Choose an Energy Efficient Computer

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The power consumption of personal computers (PCs) is finally becoming a topic of interest outside the mobile and laptop computing circles. And it's about time. In the United States alone, computers and information-technology equipment account for 2 to 3 percent of our annual electricity consumption, to the tune of US$8 billion. According to the U.S. Energy Information Administration, domestic electricity demand is projected to grow at nearly 1 percent annually, mostly to power computers, electronic equipment, and appliances.

An increasing awareness of these energy issues, the high costs and challenges associated with cooling computer processors, and the lure of a new marketing arena to hype has triggered a new interest in achieving higher efficiencies. The shift began some years ago with Sun Microsystems, IBM, Hewlett-Packard, and others moving towards more efficient central processing units (CPUs). In the past year, Intel—the PC industry's 800-pound gorilla—has finally joined the movement, and has started to flex its considerable muscle in leading the "new" performance-per-watt trend by making more efficient processors.

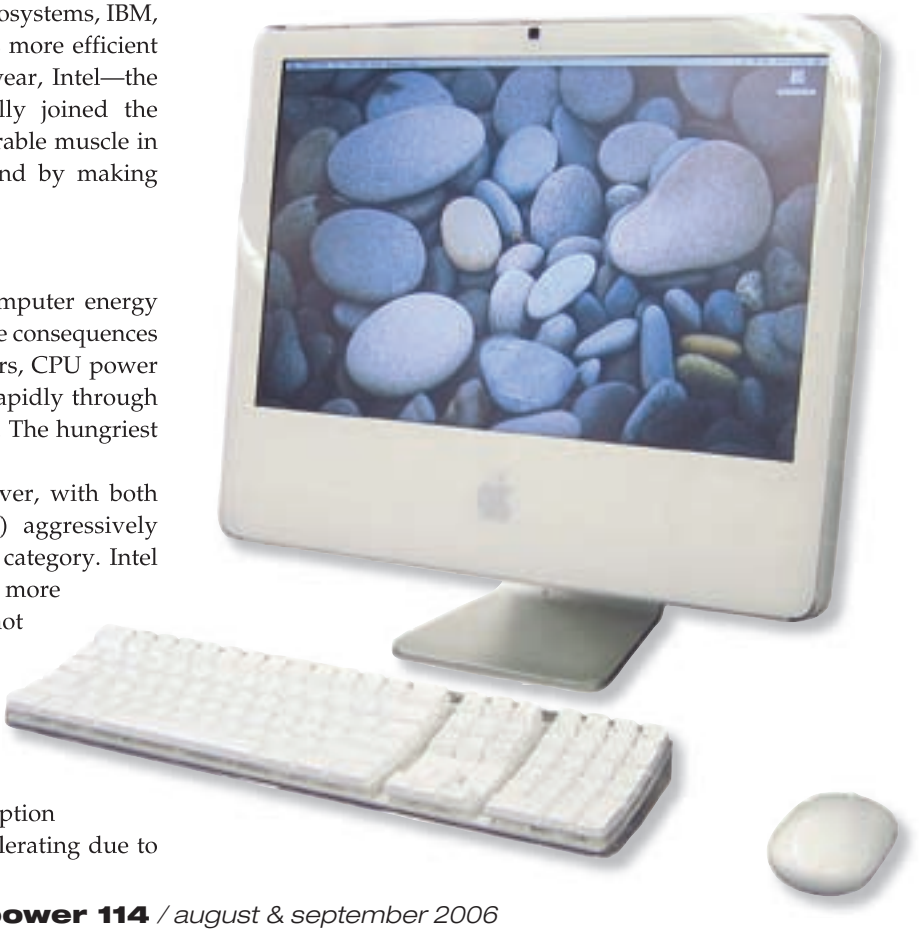
Taming Power-Hungry PCs

In the time of the old 386 and 486 chips, computer energy consumption was still in the single digits, so the consequences were not that serious. However, in recent years, CPU power demand has gone through the roof, leaping rapidly through the double digits, and past the 100-watt mark. The hungriest Intel processors consume more than 150 W.

This is a year of major transitions, however, with both Intel and Advanced Micro Devices (AMD) aggressively introducing new processor products in every category. Intel is finally showcasing new, cooler-running, more powerful chips to replace its aging, ultra-hot Prescott Pentium 4s, and AMD has made further refinements on their technologies.

One of Intel's current strategies is to blur the distinction between mobile and desktop processors, using the same chips for both types of platforms. In fact, the adoption of mobile components for desktop use is accelerating due to

The Apple 17-inch iMac Core Duo is very energy efficient, setting the stage for the future of consumer desktop computers.



17-inch iMac Core Duo

Activity / State	Noise Level (dB at 1 m)	Power (Watts)
Standby	0	2
Low-power idle	20	33
Idle	20	46
Hard-disk seek at idle	21	52
Max CPU load	22	63

Source: *Silent PC Review*

the consumer demands for ever-smaller computers at home and in the office. The new Apple iMac, based on Intel's Core Duo processor, is a perfect example of this trend. The first collaboration between Intel and Apple stuffs an entire PC into the back of a 16.9- by 6.8-inch, widescreen, flat-panel monitor (17-inch model). The CPU is a dual-core model (two processors in one core, based on the idea that two heads are better than one), originally intended for use in laptop computers. It has already been lauded as Intel's best CPU ever.

Silent PC Review (www.silentpcreview.com) reviewed the 17-inch iMac Core Duo, and found it to be the most energy-efficient integrated (monitor and computer, all in one case) PC ever tested—and one of the fastest.

AMD has commanded the top position in processor performance for the past few years. Their Athlon 64 processor's energy consumption has declined, with each new revision showing even lower demand. AMD's lead extends into the dual-core processor arena as well, with the Athlon 64 X2 processors outperforming the Intel Pentium D 800 and 900 series in both processing speed and energy efficiency—the latter is typically half that of a comparable-performance Intel. AMD, which once captured less than 10 percent of the processor market, actually outsold Intel in the first two months of 2006.

Video Cards: Still the Energy Hog

While there is progress on the CPU front, video cards have become the new energy hog in more powerful computers. High-end video cards from nVidia and ATI Technologies (the market leaders) now exceed 100 W peak demand. Both companies offer dual-video card setups for the "ultimate" gaming performance, and this can mean greater than 200 W on two daughter cards. Video cards have not yet been hit with the efficiency bug; we can only hope that the thermal overload that happened with CPUs will soon happen with graphics processing units (GPUs).

Traditional CRT monitors can use well over 100 watts.

Don't Be Misled by the Label

Before you use the Energy Star label as your guide for buying an efficient computer, consider that the current specs offer no requirements for energy consumption when the computer is in operating mode. Instead, computers are rated by the energy they use while in *sleep* mode. Current criteria stipulate that an Energy Star-qualified computer must enter sleep mode within 30 minutes of inactivity, and must not consume more than 10 percent of its power supply rating in that mode. With these standards, almost *all* computers (about 98 percent) can bear the Energy Star label.

The good news is that the U.S. Environmental Protection Agency (EPA) is working on new Energy Star computer specs for 2007, which include parameters for operating efficiency. At this time of writing, the specs are in their second draft, and propose:

- A high-efficiency (better than 80 percent) power supply must be used. This ensures that electrical energy loss (as heat in the power supply) is kept to less than 20 percent at all times. Currently, a loss of 30 percent or more is typical.
- In standby mode (power off, but AC plugged in), the appliance can draw no more than 2 W.
- In sleep mode, it must draw no more than 4 W.
- While in idle (powered up, but little or no activity), Category B desktops must draw no more than 50 W; Category A desktops must draw no more than 75 W.

Category B desktops often share the following set of features: one processor with one or two cores; one hard drive; one optical drive (maximum); 1 gigabyte (GB) of RAM or less; a GPU with a single monitor output and 128 megabytes (MB) dedicated video memory, often integrated on the motherboard. Category A desktops must have at least four of the following: multiple processors; four or more cores on a single processor; two or more GPUs or a single GPU with less than 128 MB RAM; HDTV-capable video TV tuner; two or more internal hard disk drives; 2 GB or more of installed RAM.

When the new Energy Star spec is implemented in 2007 (January 1, or perhaps July 1), the EPA expects only about one out of every four computers will meet the spec. Then, it will be far easier to choose an energy efficient computer—just look for the Energy Star logo.

Shop Smart—Now

So what if you need an energy efficient computer *today*? You'll be happy to know there are many options.

Get a laptop. Even the most energy-hungry laptop will be relatively modest in its demands, compared to a desktop. The need to conserve battery power means that virtually every component in a laptop computer is designed to run on less energy. Avoid any laptop containing a CPU described as a Mobile Pentium 4. This is a "low"-power version of the desktop P4, arguably the most energy-hungry processor made. Choose instead: Pentium M, Celeron M, Core Solo, and Core Duo among Intel processors; AMD Turion 64 and Turion 64 X2 (dual core) are also very efficient.

If you want the benefits of a large monitor, a full-sized keyboard, and a mouse, all of these can be added to any modern laptop. Plus, some laptops (Apple's new MacBook Pro, for instance) have options for 17-inch screens.

Even this large 23-inch LCD monitor only uses about 65 watts—a big energy savings over old-fashioned CRTs.

Modern laptop computers are fast and powerful, and use only a fraction of the energy of a typical desktop PC.

Get an Apple iMac (Intel Core Duo processor model). These highly efficient, yet powerful, integrated computers can even run the Windows XP operating system. Some Apple dealers are selling them with Windows installed, with dual-boot options. The only downside of these iMacs is that they are not really upgradeable. But because they are high performance computers, upgrading may not be necessary for many years.

Check the energy consumption specs of the desktop PC you are considering. Keep in mind that idle power consumption is far more important than maximum power, but for overall energy efficiency, it helps if the latter is lower too. In actual use, most computers run close to or at an idle load more than 90 percent of the time. (However, this doesn't hold true if you are an addicted gamer.) If you can't find the data online, request it from the manufacturer.

Shop for computers that use 50 W or less at idle, and ideally, not more than 125 W at full load. Power at full load will tend to go higher if the computer has a more powerful video card, which is common with PCs intended for the gaming market. Machines that incorporate "onboard" graphics on the motherboard will generally have the lowest energy consumption. Onboard graphics chips in nVidia and ATI chipset motherboards have decent performance. Try to avoid the Intel onboard graphics chips (Extreme Graphics)—they have poor performance and will be unusable with any modern games.

Avoid gaming video cards if you can. If you must have one, try not to go past the "middle" ranks. Just by itself, a midlevel gaming card at full load can use 50 W, which might be more than the rest of your components—*combined*. And a dual video card PC is an absolute no-no if your goal is energy efficiency.

Know your processors. Look for computers that use Intel Core Solo, Core Duo, "Conroe," Pentium M, or Celeron M processors. Almost all AMD processors, including Athlon 64 single and dual (X2) core, Sempron, and Turion 64 (single and dual core), are quite energy efficient. Generally speaking, choose a middle-to-low clock-speed processor,

unless you have very demanding needs. Most individuals can get by with 1 GB of memory in most cases, and more than two hard drives is a bit of an overkill. You can always add one later, and external USB hard drives are inexpensive, handy, and use no energy when disconnected.

Choose an LCD monitor rather than a CRT. Typical energy consumption of a 19-inch LCD monitor running normally is 25 W to 30 W. In sleep or standby, it will consume no energy at all. In contrast, even an Energy Star-labeled, 19-inch CRT typically draws more than 80 W in normal use. On some 19-inch CRTs, playing a video clip in high resolution can drive usage up to 120 W. When you turn your computer off, and the monitor blacks out, an Energy Star monitor should draw virtually no power, perhaps 1 to 2 W. A non-ES, 19-inch CRT may still use as much as 80 W in this standby mode. (Screensaver modes drop energy use by only about 5 to 15 percent.)

Look for Active Power Factor Correction (APFC) in the power supply. Power factor relates to AC electricity, and the way in which electrical devices interact with the incoming supply. To the power utility, a power factor of 1.0 makes the electric device "look" like a perfect resistance. In such devices, the apparent and real power consumed is the same. An electrical device with a poor power factor (such as 0.5) will draw *double* the apparent power to obtain the same amount of real power. This is easily measured with some AC watt-hour meters (see Access). An APFC power supply in a computer typically achieves a power factor greater than 0.95, compared to 0.7 for power supplies that have passive PFCs, and less than 0.6 for those that have no PFCs.

The power-saving settings window of a Windows XP laptop: Start / Control Panel / Power Options.

A switched plug strip makes it easy to power-down peripherals and phantom loads.

Not all computer specifications will note power factor, and most salespeople won't have a clue. However, you can use these telltale signs:

- An APFC power supply usually has no 120/240 VAC switch; the APFC circuit is tied to an auto-ranging AC input voltage circuit.
- A passive PFC or no-PFC power supply almost always has a 120/240 VAC selector switch.

Turn off the computer and any peripheral devices, such as monitors, printers, and scanners, when they are not in use. Sleep-mode effectiveness for computers varies tremendously—some may use just one-fifth of idle power in sleep, while others will drop barely 10 to 20 percent. At this time of writing, most PCs on the market draw between 65 W and 100 W at idle, and only somewhat less while sleeping. But as 2007 approaches, we're sure to see more energy efficient models. "Hibernation" achieves the same energy savings as turning a computer off—it really is off, but saves the current state of the computer to hard disk, for fast resumption of work upon waking up.

The power-saving settings Mac OS X desktop: Apple / System Preference / Energy Saver.

The energy consumption of printers varies tremendously, with small, slow inkjets drawing little more than 100 W maximum, and high capacity, high volume laser printers drawing more than 1,500 W. However, when idle, their draw is modest, typically less than 25 W. For printers, the difference between idle and sleep modes is usually quite small.

In almost all cases, simply turning the power off is the best way to minimize energy consumption when the machines are not needed. Pulling the AC plug from the wall may save another few watts, but most people will feel this is too inconvenient. "Smart" plug strips like BITS Smart Strip can shut off the AC at the plug when the computer itself is turned off, so that you don't have to remember to turn them all off at once (see Access).

Access

Mike Chin, *Silent PC Review* • www.silentpcreview.com • mikec@silentpcreview.com

Cooke, Devon, with Mike Chin. "17-Inch Apple iMac—The Official SPCR Review," *Silent PC Review*, 21 April 2006, www.silentpcreview.com/article594-page1.html

Current & proposed Energy Star requirements for computers • www.energystar.gov/index.cfm?c=computers.pr_crit_computers and www.energystar.gov/index.cfm?c=revisions.computer_spec

"Smart" Plug Strips & Watt-Hour Meters:

BITS Ltd. • 877-424-8758 or 631-261-8764 • www.bitsltd.net/SmartStrip/ • Smart Strip plug strips

Brand Electronics • 207-549-3401 • www.brandelectronics.com • Digital power meters

Electronic Educational Devices Inc. • 877-928-8701 or 303-282-6410 • www.doubleed.com • Watts Up power meters

P3 International Corp. • 212-346-7979 • www.p3international.com • Kill A Watt power meter

SeaSonic • www.seasonicusa.com • Power Angel power meter