

THE GRAND PRIX



The race is on... to create personal transport that cuts greenhouse gases and then stops contributing to climate change.

Hybrids – made cool by Cameron Diaz and other celebrities – are up and running using small internal combustion engines together with electricity generated by the car's momentum and braking. A computer switches between them, choosing whichever is most efficient for the driving conditions, typically getting 8.5 to 12.8 more kilometres from each litre of fuel than standard cars, and so emitting less pollution; more efficient hybrids still are on the way. They are more expensive than ordinary cars, but plenty of people seem willing to pay extra. More than 200,000 hybrids – Fords, Hondas, Renaults and Toyotas – were sold in the United States in 2005, and this is expected to grow to 750,000 annually by 2011.

Biofuels are up there too, and don't require revolutionary technology. There are two kinds: biodiesel, processed mainly from rapeseed, soybean and palm oils; and bio-ethanol, an alcohol produced from crops including sugarcane, sugar-beet and corn. Henry Ford planned to run his Model T on ethanol, and the first ever diesel engine burned peanut oil.

Some vehicles run on pure biofuels. The Austrian city of Graz powers its public transport entirely on fuel made from waste cooking oil. Two and a half million cars in Brazil run on pure ethanol alone and half the country's automobile production is of flexi-fuel cars able to run either on ethanol, or on a blend with petrol; all fuel must contain 25 per cent ethanol. Five million cars in the United States of America can already use a rich mixture of 85 per cent ethanol and 15 per cent petrol, and 'gasohol', containing 10 per cent

of the biofuel, is even more widely sold. The United States has quadrupled its ethanol production in recent years and has just opened its 100th production plant.

Biofuels burn cleaner, but take up agricultural land. So researchers from DaimlerChrysler – in cooperation with UNEP – and D1 Oils are investigating using nuts from a tree, *Jatropha curcas*, which grows on marginal or degraded land and thus could help halt desertification.

But the long-term winner may yet be hydrogen. Bill Ford, Henry Ford's great-grandson and Chairman of the Ford Motor Company, says hydrogen is 'poised to end the 100-year reign of the internal combustion engine'. Again there are two different types of hydrogen car. Most manufacturers are working on models that use fuel cells in which hydrogen reacts with oxygen to generate electricity that powers the car, but BMW plans to burn it directly in engines.

Prototype hydrogen cars exist, but the gas has to be made using renewable energy sources if it is to be truly clean. Fuel cells are expensive and building the infrastructure to distribute hydrogen would be costly too.

'It's chicken and egg,' says Katsuhiko Hirose, head of fuel system development for Toyota. 'No one wants to invest in hydrogen filling stations because there are no cars around, but no one is going to buy a hydrogen car when they cannot refuel it easily.'

'The transition will be very messy, and will take many technological paths, but the future will be hydrogen fuel cells,' says Herman Kuipers, Shell's Manager of Exploratory Research. It may take several decades, but hybrids and biofuels are ready to fill the gap while we wait.



Ford Escape, hybrid

Ford Motor Company



Toyota Prius, hybrid

Toyota (GB) PLC



Renault Koleos, hybrid

Renault



Biofuelling, Brazil

Joerg Boehling/Still Pictures



Honda FCX, fuel cell

Honda



BMW 750hL, hydrogen combustion

BMW AG