

Biofuels get mixed review

Ethanol fuel from plants may be more efficient than petrol, but for now it offers only marginal environmental benefits. That's the message from scientists who have analysed exactly how much energy goes into making such biofuels, and how much carbon dioxide they emit as they power your car.

It may seem that ethanol produced from the sugars in corn or sugarcane - known as biofuel - should be environmentally friendly, because each growing plant sucks up carbon dioxide, a greenhouse gas that is accelerating global warming.

But some studies have questioned ethanol's green credentials (see '[Alcohol fuels not so green](#)'). And others have claimed that the intensive processing needed to make ethanol uses up more energy than it supplies.

"There's a lot of confusion," says Alex Farrell, an energy expert at the University of California, Berkeley. He and his colleagues have now double-checked six key studies that calculate the costs and benefits of bioethanol.

Side benefits

The team found that some studies ignore a few of the side benefits of ethanol production. Farrell and his colleagues argue that products such as corn oil and animal feed, made as by-products of bioethanol production, should be included in the energy budget, because they have economic value and displace competing products that require energy to make.



Field of dreams? Biofuel from corn gets some thumbs up, some down. © Getty

When these factors are taken into account, biofuel gives more energy back to society than it uses in production, Farrell reports in *Science*¹.

But using ethanol rather than petrol in your car only reduces its total carbon dioxide emissions, mile for mile, by about 13%. This is in part thanks to the fact that the agricultural processing needed to create the biofuel itself produces a lot of pollution.

"The reason for using bioethanol at the moment is not really to reduce carbon emissions," agrees Richard Templer, a chemist from Imperial College London, UK. Instead, one of the biggest reasons to switch is that it reduces a country's reliance on imported oil.

Double-counting

The debate is unlikely to end here. David Pimentel, an agricultural scientist at Cornell University in Ithaca, New York, has previously shown that ethanol is not so energy efficient; he argues against Farrell's conclusions.

Pimentel says that the team have overestimated the value of side products. They cannot, for example, replace animal feed such as whole corn. Most of the plant's carbohydrates, a useful component of feed, are used up in making ethanol, says Pimentel. "You can't double-count the stuff."

He also criticizes the study for neglecting some of the environmental issues surrounding ethanol production. "Corn causes more soil erosion than any other crop grown in the United States," he says, adding that it also needs relatively large quantities of fertilizer and water.

Bang for your buck

Ethanol may yet prove itself green, however. Some scientists are working on extracting fuel from relatively indigestible plant

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material, such as cellulose. This would let them extract more fuel per plant, from crops that are easier to grow and gentler on the environment. But such research is still in its infancy.

"We're at that same point where they first drilled a hole in Texas and got oil out of it," says Art Ragauskas, a biofuel expert at Georgia Institute of Technology, Atlanta. "What we need now is a dedicated and focused research plan, and pilot plants."

Templer and Ragauskas are part of a consortium called AtlantIC Alliance, which has set out a research roadmap for better biofuels in *Science*².

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• References

1. Farrell A. E., *et al. Science*, **311**. 506 - 508 (2006).
2. Ragauskas A. J., *et al. Science*, **311**. 484 - 489 (2006).