

# Waste not, want not

## Ethanol from rubbish is the latest biofuel

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OVER the past decade, biofuels have been a disappointment. There is no denying their promise: clean-burning fuel that could reduce a country's dependence on foreign oil. But America's attempts to produce biofuels from corn and soybeans—hoping to replicate Brazil's success with sugar cane—have failed dismally. All the ethanol subsidies for Midwestern farmers ever did was raise food prices globally.

Moreover when all the environmental factors were taken into account, using biofuel made from corn or soybeans proved to be worse environmentally than burning an equivalent amount of petrol refined from oil. In some studies, it actually increased carbon emissions by as much as 50% over that produced by fossil fuels.

Attention has now turned to more benign feedstocks for biofuels—including wood-chips and other forms of agricultural waste. But most still need lots of energy or expensive enzymes to work. Meanwhile, using designer bugs to tailor-make low-emission fuels is still in its infancy (see ["Bugs in the tank"](#), May 2nd 2008).

What, then, is the most abundant feedstock for making ethanol which does not wreak havoc on food supplies, is environmentally friendly, economic and has all the enabling technologies in place? The answer, in a word, is rubbish. Ethanol made from waste—and used neat or as a blend in a "flex-fuel" petrol engine—is currently the best deal in town.

Last year America produced 8.5 billion gallons (32 billion litres) of ethanol from various sources. The latest version of the government's [Renewable Fuels Standard](#) calls for 36 billion gallons of biofuels to be



Put some trash in your tank

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produced annually by 2022. Municipal waste could supply at least half of that in the form of ethanol for motor vehicles.

As it is, petrol bought at the pump already contains 5-10% ethanol. With lead and MTBE additives now phased out, spiking petrol with a small amount of ethanol raises its octane level enough to prevent the engine from “knocking” under load. If unchecked, such knocking—caused by the air-fuel mixture detonating prematurely in a haphazard fashion—can destroy the engine.

Actually, most petrol-engined cars will run happily on 20% ethanol without the driver noticing any difference. With a few tweaks under the bonnet, a petrol engine will burn 85% ethanol or even 100% ethanol with little loss of performance. The big plus is that it produces anything up to 85% less greenhouse gases, depending on how the ethanol was brewed.

Unfortunately, ethanol-powered cars get 25% fewer miles to the gallon than their petrol equivalents. As a fuel, ethanol has a lower energy density and therefore needs more of it to do the same job. Another problem is that existing petrol engines cannot take advantage of the much higher octane rating. Ideally, an ethanol engine needs a compression ratio of 19:1 instead of the 10:1 typical of petrol engines. But then it would no longer be a flex-fuel vehicle capable of running on petrol, ethanol or blends of both.

Belatedly, carmakers have begun to take flex-fuel vehicles more seriously. Ford, General Motors and Chrysler, along with a handful of German and Japanese manufacturers, are now bolstering their ranges of petrol-powered vehicles that can run on blends of ethanol as well. That has created openings for a number of bright sparks.

One of the brightest your correspondent has come across to date is [Fulcrum BioEnergy](#) of Pleasanton, California. Fulcrum is building a \$100m plant near Reno, Nevada, to make over 10m gallons of ethanol a year from municipal solid waste. James Macias, the company’s boss, has identified 26 sites around the country with municipal rubbish supplies capable of supporting similar or even larger plants. Together, they could produce over a billion gallons of ethanol annually at roughly \$1 a gallon.

A scaled up version of Fulcrum's Reno plant could produce as much as 95m gallons of ethanol a year—all from useless landfill that would otherwise emit copious quantities of methane (the most potent greenhouse gas). Environmentalists reckon that using the ethanol produced over the lifetime of such a plant would cut carbon emissions by 75% compared with burning the equivalent amount of petrol. That would be like taking 100,000 cars off the road.

The second ethanol venture your correspondent has been impressed by recently is much more down-to-earth. [GreenHouse International](#), a San Diego-based eco-house-builder and provider of alternative fuels for the home, is in the throes of establishing a network of ethanol filling stations that are literally in people's backyards. By law, private individuals in America are allowed to store up to 50 gallons of ethanol on their premises. So far, the only people to do so have been farmers who make ethanol to fuel their tractors and harvesters.

The refuelling station that GreenHouse installs at people's homes is actually a micro-refinery that makes its own ethanol on the spot from organic waste. The feedstock—mostly beer and soft drinks that have passed their best-before date, and other waste containing lots of sugar—is supplied free by GreenHouse. Drinks firms such as Coca-Cola, as well as big breweries, currently pay large sums of money to have their waste and date-expired products hauled away and processed for disposal. So far, Chris Ursitti, GreenHouse's founder, has signed contracts for 29,000 tons of liquid waste and spent beer. After blending, a fleet of the company's trucks deliver the feedstock to customers' doors.

GreenHouse has an exclusive contract to install the so-called [MicroFueller](#) made by E-Fuel of Los Gatos, California. The MicroFueller is the brainchild of Tom Quinn, the inventor of the motion-controller that made the Nintendo Wii such a runaway success, and ethanol scientist Floyd Butterfield. The technology solves two of the headaches that have plagued ethanol production: the reliance on corn as a feedstock and the difficulty of distributing it.

The MicroFueller comprises a 250-gallon feedstock container and a separate unit holding the still, fuel tank and pumping station. With its internet connection, the MicroFueller calls GreenHouse automatically whenever it needs more feedstock or maintenance. The equipment sells for \$10,000 but tax credits in effect halve the cost. After that, owners will be billed monthly for only the ethanol they pump into

their flex-fuel vehicles. The fuel is expected to cost \$1-2 a gallon, depending on the volume used.

Unfortunately, your correspondent's two ancient Lotuses cannot digest the stuff. But the family kidmobile is young enough to cope. Now, if only he could get a couple of neighbours interested in sharing the cost...