Alternatives to petrol

Gentlemen, start your engines

DETOIT

Hybrid motors may not be all they have been cracked up to be, but America's motorists do seem interested in more fuel-efficient cars

VISITORS to the Detroit Auto Show this week will have seen some unusual presentations alongside the regular razzmatazz of concept cars and new models. With America distraught about the security of its oil supplies, and petrol prices stuck well over $2 a gallon (more than 50 cents a litre) for the past year, the once-neglected term "fuel economy" has re-entered the country's vocabulary. It is not, however, an American firm that has led the change. Instead, Toyota, a Japanese company, has made itself the market leader, with its fuel-sipping petrol-electric hybrid, the Prius.

Petrol-electric hybrids attain their fuel economy by using electric motors in stop-start city traffic and petrol engines when cruising on the highway. Toyota expects to sell 400,000 hybrids this year, and the Prius itself now has a waiting list of 18 months. In the wake of this success, every carmaker in the world seems to be touting an alternative to the petrol-driven, four-stroke engine invented by Nikolaus Otto (above left) that has dominated motoring for almost 100 years.

Otto's lotto

In America, that dominion is still overwhelming. Around 97% of cars sold there today rely solely on the pistons, spark-plugs and cylinders of conventional petrol engines to power them (compared with about 50% in Europe). But petrol-electric hybrids, modern versions of the alternative internal-combustion engine developed by Otto's rival, Rudolf Diesel (to the right-hand side of the picture), and even ethanol-burning engines are making inroads. Ford, for instance, aims to sell more than 250,000 hybrid versions of five of its mainstream models this year.

The driving force behind this is hybrids' supposed offer of up to 25% better fuel economy. Although hybrids cost $2,000-3,000 more to buy, the federal government gives tax incentives of up to $3,600 a vehicle for buyers of Priuses and seven other sorts of hybrid made by Toyota, Honda and Ford. On top of this, there are non-monetary inducements, such as the hybrid driver's right to use high-occupancy vehicle lanes on dual carriageways, even when he is alone (and even though this adds to petrol consumption per passenger mile). Equally perversely, this waiver fails to take advantage of the particular benefits of hybrids, which are built for stop-go traffic where braking recharges the battery and boosts fuel economy.

Indeed, research has been picking other holes in the hybrid story over the past two years. Consumer Reports, a product-rating publication, tested 503 vehicles in real-life town and highway driving, and found that nine out of ten of them failed to achieve the fuel-efficiency claimed for them in tests by America's Environmental Protection Agency (EPA). In some cases the shortfall was as high as 50% and the worst offenders were the hybrids. To the silent glee of Detroit's manufacturers, who were slow off the mark with hybrids, the EPA is about to revise the way it conducts its measurements. The likely outcome is that hybrids (with Toyota and Honda to the fore) will fare far worse.

Only a cynic would suggest that domestic manufacturers had encouraged this updating of fuel-economy standards—for there is indeed a case for modernising tests last revised in 1985. Since then, congestion has grown worse, energy-demanding air conditioning has become routine, and highway speed limits have risen from the 55mph that was enforced after the oil shock of 1973-74. Hybrids, then, may have been oversold. But they are not the only answer to the fuel-economy question.

Rudolf to the rescue

One effect of the 1970s oil shock was to encourage people to buy cars with diesel engines, which are usually more efficient than Otto-cycle engines. However, the fashion did not last. Diesels disappeared from American cars in the 1980s because they were dirty, dull and unreliable.

Two things, however, are reviving interest in them. One is the appearance of cleaner, low-sulphur fuel. This is already commonplace in Japan and Europe, and
Hybridisation

Toyota's hybrid vehicle sales, worldwide, '000

will be introduced to America in the autumn. It contains a mere 15 parts per million of sulphur, which is less than a thirtieth of the amount sold today. Coupled with recent advances in direct injection ("common rail") engines that improve combustion, and durable particulate traps to capture tiny but dangerous particles of soot, this new fuel is cleaning up emissions and transforming the prospects for diesels in America. J.D. Power, a market research firm, forecasts that the share of the market taken by diesel cars will quadruple from today's 3.3% by 2015.

At the motor show, Mercedes-Benz, Honda, BMW, Nissan and Chrysler all revealed their intentions to make diesel engines available in their American cars. Volkswagen, which sold about 30,000 diesels in America last year, says it could have flogged twice that number if it had anticipated the rise in demand. Mercedes is promoting its new Blue Tec system—which incorporates oxidising catalytic converters, particulate filters and a new nitrogen-oxide-reducing system that injects the fuel with urea. This chemical grabs oxygen atoms from nitrogen oxides to produce nitrogen gas (which is harmless) and water. Blue Tec will thus meet new, tougher federal rules on nitrogen-oxide pollution that come into force in 2009. Mercedes claims that the new diesel engines it intends to put on the American market will also be 20-40% more economical than their petrol equivalents. It quotes estimates by the Department of Energy which say that if only one-third of America's cars and light trucks were diesels, this would save a quantity of oil equivalent to the country's imports from Saudi Arabia.

Coal-powered cars

Dieter Zetsche, the chief executive of DaimlerChrysler, Mercedes' owner, is still awaiting formal approval from the authorities for his company's new system. He believes, however, that he has satisfied concerns from the EPA that drivers would not bother to top up the urea-injection system, and that the cars would thus pollute more than they should. He thinks diesels are about to take off as smartly as hybrids did. Others beg to differ. GM reckons it is wiser to spend its research budget on technologies such as "lean-burn" petrol engines than to try to make diesels cleaner. Lean-burn engines use a trick called homogeneous charge-compression ignition—in effect, they are petrol-burning diesels, since they use pressure rather than spark plugs to ignite the mix of air and fuel. By copying a diesel's operating cycle they obtain a similarly superior thermal efficiency and, hence, fuel economy.

And those who don't like diesels can take other paths to clean and economical cars. The latest buzz is around "plug-in" hybrids. These are vehicles with even smaller than usual petrol engines, bigger batteries and the ability to recharge from the mains overnight. Given that the average American motorist travels barely 30 miles (50km) a day, the petrol engine in such a hybrid is there mainly to stop the driver being stranded by a flat battery.

Supporters of plug-ins, such as James Woolsey, a former head of America's Central Intelligence Agency and a man obsessed with the country's energy security, think such cars offer a clever answer to dependence on petrol. By shifting the donkey-work of supplying energy for transport to power stations—which generally burn coal—they make drivers less vulnerable to the vagaries of the petroleum trade.

Carmakers, though, are sceptical about plug-ins. Publicly, they claim the batteries will not tolerate the rugged regime of recharging envisaged by Mr Woolsey and his fellow enthusiasts. Some people, however, suspect that the real reason for the scepticism is a worry that the successful marketing message which has launched the Prius and its rivals might be tarnished by memories of plug-in electric vehicles, such as General Motors' EV1, which flopped in the 1990s.

If plug-ins fail to catch on, another way of escaping the Middle East would be to burn ethanol made from crops. A blend of 85% ethanol with 15% petrol, known as E85, is gaining acceptance since it can be used in normal petrol engines, and advances in biotechnology promise cheaper ethanol by turning waste cellulose into the glucose from which ethanol is fermented. (At the moment most of it comes from maize seeds.) If that works, it would put paid to the old objection that "gasohol", as it is sometimes known, consumes more energy in the making than it releases in the engine. Further down the road, companies such as Ford and BMW see great possibilities for burning hydrogen in internal combustion engines (long before it is common in fuel-cell electric cars). And then there are fuel cells themselves—though they are still some way off. In the race to find alternatives to petroleum, the contenders are already on the grid.