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UK announces world's largest algal biofuel project

Carbon Trust launches £26m project to develop transport fuels made from algae by 2020

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Algal fuel growing in open ponds in Israel. Credit: Seambiotic

The world's biggest publicly funded project to make transport fuels from algae will be launched today by a government agency which develops low-carbon technologies.

The Carbon Trust will today announce a project to make algal biofuels a commercial reality by 2020. The plan could see up to £26m spent on developing the technology and infrastructure to ensure that algal biofuels replace a significant proportion of the fossil fuels used by UK drivers.

Mark Williamson, innovations director at the Carbon Trust, said: "We must find a cost-effective and sustainable alternative to oil for our cars and planes if we are to deliver the deep cuts in carbon emissions necessary to tackle climate change. Algae could provide a significant part of the answer and represents a multibillion-pound opportunity."

Transport accounts for one-quarter of the UK's carbon emissions and is the fastest growing sector. Finding carbon-neutral fuels will be crucial to the government meeting its target to reduce overall emissions by 80% by 2050.

A recent review by the chairman of the Renewable Fuels Agency, Ed Gallagher, identified algae as a potential way to generate sustainable biofuels. Biofuels made from food crops have been blamed for rising food prices.

Algae produce a range of chemicals depending on their species and the environmental conditions in which they grow. View how the process works here. Scientists hope to find strains that can produce oils that could be used to make fuel for cars, as a replacement for petrol and diesel. Once identified, these algae could be grown in large amounts and processed to extract the useful oils.

John Loughhead, executive director of the UK Energy Research Council, said: "Algae are potentially attractive means to harvest solar energy: they reproduce themselves, so there's no manufacturing cost for the solar converter, they can live in areas not useful for food or similar productive use, they don't need clean or even fresh water so don't add to global water stress, and can give oils, biomass, or even hydrogen as a product. Perhaps they'll be the stem cells of the energy world."

The Carbon Trust forecasts that algae-based biofuels could replace more than 70 billion litres of fossil fuels used every year around the world in road transport and aviation by 2030, equivalent to 12% of annual global jet fuel consumption or 6% of road transport diesel. In carbon terms, this equates to an annual saving of more than 160m tonnes of CO₂ globally with a market value of more than £15bn.

For the first stage of the project, the Carbon Trust will spend up to £6m in a range of British companies involved in promising algae research. "You can make algae with a very high oil content and you can make algae that grows very quickly and, at the moment, no one can do both," said Robert Trezona, R&D director at the Carbon Trust. Other problems include the best design of mass-culture systems.

John Benneman, a consultant on algae who has worked with the US Department of Energy and the International Energy Agency, said that it would take a multitude of approaches to fully realise the potential of algae. "There are many more different algae species than there are higher plant species so each algae will require specific effort. Each one will have its own peculiar requirements to figure out how to make them productive, how to get the right strains, how to harvest and process them. We cannot just depend on one or two companies."

The second phase of the project will start in around a year and involves scaling up the algae-growing operation. The Carbon Trust will build multi-hectare open ponds to act as laboratories for the most promising algae technologies identified in the early stages of the challenge. Due to the UK's gloomy weather, these will most likely be built abroad.

"If you I've got 12 months a year of warmth and sunshine, your algae farm just produces much more biomass. In a world where costs will be important, UK algae farms would have a real problem," said Trezona. This phase of the project could see the Carbon Trust, and interested partners from industry, investing up to £20m.

Loughhead welcomed the Carbon Trust project. "The critical aspect is that algae convert the energy of sunlight and the efficiency with which they do that determines the economic viability of the whole approach as sunlight is unhelpfully low in energy density. Hopefully this Carbon Trust scheme will help gather information on how well that can be done now, and start the scientific development to improve it for the future."

There have been major efforts in the past to develop biofuels from algae. Multimillion-dollar programmes funded by the US government in the 1980s found that high biomass yields were possible but research ended when no one found a way to make it commercially competitive with the low oil prices of that era. Work in Japan also faltered when researchers were unable to scale up the growth of algae in photobioreactors, closed vessels that provide plenty of light and conditions that could intensively grow the microorganisms. To date, no one has designed a system that has made it to market.

But the Carbon Trust believes that interest in algae has been renewed, thanks to the recent increases in oil prices and public awareness of climate change.

Transport minister Andrew Adonis said: "This project demonstrates our commitment to ensuring that second generation biofuels are truly sustainable — and will further our understanding of the potential for microalgae to be refined for use in renewable transport fuel development, to help reduce carbon dioxide emissions."

Several companies around the world are already involved in making fuels from algae, with one of the most prominent the San Diego-based company Sapphire Energy. Sapphire plans to use genetically modified algae to produce a chemical mixture from which it is possible to extract what it calls "green crude". Their idea is to refine this mixture into fuel for cars and airplanes. Investors include the UK's Wellcome Trust and the company has so far raised \$100m to develop its ideas.

Loughhead added that another potential benefit of algae is its ability to remove CO₂ from the air. "Although here they will re-emit it when used as fuels, there is the possibility that they could ultimately be used as a means of cleaning the atmosphere — if we can find a way of converting the algae to a safely storable form after they've grown."

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