



RENEWABLE ENERGY

Wind power reduces reliance on fossil fuels

New technologies are also gradually reducing the cost of solar power, as well as tidal and wave energy, reports Fiona Harvey

When energy is so freely available all around us, why do we go to such lengths to extract it from the ground?

Once the coal, oil or gas resources are obtained, we send them across continents to be burned, resulting in a rise of carbon dioxide emissions that may lead to global warming. So why not take energy from renewable sources instead, asks Tom Delay, chief executive of the Carbon Trust, a not-for-profit organisation set up by the UK government with support from industry. It aims to lead low carbon technology innovation.

"There are oodles of natural resources available. Wind, water and sun are in abundance. If we could capture only a small proportion of that energy, it would make an enormous impact," he says.

Yet the answer to why we still use carbon is simple: despite the costs of their production, fossil fuels are still cheaper and easier to obtain than energy from renewable sources. However, new technology is gradually increasing the opportunity for renewable energy, and greatly reducing the cost of its production.

Wind power looks the most promising technology for reducing reliance on fossil fuel in the short to medium-term. At present, the cost of conventional electricity generated from combined

cycle gas turbines is reckoned at about 2p per kilowatt hour on average. The cost of electricity generated by onshore wind turbines works out significantly more, at 3p per kilowatt hour.

Supporters of renewable energy take comfort, though, from predictions that the cost of gas-fired generation may rise to about 2.5p over the next 10 years, while the cost of wind generation will come down as economies of scale emerge, making the turbines cheaper and bringing more of them into production.

"The technology for onshore wind is well-established - and stable," notes Peter Shortt, director of the low-carbon innovation programme at the Carbon Trust. So the remaining obstacles to onshore wind farms are not technical, but aesthetic. Many people in developed countries still object to the look of the turbines.

For this reason, Mr Shortt targets offshore wind energy as more likely to solve the energy problems of developed nations with a coastline in the shorter-term. "The turbines have a negligible visual impact," he notes.

Some technical issues
Wind energy production is

relatively simple, compared to other energy sources

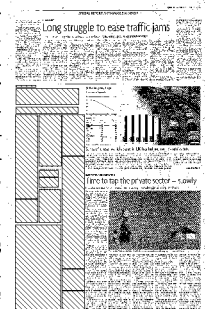
remain to be solved: for instance, most turbines are built to generate 2.5 to 3MW while offshore wind farms would require turbines capable of 5MW to be viable.

"No one has really put one of those in the water yet," says Mr Shortt. Yet he believes that these engineering problems can be solved within the next few years.

Tidal and wave energy could also provide a means of using the coastline for sustainable development. Technical issues still beset these methods, however, as engineers have not yet agreed on the best implementations. Wind energy production is relatively simple, consisting of a turbine on the end of a pole, but many different ways have been devised of generating energy from water.

"There is no agreed morphology for [tidal] technology yet," notes Mr Shortt. Some systems have proved unpopular with environmentalists as they have required the tidal flow of water in estuaries to be channelled through narrow turbines, disturbing the ecosystem.

One possible new technology comes from researchers in Aberdeen, who described their work recently in the



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New Scientist magazine. The Snail carries a pair of wings, the flow of water of which has the effect of anchoring the device to the seabed. This dispenses with the need to secure the device to the seafloor, which can be tricky and expensive – and usually impossible in waters more than 50 metres deep.

Photovoltaic cells, which generate electricity from sunlight, are another technology with a long history, but their cost has remained stubbornly high. Conventionally, the cells have been built with a liquid electrolyte, which must be made to penetrate a sponge-like structure usually made of titanium oxide, which is highly porous.

This liquid structure makes the cells rather unstable, so researchers have been looking to solid electrolytes, which are harder to make.

The cells have also been limited by their requirement for expensive silicon substrates. They work, on average, at a 10 per cent efficiency in converting energy, working out at about 100 watts of electricity per square metre. The power they produce, as a consequence, can cost up to \$4 per watt.

Salvo Coffa, director of research into renewable technology at ST Microelectronics, believes the development of polymers as substrates will bring the costs down. "Many low-cost materials now in development show promise," he says.

Fuel cells have also attracted attention recently as a potentially clean source of energy harnessing hydrogen, the most abundant element in the universe.

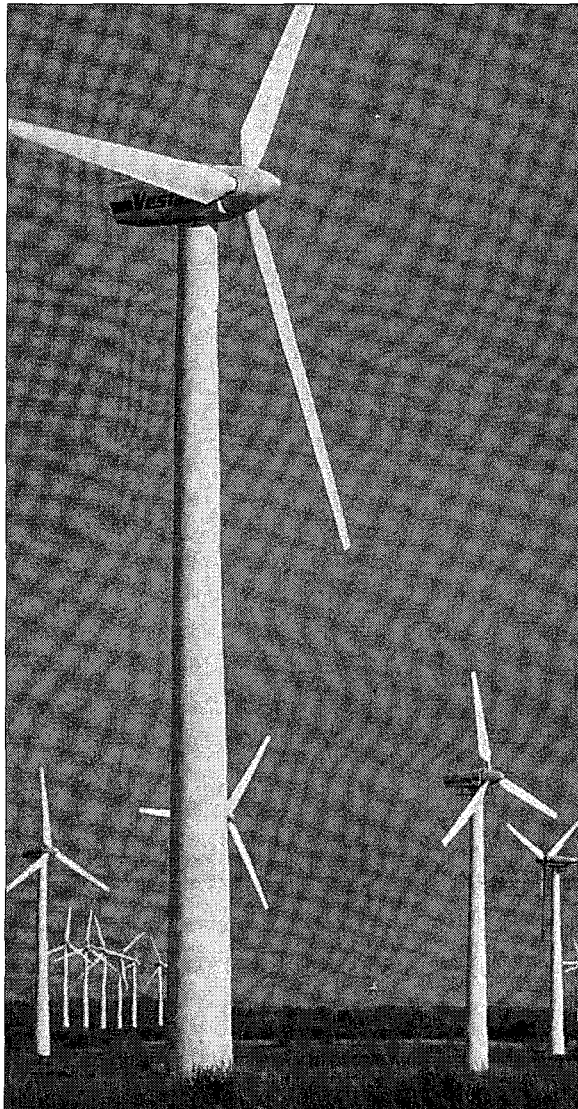
However, these are unlikely to come into widespread use for the next decade, as problems surrounding the storage and transportation of hydrogen have yet to be solved, and

arguments among developers still rage over the best way of extracting hydrogen as a fuel source.

Another low-tech and much cheaper alternative renewable energy source could be biomass, organic material – from straw and wood chip to chicken litter – which can be burned. These products, often waste from

other processes, are usually reckoned to be carbon neutral, putting no more carbon back into the atmosphere than is taken out of it when the material grows.

One drawback is that such material, while low in cost, tends to be bulky, making it uneconomic to transport it over long distances to power stations.



Windmill turbines at Staunting, west Denmark

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