

# Biofuels

With all the modern buzz about renewables, it's easy to forget that biofuels have been around almost as long as the combustion engine – Henry Ford's 1908 Model T ran on ethanol and one of the first prototypes of the diesel engine was designed to run on vegetable oil.

However, biofuels have only become a major ingredient in the mix of alternative fuels over the past 20 years, driven mainly by the need for security of fuel supply and the recognition that greenhouse gas emissions are causing global warming. The world market for biofuels exceeded \$21 billion in 2007, representing an increase of some 18 per cent on 2006. According to official US statistics by the Energy Information Agency, worldwide growth of biofuel production is set to hover at almost 20 per cent per year until 2011.

But there are distinctions between the various types of biofuels; in addition to several bioethanols and biodiesels, research and development is already at an advanced stage to roll out the next generation of biofuels, including algal kerosene for airline fuel and cellulosic bioethanol (see box). While all biofuels are expected to achieve at least double-digit gains, market expansion will be led by biodiesel and bioethanol, with projected production more than doubling in the next three years. In terms of wheat and corn crops used for ethanol, for instance, the International Grain Council estimates that global production will rise to 124 million tons by year's end, up from 43 million tons in 2005.

This surge in the production of biofuels accounted for 17 per cent of the increase in the supply of all liquid fuels worldwide last year. Moreover, the potential economic opportunity has spurred a broad range of countries to pass laws that support biofuel industries, with incentives for biofuels currently at more than \$10 billion per year. This growth is being driven largely by the United States, which overtook Brazil in ethanol production in 2005, and by Germany, which leads the world in biodiesel production.

But the race is on as many other countries seek to establish themselves either as producers of biofuels, such as those in the European Union (EU) and the Asia and the Pacific region, or as committed partners in biofuel ventures, including those in the Gulf region.

For instance, Bahrain's national carrier Gulf Air announced last month that it was jumping on the biofuel bandwagon. It has joined forces with seven other leading airline companies outside the Arab region, including Boeing and Air France, to create a group aimed at studying the prospects for biofuel jets. Currently, aircraft run mostly on kerosene, and the partnership is hoping to develop and manufacture synthetic kerosene by the ambitious target of 2013. The extra motivation to think green stems from two daunting challenges that are rocking the aviation industry, namely: oil volatility and global warming as governments across the world look at ways to cap greenhouse gas emissions from planes.

Similarly, thinking of renewable biofuels is not a flight of fancy for Dubai-based Ecobility Energy Solutions, which is establishing the first purpose-built commercial biodiesel production facility in the Gulf region. Once completed in 2009, the plant, known as EmBio, is expected to produce some 3 million gallons of biodiesel per year.

At the policymaking level, neighbouring Abu Dhabi is convening the World Future Energy Summit in January 2009 to bring together various heads of state and global investors in order to

discuss strategies in renewables, including biofuels. This comes amid concerns regarding Abu Dhabi's unenviable position as the world's highest per capita emitter of carbon dioxide, at some 34 tons of carbon dioxide per person in 2007, according to the Human Development Report.

However, despite – or perhaps because of – the success of biofuels in recent years, questions have begun to arise about the wisdom of using biofuels as an alternative energy source.

Specifically, with policies and subsidies aimed at encouraging biofuel production, farmers often find it more profitable to plant crops for fuel rather than for food, thereby diverting edible crops towards industrial uses and leading to global food shortages. The World Bank estimates that biofuel production accounted for 65 per cent in the rise of world food prices in 2007, while the International Monetary Fund (IMF) concluded that biofuel production was responsible for a significant part of the jump in commodity prices.

While the impact of biofuels on world food supplies is expected to be a short-term issue, the potential negative impact of biofuels on the environment could have longer term consequences. Within that context, recent studies by the UN and various governmental agencies have found that the amount of energy required to convert plants into fuel does not result in savings of carbon emissions. More damningly, the Organisation for Economic Co-operation and Development (OECD) – that bands together the high-income EU, United States, Canada, Australia and Japan – concluded that government support of biofuel production in member countries was both hugely expensive and environmentally unsound, particularly as precious forests continue to be lost to biofuel crops.

Moreover, with credit tightening and oil prices falling, shares of alternative energy companies have dropped more sharply than the broader stock market. Venture capital financing has therefore become more rarefied, particularly for advanced biofuel projects.

Despite these concerns, though, the overarching need for energy security and domestic economic development will continue to propel increases in biofuel consumption – especially if and when the next generation of biofuels, such as algal biodiesel, succeed in providing an affordable alternative to fuel made from edible plants.

Ultimately, the world energy markets are diversifying gradually away from fossil fuels, and global trade in biofuels will continue to develop as many high-income countries find that they cannot fully satisfy demand with domestic production. Even the UN's Food and Agriculture Organization, which has been closely monitoring the global food crisis, stopped short of suggesting that the world should end biofuel subsidies. Rather, they need to be revised in order to direct the benefits to developing nations.

This could present a welcome albeit unexpected boon for some of the world's poorest countries, particularly in Africa and Asia. For instance, the United Arab Emirates has already earmarked \$500 million to tap into Pakistan's agricultural sector, with similar investment plans in India and Sudan. Given that a growing portion of the crops in the developing world will be set aside for biofuel production, such plans could contribute significantly to both the energy and food needs of the next generation in the Gulf region. This could herald in a new paradigm for global partnerships whereby low-income, agricultural countries become the engines of the global economy.

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# Wind Power

Not since the Arab oil embargo of the early 1970s have the times been more propitious for a major shift in the way the world uses energy. In the intervening three decades, research centres across the world have produced or developed a slew of new technologies – ranging from wind to solar photovoltaics to biomass – in order to transform abundant energy sources into alternative fuels and, thereby, keeping cars running and power plants humming, while reducing the reliance on volatile oil prices and lessening the impact on climate change.

Compared to fossil fuels, these technologies are still in their infancy; renewable energy sources currently supply between 15 and 20 per cent of the world's total energy demand. But in recent years, wind and solar power in particular have become – if not fully mature – then at least frisky teenagers. Wind power is the dominant renewable technology, with a 47 per cent share among renewables for 2007, followed by solar photovoltaics, at 30 per cent.

According to the Worldwatch Institute, the global investment in renewables reached a record high of some \$71 billion in 2007, increasing from \$55 billion in 2006. This was in addition to the capital investments in new manufacturing plants and equipment, and public and private funding for research and development, which cumulatively over 2006 and 2007 amounted to more than \$100 billion.

This growth, which translates into a five-fold increase since 2000, owes largely to a closing economic gap between renewables and fossil fuels, which in turn stems from the high oil prices prior to the financial crunch, and a growing recognition of the high cost of carbon emissions.

Within that context, the “Global Wind Energy Outlook 2008”, which was published this month by the Global Wind Energy Council (Gwec) and Greenpeace, estimated that wind power could produce 12 per cent of the world's energy needs and prevent 10 billion tons of carbon emissions within 12 years – this is equivalent to taking almost 2 billion cars off roads. Moreover, by 2050, wind energy could provide up to 30 per cent of the world's electricity.

Investments in wind capacity are already driving the marketplace. Worldwide, the wind industry brought on line some 21,000 megawatts of new capacity in 2007, totalling approximately 95,000 megawatts. In 2006, 15,000 megawatts of new capacity was generated, compared to a modest 1000 megawatts of new nuclear power capacity across the world in the same year.

Given the abundant oil reserves of the Gulf region, investing in renewables was – until recently – largely perceived as tilting at windmills; most Arab countries have only just started to explore the potential of renewables. For instance, the World Trade Centre project in Bahrain includes wind turbines that are set to meet up to 35 per cent of the project's power needs; and in Iraq, feasibility studies are underway to find suitable sites for harnessing wind energy. These would complement three hydropower plants in the pipeline in Irbil, Dohuk and Suleimaniah, with a combined capacity estimated at 260 megawatts.

But Abu Dhabi in the United Arab Emirates is helping to change the mindset. Backed by billions of dollars accrued over 60 years of oil extraction, the state-owned Abu Dhabi Future Energy Company (ADFEC) launched the Masdar Initiative in 2007 in order to target renewable energy as a strategic sector into which to diversify.

Indeed, the Masdar Initiative was designed with diversification as a guiding principle. Among its key multifaceted projects are a 500-megawatt solar power plant – one of the most ambitious of its kind in the world – which will generate enough power for up to 10,000 homes; a research centre in combination with the Massachusetts Institute of Technology (MIT) that will focus on renewable-energy technologies; and a carbon-neutral residential metropolis, Masdar City (see box).

Masdar has also sought to invest in renewables outside the region. It bought a 20 per cent stake in the London Array, the large, \$4.75-billion wind project in the Thames estuary in the UK. Once completed, the project will become the world's largest windfarm, with 341 turbines and an installed capacity of more than 1000 megawatts, thereby generating enough electricity to power a quarter of London's homes. The company has also bought a stake in the Finnish wind turbine manufacturer, WinWinD, to the tune of \$176 million.

But Masdar has drawn scepticism from some analysts who see Abu Dhabi's bid to become a centre and patron of clean-energy technology as somewhat incongruous given its track record. Specifically, as the fourth largest OPEC oil-producer with about 10 per cent of the known reserves, Abu Dhabi has been singled out as one of the world's highest per capita emitters of carbon dioxide and other greenhouse gases – an average of 34.1 tons of carbon dioxide per person in 2007, according to the Human Development Report.

However, while far from reaching a tipping point, particularly in the Arab region, renewables are no longer perceived as merely “doing the right thing” and being green, but rather about making green – and global investment trends certainly reflect this thinking. As the technology improves and the price of conventional fuels like oil and natural gas remains highly volatile, newer forms of energy are set to become increasingly attractive and, inevitably, will play a more dominant role.

Bringing these technologies into the commercial mainstream, where they can make a real difference, will require public and private money and, particularly in the oil-rich states, a great deal of political will. In that sense, Masdar is well placed to lead a green revolution in the region – last month, Qatar agreed to invest \$238 million in a low-carbon energy technology fund in the UK.

Abu Dhabi has long prided itself on being an example of what petrodollars can do when put to good use. Oil helped turn Abu Dhabi from a fishing village into an influential Arab capital. Now, Abu Dhabi hopes to prepare itself for a world that is not as reliant on fossil fuels as it is today. If for no other reason, the Masdar Initiative is therefore highly significant because it is a first step in a region where, hitherto, renewable energy has never made any strides.

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