Smart Power Management

Executive Summary

The proliferation of cordless devices is making consumers more dependent on battery power—and creating a new type of energy crisis.

Consumers want the convenience of cordless products, but they also want a wireless experience that's free of frustrations related to battery life.

With next-generation power options (including fuel cell solutions) still years away, Logitech chose to ease customer frustration by using smart power management techniques to greatly extend the life of batteries in its cordless devices.

Smart power management is a total system approach to power that optimizes battery life by:

- using superior power sources
- building intelligence into cordless devices (down to the individual component level) to make more efficient use of battery power
- giving users the tools they need to help manage battery power

The energy gains from smart power management are dramatic. Logitech's entry-level cordless mouse can provide up to eight months of everyday use from a single pair of AA batteries—a 300 percent improvement over an equivalent model sold in 2003.

Smart power management offers cordless convenience without the frustrations associated with battery power.

It's a wireless world. Reflecting a lifestyle that's highly mobile and fast paced, consumers rely increasingly on devices that have cut the power cord: mobile phones, PDAs, Wi-Fi–enabled laptops, and MP3 music players.

Whether at home, in the office, or on the road, cordless devices such as mice, headphones, and keyboards are making life more convenient while eliminating unsightly tangles of cabling and wire.

But liberation from power cords also means abandoning the energy grid, a move that creates new issues for users accustomed to an unlimited power supply.

As the popularity of cordless devices grows, battery life is playing a more significant role in buying decisions. Consumers are wary of wireless devices that require frequent battery replacement or recharging. They're also concerned about the negative impact that discarded batteries can have on the environment.

The new energy crisis

It's not a secret: Battery technology is not keeping pace with development on the other fronts of wireless technology.

The battery is a Victorian-era technology—a century-old electrochemical factory that has seen only incremental improvements over the last decade.
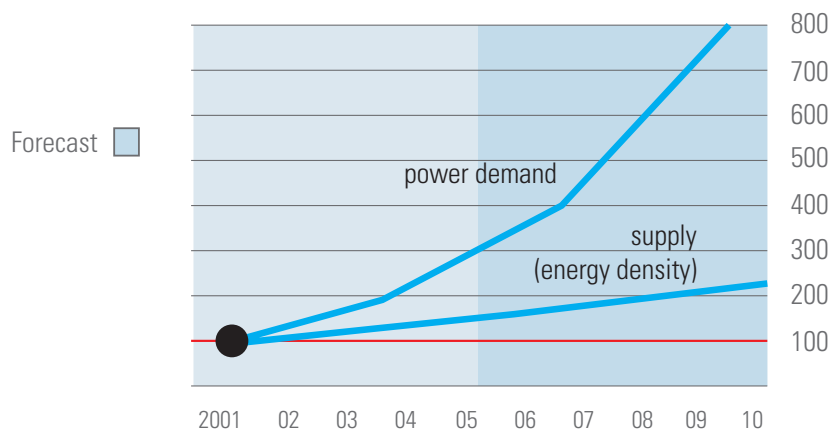
Mobile device power consumption is growing three times faster than battery energy density (measured in watt-hours per kilogram). (Source: The Boston Consulting Group)

The recent launch of a new disposable battery technology, Oxyride™, by Japanese consumer electronics giant Matsushita underscores the current predicament. Matsushita engineers spent eight years developing a new battery that lasts only 50 percent longer than an ordinary disposable battery.

According to independent studies, the energy density (amount of storable energy) of today's batteries is growing a mere 8 percent a year. (See illustration on front page.)

The widening gap between supply (energy density) and demand for energy suggests that both manufacturers and consumers will have to accept trade-offs as long as battery technology continues to lag.

The race is on

Seeing an opportunity, manufacturers are racing to identify new technologies that can produce lighter, affordable batteries capable of running longer on a single charge.

Over the past five years, lithium-ion (Li-ion) batteries have replaced nickel cadmium (NiCd) and nickel metal hydride (NiMH) as the core technology in batteries. Li-ion batteries offer a higher volumetric energy density and don't suffer from the memory effects (reduced capacity from over-charging) that plague NiCd batteries.

Although an improvement over NiCd and NiMH, an Li-ion battery is still a chemical factory packed inside a cylinder. Engineers wanting to eke out more performance are considering ways to modify the molecular structure of component chemistry, allowing each battery to be packed with more active materials.

Manufacturers are also looking at lithium polymer, a battery gel material that can be fit more efficiently inside cordless devices, and at fuel cell technologies that can power a wireless device for 20 hours or more on a few drops of methanol.

Although these emerging technologies show promise, they're still years away from making a significant impact.

The efficiency frontier

The lifespan of a battery depends on more than simply its capacity to store energy. It also depends on how the device it powers uses the stored energy.

No matter how sophisticated its design, a battery is still a "dumb" chemical factory. It can't control how its stored power is consumed—or conserved.

With advancements in battery technology still years away, manufacturers of cordless devices are exploring ways to build wireless products that are more energy efficient and capable of extending the operating life of the batteries powering them.

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Getting smart about power

With microprocessor technology advancing far more quickly than battery technology, a strategy for conserving energy from the device side is starting to make sense.

The effort to conserve energy began in the late '90s, when Intel introduced chipsets that actively reduced the power consumption of notebook computers. The trend toward power management is now full blown, touching nearly all the components that go into wireless devices.

A total system approach to battery life

Recognizing that battery life was shaping users' experiences with cordless products, Logitech took a total system approach that examined ways to conserve power across the entire product ecosystem, including the power source (battery), the device and its component parts, and the user of the device.

The result was a smart power management solution that extends battery life by using superior power sources, building power management intelligence into cordless devices, and giving users monitoring and management tools they can use to help conserve power.

The results are impressive. Logitech cordless products introduced after 2004 extend battery life far beyond the capabilities of their predecessors, and even surpass the average rate of power use improvement by other wireless devices over the same period of time.

On average, a cordless device you buy in 2005 is 20 to 40 percent more efficient than a similar model you may have purchased two years ago.

By comparison, a new Logitech cordless mouse can now provide up to eight or more months of everyday use from a single pair of AA batteries, a 300 percent improvement over the two months of useful life you could expect from the equivalent model in 2003.

> **The Logitech® V200 Cordless Notebook mouse delivers up to a year or more of operation on a pair of AA batteries, and will work with a single AA battery if a second battery is unavailable.**

And the gains are not restricted to computer mice. Logitech cordless keyboards introduced after 2004 can operate for up to 12 months and longer on a single pair of AA batteries.

Smart power management pays the biggest dividends in mobility products for which power consumption is most critical. The Logitech V200 Cordless Notebook mouse delivers up to a year or more of operation on a pair of AA batteries, and will continue working with a single AA battery if a second battery is unavailable.

Engineering power efficiency

The dramatic extension of battery life in Logitech cordless devices—mice, keyboards, controllers, and headsets—is the result of tightly integrated techniques that include automatic sleep modes, variable light intensity, power indicators, and on/off switches.

Sleeping smart

All the cordless devices in Logitech's catalog come with a sophisticated sleep mode that extends battery life by placing an unused device into what amounts to a state of suspended animation.

In normal use, the optical sensor in a mouse takes 1500 pictures per second of the mousing surface beneath it. When a Logitech cordless optical mouse is idle, the camera refresh rate automatically steps down, conserving power that would be wasted by taking thousands of detailed pictures of the same surface area. In its deepest sleep state, the sensor collects a mere two images per second, greatly reducing the power demands on the mouse's batteries.

Logitech engineers its devices to enter or leave sleep states with minimal latency. The depth of sleep is tied to the length of time a mouse is inactive. A mouse that's been sleeping for a short period of time wakes up almost instantly, without annoying lags.

Optimizing optics

In addition to sleep modes, the optical sensor inside a Logitech mouse can automatically adjust its light intensity, choosing a level of brightness that best conforms to the darkness of the surface beneath it.

A reduced brightness level requires less energy, resulting in a power savings. (Owners of a Logitech cordless mouse can extend battery life up to 30 percent simply by using a light-colored mouse pad.)

All Logitech laser mice and Logitech cordless optical mice introduced after December 2004 offer additional power savings with invisible light sensors that use less energy than the traditional red LED light.

Rechargeable devices

In addition to advanced technology, smart power management solutions also rely on strategic innovations to satisfy customers' needs.

For some users, performance outweighs power concerns. Expert-level gamers, for example, want a mouse or keyboard with high-performance radio technology offering the lowest possible latency. They also demand high-resolution optical sensors that deliver ultra-smooth tracking.

Promising this user six months of alkaline battery life would be unrealistic. Instead, Logitech equips selected cordless devices, including its top-of-line, gaming-grade mice, with high-quality rechargeable batteries and a high-speed charger that doubles as a mouse receiver base.

This solution gives these power-hungry users the peak level of performance they crave while eliminating the need to swap out batteries every two weeks or so.

The charger keeps the mouse topped off and ready for action. And the advanced fast-charge capability supplies a day's worth of power from only 10 minutes of charging.

All Logitech Bluetooth keyboard/mouse combinations offer a rechargeable mouse base that gives users high-end cordless performance without power compromises.

Powering users

Another critical factor in power consumption and management is the user of the device. Cordless mouse customers told Logitech that they wanted an on/off switch and a battery indicator that would eliminate painful, dead-battery surprises. In other words, users want tools that let them actively manage battery power.

Early warning system

Research shows that consumers are most frustrated by abrupt power outages that come without advance warning. Batteries are inexpensive and plentiful, but that's little comfort if the nearest battery is five miles away when a mouse goes dead.

The Logitech response was to build an early warning system into all next-generation cordless mice and keyboards. An onboard LED light flashes when battery life is down to about 10 percent of capacity, giving users plenty of time (up to 10 days and more) to replace a battery before a power outage occurs.

The Logitech® diNovo™ Media Desktop™ and Logitech® MX™ 5000 Cordless Desktop® Laser keyboard/mouse combinations go a step further. Both feature an LCD that displays the current battery level along with other system information.

Keyboard includes an LED battery status indicator and test key

Post-2004, Logitech mice powered by Li-ion batteries offer a four-level illuminated battery indicator. Active only when the mouse is in use, the indicator LED provides an accurate snapshot of existing battery life, giving users information they can use to plan a recharge.

A test of confidence

The latest models of Logitech cordless keyboards offer a function-key test button that allows users to check the battery state of their device. Pressing the F1 key flashes a green or red light, depending on the current level of battery charge.

A simple switch

Sometimes the best solution is also the most obvious one. In the past, users who forgot to remove the batteries from their cordless mice became frustrated upon discovering that the fully charged mouse they had put aside was now a dead mouse.

Post-2004 models of Logitech cordless keyboards and mice include on/off buttons that allow users to switch their mouse off when it's not in use. Each time the device is switched on, the onboard LED performs a battery check and reports power status by lighting green or red.

Simple in design and execution, the power switch lets energy-conscious users actively manage the way devices use power.

One for the road

For Logitech cordless notebook mice introduced after 2004, power toggling is also automatic.

When not in use, the USB receiver conveniently snaps onto the base of the mouse for easy transport, automatically switching off the mouse power to conserve battery life.

Conclusion

Smart power managment is more than a technology; it's a commitment to building cordless products that are both convenient and practical.

Logitech's total system approach to power conservation, and to its products in general, underscores the company's ability to create real solutions that find acceptance with consumers.

The power efficiency that Logitech builds into its cordless products reflects a creative and disciplined approach to engineering that keeps the company at the leading edge of personal peripheral technology.