Technology trends

Be a power broker in your own home
Ditch your dependence on polluting power stations - electricity generation is coming much closer to home

MICK HAMER

Imagine watching your electricity meter run backwards as, instead of using power, you actually donate some to the grid. That's the offer that will be held out to consumers over the next decade as millions of households get the chance to generate their own electricity using a new breed of domestic power generators.

Whether they are based on gas-powered boilers that heat the house too, or satellite-dish-sized wind turbines fixed to the roof, these appliances will make entering the power market as easy as buying a washing machine. At least, that's the theory.

The prospect stems not so much from technological advance, but rather from the liberalisation of electricity markets in most major economies, allowing power to be sold back into the grid by small-scale producers.

"The technology has been around for a long, long time," says Jon Slowe of power industry analysts Platts Research and Consulting, based in Boulder, Colorado. "The change is a confluence of the opening up of electricity markets and the increasing importance of the environment."

There is little doubt that given the chance, people will want to generate their own electricity. For instance, Osaka Gas in Japan sold 2000 of its 1-kilowatt Ecowill domestic generators last year. Powered by an internal combustion engine that burns natural gas, the Ecowill generates enough electricity to run a computer, a TV and a few lights.

In the UK, two companies are conducting commercial trials of domestic-sized combined heat and power (microCHP) plants. Only two years ago microCHP technology was in its infancy (New Scientist, 2 March 2002, p 36) but it is now maturing into a consumer product. These plants use a Stirling engine to generate electricity, while the heat produced warms household water (see "Stirling stuff").

The attraction of microCHP plants is partly environmental and partly economic. Consumers pay less for their electricity, while the environment benefits from lower CO₂ emissions. The advantage stems from the fact that microCHP plants are 85 per cent efficient, compared with only 35 per cent for power stations.
Powergen, whose main business is running conventional power stations in the UK, has teamed up with Whisper Tech of Christchurch, New Zealand, to produce a microCHP that is currently being tested in 400 UK homes. Meanwhile a firm called Microgen of Reading, UK, is running a trial of its home-grown microCHP in 50 British homes. Both companies plan a full commercial launch later this year.

Powergen says that the cost of its microCHP plants, including installation, is around 25 per cent more than a conventional boiler. The company calculates that the electricity they generate will cover that extra cost in about four years.

A report last year by the SPGI, a UK trade association representing more than 50 energy companies, predicts a bright long-term future for CHP. "A conservative estimate for the potential UK market is around 14 million units," it said.

However, no one expects this growth overnight. "If 10 per cent of houses have microCHP plants in 10 years' time, that would be quite an achievement," says Slowe. Boilers are expensive, and people normally only buy a new one when the old one breaks down, says Walt Patterson, an energy specialist at the Royal Institute of International Affairs in London. He too expects growth to be slow.

Other potential methods for generating electricity on a domestic scale avoid fossil fuels altogether. Windsave, a British start-up based in Glasgow, has already sold 12,000 of its small 750-Watt, 1-metre-diameter wind turbines to businesses. These are designed to fit on a roof, and go on sale to the public later this year. Inventor David Gordon says it complements microCHP. "Anything that helps reduce CO₂ is good. No one method will achieve the government's target," he says.

Solar power and fuel cells are also options. But fuel cells are expensive, and Slowe says it will be a few years before they are shown to be reliable enough to be marketed as a consumer product.

The efficiency of solar cells is increasing rapidly, and cells integrated into roof tiles are an elegant solution for new roofs. But solar power remains a very expensive option. At British latitudes, a 12-square-metre, south-facing roof would generate peak power of 1 kilowatt. But even after government subsidies of around a third of the cost, it is likely to take 15 years or more before they pay for themselves.

Patterson expects domestic generation of power to become increasingly important, both for its environmental benefits and because it frees consumers from dependence on the grid. "It means that no one else can turn off your lights," he says. "I think it's going to be a central trend in energy for the rest of my life."

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STIRLING STUFF

At nearly 190 years old, the Stirling engine pre-dates the internal combustion engine. Yet its use in microCHP systems is its first large-scale application.

A source of heat is applied to one end makes the gas expand, forcing a piston along the cylinder. Cooling water applied to the far end of the cylinder cools the gas, making it contract and forcing the piston to return to its starting point.

In practice a more complex arrangements of pistons – Whisper Tech uses four – increases the engine's efficiency. But even sophisticated Stirling engines have a small number of moving parts, which makes them both reliable and quiet. MicroCHP units produce no more noise than a typical fridge – about 50 decibels.