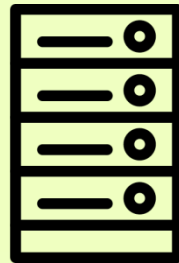
Server rooms and data centers use a lot of energy. And it's not just big data centers. The average commercial office building spends close to one quarter of its annual energy bill powering server rooms and closets.

Why are server rooms and data centers such energy hogs? The quick answer is that servers generate a tremendous amount of waste heat. Just one rack of blade servers, for example, can generate heat equivalent to four Weber gas barbecue grills in constant use! All of this heat must be removed by cooling systems that consume energy; otherwise the equipment can overheat and fail.

THREE AREAS OF OPPORTUNITY IN SERVER ROOMS & DATA CENTERS

1. **Reducing IT load.** It's important to focus on the efficiency of the IT equipment in your data center or server room. Saving just one watt of power at the server level can result in nearly three watts of total savings in a data center, because less power is consumed supporting the electrical infrastructure and cooling IT equipment.

   Strategies for reducing IT loads in data centers include server virtualization, consolidating lightly-used servers and removing unused servers, better management of data storage, and selecting more energy-efficient equipment (e.g., servers, uninterruptable power supplies, and power distribution units.)

2. **Airflow efficiency.** Airflow management is about delivering cold air from AC units and/or fans as efficiently as possible to the fronts of servers, and removing hot exhaust air from the backs of servers to the AC return registers as efficiently as possible.

   Airflow management strategies include orienting server racks to create cold aisles and hot aisles, using enclosures around server racks to reduce the mixing of cold air and hot exhaust air, using variable speed fan drives in AC units, and properly deploying airflow management devices such as diffusers, blanking panels, and structured cabling systems.

3. **HVAC & humidification efficiency.** Because high temperatures and damp or excessively dry conditions can harm sensitive data center equipment, temperatures and humidity levels must be managed.

However, today's data center equipment can tolerate much wider temperature and humidity ranges than in the past. As a result, it's often possible to save energy by doing less cooling and humidification (or dehumidification). Additionally, there are new, vastly more efficient ways to humidify data center air than the old standby – producing steam.

Other strategies for reducing cooling costs include air-side and water-side economizers, which take advantage of lower outside temperatures whenever possible to avoid having to mechanically cool air.

For non-technical descriptions of all of these strategies, their costs, and practical implementation considerations, see ENERGY STAR's, 12 Ways to Save Energy in the Data Center.

How to Lead an IT Energy Efficiency Effort
(No, You Don't Need to be a Techie!)

Unfortunately your IT colleagues may not greet a computer power management initiative with a sense of enthusiasm or urgency for three reasons:

1. **They don't pay the utility bill**. IT departments call the shots when it comes to managing computer networks, but they rarely pay the electricity bills, so they don't directly benefit from energy efficiency measures. In fact, IT energy efficiency measures may "cost" them in terms of staff time.
2. **Competing priorities.** An IT manager's job, first and foremost, is to keep computer networks up and running. Security threats, viruses, malware, hardware failures and software upgrades ensure that this job remains deeply challenging, and that all other initiatives take a distant back seat.
3. **Lack of expertise.** Energy efficiency is almost never a part of an IT professional's training. The time it takes to research energy-saving strategies, tools and techniques is often significant enough to serve as a barrier to action.

The good news is that hundreds of organizations like yours have overcome these hurdles. In this section we'll show you how. We'll use computer power management as an example, but these same four steps apply to almost any IT energy efficiency opportunity.

Tips for Getting Your IT Colleagues On Board

1. **ACKNOWLEDGE THEIR TOP PRIORITIES**

   An IT manager's job, first and foremost, is to keep computer networks up and running.

2. **BUST THE MYTHS**

   The Energy Star website provides answers to frequently asked questions and debunks some of the most common myths about computer power management.

3. **OFFER EXPERT TECHNICAL ASSISTANCE**

   IT professionals may not feel like they have the time to properly research energy-saving strategies, tools and techniques. A free one-on-one phone consultation with an Energy Star expert can answer all of their questions in less than an hour.

4. **SHARE THE SAVINGS**

   If possible, offer to share some of the cost savings with your IT department in return for their assistance.

1. ESTIMATE YOUR RETURN ON INVESTMENT (ROI)
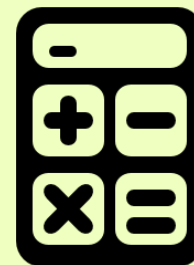
ADD UP THE BENEFITS

Obviously the most direct benefit of computer power management is energy savings. CPM features cut the electricity used by computers roughly in half. The resulting savings range from $10-100 per computer annually. You can estimate cost savings for your organization with Energy Star's free calculator (under the "Quick Links" sidebar.)

Additional quantifiable benefits include:

- **Reducing office cooling loads**, saving an additional $5–10 per computer annually, and as much as $10–25 or more in warm climates.
- **Decreasing peak load demand charges** levied by utilities.
- **Improving user productivity** by eliminating the daily wait for computers to boot up.

ESTIMATE IMPLEMENTATION COSTS

In contrast to these savings, the costs associated with activating these settings are minimal. And keep in mind that your utility might cover some or all of your software costs, should you incur any. (Remember to talk with your utility representative before starting work.)

Implementation costs may include:

- **IT staff time.** It may be necessary to adjust the way software updates are distributed to computers. Additionally, older software applications and peripheral devices should be tested for "sleep" compatibility. Even for the largest companies, these precautions rarely take more than a few days of work.
- **Software solutions.** There are lots of ways to activate sleep settings across entire networks of computers, and many are free. Commercially available software packages offer more feature-rich solutions and may deliver more energy savings, but they involve fees of roughly $3-15 per PC. (Energy savings can pay back this investment in as little as a few months.) Energy Star case studies document both free and commercial solutions in a number of diverse organizations.

2. MAKE A FEW FRIENDS

Build support from across your organization for power managing computers. Each of the benefits listed in the section entitled "Reasons for Activating Computer "Sleep" Settings" (above) will appeal to different people in your organization: talk to your colleagues in finance, facilities, IT security, sustainability, and corporate communications.

Let them know that by power managing computers, you'll be in good company: hundreds of organizations have already done so.

3. PUT A TECHNICAL EXPERT ON YOUR TEAM

Any organization can take advantage of free expert phone consultations from Energy Star. Setting up a call between your IT manager and a "Green IT" expert can transform your initiative from an abstract idea into a concrete implementation plan in as little as an hour. And it will cost you nothing.

4. CALL YOUR UTILITY

Many utilities sweeten the pot by offering cash incentives to organizations that power-manage networked computers. Just be sure to talk to your utility company representative before starting work — these incentives are not available if you're already saving energy.

Stuff for the IT Professional

WE KNOW YOU'RE BUSY!

HERE'S WHY YOU SHOULD ACT ON ENERGY EFFICIENCY ANYWAY

1. **Energy efficiency goes hand in hand with network security and data center uptime.** That's why Microsoft, Google, Intel and other tech leaders regard the energy efficiency measures discussed in this guide as IT management best practices. To cite just one example, computer power management features, used in conjunction with screen passwords, reduce the chance that valuable information is displayed on unattended computers. A report by the International Energy Agency provides numerous examples of energy efficiency measures that are considered best practices in the data center.
2. **It's a rare opportunity to be the hero**. IT professionals don't often hear from leadership unless there's a problem. Here's a very visible opportunity to proactively save your organization money and earn some well-deserved recognition.
3. **Demonstrate that you're a team player**. Energy efficiency initiatives present IT professionals with opportunities to build working relationships across organizational boundaries. By helping your facility, sustainability, or finance colleague save energy, you earn their trust. Someday you may need their help!

TECHNICAL RESOURCES

TAP INTO FREE TECHNICAL CONSULTATION & SUPPORT

Any organization can take advantage of free expert phone consultations from Energy Star. Their technical experts have helped hundreds of IT professionals, and their advice can save you days of work you might otherwise spend researching and testing solutions. They can help you with any of the energy efficiency measures discussed in this guide. Best of all, it will cost you nothing.

COMPUTER POWER MANAGEMENT RESOURCES

FOR INDIVIDUAL COMPUTERS

It's easy to manually activate computer power management features on individual computers in small organizations. Individual computers in small organizations generally rely on automated services like Windows Update, Norton Anti-Virus, and other client-driven update services to download and install software patches. When these services are running in conjunction with a sleeping, network disconnected, or "off" computer, the next time the computer is turned on or connected to the network, these services force a check-in with the update server. The client computer then downloads and installs software updates in order to "catch-up" to the current level of patching. If a reboot is required, the user is presented with an option to postpone it. Bottom line: you won't have to worry about sleeping computers missing software updates. To activate sleep on individual computers, follow these detailed instructions.

FOR NETWORKED COMPUTERS

System administrators need to ensure that activating sleep features on computers does not interfere with network maintenance. There are many ways to activate sleep settings across entire networks of computers, including a number of public domain/operating system solutions, and a number of commercial software packages.

These solutions utilize public domain software tools, and/or tools that you may already have at your disposal. Click on the links below to review information on tools to:
1. **Activate sleep settings.**
2. **Ensure that sleeping computers can still receive administrative software updates** (such as Windows security patches and antivirus definitions).
3. **Enable Remote Desktop** on a sleeping computer.

A number of **commercial software packages** provide computer power management functionality. Commercial software packages typically offer more feature-rich solutions, such as energy-savings reporting capabilities and tools for ensuring that administrative software updates (like Windows updates and antivirus definitions) are applied to computers that "sleep." They may deliver more energy savings, but they also involve fees.

Energy Star has a list of commercial software packages that help reduce computer network power consumption.

FAQS AND COMMON MYTHS

The Energy Star website provides answers to frequently asked questions and debunks some of the most common myths about computer power management.

SERVER ROOMS AND DATA CENTERS

The following sources provide more detailed technical information about data center energy efficiency measures.

- Energy Star
- US Department of Energy
- The Green Grid