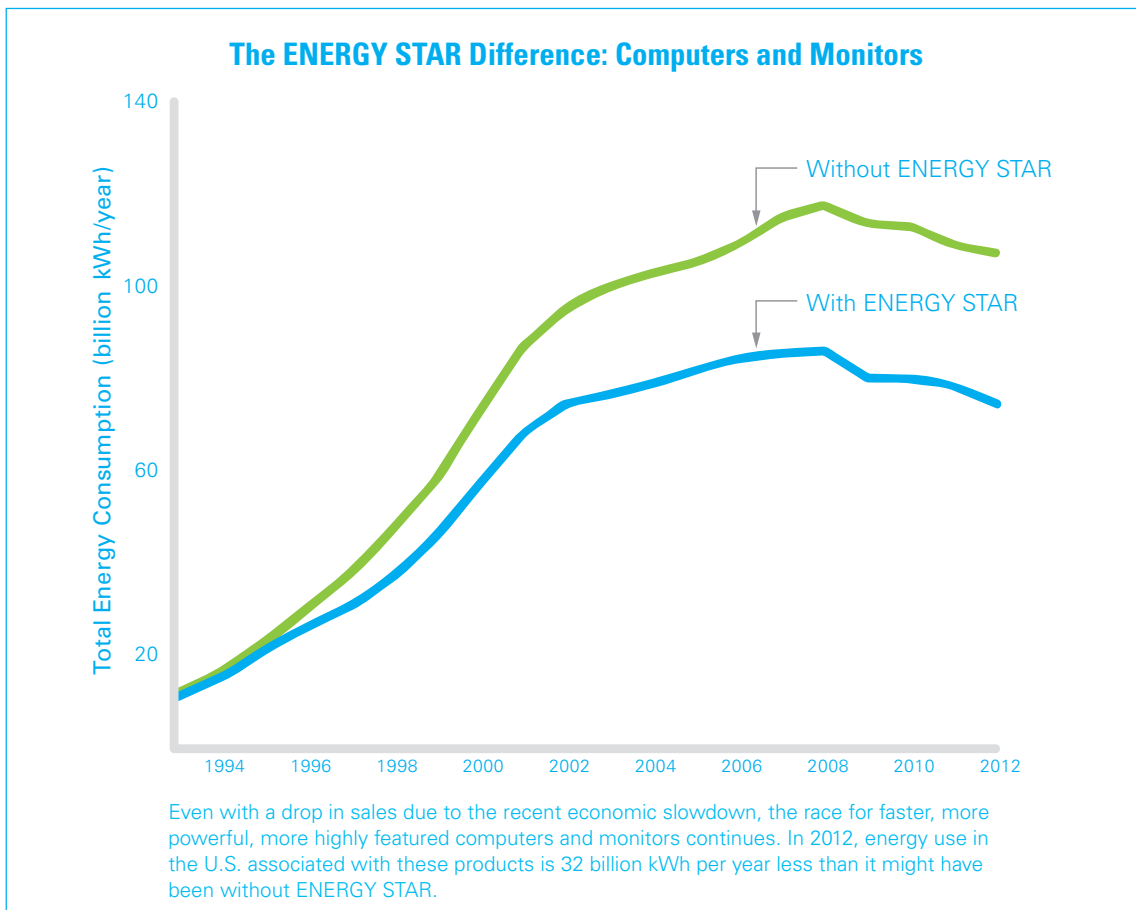# Product Retrospective: Computers and Monitors

It was 1992: a typical office information processing set-up included a CRT (cathode ray tube) monitor, usually beige and occupying about 15 x 15 inches of desk space, attached by wires to a keyboard and sitting atop or next to an equally large computer. About two percent of the U.S. population had access to the Internet,[1] and leading-edge companies were debating whether to build websites or continue to invest in bulletin board systems to share information. Employees were becoming increasingly computer literate, able to produce smartly desktop-published documents for spiral binding, using functions such as "ctrl-v 4,34," a standard keystroke on an IBM desktop computer platform.

Unfortunately, those same employees for whom computers were becoming an integral part of work life had little tolerance for shutting down and later rebooting their computers or monitors if they stepped away from their cubicles or offices. Nor were they cognizant of the environmental impact of leaving computers turned on. Few people understood or internalized the link between their energy use and CO_2 (carbon dioxide) emissions, a leading contributor to global warming.

The Information Age was changing the way we worked, learned and interacted, and technology was evolving rapidly to create and keep up with growing demand. Not inconsequentially, the energy use associated with technological innovation was also on the rise. Estimates in 1990 indicated that computers and related peripheral equipment consumed 40 billion kilowatt-hours of electricity in the U.S.—five percent of commercial sector electricity—and were one of the fastest-growing but most overlooked electricity loads.[2]

The ENERGY STAR Difference: Computers and Monitors

Total Energy Consumption (billion kWh/year)

Without ENERGY STAR

With ENERGY STAR

Even with a drop in sales due to the recent economic slowdown, the race for faster, more powerful, more highly featured computers and monitors continues. In 2012, energy use in the U.S. associated with these products is 32 billion kWh per year less than it might have been without ENERGY STAR.

By then, the scientific link between manmade greenhouse gas emissions and global climate change was also well established. President George H.W. Bush outlined in his 1992 National Action Plan for Global Climate Change several strategies to reduce emissions by reducing energy consumption. The U.S. Environmental Protection Agency's (EPA's) voluntary programs, including the ENERGY STAR computer program, were among those strategies. Their shared mission: to demonstrate market-based approaches for reducing greenhouse gases and other air pollutants by understanding the barriers that limit greater investment in energy efficiency, and developing and deploying strategies to overcome those barriers.

Lack of supply and lack of demand were identified as interrelated barriers to greater computer efficiency:

1992

- Among computer users there were widespread but unfounded beliefs that turning computers off, even occasionally, shortened typical lifespan and that using screensavers reduced electricity consumption. In addition, there was an obvious lack of efficient product supply and no way to differentiate energy-efficient models even if they existed.[3]

- Initial concerns with efficient technologies were related to adverse effects on component lifetimes as well as cost premiums. But by 1992, technological hurdles were less of an issue. Instead, manufacturers cited lack of market demand for efficient products as the biggest barrier. A product development specialist for a major computer manufacturer remarked that they had once considered incorporating low power states into their main-stream product line but were told by their marketing department not to bother.[4]

Seeking to offer a credible way to designate energy-efficient products, EPA initiated meetings with members of the computer industry to discuss forming the ENERGY STAR program. The first step was to figure out a way to define and implement energy-saving features.

EPA and stakeholders ultimately coalesced around a functional criterion: the ability of a computer or monitor to go into a low power or "sleep" state after a period of inactivity. Power management was not yet a product attribute for desktop computers and monitors.[5] The first ENERGY STAR specification required computers and monitors to consume 30 watts or less in this mode—a 70 percent savings from normal usage (integrated computers and monitors were given a budget of 60 watts in sleep mode).

That same year, EPA rolled out the "EPA Energy Star—Pollution Preventer" logo as a way for consumers to easily recognize efficient products from a trusted source: the U.S. government.

The government did something else to drive demand and supply for energy-efficient computers and monitors—it became the largest procurer. On April 21, 1993, President William Clinton issued an Executive Order directing federal agencies to purchase ENERGY STAR computers and monitors.[6] This significantly increased the supply of ENERGY STAR qualifying products; by the end of 1994, more than 2,000 ENERGY STAR qualified models were available, and all major manufacturers were participating in the program.[7]

Since then, the ENERGY STAR computer and monitor specifications have been revised multiple times, ratcheting down the power that computers and monitors consume in sleep mode from 30 to 2 watts or less. They now include requirements that power-saving features be preset and enabled to conserve energy, and they have tackled energy-saving opportunities in other modes such as "idle," where desktop computers spend 30–60 percent of the time running basic default applications after the operating system and software have completed loading. Efficiency criteria were eventually
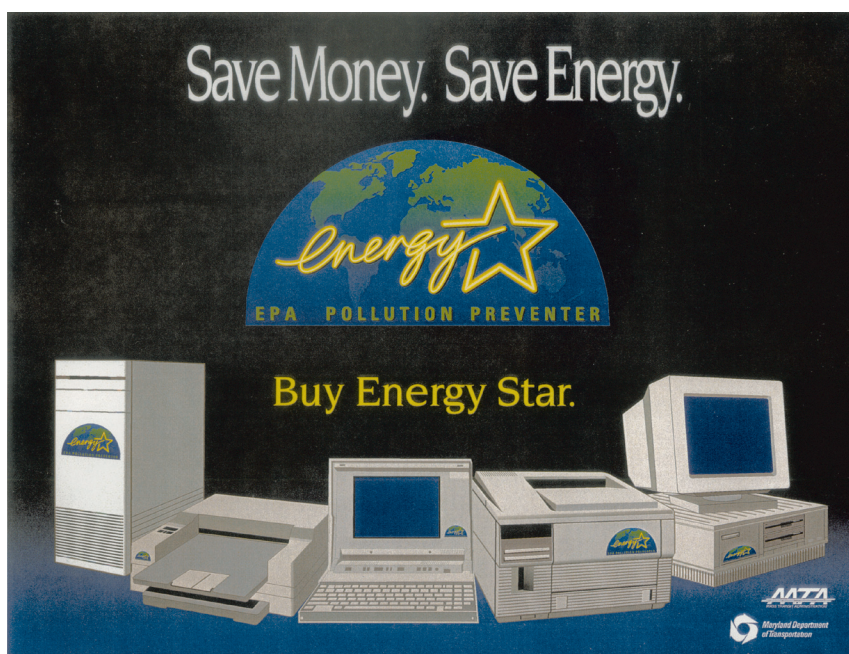
added for internal and external power supplies, the components that convert alternating current (AC) from the wall socket into direct current (DC) and regulate the voltage needed to operate computers. Efficient power supplies enhance the efficiency of computers in all operating modes.

Today, work continues on improving the efficiency of networked systems. To address these new savings opportunities, the European Commission and other international partners, the Natural Resources Defense Council (NRDC), Information Technology Industry Council members, other program stakeholders and EPA work collaboratively to research and coordinate development of internationally acceptable definitions and test procedures.

As the information technology marketplace has evolved, so has the ENERGY STAR program—expanding to cover other office products, tackling new operational modes and usage patterns and learning along with industry how best to manage power while responding to innovation. So far, EPA estimates that ENERGY STAR office equipment has saved more than 500 terawatt-hours (TWh) of energy in the U.S., resulting in energy-bill savings of more than $50 billion.

ENDNOTES

[1] World Bank. (2011). *World Development Indicators 2011; Internet users per 100 people.* Retrieved from http://data.worldbank.org/indicator/IT.NET.USER. P2.

[2] Norford L., Hatcher A., Harris, J., Roturier, J., and Yu, O. (1990). Electricity Use in Information Technologies. Annual Review of Energy, 15, 423-53. As cited in Johnson and Zoi, 1992.

[3] Harris, J., Roturier, J., Norford L.K., and Rabl, A. (1988, November). Technology Assessment: Electronic Office Equipment (LBL-25558). Lawrence Berkeley Laboratory . As cited in Johnson and Zoi, 1992.

[4] Johnson, B.J., & Zoi, C.R. (1992). EPA ENERGY STAR Computers: The Next Generation of Office Equipment. Published in the 1992 *Proceedings of ACEEE Summer Study on Energy Efficiency in Buildings.*

[5] Power-saving features were emerging for battery-powered laptop and notebook computers.

[6] On April 21, 1993, President Clinton issued executive orders (EOs 12843, 12844, and 12845) directing federal agencies to reduce their use of ozone-depleting materials, increase their use of alternative-fueled vehicles, and purchase energy-efficient computers. **Source:** The White House Council on Environmental Quality. (2000). Chapter 13: Environmental Actions by President Clinton and Vice President Gore. *In Earth Day 2000 Report.* Retrieved from http://clinton4. nara.gov/CEQ/earthday/ch13.html.

[7] Estimate also includes printers, which became eligible for the ENERGY STAR label in January 1993. **Source:** EPA. (1995). Purchasing an ENERGY STAR Computer (430-K-94-006). U.S. EPA Office of Air and Radiation.