Electronic Products: Making Power Supplies More Efficient

The Problem

Most office equipment and consumer electronic devices use external power supplies to convert high-voltage alternating current (AC) into the low-voltage direct current (DC) that they need to operate. The majority of these power supplies are far less efficient than they could be—their efficiency is on the order of 65 to 70 percent. These power supplies consume about 2 percent of all electricity produced in the United States.

The Solution

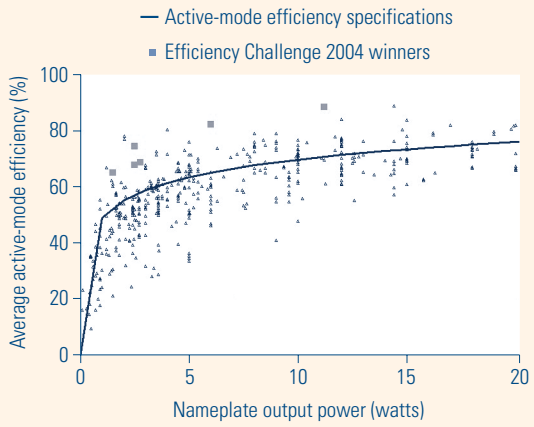
To encourage the adoption of energy-efficient power supplies, the U.S. Environmental Protection Agency's Energy Star® program developed a labeling protocol for energy-efficient external power supplies. The program was launched in early 2005 in the U.S. and China—the world's two largest power-supply markets. In addition, the California Energy Commission's Public Interest Energy Research (PIER) program funded a two-year focused analysis of power-supply energy savings opportunities. The project team—which also included the Electric Power Research Institute (EPRI), Ecos Consulting, and Electricity Innovation Institute (E2I)—held a design competition to encourage efficiency improvements for next-generation power supplies; developed a standard method for measuring the efficiency of power supplies; and produced a design guide for efficient power supplies.

Figure 1: Smaller is better

Efficient power supplies, such as the one in the middle, are lighter and more compact than typical power supplies on the market.

Figure 2: And the winners are . . .

Winning designs in the efficient-power-supply competition, in the "greater than 20 watts" category, topped Energy Star standards by 10 to 20 percentage points.



Features and Benefits

This project resulted in four major accomplishments that should lead to widespread energy savings.

New Energy Star labeling. In 2005, the Energy Star program began labeling products—such as cell phones, PDAs, digital cameras, and camcorders—that are manufactured with Energy Star–qualified external power supplies. Eventually, more Energy Star products—including laptop computers, cordless phones, and office equipment—will incorporate the external power supply requirement. Qualifying power supplies will also be sold separately as replacement products. To qualify initially, a power supply's average efficiency must fall in the top 25 percent of units on the market.

Design competition. To encourage research on advanced, energy-efficient designs from power-supply manufacturers, the project partners held an international design competition with sponsorship from the California Energy Commission and the Energy Star program. The winning designs were announced in early 2005. They are more efficient, more compact, and, in many cases, dramatically smaller than typical power supplies on the market (**Figure 1**). They demonstrate the efficiency improvements likely to be made in products that will hit the market in the future, with gains of 5 to 20 percentage points above Energy Star specifications. Improvements were especially dramatic among low-wattage power supplies, which tend to be less efficient than higher-power units (**Figure 2**).

Standardized test procedures. To measure and compare power-supply energy efficiency consistently and accurately, a standardized procedure is necessary. The project team developed such a procedure and used it to test hundreds of power supplies. The procedure is now available for use as a common technical foundation for power-supply labeling, standards, and procurement programs. It has been adopted for use by the governments of the U.S., China, Australia, Canada, Brazil, and several European countries.

Design guide. A design guide for efficient power supplies, called "Designing AC-DC Power Supplies for Improved Energy Efficiency: A Technical Primer," has been published. It identifies the main components and subsystems that contribute to the majority of losses in power-supply efficiencies, and it recommends ways to improve designs.

The project team hopes that these accomplishments will have a big impact on power-supply energy consumption. The team estimates that if efficiencies of new external power supplies sold in the U.S. improved from about 30 percent to 80 percent in the active mode, annual energy savings would amount to more than 5 billion kilowatt-hours.

Applications

The technologies and procedures developed in this program can be applied to internal and external AC-to-DC power supplies for various types of electronic equipment, including digital displays, electronic timers, transmitters, receivers, DC motors or lighting, speakers, remote controls, keyboards, rechargeable batteries, and all AC-powered products that use integrated circuits.

California Codes and Standards

The California Energy Commission has adopted mandatory appliance energy-efficiency standards, in active and no-load mode, for external power supplies (for example, in laptops, cell phones, printers, scanners, personal data assistants, and digital cameras) that are sold or offered for sale in California and manufactured on or after January 1, 2007. All other external power supplies will have an effective compliance date of July 1, 2007. The required efficiency levels are initially the same as those required by the Energy Star program and are scheduled to become more stringent on July 1, 2008.

What's Next

Energy Star has finalized a labeling program for desktop computers that includes specifications for internal power supplies. Internal power supplies are located inside the devices that they power. This specification, which uses efficiency levels recommended by the project team, will go into effect soon. Also, the International Electrotechnical Commission will consider adopting the standardized test procedures developed by the PIER program for international use.

Collaborators

The organizations involved in the project were EPRI Solutions, Ecos Consulting, and E2I.

For More Information

Reports documenting this project and providing more details may be downloaded from the web at www.efficientpowersupplies.org.

To view Technical Briefs on other topics, visit www.esource.com/public/products/cec_form.asp.

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About PIER

This project was conducted by the California Energy Commission's Public Interest Energy Research (PIER) program. PIER supports public-interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

Arnold Schwarzenegger, ***Governor***

For more information see www.energy.ca.gov/pier

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