

## **Shift from hard drives to flash may have environmental benefits Green flash: solid state drives pay dividends beyond performance**

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*The transition from standard hard drives to flash drives in laptops may have unexpected environmental benefits.*

A leading technology research group says flash, or solid state memory drives may soon replace the standard hard drives in laptops. Over the past few years, flash memory technology has been claiming an increasingly sizeable share of the market, particularly in the form of USB drives. According to the Gartner Group, the NAND flash market has grown from 1.56 billion in 2000 to 11.42 billion in 2005, with even higher projections for the next two years. This summer, Samsung set a new bar by releasing computers that utilize flash memory storage, negating the need for traditional magnetic disk media. The implications of a shift for laptops are significant for a number of reasons including changing performance demand, market trends and investment opportunities. Unconsidered at this point, but nonetheless compelling, is the possible environmental impact of such a transition.

There are many elements of this technology that strengthen the environmental case for flash over traditional memory storage. From a materials standpoint, flash memory devices appear to have a lower impact on the environment than spinning disks. Hard-disk platters typically are made of aluminum, a metal that is energy-intensive to refine and, in its pure form, corrodes easily and must be coated with other materials, most often cobalt. Cobalt is lightly toxic, and in metallic form is radioactive. Cobalt also has a tendency to develop dust, which can cause damage to the computer and physical irritation the user.

The semiconductor materials in flash memory drives are very different from those in hard drives. SanDisk, a leading developer and manufacturer of flash memory devices, is one of the early adopters of the so-called RoHS directive, a new EU regulation restricting the use of hazardous materials in new electrical and electronic equipment. The directive went into effect on July 1 of this year and limits cadmium, hexavalent chromium, lead, mercury, polybrominated biphenyl and polybrominated diphenyl ether flame retardants to established



Improved performance at a lower environmental cost. Both in form and in function, flash memory may trump hard disks at the green level.

tolerance levels.

SanDisk is also working on a number of "green" products that will lack the toxic halogens and antimony currently present in some batteries and other devices. By eliminating the dangerous materials of hard-disk computers, flash drives are already more environmentally friendly than the current standard. The performance of the solid-state technology only heightens its green appeal.

The architecture of flash memory devices allows for efficiency and a certain ruggedness that is rare in computers. Without the spinning platters of hard disk drives, less heat is generated, eliminating the need for a cooling fan and silencing the noise that goes with it. The lack of moving parts also results in smaller, lighter, more space-efficient components and computers. And with no moving parts, these drives are considerably more shock and mechanical failure resistant. Solid-state disks can withstand twice the impact that spinning-disk machines can, and data is more easily retrieved if damage does occur.

Beyond their hardiness, the drives are markedly more energy-efficient. Flash drives use silicon storage, which does not require a constant flow of electricity to maintain its data. This eliminates slow boot-up sequences, and since solid state disk memory is non-volatile, no battery is needed to retain information.

Experts estimate that hard drives consume 8 to 10 percent of laptop power. Flash memory is capable of providing measurable savings within that portion of power consumption. Less power is used overall with silicon read/write technology, so battery life is longer and speed is optimal. Solid-state technology is 300 percent (53Mbps) faster for reading and 150 percent (28Mbps) faster for writing.

Currently, the majority of users do not require the level of performance that flash provides, but as the price of this technology drops, the demand will certainly increase. Insiders suggest the transition may take up to 10 years, but once the price falls, many consumers are likely to reach for flash drives over hard disks. Smaller high-speed and high-capacity flash drives like thumb drives are already growing in popularity while falling in price. Semico Research predicts the worldwide high-density memory-card market will grow from 115 million units in 2006 to 750 million units by 2009.

Even with all the buzz about flash, industry mavens maintain there will always be a demand for both types of memory. A SanDisk representative explains: "Hard drives have a price floor due to the cost of mechanics. Because of this, [solid state drives] are more economical at capacities that cost less than this price floor. As the price per megabyte for flash devices falls, the capacity points that are more affordable will continuously increase." At some point in the future, the representative predicts, "the cost of a 32 GB flash drive... will be well below the minimum cost of a hard drive."

Other recent developments have the potential to make the transition smoother and faster. In a bid to increase performance and battery longevity, some manufacturers are developing hybrid models that integrate flash memory with the standard platter. Leading the pack is Samsung, which plans to release hybrids in January 2007, with Seagate close behind. The new Samsung drives will spin for only a few seconds every 10 to 20 minutes, extending battery life by 8 to 10 percent. Microsoft says hybrid drives will be required for its Windows Vista Premium Ready notebooks starting on June 1, 2007. User acceptance and price reductions could lead the way to

high demand for wholly solid-state drives.

While the transition from hard disks to hybrid and complete flash drives in computers will have obvious and immediate performance benefits for the user, the technology's green features may be what leave the most lasting impression. Enhancing function without forgoing form, all at the lower environmental cost to the world points to an ideal future for industrial design. By emulating natural economy, technology can advance intelligently, effectively and ultimately, more sustainably. The environmental impact of this shift may not be immediately measurable, however the benefits seem too good to ignore.

Is your old computer starting to look a little green with envy?