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# BIOFUELLING THE FUTURE

The idea of using living plants as a way to capture the all-but-unlimited energy of the Sun has a powerful romantic attraction. Unfortunately, plants have a basic problem in this respect. Compared with, say, an array of solar cells, they are strikingly poor transducers of the Sun's energy; even an intensively managed plantation struggles to store away more than a watt or two per square metre on average.

But plants have advantages that, in some circumstances, outweigh their low efficiency. For a start, unlike solar cells, plants are very cheap to make; indeed, with a moderate supply of water and nutrients they will make themselves. They use up carbon dioxide in the process, which is a definite environmental plus — and they turn that carbon, along with the Sun's energy, into stable organic compounds.

This means that the Sun's energy is made available at a later date when the Sun isn't shining. And it means that it can be processed, at some cost and effort, into hydrocarbon fuel of the sort that today's cars, trucks and planes can handle with relatively little modification. To governments worried about the stability of their fuel imports, or indeed the long-term future of global oil production, that could matter quite a lot.

So although their inefficiency means that plants will never be the total answer to our global energy problems, they have substantial potential as a source for carbon-neutral fuel for the ever-thirsty transportation sector, as long as oil prices stay reasonably high.

Our Features this week look at this potential in three different areas. The first (see page 670) addresses the world's most substantial biofuel success — the Brazilian sugar-cane ethanol industry — and assesses its impact and potential. The second (see page 673) looks at the possibilities of making ethanol, or other alcohols, out of sources of cellulose from farm waste to poplar plantations — possibilities currently entrancing US entrepreneurs.

The third feature (see page 677) looks at a different approach to alternative fuels — the thermochemical route. This technology can be used to make fuel from biomass — but it can also, more easily, be used to make liquid hydrocarbons from solid coal, and this is where most research in the area is focused. For countries that have a lot more coal than oil, this coal-to-diesel technology can look attractive purely on an energy-independence basis. But without careful and costly sequestration of the carbon dioxide produced, it would be a significant additional source of greenhouse gases.

No fuel technology is perfect. But, as we argue in our Editorial (see page 654), a greenhouse-gas crisis and worries over oil supply mean that diversifying the range of options makes good sense — as does the development of new routes from research to large-scale deployment. ■



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