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Biofuels: Fields of dreams

We can run our cars on corn, sugar cane or wheat: limitless cheap energy grown on our doorstep. But are biofuels the answer to exhausted oil wells or just another nightmare scenario?

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John Anderson is motoring with chip fat. Sir Rob Margetts swears by fizzy drinks and chicken feed. George Bush is banking on corn. Everyone, from pub to parliament, knows we're going to have to do something about transport fuel. Oil prices have already passed the threshold of pain, and emissions targets for greenhouse gases will not be met unless we wean ourselves off petrol.

The solution is both easy and obvious. In place of fossil energy – the power of ancient sunlight – we can recover the solar energy locked up in field crops, which, unlike mineral oils, we can endlessly replenish.

With plant oils in the tank, we will ride to work on sunbeams.

And yet “biofuels” have fallen precipitously from grace. In January, two official reports – one from the Royal Society, one from a committee of MPs – did more than just cast doubts on their efficacy: they blew them away. Widespread conversion to plant-based fuels, they said, would increase rather than reduce the output of greenhouse gas, and would take food from the mouths of the poor. And yet...

Only two months had passed since Lord Rooker, minister for sustainable food and farming and animal health, had opened the UK's first bioethanol plant at Wissington near Downham Market in Norfolk, when he pronounced himself “pleased to see the UK is leading the way in promoting sustainable biofuel production”. And the renewable-energy company Ensus, with full government backing and a whack of venture capital, was pressing ahead with Europe's biggest bioethanol plant at Wilton on Teesside. Nor were these the only contradictions.

Last year Ford in the UK sold 350,000 cars. Of these, just 150 were FFVs (flexible fuel vehicles) able to

run on the high-blend biofuel E85 – 85% ethanol and 15% petrol. This is not so much a niche market as an invisible one. So why all the fuss and blather? Why all the headlines?

The answer is so complex that, for all their weight and scientific language, both the Royal Society and the House of Commons environmental audit select committee, whose reports together ran to 125 pages, were accused of over-simplification. “What I wish,” said one leading figure in the industry, “is that the experts would get more expert.” This is indeed the ring tone of the new scepticism. “We need more research.”

Until it’s done, the MPs want the government to suspend all support for biofuels.

The Royal Society didn’t go quite that far, but it was looking for concerted action and big changes. And it had a dream. All departments of government involved with industry, transport, taxation and the environment should agree a common policy, then join up with the fuel and motor companies and make a plan. International standards will be set. There will be sustainability! There will be carbon savings! There will be social justice, win-win situations and power with responsibility. Hosanna!

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There are two kinds of biofuel – biodiesel, which is made from oil-rich crops such as rape, soy and palm; and bioethanol, which substitutes for petrol and is made from starchy crops such as sugar cane, beet, maize and wheat. The case against biodiesel is that virgin rainforest in Indonesia and Malaysia is being cut down to make way for soy and palm. Result: more CO₂ is being released into the atmosphere by deforestation than is being saved by reductions in fossil fuel.

The problem with bioethanol is that it uses human or animal food crops, and so threatens to create shortages and price increases that will make hungry people even hungrier. Population growth means the world will need 40% more food by 2020, and climate change will mean less land to grow it on. Worse: as they get richer, India and China will switch to western-style grain-and meat-based diets. The result could be a doubling of grain consumption in 40 years. And yet already, in George Bush’s drive for energy security, 25% of the US corn crop is going for bioethanol, and wheat prices compete with oil in the frequency with which they set new records.

This is why the environmental audit committee wanted to apply the handbrake. “It will take considerable courage,” it said, “for the government and EU to admit that the current policy arrangements for biofuels are inappropriate.”

More than courage, it would take a U-turn.

In the very same week that the MPs published their protest, the EU reaffirmed its targets – 5.75% of transport fuels (that is by energy, not volume) to come from biofuels by 2010, and 10% by 2020. Oxfam already had registered its horror. “This target,” it said in November, “is ... posing a serious threat to vulnerable people at risk from land-grabbing, exploitation, and deteriorating food security.”

The Royal Society said the same. “Any major switch to biofuels from crops would create a direct competition with their use for food and animal feed, and in some parts of the world we are already seeing the economic consequences...” It didn’t give examples, but they are not hard to find. Last May Victoria Tauli-Corpuz, chair of the UN Permanent Forum on Indigenous Issues, warned that 60m Malaysian and Indonesian forest-dwellers were likely to be forced into urban slums.

A review by the African Biodiversity Network (ABN), published in July 2007, contained an anguished report from Tanzania, where European and US biofuel companies were already moving in. “Huge changes in land use and land ownership are scheduled,” it said, “meaning that fuel will be grown instead of food, and small-scale farmers will be pushed off their lands...” The author, Abdallah Mkindee, pointed out that Tanzania repeatedly had been hit by drought, forcing the government to rely on food aid. “NGOs... ask themselves why, then, the government is... looking to displace food production and precious water resources for production of agrofuels for export.”

Again the Royal Society agreed. “Significantly,” it said, “if market conditions are right, biofuel crops will

always start to be cultivated on the most productive land...”; and it warned against the risk of Europe exporting environmental problems to developing countries supplying the fuels. Harsher critics say this was not so much a risk as an actuality, and that it’s brute force, not market force, that sets the pace. “In Colombia,” says Oxfam, “paramilitary groups are forcing people from their land at gunpoint, torturing and murdering those that resist...”

And yet, again and again from within the industry, one hears South America or Africa described as “the Middle East of biofuels”, and the EU goes on setting targets that cannot be met without imports. So there we are – damned if we do, damned if we don’t. The mistake is to believe, as the environmental audit committee apparently does, that we can hold biofuels on pause and wait for some throbbing genius to come up with a perfect technological fix in which everyone gains and nobody loses. You can’t run cars on fresh air. And the problem is right here and now. Transport delivers 25% of the UK’s carbon emissions, and 20% of the world’s. Improvements from cleaner engines are being more than offset by the growth in vehicle ownership. By 2030, at the current rate of increase, transport worldwide will consume 80% more energy and pump out 80% more carbon than it does today. With oil wells depleting, the climate warming and no other technology ready to turn the wheels, there is only one way forward: it’s biofuels or bust.

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In pitch dark one January night, I pick my way down a track in deep countryside near King’s Lynn. At the end of it, next to the stump of an old windmill, is a house and barnyard cluttered with vehicles. The owner, John Anderson, is one of those people best described as enthusiasts – the kind for whom practice speaks louder than theory. His latest passion is in the barn, an Etruk 200 home biodiesel processor that he reckons will convert used cooking oil into diesel for about 50p per litre. Most of this is accounted for by the 30p per litre he pays for the oil (the equipment manufacturer says that with free oil he could get it down to as little as 12p). The equipment is unsophisticated but tidy – a couple of plastic containers on a stand, with various bits of pipework, filters and pumps, about the size of a domestic fridge. The process takes 24 hours to complete and will yield about 140 litres.

It is all perfectly legal. HM Revenue and Customs permits an annual allowance of 2,500 litres a year, duty-free, for people making biodiesel for their own use. It is this, not the fact that the fuel is carbon neutral, that drives John Anderson's enthusiasm. “I’m not a great one for being green,” he says. “For me, the beauty is making my 2,500 litres and not paying duty.” As his wife is entitled to a similar allowance of her own, the total benefit per year – assuming, in his case, a saving of 50p per litre – is £2,500 which, when set against an equipment cost of £1,800, looks like the nearest thing anyone will get to a snog from Gordon Brown. The downside is that home-brew may be of varying quality and so does not conform to the European standard specified by vehicle manufacturers in their warranties.

This is an important point. If the consumption of commercial biofuels is to increase, then there will have to be some incentive for car makers and their customers to build and drive vehicles that run on them. At the moment, European fuel standards allow suppliers to mix up to 5% of biofuel into regular petrol or diesel. From April this year the UK government’s Renewable Transport Fuel Obligation (RTFO) will require 2.5% of road fuels (by volume) to be from “renewable” – note, not “sustainable” – sources, rising to 5% in 2010-11. European standards are also being revised, and may increase the proportion of bio in regular blends to 10%.

According to the government, in terms of carbon saving, the RTFO “will be the equivalent of taking close to a million cars off the road”. Even if it’s right, this will be nothing like enough to meet the biofuel targets. “Significantly higher” blends will be needed, says the Royal Society. More importantly, it complains that the obsession with supply targets means that “important opportunities to deliver greenhouse-gas reductions are being missed”. The RTFO, it suggests, would be better reborn as a “Low Carbon Transport Fuel Obligation”, with vehicle excise duties graded to favour the cleanest cars. The

technology is here and now. Ford, Volvo and Saab all produce FFVs capable of running on any ethanol/petrol mix right up to the 85% blend in E85. In Sweden they are swarming out of the showrooms. Volvo, which has a 21% market share on its home turf, sells 60,000 cars a year. In 2007, 15% of these were FFVs and this year it expects 30%. Contrast this with Ford's sale in the UK of 150 a year, and Saab's 170. In the last five months of 2007, Volvo itself sold just 34.

In Scandinavia, of course, they do different. Sweden, which aims to be independent of fossil fuels by 2020, offers biofuel drivers exemption from oil tax; 20% off company-car tax; free city parking; exemption from congestion charges; 20% insurance cuts and 1,050-euro bonuses for purchasers of FFVs. And what does the UK offer? A 20p per litre cut in fuel duty.

This doesn't sound ungenerous until you visit the pumps. The small volume and thus higher unit cost of E85 means the price advantage shrinks to 2p. Worse: you get a quarter less mileage with E85 than with regular unleaded, so you'd need a 25% price differential just to break even. This is why so few FFVs sell here. It's why Morrisons is the only national forecourt chain selling E85, and why it has only 19 pumps in the UK.

Ford has had FFVs for sale in Britain since 2005. Initially it charged £2,000 for the necessary engine refinements but now offers FFV versions of the Focus and C-Max at the same price as the petrol models. Mondeo, Galaxy and X-Max versions will follow later in the year. "We've done our bit," says a company representative. "We have brought the car to market and wiped out the premium. Morrisons haven't done a bad job either."

What's lacking, he says, is support from the government. Chris Brookhouse of Blue Ocean, supplier of "Harvest Energy" E85 to Morrisons, agrees. "Greater fiscal incentives are necessary." Saab, too, is urging the government "to take hard action and make a financial commitment to offset the cost of going green". Despite all this – the unfriendly tax regime, the bad-mouthing from MPs and the Royal Society, the recent admission by the EU's environment commissioner, Stavros Dimas, that its biofuel policy was rolling in choppy waters – the construction of Europe's biggest bioethanol plant is forging ahead on Teesside. It will go into production next year, annually converting 1m tonnes of wheat into over 400m litres of fuel, and the company behind it, Ensus, is now looking for another site in Europe. Its rationale is blindingly simple. Ethanol – in plain language, alcohol – is an old technology, well understood (the Model T Ford ran on it). It is made from sustainable crops, and it drastically cuts carbon emissions.

It's important to understand what this means. A motor-trade website repeats a common fallacy: "When running on the fuel, cars typically emit 50% to 70% less carbon dioxide than their petrol equivalents." This is baloney. Tailpipe emissions remain much the same. It is not burning the fuel that saves carbon; it's the production of it. Biofuels return to the atmosphere the same amount of carbon that was locked up in the plants they were made from – this is what is meant by "carbon neutral". They add nothing, and they take nothing away. But of course this is exactly the ground on which they are criticised. By vandalising forests, displacing food crops and using fossil fuels to run their vehicles and plant, biofuel companies are not damping down climate change; they are stoking it. Ensus's big-money punt therefore raises a question. Is this an outfit run by crazed idealists whose faith is proof against reason; or by cynics who simply reckon there's a killing to be made? Suspicion hardens when I learn that Ensus is backed by the Carlyle Group, a global private equity giant admired in the City (as one insider grudgingly tells me) as "hard-nosed bastards". It hardens again when company representatives invite me to an address in Mayfair, just around the corner from St James's Palace. Fatcat country.

Facing me across the table are the chairman, Sir Rob Margetts, and the CEO, Alwyn Hughes. Margetts is a super-heavyweight – chairman of Legal & General, former chairman of BOC and vice-chairman of ICI. He radiates energy; but he delivers his words with pared-down intellectual detachment, like a professor in a tutorial. Interestingly for a fuel baron, he is also chairman of the Natural Environment Research Council.

Hughes has an executive career in ICI behind him, and fills the rare gaps in Margetts' discourse with bluff Welsh charm. For two hours they deliver the full proselytising works: facts, figures, philosophy. Heavily distilled, the case is this:

If existing arable land could be farmed more intensively (in eastern Europe, say); if unused land could be cultivated (South America, Africa and Asia) and if set-aside could be brought back into production (Europe), there need be no conflict between food and fuel. About 400m hectares are available worldwide, and Europe alone has the potential to increase its harvest by 30m tonnes of wheat. The UK has an annual surplus of 20%, which means Ensus's seemingly extravagant appetite (1m tonnes is 6% of the national total) can be easily satisfied. By agreeing international standards, the debit side of the equation could be removed altogether. An effective certification system would ensure that populations were not displaced or starved; that rainforests and peatlands were not sacrificed either to biofuels or to food crops displaced by them; that greenhouse emissions and the other environmental costs of cultivating, fertilising, irrigating, transporting and processing biofuel crops were properly accounted for. All this Ensus says it will do along its own supply and production lines. Better still: by breeding wheat with a higher starch content, more energy could be extracted from less grain; and – this is the really big one – you can get three products for the price of one. Carbon dioxide can be captured and sold for a range of uses, including coolant for nuclear reactors and putting the sparkle into fizzy drinks. The best thing, however, is what is left of the grain after the starch has been extracted. Protein.

Suddenly we're talking about meat. Food animals, says Margetts, typically need 20% protein in their diets. The problem with wheat is that it contains only 10-12% protein, so it needs to be reinforced with concentrate. Most commonly this comes in the form of soya-bean meal from the US or Brazil, which is about 40% protein. But there is a snag. Not only does soya have to be imported, which increases its carbon footprint, but it's less good at storing energy and carbon than wheat or maize. And of course Ensus has the answer. The dry residue from its fermentation process, known in the trade as DDGS (Distillers' Dried Grains with Solubles), will be 35%-40% protein, and it's going to produce an awful lot of it – 350,000 tonnes a year, which it will sell as animal feed. This is a multiple whammy. It cuts carbon, reduces imports, increases profitability and releases land from soya. "And then of course," says Margetts, "on that land you could put more wheat or corn, and capture more CO₂ and energy. So you're getting a whole lot extra. It's not fuel versus food. It's fuel and food."

What irritates the industry – the reason it wants experts to be more expert – is that committees sitting in judgment tend to be a few columns short of a full balance sheet. It takes no particular insight to conclude that biofuels should not be made at the expense of the rainforest, or of the ability of Africa to feed itself, or of a liveable climate. It does take insight to see that, with effective political leadership, all these needs might be balanced. Effective leadership means more than just a few pence off fuel duty. It is like climate change. You need global support and a co-ordinated advance across many fronts.

"Biofuels must not be associated with deforestation," says Ensus's Alwyn Hughes. "The sooner we get robust sustainability certification in place, well-thought-out processes for measuring carbon, and holding people like ourselves to account, the better." It is unusual to see an industry clamouring for regulation, but it believes this is the only way forward. Mandatory EU targets will create a demand for biofuels. This in turn will apply market pressure, stimulating competition and investment.

By this argument, tax breaks are pointless. What would be the use of stimulating demand for E85 before there is enough biofuel to sustain it? "At the moment," says Hughes, "there isn't the capacity, and nor will there be in the foreseeable future, for anybody other than a minority to have high concentrations." The vast majority of what the industry does produce – including Ensus's entire output, which will be sold to Shell – will go into the regular 5% blends.

This may be all fine and dandy when viewed from Europe. Other than yet more foreign exploitation,

what's in it for Africa? The possibilities range between zero and a lot. What's certain is that the concerns of Oxfam and the Royal Society cannot be met without international support. The World Trade Organization blames first-world protectionism for the impoverishment of third-world agriculture. Dumping farm products out of the first world into the third, says Sir Rob Margetts, is "killing prices and killing motivation". Stimulating agriculture therefore means cutting subsidised exports from Europe and America, and creating incentives for enterprises such as biofuel crops.

The risk highlighted by the Royal Society is that higher prices will then enrich the rural population at the expense of the urban, who will have to pay more for their food. The optimists' answer is that revived rural economies will halt the flow of villagers into urban slums. Same with Europe. Greening the plains in the east, reviving what was once the breadbasket of Europe and stimulating local economies, might even staunch the politically troublesome flow of population from east to west.

It's hard to know who is right, though it's as clear as anything can be that there are good biofuels and bad. There is baby and there is bath water, and no obvious case for throwing out the one with the other. This is why senior figures in the fuel industry feel the Royal Society's and, in particular, the environmental audit committee's reports were flawed. "Not a high-quality analysis of the problem," as one of them put it. "We understand their concerns about food and fuel, though we believe these can be accommodated. And we understand their concerns about the rainforest and biodiversity. But they jump from those arguments, missing out the discussion to the conclusion." Which is that there should be a moratorium on biofuels until so-called "second-generation feedstocks" – switchgrass, jatropha seeds, woodchip, municipal waste or other organic materials – are ready for wide-scale production. But the problem is time. Designing, financing and building a biorefinery takes years, not months, and we do not have years in the bank.

Alwyn Hughes spells it out: "We see some people saying, until we reach perfection let's pause, let's work it all out, spend the next 20 years ensuring it's absolutely perfect. But we're living on a planet that's going to warm up in that 20 years. Our strategy is to get going with criteria of what we need to do to be good, let the industry learn... The sooner we get the thing moving, the better. I think through that you can create a continuum of development."

Back at his mill house in Norfolk, John Anderson has created his own little continuum of development. He's on to his third batch of biodiesel now and pronounces himself happy with his investment. His cars are happy, too. He's adding 15% of mineral diesel to keep the fuel liquid at winter temperatures (in summer he'll run on 100% bio) and has noticed no difference in driving performance save a change in the cars' external odours. The exhaust gases, he says, smell less like conventional diesel and more like a chip shop. He is even contemplating a second product stream. The waste glycerine from the production process, he says, will be turned into soap.

The car before the storm

Could this vehicle be the key to a cleaner future for road travel — or is it just a pipe dream? Joseph Dunn meets the driving force behind the futuristic LIFECar

Hugo Spowers is a man in a hurry. For one thing, he is on a mission to save the world — "and we just don't know when it will be too late, we might already be past the point of no return" — and for another, he must get his wife to the train station in time for the 3:55 to Paddington.

His foot is planted firmly on the throttle of his Audi A2. He is wearing an orange jumper and stained jeans, but no seat belt, and we are bombing down a B-road somewhere near the Wales border at speeds that would make Lewis Hamilton wince. But Spowers, an ex-racing driver and engineer with a penchant for bungee jumping, seems to have only half his mind on the road. "You have to keep the engine at constant revs to get the best fuel economy," he shouts above the engine noise.

Fuel economy is something that occupies a lot of Spowers's time. His latest project is a car that will run on hydrogen, produce no emissions and redefine the concept of what a car is supposed to be. He calls it a

“holistic approach to the future of personal transportation”; others call it bonkers, and this week, a prototype is on display at the Geneva motor show.

In motoring circles, the concept of a hydrogen fuel cell is known as the holy grail, and the search for a viable one has occupied the best engineering minds for 20 years. The reason is simple: get one to work in a car and you get cheap, limitless energy with none of the pollution associated with conventional fuels. The concept is not new — the first fuel cell, which combines hydrogen with oxygen to form water and in the process creates electricity, was developed in 1839 by Sir William Grove and a version of one was used by the Apollo space mission in the 1960s — but in recent years the race to refine the technology has moved up several gears.

With road transport accounting for around 25% of global carbon-dioxide emissions and oil prices climbing, the prize for an alternative energy source is glittering. Meanwhile, the US Department of Energy recently projected that if only 10% of American cars were powered by fuel cells, air pollutants would be cut by 1m tonnes a year and 60m tonnes of the greenhouse-gas carbon dioxide would be eliminated. It would also cut oil imports by 800,000 barrels a day. But there is a problem with the fuel cell that has so far flummoxed the greatest engineers on the planet, leaving the green utopian dream tantalisingly out of reach. Spowers, a man without a billion-dollar budget, thinks he has cracked it. And he has done so with the help of a small family-run firm in the town of Malvern.

If there is one car-maker that epitomises wind in the hair, bugs in the mouth motoring, it is Morgan Motor Company. This is a car-maker so steeped in tradition that since it built its first car in 1909, it has resisted modernity: its classically styled two-seater cars are hand-built by the dozen. Newfangled ideas such as steel chassis are not wanted here — each car has its frame laboriously whittled from ash.

For the past 2½ years Morgan has worked alongside Spowers’s company OSCar to create a vehicle that runs on a fuel cell but boasts the performance and looks of a traditional car: the LIFECar (Lightweight Fuel Efficient Car). Sleek body styling and swooping rear wing notwithstanding, it is a radical departure for Morgan. “We are hoping younger people will be looking at it and getting excited as well as the more traditional Morgan owners,” says Matthew Humphries, the designer. As well as smaller wheels, to decrease the amount of energy lost through ground contact, the car boasts ultra-aerodynamic lines to reduce drag and is built almost entirely from lightweight aluminium.

There are already fuel-cell powered vehicles in development. In summer, Honda, one of the leading proponents of the system, will launch its second-generation FCX vehicle in California. It remains tight-lipped about how much the car would cost in the real world, mainly because it will be prohibitively expensive. The reason for the huge cost is not just the billions poured into research and development, but the cost of the fuel cell. To provide adequate power, the FCX must use two fuel-cell stacks with a total output of 100 kilowatts. The engine alone costs £25,000. What Spowers has done with the LIFECar is turn the problem on its head, by slashing the size of the fuel cell without affecting performance levels. By decoupling the parts of the car that provide cruise power and acceleration, he has been able to install a tiny 25-kilowatt fuel cell, which he says will still allow for a range of 200 miles and decent performance thanks to powerful capacitors that store surplus electricity, harvested from a regenerative braking system, and then release it when under acceleration.

The technology behind it comes from a collective of small industry leaders, including QinetiQ (which designed the fuel cell) and Cranfield and Oxford Universities. The project has cost £1.9m, half of which came from a Department of Trade and Industry grant, the rest from private investors. The only problem is that the LIFECar will never be built. It’s a demonstration vehicle, destined to gather dust in Morgan’s factory.

Spowers is sanguine about the fate of the LIFECar. “Yes, it probably won’t be built, but that was never the point. What it does is showcase what is possible.” But he has another project under way, and it’s bigger

than just a car (although it is that too). The blueprints are in his attic study and he hopes to showcase it in two years. Why has this man given up his job, relying on his wife's income, while he works on designs and theories that for the past 15 years nobody has been interested in?

Global warming, he says, is a bigger threat than Hitler. "At least when he was standing at Calais we all knew about it and stood to attention. But with climate change there is not going to be any evidence of it biting us in our personal lives until it is 30 years too late." There is something of the pioneering eccentric about him, and it's no coincidence that Colin Chapman, the maverick genius behind Lotus Engineering, the British sports-car company, was one of his heroes. "I sit and think and hypothesise" said one academic who has had dealings with Spowers. "Hugo sits, thinks, hypothesises and then goes and does it."

At Oxford University in the 1980s he was one of the founders of the Dangerous Sports Club, the group of gilded thrill-seekers intent on pushing the boundaries of what was possible by skiing the Alps on a grand piano and taking on the Cresta Run on a tea tray. Spowers also holds the dubious distinction of being the first person to bungee into water.

After university came a spell owning his own racing team, racing in the Formula Three series.

The venture nearly bankrupted him — as well as beginning to sit uncomfortably alongside his views on the environment — and he sold his business to return to university where he wrote a dissertation on the feasibility of the fuel cell. "Racing is a fantastically pure challenge with a sophisticated engineering problem: get around a track as fast as possible. A complex problem with a clear brief."

His latest solution to the complex problem of climate change is the Hydro car, and although it is still only a theoretical possibility, Spowers is convinced it will work.

As with the LIFECar, the key is in the separation or "de-coupling" of the fuel cell and the capacitors that provide the extra power for acceleration, and means a smaller fuel cell. But where the LIFECar, futuristic as it may look, is still based on the conventions of contemporary cars, the Hydro car project is an altogether more radical design, taking in not just the car itself but the whole of the auto industry, from how you purchase the car (it will be leased not bought) to how it is serviced (the supplier will bear the cost as a way of incentivising good workmanship and minimising waste and repairs).

"In order to make progress we need to start again. Modern cars are a product of the internal combustion engine technology. The fuel-cell vehicle is so different that I believe you need to change everything, not just the car but the business strategies and the supply chain and distribution. If you try and do what I am doing conventionally you are doomed to failure."

He calculates that the Hydro car will be so light it will be capable of running on a fuel cell with just five kilowatts, making it the first truly commercially viable fuel-cell car. This is all very well, and one day it may come to pass, but for now there is an elephant in the attic, and no amount of technological wizardry or whole system design approaches will make it vanish.

The elephant is hydrogen itself: or rather the lack of it.

Just past Woolworths in the Essex town of Hornchurch, there is an otherwise unremarkable BP garage. Its forecourt is just like any other, but for one now disused pump. This is the site of the UK's first and so far only hydrogen filling station, brought to life amid much fanfare to fuel the three hydrogen-powered buses that formed part of a pilot study in the gas's feasibility. The study ended in 2006 and the buses were decommissioned, as was the pump that fed them.

According to Transport for London, which ran the original programme, and the Department for Transport, there are no plans to reintroduce hydrogen filling stations in the UK any time soon. In fact there seems to be a distinct cooling in the government's approach to hydrogen. In October, Professor Julia King released the first part of an independent review on low-carbon cars. In it, she reported that the best way forward is not with hydrogen, but battery-powered vehicles that can run while being recharged with electricity from the mains. The second part of her review is due to be released later this month and is expected to further

relegate the role of hydrogen.

Meanwhile the big car makers say they have hit an impasse: without an infrastructure there is little point in continuing with hydrogen-powered cars. “The reality is that the infrastructure for hydrogen is a mile away,” says Duncan Forrester, of BMW. “A realistic hydrogen economy is still at least 15-20 years away.” He has a point, as well as a vested interest: so far not only are there no filling stations for hydrogen cars in the UK, but no construction and use legislation, and no rules for tax on the gas, a sure sign that its widespread use is not imminent.

There are also signs that hydrogen is not quite as clean as first assumed: “Hydrogen has to be made,” says Paul Nieuwenhuis, of the automotive-research unit at Cardiff University. “The fact is that while it may be clean at point of use, manufacturing it is a filthy business — the so-called well-to-wheel environmental cost of hydrogen is on a par with oil — unless you do so by means of sustainable energy, such as wind or solar power, and that simply isn’t viable for the amount that we need. Even if you could make a fuel cell cheap enough to power a car people would actually want to drive, there are still huge barriers to it becoming a viable replacement for what we have at the moment.”

None of this seems to worry Spowers. “I have spent the past 15 years of my life working on this, and it is only in the past five years that people have started listening. We are making progress.”

Back in the Audi, Spowers hits the car park as the train is pulling into the station. “I told you we’d make it in the end,” he grins. His wife doesn’t find it so funny, but before she flies out of the car, she says: “The thing you have to remember is that Hugo has spent a long time being a lone voice in the wilderness, and now people are taking it seriously. It has already made a big difference.

<http://www.timesonline.co.uk/tol/news/environment/article3489640.ece>