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Cutting the clutter

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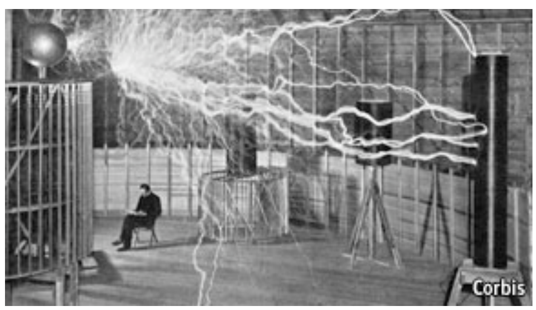
A wireless replacement for all those pesky power cables

BENEATH your correspondent's desk is a cat's cradle of tangled cables linking a pair of computers to numerous peripherals and laptops around the office. On the credenza opposite is another jumbled nest of wires for recharging mobile phones, cameras, netbooks, MP3 players and other portable gizmos. When everything is humming, there are no fewer than 15 transformers plugged into various wall sockets and power strips, along with all the other electrical cables for powering computers, monitors, printers and still hungrier office gear.

Lately, your correspondent has taken to unplugging the power adaptors—at least those he can lay his hands on—when they are not being used to recharge their tethered friends. As it is, his office becomes a veritable Christmas tree of fairy lights at night with all the red, green and amber standby diodes twinkling in the dark.



Running the numbers, he has found that a five-watt adaptor used to recharge a device for one hour a day will consume at least as much power on standby during the remaining 23 hours. In some cases, up to seven times as much juice is used during standby versus normal operation, says Fulton Innovation, a Michigan company that specialises in developing electrical technology.

Anyone doubting such a claim should check with the adaptor-maker to see what the conversion efficiency is for a typical small transformer and how much it consumes when on no-load compared with full-load. Your correspondent has found many of these so-called "wall warts" to have conversion efficiencies of little more than 30%. In other words, two-thirds of the electricity they draw goes to waste. And there are an awful lot of them around. Some 730m such adaptors were shipped in America during 2008, with more than 370m finishing up as landfill. That is a profligacy the world can manage without.

The obvious answer is to cut the cables and go wireless. Today, we take for granted that wired communication —whether voice, data or multimedia—has largely gone wireless. But wired power, even for portable gizmos, remains the rule.

One of the few exceptions is the rechargeable toothbrush. A coil in the charging unit that is connected to the electricity supply generates a magnetic field, which induces an electric current in a coil in the base of the toothbrush handle for replenishing the battery. A handful of electric razors are recharged in a similar fashion. Your correspondent is not alone in wishing to see similar inductive couplings used to replace the various recharging units cluttering up his office.

The idea of transmitting power wirelessly has been around since the 1830s when Michael Faraday introduced his celebrated law of induction. Loosely stated, this says that an electrical current in one conductor will induce a current in a second, wholly separate, conductor that shares the same magnetic field. The concept of transmitting power across an air gap between one coil of wire and another led to electrical transformers, generators and motors—and ushered in the era of electrical engineering.

By the 1890s, Nikola Tesla had demonstrated that not just magnetic fields but also electromagnetic waves themselves could transmit power—and over far greater distances. In one experiment, Tesla powered lights in his laboratory grounds remotely from a transmitter coil many metres away. More recently, a government laboratory in Canada built an unmanned aircraft to act as a communications relay station circling 21km up in the sky for months on end. Power was supplied by a microwave transmitter on the ground. A large disc-shaped rectifying antenna attached to the fuselage harvested the microwave energy, turning it into direct current to power an electric motor attached to the plane's propeller.

Some researchers have proposed using microwave beams to transmit electricity from solar-power stations in orbit, or even on the moon, to receivers on the surface of the Earth. Microwaves pass through the atmosphere with little absorption, and rectifying antennae are adept at converting microwave energy into electricity. But worries about the potential health hazards associated with a powerful microwave beam mean that such proposals have so far remained pie in the sky.

More down to Earth, several companies have started offering mats and work-surfaces capable of simultaneously recharging a number of portable devices. One of the simplest comes from a firm called WildCharge, based in Colorado. An adaptor is attached to each gadget (often as a specially designed replacement for its back cover) with three lugs on its back for making contact with the charging mat's conductive surface. Because of the way the mat is configured, at least one lug always makes contact with a positive region of the conductive surface and one with a negative part. Power is transferred to each device by direct contact rather than via a magnetic field and induction.

Though delightfully simple, the WildCharge approach is a proprietary one that requires each device to have its own controller for managing the transfer of electricity from the charger's conductive surface to the appliance's rechargeable battery. In an ideal world, the wireless recharging system would work, out of the box, like Wi-Fi and Bluetooth devices—with any approved gadget and requiring no special adaptors.

The Wireless Power Consortium, a trade group with some three dozen members, is in the process of developing such an open standard. Though its recommendation has yet to be finalised, this global consortium of mobile-phone companies, chipmakers, battery manufacturers and electronics firms wants its interoperable standard, called Qi (pronounced "chee" in Chinese and "ki" in Japanese, and loosely meaning "vitality"), to do for wireless power what the USB connector did for the wired world.

Initially, the standard will apply only to low-power devices needing five watts or less—a range that covers most consumer gadgets, including mobile phones, iPods, cameras and even laptops. A glimpse of what the likely standard might look like was seen at the Consumer Electronics Show in Las Vegas earlier this year. KI, a supplier of industrial furniture, demonstrated classroom desks and tables kitted out with smart recharging surfaces supplied by Leggett & Platt, an engineering company based in Missouri. Leggett & Platt licensed the technology for its smart desktop from Fulton Innovation.

As one of the leading lights in wireless power, Fulton's "eCoupled" approach is expected to influence the final Qi standard heavily. When phones and laptops are placed on an eCoupled surface, the power transmitter in the work-surface detects the resonant circuit in the device's receiver, which then tells the transmitter how much power to send. The power transmitter adjusts its primary coil's transmission frequency to match the receiver's and the appropriate amount of charge is transmitted across the air gap. This matching makes the process of transfer far less wasteful than it is with a traditional transformer-based adaptor. A modern inductive coupling like Fulton's can have an efficiency of more than 98%.

With electric vehicles in mind, the consortium's battery-makers, in particular, are keen to extend the Qi standard to much higher power levels. Meanwhile, computer-makers like Dell have started building eCoupled receivers into laptops in anticipation of the consortium's pending standard. Peter Goerdt of KI expects desks and other work-surfaces incorporating the latest thinking in wireless recharging to start trickling into classrooms and offices over the next year or two. By then, your correspondent will be just about ready to junk his wire-strewn office for one with far, far fewer cables.