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## On the move at last?

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### Energy: Fuel cells capable of powering portable electronic devices are finally heading towards the marketplace

ARE you a member of the power elite? You will find out at the end of this month—for that is when Medis Technologies, a small firm based in New York, plans to distribute hundreds of its new Power Pack portable fuel cells to a select group of business people, politicians and opinion formers. Each fuel cell is about the size of a cigarette packet, weighs 150 grams, and generates electricity by combining oxygen from the air with an internal fuel. It can be plugged into a hand-held device (such as a mobile phone, music player or portable games console) to power or recharge it, and has sufficient capacity to provide around 30 hours of talk-time on a mobile phone, or 60-80 hours of playback time for an iPod music-player. Once it has been exhausted, the Power Pack can be thrown away. "We will have them on sale by the end of 2006," says Robert Lifton, the boss of Medis. At last, it seems, fuel cells capable of powering portable devices are coming to market.

Fuel-cell based rechargers are "a good transition to full commercialisation for fuel cells," says Sara Bradford, an analyst at Frost & Sullivan. Integrating fuel cells directly into electronic devices such as mobile phones is complicated, but stand-alone rechargers can simply plug into existing devices. Another challenge for fuel-cell-powered devices is that standards for fuel-refill cartridges have yet to be agreed. Medis's recharger, being disposable, neatly sidesteps this problem. This is a consequence of its low cost, which is in turn the result of its unusual design. Most fuel cells being developed for portable use are based on direct-methanol technology, which requires an expensive platinum catalyst. Medis's fuel cell, however, is based on sodium borohydride, which is simpler and cheaper. Each Power Pack can be made for around \$5, says Mr Lifton, which is comparable to the cost of the platinum alone in a direct-methanol fuel cell. (Medis plans to sell its Power Packs to wholesalers for \$8, and the retail price will be \$12-15.)

Clever though this is, it is just a stepping stone towards the direct incorporation of fuel cells into portable devices and, in particular, laptops—the application that remains the industry's holy grail. It is not simply the case of slotting in a fuel cell in place of the battery. Instead, it involves switching from a battery to a hybrid power source that combines a battery with a fuel cell, argues Jim Balcom of PolyFuel, a leading maker of components for direct-methanol fuel cells based in Mountain View, California. “People think it's batteries against fuel cells—it's not,” he says. “It's about battery augmentation.” In a laptop, the fuel cell will provide a constant amount of power, topped up by the battery during periods of peak demand. This hybrid power source will provide at least double the running time of today's battery-powered systems—with the option of using extra fuel cartridges.

The complexity of such systems, along with their high cost, relatively low efficiency (most prototypes still produce more heat than electrical power) and the unresolved question of standards for refill cartridges, collectively explain why fuel-cell-powered laptops have been perpetually two years away for so long, says Ms Bradford. But, she says, “I think it really could be two years away this time.” Laptops powered by direct-methanol fuel cells are getting close to market, she says; every year the prototypes get smaller and more efficient. Demand is clear, and today's lithium-ion battery technology is reaching its theoretical limits.

Mr Balcom's firm has licensed its fuel-cell membrane technology to several large electronics firms, including NEC and Sanyo, the world's biggest maker of rechargeable batteries. PolyFuel's shipments of membranes are ramping up steadily, and the company's customers are preparing for commercial launch of fuel-cell-based portable devices in 2007-08, he says. They anticipate that 30% of laptops will incorporate fuel cells, “though we would be happy with 10%” says Mr Balcom. (Around 65m laptops were sold in 2005.)

Business travellers are expected to be the keenest adopters of the new technology. But will they be allowed to use fuel cells on planes? Earlier this year the International Civil Aviation Organisation, which regulates such matters, voted to allow the use of direct-methanol fuel cells that meet certain criteria from January 2007—a “giant step”, says Ms Bradford. But so far the rules do not allow the use of borohydride fuel cells, such as the Medis design. Mr Lifton insists that there is no regulation that prevents the use of his company's device on aircraft, however, since “it is no more flammable or toxic than a T-shirt or a newspaper.” If regulators disagree, he says, “I'll sue them.”

In short, portable fuel cells must still overcome both technical and regulatory hurdles, but progress is being made on both fronts. Ms Bradford expects sales of 3m devices next year, and 80m in 2012. Most people will use a fuel cell in a portable device long before they encounter one in a car, Mr Balcom predicts. And for the recipients of Medis's fuel cell, which provides a glimpse of this future, that could be as soon as this month.